Overconfidence, Under-Reaction, and Warren Buffett's Investments

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Abstract

Warren Buffett is a long-term investor, but is required by law to disclose his trades on a quarterly basis. The market seems to under-react to the revelation of his trades. From 1980 to 2006, it has been possible to achieve investment results similar to Buffett's own simply by following his trades disclosed by Berkshire Hathaway. We consider overconfidence by sophisticated market participants as a contributing factor to the apparent under reaction to information contained in public disclosures of changes in Berkshire Hathaway's holdings of stocks. Net sales of corporate insiders of stocks held by Berkshire Hathaway tend to decrease when those holdings increase consistent with shared private information. However, financial analysts' recommendations tend to downgrade and institutions tend to sell at those times. This behavior by analysts and fund managers is consistent with pejorative experts displaying overconfidence by over estimating their stock picking abilities or precision of their independent private information and, as a consequence, underweighting public information in making their decisions.

1. Introduction

Warren Buffett, Chairman and CEO of Berkshire Hathaway, is widely respected for his investment acumen. Berkshire Hathaway's portfolio of publicly traded stocks has substantially outperformed the market during his tenure. Assuming Buffett's success is attributable to superior information, the rationale for Berkshire Hathaway holding positions beyond public disclosure of trades based on that information is puzzling. [1] An efficient market, in the semi-strong form, would quickly drive equilibrium prices to reflect the information content of such disclosures, implying no further benefit should be in the offing.[2] Moreover, if the market under reacts, then given required quarterly disclosure of portfolio changes, it would seem a simple matter to mimic that strategy and achieve quite similar success. Accordingly, one would expect that sophisticated market participants would quickly dissipate any inefficiency of that nature. However, as we will show, this does not occur.

If the market under reacts to public disclosures, then it makes sense for Buffett to hold positions until the market price fully adjusts to the information that may be driving Berkshire Hathaway's investments. What is unexplained is the under reaction. An explanation that we pursue in this study is overconfidence on the part of market participants such as financial analysts and institutional fund managers whose recommendations and trades are most likely to influence prices. Theoretical models by Odean (1998) and Daniel, Hirshleifer, and Subramanyan

[1] Closely related to an informational advantage *per se* is the prospect that Buffett's influence on managerial decisions for companies in which he has a stake improves future cash flows. Information in this context can be interpreted as foreknowledge of the opportunity to exercise such influence. Public disclosure of Buffett having taken a position would then signal a change in expected future cash flows rather than better information about future cash flows *sans* any influence.

[2] Abnormal returns up to the time of public disclosure can be viewed as compensation for incurring costs to acquire private information (Grossman and Stiglitz 1980) and, hence, entirely consistent with market efficiency.

(1998), analyzing the consequences of investor overconfidence in the form of overestimation of precision of their private information, predict an initial under-reaction to public information followed by a future drift in prices as the market ultimately adjusts. Moreover, similar to overconfidence in the sense of Odean (1998) and Daniel, Hirshleifer, and Subramanyan (1998), financial analysts and fund managers may believe their independent judgment is superior and seek to distinguish their expertise by purposefully not mimicking others such as Buffett. Both interpretations are treated as coming under the same rubric of overconfidence.

We begin our analysis by documenting abnormal returns to portfolios that that mimic Berkshire Hathaway's holdings of publicly traded stocks formed following quarterly disclosures during a sample period from 1980 to 2006. Such abnormal returns are remarkably similar in magnitude to those earned by Berkshire's portfolio, and they are independent of other well-known pricing anomalies. We then take an event study approach and examine price reactions in windows surrounding public disclosure of changes in holdings. While we find evidence of information content to such disclosures in short windows, price reactions at that time are incomplete as implied by abnormal returns from mimicking portfolios over longer windows. Next, we investigate overconfidence on the part of sell-side financial analysts and institutional fund managers by examining changes in recommendations and institutional holdings in relation to changes in Berkshire Hathaway's portfolio. In both cases, we find either no significant reaction or evidence of contrarian behavior: analysts tend to downgrade their recommendations following increases in Berkshire Hathaway's holdings and institutions appear to take the other side of Berkshire Hathaway's trades by selling when Berkshire Hathaway is buying.[3] These

[3] We also, examine trades by corporate insiders in stocks held by Berkshire Hathaway and find that, as net sellers, they sell less following Berkshire Hathaway buys consistent with their likely access to information similar to that guiding Buffett's trading strategy.

findings we ascribe to overconfidence instilled by competition and high rewards for these activities in the investment community.

At the outset, we acknowledge the alternative explanation for Berkshire Hathaway's performance as measured by abnormal returns consistent with market efficiency is that Buffett's success is due to chance. The fact that our choice to examine Buffett's record is *ex post* implies that selection bias is clearly an issue. If Buffett's success is due to chance, then investors could rationally choose not to mimic despite his past performance. We offer the following counter arguments: First, we observe that in the several years preceding the principal time frame of our study, Berkshire Hathaway experienced remarkable annual returns of approximately 60%, establishing Buffett's sobriquet as the "Oracle of Omaha" and suggesting unusual stock picking ability. Second, Martin and Puthenpurackal (2008) conduct a Monte Carlo simulation based on an approach introduced by Marcus (1980) and report that the probability that luck could have produced a similar performance to that of Berkshire Hathaway's portfolio over the same years as our study is less than one-percent. Accordingly, a strong *ex ante* case for investors to have recognized Buffett's performance by 1980 as indicative of his ability and considered mimicking his trades. Last, we find similar under reaction for institutions in the highest quintile ranking of past performance excluding Berkshire Hathaway, suggesting that under reaction to superior performance by fund managers in general is not unusual.[4]

The remainder of our study is organized as follows: Section 2 provides a review of related literature; section 3 describes our data; section 4 contains our results; and section 5 concludes.

[4] In the same vein, Frank, Poterba, Shackelford, and Shoven (2004) find that "copy cat" funds earn approximately the same after expense returns as actively managed mutual funds.

2. Related Literature

2.1 Market Under-Reaction

Martin and Puthenpurkal (2008) conduct a comprehensive study of Berkshire Hathaway's performance over the same sample period as our study. Among other results, they find that a portfolio that mimics Berkshire Hathaway's investments in publicly traded stocks rebalanced at the beginning of months following public disclosure earns significantly positive annualized abnormal returns of about 5.3% estimated using Carhart's (1997) four-factor model.[5] As mentioned above, a distinctive feature of their analysis of whether Berkshire Hathaway's superior performance could be attributable to chance is a Monte Carlo simulation in which they report a likelihood ranging from .01% to .64% depending on how many hypothetical managers are assumed in the competition. Their interest does not extend to tests for overconfidence as a possible explanation for Buffett's long-term strategy.

