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

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Abstract:

The stock portfolio of Berkshire Hathaway, comprising primarily of stocks of large-cap companies, has beaten the S&P 500 index in 20 out of 24 years for the time period 1980-2003. In addition, the average annual return of Berkshire Hathaway's stock portfolio exceeds the average annual return of the S&P 500 by 12.24% over this time period. We examine various potential explanations for Berkshire Hathaway's investment performance. We first explore the explanation that Berkshire Hathaway's performance may be due to pure luck. We find that while beating the market in 20 out of 24 years is possible due to luck at a 5% significance level, incorporating the magnitude by which Berkshire beats the market makes the "luck" explanation unlikely. After employing sophisticated adjustments for risk, we find that Berkshire's high returns can not be explained by high risk. Specifically, over the time period 1980-2003, we find that Berkshire's stock portfolio provides a positive annualized calendar time abnormal return of 8.56% using a benchmark portfolio consisting of returns taken from the value weighted twenty-five Fama and French size and book-to-market portfolios and 11.38% using a benchmark of value weighted returns of all stocks in CRSP. Ruling out the major alternate explanations to Berkshire's investment performance leaves us with the potential explanation that Warren Buffett is an investor with superior stock-picking skills that allows him to identify undervalued securities and thus obtain risk-adjusted positive abnormal returns. Consistent with this explanation, we find a significant positive stock price reaction around the announcement that Berkshire has acquired a stock suggesting that Berkshire's investments are viewed as positive information signals by the stock market.

JEL classification: G11; G14; G22; C22

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

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Abstract

The stock portfolio of Berkshire Hathaway, comprising primarily of stocks of large-cap companies, has beaten the S&P 500 index in 20 out of 24 years for the time period 1980-2003. In addition, the average annual return of Berkshire Hathaway's stock portfolio exceeds the average annual return of the S&P 500 by 12.24% over this time period. We examine various potential explanations for Berkshire Hathaway's investment performance. We first explore the explanation that Berkshire Hathaway's performance may be due to pure luck. We find that while beating the market in 20 out of 24 years is possible due to luck at a 5% significance level, incorporating the magnitude by which Berkshire beats the market makes the "luck" explanation unlikely. After employing sophisticated adjustments for risk, we find that Berkshire's high returns can not be explained by high risk. Specifically, over the time period 1980-2003, we find that Berkshire's stock portfolio provides a positive annualized calendar time abnormal return of 8.56% using a benchmark portfolio consisting of returns taken from the value weighted twenty-five Fama and French size and book-to-market portfolios and 11.38% using a benchmark of value weighted returns of all stocks in CRSP. Ruling out the major alternate explanations to Berkshire's investment performance leaves us with the potential explanation that Warren Buffett is an investor with superior stock-picking skills that allows him to identify undervalued securities and thus obtain risk-adjusted positive abnormal returns. Consistent with this explanation, we find a significant positive stock price reaction around the announcement that Berkshire has acquired a stock suggesting that Berkshire's investments are viewed as positive information signals by the stock market.

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

Warren Buffett's investment record speaks for itself. He transformed Berkshire Hathaway from a textile manufacturer to a holding company with a value in excess of $130 billion. His 40% beneficial interest makes him the second wealthiest person in America according to *Forbes* (coincidentally behind Bill Gates, co-founder of Microsoft who recently was named a director of Berkshire Hathaway) and he has been called a genius by the famous economist, Paul Samuelson (Samuelson (1989)). Berkshire Hathaway controls almost 100 different subsidiaries, many of which are industry leaders in both market share and financial strength and a stock portfolio of publicly traded companies with a value that would equate to the 5th largest equity mutual fund. The portfolio has beaten the S&P 500 index in 20 out of 24 years from 1980 to 2003 and has exceeded the average annual return of the S&P 500 by 12.24% over this period. While there have been many books written about Buffett attempting to analyze his investment philosophy, little academic work has progressed and none has provided a rigorous analysis of Berkshire Hathaway's investment performance. Yet Buffett's performance is often cited by inefficient market proponents as a violation of efficient markets theory.

So how does one explain the investment success of Warren Buffett which has been achieved over a long period of time?[1] There are a number of potential explanations. First, consistent with efficient markets theory, Buffett may have been just lucky. That is, if 500 people flip coins 24 times in a row, a few people are going to get more than 20 heads just due to chance. Second, Berkshire's high returns may just be compensation for high risk in its stock portfolio. This explanation will also be consistent with efficient markets theory. An alternative explanation inconsistent with strict efficient markets theory is that Buffett is a skilled investor who is able to identify under-valued securities which allows him to obtain risk-adjusted positive abnormal returns. Thus, this explanation requires that even if stock markets may be efficient on average, some stocks can be undervalued at some points in time allowing skilled investors to obtain positive abnormal returns.

In this paper, we analyze Berkshire Hathaway's stock portfolio from 1980 to 2003 and explore potential explanations for its performance. We examine in depth its characteristics showing how the popular press has mischaracterized Buffett's investment style; demonstrate how news of new equity stake taken by Berkshire Hathaway has the power to move markets and measure the portfolio's performance not only against standard

[1] Buffett started managing funds in the 1950s and acquired Berkshire Hathaway in 1965. The company became listed on the NYSE in 1976.

benchmarks but against some of the most stringent devised. We also show that an investor who mimicked the portfolio's holdings after public disclosure of such could also have received large returns although not to the extent of Berkshire Hathaway. Finally we argue through a series of tests, the performance cannot be explained under efficient market theory.

Our motivation is threefold. First, while many have lauded the investment success of Warren Buffett and countless books and articles claim to provide insights into his investment philosophy, none have taken a rigorous, agnostic approach leading to a common misconception of Buffett as a "value" investor. Second, the results have policy implications not only regarding requests for confidential treatment of regulatory filings by Warren Buffett and Berkshire Hathaway, but other highly followed investment professionals. Finally, we attempt to explain the performance in terms of market efficiency going so far as to testing performance even after accounting for ex-post selection bias and risk factors.

A univariate description of the investment portfolio from 1980 to 2003 is presented which documents Berkshire's investment strategy more as a large-cap growth style contrary to the popular notion of Buffett being a traditional "value" or "contrarian" investor. We integrate Buffett's own definition of risk into our analysis showing portfolio concentration rather than diversification with the top 5 holdings often comprising over 70% of the stock portfolio.

If the stock market interprets Berkshire's buying of a stock as indicating undervaluation and potential positive risk-adjusted returns in the future, the impact of the news on the purchased stock will be positive. We document that over the period from 1980 to 2003, the market reacts positively to the public disclosure of a Berkshire Hathaway stock investment with an abnormal return of 1.36% on the day of announcement. The market reaction is stronger in the second half of the study period with an abnormal return of 2.95% as compared to a 0.78% in the first half. 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. Overall, the evidence suggests that Warren Buffett may have superior stock picking skills. This result is consistent with findings in a number of 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) which find evidence that suggest that future abnormal returns ("alphas") can be forecast using

past returns or alphas. As discussed in Baks et al. (2001), this evidence suggests that it is possible alphas are persistent, and that some managers may have positive expected alphas.

As highlighted in Marcus (1990) and Statman and Scheid (2001), Buffett has been identified ex-post as a successful investor. Hence, we should not be surprised to find his performance is far above the mean. We also know that 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 successful investor, pure chance can not account for the performance? 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 the markets are efficient. Once derived, we can assess whether a winner's abnormally good performance is evidence of an ability to beat the market even after accounting for the fact that we have selected the best performing investor. After accounting for manager-specific risk factors or market noise we develop a benchmark for the best performing manager under efficient markets theory and use it to test the performance and show that at reasonable levels of market noise, the level of performance could be construed as a contradiction to efficient markets theory.

