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

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Abstract:

We analyze Berkshire Hathaway's equity portfolio over the 1976 to 2006 period and explore potential explanations for its superior performance. Contrary to popular belief, we find Berkshire Hathaway invests primarily in large-cap growth rather than "value" stocks. Over the period the portfolio beat the benchmarks in 27 out of 31 years, on average exceeding the S&P 500 Index by 11.14%, the value-weighted index of all stocks by 10.92%, and a Fama and French characteristic-based portfolio by 8.56% per year. Although beating the market in all but four years can statistically happen due to chance, incorporating the magnitude by which the portfolio beats the market makes a luck explanation extremely unlikely even after taking into account ex-post selection bias. We find that Berkshire Hathaway's portfolio is concentrated in relatively few stocks with the top five holdings averaging 73% of the portfolio value. While increased volatility is normally associated with higher concentration we show the volatility of the portfolio is driven by large positive returns and not downside risk. The market appears to under-react to the news of a Berkshire Hathaway stock investment since a hypothetical portfolio that mimics the investments at the beginning of the following month after they are publicly disclosed also earns significantly positive abnormal returns of 10.75% over the S&P 500 Index. Our evidence suggests the Berkshire Hathaway triumvirates of Warren Buffett, Charles Munger, and Lou Simpson posses' investment skill unlikely to be explained by Efficient Market Theory.

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

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Abstract

We analyze Berkshire Hathaway's equity portfolio over the 1976 to 2006 period and explore potential explanations for its superior performance. Contrary to popular belief, we find Berkshire Hathaway invests primarily in large-cap growth rather than "value" stocks. Over the period the portfolio beat the benchmarks in 27 out of 31 years, on average exceeding the S&P 500 Index by 11.14%, the value-weighted index of all stocks by 10.92%, and a Fama and French characteristic-based portfolio by 8.56% per year. Although beating the market in all but four years can statistically happen due to chance, incorporating the magnitude by which the portfolio beats the market makes a luck explanation extremely unlikely even after taking into account ex-post selection bias. We find that Berkshire Hathaway's portfolio is concentrated in relatively few stocks with the top five holdings averaging 73% of the portfolio value. While increased volatility is normally associated with higher concentration we show the volatility of the portfolio is driven by large positive returns and not downside risk. The market appears to under-react to the news of a Berkshire Hathaway stock investment since a hypothetical portfolio that mimics the investments at the beginning of the following month after they are publicly disclosed also earns significantly positive abnormal returns of 10.75% over the S&P 500 Index. Our evidence suggests the Berkshire Hathaway triumvirates of Warren Buffett, Charles Munger, and Lou Simpson posses' investment skill unlikely to be explained by Efficient Market Theory.

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

Warren Buffett's investment record suggests he is one of the most successful investors of all time.[1] With his long-time partner Charles Munger, they transformed Berkshire Hathaway from a struggling textile manufacturer to a holding company with a market capitalization greater than $200 billion. In 1985 with the acquisition of GEICO, Lou Simpson was added to the collective that makes investment decisions for the company. According to Forbes, Buffett's beneficial interest in Berkshire Hathaway gives him an estimated net worth of $62 billion making him the wealthiest person in the world.[2] Berkshire Hathaway controls a diverse group of subsidiaries, many of which are industry leaders in both market share and financial strength, and an equity portfolio in excess of $74.6 billion in publicly traded companies whose value alone would equate to the 6th largest mutual fund according to Lipper.[3] The performance of Berkshire's equity portfolio has beaten the S&P 500 index in 27 out of 31 years from 1976 to 2006 exceeding its average annual return by 11.14% over this period.

While many books have attempted to explain Buffett's investment philosophy and success there has been no rigorous empirical analysis of his exceptional performance. Academic research generally has focused on analyzing performance of mutual funds in order to determine if superior performance may exist however, obtaining a better understanding of the performance of arguably the world's greatest investor would be valuable in determining whether it can be explained by such theories as the Efficient Markets Theory (EMT).

So how does one explain the investment success of Berkshire Hathaway which has been achieved over a long period of time? Consistent with efficient markets theory Buffett may just have been lucky.

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[1] Buffett started managing funds in the 1950s and acquired Berkshire Hathaway in 1965. The company became listed on the NYSE in 1976. We use Berkshire Hathaway and Buffett interchangeably throughout the paper although Charlie Munger and Lou Simpson are also responsible for Berkshire Hathaway's investment decisions.

[2] http://www.forbes.com/lists/2008/03/05/richest-people-billionaires-billionaires08-cx_lk_0305billie_land.html

[3] Including fixed income investments of $27.9 billion and cash of $28.3 billion it easily surpasses the value of the largest mutual fund the American Funds Growth Fund of America whose total net assets as of March 31, 2008 were $83.5 billion according to Lipper.

That is, if enough investors participate in the market, due to pure luck, some investors can obtain very successful investment records.[4] Buffett's successful performance has also been identified after-the-fact so his record is subject to ex-post selection bias. We mitigate this bias in two ways. First, we begin our analysis in 1976, a point in time when Buffett had already developed a reputation as a very successful investor.[5] Second we use a procedure developed by Marcus (1990) to show that Berkshire Hathaway's equity investment performance is statistically not likely due to luck even after accounting for ex-post selection bias.