Previous research has detected market under reaction to public disclosures of various types including book to market ratios (Fama and French 1993), earnings announcements (Bernard and Thomas 1989), dividend initiations (Michaely, Womack, and Thaler 1995), accounting accruals (Sloan 1996), sales growth (La Porta 1996), analysts' recommendations (Michaely and Womack 1999), asset investments (Titman, Wei, and Xie 2001), and leverage (Penman, Richardson, and Tuna 2007). Given the possible co-incidence of these anomalies, as well as price momentum (Jegadeesh and Titman 1993) and price volatility (Ang, Hodrick, Xing, and Zhang 2006), we consider the extent to which changes in Berkshire Hathaway's holdings and future returns may be associated with variables that capture these anomalies including book-

[5] As we later report, this result is similar to our estimate of 5.52% using Carhart's model.

to-price ratio, market capitalization, accrual component of earnings, five-year sales growth, change in capital assets, leverage ratio, past returns, and standard error of market model residuals. As we report later, while mimicking portfolio composition and abnormal returns in our study are sensitive to some of these variables, changes in Berkshire Hathaway's holdings contribute to those returns after controlling for other anomalies.

More to our conjecture, evidence of market under reaction to public information from the literature on pricing anomalies is fairly ubiquitous suggesting the likelihood of some common behavioral factor such as investor overconfidence could be present.

2.2 Investor Overconfidence

There is substantial evidence in psychology of overconfidence in a number of forms. Relative to a certain benchmark, physicians overestimate accuracy of diagnoses (Chistensen-Szalanski and Busyhead 1981), workers overestimate the speed with which they can complete tasks (Buehler, Griffin, and Ross 1994), and individuals in general overestimate their control over events (Presson and Benassi 1996). Relative to a comparison group, substantially more than 50% of automobile drivers believe themselves to be better than the median (Svenson 1981), more than 35% of engineers place themselves among the top 5% of firm performers (Zenger 1992), and 25% of high school seniors rate themselves in the top 1% in the ability to get along with others (College Board 1976-1977). Hence, it seems that overconfidence is quite pervasive as a characteristic of human behavior in general.

Of special interest to our study is overconfidence in the form of individuals overestimating the precision of their information (Alpert and Raiffa 1982; Klayman, Soll, Gonzales-Vallejo, and Barlas 1999; and Soll and Klayman 2004). The connection between the

tendency toward overestimating precision of private information and market under reaction observed in studies of pricing anomalies is made theoretically by Odean (1998) and Daniel, Hirshleifer, and Subramanyan (1998). Both studies interpret overconfidence as an overweighting of private information and consequent underweighting of public information in trading decisions. The result of such asymmetric weighting is a positive correlation between consecutive changes in asset prices. In the context of our study, this phenomenon translates into analysts and fund managers underweighting the information content of changes in Berkshire Hathaway's portfolio resulting in persistence of abnormal returns on mimicking portfolios formed up to a year following public disclosure.

Seyhun (1998) summarizes evidence strongly implying that corporate insiders extract profits from trades based on their private information. Recently, Aboody, Hughes, Liu, and Su (2008) find evidence linking insiders' option exercise and selling decisions to private information. Since it is likely that private information of insiders overlaps with that of Buffett when Berkshire Hathaway has a position in stocks of their companies, then these trades are most likely to follow Buffett's lead, albeit with little effect on market prices given the relatively small scale of such trading activity. We further note that to the extent insiders share the same private information as Buffett with respect to their firms, overconfidence in the form of overweighting private information could conceivably add to the prospect of insiders appearing to mimic his trades.[6]

At a more tangential level, recently, theorists have examined the effects of overconfidence within the construct of formal asset pricing theory as a possible explanation for

[6] We also note that the public record of insider trading may serve as a further reflection of insiders' private information and, hence, that of Buffett's to other market participants. However, overconfidence of officers and directors may more likely be manifest in operating decisions wherein lies their expertise than in person portfolio decisions.

price bubbles. In this regard, Scheinkman and Xiong (2003) point to investor overconfidence as a source of differences in opinion that, in turn, can cause the price of an asset to exceed the highest estimate of its intrinsic value. This work is a continuous time extension of Harrison and Kreps (1978) who observed that differences in opinion along with short sale constraints can induce bubbles within which investors buy overpriced assets under the belief that other traders are willing to pay even higher prices. While we distinguish between market under reaction and asset bubbles, the common element is that investor overconfidence in a broad sense that includes differences in opinion may play a significant role in trading decisions or recommendations.

As one of the most successful investors of all time, Buffett has been extensively studied by practitioners and biographers. Among many publications that seek to extract useful insights form Buffett's investing and teaching, Lowenstein (2008) and Schroeder (2009) provide first-hand information through detailed biographies of Buffett and Buffett and Cunningham (2008) compile Buffett's business writings (mostly from Berkshire Hathaway's annual reports).

3. Data and Descriptive Statistics

Since 1979, Berkshire Hathaway has been required to provide quarterly reports of its security holdings to the Security and Exchange Commission (SEC). We obtain the content of those reports from Thomson Financial's data base of 13f filings over the period from April, 1980 to December, 2006. In all, we extract 2,140 quarter-stock observations on publicly traded holdings. We add 275 observations for which Berkshire Hathaway has received SEC approval for confidential treatments that, as a consequence, surface in later reports. We obtain stock price and returns data from the CRSP monthly tape and financial data from COMPUSTAT's industrial, full coverage, and research tapes. We lose 66 and 97 observations for lack of data on CRSP and

COMPUSTAT, respectively, leaving us with a total sample consisting of 2,252 observations. We obtain stock recommendations from the I/B/E/S summary file. Last, we obtain trading data on corporate insiders (officers, directors, and owners of 10% or more of equity class securities) starting in January, 1985 from the CDA/Investment section of Thompson/First Call.

Table 1 provides comparisons of Berkshire Hathaway's portfolio holdings with the S&P 500 and the COMPUSTAT universe pooled over the sample period. Characteristics compared in Panel A include size, book-to-price, institutional ownership (excluding Berkshire Hathaway), and coded analysts' recommendations. Berkshire Hathaway's holdings are similar to the S&P 500 and quite different from the COMPUSTAT universe. The similarity with the S&P 500 and the relatively low book-to-price ratios of Berkshire Hathaway's holdings runs counter to the popular view of Buffet as a value investor in the traditional sense, but is consistent with his claim of having switched from "cigarette butts" to "great companies at a fair price" (Buffett and Cunningham 2008). We note that analysts' recommendations are somewhat contrarian in the sense of being lower for Berkshire Hathaway's holdings than for the S&P 500. Measured on a five-point scale ranging from strong buy to strong sell, the median recommendations are 2.26 and 2.13, respectively.

(Insert Table 1 about here)

Panel B describes numbers of stocks held and lengths of holding periods for Berkshire Hathaway over our sample period. True to the perception of Buffett as a long-term investor, we observe a median holding period of a year, with approximately 20% of stocks held for more than two years. At the other end of the spectrum, approximately 30% of stocks are sold within six months. Berkshire Hathaway's holdings are highly concentrated; a mean of 22 stocks for the

decade ending in 1990, 12 for the next decade, and 33 beyond 2000. The holdings range from no more than 95 to as few as 5 over the 26 years of our sample. The apparent under diversification is consistent with the presumption of an information advantage. Using Fama and French's (1997) industry classifications, it is clear that Berkshire Hathaway's portfolios are tilted toward banking, business services, insurance, and publishing. The first three of these industries suggest a limited range to Buffett's expertise, or working, as he would say, only within his "circle of competence."