We then examine whether Berkshire's high investment returns are a result of high risk in its stock portfolio. We compute calendar time abnormal returns using two reference portfolios. The first consists of the value weight returns of all stocks in CRSP and the second consists of the returns taken from the value weight twenty-five Fama and French size and book-to-market portfolios. Over the sample period, the Berkshire stock portfolio beat the value weight portfolio by 11.38% per year and the Fama and French reference portfolio by a risk-adjusted 8.56% per year. This indicates that Berkshire's investment performance is not being driven by high risk.

Finally, we show that an investor who mimicked Berkshire's investments over the 1980-2003 time period after they were publicly disclosed in regulatory filings could obtain calendar time positive annualized abnormal returns of 7.46% and 10.32% over the value weight twenty-five Fama and French size and book-to-market portfolios and the value weight returns of all stocks in CRSP respectively, as the reference portfolios.

The rest of the paper is organized as follows. Section I provides a review of the literature on the ability of financial professionals to beat the market as well as long run performance measurement issues. 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 various financial professional recommendations to determine if they can outperform the market or other suitable benchmarks. These professionals include analysts, investment newsletters, money managers, pension funds and various other portfolio recommendations. Since Jensen (1968), most papers have found that mutual funds, on average, do not outperform their benchmarks. In particular, Cahart (1995), Malkiel (1995) and Daniel et al. (1997) all find small or zero average abnormal returns by using modern performance evaluation methods on samples that are relatively free of survivorship bias suggesting that the average active mutual fund should be avoided. On the other hand, 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 that suggests that future abnormal returns ("alphas") can be forecast using past returns or alphas. As discussed in Baks et al. (2001), this evidence suggests it is possible alphas are persistent, and that some managers have positive expected alphas. Thus in only a relatively few cases has it been demonstrated that a marginal ability if any may be present. Usually after an initial reaction, the recommendations show no sustained superior performance once an appropriate testing methodology and benchmark are used.

Desai and Jain (1995) find that 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, papers like Black (1973), Copeland and Mayers (1982), Stickel (1985) and Lewis et al. (1997) that 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) showed investment newsletters fail to offer superior market timing ability. On the other hand, 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 that trades of individual investors

classified in the top 10 percent exploit market inefficiencies to earn abnormal profits above those from other well-known strategies.

B. Performance Testing and Benchmarking Methodologies

Prior research demonstrates that results of long term performance studies may be dependent upon the chosen testing methodology and the benchmark. It is therefore extremely important the test and benchmark: (1) provide a reasonable estimate and logical proxy of expected returns for the sample under study; (2) are grounded in financial theory; and (3) provide well specified statistics. The two most popular choices for long-term abnormal return measurement are the cumulative abnormal return (CAR) and the buy-and-hold abnormal return (BHAR). The CAR is calculated by simply summing the abnormal returns over all the periods of the tested horizon. Alternatively, the BHAR is determined by compounding each periodic return into a buy-and-hold measure over the tested horizon. Each method, however, has particular drawbacks that could bias test statistics to yield different results.

Barber and Lyon (1997) argue for the use of the BHAR over the CAR. They demonstrate CAR suffers from a measurement bias by ignoring compounding making it a biased predictor of BHAR. However, the potential inclusion of newly listed firms in a benchmark and not in the sample under consideration may cause the mean CAR and mean BHAR to be non-zero. Both the methods provide statistics that are positively skewed; however, the BHAR suffers more from this skewness bias. Finally, the BHAR suffers from a rebalancing bias when using an equal-weighted benchmark with periodic rebalancing. This rebalancing implies overperforming firms (relative to the market) are sold in favor of adding underperforming firms. Although Barber and Lyon (1997) acknowledge these problems (and their results demonstrate that less problematic inferences may be made from CARs), they prefer use of BHAR to CAR because they believe that the BHAR more accurately represents investor experience.

Kothari and Warner (1997) verify the extreme skewness of the BHAR measure in their simulation evidence. They report that tests using an asset pricing model such as the Fama and French (1993) three factor model as a benchmark for expected returns reject the null of zero abnormal returns too often. They also report that the use of BHARs or CARs when using this benchmark does not alter inferences; however, their analysis of the distributional properties of their estimates supports the necessity of adjusting BHARs for extreme skewness. They recommend the procedure used by Ikenberry, Lakonishok and Vermaelen (1995) where the empirical distribution of

the abnormal return is generated by one thousand random samples of abnormal returns of event firms matched in time with firms of similar size and book-to-market equity characteristics.

Fama (1998) argues for the use of CARs. Any test of market efficiency, however, implicitly includes a simultaneous test of the model of expected returns being used in the test. This bad model problem is more acute for BHARs which compounds the problems associated with accurately measuring the expected return. For a long-horizon study, this compounding effect becomes even more problematic. Fama advocates using a firm-specific model, such as the market model, as a potential correction to the bad model problem. Specifically, one estimates the coefficients in a regression of the individual stock's return on the market return and uses the estimated coefficients to calculate the abnormal return. The comparison period approach of Masulis (1980) is also suggested as a way to avoid the bad model problem. However, Fama (1998) admits that many corporate news events are preceded by unusual returns as well, which makes it difficult to identify a "normal" period in which to estimate model parameters. The alternative is to select an asset pricing model which constrains the cross-section of expected returns, but this induces the bad model problem that plagues proper calculation in the first place. BHARs, however, suffer most from the bad model issue. Fama (1998) argues that a formal test of performance "should use the return metric called for by the model invoked to estimate expected (normal) returns." (p. 294). He suggests that using a compounded return on a horizon of up to sixty months is inconsistent with the single (shorter) period assumptions under which most asset pricing models were derived and that monthly returns provide a more well-behaved measure of abnormal performance. For these reasons, he strongly argues for the use of CARs.

Lyon, Barber and Tsai (1999) improve upon the Barber and Lyon (1997) methodology. Specifically, they control for the new listing, rebalancing, and skewness biases discussed above and find that two measures of abnormal returns are well-specified in random samples. First, they develop a set of size and book-to-market reference portfolios designed to eliminate the new listing and rebalancing biases. They then calculate and test BHARs of random firms against (1) a bootstrapped distribution to adjust for skewness and (2) against the simulated distribution of mean returns using pseudo-portfolios as in Ikenberry, Lakonishok and Vermalaen (1995). This method results in well-specified test statistics in random samples. They also test the calendar-time methodology of Jaffe (1974) and Mandelker (1974) and advocated by Fama (1998) and Mitchell and Stafford (2000). While arguing that it does not reflect of the returns experienced by actual investors, formation of calendar-time portfolios eliminates the cross-sectional dependence of observations and results in well-specified test statistics.

