

Imitation is the Sincerest Form of Flattery: Warren Buffett and Berkshire Hathaway

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October 19, 2007

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JEL classification: G11; G14; G22; C22

Keywords: Warren Buffett, Berkshire Hathaway, efficient markets, long-term performance, investment performance, abnormal returns, simulation.

We thank Charles Cuny and Ro Gutierrez for their helpful comments and suggestions. We also thank Kapil Shiohare for his assistance in collecting data from the SEC Public Reference Room and Logan Strohm for research assistance.

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Abstract

We analyze the performance of Berkshire Hathaway's equity portfolio and explore potential explanations for its superior performance. Contrary to popular belief we show Berkshire's investment style is best characterized as a large-cap growth. We examine whether Berkshire's investment performance is due to luck and find that beating the market in 28 out of 31 years places it in the 99.99 percentile; however, incorporating the magnitude by which Berkshire beats the market makes the "luck" explanation unlikely even after taking into account ex-post selection bias. After adjusting for risk we find that Berkshire's performance cannot be explained by assuming high risk. From 1976 to 2006 Berkshire's stock portfolio beats the S&P 500 Index by 14.65%, the value-weighted index of all stocks by 10.91%, and the Fama and French characteristic portfolio by 8.56% *per year*. The market also appears to under-react to the news of a Berkshire stock investment since a hypothetical portfolio that mimics Berkshire's investments created the month after they are publicly disclosed earns positive abnormal returns of 14.26% per year. Overall, the Berkshire Hathaway triumvirates of Warren Buffett, Charles Munger, and Lou Simpson possess investment skill consistent with a number of recent papers that argue investment skill is more prevalent than earlier papers suggest.

Imitation is the Sincerest Form of Flattery: Warren Buffett and Berkshire Hathaway

Warren Buffett's investment record suggests he is one of the most successful investors of all time. With his long-time partner Charles Munger, they transformed Berkshire Hathaway from a textile manufacturer to a holding company with a value in excess of \$170 billion. In 1985 with the acquisition of GEICO, Lou Simpson was added to the collective genius that makes investment decisions for the company. According to *Forbes*, Buffett's 40% beneficial interest in Berkshire Hathaway makes him the second wealthiest person in America (coincidentally behind Bill Gates, co-founder of Microsoft who is a director of Berkshire Hathaway and whose foundation is the beneficiary of Buffett's philanthropy) and he has been called a genius by the famous economist and efficient market theory proponent, Paul Samuelson (Samuelson (1989)). Berkshire Hathaway controls a diverse group of subsidiaries, many of which are industry leaders in both market share and financial strength, and a stock portfolio in excess of \$50 billion in publicly traded companies whose value would equate to the 9th largest equity mutual fund. The performance of Berkshire's equity portfolio has beaten the S&P 500 index in 28 out of 31 years from 1976 to 2006 exceeding its average annual return by 14.65% over this period. While there have been many books written about Buffett attempting to explain his investment philosophy and success, to our knowledge, no academic work has provided a rigorous analysis of Berkshire Hathaway's investment performance. Yet, Buffett's performance is often cited by the anti-efficient market faction as a violation of efficient markets theory.¹

So how does one explain the investment success of Berkshire Hathaway which has been achieved over a long period of time?² There are a number of potential explanations. First, consistent with efficient markets theory Buffett may have been lucky. That is, if enough people participate in the market, over a

¹ In the book "Poor Charlie's Almanack", Charles T. Munger, Berkshire Hathaway's Vice Chairman, interestingly notes that Paul Samuelson who was one of the important early proponents of efficient markets theory has had a significant investment in Berkshire Hathaway for a long time. In Munger's words, "it appears Samuelson was hedging".

² Buffett started managing funds in the 1950s and acquired Berkshire Hathaway in 1965. The company became listed on the NYSE in 1976. We use Berkshire and Buffett interchangeably throughout the paper.

31-year period a few people are going to beat it in all 31 years simply by chance. So, due to pure luck, some investors can obtain very successful investment records. Buffett's successful performance has also been identified after-the-fact so his record is subject to ex-post selection bias. However, we mitigate this by beginning our analysis in 1976, at a point in time when Buffett had already developed a reputation as a very successful investor.³ Using a procedure developed by Marcus (1990) we show that Berkshire's investment performance is not due to skill or luck after accounting for ex-post selection bias. We also show that Berkshire's high returns are not simply compensation for high risk.

Efficient Market Theory does not claim that stock prices are correct at all times, it only states that stock prices are correct on average. At any point in time, stocks may be mispriced but one does not know whether they are underpriced or overpriced. If an investor is successful in identifying the direction of pricing errors in a majority of their investments, they can obtain positive risk-adjusted returns. Such a scenario would appear to be a violation of EMT since investors should not be able to systematically identify the direction of pricing errors. However, other interpretations of EMT suggest skilled investors may be rewarded for the cost of information production (acquiring better information and/or better processing of available information) keeping markets efficient or that investors may have different interpretations of the same information allowing a skilled information processor to identify the true value of stocks before the market does. Such ability would enable the investor (efficiency insurer) to identify mispriced stocks and earn positive risk-adjusted returns as compensation for their information production. Under these alternative interpretations, Berkshire may obtain positive risk-adjusted returns that are still potentially consistent with EMT. However, since we find that a portfolio that mimics Berkshire's investments after they are made public in regulatory filings earns significantly large risk-adjusted returns using various benchmarks, it suggests this information does not get transmitted quickly into stock prices and would therefore be inconsistent with the predictions of EMT.

³ Buffet ran a successful investment partnership which he used to take control of Berkshire Hathaway and distributed shares of the firm to the partners when he liquidated the partnership in 1969. In the early 1980's he was profiled Barron's and had a famous debate with Michael Jensen at the Columbia Business School on whether markets are efficient.

Buffet is often characterized as a “value” investor by the financial press. In order to determine his investment style, we classify the distribution of investments using the Fama and French small vs. big and value vs. growth scheme. While Buffet takes exception to the “value versus growth” classification of investment style because growth is an integral component in the calculation of value and the characteristics used to determine growth stocks such as a high ratio of price to book value is in no way inconsistent with a "value" purchase, we find contrary to the popular notion of being a value investor, Berkshire’s investment style is better described as a large-cap growth.

Finally, we examine firms’ stock price reaction to the news of Berkshire’s initial investment in the stock. If the market interprets Berkshire’s investment as indicating undervaluation with potential future positive risk-adjusted returns, the impact of the news on the purchased stock will be positive and significant. We show that over the period from 1976 to 2006, the market reacts positively to the public disclosure of a Berkshire Hathaway stock investment with an abnormal return of 4.03% on the day of announcement. The market reaction is stronger in the second half of the study period with an abnormal return of 4.40% as compared to a 0.82% in the first half suggesting the market views the news as a creditable signal of positive future risk-adjusted returns and this signal has become stronger as the investment success of Buffett has become more well-known. However, the market appears to under-react to this information since investors who mimic Berkshire’s stock investments after they become publicly known are still able to obtain subsequent positive risk-adjusted returns.

Our results suggest that Buffett’s investment skill cannot be explained by Efficient Market Theory. This is consistent with findings in a number of recent papers such as Chen, Jegadeesh and Wermers (2000), Cohen, Coval and Pastor (2005), Wermers (2000) and Kosowski, Timmermann, Wermers and White (2005) who argue investment skill is more prevalent than previous research indicate.

The rest of the paper is organized as follows. Section I provides a review of related literature. Section II discusses our data sources. Section III provides details on the empirical methodologies adopted in this paper. Section IV provides the empirical analyses followed by our conclusion in Section V.

I. Literature Review

A. Performance of financial professionals

Many studies have investigated the performance of mutual funds and various financial professional recommendations to determine if they outperform the market or other suitable benchmarks. Since Jensen (1968), most papers have found that mutual funds, on average, do not outperform their benchmarks. Cahart (1995), Malkiel (1995), and Daniel et al. (1997) find small or zero average abnormal returns by using modern performance evaluation methods on samples that are relatively free of survivorship bias suggesting the average active mutual fund should be avoided. Alternatively, papers like Carlson (1970), Lehman and Modest (1987), Grinblatt and Titman (1988, 1992), Hendricks et al. (1993), Goetzmann and Ibbotson (1994), Brown and Goetzmann (1995), Elton et al. (1996), and Cahart (1997) have found evidence suggesting future abnormal returns or “alphas” can be forecast using past returns or alphas. As discussed in Baks et al. (2001), this evidence suggests the possibility alphas are persistent and that some managers have positive expected alphas.

Desai and Jain (1995) find the recommendations of the Roundtable of Barron’s Superstar money managers experienced a positive abnormal return on the day of the first public announcement but failed to provide superior performance thereafter. Similarly, Black (1973), Copeland and Mayers (1982), Stickel (1985), and Lewis et al. (1997) who examine the “Value Line Anomaly” show that after an initial reaction, the recommendations show no sustained superior performance once an appropriate benchmark is used. Graham and Harvey (1996), Jaffe and Mahoney (1999), and Metrick (1999) show investment newsletters fail to offer superior market timing ability. In contrast, Barber and Loeffler (1993) show a positive abnormal return on analyst’s recommendations and Womack (1996) indicates that analysts appear to have market-timing and stock-picking abilities. In addition, Coval, Hirshleifer, and Shumway (2002) demonstrate trades of individual investors classified in the top ten percent exploit market inefficiencies to earn abnormal profits above those from other well-known strategies. Thus previous research suggests only in relatively few cases does there appear to be possible evidence of superior investment skill.

Recent research suggests some fund managers may have superior investment skill. Wermers (2000) finds high-turnover mutual funds held stocks that substantially beat the S&P 500 index from 1975 to 1994. Chen et al. (2000) investigate the value of active mutual fund management by examining the stockholdings and trades of mutual funds and find growth-oriented funds exhibit stock selection skills especially in large growth stocks. Kosowski et al. (2006) provide a comprehensive examination of mutual fund performance explicitly controlling for luck. Across a wide array of performance measurements their tests indicate the large, positive alphas of the top ten percent of funds (net of costs) are extremely unlikely to be solely due to luck. Subsequent tests indicate the superior performance is concentrated among growth-oriented funds. They also find stronger evidence of superior fund management during the first half of their sample period (pre-1990s) not simply due to luck. Finally, they find significant persistence in net return alphas for the top (sometimes top two) deciles of managers. Cohen et al. (2005) develop a performance evaluation approach in which a manager's skill is judged by the extent to which the manager's investment decisions resemble the decisions of managers with distinguished historical performance records and find strong predictability in the returns of U.S. equity funds. Stocks commonly held by managers who have been performing well tend to out-perform in the future even after adjusting for momentum in stock returns indicating some collective investment skill on the part of these managers. They also find fund flows do not respond significantly to their measures indicating investors are unaware of the information contained them. The more recent research suggests some fund managers may have superior investment skill.