We show that Berkshire Hathaway's high returns are not simply compensation for higher risk as measured by traditional empirical benchmarks and portfolio analysis techniques. We find the portfolio is concentrated in relatively few stocks resulting in a highly undiversified portfolio. Such concentration exposes the portfolio to significant amounts of unsystematic risk which will likely produce consistently superior returns only in the presence of investment skill. Using simulations of concentrated portfolios where stocks are picked randomly we find their performance is highly unlikely to produce an investment record like Berkshire Hathaway's. Finally we show that Berkshire Hathaway's portfolio historically has experienced low downside risk further indicating the presence of stock picking skills.

Can Efficient Markets Theory (EMT) explain Berkshire Hathaway's investment performance? EMT does not claim that stock prices are correct at all times, it only states that stock prices are correct on average. At any point in time, stocks may be mispriced with the market reacting quickly to correct the mispricing. If an investor is successful in identifying the direction of pricing errors in a majority of their investments, they can earn positive risk-adjusted returns. Grossman and Stiglitz (1980) explain that

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

[5] In Buffett's words, if an investor continues to outperform *after* being identified as a successful investor, it is likely that he knows something. Buffett ran a highly successful investment partnership from 1957 to 1968 obtaining an average annual return of 32.4% with zero negative return years and a minimum annual return of 10.4%. He beat the Dow Jones Industrial Average by an average annual return of 22.1% (the DJIA had 3 negative return years) over this period. In the early 1980's, he was also profiled in Barron's and had a famous debate with Michael Jensen at the Columbia Business School on whether markets are efficient.

skilled investors are rewarded for the cost of information production (acquiring better information and/or better processing of available information) that keep markets efficient. Such ability would enable the skilled investors (efficiency insurers) to identify mispriced stocks and earn positive risk-adjusted returns as compensation for information production. Under this interpretation, Berkshire Hathaway's positive risk-adjusted returns are still potentially consistent with EMT.

It is not clear whether unskilled investors can profit from the information produced by skilled investors. Proponents of EMT proponents (e.g. Samuelson, 1989) state that skilled investors will charge a higher management fee thus capturing most of the excess return leaving little for unskilled investors. It is also argued that information produced by skilled investors is quickly incorporated into stock prices by the trading activity of skilled investors so that unskilled investors are unable to profit from this information. We find that unskilled investors who mimicked Buffett's investments at the beginning of the following month after they are made public would have earned significantly large positive risk-adjusted returns. This suggests that information produced by skilled investors such as Buffett may not be rapidly incorporated into stock prices; a finding not consistent with traditional interpretations of EMT.

We investigate this further using event-study methodology by examining the market reaction to the news of Berkshire Hathaway's initial investment in a stock. If the market interprets the news as an indicator of undervaluation with potential future positive risk-adjusted returns, the reaction will be positive and significant. We show over the study period the market reacts positively to the public disclosure of a Berkshire Hathaway stock investment with an average abnormal return of 4.03% the day of announcement. The reaction is stronger in the second half of the study period with a 4.40% abnormal return as compared to a 0.82% in the first half suggesting the market views the news as a credible signal of under-pricing with the signal becoming stronger as Buffett's investment success has become more celebrated. Though the information signal produced by Buffett appears to be incorporated rapidly into stock prices, the market appears to under-react to this information since investors who mimic the stock investments after they become publicly known are still able to obtain significant positive risk-adjusted returns. The higher stock price reaction to Berkshire's investments in the more recent period suggests

that the extent of under-reaction may be decreasing over time as more investors become convinced of Buffett's investment skill.

Finally we examine Buffett's investments to determine his investment style. Contrary to the popular characterization of Buffett as "value investor" we find Berkshire Hathaway's investments are more consistent with a large-cap growth approach when using the Fama & French 2x3 size and book-to-market classification scheme. Interestingly, Buffett objects to such a "value versus growth" characterization of investment style because of the inextricable link between value and growth. A growth stock can still be a "value" purchase as long as the intrinsic value is higher than the market price.

Collectively, our findings suggest that Berkshire Hathaway's exceptional investment record is due to investment skill and not due to luck or as compensation for high risk. This is consistent with findings in a number of recent papers such as Chen, Jegadeesh, and Wermers (2000), Cohen, Coval, and Pastor (2005), Wermers (2000), Kosowski et al. (2005), and Kacperczyk, Sialm, and Zheng (2005) who argue investment skill is more prevalent than previous research indicate. The significant positive excess returns of a mimicking strategy beginning the following month after Berkshire Hathaway's holdings are publicly disclosed does not appear to be explained by the traditional or alternative interpretations of EMT.

I. Literature Review

A. Performance of financial professionals

Many studies have investigated the performance of mutual funds and various financial professional recommendations to determine if they outperform the market or other suitable benchmarks. Since Jensen (1968), most papers have found that mutual funds on average do not outperform their benchmarks. Cahart (1995), Malkiel (1995), and Daniel et al. (1997) find small or zero average abnormal returns using modern performance evaluation methods on samples that are relatively free of survivorship bias suggesting the average active mutual fund should be avoided. Alternatively, papers like Carlson (1970), Lehman and Modest (1987), Grinblatt and Titman (1988, 1992), Hendricks et al. (1993), Goetzmann and Ibbotson (1994), Brown and Goetzmann (1995), Elton et al. (1996), and Cahart (1997)

have found evidence suggesting future excess returns or "alphas" can be forecast using past returns or alphas. As discussed in Baks et al. (2001), this evidence suggests the possibility alphas (abnormal performance) are persistent and that some managers have positive expected alphas and therefore may be able to beat the market.