Mitchell and Stafford (2000) echo many of the concerns of Fama (1998) and argue that BHARs are not a superior method of measuring long-term abnormal returns. Specifically, BHARs suffer from statistical problems that cannot be solved by the bootstrapping procedures previously discussed. Even if one can properly adjust the mean of the distribution of abnormal returns, they argue the distribution is too "thin" because the bootstrapped distribution does not correct for the cross-correlation of residuals created by the non-independence of event firms. Applying an ad hoc procedure to correct for non-independence, they demonstrate that long-term post-event BHARs are not significantly different from zero for samples of merged firms, firms executing seasoned equity offerings and firms repurchasing shares of common equity. Their preferred solution is to use calendar-time abnormal returns (CTAR). From the standpoint of appropriately measuring abnormal returns, Mitchell and Stafford (2000) present evidence in favor of the use of the calendar-time methodology of Jaffe (1974) and Mandelker (1974) and they test many different techniques to a sample of mergers from 1958 to 1993. They conclude that tests for abnormal returns should be conducted using the calendar-time method. They do admit, however, that the calendar-time method is not without its own concerns (including heteroskedasticity, the assumption that factor loadings remain constant through time, equal weighting of each month, and low power); however, unlike the issue of non-independence, these issues can be solved econometrically with relatively standard robustness checks. Calculation of adjusted CTARs reveals that many of the market efficiency contradictions proposed in previous empirical studies are inaccurate. Candidates for use as benchmarks while employing the calendar-time method include reference portfolios (such as the value-weighted or equal-weighted index of firms maintained by the Center for Research in Security Prices (CRSP) or the twenty-five size and book-to-market portfolios of Fama and French (1993)), 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).

Finally, Marcus (1990) argues that any ex-post test of performance of a particular manager should use as a benchmark the hypothetical winning manager's performance derived under the assumption of an efficient market. He uses a Monte Carlo simulation to derive the extent and probability distribution of the best performing manager beating the market under the Efficient Market Hypothesis. To account for cross-sectional variations in manager-specific risk, he uses a range of noise estimates in the market to establish a margin by which the best performing manager should beat the market. Once an exceptional performing manager has been identified, the appropriate

benchmark to measure performance is no longer the average market performance but rather the performance of this best performance or winning manager.

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 include forms 13F, 13D, 13G, 3, 4 and 5 which are currently available on the SEC's EDGAR website.[2] 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.[3]

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 CRSP[4] during the study period. For example, Berkshire's common stock investment in American Express in 1994 was the result of automatic conversion of Preferred Equity Redemption Cumulative Stocks (PERCS) acquired three years earlier. In our analysis we assume investment occurred in the quarter the PERCS were converted at a price reported at the end of month. Several other equity investments were also preceded by or were increased through investments in convertible preferred stock including First Empire State, Geico, Gillette, Salomon and US Airways. Berkshire's initial investment in Federal Home Loan Mortgage (Freddie Mac), although technically a preferred stock, was for all practical purposes a common stock

[2] 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.

[3] http://www.berkshirehathaway.com.

[4] 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 made at a time when it was available only to lending institutions[5]. Since exact dates, cost of purchases and proceeds from sales aren't reported, we make a simplifying assumption they all occur at month-end closing price. Due to these limitations and the assumptions made to overcome them, our reported returns of Berkshire's stock investment portfolio are biased downwards. These limitations, however, do not affect the returns reported in our mimicking portfolio of an investor who follows Berkshire's investments. The returns of a mimicking strategy are determined by the timing of investments due to reporting delay, confidential treatment of filings and the availability of the investment at time of public disclosure.

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.[6] 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 on May 17, 1979.

Institutional investment managers may request confidential treatment of their 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

[5] 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.

[6] 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.

filed. If granted, the SEC will allow the investment manager to withhold certain investments from the report for a period of 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.[7]

Berkshire Hathaway has often requested confidential treatment for certain investments and only recently have some of those requests been denied confidential treatment.[8] 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 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.[9]

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.

Another source is 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 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

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[7] 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.

[8] 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.

[9] 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.

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. Additionally, in the case of Berkshire Hathaway, a Schedule 13D in lieu of a 13G filing 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. Any 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 in 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 with the December 31, 1978 to date.[10] The study period was limited from January 1, 1980 to December 31, 2003 for the following reasons: (1) 1980 was the first calendar year in which Berkshire Hathaway's Form 13Fs were filed on the normal required filing dates; (2) Form 13Fs are a richer data source covering more securities and higher frequency of reporting; and (3) by 1980 Warren Buffett had already established a reputation as a successful investor (Statman and Scheid (2001)). For each filing we record the source, the name of securities reported, CUSIP numbers, shares, effective date of filing and market value on date of filing. We supplement this data by searching Berkshire Hathaway's annual reports, LexisNexis[11] and earlier regulatory filings to determine the initial acquisition of stock holdings that were reported at the beginning of the study. When a security shows up the first time on any report, the filing date of this report is recorded and flagged as the basis for the first public disclosure date. For every recorded investment, LexisNexis is then searched beginning with this date for the first press announcements which is recorded as the first public disclosure date if found, otherwise, we use the day following the date of filing for the first public disclosure date.[12] The ending date of December 31, 2003 was the last date for which return data was available in CRSP.

[10] As of November 5, 2004, the latest 13F filing for which data is collected was reported as of June 30, 2004.

[11] Source: LexisNexis, a division of Reed Elsevier Inc. Used with permission. All rights reserved.

[12] 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.

C. Financial Data

We used the reported CUSIP numbers and dates of reported holdings to gather data on net sales, total assets and common equity from Compustat[13] 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]

Since available CRSP data includes only returns for common stocks, we limit our analysis to common equity investments. The resulting data set includes 261 common equity investments in the period from January 1, 1980 to December 31, 2003.[15] Data is available in CRSP over the relevant period for all but three of the securities: Multimedia Inc reported on 03/31/80, Guiness 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 of the securities. For these eight securities data was gathered directly from the company's financial reports and substituted for the Compustat data.

D. Arbitrage versus Long Term

When long-term investment possibilities are limited, Berkshire Hathaway has used risk arbitrage as an alternative to holding short-term cash equivalents. These are arbitrage opportunities that present themselves after an announced corporate event such as sale of the company, merger, recapitalization, reorganization, liquidation, self-

[13] Source: Compustat, Standard & Poor's, a division of The McGraw-Hill Companies, Inc. Used with permission. All rights reserved.

[14] Source: Kenneth R. French. Carl E. and Catherine M. Heidt Professor of Finance, Tuck School of Business, The University of Dartmouth 2004. Used with permission. All rights reserved. http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/index.html.

[15] Due to name changes and mergers and acquisitions there are 291 unique securities as defined by CUSIP numbers. For example, Berkshire's initial investment in Omaha National ultimately resulted in shareholdings of US Bancorp but not before a name changes initially to FirsTier then to FirsTier Financial followed by acquisition in a stock merger by First Bank System who then acquired US Bancorp and assumed its name.

tender, etc. The major risk incurred 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 long term or arbitrage. An investment was considered arbitrage if it was labeled by Warren Buffett in Berkshire annual reports as an arbitrage investment or if the following conditions were met: (1) the investment period for the stock was two years 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 or cancellation of the event. All other investments were categorized as long term.

The arbitrage investments have several implications when analyzing possible returns of a shareholder trying to mimic Berkshire's investments. There may be up to a 135 day delay between investment by Berkshire and the appearance of the investment in required regulatory filings. As time passes under this strategy, the opportunity to profit from it diminishes as uncertainties are reduced as the announced event approaches. In certain circumstances, public disclosure for specific investments may be delayed for longer periods until the investment opportunity is no longer available to the public through a request for confidential treatment of quarterly filings preventing an investor attempting to mimic Berkshire's investments from even participating.

III. Empirical Methods

We perform three types of empirical tests to estimate the market impact and performance of Berkshire Hathaway's stock investments. An event study is used to determine the significance of abnormal returns associated with the first public disclosure of stock investments by Berkshire Hathaway. This test is to shed light on whether the stock market follows Berkshire's investments and if it views them as positive information signals. The event date is determined by the filing date of the first regulatory filing with the SEC reporting an investment in a stock or an article reporting the initial investment appears in LexisNexis, whichever is earlier. The event study includes only investments revealed for the first time between January 1, 1980 and December 31, 2003. It does not include investments in the portfolio as of and acquired prior to January 1, 1980. A second test uses calendar-time abnormal returns (CTAR) first used by Jaffe (1974) and Mandelker (1974) and strongly advocated by Fama (1998) and Mitchell and Stafford (2000) to 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 over the study period. The third test compares the annual performance of the portfolios using a Monte Carlo simulation to create an annual return benchmark of the best ex-post performance of a manager under the assumption of an efficient market as developed by Marcus (1990).