B. Optimal information disclosure by institutional investors

Grossman and Stiglitz (1980) argue that skilled investors are rewarded for the cost of information production (acquiring better information and/or better processing of available information) keeping markets efficient. Kurz and Motolese (2000) alternatively argue that rational agents can have diverse interpretations of the same information suggesting that an investor who is skilled at processing available public information may be able to identify the true value of stocks before the market does. Such ability

would enable an investor to identify mispriced stocks and earn positive risk-adjusted returns. These interpretations allows for skilled investors (efficiency insurers) to earn positive abnormal returns as compensation for their information production. If we find that Berkshire obtained positive risk-adjusted returns it is therefore still potentially consistent with EMT.

It is unclear how the superior information of skilled investors gets transmitted into stock prices. The traditional explanation under EMT is that skilled investors will trade on their superior information which gets reflected in stock prices quickly. These investors will have an incentive to conceal their trading activities until they establish their investment positions since the market over time will recognize their superior skill and react to the news of their investments reducing returns. Conversely, skilled investors should welcome mimicking or copy-cat investors after establishing their positions since this would quicken the correction of miss-pricings and the realization of positive abnormal returns (Frank et al., 2004). Regulatory rules that require frequent disclosures of holdings may improve the efficiency of markets since the information produced by skilled investors is incorporated into stock prices faster. Frequent disclosures may also lower the returns of skilled investors reducing incentives to undertake the activities with possible adverse effects for the efficiency of markets. Once the investor's activity in a particular security becomes known to the market through disclosure, additional investment will come at a higher cost or sales at lower prices.

C. Performance testing and benchmarking methodologies

Prior research demonstrates the results of long-term performance studies may be dependent upon the chosen testing methodology and the benchmark. The two most popular choices for long-term abnormal return measurement are the cumulative abnormal return (CAR) and buy-and-hold abnormal return (BHAR). The CAR is calculated by summing the abnormal returns (actual returns less benchmark returns) over all periods of the tested horizon. Alternatively, BHAR is calculated by compounding each periodic return into a buy-and-hold measure over the tested horizon and subtracting from it the buy-and-

hold benchmark return. Barber and Lyon (1997) and Kothari and Warner (1997) argue that both methods have drawbacks that could bias test statistics to yield different results.

Lyon, Barber, and Tsai (1999) test the calendar-time methodology of Jaffe (1974) and Mandelker (1974) that is advocated by Fama (1998) and Mitchell and Stafford (2000). While it does not reflect of the returns experienced by actual investors, the formation of calendar-time portfolios eliminates the cross-sectional dependence of observations and results in well-specified test statistics. Mitchell and Stafford (2000) apply several different measurement techniques to a sample of mergers from 1958 to 1993 and find the calendar-time method is best for testing for abnormal returns. Possible benchmarks include the value-weighted or equal-weighted CRSP index, reference portfolios such as the Fama and French (1993) twenty-five size and book-to-market portfolios, a set of control firms selected in a manner designed to mimic the risk of sample firms, and the application of an asset pricing model such as the three factor model of Fama and French (1993) or the four factor model of Carhart (1997).

D. Ex-post selection bias

As explained in Marcus (1990) and Statman and Scheid (2001), Buffett may have been identified ex-post as a successful investor and should therefore not be surprised to find his performance far above average. We also acknowledge after-the-fact some managers will have been lucky. So, the question becomes when is the performance of a manager so good that even after accounting for the ex-post selection bias can pure luck fail to account for the performance? We use a Monte Carlo simulation technique described by Marcus (1990) to derive a numerical approximation of the probability distribution of the hypothetical winning manager's performance derived under the assumption of an efficient market as a benchmark. To account for cross-sectional variation in manager-specific risk we use a range of noise estimates in the market to establish a margin by which the best performing manager should beat the market in order for it to be interpreted as being due to skill and not luck. Once derived, we can test whether a winner's abnormally good performance is evidence of an ability to beat the market after accounting for the fact that we have selected the best performer.

II. Data

Data on Berkshire Hathaway's stock investments was gathered from regulatory filings required by the Security and Exchange Commission and from the Berkshire Hathaway annual reports. The SEC filings examined include forms 10K, 13F, 13D, 13G, 3, 4 and 5 which are currently available on the SEC's EDGAR website.⁴ All form 13F reports for Berkshire Hathaway starting with the report dated December 31, 1998 are available via the internet on EDGAR. Schedule 13D and 13G reports are available online since March 4, 1994 and Forms 3, 4 and 5 have only recently become available online. Data from filings for prior dates were collected directly from the SEC's Public Reference Room. Berkshire Hathaway provides their annual report to shareholders on their website since 1995 and Warren Buffett's Letter to Berkshire Shareholders since 1977.⁵

It is important to note we do not claim to exactly replicate Berkshire Hathaway's investment portfolio. Certain limitations to the data sources including timing, availability of acquisition cost, availability of the investment itself, and the source of stock return data restricts our analysis to common equity investments that are publicly disclosed and only those with return data available in CRSP⁶ during the study period. For example, Berkshire's common stock investment in American Express in 1994 was the result of an automatic conversion of Preferred Equity Redemption Cumulative Stocks (PERCS) acquired three years earlier. In our analysis we assume the investment occurred in the quarter the PERCS were converted to common stock at the price reported at the end of month of conversion. Several other equity investments were also preceded by or were increased through investments in convertible preferred stock including First Empire State, Geico, Gillete, Salomon, and US Airways. Berkshire's initial

⁴ EDGAR, the Electronic Data Gathering, Analysis, and Retrieval system, performs automated collection, validation, indexing, acceptance, and forwarding of submissions by companies and others who are required by law to file forms with the U.S. Securities and Exchange Commission. <http://www.sec.gov>.

⁵ <http://www.berkshirehathaway.com>.

⁶ Source: CRSP, Center for Research in Security Prices. Graduate School of Business, The University of Chicago 2003. Used with permission. All rights reserved. <http://www.crsp.uchicago.edu>

investment in Federal Home Loan Mortgage (Freddie Mac), although technically a preferred stock, was for all practical purposes a common stock investment made at a time when it was available only to lending institutions.⁷ For these reasons the calculated performance of Berkshire's investment portfolio will understate the true investment returns earned.

A. Data Sources

The primary source of data is Form 13F reports required to be filed by institutional investment managers defined as any entity (person or company) that exercise investment discretion at the end of any calendar month over \$100 million or more in securities as specified in Section 13(f) of the Securities Exchange Act of 1934. The securities requiring reporting are found in the Official List of Section 13(f) Securities published quarterly and are available on the SEC's website.⁸ The Form 13F requires disclosure of the names of institutional investment managers, the names and class of the securities they manage, the CUSIP number, the number of shares owned, and the total market value of each security as of the last day of the calendar quarter. The first 13F filing by Berkshire Hathaway occurred for the quarter ended December 31, 1978 filed with the SEC on May 17, 1979.

Institutional investment managers may request confidential treatment of certain securities ordinarily required to be reported on Form 13F which would exempt them from public disclosure if the either the information would identify securities held by the account of an individual, certain estates and trusts; or the information would reveal an investment manager's program of acquisition or disposition that is ongoing both at the end of a reporting period and at the time that the Form 13F is filed. If granted, the SEC will allow the investment manager to withhold certain investments from the report for a period of

⁷ Berkshire acquired interest equal to the maximum allowed by law through Mutual Savings and Loan a non-insurance subsidiary of Blue Chip Stamps, itself a subsidiary of Berkshire Hathaway. One year later trading in the stock became available to the public on the New York Stock Exchange.

⁸ Section 13(f) securities include equity securities that trade on an exchange or are quoted on the NASDAQ National Market, certain equity options and warrants, shares of closed-end investment companies, and some convertible debt securities. Mutual funds (open-end investment companies) and foreign stocks are not included on the list and are therefore not required to be reported. See <http://www.sec.gov/about/forms/form13f.pdf> for information regarding Form 13F and <http://www.sec.gov/divisions/investment/13flists.htm> for a list of securities for which disclosure is required.

time. If the investment subsequently becomes public knowledge or the need for confidential treatment ceases, the manager must file an amended Form 13F for each period confidential treatment was granted, providing information that would have been disclosed had confidential treatment not been granted.⁹

Berkshire Hathaway has often requested confidential treatment for certain investments and only recently have some of those requests been denied confidential treatment.¹⁰ Not only does confidential treatment of new investments delay the disclosure to the public of acquisitions, confidential treatment of existing investments might mistakenly indicate a divestment of a particular security. Indeed this occurred when numerous press accounts reported Berkshire had divested its holdings of Wells Fargo based upon (the lack of) information contained in the latest Form 13F. These presumptuous press accounts triggered a temporary, but significant, decline in the price of Wells Fargo's stock. Certain articles attributed the confusion about the holdings to the operation of the Commission's rules on confidential treatment of information filed on Form 13F.¹¹

A final limitation of using Form 13F is due to the requirement of reporting holdings as of the end of the calendar quarter. Any security acquired and sold between the quarterly report dates or activity that results in no net change in number of shares held from the prior report would never be disclosed as long as other regulatory reporting requirements are not triggered.

Additional sources include Schedule 13D, 13G and related amendments filings. These are required to be filed by any person within 10 days of acquisition who, directly or indirectly acquires the beneficial ownership of more than five percent of an equity security of a class specified in Section

⁹ Confidential treatment of Form 13F will limit the ability of a researcher to construct the institutional investment manager's portfolio from the Thomson Financial Institutional Holdings Data because Thomson does not "backfill" data delayed from the amended filings due to confidential treatment.