Desai and Jain (1995) find the recommendations of the Roundtable of Barron's Superstar money managers experienced a positive abnormal return on the day of the first public announcement but failed to provide superior performance thereafter. Similarly, Black (1973), Copeland and Mayers (1982), Stickel (1985), and Lewis et al. (1997) examine the "Value Line Anomaly" show that after an initial reaction, the recommendations show no sustained superior performance once an appropriate benchmark is used. Graham and Harvey (1996), Jaffe and Mahoney (1999), and Metrick (1999) show investment newsletters fail to offer superior market timing ability. In contrast, Barber and Loeffler (1993) show a positive abnormal return on analyst's recommendations and Womack (1996) indicates that analysts appear to have market-timing and stock-picking abilities. Prior research is therefore generally mixed regarding possible evidence of superior investment skill.

More recent research suggests some fund managers may have superior investment skill. Wermers (2000) finds high-turnover mutual funds held stocks that substantially beat the S&P 500 index from 1975 to 1994. Chen et al. (2000) investigate the value of active mutual fund management by examining the stockholdings and trades of mutual funds and find growth-oriented funds exhibit stock selection skills especially in large growth stocks. Coval, Hirshleifer and Shumway (2002) demonstrate trades of individual investors classified in the top ten percent exploit market inefficiencies to earn abnormal profits above those from well-known strategies. Kosowski et al. (2006) provide a comprehensive examination of mutual fund performance explicitly controlling for luck. Across a wide array of performance measurements their tests indicate the large, positive alphas of the top ten percent of funds (net of costs) are extremely unlikely to be solely due to luck. Subsequent tests indicate the superior performance is concentrated among growth-oriented funds. They also find stronger evidence of superior fund management during the first half of their sample period (pre-1990s) not simply due to luck. Finally, they

find significant persistence in net return alphas for the top (sometimes top two) deciles of managers. Cohen et al. (2005) develop a performance evaluation approach in which a manager's skill is judged by the extent to which the manager's investment decisions resemble the decisions of managers with distinguished historical performance records and find strong predictability in the returns of U.S. equity funds. Stocks commonly held by managers who have been performing well tend to out-perform in the future even after adjusting for momentum in stock returns indicating some collective investment skill on the part of these managers.

The latest stream of literature argues that skilled investors hold more concentrated portfolios to better exploit their informational advantages. Kacperczyk et al. (2005) examine the relationship between industry concentration and the performance of actively managed U.S. mutual funds from 1984 to 1999 and find that on average more concentrated funds perform better after controlling for risk and style differences. Similarly, Ivkovic, Sialm and Weisbenner (2007) test whether information advantages help explain why some individual investors concentrate their portfolios in a few stocks and find that households that choose a concentrated approach outperform those with diversified portfolios. On the other hand Sapp and Yan (2008) examine gross fund returns based on number of securities held and find no evidence that focused funds outperform diversified funds. Overall, the most recent research finds stronger evidence that some fund managers may have superior investment skill.

B. Optimal information disclosure by institutional investors

Grossman and Stiglitz (1980) argue that skilled investors are rewarded for the cost of information production (acquiring better information and/or better processing of available information) which keeps markets efficient. Kurz and Motolese (2000) also argue that rational agents can have diverse interpretations of the same information suggesting that an investor who is skilled at processing available public information may be able to identify the true value of stocks before the market does. Such ability would enable an investor to identify mispriced stocks and earn positive risk-adjusted returns. These

interpretations allow for skilled investors (efficiency insurers) to earn positive abnormal returns as compensation for their information production.

It is unclear how the superior information of skilled investors gets transmitted into stock prices. A potential explanation is that skilled investors will trade on their superior information which gets reflected in stock prices quickly. These investors will have an incentive to conceal their trading activities until they complete their positions since the market over time will recognize their superior skill and react to the news of their investments and reduce their returns. For example, once the skilled investor's buying (selling) activity in a particular security becomes known to the market, additional buying (selling) will be at higher (lower) prices. Conversely, skilled investors should welcome mimicking or copy-cat investors after establishing their positions since this would quicken the correction of miss-pricings and the realization of positive abnormal returns (Frank et al., 2004). Regulatory rules that require frequent disclosures of holdings attempt to improve the efficiency of markets allowing the information produced by skilled investors to be incorporated into stock prices faster. Since frequent disclosures may lower the returns of skilled investors they may reduce incentives to undertake information production/information processing activities with possible adverse effects for the efficiency of markets. So, disclosure regulations need to be formulated taking both of these factors into consideration.

C. Performance testing and benchmarking methodologies

Prior research demonstrates the results of long-term performance studies may be dependent upon the chosen testing methodology and the benchmark. The two most popular choices for long-term abnormal return measurement are the cumulative abnormal return (CAR) and buy-and-hold abnormal return (BHAR). The CAR is calculated by summing the abnormal returns (actual returns less benchmark returns) over all periods of the tested horizon. Alternatively, BHAR is calculated by compounding each periodic return into a buy-and-hold measure over the tested horizon and subtracting from it the buy-and-hold benchmark return. Barber and Lyon (1997) and Kothari and Warner (1997) argue that both methods have drawbacks that could bias test statistics to yield different results.