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 the expected return from the return observed on the date of disclosure (Equation 1).

$$AR_i = R_i - E(R_i) \tag{1}$$

where:

AR_i = *abnormal return of firm i*

R_i = *observed return of firm i*

$E(R_i)$ = *expected return of firm i*

The value weight index of all firms in NYSE/AMEX/NASDAQ with dividends from CRSP is used as a proxy for the expected return. The value weight index, which weights returns based upon market capitalization, 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 then the abnormal returns will be insignificant from zero. To test the significance of abnormal returns surrounding the public disclosure, a parametric test using the Student's t test of means and a non-parametric Wilcoxon rank sum test of medians are used with a null hypothesis of zero abnormal returns.

The event study sample size of 119 stock investments is less than the 261 total investments in the period from 1980 to 2003 for several reasons. First, as discussed above, three of the stocks are not included in the CRSP files. Second, 94 stocks in the portfolio at the beginning of the study period were acquired prior to January 1, 1980. Third, Berkshire Hathaway's arbitrage activity of acquiring stocks of firms after a tender offer has been made for the firm's shares then tendering or selling the resulting shares upon completion of the acquisition coupled with the 45 day time lag between the *Report Date* and the required *Filing Date* and the ability to delay the public disclosure of

such investment activity through confidential treatment of Form 13F filings, delays the public disclosure of 45 stocks until after the investment is no longer available to the public (stock has been delisted from CRSP). This results in the event study covering 119 of the 261 investments.

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. For example, 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. For example 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 should avoid any abnormal returns being included in the mimicking portfolio due to any 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 from the mimicking portfolio at the closing price at the end of the filing month. This assumption would therefore include any negative abnormal return associated with the public disclosure of the sale. 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 261 stock investments over the 288 month study period from 1980 to 2003 and the average holding period for a stock in Berkshire Hathaway's portfolio over this period exceeds 30 months, transaction costs incurred due to rebalancing should be minimal.

Calendar-time abnormal returns are calculated each month in the study period by subtracting the expected return proxied by a benchmark portfolio or index from the portfolio returns. 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

[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.).

(Fama (1998) and Mitchell and Stafford (2000)). To test the Berkshire Hathaway portfolio's investment performance, we compute the abnormal return of the portfolio using a corresponding benchmark portfolio or index based upon the value weight investment in the portfolio as in Equation 2.

$$CTAR_T = \frac{1}{N_t}\sum_{t=1}^{N_t}\left[\sum_{i=1}^{N_i}\left[\frac{V_i}{\sum_{i=1}^{Ni} V_i}\left(R_{it} - E\left(R_{it}\right)\right)\right]\right] \tag{2}$$

where:

R_{it} = *return of firm i in period t*

$E(R_{it})$ = *expected return firm i in period t*

V_i = *value of investment in firm i in period t*

N_i = *number of firms in portfolio in period t*

N_t = *number of calendar periods*

Since it may be tedious to determine the appropriate weights of each investment in the mimicking portfolio we also test the abnormal performance of the mimicking portfolio using equal weight portfolios as in Equation 3.

$$CTAR_T = \frac{1}{N_t}\sum_{t=1}^{N_t}\left[\frac{1}{N_i}\sum_{i=1}^{N_i} R_{it} - E\left(R_{it}\right)\right] \tag{3}$$

where:

R_{it} = *return of firm i in period t*

$E(R_{it})$ = *return of firm i in period t*

N_i = *number of firms in portfolio in period t*

N_t = *number of calendar periods*

We use two different benchmarks to proxy for expected returns: (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 mimic the risk of sample firms. To construct the benchmark return using the Fama and French 25 size and book-to-market portfolio returns, for each firm each month the a benchmark return is determined based upon the market equity of the firm at the beginning of the month and the book-to-market equity ratio calculated using Common Equity - Total (Item 60) from Compustat in the last reported fiscal year end. These benchmarks are used for the expected returns since Berkshire Hathaway's investment portfolio predominantly consists of large firms.

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

We create a hypothetical benchmark to test whether the ex-post performance of the portfolios under the Efficient Market Hypothesis is due to luck or superior skill (Marcus (1990)). As Marcus (1990) points out since we are assessing performance *after* it is known to be outstanding, the appropriate benchmark is no longer a proxy for the market but rather the *best* performance from a sample of returns from many managers. The probability distribution of the best performance can be derived using a Monte Carlo simulation using the experiment as described in Marcus (1990) where you allow a given number of managers to flip a coin over a set number of times (representing years or periods of performance) and record the score of the manager with the greatest number of heads. You repeat the procedure over a large number of trials (10,000) and record each of the results. The frequency distribution of the winning score therefore provides the probability distribution and the number of standard deviations represents the margin by which the winning manager beats the market in an efficient market. The extent to which a manager beats the market, however, is dependent on the volatility of the manager-specific risk. Winning managers using high variance strategies will result in higher winning margins. If the manager specific risk or noise in the market has a standard deviation of 15% per year, it would imply that about one-third of the managers would perform either better or worse than the market by a margin of 15%. The standard deviation of average annual returns over a 24-year period would be $15\%/\sqrt{24} = 3.06\%$. Multiplying the number of standard deviations by which the winning manager in the Monte Carlo simulation beats the market by the standard deviation of average annual returns produces the expected margin by which the winning manager will beat the market as a function of the assumed manager-specific risk or noise level.

IV. Empirical Analyses

A. Investment Characteristics

Berkshire Hathaway's stock portfolio from 1980 to 2003 has experienced large returns and is dominated by large stakes in large firms in few industries over relatively long holding periods. Table 1 provides univariate

statistics and tests for the two distinct investment strategies using annualized returns, holding period, initial and maximum ownership levels, market capitalization, net sales, total assets and common equity of the 261 investments during the study period. Fifty-nine of the investments 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. The remaining 202 we label long-term. Three of the 202 long term investments do not have returns available in CRSP during Berkshire's holding period: Multimedia Inc, Guinness PLC and Comdisco Holdings Inc.

The mean (median) annualized returns for the stock investments in Berkshire's portfolio from 1980 to 2003 are an extraordinary 39.38% (19.92%). The mean (median) annualized return for arbitrage stocks, 81.28% (29.31%), exceeds those of 26.96% (18.54%) for long term stocks. The difference is significant using a parametric t-test of means at a level of 0.019 and with a non-parametric Wilcoxon rank sum test of medians at a level of 0.036. The long term stocks have a mean (median) holding period of 39.14 (14.00) months exceeding the 5.56 (4.00) months for the arbitrage stocks, significant at <.001. The mean initial ownership stake taken in the long term stocks is slightly larger at 2.73% versus 1.57% which is significant at <.05, however, there is no significant difference in the median of 0.53% for the long term stocks and 0.90% for the arbitrage stocks. Similarly the mean maximum ownership stake of 4.65% for long term stocks and 1.96% for arbitrage stocks are different at <.001 while there is no significant difference in the medians of 0.90% for long term stocks and 1.07% for arbitrage stocks. The mean (median) market capitalization of the long term stocks are slightly lower at $4.75b ($1.90b) compared to $6.30b ($2.07b) but the difference is not significant. Mean (median) net sales for the long term stocks are $6.55b ($2.79b) and $7.92b ($2.47b) for the arbitrage stocks also not statistically different. Total assets of the issuers are not statistically different with a mean (median) of $11.12b ($2.74b) for the long term and $18.62b ($3.76b) for the arbitrage stocks as are common equity of $2.59b ($0.93b) for long term stocks and $2.93b ($1.24b) for arbitrage stocks.