¹⁰ See *In the Matter of Berkshire Hathaway, Inc.*, File No. 28-4545, Securities Exchange Act of 1934 Release No. 43142, August 10, 2000 available at <http://www.sec.gov/rules/other/34-43142.htm>.

¹¹ See, e.g., Norris, *A Misinterpretation of a Buffett Filing Stings Wells Fargo*, NY Times (Aug. 22, 1997) at A1; Fromson, *SEC Disclosure Exemption Questioned*, Washington Post (Aug. 23, 1997) at C1; *Mixup Sheds Light on Confidential Stock Buys*, Chicago Sun-Times (Aug. 25, 1997) at 43. Further guidance on the Commission's guidelines for the confidential treatment of Form 13F filings may be found at <http://www.sec.gov/divisions/investment/guidance/13fpt2.htm>.

13(d)(1) of the Exchange Act. The information contained in these filings include, name of the security, the CUSIP number, the number of shares beneficially owned, and the date of event which requires the schedule to be filed. Changes in these holdings must be reported in an amendment to the original filing and is classified as an amended filing with a “/A” added to the original form (“13D/A” or “13G/A”) and a serial amendment number indicating the number of amendments to date. Once the holdings fall below the five percent level the filing will indicate the beneficial owner no longer meets the five percent ownership level and will no longer be subject to the reporting requirements. Berkshire Hathaway has often taken a five percent or greater position in a security which triggered the requirement of these filings. Once a holding reaches and remains above the five percent level, Schedules 13D, 13G and their amendments provide a better estimate of dates of securities transactions, but, if and only if ownership exceeds the five percent level. The shorter 13G filing is available only for certain classes of investors and only when they are not attempting a change in control. In the case of Berkshire Hathaway, a Schedule 13D filed in lieu of a 13G may signal intent to change or influence control which indeed seems to be the case with 13D filings in Salomon (where Warren Buffett served as CEO), Gillette (where Mr. Buffett served as Director) and Benjamin Moore, Comdisco Holding Co, CORT Business Services Corp, Finova Group, General Re, Justin Industries, International Dairy Queen, MidAmerican Energy Holdings, Shaw Industries, and Xtra Corp all of which became operating entities under Berkshire Hathaway. All other holdings of five percent or more without intent to influence control are reported using Schedule 13G except when insider holdings on Forms 3, 4 or 5 are reported.

A company's officers and directors, and any beneficial owners of more than ten percent of a class of the company's equity securities registered under Section 12 of the Exchange Act are considered corporate insiders and must file with the SEC a statement of ownership regarding those securities using Form 3, 4 or 5. Form 3 is used for the initial filing by an insider and must occur no later than the effective date of registration if the issuer is registering equity securities for the first time or within ten days of becoming an officer, director, or beneficial owner of securities previously registered. Changes in ownership are reported on Form 4 and must be filed at the Commission within two business days. There

are limited categories of transactions not subject to the two-day reporting requirement. A Form 5 is used to report any transactions that should have been reported earlier on a Form 4 or were eligible for deferred reporting and are required to be filed 45 days after the end of the issuer's fiscal year. Since June 30, 2003, the SEC has required insiders to submit forms electronically through the SEC's EDGAR system (prior to that date, insiders could choose, but were not required, to file electronically). The SEC also requires companies that maintain websites to post the forms by the end of the next business day after filing them with the SEC.

As with Schedule 13D and 13G and unlike Form 13F, the insider reports of Forms 3, 4 and 5, require the beneficial owner to disclose initial holdings or changes in holdings with only a short delay from the event date necessitating the filing. Warren Buffett was required to file these forms for Coca Cola and Gillette because of directorships at these firms and his status as a control person of Berkshire Hathaway which owns substantial holdings in these firms.

B. Period of Study

We searched EDGAR and the SEC's Reference Room for all ownership filings beginning in 1976 to date.¹² From each filing we record the source, transaction date, filing date, and date the filing became public, the name and CUSIP numbers of securities reported, change in number of shares owned, and market value on date of filing. We supplement this data by searching Berkshire Hathaway's annual reports, LexisNexis, and earlier regulatory filings to determine the initial acquisition of stock holdings that were reported at the beginning of the study. In order to determine the market's reaction to the initial news of a Berkshire investment we searched LexisNexis for the first date for which public disclosure occurred. If none was found we recorded the day following the date of filing as the first public disclosure

¹² As of October 16, 2007, the latest 13F filing for which data is collected was reported as of June 30, 2007.

date.¹³ The ending date of December 31, 2006 was the last date for which return data was available in CRSP.

C. Financial Data

We used the reported CUSIP and dates of holdings to gather data on net sales, total assets and common equity from *Compustat* in the fiscal year prior to the first reported holding. Monthly return, price and outstanding share data from the CRSP database was used to determine monthly returns and market capitalization. Benchmark portfolios were formed using the value-weight index of NYSE/AMEX/NASDAQ stocks with dividends from CRSP and the value-weight Fama and French 25 size and book-to-market equity returns.¹⁴

We limit our analysis to common equity investments only due to data availability. The resulting data set includes 335 common equity investments in the period from January 1, 1976 to December 31, 2006. Data is available in CRSP over the relevant period for all but three of the securities: Multimedia Inc reported on 03/31/80, Guinness PLC reported 12/31/91 and Comdisco Holdings Inc reported 12/31/02 whose initial investments were \$3.2, \$296.8 and \$113.3 million respectively accounting for approximately 0.4%, 3.0% and 0.4% of the portfolio value. Except for the univariate analysis of investment characteristics, these investments are omitted from the empirical analysis. *Compustat* data was available for all but eight firms which was gathered directly from the companies' financial reports and substituted for the *Compustat* data.

D. Arbitrage versus Long Term

Berkshire Hathaway has often used risk arbitrage as an alternative to holding short-term cash equivalents. These are arbitrage opportunities that present themselves after an announced corporate event

¹³ Each filing receives a time stamp when received at the SEC. Most of the time stamps examined occurred late in the afternoon either near or after close of the markets and, in the earlier periods, it took at least a day for the SEC to process the filing before it became available to the public.

¹⁴ Source: Kenneth R. French. Carl E. and Catherine M. Heidt Professor of Finance, Tuck School of Business, The University of Dartmouth 2004. <http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/index.html>.

such as sale of the company, merger, recapitalization, reorganization, liquidation, self-tender, etc. The major risk incurred in these investments is the risk of the event not happening. Berkshire prefers to engage in only a few large transactions each year because of the effort required to monitor the progress of transactions and the market movements of related stocks (Letter to Berkshire Shareholders, 1985). We categorized each investment into one of two investment categories: long-term or risk arbitrage. An investment was categorized as risk arbitrage *if and only if* either Warren Buffett indicated it was in Berkshire's annual reports or if *all* of the following conditions were met: (1) the investment appeared in regulatory filings after a public announcement of a merger, restructuring, liquidation or tender offer; (2) the investment holdings were disposed of after the completion or cancellation of the event; and (3) the investment was for a period of less than two years. All other investments were categorized as long-term. It may be noted there is likely to be some uncertainty in determining whether an investment is a long-term investment or a risk arbitrage investment for an investor evaluating Berkshire's investments in real time.¹⁵ Our primary purpose in making this classification is to better describe Buffett's investment methods. We also note that an investor mimicking Berkshire's investments may not be able to participate in many of the risk arbitrage investments because by the time they become public, the investment opportunity is no longer available. Also, as time passes, the opportunity to profit from arbitrage investments diminishes since uncertainties are reduced as the announced event approaches.

III. Empirical Methods

We perform three types of empirical tests to evaluate the performance and market impact of Berkshire Hathaway's stock investments. First, we use standard event study methodology to evaluate the market reaction to the news of Berkshire acquiring a stock for the first time. Second, we test the risk-adjusted investment performance of Berkshire's stock investment portfolio and a mimicking portfolio created by an investor following the investments made by Berkshire using both annual buy-and hold and

¹⁵Even Buffett, in his 1992 letter to Berkshire shareholders explained an initial investment in General Dynamics was intended as a risk arbitrage but changed into a long-term holding after evaluating the direction new CEO Bill Ander's was taking the firm. <http://www.berkshirehathaway.com/letters/1992.html>

calendar-time abnormal returns (CTAR). Finally, we test whether Berkshire's investment performance could be due to luck after controlling for ex-post selection bias using a Monte Carlo simulation technique described in Marcus (1990) to derive a close numerical approximation of the probability distribution of the best performing manager under the assumption of efficient markets.

A. Event Study

We use standard event study methodology to determine the market impact of the first public disclosure of a Berkshire Hathaway stock investment by subtracting a benchmark or expected return from the return observed on the date of disclosure to calculate the abnormal return. The benchmark used is the return of the value-weight index of all firms in NYSE/AMEX/NASDAQ with dividends from CRSP. This index is an appropriate choice over the equal-weight index due to the preponderance of large firm investments in the Berkshire Hathaway portfolio. If the disclosure of an investment by Berkshire has no market impact the abnormal returns will be not be significantly different from zero. The significance of the abnormal returns are determined using both a parametric Student's t test and a non-parametric Wilcoxon rank sum test.

B. Calendar Time Abnormal Returns

To test the long-term performance of Berkshire Hathaway's stock portfolio and a mimicking investment strategy, we use calendar-time abnormal returns. The CTAR is calculated as the difference in the return on a portfolio of stocks less the return on a benchmark portfolio or index in each calendar month over the study period. The test of abnormal performance is a t -test of the time-series average monthly abnormal return being different from zero. We first test for abnormal performance of the Berkshire Hathaway stock portfolio and then test for abnormal performance of an investment strategy which mimics Berkshire's investments after they are publicly disclosed. Due to the reporting limitations discussed above and to eliminate abnormal returns surrounding initial disclosure in the mimicking

portfolio, several assumptions were made on the timing of purchases and sales of the stocks in both portfolios.