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

II. Data

Data on Berkshire Hathaway's stock investments was gathered from regulatory filings required by the Security and Exchange Commission and from the Berkshire Hathaway annual reports. The SEC filings examined include forms 10K, 13F, 13D, 13G, 3, 4 and 5 and amendments which are available on the SEC's EDGAR website.[6] 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.[7]

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,

[6] 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.

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

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[8] during the study period. For example, Berkshire's common stock investment in American Express in 1994 was the result of an automatic conversion of Preferred Equity Redemption Cumulative Stocks (PERCS) acquired three years earlier. In our analysis we assume the investment occurred in the quarter the PERCS were converted to common stock at the price reported at the end of month of conversion. Several other equity investments were also preceded by or were increased through investments in convertible preferred stock including First Empire State, Geico, Gillete, Salomon, and US Airways. Berkshire's initial investment in Federal Home Loan Mortgage (Freddie Mac), although technically a preferred stock, was for all practical purposes a common stock investment made at a time when it was available only to lending institutions.[9] Since Berkshire's conversion prices would have been lower than our assumed prices, our calculated performance of Berkshire's investment portfolio will understate its actual returns on these investments.

A. Data Sources

A primary source of data is Form 13F filings required by institutional investment managers that are 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.[10] The Form 13F requires

[8] 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

[9] 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.

[10] 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

disclosure of the names of institutional investment managers, the names and class of the securities they manage, the CUSIP number, the number of shares owned, and the total market value of each security as of the last day of the calendar quarter. The first 13F filing by Berkshire Hathaway occurred for the quarter ended December 31, 1978 filed with the SEC on May 17, 1979.

Institutional investment managers may request confidential treatment of certain securities ordinarily required to be reported on Form 13F which would exempt them from public disclosure if the information would reveal an investment manager's program of acquisition or disposition that is ongoing. If granted, the SEC will allow the investment manager to withhold certain investments from the 13F 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.[11]

Berkshire Hathaway has often requested confidential treatment for certain investments and only recently have some of those requests been denied confidential treatment.[12] Not only does confidential treatment of new investments delay the disclosure to the public of acquisitions, confidential treatment of existing investments might mistakenly indicate a divestment of a particular security. Indeed this occurred when numerous press accounts reported Berkshire had divested its holdings of Wells Fargo based upon (the lack of) information contained in the latest Form 13F. These presumptuous press accounts triggered a temporary, but significant, decline in the price of Wells Fargo's stock. Certain articles attributed the

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information regarding Form 13F and http://www.sec.gov/divisions/investment/13flists.htm for a list of securities for which disclosure is required.

[11] 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.

[12] 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.

confusion about the holdings to the operation of the Commission's rules on confidential treatment of information filed on Form 13F.[13]

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 not be disclosed as long as other regulatory reporting requirements are not triggered.

Additional sources include Schedule 13D, 13G and related amendments filings. These are required to be filed by any person within 10 days of acquisition who, directly or indirectly acquires the beneficial ownership of more than five percent of an equity security of a class specified in Section 13(d)(1) of the Exchange Act. The information contained in these filings include, name of the security, the CUSIP number, the number of shares beneficially owned, and the date of event which requires the schedule to be filed. Changes in these holdings must be reported in an amendment to the original filing and is classified as an amended filing with a "/A" added to the original form ("13D/A" or "13G/A") and a serial amendment number indicating the number of amendments to date. Once the holdings fall below the five percent level the filing will indicate the beneficial owner no longer meets the five percent ownership level and will no longer be subject to the reporting requirements. Berkshire Hathaway has often taken a five percent or greater position in a security which triggered the requirement of these filings. Once a holding reaches and remains above the five percent level, Schedules 13D, 13G and their amendments provide a better estimate of dates of securities transactions. The shorter 13G filing is available only for certain classes of investors and only when they are not attempting a change in control. In the case of Berkshire Hathaway, a Schedule 13D filed in lieu of a 13G may signal intent to change or influence control which indeed seems to be the case with 13D filings in Salomon (where Warren Buffett served as

[13] 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.

CEO), Gillette (where Mr. Buffett served as Director) and Benjamin Moore, Comdisco Holding Co, CORT Business Services Corp, Finova Group, General Re, Justin Industries, International Dairy Queen, MidAmerican Energy Holdings, Shaw Industries, and Xtra Corp all of which became operating entities under Berkshire Hathaway. All other holdings of five percent or more without intent to influence control are reported using Schedule 13G except when insider holdings on Forms 3, 4 or 5 are reported.