Figure 1 depicts Berkshire Hathaway's investment of public stocks as a percentage of its total assets and the extent of leverage employed in financing its investments. There is a clear shift in the proportions of holdings in publicly traded firms from a high of 80% in the earlier years down to 20% by 2006. The leverage effect is relevant in explaining the disparity in performance between Berkshire Hathaway's portfolio of publicly traded stocks and the holding company in its entirety as we later report.

(Insert Figure 1 about here)

4. Empirical Findings

4.1 Buffett's Performance

We first estimate abnormal returns to a portfolio that mimics Berkshire Hathaway's holdings of publicly traded stocks by employing Carhart's (1997) four factor model:

$$R_t - R_{f,t} = \alpha + \beta_1 (R_{M,t} - R_{f,t}) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 MOM_t + \varepsilon_t$$

where R_t is the mimicking portfolio return in month t; $R_{f,t}$ is the risk free rate, measured as the one-month treasury bill rate, and MKT_t, SMB_t, HML_t, and MOM_t are the returns on factor mimicking portfolios for the market, size, book-to-price, and momentum, respectively.[7] In each month, we calculate both value-weighted and equal-weighted portfolio returns based on Berkshire Hathaway's holdings as most recently disclosed.[8] Because our inference of trades from changes in holdings is only of quarterly precision, we conduct three distinct regressions assuming that trades were completed by the end of the first, second, or third month in each quarter. Next, we substitute returns on Berkshire Hathaway's stock in the dependent variable. The results are reported in Table 2.

(Insert Table 2 about here)

Panel A contains the estimates of abnormal returns for the portfolio mimicking Berkshire Hathaway's holdings of publicly traded stocks. The results are not sensitive to which of the three starting date assumptions is employed. Similar to Martin and Puthenpurkal (2008), estimates of Jensen's alpha imply average annualized abnormal returns across the three regressions of approximately 6% and 6.6% for the value- and equal-weighted mimicking portfolios, respectively. The difference in abnormal returns suggests that stocks of smaller companies performed better than those of larger companies. The two mimicking portfolios differ somewhat in their exposure to risks captured by *SMB* and *MOM* with the value (equal) weighted portfolio having significantly negative (insignificant) exposure to the former and insignificant (significantly negative) exposure to the latter. More notably, the lower book-to-market ratio, but significantly positive exposure to *HML* is likely a manifestation of the subtle difference between

[7] We obtained factor returns data from French's website.

[8] The equally weight approach eliminates a size effect apart from control in the form of a size factor. Also, we note that changes in the mimicking portfolio weights are solely an artifact of stocks entering or exiting Berkshire Hathaway's portfolio. This independence of price changes *per se* may better capture actual trades.

risk-factor and firm-characteristic based explanations for predictable stock returns (Fama and French 1993; Daniel and Titman 1997).

The results in Panel B on the performance of Berkshire Hathaway as a whole are sensitive to the time frame employed. Given that the limitation to availability of quarterly SEC filings does not apply, we can estimate abnormal returns for the period commencing in 1976. The annualized abnormal return over the entire period is 12%, a remarkable record notwithstanding that abnormal return for 1976-1979 is 60%. Restricting the sample period to 1980-2006, the abnormal return is 7.2% compared to 6-6.6% for the mimicking portfolio reflecting the leverage employed by Berkshire Hathaway. We also note a drop in the significance level for Jensen's alpha due to the higher volatility of Berkshire Hathaway's stock compared to that of its asset portfolio.

A natural question in assessing the source of abnormal returns in either Panel A or B is whether Buffett has been exploiting other well known empirically documented anomalies. In addressing this question, we identify variables intended to capture the anomalies mentioned earlier:

B/P: Book-to-price ratio. Book value is from last fiscal year and price data is from the last month prior to the event quarter;

Size: Log market capitalization at the beginning the event quarter;

Acc: Accounting accruals in the most recent annual earnings, measured as the change in non-cash current assets minus depreciation and the change in current liabilities, excluding the current portion of long-term debts and tax payables. We standardized by the average total assets in the past two years.

Ltsg: Annualized annual sales growth rate in the past five years.

ΔPPE: Change in gross property, plant and equipment from the previous year, standardized by the average total assets in the last two years.

Xret: Market adjusted returns in the past 12 months before the event quarter.

Lev: Leverage equal to book value of debt in the latest annual report divided by the market capitalization before the event quarter;

Vol: Volatility measured by the standard deviation of the stock's idiosyncratic risk. We take the 36 monthly stock returns before the event date and run a market model to derive residuals, and use root mean squared error to measure volatility.

In order to reduce the influence of outliers, we rank transform the above variables into values between zero and one.

The panels in Table 3 report three separate regressions. Regression 1 seeks to examine whether Buffett is exploiting some known anomalies in his stock selection. The dependent variable (Sample-id) is a dummy variable that takes a value of one if it the stock is in Buffett's portfolio and zero otherwise. In regressions 2 and 3, the dependent variable is the future 12-month stock return after each reporting quarter. While Regression 2 documents the return predicting power of the independent variables during the sample period, Regression 3 examines whether Buffett's stock picking ability is subsumed by these known anomalies. *A la* Fama and MacBeth (1973), the regressions are run quarterly and tests of average coefficients are based on Newy-West corrected t-statistics. Table 3 presents our results in two panels; Panel A without also including industry dummies to control for industry fixed effects and Panel B including industry dummies.

(Insert Table 3 about here)

From Panel A, Regression 1, we see significant correlations of changes in Berkshire Hathaway's stock holdings with variables serving as proxies for several anomalies. The results from Regression 2 are broadly consistent with previous studies; negative associations of future returns with accounting accruals, asset investments, and size and a positive association with book-to-market. These findings suggest that Buffett's stock picking ability may be related to exploiting anomalies. However, comparing results of Regressions 1 and 2, it appears that Buffett avoids firms with high asset growth that under-perform the market and invests in large firms with low book-to-market ratios and large accounting accruals, characteristics generally associated with low returns. The negative coefficient on book to market ratio in Regression 1 is, again, noteworthy since this variable is often taken to signify value stocks. While Buffett has been viewed as a value investor, this result is consistent with the shift in his strategy mentioned earlier. The significant positive coefficient on the indicator variable in Regression 3 suggests that Buffett trading reflects unique insights that contribute to the generation of future returns.

Recall from Table 1 that Berkshire Hathaway's portfolio has a clear emphasis on banking, business services, insurance, and publishing suggesting that the results in Panel A could be influenced by industry factors. It is evident from Panel B that some but not all future returns may be a consequence of successful bets on industries.

4.2 Market Under-reaction

The results in 3.1 depict Buffet's impressive ability to generate superior returns over a sustained period of time. We now consider the extent to which there exists a potentially exploitable price drift following public disclosure of changes in Berkshire Hathaway's portfolio

holdings. Table 4 contains estimates of abnormal returns from mimicking portfolios formed up to 12 months succeeding quarterly 13f filings with the SEC, again, using Carhart's (1997) four-factor model employing both value and equal weights. Results are reported for abnormal returns both with and without changes involving confidential treatments. Trades receiving confidential treatment are unobservable until later quarters where they can be inferred suggesting an unavoidable delay in attempts to mimic changes from such trades. However, the impact of including these trades is negligible.