First, since investments are reported in Form 13F filings as of the end of the quarter and actual acquisition dates are not reported, any new investments in the quarter are assumed to have occurred at the end of the first month in the quarter. For example, if a stock showed up for the first time in a filing for the quarter ending December 31, 1990, it is assumed to have been acquired at the closing price of the last trading date in October 1990. Second, a stock that no longer appears or the filing indicates a sale has taken place, it is assumed to have occurred at the closing price at the end of the month following the last reported holding. A stock that no longer appears in the Form 13F filing for the report ending June 30, 1995 is assumed to have been sold at the closing price of the last trading date in April 1995. For other filings including Schedule 13D and 13G (including amendments) and Forms 3, 4 and 5, it is assumed purchases and sales occurred at the month end closest to the event date causing the reports to be filed. These assumptions allow us to use the monthly returns file in CRSP for the investments and the monthly Fama and French size and book-to-market benchmark returns to test portfolio performance.

We use a different set of assumptions for creating the mimicking portfolio in order to exclude from the portfolio performance any potential abnormal returns surrounding the public disclosure of an initial acquisition or additions to existing Berkshire Hathaway investments. The filing of Form 13F is required 45 days from the end of the report date which results in the filing for a report dated December 31, 1990 to be made available on February 14, 1991. When creating the mimicking portfolio, we assume new investments appearing for the first time begin at the closing price of the *last trading day* of the month following the public disclosure. A new investment appearing on the December 31, 1990 report filed and made public on February 14, 1991 is assumed to start at the close on February 28, 1991. This two-week delay avoids any positive abnormal returns being included in the mimicking portfolio due to the initial reaction to the public disclosure of the investment. Similarly, when a filing indicates a sale has taken place, it is assumed to be sold in the mimicking portfolio at the closing price at the end of the filing month. This causes any negative abnormal return associated with the public disclosure of the sale to be

included in the returns of the mimicking portfolio. These assumptions bias against finding a significant positive abnormal return in the mimicking portfolio.

The effect of the filing delay and confidential treatment causes the mimicking portfolio to have fewer stocks than Berkshire Hathaway's actual portfolio and to be positively time shifted in stock purchases by an average of 223 days (122 median) and positively shifted by 48 days (31 median) in stock sales.¹⁶ Confidential treatment of holdings will cause either a further delay in its appearance in the mimicking portfolio or a premature liquidation if the stock is already in the mimicking portfolio. Each month the portfolios are rebalanced according to the calculated holdings. Since there are a total of 335 stock investments over the 372 month study period from 1976 to 2006 and the average holding period for a stock in Berkshire Hathaway's portfolio over this period exceeds 34 months, transaction costs associated with rebalancing are minimal.

Calendar-time abnormal returns are calculated each month in the study period by subtracting the return of the benchmark portfolio or index from the portfolio return. The mean and standardized mean abnormal return calculated by dividing each calendar month portfolio mean return by its corresponding standard deviation estimate are calculated. Finally, the time-series mean abnormal return is calculated to provide the estimate of portfolio performance while the standardized means are used in the time-series *t*-test. Using standardized means for the test helps to control for heteroskedasticity and provide greater weights to periods of heavy event activity (Fama (1998) and Mitchell and Stafford (2000)). We also test the abnormal performance of the mimicking portfolio using equal-weight portfolios since it may be tedious for an investor desiring to mimic Berkshire's investments to determine the appropriate weights of each investment every period.

¹⁶ For example a report for March 31, 1991 which is filed on May 14, 1991 indicates a stock is no longer held, it is assumed the stock is disposed of in the Berkshire Hathaway portfolio on January 31, 1991 and the mimicking portfolio on May 30, 1991. Due to confidential treatment of some filings, a security may be removed from the mimicking portfolio before Berkshire Hathaway actually sells the stock (see footnote 8 regarding Wells Fargo & Co.).

We use two different benchmarks: (1) the value-weight index return with dividends of all stocks from CRSP; and (2) a portfolio created by using the returns from the value-weight 25 size and book-to-market equity portfolios of Fama and French (1993) selected in a manner designed to match the risk of the investments. The Fama and French characteristic-based benchmark was constructed by selecting for each firm-month the return associated with a portfolio of firms with similar market equity at the beginning of the month and book-to-market equity from the last reported fiscal year end. These benchmarks are used because Berkshire Hathaway's investment portfolio predominantly consists of large firms.

C. Monte Carlo Simulation of Best Performing Manager under Efficient Markets

We create a hypothetical benchmark of the best investment performance assuming EMT holds to test whether the performance of an investor chosen ex-post is due to luck or superior skill (Marcus, 1990). According to Marcus (1990) when assessing performance *after* it is known to be outstanding the standard market benchmarks no longer apply. The appropriate benchmark is the *best* performance from a sample of returns from many managers assuming EMT holds. The probability distribution of the best performance can be derived through Monte Carlo simulation using the experiment described in Marcus (1990). The simulation starts as a contest between (n) managers each of whom flips a coin a number of trials (t). The winning manager and score are determined by manager with the greatest number of heads (h) that occurred in the (t) flips. This procedure is repeated over a large number of trials ($n \geq 10,000$) to create a frequency distribution of the winning score. The winning score (h) will be an increasing function of the number of managers (n) and the number of flips (t) in the contest. The frequency distribution of the winning score provides an estimate of the probability distribution of the best performance due to luck in an efficient market. The number of standard deviations from the mean represents the margin by which the winning manager beats the market in an efficient market due to luck

$(M_{n,t} = (\max(h_{n,t}) - \bar{h}_{n,t})/\sigma_{n,t})$. However, when evaluating investment results under efficient markets, the winning manager's margin is also dependent on the amount of risk or volatility the manager

assumes (manager-specific risk). Winning managers using high variance strategies will result in higher winning margins. If manager-specific risk (noise) due to high volatility strategies in the market has a standard deviation of $\hat{\sigma} = 15\%$ per year, under the normal distribution it would imply that about one-third of the managers would perform either better or worse than the market by a margin of 15% (Figure 1). This implies the estimated standard deviation of average annual returns over a 31-year period ($\sigma_t = \hat{\sigma}/\sqrt{t}$) is $15\%/\sqrt{31} = 2.69\%$. Multiplying the number of standard deviations by which the winning manager in the Monte Carlo simulation beats the market ($M_{n,t}$) by the standard deviation of average annual returns (σ_t) produces the benchmark of the expected margin by which the winning manager will beat the market ($E(r_{n,t}|EMT) = M_{n,t}\sigma_t$). The benchmark will be an increasing function the number of managers (n), the number of trials (t), and the assumed manager-specific risk or noise level ($\hat{\sigma}$) due to luck in an efficient market.

IV. Empirical Analyses

A. Investment Characteristics

We classify Berkshire Hathaway's stock portfolio into three separate categories based upon different investment philosophies. The first group consists of stocks from firms acquired through a tender offer and includes Benjamin Moore, Blue Chip Stamps, CORT Business Services, GEICO, General Re, International Dairy Queen, Johns Manville, Justin Industries, MidAmerican Energy Holdings, Scott & Fetzer, Shaw Industries, and XTRA Corp. The second consists of 221 long-term investment horizon stocks characterized by large stakes in large firms in few industries. The third consists of 104 short-term risk-arbitrage investments that were either labeled by Warren Buffett in Berkshire annual reports as arbitrage investments or were categorized as such if following conditions were met: (1) the investment period for the stock was one year or less; (2) the investment appeared in regulatory filings after a public announcement of a merger, restructuring, liquidation or tender offer; (3) the resulting investment holdings were disposed of after the completion of the event. Table 1 provides univariate statistics for the three

distinct investment classes and statistical tests between long-term holdings and short-term risk-arbitrage investments using, holding period, initial and average ownership levels, market capitalization, total assets, common equity and book-to-market of the 335 stock investments during the study period. Three of the 221 long term investments do not have returns available in CRSP during Berkshire's holding period: Multimedia Inc, Guinness PLC and Comdisco Holdings Inc.

The long-term holding stocks have a mean (median) holding period of 46.15 (18.50) months exceeding the 8.31 (9.74) months for the risk arbitrage stocks at $p\text{-value} < 0.0001$. The mean (median) of initial ownership stake in the long-term holding stocks is 2.66% (0.57%) is not statistically different from the 2.50% (0.81%) ownership for the risk arbitrage stocks. Similarly the average ownership stake of 3.42% (1.09%) for long-term holding stocks is not statistically different from the 2.51% (0.89%) for risk arbitrage stocks. The mean (median) market capitalization of the long-term holding stocks are \$11.24b (\$2.12b) are also not statistically different from the \$7.38b (\$1.86b) for risk arbitrage stocks. The mean total assets of the issuers of the long-term holdings stocks are slightly higher at \$20.46b compared to \$12.62b for risk-arbitrage stocks at a $p\text{-value} < 0.0830$. The medians are approximately the same at \$2.77b and \$3.86b respectively. The mean value of book equity for issuers of long-term holding stocks is \$5.30b and \$3.35b for risk arbitrage stocks different at a $p\text{-value} = 0.0665$. The medians are not statistically different at \$1.01b and \$1.23b respectively. The mean initial book-to-market ratio of the issuers of both the long-term holding and risk arbitrage stocks is 0.80 while the medians are 0.64 and 0.63 respectively.

True to the philosophy of investing in businesses which they can understand and are comfortable with, Table 2 shows a highly concentrated portfolio both by industry and size. Nearly forty-two percent (140 of 335) are in manufacturing, followed by 21% (72) in finance, insurance and real estate services and 16% (55) in transportation, communication, electric, gas and sanitary services. Sixty-six percent (221) are in the largest three size deciles by market capitalization of equity. A Chi-square test of equal expected proportions supports the findings of industry concentration in at least one of the industry groups at a $p\text{-value} < 0.001$ level as does the concentration in at least one of the size deciles. Industries with the

highest concentrations of stock investments are also those in which Berkshire Hathaway's operating subsidiaries are engaged. The largest five holdings average 73.1% of the total portfolio also indicating a high degree of concentration. Overall, this suggests that Berkshire's investments are generally consistent with its stated investment philosophy. However, it may be noted that while the large core holdings tend to be held for long periods of time, smaller investments are often held for relatively shorter periods.