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. Forty-four percent (115 of 261) are in manufacturing, followed by 22% (57) in finance, insurance and real estate services and 15% (39) in transportation,

communication, electric, gas and sanitary services. Eighty-six percent (224) 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 the <.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 in. We also find that the top 5 holdings often comprise over 70% of the total portfolio using market value which indicates a high degree of concentration (Table 6). 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 a predominately "Big-Growth" approach (Table 3). 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, 81% (211 of 261) investments fall into the big size category (market equity ≥ 50th percentile) while 50% (132 of 261) fall into the low book-to-market or growth category (book-to-market equity ≤ 30th percentile). Since only 15% (39 of 261) fall into the value category and 19% (50 of 261) fall into the small category, Berkshire's strategy would be better be characterized as a big-growth investment strategy.

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

The reaction to public disclosure of initial investments by Berkshire Hathaway using an event study is presented in Table 4. In Panel A, the mean (median) market-adjusted return of the first public disclosure of 193 Berkshire Hathaway stock investments between 1980 and 2003 is 1.3571% (0.6627%) significant at <.001 level. Additionally 73.63% of the announcements have a positive abnormal return. Partitioning the investments into long

term and arbitrage stocks yields slightly higher average returns for arbitrage than long term investments but lower median returns. The difference, however, is not statistically significant. This indicates the market reacts favorably upon public disclosure of a Berkshire Hathaway interest in a firm.

Panel B partitions the initial disclosure of stock investments between the first half (1980 to 1991) and the second half of the study period (1992 to 2003). While most (142 of 193) of the investment returns occur in the first half, the abnormal returns of the 51 disclosures experienced in the second half exceed those of the first half. The mean (median) abnormal return for disclosures from 1980 to 1992 is 0.7843% (0.5030%) both significant at the <.001 level. The mean (median) abnormal return for disclosures from 1992 to 2003 are larger at 2.9521% (1.6222%) also significant at the <.001 level. A t-Test of the difference in the means is significant at 0.007 level and a non-parametric Wilcoxon rank sum test of the difference in medians is significant at the <.001 level.

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. Overall, we interpret the positive stock price reaction as evidence that the stock market interprets Berkshire's buying of a stock as signaling undervaluation and potential positive risk-adjusted returns in the future. This explanation that Buffett may have superior stock picking skills is consistent with findings in a number of 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) which find evidence that suggest that future abnormal returns ("alphas") can be forecast using past returns or alphas. As discussed in Baks et al. (2001), this evidence suggests that some managers may have positive expected alphas.

B. 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 0.6866% (0.8319), significant at the 0.005 (<.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 0.9024% (0.9733%), significant at the p < .001 (.001) level. This equates to an annualized excess return of 8.56% over the Fama and French 25 size and book-to-market equity benchmark portfolio and an annualized excess return of 11.38% over the value weight index.

Similarly the mimicking portfolio also shows positive abnormal returns. Since it may be cumbersome for a follower to weight the investments in a mimicking portfolio according to the actual weights incurred by Berkshire Hathaway, we also test the mimicking portfolio by equally weighting the stocks. As shown in Table 5 Panel B, the monthly mean (median) CTAR of the value weight mimicking portfolio using the value weight index as a proxy for expected returns is 0.8216% (0.9126%), significant at the < .001 (<.001) level. Using the Fama and French benchmark portfolio returns as a proxy for expected returns, the mean (median) monthly return is slightly lower at 0.6014% (0.6629), significant at the 0.003 (<.001) level. This equates to an annual excess return of 10.32% over the value weight index and a 7.46% excess return over the Fama and French benchmark portfolio.

The equal weight mimicking portfolio strategy yields lower returns than a value weighting strategy. The mean (median) CTAR of the equal weight mimicking portfolio using the value weight index as a proxy for expected returns is 0.5812% (0.5790%), significant at the 0 .002 (<.001) level. Using the Fama and French benchmark portfolio returns as a proxy for expected returns, the mean (median) monthly return is lower at 0.3648% (0.5628), significant at the 0.023 (0.008) level. The annualized excess return is 7.20% over the value weight index and a 4.47% excess return over the Fama and French benchmark portfolio.

Table 6 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 24 year period from 1980 to 2003, the returns on the investment portfolio exceed: the returns on the S&P 500 Index in all but four years; the returns on the value weight index of all stocks in all but five years; and the return on the Fama and French portfolio in all but 6 years. However, it is interesting to note that the investment portfolio underperformed the Fama and French portfolio in four of the last six years of the study period. It is also interesting to note that the return on Berkshire Hathaway stock has the opposite result. It actually exceeds

the returns on the Fama and French portfolio in four of the last six years. The underperformance of the investment portfolio relative to Berkshire Hathaway stock may be due to the acquisition activity where stocks that were previously in Berkshire Hathaway's investment portfolio became operating subsidiaries such as Johns Manville, MidAmerican Energy Holdings, and Shaw Industries.

The average annual return of Berkshire Hathaway's stock portfolio in Table 6 exceeds the average annual return of the S&P 500 by 12.24%, the value weight index of all stocks by 12.83% and the Fama and French benchmark portfolio returns by 10.02% over the sample period. How does one explain the investment success of Warren Buffett which over this long period of time? There are several potential explanations. First, consistent with efficient markets theory, Buffett may have been just lucky. That is, if 500 people flip coins 24 times in a row, a few people are going to get more than 20 heads just due to chance. Second, and also consistent with efficient markets theory, Berkshire's high returns are compensation for high risk in its stock portfolio. An alternative explanation, not consistent with perfectly efficient markets, is that Buffett is a skilled investor who is able to identify under-valued securities which allows him to obtain risk-adjusted positive abnormal returns. Thus, this explanation requires that even if stock markets may be efficient on average, some stocks can be undervalued at some points in time thus allowing skilled investors to obtain positive abnormal returns.

C. Luck versus Skill

Although by the start of our sample period in 1980 Buffett had already established a reputation as a successful investor, there may still have been uncertainty about his future success (Statman and Scheid (2001)). However, as pointed out in Marcus (1990) and Statman and Scheid (2001), we are nonetheless susceptible to an ex-post selection bias when considering Buffett's performance. Hence, we should not be surprised to find his performance is far above the market. We also know that 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 can not account for the performance? In assessing the performance of ex-post most successful investors, the appropriate benchmark should therefore be the best return from a sample of returns of many managers. Once we derive the probability distribution of the best performance of a sample of managers assuming that the market is efficient, we can then determine whether the performance of the

actual winner should be considered beyond that is likely by pure chance. 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 this is derived, we can assess whether a winner's abnormally good performance is evidence of an ability to beat the market even after accounting for the fact that we have selected the best performing investor.

Table 7 Panel A provides the frequency distribution of the Monte Carlo simulations prescribed by Marcus (1990) for 214, 500 and 1,000 managers[17]. In the experiment using 214 managers, the chance of a winning manager beating the market as many years or more as Buffett (20) over the 24-year period is 15.08%. Increasing the number to 500 managers, the probability of a beating the market 20 years or more increases to 32.11% and for 1,000 managers the probability is 54.00%. Using the conventional 5% significance level, we can not reject the hypothesis that Berkshire's beating the market in 20 out of 24 years is due to chance. That is, once we take into consideration that Berkshire is not an investment fund chosen at random, but a fund that has been identified as an ex-post winner, the frequency with which it beats the market is no longer high enough to constitute a contradiction of market efficiency.