(Insert Table 4 about here)

Because mutual fund managers have until 45 days after the end of a quarter to report their trades, it may not be possible to replicate abnormal returns realized during the first two months following the quarter in which changes in portfolio holdings occur. Notably, annualized abnormal returns on mimicking portfolios formed two months after disclosure are over 5%. More remarkably, such returns are as high as approximately 4% when mimicking portfolios are formed a year following disclosure. As before, the under-reaction is somewhat stronger for the equally weighted portfolios as exhibited by slightly higher t-statistics.

As a complement to evidence of market under-reaction in the form of abnormal returns well after public disclosure, we examine reactions to the disclosures *per se* by conducting an events study approach in which we estimate market-adjusted returns (returns on traded stocks net of returns on CRSP's value-weighted portfolio) for 13f reported trades resulting in increases, no changes, decreases, and revelations of previous purchases receiving confidential treatment. Table 5 contains our results. Periods centered on the event date within which we calculate market-adjusted returns include relatively short windows of five days and two weeks (Panel A)

and long windows by quarter for one, two, and three quarters either side of the quarter in which the change occurred (Panel B).

(Insert Table 5 about here)

As reported in Panel A, we find that the market does react to disclosures of Buffett's trades. Market-adjusted returns range from approximately .7% to .9% over the five-day and two-week windows, respectively, for increases. They are more pronounced for disclosures of purchases receiving confidential treatment (1.3% to 2.3%) suggesting greater information content than for trades not receiving such treatment. It further appears that the market sees good news in continued holdings, although market-adjusted returns are substantially lower. Market reactions to decreases are insignificant at conventional levels. Consistent calendar regression results in Table 4, in Panel B we see that market-adjusted returns are significantly positive for several quarters following disclosure for increases and no change. While market-adjusted returns in quarters leading up to disclosure are also significantly positive for no change, the magnitudes are smaller consistent with no change being viewed as good news as in Panel A. Market-adjusted returns are also significantly positive for decreases in quarters following disclosure suggesting profitability to trades contrarian to those of Buffett.

Comparing the findings for short windows in Panel A with those of long windows in Panel B, we conclude that market reactions at the time of disclosure are incomplete. We next turn to our conjecture that the under reaction may be an artifact of over confidence on the parts of financial analysts and institutional fund managers.

4.3 Investor Overconfidence

As noted earlier, market under reaction is linked to investor overconfidence by Odean (1998) and Odean, Hirshleifer, and Subramanyan (1998) who demonstrate analytically that overconfidence in the form of over estimating the precision of one's private information can lead to under weighting of public information resulting in market under reaction as observed in many studies of pricing anomalies. We investigate whether overconfidence could explain why the abnormal returns to mimicking Buffet's trades as documented in section 4.2 do not disappear even over fairly protracted periods by examining the behavior of three classes of market participants: corporate insiders of firms for which Berkshire Hathaway has stock holdings, sell-side financial analysts, and institutional fund managers.

Corporate insiders, defined as officers, directors, and major stockholders, are best positioned to have access to similar information to that of Buffett in the sense predicting future cash flows of their companies, or to draw inferences from the observation of Buffett's trades. Accordingly, among classes of investors, it would seem that insiders are the most likely to emulate changes in Berkshire Hathaway's holdings of their stock and all the more if insiders are themselves overconfident.[9] However, it is also likely that either the order flow from insiders or the public record of their trades is insufficient to move prices to the point of incorporating all of the information that may be driving those changes. In that regard, we also note that market makers may be unable to disentangle diversification from exploiting bad news as the motive for insiders to sell. This suggests that mimicking by insiders is likely to be most discernible on the buy side where, as net sellers, insiders would sell less when Berkshire Hathaway's holdings increase.

[9] CEOs, who under exercise their stock options, have been characterized as overconfident by Malmendier and Tate (2005). On one hand, given overlapping private information, overconfidence by insiders is likely to reinforce a tendency to trade in the same direction as Buffett's trades in their companies' stock. On the other hand, overconfidence of firm managers may relate more to operating decisions rather than to personal portfolio decisions.

In contrast, overconfidence seems likely to deter financial analysts and institutional fund managers, participants who may well affect prices through recommendations and trades, respectively, from following Buffett's lead. Analysts are likely to acquire their own information independent of Buffett and, if overconfident, may tend to overweight the precision of their information relative to information that is publicly available. As well, given that the investment field is highly competitive with out-sized rewards for distinctive success, analysts have strong incentives to distinguish their abilities apart from mimicking others in forming their stock recommendations, a factor that may contribute to the survivorship of those endowed with overconfidence. [10] Fund managers face similar conditions to those of analysts with respect to breeding overconfidence. Apart from overconfidence, however, fund managers' trading decisions may also be restricted by diversification and other constraints which could further mute their responses to public disclosures of changes in Berkshire Hathaway's holdings. In both cases, it is reasonable to anticipate that overconfidence might play a role with these participants as they react to the information content of Berkshire Hathaway's public disclosures.

Table 6 reports our results on insider trading, analysts' recommendations, and changes in institutional holdings over seven quarters centered on the quarter in which Berkshire Hathaway's holdings changed. We tabulate trading by insiders by the following formula:

$$snis = \frac{\text{number of shares insiders buys - number of shares insiders sell}}{\text{number of shares insiders buys + number of shares insiders sell}}$$

We use a numerical scale for analysts' recommendations: 1-strong buy, 2-buy, 3-hold, 4-sell, and 5-strong sell and calculate a mean recommendation for analysts surveyed by I/B/E/S. Institutional ownership changes are in the form of the quarterly change in all institutional

[10] Another factor is that analysts' recommendations may be biased upward in order to covey favor with firm managers, thereby further muting responses to public information when that information implies bad news.

holdings the same stocks as Berkshire Hathaway excluding holdings of Berkshire Hathaway divided by total shares outstanding for those companies. Table 6 is divided into three panels, with Panels A, B and C presenting the evidence for share increases, no change, and decreases, respectively.

(Insert Table 6 about here)

Consistent with there being information content to Buffet's trades shared or inferred by corporate insiders who, if overconfident, may even overweight that information, net sales by insiders decrease by 0.11 (significant at 5% level) in the same quarter as Berkshire Hathaway's holdings of stock in their companies increases. This decrease in net sales is short-lived suggesting that while Buffett's trades have an effect coincident with a favorable market reaction at that time, insiders are not exploiting the post disclosure price drift noted earlier possibly because maintaining an under diversified position for an extended period is not justified by the expected gains. Moving to Panels B and C, there appears to be no effect on disclosures of no change or decreases. This result is consistent with Table 5, which finds significant positive results for share increases, but less significant results in unchanged positions and share decreases.

On average analysts revise their recommendations significantly downward in the quarter when Berkshire Hathaway's holdings increase and over the next three quarters suggesting that they place little if any weight on public disclosure of those changes.[11] Consistent with analysts' behavior, institutions appear to take small notice of Buffett's trades with fund managers, if anything, taking the opposite side of trades associated with increases in Berkshire Hathaway's holdings. To the extent that institutions are reacting positively to such increases, this does not

[11] The same is observed for analyst recommendation for the unchanged case.

materialize until the third following quarter. As noted, insiders, analysts, and fund managers may have shorter horizons over which to realize the effects of their decisions than the periods necessary to take advantage information revealed by Berkshire Hathaway's disclosures.[12]

Financial analysts and institutional fund managers are prominent among classes of the investment community with an ability to move prices either through recommendations to large traders or through large trades. Yet, notwithstanding opportunities to follow the lead of one of the country's best known and most successful traders in modern times based on public information, these participants have not behaved in a manner that would resolve apparent market inefficiency as evidenced by post disclosure price drifts that persist for up to a year. While we cannot unambiguously establish that overconfidence is driving this phenomenon, our evidence suggests that this may be the case.