Contrary the financial press characterization of Buffett as a "value" investor, we categorize the investments by the six Fama and French size and book-to-market equity groupings and find the largest group to be "Large Cap-Growth." We use market value of equity from CRSP at the time of investment to categorize investments into small versus big stocks using the 50th percentile breakpoint as the division. Value versus growth is based upon book-to-market ratios calculated using common equity from Compustat in the last reported fiscal year prior to investment divided by in the market value of equity at the time of investment. Value stocks are firms with book-to-market ratios greater than the 70th percentile while growth stocks have book-to-market ratios less than the 30th percentile of all book-to-market ratios. As shown in Table 3, 77% (259) investments fall into the large cap category (market equity \geq 50th percentile) while 41% (138) fall into the low book-to-market or growth category (book-to-market equity \leq 30th percentile). Since only 19% (64) fall into the value category and 23% (76) fall into the small category, Berkshire's strategy would be best characterized as a large cap-growth investment strategy. This is an important finding since a number of papers (e.g. Lakonishok, Shleifer and Vishny (1994)) have documented that stocks identified as "value" stocks outperform "growth" stocks over the subsequent five year period. Lakonishok et al. suggests that investors extrapolate the bad news associated with value stocks too far (underpricing them) and the good news associated with growth stocks (overpricing them). Fama and French (1993), on the other hand, suggest the higher returns associated with "value" stocks is due to risk. Not being a traditional "value" investor, Buffet's performance suggests the traditional explanation for the abnormal performance by "value" stocks is not applicable for explaining Berkshire's portfolio performance. Berkshire's performance does not appear to be driven by buying traditional

“value” stocks (i.e. beaten down stocks), but rather by buying stocks whose growth potential is undervalued by the market.

B. Market Reaction to Initial Public Disclosure of Berkshire Hathaway Investments

Table 4 presents the results of an event study using the initial disclosure of 208 of the 335 stocks in Berkshire’s portfolio. The event study sample size is less than the total number of investments in the period from 1976 to 2006 for several reasons: (1) five stocks are not included in the CRSP files; (2) twenty-two investments were not publicly trading at the time of announcement; and (3) the disclosure date is unknown for 100 stocks.

In Panel A, the mean (median) market-adjusted return of the first public disclosure of 208 Berkshire Hathaway stock investments between 1976 and 2006 is 4.03% (1.36%). However, when we separate the ten acquisition stocks the market-adjusted return drops to 3.09% (1.20%) significant at a p-value < 0.001. Additionally 84.42% of the announcements have a positive abnormal return.

Panel B partitions the initial disclosure of stock investments (omitting acquisitions) between the first half of the study period from January 1976 to June 1991 and the second half from July 1991 to December 2006. The mean (median) abnormal return of disclosures in the first half is 0.82% (0.73%) significant a p-value < 0.001 level. The mean (median) abnormal return of disclosures in the second half are significantly higher at 4.40% (1.89%) also significant at p-value < 0.001. A t-Test of the difference in the means is significant at a p-value < 0.001 and a non-parametric Wilcoxon rank sum test is also significant at a p-value < 0.001.

The difference between the first half and the second half could be for a variety of reasons. As more investors recognize the investment prowess of Warren Buffett, the disclosures would have a greater impact in the second half. It is also possible, due to the less comprehensive coverage of news sources over the first half of the study; we were unable to record the correct public disclosure date. This problem becomes less of an issue after the late 1980s due to the growth of electronic medium. We interpret the positive stock price reaction as evidence that the market views Berkshire’s buying a stock as a signal of

positive future risk-adjusted returns and this signal has become stronger as the investment success of Buffett has become more well-known. The significant stock price reaction to the news of Berkshire buying a stock suggests that Berkshire's investments are heavily followed by copy-cat investors.

C. Berkshire's Long-term Investment Performance

The results of the calendar time abnormal return test of the Berkshire Hathaway portfolio, presented in Table 5 Panel A, indicate that Berkshire has obtained significant positive abnormal risk-adjusted returns. The monthly mean (median) CTAR of the stock investment portfolio using Fama & French 25 size and book-to-market portfolio returns as a proxy for expected returns is 0.53% (0.53%), significant at a p-value < 0.003 (0.001) level. Using the value weight returns of all stocks in CRSP as a proxy for expected returns, the monthly mean (median) CTAR of the stock investment portfolio is 0.72% (0.53%), significant at a p-value < 0.001 (0.001) level. This equates to an annualized excess return of 6.55% over the Fama and French 25 size and book-to-market equity benchmark portfolio and an annualized excess return of 8.99% over the value weight index. Similarly, the CTAR performance of the mimicking portfolio also beats the Fama and French and value-weight index as indicated in Panel B of Table 5.

Table 6 presents the results of factor regressions using the Fama and French 3-Factor and Carhart 4-Factor models on the returns of both the Berkshire Hathaway and mimicking portfolios. The alphas or intercept terms are all statistically significant at p-values < 0.025 as are the excess market return and high-minus low book-to-market factors at p-values < 0.001 . The small-minus-big market equity and prior 2-12 month return momentum factors are not significant in explaining the returns of either portfolio.

Table 7 presents an annual comparison of the performance of Berkshire Hathaway's stock investment portfolio with the return on Berkshire Hathaway stock, the return on the S&P 500 Index, the value weight index of all stocks, and the portfolio formed using returns from the value weight 25 Fama and French size and book-to-market equity portfolios. There is only one year, 2001, when the Berkshire investment portfolio experiences a negative return. Over the 31 year period from 1976 to 2006, the

returns on the Berkshire portfolio exceeded the returns on the S&P 500 Index in all but three years with the average annual return exceeding the S&P 500 by 14.65%. Average annual excess returns using the value weight and Fama and French benchmark portfolio are 10.91% and 8.56%.

D. Potential Explanations for Berkshire's Investment Performance

1. Risk

The positive and significant results using the calendar time abnormal returns methodology indicates that risk does not appear to explain Berkshire's performance. Since this methodology controls for risk using benchmark portfolios, it suggests that Berkshire obtained positive and significant risk-adjusted returns. As robustness check, we calculated a Berkshire portfolio Beta of 0.811 over the sample period. Additionally, the Beta of 0.880 was slightly higher in the first half of the sample period (January 1976 - June 1991) than a beta of 0.725 over the second half (July 1991- December 2006). This implies that Berkshire's portfolio appears slightly *less* risky than the market. This indicates that Berkshire's investment performance cannot be explained by higher portfolio risk.

2. Luck

By the start of our sample period in 1976 Buffett had already established a reputation as a successful investor; however, there may still have been uncertainty about his future success (Statman and Scheid (2001)). Since we chose Buffett due to his successful record, we should not be surprised to find his performance far exceeds the market. We also know after-the-fact some managers will have been lucky. So, the question becomes when is the performance of a manager so good that even after accounting for the bias associated with selecting the ex-post most successful investor, pure chance cannot account for the performance? In assessing the performance of ex-post most successful investors, the appropriate benchmark should therefore be the best return from the returns of many investment managers. We use the Monte Carlo simulations proposed by Marcus (1990) to derive a close numerical approximation of the probability distribution of the best performance of a sample of managers assuming that the markets are efficient. Once derived, we can compare Berkshire's performances with that of the

best performing manager to determine if abnormally good performance is evidence of an ability to beat the market after accounting for the fact that we have selected ex post, the best performing investor.

Table 8 Panel A provides the frequency distribution of the Monte Carlo simulations prescribed by Marcus (1990) for 173, 1,407 and 2,591 managers¹⁷. In the experiment using 173 managers, the chance of a winning manager beating the market as many years or more as Buffett (28) over the 31-year period is 0.01%. Increasing the number to 1,407 managers, the probability of a beating the market 28 years or more increases to 0.31% and for 2,591 managers the probability is 0.56%. Using the conventional 10% significance level, we therefore can reject the hypothesis that Berkshire's beating the market in 28 out of 31 years is due to chance. That is, once we take into consideration that Berkshire is not an investor chosen at random, but one that has been identified as an ex-post winner, the frequency with which it beats the market is high enough to constitute a contradiction of market efficiency.

This test, however, ignores the magnitude by which Berkshire outperformed the market over the period. As indicated in Table 8, the mean winning margin of the best performing manager is 2.65, 3.24, and 3.39 standard deviations in a contest of 173, 1,407 and 12,591 managers respectively. However, one would expect the extent to which the best performer beats the market would also depend on the volatility of the manager-specific bets or risk. High variance strategies will result in a winning manager with a large margin over the market so the expected return for the best performing manager is also a function of manager-specific risk or noise in the market. By assuming some noise level, we can estimate the standard deviation of the manager-specific risk and include it in the margin of the winning manager's score in the simulation to derive the expected return benchmark of the best performing manager. Berkshire's return can then be tested against the expected return benchmark of the best performing manager at a given noise level. The drawback to this approach is determining how much noise is in the market.

¹⁷ We choose 173 since this is the number of unique investment managers in the CDA/Spectrum Institutional Money Manger 13(f) Holdings database from Thomson Financial with holdings over the entire available data period from 1979 - 2006; 1,407 is the annual average number of investment managers over this period, and 2,591 represents the maximum number of investment managers in one year. Used with permission. All rights reserved.

The standard deviation of noise is a function of the square root of time. For example, at a given noise level of 10%, the standard deviation of manager-specific noise for the 31-year period is $10\%/31^{1/2} = 1.80\%$. It is helpful to think in terms of the probability distribution of the assumed noise level. An assumed noise level of 10% is analogous to one-third of all managers performing better or worse than the market by at least 10%. According to Capital Resource Advisors (formerly SEI) the median tracking error of fund managers is approximately 5%. Using the CDA/Spectrum Institutional Money Managers 13(f) Holdings data base and merging it with CRSP, we estimate the noise level to be 13.65% by finding the noise level that provides a distribution such that one-third of the managers perform greater than or less than that level. We therefore establish benchmarks for levels of noise ranging from 5% to 20% including the 13.65% empirically estimated noise level (Figure 1).

Table 9 Panel A provides the results of a test of the performance of the Berkshire Hathaway against the expected return of the best performing manager at noise levels of 5% to 20% and number of managers of 173, 1,407 and 2,591. The mean annual excess performance of 14.65% for the Berkshire Hathaway portfolio exceeds the expected returns of the best performing investment manager at $p\text{-value} < 0.001$ for all managers/noise combination levels except for the 20%-noise/173-manager combination which is significant at a $p\text{-value} < 0.011$. Once we account for the magnitude by which Berkshire beats the market, performance due to “luck” is very unlikely and we conclude Berkshire’s performance cannot be explained as due to luck or chance after accounting for ex-post selection bias.