A company's officers and directors, and any beneficial owners of more than ten percent of a class of the company's equity securities registered under Section 12 of the Exchange Act are considered corporate insiders and must file with the SEC a statement of ownership regarding those securities using Form 3, 4 or 5. Form 3 is used for the initial filing by an insider and must occur no later than the effective date of registration if the issuer is registering equity securities for the first time or within ten days of becoming an officer, director, or beneficial owner of securities previously registered. Changes in ownership are reported on Form 4 and must be filed at the Commission within two business days. There are limited categories of transactions not subject to the two-day reporting requirement. A Form 5 is used to report any transactions that should have been reported earlier on a Form 4 or were eligible for deferred reporting and are required to be filed 45 days after the end of the issuer's fiscal year. Since June 30, 2003, the SEC has required insiders to submit forms electronically through the SEC's EDGAR system (prior to that date, insiders could choose, but were not required, to file electronically). The SEC also requires companies that maintain websites to post the forms by the end of the next business day after filing them with the SEC.

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

B. Period of Study

We searched EDGAR and the SEC's Reference Room for all ownership filings beginning in 1976 through December 31, 2007. From each filing we record the source, transaction date, filing date, and date the filing became public, the name and CUSIP numbers of securities reported, change in number of shares owned, and market value on date of filing. We supplement this data by searching Berkshire Hathaway's annual reports, LexisNexis, and earlier regulatory filings to determine the initial acquisition of stock holdings that were reported at the beginning of the study. In order to determine the market's reaction to the initial news of a Berkshire investment we searched LexisNexis for the first date for which public disclosure occurred. If none was found we recorded the day following the date of filing as the first public disclosure date.[14] The ending date of December 31, 2006 was the last date for which return data was available on CRSP.

C. Financial Data

We used the reported CUSIP and dates of holdings to gather data on net sales, total assets and common equity from *Compustat* in the fiscal year prior to the first reported holding. Monthly return, price and outstanding share data from the CRSP database was used to determine monthly returns and market capitalization. Benchmark portfolios were formed using the value-weight index of NYSE/AMEX/NASDAQ stocks with dividends from CRSP and the value-weight Fama and French 25 size and book-to-market equity returns.[15]

We limit our analysis to common equity investments due to data availability. The resulting data set includes 335 common equity investments in the period from January 1, 1976 to December 31, 2006. Data is available in CRSP over the relevant period for all but three of the securities: Multimedia Inc

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

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

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 firms which was gathered directly from the companies' financial reports and substituted for the missing *Compustat* data.

D. Arbitrage versus Long Term

Berkshire Hathaway has often used risk arbitrage as an alternative to holding short-term cash equivalents. These arbitrage opportunities present themselves after an announced corporate event such as sale of the company, merger, recapitalization, reorganization, liquidation, self-tender, etc. The major risk incurred in these investments is the risk of the event not happening. Berkshire prefers to engage in only a few large transactions each year because of the effort required to monitor the progress of transactions and the market movements of related stocks (Letter to Berkshire Shareholders, 1985). We categorized each investment into one of two investment categories: long-term or risk arbitrage. An investment was categorized as risk arbitrage if and only if either Buffett indicated it was in Berkshire's annual reports and SEC filings or if all of the following conditions were met: (1) the investment appeared in regulatory filings after a public announcement of a merger, restructuring, liquidation or tender offer; (2) the investment holdings were disposed of after the completion or cancellation of the event; and (3) the investment was for a period of less than two years. All other investments were categorized as long-term. It may be noted there is likely to be some uncertainty in determining whether an investment is a long-term investment or a risk arbitrage investment for an investor evaluating Berkshire's investments in real time.[16] Our primary purpose in making this classification is to better describe Buffett's investment methods. We

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

also note that an investor mimicking Berkshire's investments may not be able to participate in many of the risk arbitrage investments because by the time they become public, the investment opportunity is no longer available. Also, as time passes, the opportunity to profit from arbitrage investments reduces since the uncertainty associated with the announced event diminishes.

III. Empirical Methods

We perform three types of empirical tests to evaluate the performance and market impact of Berkshire Hathaway's stock investments. First, we use standard event study methodology to evaluate the market reaction to the news of Berkshire acquiring a stock for the first time. Second, we test the risk-adjusted investment performance of Berkshire's stock investment portfolio and a mimicking portfolio created by an investor following the investments made by Berkshire using both annual buy-and hold and calendar-time abnormal returns (CTAR). Finally, we test whether Berkshire's investment performance could be due to luck after controlling for ex-post selection bias using a Monte Carlo simulation technique described in Marcus (1990) to derive a close numerical approximation of the probability distribution of the best performing manager under the assumption of efficient markets.

A. Event Study

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

B. Calendar Time Abnormal Returns

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

Due to the reporting limitations discussed above and to eliminate abnormal returns surrounding initial disclosure in the mimicking portfolio, several assumptions were made on the timing of purchases and sales of the stocks in Berkshire's stock portfolio and the mimicking portfolio. For Berkshire's stock portfolio, we make the following assumptions. When 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. When a stock no longer appears on the filing or it 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 (and 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 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 Berkshire investment appearing on the December 31, 1990 report filed and made public on February 14, 1991 is assumed to be added to the mimicking portfolio at the close on February 28, 1991. This two-week delay avoids any positive abnormal returns due to the initial reaction to the public disclosure of the investment being included in the mimicking portfolio return. The reason for having this two-week delay is that a mimicking investor may not be able to obtain this initial reaction. Similarly, when a filing indicates a sale has taken place, it is assumed to be sold in the mimicking portfolio at the closing price at the end of the filing month. This causes any negative abnormal return associated with the public disclosure of the sale to be included in the returns of the mimicking portfolio. These assumptions bias against finding a significant positive abnormal return in the mimicking portfolio.