Last, we consider whether superior performance by other professional traders also is accompanied by market under reaction. For each month and institution, we step back and calculate abnormal returns for the previous 10 years. We then form quintile portfolios based on the rank order of those returns that mimic the holdings of institutions within those quintiles. Finally, we regress monthly mimicking portfolio returns on Carhart's (1997) four factors. Table 7 contains our results. We observe that estimates of abnormal returns in the form of Jensen's alpha are non-decreasing and significantly positive for quintiles 4 and 5. Not surprisingly in light of Buffett's extraordinary performance, the magnitudes are smaller than those for portfolios mimicking Berkshire Hathaway's holdings. However, the presence of abnormal returns for past top performing institutions suggests that the market under reaction to public disclosures by

[12] Extending this though further, earlier we suggested the possibility that Buffett's involvement with firms for which Berkshire Hathaway has an interest may positively affect future cash flows. Such an impact may take time to become realized. Accordingly, investors may take a wait and see posture until changes in cash flows begin to surface.

professional investors is not confined to Berkshire Hathaway. Accordingly, the same arguments for overconfidence among sophisticated market participants as a plausible explanation would seem to apply.

(Insert Table 7 about here)

5. Conclusion

Behavioral finance offers a new perspective on market under reactions to public information. Taking our cue from Odean (1998) and Odean, Hirshleifer, and Subramanyan (1998), we explore the plausibility of investor overconfidence in the form of overweighting one's private information as an explanation for under reactions to quarterly public disclosures of Berkshire Hathaway's portfolio holdings. Warren Buffett's record by the start of our sample period strongly suggests he is a gifted trader. His success in subsequent years in generating abnormal returns does not in itself imply market inefficiency. Rather such returns can be construed as compensation for his extraordinary talent and acquisition of private information. However, the facts that he is a long-term investor and, yet, must provide public disclosure of Berkshire Hathaway's holdings on a quarterly basis poses intriguing questions. What benefits can be achieved once trades based on private information are disclosed? If benefits to holding positions beyond disclosure derive from market under reaction, then what explains that under reaction?

Findings of market under reaction to Berkshire Hathaway's public disclosures through quarterly filings of their holdings of publicly traded company stocks through Form 13f with the SEC for up to a year or more rationalizes Buffett's long-term investment strategy. We investigate overconfidence as an explanation for under reaction indirectly by examining associations

between changes in Berkshire Hathaway's holdings and changes in both financial analysts' recommendations and institutional holdings for the same stocks. Our results suggest that analysts tend to downgrade following increases in Berkshire Hathaway's holdings and institutions tend toward taking the other side of the implied trades. The link to overconfidence is based on the argument that overconfidence on the part of analyst and fund managers is likely given the highly competitive investment community in which they perform and the high rewards afforded those who distinguish themselves as possessing independent expertise. As a complementary finding, insiders whose overconfidence is more likely to overweight similar private information to that of Buffett tend to follow Buffett's lead when buying by, as net sellers, selling less.

A useful extension of our study would be to identify a measure of overconfidence that could be applied to professional market participants thereby making it possible to conduct more refined cross-sectional assessments on our conjectured association between overconfidence and under reaction to public information.

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Figure 1: Berkshire Hathaway's Leverage and Investment in Publically Traded Stocks

Holding percentage (left y axis) is defined as the market value of Berkshire Hathaway's stock investments as a percentage of its total assets (TA) ; Leverage (right y axis) is defined as the total liability as percentage of the market capitalization; both are measured at the end of each year.