3. Evidence using long term returns to a mimicking portfolio

The preceding arguments suggest that Berkshire’s performance is not due to higher levels of risk or pure luck, explanations which are consistent with EMT. However, under Grossman and Stiglitz’s (1980) interpretation of EMT, positive abnormal returns may be compensation for information production that keeps market efficient. If this is correct, Berkshire’s positive risk-adjusted performance is still potentially consistent with EMT. If we find that if an investor who mimics Berkshire investment portfolio earns positive abnormal returns, this would suggest that the information produced by skilled investors does not get transmitted quickly into stock prices and would appear inconsistent with the

Grossman and Stiglitz prediction of EMT. Table 9 Panel B provides the results of a test of the performance of the mimicking portfolio against the expected return of the best performing manager at noise levels of 5% to 20% and number of managers of 173, 1,407 and 2,591. The mean annual excess performance of 14.26% for the mimicking portfolio exceeds the expected returns of the best performing manager at manager noise levels of 15% and below at a p-value < 0.001 . At the 20% manager noise level with 173 managers the p-value < 0.021 . Therefore at any noise level up to 20%, the performance of the mimicking portfolio exceeds the performance of the best performing manager under efficient market theory. Noise levels of greater than 20% are not likely under EMT. The magnitude by which mimicking portfolio beats the market indicates that information does not get transmitted quickly into stock prices and therefore appears inconsistent with the Grossman and Stiglitz interpretation of EMT. Overall, we conclude the performance of Berkshire Hathaway's investment portfolio indicates superior investment skill in direct contradiction to Efficient Market Theory.

IV. Conclusion

This paper provides one of the most rigorous analyses of Berkshire Hathaway's investment performance to date. We analyze Berkshire Hathaway's investment style and explore potential explanations for its superior investment performance. We show that Berkshire's investment style is better described as a large-cap growth style contrary to the popular notion of Buffett being a traditional "value" or "contrarian" investor. Hence, Berkshire's performance does not appear to be driven by buying traditional "value" stocks (i.e. beaten down stocks) but by buying stocks whose growth potential is undervalued by the market.

We explore a number of potential explanations for Berkshire's investment performance. Since Buffett has been identified ex-post as a successful investor, we should not be surprised to find his performance is far above the mean. We use the Monte Carlo simulation methodology proposed by Marcus (1990) to derive a close numerical approximation of the probability distribution of the best performance of a sample of managers, assuming that markets are efficient. Using this as a benchmark, we

assess whether Berkshire's performance is evidence of an ability to beat the market even after accounting for the fact that we have selected the best performing investor. We show that under reasonable assumptions, pure luck appears to be an unlikely explanation for Berkshire's performance.

We then examine whether Berkshire's high investment returns is a result of high risk in its stock portfolio. We compute calendar time abnormal returns using three benchmarks and find that returns to Berkshire's investment are statistically greater indicating that Berkshire's investment performance is not being driven by high risk.

We evaluate the performance of an investment strategy that mimics Berkshire's investments after they are publicly disclosed to evaluate how quickly information produced by skilled investors gets incorporated into stock prices. We find that an investor who mimicked Berkshire's investments from 1976 to 2006 after they were publicly disclosed in regulatory filings could obtain calendar time positive annualized abnormal returns significantly greater statistically and economically over returns of three different benchmarks of similar risk characteristics. This would suggest that the market under-reacts to the information that Berkshire has bought a stock and indicates that the market is slow in incorporating the information produced by skilled investors. So, while Grossman and Stiglitz's interpretation of EMT allows for the existence of skilled investors who earn positive abnormal returns while ensuring the efficiency of markets, the slow incorporation of their information into stock prices appears inconsistent with traditional predictions of EMT.

We also examine the stock price reaction to the news of Berkshire buying a stock. We find that the market reacts positively to the public disclosure of a Berkshire Hathaway stock investment with the market reaction becoming stronger in the second half of the study period. This suggests that the market views Berkshire's buying a stock as a signal of positive future risk-adjusted returns and this signal has become stronger as the investment success of Buffett has become more well-known. The significant stock price reaction to the news of Berkshire buying a stock suggests that Berkshire's investments are heavily followed by copy cat investors.

We conclude that Warren Buffett appears to possess investment skill. This result is consistent with findings in a number of recent papers such as Chen, Jegadeesh and Wermers (2000), Cohen, Coval and Pastor (2005), Wermers (2000) and Kosowski, Timmermann, Wermers and White (2005) that argue that investment skill is more prevalent than earlier papers indicate.

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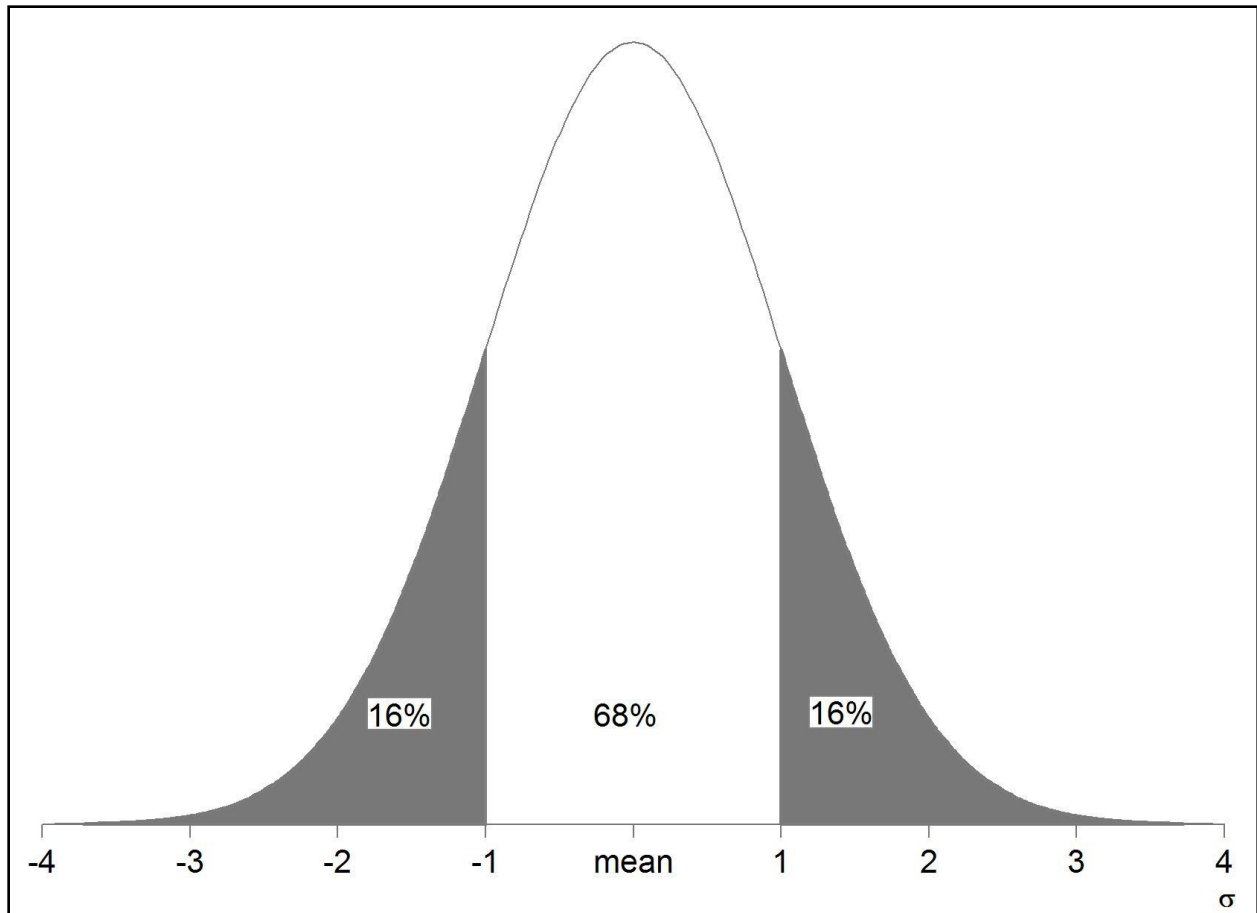


Figure 1: Manager-Specific Risk (Noise) under Efficient Markets

Under efficient markets using the normal distribution the assumed level of manager-specific risk (noise) would imply that 16% of the managers would perform better and 16% worse than the market average by the assumed level. Prior empirical research estimates this level to be from 5% to 20%. Using the CDA/Spectrum Institutional Money Managers 13(f) Holdings data base and merging it with CRSP we empirically estimate this level is 13.65%.

Table 1: Characteristics of Berkshire Hathaway Common Equity Investments 1976 to 2006

Characteristics of common equity investments by Berkshire Hathaway from 1979 to 2006. *Acquisition* stocks are from firms in the process of being acquired by Berkshire Hathaway as operating entities, *Long-Term Holding* stocks are long-term investment holdings and *Risk Arbitrage* stocks are short-term risk arbitrage investments. Ownership percentages are calculated using reported shares owned and shares outstanding in the initial investment month, the average monthly percentage ownership by holding over the entire period, and the month corresponding to the maximum percentage ownership of the stock. *Market capitalization* is determined at the end of the month prior to the first date of holding. *Total assets*, *Book equity*, and *Book-to-market* are based on the latest reported values in the fiscal year end prior to the initial investment. Univariate tests are presented between *Long-Term Holding* and *Risk Arbitrage* investments. The top *Test Statistic* and corresponding *p-value* is based upon a parametric Satterthwaite t-test for samples of unequal variances and the bottom a normal approximation of a non-parametric Wilcoxon rank sum test.