This test, however, ignores the magnitude by which Berkshire outperformed the market over the last 24 years. The mean, median and selected percentiles of the winning margin in standard deviations of the best performing managers is presented in Panel B and shows that the winning manager on average, exceeds the market by 2.70, 2.94 and 3.12 standard deviations respectively in a contest of 214, 500 and 1,000 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 214 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 sample period. Used with permission. All rights reserved.

The standard deviation of noise is a function of the square root of time. So for a given noise level, say 10%, the standard deviation of manager-specific noise for the 24-year period is $10\%/\sqrt{24} = 2.04\%$. 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 15% 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%.

Table 8 provides the results of testing the performance of the Berkshire Hathaway and the mimicking portfolio against the expected return of the best performing manager at noise levels of 5% to 20% and number of managers of 214, 500 and 1,000. In Panel A, the mean annual excess performance of 12.24% of the Berkshire Hathaway portfolio exceeds the expected returns of the best performing manager at the 5% and 10% noise level for all number of managers at a 0.05 level of significance. Tests with noise levels of 15% and 20%, however, result in p-values that are greater than 0.124. Similarly the mean annual excess performance of 11.56% for the mimicking portfolio exceeds the expected returns of the best performing manager at the 5% and 10% noise levels for all number of managers at least at a p-value of 0.010. Tests with noise levels of 15% and 20% also result in p-values greater than 0.209. Therefore at any noise level up to 10%, the performance of the Berkshire Hathaway portfolio and the mimicking portfolio exceed the performance of the best performing manager under efficient market theory. At noise levels of 15% and above we can not reject the hypothesis that either Berkshire's portfolio or the mimicking portfolio is due to chance for any of the manager pool sizes. Hence, the performance due to "luck" is dependent on the assumption of the assumption of the amount of standard deviation per year of manager-specific noise. Overall, we conclude Berkshire's performance can not be explained as due to luck or chance even after accounting for ex-post selection bias.

C. Risk versus Skill

We have shown the magnitude of Berkshire Hathaway's investment portfolio, with reasonable estimates of market noise, cannot be accounted for under efficient market theory. However, if the returns are due to high risk investments then we can not accept that Warren Buffett's stock picking ability is due to superior skill. It is unlikely Berkshire Hathaway employs a high-risk strategy despite its portfolio concentration. In his 1993 Letter to Berkshire Shareholders Buffett provides his definition of risk:

> "The strategy we've adopted precludes our following standard diversification dogma. Many pundits would therefore say the strategy must be riskier than that employed by more conventional investors. We disagree. We believe that a policy of portfolio concentration may well decrease risk if it raises, as it should, both the intensity with which an investor thinks about a business and the comfort-level he must feel with its economic characteristics before buying into it. In stating this opinion, we define risk, using dictionary terms, as "the possibility of loss or injury.""

As shown in Table 6, Berkshire Hathaway's portfolio experienced only one negative return year (2001) while the S&P 500 had 5 negative return years during the 1980-2003 time period. We also calculated a portfolio beta of 0.811 over the sample period. The beta of 0.880 was slightly higher in the first half of the sample period (1980-1991) than a beta of 0.725 over the second half (1992-2003). This implies the portfolio is actually slightly *less* risky than the market. Finally, use of leverage is not a potential explanation for the high returns. These results suggest that Berkshire's investment performance can not be explained by high portfolio risk.

IV. Conclusion

This paper provides one of the most rigorous analyses of Berkshire Hathaway's investment performance to date. We have carefully constructed our sample and conducted the tests in a manner that will bias against finding abnormal returns. Not only do we use standard benchmarks such as the S&P 500 and the value weight index to measure performance, we develop a benchmark using the Fama and French 25 size and book-to-market equity returns to help mitigate any unusual risks and go beyond by creating a hypothetical best performing manager under efficient market theory for the ultimate benchmark. Our investigation reveals how successful Warren Buffett's

investment strategies really are by eschewing standard diversification objectives in favor of concentration while reducing risk and dispels a popular misconception about his investment style.

First we empirically determine the returns Berkshire Hathaway has experienced in both the long-term and risk arbitrage investment activities and estimate annualized returns in the arbitrage investments to be several times larger than even Buffett's estimates. Next we show a popular mischaracterization of Warren Buffett's investment style. Most books and financial press accounts describe Buffett as a value investor who looks for undervalued securities. This is not borne out by his investments from 1980 to 2003. Using the Fama and French size and book-to-market categories we show Buffett's style is consistent with a growth investor in big stocks. Buffett himself admits in his 1987 Letter to Berkshire Shareholders "Charlie and I have found that making silk purses out of silk is the best that we can do; with sows ears, we fail." His philosophy places emphasis squarely on the determinants of value: the estimation of future cash flows and growth rates which is also consistent with his principle of investing in businesses that he understands and is not difficult to predict.

While Buffett, for the most part, refuses to discuss his investments, the market reacts strongly to the disclosure of an initial investment by Berkshire Hathaway. This is not surprising; few investment professionals have deserved nor garnered the attention that Warren Buffett has and while he exhumes ethical standards, it is this very success that provides the potential to manipulate markets and has important policy implications. The Securities and Exchange Commission must consider carefully any request for confidential treatment for 13(f) of holdings simply because of this power to move markets.

We explore a number of potential explanations for Berkshire's investment performance. We examine the explanation that Buffett's performance is due to luck or chance. Even though Buffett's expertise was well known prior to the beginning of our study, we find that once we take into consideration the fact that he is not a manager chosen at random, but one that has been identified as an ex-post winner we demonstrate the magnitude of his performance cannot be explained by efficient market theory although the frequency with which he beats the market is not enough to constitute a contradiction. After finding the magnitude of performance is large enough to challenge market efficiency we proceed to counter the final argument the performance is due to manager-specific risks.

Ruling out the major alternate explanations to Berkshire's investment performance leaves us with the potential explanation that Warren Buffett is an investor with superior stock-picking skills that allows him to identify undervalued securities and thus obtain risk-adjusted positive abnormal returns. This explanation that Buffett may

have superior stock picking skills is consistent with findings in a number of 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) which find evidence that suggest that future abnormal returns ("alphas") can be forecast using past returns or alphas. As discussed in Baks et al. (2001), the evidence suggests that some managers may have positive expected alphas.

Finally, we show that an investor who mimicked Berkshire's stock portfolio over the 1980-2003 sample period by monitoring regulatory disclosures could obtain positive annual abnormal returns even after controlling for time delays, the initial public disclosure of investments and including the public disclosure of divestments.

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Table 1: Characteristics of Berkshire Hathaway Stock Investments 1980 to 2003

Characteristics of 261 common stock investments by Berkshire Hathaway from 1980 to 2003. Stocks are separated by type of investment strategy into Long Term and Arbitrage based upon Berkshire's classification. Data is gathered from SEC 13F, SC 13D and SC 13G filings and Berkshire annual reports. Ownership percentages are calculated using reported shares owned and shares outstanding in CRSP on the initial investment date and the report date corresponding to the maximum percentage ownership of the stock. Market capitalization is determined as of the first investment date using CRSP. Net sales, total assets and common equity are based on reported values in the fiscal year end prior to the initial investment using Compustat and issuer's annual reports. Test statistics and p-values are based upon parametric t-test for means and non-parametric Wilcoxon rank sum test of medians.