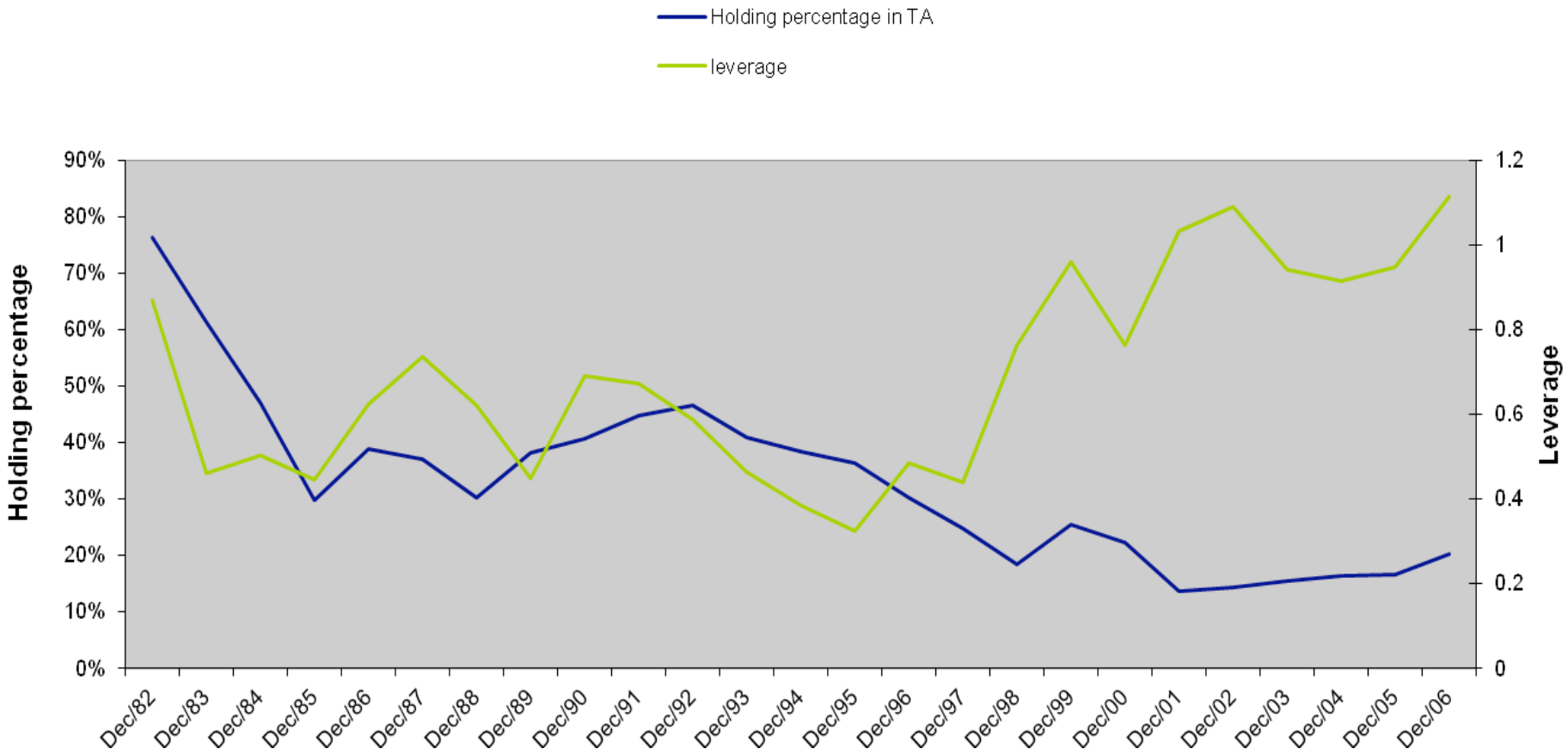

Table 1: Descriptive Statistics on Berkshire Hathaway's Holdings

This table contains the descriptive statistics for Berkshire Hathaway's portfolio of publicly traded stocks. Panel A compares the portfolio's composition with the S&P 500 and the COMPUSTAT universe. In each firm-quarter, we match Berkshire Hathaway's holdings with the S&P 500 index and the COMPUSTAT universe and then calculate statistics for the pooled data. Size is the log of market cap measured one month before the holding quarter. The book-to-price ratio is based on book value from the most recent fiscal year and price from the last month before the holding quarter. Institutional ownership is all institutional holdings excluding Berkshire Hathaway's divided by the shares outstanding measured at the end of holding quarter. The analysts' recommendation score takes values between 1 and 5, where 1, 2, 3, 4, 5 correspond to strong-buy, buy, hold, sell, and strong-sell, respectively. Panel B reports the distribution of holding period lengths and numbers of stocks held by Berkshire Hathaway's. Panel C compares the industry distributions of Berkshire Hathaway's holdings, the S&P 500, and the COMPUSTAT universe according to Fama and French's (1997) industry classification.

Panel A: Comparative characteristics of Berkshire Hathaway's holdings

	1%	*25%*	*Median*	*75%*	*99%*	*N*
Size						
Berkshire Hathaway	17.45	20.25	21.77	23.21	25.98	2,244
S&P 500	18.24	20.98	21.97	22.91	25.55	50,133
COMPUSTAT Universe	13.95	16.89	18.27	19.77	23.61	695,330
Book-to-price ratio						
Berkshire Hathaway	-0.04	0.30	0.45	0.75	2.86	2,125
S&P 500	-0.01	0.28	0.47	0.74	2.22	47,466
COMPUSTAT Universe	-0.75	0.29	0.57	0.98	34.89	595,356
Institutional ownership						
Berkshire Hathaway	0.03	0.42	0.57	0.75	0.92	2,237
S&P 500	0.04	0.42	0.58	0.72	0.98	20,507
COMPUSTAT Universe	0.00	0.07	0.21	0.45	0.99	423,113
Analysts' recommendations						
Berkshire Hathaway	1.32	2.00	2.26	2.60	3.34	1,157
S&P 500	1.31	1.89	2.13	2.42	3.29	21,688
COMPUSTAT Universe	1.00	1.70	2.04	2.56	4.00	214,086

Panel B: Holding period lengths and numbers of stocks held by Berkshire Hathaway

Holding Quarters	*Number of Stocks*	*Percentage*	*Cumulative Percentage*
1	39	16.96	16.96
2	29	12.61	29.57
3	16	6.96	36.52
4	55	23.91	60.43
5-10	34	14.78	75.22
10-20	20	8.70	83.91
20-30	15	6.52	90.43
30-40	13	5.65	96.09
40-50	2	0.87	96.96
>50	7	3.04	100.00
Total	230	100	

Holding Periods	*Max # of stocks*	*Min # of stocks*	*Mean*
1980 – 1990	95	8	22
1990 – 2000	30	5	12
2000 – 2006	40	27	33

Panel C: Industry distribution

Industry	*Berkshire*	*%*	*S&P 500*	*%*	*Compustat*	*%*
Banking	346	15.36	3,443	6.85	73,382	10.15
Business Services	317	14.08	2,035	4.05	63,209	8.75
Insurance	173	7.68	2,244	4.47	21,056	2.91
Printing and Publishing	168	7.46	1,067	2.12	5,394	0.75
Retail	111	4.93	3,465	6.9	30,808	4.26
Telecommunications	106	4.71	1,728	3.44	18,523	2.56
Steel Works, Etc.	88	3.91	1,282	2.55	9,257	1.28
Construction Materials	85	3.77	1,290	2.57	13,246	1.83
Transportation	85	3.77	1,416	2.82	15,217	2.11
Alcoholic Beverages	79	3.51	619	1.23	2,089	0.29
Personal Services	73	3.24	234	0.47	5,623	0.78
Petroleum and Natural Gas	70	3.11	2,521	5.02	31,197	4.32
Food Products	65	2.89	1,557	3.1	10,163	1.41
Utilities	61	2.71	3,929	7.82	28,948	4.01
Apparel	58	2.58	653	1.3	8,624	1.19
Machinery	55	2.44	1,800	3.58	20,757	2.87
Consumer Goods	35	1.55	1,145	2.28	12,204	1.69
Business Supplies	28	1.24	1,666	3.32	8,991	1.24
Pharmaceutical Products	28	1.24	1,737	3.46	27,193	3.76
Shipbuilding, Railroad Eq	28	1.24	351	0.7	1,392	0.19
Restaurants, Hotel, Motel	27	1.2	745	1.48	11,991	1.66
Chemicals	25	1.11	1,604	3.19	10,425	1.44
Other	141	6.26	13,702	27.28	292,951	40.54
Total	2,252	100	50,233	100	722,640	100

Table 2: Abnormal Returns on Portfolios Mimicking Berkshire Hathaway's Holdings

This table reports estimates of abnormal returns on mimicking Berkshire Hathaway's portfolio of publicly traded stocks. We adjust for risk using the Carhart (1997) four factor model: $R_t - R_{f,t} = \alpha + \beta_t MKT_t + \delta_t SMB_t + \sigma_t HML_t + \gamma_t MOM_t$, where R_t is the portfolio return in month t; R_f is the risk free rate, measured as the one month treasury bill rate; MKT_t is the excess return on the market portfolio; and SMB_t, HML_t, and MOM_t are the returns on the size, book-to-market, and momentum factor mimicking portfolios, respectively. In Panel A, the independent variables are based on Berkshire Hathaway's holdings of publicly traded stocks, from April, 1980 to Dec, 2006. Portfolio information is obtained from 13f reports and amendment filings when Berkshire Hathaway has been granted confidential treatment for its trading. In each month, we calculate value weighted returns (VW) using the most recently disclosed portfolio weights and equally weighted portfolio returns (EW). Because our knowledge about Buffett's trading is only up to a quarterly precision, we report three separate regressions assuming that the trading is done by the end of the first, second and the third month in each quarter. In Panel B, the dependent variable is based on Berkshire Hathaway's stock returns, from Sep, 1976 to Dec, 2006.

Panel A: Four-factor model regressions for mimicking portfolios (VW and EW).