The effect of the filing delay and confidential treatment causes the mimicking portfolio to have fewer stocks than Berkshire Hathaway's actual portfolio and to be positively time shifted in stock purchases by an average of 223 days (122 median) and positively shifted by 48 days (31 median) in stock sales.[17] 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. At the end of each month the portfolios are rebalanced according to the calculated holdings. Since there are a total of 335 stock investments over the 372 month study period from 1976 to 2006 and the average holding period for a stock in Berkshire Hathaway's portfolio over this period exceeds 34 months, transaction costs associated with rebalancing are minimal.

[17] For example using the 13F filing for March 31, 1991 filed on May 14, 1991 indicating a position that is no longer held, it is assumed the stock is disposed of in the Berkshire Hathaway portfolio on January 31, 1991 and in 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 11 regarding Wells Fargo & Co.).

Calendar-time abnormal returns are calculated each month in the study period by subtracting the return of the benchmark portfolio or index from the portfolio return. The mean and standardized mean abnormal return are calculated by dividing each calendar month portfolio mean return by its corresponding standard deviation estimate. 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 lower weights to periods of heavy event activity (Fama (1998) and Mitchell and Stafford (2000)).

We use three different benchmarks: (1) the S&P 500 index with dividends, (2) the value-weight return with dividends of all stocks from CRSP; and (3) a characteristic portfolio created by using the returns from the value-weight 25 size and book-to-market equity portfolios of Fama and French (1993) selected in a manner designed to match the risk of the investments. The Fama & French characteristic-based benchmark was constructed by selecting for each firm-month the return associated with a portfolio of firms with similar market equity at the beginning of the month and book-to-market equity from the last reported fiscal year end. These benchmarks are used because Berkshire Hathaway's investment portfolio predominantly consists of large firms.

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

We create a hypothetical benchmark of the best investment performance assuming EMT holds, to test whether the performance of an investor chosen ex-post is due to luck or superior skill. As discussed in Marcus (1990) and Statman and Scheid (2001) when assessing performance *after* it is known to be outstanding, the standard market benchmarks no longer apply. The appropriate benchmark is the *best* performance from a sample of returns from many managers assuming EMT holds. The probability distribution of the best performance can be derived through Monte Carlo simulations using the experiment described in Marcus (1990). The simulation starts as a contest between (n) managers each of whom flips a coin a number of trials (t). The winning manager and score is the one with the greatest number of heads (h) that occurred in the (t) flips. This procedure is repeated over a large number of trials

($n \geq 10{,}000$) to create a frequency distribution of the winning score. The winning score (h) will be an increasing function of the number of managers (n) and the number of flips (t) in the contest. The frequency distribution of the winning score provides an estimate of the probability distribution of the best performance that can happen due to luck even when markets are efficient. The number of standard deviations from the mean represents the margin by which the winning manager beats the market in an efficient market due to luck $\left(M_{n,t} = \left(\max\left(h_{n,t}\right) - \bar{h}_{n,t}\right)/\sigma_{n,t}\right)$. The winning manager's performance in terms of excess returns is dependent on the amount of risk or volatility the manager assumes (manager-specific risk). Winning managers using high variance strategies will result in higher excess returns. If manager-specific risk (noise) due to high volatility strategies in the market has a standard deviation of $\hat{\sigma} = 15\%$ per year, under the normal distribution it would imply that about one-third of the managers would perform either better or worse than the market by a margin of 15% (Figure 1). This implies the estimated standard deviation of average annual returns over a 31-year period $\left(\sigma_t = \hat{\sigma}/\sqrt{t}\right)$ is $15\%/\sqrt{31} = 2.69\%$. Multiplying the number of standard deviations by which the winning manager in the Monte Carlo simulation beats the market ($M_{n,t}$) by the standard deviation of average annual returns (σ_t) produces the benchmark of the expected margin by which the winning manager will beat the market $\left(E\left(r_{n,t}\middle|EMT\right) = M_{n,t}\sigma_t\right)$. The benchmark will be an increasing function of the number of mangers (n), the number of trials (t), and the assumed manager-specific risk or noise level.

IV. Empirical Analyses

A. Investment Characteristics

We classify Berkshire Hathaway's stock portfolio into three separate categories based upon different investment philosophies. The first group consists of stocks of firms acquired through a tender offer and includes Benjamin Moore, Blue Chip Stamps, CORT Business Services, GEICO, General Re, International Dairy Queen, Johns Manville, Justin Industries, MidAmerican Energy Holdings, Scott & Fetzer, Shaw Industries, and XTRA Corp. The second consists of 221 long-term investment horizon

stocks characterized by large stakes in large firms in few industries. The third consists of 104 short-term risk-arbitrage investments that were either labeled by Warren Buffett in Berkshire annual reports as arbitrage investments or were categorized as such if all the following conditions were met: (1) the investment appeared in regulatory filings after a public announcement of a merger, restructuring, liquidation or tender offer; (2) the investment holdings were disposed of after the completion or cancellation of the event; and (3) the investment was for a period of less than two years. Table I provides univariate statistics for the three distinct investment classes and statistical tests between long-term holdings and short-term risk-arbitrage investments using, holding period, initial and average ownership levels, market capitalization, total assets, common equity and book-to-market of the 335 stock investments during the study period. Three of the 221 long term investments do not have returns available in CRSP during Berkshire's holding period: Multimedia Inc, Guinness PLC and Comdisco Holdings Inc.