		All Stocks	Log Term	Arbitrage	Test Statistic	p-value
Number of stocks	N	261[1]	202[1]	59		
Annualized return	Mean	39.38%	26.96%	81.28%	-2.41	0.019
	Median	19.92%	18.54%	29.31%	8548	0.036
Holding period (months)	Mean	31.55	39.14	5.56	8.45	<.001
	Median	14.00	14.00	4.00	3538	<.001
	Min	3.00	3.00	3.00		
	Max	368.00	368.00	17.00		
Initial ownership stake	Mean	2.45%	2.73%	1.57%	2.00	0.047
	Median	0.58%	0.53%	0.90%	8313	0.126
Maximum ownership stake	Mean	4.04%	4.65%	1.96%	3.57	<.001
	Median	0.94%	0.90%	1.07%	7765	0.472
Market capitalization ($mil)	Mean	5,101.15	4,750.43	6,298.77	-1.18	0.238
	Median	1,903.83	1,896.36	2,069.18	8366	0.106
	Min	14.25	14.25	23.15		
	Max	63,941.18	63,941.18	48,965.93		
Net sales ($mil)	Mean	6,865.70	6,550.48	7,924.64	-0.72	0.473
	Median	2,704.44	2,787.08	2,468.64	8191	0.182
	Min	11.08	31.79	11.08		
	Max	104,859.00	104,859.00	55,977.00		
Total assets ($mil)	Mean	12,827.77	11,122.38	18,618.79	-1.31	0.196
	Median	2,912.38	2,744.20	3,761.20	8356	0.110
	Min	23.26	23.26	50.03		
	Max	269,425.00	180,978.00	269,425.00		
Common equity ($mil)	Mean	2,683.69	2,587.98	2,933.21	-0.50	0.620
	Median	98,110.00	927.45	1,239.87	8313	0.126
	Min	-560.00	-560.00	27.62		
	Max	40,620.36	40,620.36	19,900.00		

1. Returns are not available in CRSP for three of the firms during the holding period: Multimedia Inc, Guinness PLC and Comdisco Holdings Inc.

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

Distribution of Berkshire Hathaway Investments from 1980 to 2003 partitioned by the SIC-based industry and size deciles. Industry is determined by using the SIC code partitioned into the SIC Division structure. Size deciles are based on market value of equity relative to NYSE, AMEX, and NASDAQ firms in the CRSP database on the first date of reported holding. Chi-square test of proportions indicates at least one size based deciles (χ^2 = 1044, p-value = <.0001) and one industry classification (χ^2 = 643, p-value = <.0001) contain more observations than expected.

			Sized-Based Deciles									
SIC		Total	Larger Firms									Smaller Firms
Division	Industry	Firms	10	9	8	7	6	5	4	3	2	1
01 - 09	Agriculture, Forestry & Fishing	0	-	-	-	-	-	-	-	-	-	-
10 - 14	Mining	9	5	3	-	-	1	-	-	-	-	-
15 - 17	Construction	1	-	1	-	-	-	-	-	-	-	-
20 - 39	Manufacturing	115	72	18	14	4	2	2	2	1	-	-
40 - 49	Transportation, Communication, Electric, Gas & Sanitary Services	39	22	10	4	1	1	1	-	-	-	-
50 - 51	Wholesale Trade	2	-	1	-	1	-	-	-	-	-	-
52 - 59	Retail Trade	16	10	4	-	1	-	1	-	-	-	-
60 - 67	Finance, Insurance, & Real Estate	57	29	9	6	4	6	2	1	-	-	-
70 - 89	Services	22	10	5	1	3	3	-	-	-	-	-
	Total	261	148	51	25	14	13	6	3	1	0	0

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

Distribution of Berkshire Hathaway stock investments from 1980 to 2003 using Fama & French small vs. big (size) and value vs. growth (book-to-market equity) classification. Percentiles are determined based upon breakpoints provided by Ken French using market value of equity on the first date of reported holding and book equity as reported in the previous fiscal year end.

	Market Equity		
Book-to-Market Equity	**Small**	**Big**	**Total**
Value ($\geq 70^{th}$ percentile)	17	22	39
Neutral	24	62	86
Growth ($\leq 30^{th}$ percentile)	9	123	132
Negative	-	4	4
Total	50	211	261

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

Average market-adjusted returns of first public disclosure of Berkshire Hathaway stock investments between 1980 and 2003. Abnormal returns are measured on the day of public disclosure relative to the value weighted index of all stocks in CRSP. Parametric test of means use the Student's t distribution and non-parametric test of the medians use the Wilcoxon rank sum test. Panel A compares the results of Long Term versus Arbitrage investments. Panel B compares the results of the first half of the sample period with the second half. Returns are not available for the initial public disclosure of some investments due to investment occurring prior to January 1, 1980, the delay in filings, and confidential treatment of filings.

Panel A: Disclosure of Long Term versus Arbitrage Stock Investments

				Log Term vs. Arbitrage	
	All Stocks	Long Term	Arbitrage	Test Statistic	p-value
Number stocks acquired after January 1, 1980	204	161	43		
Number of returns	193	158	35		
Number missing	11	3	8		
Percent positive	73.6%	74.7%	68.6%		
Mean	1.3571%	1.2208%	1.9724%	-0.69	0.493
T	5.7204	7.26352	1.8391		
Pr > |t|	<.001	<.001	0.075		
Median	0.6627%	0.6964%	0.4047%	3086	0.151
s	6245.5	4304.5	182.0		
Pr > |s|	<.001	<.001	0.002		

Panel B: Disclosure of Stock Investments in First Half (1980 – 1991) Versus Second Half (1992 – 2003) of Study

				First Half vs. Second Half	
	All Stocks	1980 - 1991	1992 - 2003	Test Statistic	p-value
Number stocks acquired after January 1, 1980	204	149	55		
Number of returns	193	142	51		
Number missing	11	7	4		
Percent positive	73.6%	67.6%	90.2%		
Mean	1.3571%	0.7843%	2.9521%	-2.79	0.007
t	5.7204	5.35743	3.8747		
Pr > |t|	<.001	<.001	<.001		
Median	0.6627%	0.5030%	1.6222%	6462	<0.001
s	6245.5	2699.5	628.0		
Pr > |s|	<.001	<.001	<.001		

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

Calendar-time abnormal returns (CTARs) of Berkshire Hathaway stock investment portfolio and mimicking portfolio from 1980 to 2003. Mean and median CTARs 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. Mean and median CTARs are calculated from the time-series of monthly abnormal returns. 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|
Value Weight Index	288	62.5%	0.9024%	3.7735	<.001	0.9733%	7022	<.001
Fama & French 25 Size-BE/ME Portfolio	288	61.5%	0.6866%	2.8492	0.005	0.8319%	5730	<.001

Panel B: Mimicking Portfolio

Portfolio/Benchmark	N	%Pos	Mean	t	Pr > |t|	Median	s	Pr > |s|
Value Weight Returns								
Value Weight Index	288	60.8%	0.8216%	3.6069	<.001	0.9126%	6623	<.001
Fama & French 25 Size-BE/ME Portfolio	288	59.0%	0.6014%	2.9855	0.003	0.6629%	5222	<.001
Equal Weight Returns								
Value Weight Index	288	59.7%	0.5812%	3.1122	0.002	0.5790%	5287	<.001
Fama & French 25 Size-BE/ME Portfolio	288	56.9%	0.3648%	2.0067	0.046	0.5628%	3746	0.008

Table 6: Annual Performance Summary of Berkshire Hathaway Stock, Stock Portfolio and Various Benchmarks.