Trading Month	α		*MKT*		*SMB*		*HML*		*MOM*		R^2 *adjusted*	
	VW	*EW*	*VW*	*EW*	*VW*	*EW*	*VW*	*EW*	*VW*	*EW*	*VW*	*EW*
1	0.46	0.53	0.90	0.91	-0.20	0.06	0.31	0.42	0.01	-0.09	0.52	0.66
	(2.30)	(3.48)	(17.74)	(23.41)	(-3.16)	(1.20)	(4.09)	(7.32)	(0.22)	(-2.56)		
2	0.47	0.55	0.89	0.92	-0.20	0.06	0.31	0.43	0.01	-0.08	0.52	0.68
	(2.37)	(3.75)	(17.64)	(24.59)	(-3.22)	(1.27)	(4.15)	(7.81)	(0.19)	(-2.62)		
3	0.51	0.55	0.89	0.92	-0.19	0.05	0.32	0.44	0.01	-0.09	0.51	0.69
	(2.54)	(3.82)	(17.43)	(25.05)	(-2.95)	(1.17)	(4.26)	(7.98)	(0.14)	(-2.93)		

Panel B: Four-factor model regressions for Berkshire Hathaway's stock.

	α	*MKT*	*SMB*	*HML*	*MOM*	R^2 *adjusted*
	5.31	1.45	-0.04	1.33	-1.15	0.24
Subsample 1976-1979	(3.03)	(3.06)	(-0.05)	(1.42)	(-1.71)	
	0.63	0.99	-0.31	0.60	0.09	0.29
Subsample 1980-2006	(1.80)	(11.39)	(-2.78)	(4.61)	(1.22)	
	0.97	1.00	-0.25	0.65	0.06	0.26
Whole sample 1976-2006	(2.73)	(11.40)	(-2.20)	(4.87)	(0.77)	

Table 3: Berkshire Hathaway's Holdings and Known Anomalies

This table examines the relation between Berkshire Hathaway's portfolio holdings and known anomalies. The difference between the two panels is that industry dummies, according to the Fama and French (1997) 48 industry classification, are included in Panel B, but not in Panel A. In each panel, there are three regressions. In Regression 1, the dependent variable (Portfolio-id) is a dummy variable that takes a value of one if it the stock is in Berkshire Hathaway's portfolio and zero otherwise. In Regressions 2 and 3, the dependent variable is the future 12-month stock return after each reporting quarter. The independent variables are all standardized using rank transformation into fractions between zero and one. They include the portfolio dummy (Portfolio_*id*), accounting accruals (*Acc*), book to price ratio (*B/P*), annualized sales growth rate in the past 5 years (*Ltsg*), changes of property, plant and equipment in the previous year (Δ*PPE*), leverage (*Lev*), log market capitalization (*Size1*), volatility (*Vol*) and the market-adjusted stock return for the past 12 months (*Xret_1*) as well as the industry dummies (results omitted). Detailed definitions of variables are in the body. We estimate the regression coefficients on a quarterly basis using the Fama-MacBeth (1973) procedure and report Newey-West corrected t-statistics.

Panel A: Without industry dummies

	Regression 1		*Regression 2*		*Regression 3*	
	Portfolio_id		*Future Return*		*Future Return*	
	Estimate	*t-value*	*Estimate*	*t-value*	*Estimate*	*t-value*
Intercept	0.011	(7.62)	0.124	(2.55)	0.123	(2.54)
Portfolio_id					0.055	(4.80)
Acc	0.001	(1.88)	-0.080	(-3.90)	-0.080	(-3.90)
B/P	-0.004	(-2.89)	0.107	(6.83)	0.107	(6.85)
Ltsg	-0.003	(-3.68)	0.017	(0.87)	0.017	(0.87)
Δ*PPE*	-0.005	(-5.62)	-0.052	(-3.57)	-0.052	(-3.56)
Lev	-0.004	(-9.37)	-0.024	(-0.67)	-0.024	(-0.66)
Size1	0.018	(3.56)	-0.125	(-3.63)	-0.125	(-3.63)
Vol	-0.010	(-7.78)	0.005	(0.1)	0.006	(0.11)
Xret_1	-0.003	(-3.50)	0.000	(0.00)	0.000	(0.01)

Panel B: Controlling for industry dummies

	Regression 1		*Regression 2*		*Regression 3*	
	Portfolio_id		*Future Return*		*Future Return*	
	Estimate	*t-value*	*Estimate*	*t-value*	*Estimate*	*t-value*
Intercept	0.013	(2.36)	0.040	(0.70)	0.040	(0.70)
Portfolio_id					0.049	(4.12)
Acc	0.002	(4.03)	-0.088	(-4.99)	-0.088	(-4.99)
B/P	-0.003	(-1.92)	0.116	(8.48)	0.116	(8.50)
Ltsg	-0.003	(-4.41)	0.013	(0.75)	0.013	(0.76)
ΔPPE	-0.004	(-4.42)	-0.041	(-3.59)	-0.040	(-3.59)
Lev	-0.002	(-6.83)	-0.007	(-0.24)	-0.007	(-0.24)
Size1	0.017	(3.58)	-0.117	(-3.45)	-0.118	(-3.45)
Vol	-0.011	(-7.32)	0.000	(0.00)	0.001	(0.02)
Xret_1	-0.003	(-3.43)	-0.005	(-0.18)	-0.005	(-0.17)
Industry dummies						

Table 4: Abnormal Returns on Delayed Implementation of Portfolios Mimicking Berkshire Hathaway's Holdings

This table reports abnormal returns on mimicking portfolios constructed after Berkshire Hathaway's 13f filings. We form equally weighted (EW) and value weighted (VW) mimicking portfolios assuming that they are constructed at the end of each of one through 12 months after Berkshire Hathaway's filing. We report estimates of abnormal returns (alphas) and associated t-statistics using Carhart's (1997) four factor model: $R_t - R_{f,t} = \alpha + \beta_t MKT_t + \delta_t SMB_t + \sigma_t HML_t + \gamma_t MOM_t$, where R_t is the portfolio return in month *t*; R_f is the risk free rate, measured as the one month treasury bill rate; MKT_t is the excess return on the market portfolio; and SMB_t, HML_t, and MOM_t are the returns on the size, book-to-market, and momentum factor mimicking portfolios, respectively.

	With confidential holdings				*Without confidential holdings*			
Trading Month	α		R^2 *adjusted*		α		R^2 *adjusted*	
	VW	*EW*	*VW*	*EW*	*VW*	*EW*	*VW*	*EW*
1	0.48	0.5	0.51	0.69	0.49	0.47	0.49	0.67
	(2.42)	(3.44)			(2.36)	(3.1)		
2	0.45	0.47	0.50	0.70	0.46	0.4	0.48	0.67
	(2.26)	(3.33)			(2.19)	(2.74)		
3	0.44	0.5	0.49	0.69	0.44	0.42	0.47	0.67
	(2.17)	(3.51)			(2.09)	(2.9)		
4	0.41	0.45	0.50	0.69	0.41	0.33	0.47	0.68
	(2.05)	(3.16)			(1.94)	(2.27)		
5	0.4	0.43	0.49	0.68	0.4	0.34	0.47	0.66
	(1.98)	(2.94)			(1.89)	(2.26)		
6	0.41	0.37	0.49	0.68	0.41	0.28	0.47	0.67
	(1.99)	(2.54)			(1.93)	(1.85)		
7	0.42	0.37	0.48	0.69	0.43	0.33	0.46	0.67
	(2.05)	(2.54)			(2.01)	(2.24)		
8	0.43	0.35	0.49	0.69	0.43	0.33	0.47	0.67
	(2.08)	(2.4)			(2.03)	(2.2)		
9	0.41	0.33	0.48	0.68	0.43	0.34	0.47	0.66
	(1.97)	(2.22)			(1.98)	(2.18)		
10	0.39	0.27	0.48	0.67	0.4	0.28	0.46	0.65
	(1.84)	(1.77)			(1.85)	(1.76)		
11	0.36	0.32	0.47	0.67	0.36	0.28	0.46	0.65
	(1.71)	(2.04)			(1.66)	(1.8)		
12	0.33	0.3	0.47	0.66	0.33	0.29	0.46	0.64
	(1.55)	(1.92)			(1.52)	(1.83)		

Table 5: Market Reactions to Changes in Berkshire Hathaway's Holdings

This table reports the market reactions to Public Disclosure of changes in Berkshire Hathaway's Holdings. CRSP's value weighted market return is subtracted from stock returns to arrive at the market adjusted returns. Panel A and Panel B report reactions over short and long windows centered on the disclosure date, respectively.