The long-term holding stocks have a mean (median) holding period of 46.15 (18.50) months exceeding the 12.07 (8.00) months for the risk arbitrage stocks at p-value < 0.001. The mean (median) of initial ownership stake in the long-term holding stocks is 2.66% (0.57%) is not statistically different from the 2.50% (0.81%) ownership for the risk arbitrage stocks. Similarly the average ownership stake of 3.42% (1.09%) for long-term holding stocks is not statistically different from the 2.51% (0.89%) for risk arbitrage stocks. The mean (median) market capitalization of long-term holdings is $11.24 billion ($2.12 billion) also not statistically different from the $7.38 billion ($1.86 billion) for risk arbitrage stocks. The mean total assets of long-term holdings stocks are slightly higher at $20.46 billion compared to $12.62 billion for risk-arbitrage stocks at a p-value < 0.083. The medians are approximately the same at $2.77 billion and $3.86 billion respectively. The mean value of book equity for issuers of long-term holding stocks is $5.30 billion and $3.35 billion for risk arbitrage stocks different at a p-value = 0.067. The medians are not statistically different at $1.01 billion and $1.23 billion respectively. The mean initial book-to-market ratio of the issuers of both the long-term holding and risk arbitrage stocks is 0.80 while the medians are 0.64 and 0.63 respectively.

Consistent with Berkshire's stated philosophy of investing in businesses they can understand and are comfortable with, Table II shows a highly concentrated portfolio both by industry and size. Nearly 42% (140 of 335) are in manufacturing, followed by 21% (72) in finance, insurance and real estate services and 16% (55) in transportation, communication, electric, gas and sanitary services. Sixty-six percent (221) are in the largest three size deciles by market capitalization of equity. A chi-square test of equal expected proportions supports the findings of industry concentration in at least one of the industry groups at a p-value < 0.001 level as does the concentration in at least one of the size deciles. Industries with the highest concentrations of stock investments are also those in which Berkshire Hathaway's operating subsidiaries are engaged. The large core holdings tend to be held for longer periods of time while smaller investments are often held for relatively shorter periods. The largest five holdings on average account for about 73% of the total portfolio. This indicates a concentrated portfolio approach consistent with Berkshire Hathaway's stated policy of investing heavily when they identify undervalued stocks. Buffett admits that markets are, for the most part, efficient but that occasionally, skilled investors are able to identify mispriced stocks. When such situations arise, he bets heavily to maximize returns from correctly identifying the mispriced stocks.

Contrary to the popular press' characterization of Buffett as a "value" investor, after categorizing investments by the six Fama and French size and book-to-market equity groupings, we find Berkshire's investments are primarily in large cap growth stocks. 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 III, 77% (259) investments fall into the large cap category (market equity $\geq$ 50th percentile) while 41% (138) fall into the low book-to-market or growth category (book-to-market equity $\leq$ 30th percentile). Since only 19% (64) fall into the value

category and 23% (76) fall into the small category, Berkshire's strategy is best characterized as a large cap-growth investment strategy. This is an important finding since a number of papers (e.g. Lakonishok, Shleifer and Vishny (1994)) have documented that stocks identified as "value" stocks outperform "growth" stocks over the subsequent five year period. Lakonishok et al. suggest that investors extrapolate the bad news associated with value stocks too far (underpricing them) and extrapolate the good news associated with growth stocks too far (overpricing them). Since Berkshire Hathaway's investments are primarily in large cap growth stocks the "value" beats "growth" finding cannot be used to explain the performance of the portfolio. Berkshire Hathaway's performance does not appear to be driven by buying traditional "value" stocks (i.e. beaten down stocks), but rather by buying stocks whose growth potential is undervalued by the market.

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

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

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

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

difference in the means is significant at a p-value < 0.001 and a non-parametric Wilcoxon rank sum test is also significant at a p-value < 0.001.

The greater positive stock price reaction in the second half may occur for a variety of reasons. As more investors become convinced of Buffett's investment skill, the disclosures would have a greater impact in the second half as the market views the acquisition of stocks by Berkshire Hathaway as an indicator of positive future risk-adjusted returns. It is also possible, due to the less comprehensive coverage of news sources over the first half of the study; that we were unable to record the correct public disclosure date or the news was spread over more dates. This becomes less of an issue after the late 1980s due to the growth of electronic medium.

C. Berkshire's Investment Performance

Figure 1 provides a comparison of the performance of Berkshire Hathaway's stock investment and mimicking portfolios along with the performance of Berkshire Hathaway Class A shares and the S&P 500 index with dividends. During the 1976 to 2006 period, the stock investment portfolio beat the S&P 500 index with dividends by a factor of 14.7 times. The cumulative return for the stock portfolio is 59,343% as compared to the 4,043% return of the S&P 500 index. Although not as high as the performance of Berkshire's stock portfolio, the mimicking portfolio experienced a 51,399% cumulative return which beats the S&P 500 index by a factor of 12.7 times. The performance of the equity portfolio has contributed to the return of Berkshire Hathaway's Class A shares which experienced a 161,650% cumulative return or nearly 40 times the S&P 500 index.