Annual performance summary of Berkshire Hathaway stock return, 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. 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. Beta (β) is calculated using 60 month rolling returns from CRSP.

	Berkshire Hathaway						Benchmark					
	Stock		End of Year Stock Portfolio				S&P 500 Index		Value Weight Index		F&F 25 Size-BE/ME	
Year	Return	β	N	Value	Largest 5 Holdings	Return	Return	Difference	Return	Difference	Return	Difference
1980	31.06%	1.030	102	$761	48.3%	20.09%	32.30%	-12.21%	33.23%	-13.15%	35.08%	-14.99%
1981	30.64%	1.021	27	$854	61.3%	32.30%	-5.00%	37.30%	-3.98%	36.28%	2.04%	30.26%
1982	38.50%	0.996	22	$1,287	68.4%	54.79%	21.40%	33.39%	20.42%	34.37%	27.69%	27.11%
1983	69.33%	1.067	14	$1,424	86.1%	37.80%	22.40%	15.40%	22.65%	15.15%	27.36%	10.44%
1984	-2.83%	0.789	16	$1,400	77.1%	11.66%	6.10%	5.56%	3.16%	8.50%	5.61%	6.05%
1985	91.84%	0.585	13	$1,468	83.6%	88.76%	31.60%	57.16%	31.42%	57.34%	33.69%	55.07%
1986	14.17%	0.709	11	$2,118	95.0%	24.21%	18.60%	5.61%	15.57%	8.64%	14.49%	9.72%
1987	4.61%	0.847	13	$2,484	96.2%	22.36%	5.10%	17.26%	1.82%	20.54%	3.07%	19.29%
1988	59.32%	0.871	16	$3,556	91.0%	16.07%	16.60%	-0.53%	17.55%	-1.48%	18.21%	-2.14%
1989	84.57%	0.982	10	$5,727	94.0%	53.96%	31.70%	22.26%	28.43%	25.53%	30.96%	23.00%
1990	-23.05%	1.064	11	$5,762	91.8%	4.87%	-3.10%	7.97%	-6.08%	10.95%	-0.82%	5.69%
1991	35.58%	0.998	12	$9,219	88.6%	48.76%	30.50%	18.26%	33.64%	15.12%	46.26%	2.50%
1992	29.83%	1.036	14	$11,800	83.1%	20.92%	7.60%	13.32%	9.06%	11.86%	7.75%	13.17%
1993	38.94%	1.169	23	$12,756	74.3%	13.45%	10.10%	3.35%	11.59%	1.86%	2.95%	10.50%
1994	24.96%	1.019	29	$16,270	69.5%	17.04%	1.30%	15.74%	-0.76%	17.80%	3.42%	13.61%
1995	57.35%	0.911	30	$23,760	70.9%	47.62%	37.60%	10.02%	35.67%	11.95%	35.74%	11.87%
1996	6.23%	0.643	30	$28,800	72.2%	36.92%	23.00%	13.92%	21.16%	15.76%	23.78%	13.14%
1997	34.90%	0.703	30	$37,807	72.8%	40.89%	33.40%	7.49%	30.35%	10.55%	34.53%	6.36%
1998	52.17%	0.824	33	$38,264	77.3%	13.80%	28.60%	-14.80%	22.31%	-8.51%	35.70%	-21.91%
1999	-19.86%	0.862	35	$37,332	78.4%	7.14%	21.00%	-13.86%	25.39%	-18.25%	20.21%	-13.07%
2000	26.56%	0.834	41	$37,549	76.3%	15.57%	-9.10%	24.67%	-11.16%	26.73%	-2.06%	17.63%
2001	6.48%	0.715	34	$29,083	76.2%	-10.50%	-11.90%	1.40%	-11.26%	0.76%	-7.05%	-3.45%
2002	-3.77%	0.526	35	$28,483	74.8%	2.52%	-22.10%	24.62%	-20.98%	23.50%	-19.92%	22.44%
2003	15.81%	0.380	32	$35,535	74.1%	29.26%	28.70%	0.56%	33.09%	-3.83%	31.09%	-1.84%
Average	29.31%	0.858	26.4	$15,562	78.39%	27.09%	14.85%	12.24%	14.26%	12.83%	17.07%	10.02%
σ	0.2979					0.2147	0.1665	0.1646	0.1679	0.1676	0.1718	0.1613

Table 7: Monte Carlo Simulation of Berkshire Hathaway and Mimicking Portfolios versus the Best Performing Manager in an Efficient Market

Panel A provides the frequency distribution of the number of years the best performing manager beats the market over a 24 year period assuming the market is efficient and the relative performance of Berkshire Hathaway's stock portfolio. Panel B provides the mean and key percentiles of the winning manager's margin in terms of standard deviations above the mean.

Panel A: Frequency Distribution of the Number of Years the Winning Manager Beats the Market

Winning Years	Number of Managers in Contest		
	214	**500**	**1,000**
16	0.06%	-	-
17	8.15	0.29%	-
18	40.88	19.46	3.74%
19	35.83	48.14	42.26
20	12.09	25.51	41.48
21	2.61	5.77	10.94
22	0.34	0.79	1.47
23	0.04	0.04	0.11
24	-	-	-
Mean winning years of best performer	18.61	19.20	19.64
Berkshire Hathaway's Relative Performance:			
Years	20	20	20
Percentile	84.92	70.89	54.00

Panel B: Winning Manager's Performance in Excess of the Market in Standard Deviations

Statistic	Number of Managers in Contest		
	214	**500**	**1,000**
Mean	2.70	2.94	3.12
Median	2.66	2.89	3.16
90^{th} Percentile	3.17	3.35	3.58
95^{th} Percentile	3.33	3.56	3.69
99^{th} Percentile	3.68	3.84	4.01
100^{th} Percentile	4.57	4.61	4.68

Table 8: 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 respectively, 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 that implies about 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 deviations of the winning manager in the simulation by the implied risk per standard deviation of Manager Noise. The t-value (t) and p-values represent a test of the hypothesis that the performance of Berkshire Hathaway's portfolio exceeds the performance of the winning manager. 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 = 12.24%, σ = 0.1646)

		Number of Managers in Contest								
Manager	Implied	214 (σ = 2.70)			500 (σ = 2.94)			1,000 (σ = 3.12)		
Noise	Risk	E(r)	t	p-value	E(r)	t	p-value	E(r)	t	p-value
5%	1.02%	2.76%	2.82	0.005	3.00%	2.75	0.006	3.18%	2.70	0.006
10	2.04	5.51	2.00	0.028	6.00	1.86	0.038	6.37	1.75	0.047
15	3.06	8.27	1.18	0.124	9.00	0.96	0.172	9.55	0.80	0.216
20	4.08	11.02	0.36	0.360	12.00	0.07	0.472	12.74	-0.15	0.442

Panel B: Mimicking Portfolio (Mean excess return = 11.56%, σ = 0.1602)

		Number of Managers in Contest								
Manager	Implied	214 (σ = 2.70)			500 (σ = 2.94)			1,000 (σ = 3.12)		
Noise	Risk	E(r)	t	p-value	E(r)	t	p-value	E(r)	t	p-value
5%	1.02%	2.76%	2.51	0.010	3.00%	2.44	0.011	3.18%	2.38	0.013
10	2.04	5.51	1.67	0.054	6.00	1.52	0.071	6.37	1.41	0.086
15	3.06	8.27	0.66	0.209	9.00	0.60	0.277	9.55	0.43	0.335
20	4.08	11.02	-0.02	0.493	12.00	-0.32	0.377	12.74	-0.54	0.297