		All Stocks	Acquisition	Long-Term Holding	Risk Arbitrage	Long-Term vs. Risk Arbitrage	
						Test Statistic	p-value
Number of stocks	N	335	10	221	104		
Holding period (months)	Mean	34.32	4.20	46.15	12.07	8.31	<.0001
	Median	18.00	4.00	18.50	8.00	9.74	<.0001
	Min	2.00	2.00	5.00	2.00		
	Max	412.00	7.00	412.00	71.00		
Initial ownership stake	Mean	3.02%	16.38%	2.66%	2.50%	0.24	0.8141
	Median	0.71%	18.29%	0.57%	0.81%	-0.90	0.3686
Average ownership	Mean	3.54%	17.11%	3.42%	2.51%	1.31	0.1909
	Median	1.11%	18.29%	1.09%	0.89%	0.12	0.9078
Market capitalization (\$MM)	Mean	9,781.64	2,402.45	11,243.98	7,383.70	1.34	0.1822
	Median	1,866.76	532.22	2,116.35	1,863.03	0.09	0.9289
	Min	13.21	228.41	13.21	19.18		
	Max	346,041.97	16,822.64	346,041.97	179,515.77		
Total assets (\$MM)	Mean	17,591.19	5,864.92	20,463.36	12,615.35	1.74	0.0830
	Median	3,008.05	1,020.79	2,773.00	3,861.10	-0.36	0.7179
	Min	1.11	229.43	1.11	50.03		
	Max	673,342.00	41,459.00	673,342.00	152,910.36		
Book equity (\$MM)	Mean	4,575.92	1,426.25	5,296.22	3,348.12	1.84	0.0665
	Median	1,051.89	519.71	1,005.00	1,230.85	-0.36	0.7160
	Min	-553.00	183.03	-416.60	-553.00		
	Max	125,684.00	9,041.00	125,684.00	38,455.59		
Book-to-market	Mean	0.80	0.73	0.80	0.80	-0.07	0.9415
	Median	0.64	0.66	0.64	0.63	0.35	0.7274
	Min	-0.37	0.54	-0.37	-0.16		
	Max	7.05	1.37	7.05	3.07		

Table 2: Distribution of Berkshire Hathaway Investments by Industry and Firm Size

Distribution of Berkshire Hathaway investments from 1976 to 2006 by the SIC-based industry and portfolio size-based deciles. Industry is determined by SIC code partitioned into the SIC Division structure. Size deciles are based on market value of equity relative to NYSE firms in the CRSP database at the end of the month prior to the first date of holding. Chi-square test of proportions indicates at least one size based deciles ($\chi^2 = 321.99$, p-value = <.0001) and one industry classification ($\chi^2 = 370.27$, p-value = <.0001) contain more observations than expected.

SIC Division	Industry	Total Firms	Sized-Based Deciles									
			Larger Firms					Smaller Firms				
			10	9	8	7	6	5	4	3	2	1
01 - 09	Agriculture, Forestry & Fishing	0	-	-	-	-	-	-	-	-	-	-
10 - 14	Mining	7	4	-	1	1	1	-	-	-	-	-
15 - 17	Construction	1	-	-	-	1	-	-	-	-	-	-
20 - 39	Manufacturing	140	66	18	22	7	5	9	5	1	3	4
40 - 49	Transportation, Communication, Electric, Gas & Sanitary Services	55	17	12	10	7	2	2	-	3	2	-
50 - 51	Wholesale Trade	3	-	-	1	-	-	-	1	1	-	-
52 - 59	Retail Trade	24	12	3	3	1	2	-	1	1	1	-
60 - 67	Finance, Insurance, & Real Estate	72	18	14	4	3	4	6	7	4	5	7
70 - 89	Services	33	7	3	6	2	2	-	5	3	2	3
	Total	335	124	50	47	22	16	17	19	13	13	14

Table 3: Distribution of Berkshire Hathaway Investments by Fama & French Size and Book-to-Market Equity Classification

Distribution of Berkshire Hathaway stock investments from 1976 to 2006 using Fama & French small vs. big (size) and value vs. growth (book-to-market equity) classification. The classification is based upon portfolios constructed at the end of each June, as the intersection of 2 portfolios formed on size (market equity) and 3 portfolios formed on the ratio of book equity to market equity. The size breakpoint for year t is the median NYSE market equity at the end of June of year t. BE/ME for June of year t is the book equity for the last fiscal year end in t-1 divided by ME for December of t-1. The BE/ME breakpoints are the 30th and 70th NYSE percentiles. The firms are classified based upon the book value from the latest annual financial information available and the market equity value at the end of the month prior to the first date of holding.

Book-to-Market Equity	Market Equity		Total
	Small	Big	
Value ($\geq 70^{\text{th}}$ percentile)	27	37	64
Neutral	31	95	126
Growth ($\leq 30^{\text{th}}$ percentile)	17	121	138
Negative	1	6	7
Total	76	259	335

Table 4: Abnormal Returns of Initial Public Disclosure of Berkshire Hathaway Investments

Average market-adjusted returns of first public disclosure of Berkshire Hathaway stock investments between 1976 and 2006. Abnormal returns are measured on the day of public disclosure relative to the value weighted index of all stocks in CRSP. Panel A contrasts acquisition announcements and investment announcements consisting of long-term and risk arbitrage investments. Panel B compares the results of the first half of the study period with the second half pre and post June 30, 1991. Announcement returns are not available for some stocks due to: (1) returns unavailable from CRSP or other sources; (2) investment unavailable due to not trading; and (3) public announcement date unknown. Parametric test uses the Student's *t* distribution and non-parametric test uses the Wilcoxon rank sum test.

Panel A: Abnormal Returns by Announcement Type

	All Stocks	Acquisition	Investment	Test Statistic	p-value
Number of stocks	335	10	325		
Returns unavailable	5	1	4		
Investment unavailable	22	0	22		
Announcement unknown	100	0	100		
Available returns	208	9	199		
Percent positive	85.10%	100.00%	84.42%		
Mean	4.03%	24.91%	3.09%	-1.97	0.083
t	6.71	3.53	6.91		
Prob > t	<.001	0.008	<.001		
Median	1.36%	22.62%	1.20%	2.40	0.017
s	8,922.0	22.5	8,005.5		
Prob > s	<.001	0.004	<.001		

Panel B: Disclosure of Stock Investments Pre and Post June 30, 1991

	All Investments	1 st Half Pre-06/30/91	2 nd Half Post-06/30/91	First Half vs. Second Half Test Statistic	p-value
Number of stocks	325	174	151		
Returns unavailable	4	2	2		
Investment unavailable	22	7	15		
Announcement unknown	100	92	8		
Available returns	199	73	126		
Percent positive		72.60%	91.27%		
Mean		0.82%	4.40%	-5.15	<.001
t		4.35	6.57		
Pr > t		<.001	<.001		
Median		0.73%	1.89%	-5.06	<.001
s		759.5	3,608.5		
Pr > s		<.001	<.001		

Table 5: Calendar-Time Returns of Berkshire Hathaway and Mimicking Portfolios

Monthly calendar-time returns (CTRs) of Berkshire Hathaway stock investment portfolio and mimicking portfolio from 1976 to 2006. Mean and median CTRs are calculated each month as the difference between the portfolio return and the expected return represented by a value weight index of all stocks in CRSP and a portfolio formed using the returns from the Fama & French 25 size and book-to-market equity portfolios. The Fama & French size and book-to-market equity benchmark portfolio is created by selecting for each firm the corresponding monthly returns from the 5 x 5 matrix of value weight returns and weighting by the matching investment in the Berkshire Hathaway portfolio. The corresponding cell in the 25 size and book-to-market equity matrix is determined using market equity of the firm at the beginning of the month and the book value of equity from Compustat in the fiscal year end prior to the reported quarter. Student's t tests and resulting p-values are based upon the mean CTAR standardized by the portfolio residual standard deviation. Non-parametric tests of medians are based upon Wilcoxon rank sum tests. Panel A presents the return on Berkshire Hathaway's portfolio calculated based upon the investment weights as reported in regulatory filings with monthly prices and returns from CRSP. Panel B presents returns on a mimicking portfolio formed each month beginning the month after the investment is reported in regulatory filings. Monthly portfolio returns are formed using both investment weights and equal weights. The investment opportunity in a mimicking portfolio is restricted due to delay in filings, confidential 13F filings and Berkshire Hathaway arbitrage activities.

Panel A: Berkshire Hathaway's Portfolio

Benchmark	N	%Pos	Mean	t	Pr > t 	Median	s	Pr > s
S&P 500 Index	372	64.5%	1.01%	5.30	<.001	0.91%	12,544	<.001
Value Weight Index	372	59.9%	0.72%	3.74	<.001	0.53%	9,315	<.001
Fama & French 25 Size- BE/ME Portfolio	372	58.9%	0.53%	2.95	0.003	0.53%	7,468	<.001

Panel B: Mimicking Portfolio

Portfolio/Benchmark	N	%Pos	Mean	t	Pr > t 	Median	s	Pr > s
S&P 500 Index	372	65.6%	0.99%	5.08	<.001	0.88%	12,100	<.001
Value Weight Index	372	59.4%	0.71%	3.57	<.001	0.61%	8,910	<.001
Fama & French 25 Size- BE/ME Portfolio	372	58.9%	0.50%	2.75	0.006	0.51%	7,100	<.001

Table 6: Factor Regressions of Berkshire Hathaway and Mimicking Portfolios

Fama & French three factor and Carhart four factor regressions of Berkshire Hathaway stock investment portfolio and mimicking portfolio from 1976 to 2006. Portfolio returns for each month are regressed on the three/four factors shown to explain returns in Fama and French (1993) and Carhart (1997) respectively. The Fama/French factors are constructed using the 6 value-weight portfolios formed on size and book-to-market. *Small-minus-big* is the average return on the three small market capitalization portfolios minus the average return on the three big market capitalization portfolios. *High-minus-low* is the average return on the two value portfolios (high book-to-market) minus the average return on the two growth (low book-to-market) portfolios. *Excess return on the market* is the value-weight return on all NYSE, AMEX, and NASDAQ stocks (from CRSP) minus the one-month Treasury bill rate (from Ibbotson Associates). *Momentum* is the average return on the two high prior return portfolios minus the average return on the two low prior return portfolios formed by the intersections of 2 portfolios formed on size (market equity) and 3 portfolios formed on prior (2-12) monthly return. The monthly size breakpoint is the median NYSE market equity. The monthly prior (2-12) return breakpoints are the 30th and 70th NYSE percentiles. P-values using robust standard errors are presented below coefficient estimates.