Panel A: Short-window market reactions

	N	*Market adjusted return (-2, 2)*	*Market adjusted return (-7, 7)*
Reported increase	367	0.69%	0.91%
		(3.11)	(2.55)
Reported unchanged	1277	0.20%	0.39%
		(2.13)	(2.18)
Reported decrease	419	0.09%	0.53%
		(0.51)	(1.53)
Confidential release	72	1.31%	2.34%
		(2.35)	(2.01)

Panel B: Long-window market reactions

	Quarter	*-3*	*-2*	*-1*	*0*	*1*	*2*	*3*
Increase	*Mkt-adj Return*	0.63%	1.09%	-0.97%	0.66%	2.99%	3.47%	1.44%
	t statistics	(1.12)	(1.87)	(-1.46)	(0.96)	(4.72)	(5.09)	(2.07)
	N	493	494	497	502	494	470	447
Unchanged	*Mkt-adj Return*	1.50%	1.32%	1.56%	1.71%	2.11%	2.05%	2.10%
	t statistics	(3.56)	(3.14)	(3.64)	(4.10)	(4.82)	(4.66)	(4.74)
	N	1462	1465	1469	1469	1439	1392	1354
Decrease	*Mkt-adj Return*	0.34%	0.92%	2.49%	3.18%	2.11%	1.33%	2.31%
	t statistics	(0.58)	(1.40)	(4.23)	(5.00)	(3.27)	(2.14)	(3.60)
	N	561	564	565	566	553	543	531

Table 6: The Behavior of Insiders, Institutions and Analysts

This table reports the behavior of corporate insiders, institutions and financial analysts. Analysts' recommendation scores take values between 1 and 5, where 1, 2, 3, 4, 5 correspond to strong-buy, buy, hold, sell, and strong-sell, respectively. Mean-rec is the average recommendation of analysts surveyed by IBES. Institutions' reactions are measured by their quarterly ownership changes. Institutional ownership consists of all institutional holdings excluding Berkshire Hathaway's divided by the number of shares outstanding measured at the end of a holding quarter. Insider trading is defined as

$$snis = \frac{\text{number of shares insiders buys - number of shares insiders sell}}{\text{number of shares insiders buys + number of shares insiders sell}}.$$

Both other insider snis and other institutional ownership change are detrended by its global mean at each quarter. The difference between quarter zero and the average of negative quarters, and the difference between the average of positive quarters and the average of negative quarters are reported. Statistics are based on two-tailed p value. ***,** and * denote significance at 10%, 5% and 1% level, respectively.

Panel A: Share Increase

Quarter relative to events	*N*	*Other insiders snis*	*N*	*Other Institutional ownership change*	*N*	*meanrec*
-3	178	-0.417	263	2.34%	186	2.142
-2	178	-0.366	263	1.13%	186	2.165
-1	178	-0.336	263	0.67%	186	2.203
0	178	-0.263	263	-1.09%	186	2.255
1	178	-0.386	263	0.53%	186	2.292
2	178	-0.440	263	1.40%	186	2.317
3	178	-0.394	263	-0.21%	186	2.320
Diff btw Q0 and negative quarters		0.110**		-2.47%**		0.072***
Diff btw positive and negative quarters		-0.034		-0.80%		0.127***

Panel B: Share Unchanged

Quarter relative to events	*N*	*Other insiders snis*	*N*	*Other Institutional ownership change*	*N*	*meanrec*
-3	894	-0.351	1267	-0.05%	794	2.322
-2	894	-0.353	1267	0.18%	794	2.342
-1	894	-0.343	1267	-0.36%	794	2.358
0	894	-0.349	1267	0.08%	794	2.377
1	894	-0.337	1267	-0.30%	794	2.383
2	894	-0.321	1267	-0.14%	794	2.386
3	894	-0.318	1267	-0.17%	794	2.393
Diff btw Q0 and negative quarters		0.000		0.16%		0.041***
Diff btw positive and negative quarters		0.024		-0.12%		0.054***

Panel C: Share Decrease

Quarter relative to events	*N*	*Other insiders snis*	*N*	*Other Institutional ownership change*	*N*	*meanrec*
-3	224	-0.373	398	1.23%	223	2.204
-2	224	-0.379	398	0.50%	223	2.211
-1	224	-0.392	398	1.43%	223	2.218
0	224	-0.430	398	1.11%	223	2.202
1	224	-0.351	398	1.16%	223	2.204
2	224	-0.357	398	-0.25%	223	2.213
3	224	-0.391	399	0.57%	223	2.216
Diff btw Q0 and negative quarters		-0.049		0.03%		-0.004

Diff btw positive and negative quarters	0.014	-0.59%**	0.002

Table 7: Mimicking Other Institutions' Holdings

This table reports the regression results by mimicking holdings of institutions ordered by past performance. Institutions in the 13f reports are first ranked by their past 10 years trading performance and divided into quintiles each month. Portfolios are then constructed by mimicking institutions' holdings within each quintile. Returns are measured for the following month after portfolio is constructed. Abnormal returns are estimated by alphas using Carhart's (1997) four-factor model: $R_t - R_{f,t} = \alpha + \beta_t MKT_t + \delta_t SMB_t + \theta_t HML_t + \gamma_t MOM_t$, where R_t is the portfolio return in month t; R_f is the risk free rate, measured as the one month treasury bill rate; MKT_t is the excess return on the market portfolio; and SMB_t, HML_t, and MOM_t are the returns on the size, book-to-market, and momentum factor mimicking portfolios, respectively.

Abnormal returns of quintile portfolios mimicking institutions					
Past Performance Rank	α	*MKT*	*SMB*	*HML*	*MOM*
Lowest Rank 1	0.08	1.08	0.34	0.17	-0.18
	(1.19)	(61.62)	(18.15)	(7.25)	(-13.15)
2	0.08	1.05	0.36	0.23	-0.16
	(1.47)	(72.36)	(22.9)	(11.94)	(-14.06)
3	0.08	1.06	0.34	0.25	-0.13
	(1.66)	(83.11)	(25.34)	(14.75)	(-13.08)
4	0.14	1.06	0.34	0.23	-0.13
	(2.74)	(77.26)	(23.05)	(12.85)	(-12.44)
Highest Rank 5	0.2	1.09	0.44	0.14	-0.11
	(3.85)	(77.5)	(29.24)	(7.38)	(-10.16)