Variable	Berkshire Hathaway Portfolio		Mimicking Portfolio	
	Fama & French 3-Factor Model	Carhart 4-Factor Model	Fama & French 3-Factor Model	Carhart 4-Factor Model
Intercept	0.0045 (0.012)	0.0044 (0.019)	0.0045 (0.016)	0.0044 (0.024)
Excess market return	1.0450 (<.001)	1.0459 (<.001)	1.0256 (<.001)	1.0263 (<.001)
Small-minus-big (market equity)	-0.0148 (0.880)	-0.0177 (0.856)	-0.0052 (0.960)	-0.0070 (0.946)
High-minus-low (book-to-market)	0.5546 (<.001)	0.5573 (<.001)	0.5565 (<.001)	0.5582 (<.001)
Momentum (prior 2-12 returns)		0.0175 (0.766)		0.0109 (0.865)
F Value	179.76	134.56	162.51	121.59
Pr > F	<.001	<.001	<.001	<.001
Adj R-Square	59.11%	59.02%	56.64%	56.52%

Table 7: Berkshire Hathaway Stock Portfolio vs. Benchmarks.

Annual performance summary of Berkshire Hathaway stock investment portfolio return and various benchmarks. The return on Berkshire Hathaway stock portfolio is calculated based upon the investment weights at the end of a reported quarter with monthly returns from CRSP for the three months that correspond to the quarter's end. *N* and *Value* are the number of stocks and the portfolio value at the end of each calendar year. *Largest 5 Holdings* is the percentage of the portfolio value the 5 largest holdings represent and *Return* is the return on the stock portfolio for the year. *Turnover Ratio* is calculated as the minimum of the sum of total purchases and total sales divided by average portfolio value. The *S&P 500 Index* return is reported in the 2003 Berkshire Hathaway Annual Report and *the Value Weight Index* is the value-weight index of all stocks listed in CRSP. The Fama & French 25 size and book-to-market equity portfolio is calculated by creating a portfolio of stock returns corresponding to the cell each firm would fall based upon the 5 x 5 matrix of quintiles created by market equity and the book-to-market equity ratio.

Year	Berkshire Hathaway Stock Portfolio				Benchmarks					
	N	Value	Largest 5 Holdings	Return	S&P 500 Index		Value Weight Index		F&F 25 Size-BE/ME	
					Return	Difference	Return	Difference	Return	Difference
1976	11	\$125	77.2%	121.12%	19.15%	101.97%	26.77%	94.35%	44.41%	76.71%
1977	19	196	55.4	16.43	-11.50	27.93	-2.98	19.41	13.52	2.92
1978	22	290	56.5	12.99	1.06	11.92	8.54	4.44	12.98	0.01
1979	96	534	45.5	24.64	12.31	12.33	24.41	0.23	24.37	0.27
1980	110	665	49.1	13.34	25.77	-12.43	33.23	-19.89	34.54	-21.19
1981	29	748	64.2	26.63	-9.73	36.36	-3.98	30.61	2.93	23.70
1982	25	1,162	71.5	46.50	14.76	31.74	20.42	26.08	22.57	23.94
1983	15	1,405	85.8	34.78	17.27	17.51	22.65	12.13	26.34	8.43
1984	18	1,394	76.6	10.13	1.40	8.72	3.16	6.96	2.14	7.99
1985	14	1,467	83.3	71.95	26.33	45.61	31.41	40.53	34.61	37.33
1986	11	2,115	95.4	21.46	14.62	6.84	15.56	5.90	12.16	9.31
1987	15	2,499	95.3	18.56	2.03	16.54	1.82	16.74	5.11	13.46
1988	20	3,730	87.4	18.53	12.40	6.13	17.55	0.98	10.36	8.17
1989	12	5,741	93.0	50.20	27.25	22.95	28.43	21.77	31.80	18.40
1990	13	5,819	91.6	0.00	-6.56	6.56	-6.08	6.08	4.91	-4.91
1991	16	10,295	85.0	43.36	26.31	17.05	33.64	9.71	43.35	0.01
1992	18	12,890	78.3	15.70	4.46	11.23	9.06	6.63	7.56	8.14
1993	24	13,652	70.8	9.73	7.06	2.68	11.59	-1.85	1.49	8.24
1994	29	16,045	70.6	12.20	-1.54	13.74	-0.76	12.96	2.74	9.46
1995	27	23,221	73.3	44.54	34.11	10.43	35.67	8.87	38.84	5.70
1996	34	28,840	71.0	33.69	20.26	13.42	21.16	12.52	23.44	10.24
1997	35	37,908	71.2	36.87	31.01	5.86	30.33	6.54	33.13	3.74
1998	35	38,450	77.5	10.17	26.67	-16.49	22.29	-12.12	37.69	-27.51
1999	48	38,188	76.9	0.18	19.53	-19.35	25.26	-25.08	23.25	-23.07
2000	55	39,796	73.8	7.76	-10.14	17.90	-11.04	18.81	-8.17	15.93
2001	51	31,196	71.8	-10.33	-13.04	2.71	-11.27	0.94	-10.34	0.01
2002	45	31,295	68.7	-1.44	-23.37	21.93	-20.84	19.40	-20.41	18.97
2003	44	39,807	66.3	43.34	26.38	16.96	33.15	10.20	27.76	15.67
2004	42	43,284	62.3	13.32	8.99	4.33	13.00	0.32	8.86	4.46
2005	43	47,808	64.3	7.50	3.00	4.50	7.31	0.19	4.66	2.84
2006	50	62,785	57.9	20.21	13.62	6.59	16.23	3.99	12.17	8.04
Average	33.1	\$17,527	73.1%	24.97%	10.32%	14.65%	14.05%	10.91%	16.41%	8.56%
σ				25.32	14.90	21.18	15.39	20.41	16.50	18.30

Table 8: Monte Carlo Simulation of Best Performing Manager in an Efficient Market

Monte Carlo simulations are used to calculate the statistical properties of the winning margin of the best performing manager over a 31-year period in an efficient market. Distributions are calculated over 10,000 iterations using 173, 1407, and 2591 managers in a contest flipping a coin 31 times and recording the score of the manager with the most heads. The average mean, maximum, standard deviation, and winning margin in standard deviations are presented followed by the probability and cumulative density frequency distributions.

	Number of Managers in Contest (<i>n</i>)					
	173		1,407		2,591	
Mean:	15.50		15.50		15.50	
Maximum:	22.85		24.52		24.94	
Std Deviation:	2.78		2.78		2.78	
Margin:	2.65		3.24		3.39	
Years	PDF	CDF	PDF	CDF	PDF	CDF
18	-	-	-	-	-	-
19	-	-	-	-	-	-
20	0.22%	0.22%	-	-	-	-
21	7.93	8.15	-	-	-	-
22	32.23	40.38	0.04%	0.04%	-	-
23	35.18	75.56	9.30	9.34	1.34%	1.34%
24	17.49	93.05	44.86	54.20	30.91	32.25
25	5.32	98.37	33.34	87.54	45.56	77.81
26	1.42	99.79	10.14	97.68	17.92	95.73
27	0.20	99.99	1.95	99.63	3.63	99.36
28	0.01	100.00	0.31	99.94	0.56	99.92
29	-	100.00	0.06	100.00	0.07	99.99
30	-	100.00	-	100.00	0.01	100.00
31	-	100.00	-	100.00	-	100.00

Table 9: Hypothesis Test of Berkshire Hathaway and Mimicking Portfolios Exceeding the Winning Manager’s Portfolio at Various Levels of Managerial Noise

Panel A and Panel B are tests of Berkshire Hathaway’s stock portfolio performance and the mimicking portfolio exceeding the winning manager’s performance in efficient markets assuming various levels of manager-specific risk. *Manager Noise* is the level of manager specific-risk in an efficient market implying that approximately one-third of the managers would perform either better or worse than the market in any year by the specified percent. *Implied Risk* is calculated by dividing the *Manager Noise* by the square-root of the number of years. *E(r)* is the expected excess return calculated by multiplying the mean standard deviation (σ) of the winning manager in the simulation by the implied risk per standard deviation of *Manager Noise*. The *t* and *p-values* represent a test of the hypothesis that the performance of the Berkshire Hathaway and mimicking portfolios exceed the performance of the winning manager under efficient markets. The mean excess return is the average annual return of the portfolio minus the average annual return of the S&P 500 index.

Panel A: Berkshire Hathaway Portfolio (Mean excess return = 14.65%, σ = 21.18%)

Manager Noise	Implied Risk	Number of Managers in Contest								
		173 (σ = 2.65)			1,407 (σ = 2.96)			2,591 (σ = 3.15)		
$\hat{\sigma}$	$\hat{\sigma}/\sqrt{31}$	E(r)	<i>t</i>	p-value	E(r)	<i>t</i>	p-value	E(r)	<i>t</i>	p-value
5%	0.90%	2.38%	7.42	<.001	2.66%	20.66	<.001	2.83%	27.65	<.001
10	1.80	4.76	5.55	<.001	5.32	14.94	<.001	5.66	19.54	<.001
13.65	2.45	6.50	4.25	<.001	7.26	9.94	<.001	7.72	14.00	<.001
15	2.69	7.14	3.81	<.001	7.97	9.65	<.001	8.49	12.08	<.001
20	3.59	9.52	2.32	0.011	10.63	5.18	<.001	11.33	5.80	<.001

Panel B: Mimicking Portfolio (Mean excess return = 14.26%, σ = 22.96%)

Manager Noise	Implied Risk	Number of Managers in Contest								
		173 (σ = 2.65)			1,407 (σ = 2.96)			2,591 (σ = 3.15)		
$\hat{\sigma}$	$\hat{\sigma}/\sqrt{31}$	E(r)	<i>t</i>	p-value	E(r)	<i>t</i>	p-value	E(r)	<i>t</i>	p-value
5%	0.90%	2.38%	6.65	<.001	2.66%	18.52	<.001	2.83%	24.76	<.001
10	1.80	4.76	4.99	<.001	5.32	13.39	<.001	5.66	17.48	<.001
13.65	2.45	6.50	3.82	<.001	7.26	9.83	<.001	7.72	12.46	<.001
15	2.69	7.14	3.41	<.001	7.97	8.60	<.001	8.49	10.71	<.001
20	3.59	9.52	2.05	0.021	10.63	4.47	<.001	11.33	4.90	<.001