Table V Panel A presents an annual comparison of the performance of Berkshire Hathaway's stock investment portfolio with the return on Berkshire Hathaway Class A stock, the return on the S&P 500 Index, the value weight index of all stocks, and the portfolio formed using returns from a characteristic portfolio using the value-weight 25 Fama & French size and book-to-market equity portfolio returns. Berkshire Hathaway's stock portfolio experiences a negative return in only two years, 2001 and 2002. Over the 31 year period from 1976 to 2006 the returns of the portfolio exceeded the

returns of each of the benchmarks in all but four years. The average annual return exceeded the S&P 500 by 11.14%, the value-weight index by 10.92% and the Fama & French characteristic portfolio by 8.56%.

The calendar time abnormal return tests of the Berkshire Hathaway and the mimicking portfolios show significant positive abnormal returns. As shown in Table VI Panel A, the monthly mean (median) CTAR of the stock portfolio exceeds the S&P 500 Index without dividends[18] by 1.01% (0.91%), the value-weight index of all stocks by 0.72% (0.53%), and the Fama & French characteristic portfolio by 0.53% (0.53%) significant at p-values < 0.003. This equates to an excess mean annualized return of 12.82% over the S&P 500 Index, 8.99% over the value-weight index, and 6.55% over the Fama & French characteristic portfolio. The monthly mean (median) CTAR of the mimicking portfolio exceeds the S&P 500 Index by 0.99% (0.88%), the value-weight index of all stocks by 0.71% (0.61%), and the Fama & French characteristic portfolio by 0.50% (0.51%) all significant at a p-value < 0.006. The excess mean annualized returns are 12.55% over the S&P 500 index, 8.86% over the value-weight index, and 6.17% over the Fama and French characteristic portfolio.

The results of the factor regressions using the Fama & French 3-factor and Carhart 4-factor models on the monthly returns of the Berkshire Hathaway and mimicking portfolios are presented in Table VII. The intercepts or alphas (excess risk-adjusted returns) are positive and significant for both portfolios at 0.45% and 0.44% per month for the Fama & French and Carhart models respectively which are statistically significant at p-values < 0.024. The excess market return and high-minus low book-to-market factors are also positive and significant at p-values < 0.001. The small-minus-big market equity and prior 2-12 month return momentum factors are not significant in explaining the returns of the portfolio. These regressions indicate the returns of both the Berkshire Hathaway and mimicking portfolios exceed the prediction by both models and are not sensitive to either the small-minus-big or momentum factors.

[18] The CRSP files include monthly returns only for the S&P 500 Index without dividends.

D. Potential Explanations for Berkshire's Investment Performance

1. Risk

The abnormally high returns of Berkshire Hathaway's stock portfolio may be compensation for higher risk investment strategies. Increased risk may take the form of higher market risk or higher unsystematic risk. As presented in Table V Panel B, total risk measured as the standard deviation of returns for the portfolio is 25.32 and is significantly higher than any of the benchmark portfolios at 15.40 for the S&P 500 index, 15.39 for the value-weight index, and 16.50 for the Fama & French characteristic-based portfolio. This is expected since Berkshire's stock portfolio is concentrated in relatively fewer stocks while the benchmark portfolios are fairly diversified. As shown in Table V Panel A, there are several instances of high returns and only two years with negative returns for the Berkshire Hathaway portfolio so the high standard deviation is driven by variation in positive returns. The upside (downside) deviations of the Berkshire Hathaway portfolio is 35.80 (1.90), the S&P 500 Index is 20.20 (5.17), the value-weight index is 20.40 (4.98), and Fama & French characteristic-based portfolio is 23.04 (4.44). The ratio of upside to downside deviation for the Berkshire Hathaway portfolio is 18.80 compared to 3.91 for the S&P 500 Index, 4.09 for the value-weight index, and 5.19 for the Fama & French characteristic-based portfolio. From the Capital Asset Pricing Model, the Beta of the portfolio using the S&P 500 Index with dividends as the proxy for the market portfolio is 0.92 with an R-square of 0.31 resulting in a portfolio consisting of 31.37% systematic (market) risk and 68.63% unsystematic risk. Compared to the S&P 500 index with systematic (unsystematic) risk of 100% (0.00%), the value-weight index with 96.46% (3.54%), and the Fama & French characteristic-based portfolio of 82.87% (17.13%) the Berkshire Hathaway portfolio is exposed to low systematic risk and high unsystematic risk, however, as indicated with the high upside and low downside deviation the unsystematic risk is due to high positive returns rather than negative returns.

The Sharpe ratio which measures average amount of return in excess of the risk-free rate per unit of standard deviation of return is higher at 64.40 for the Berkshire Hathaway portfolio than for the S&P 500 Index (40.19), the value-weight index (41.68), and the Fama & French characteristic-based portfolio

(52.57). Since traditional measures of risk penalize portfolios for volatility deriving from excess positive performance, the Sortino ratio is calculated that measures average amount of return in excess of the risk-free rate per unit of downside deviation of return. The Sortino ratio for the Berkshire Hathaway portfolio is 856.37 and is over seven times the S&P 500 Index at 119.70, over 6.6 times the value-weight index at 128.70, and over 4.3 times the Fama & French characteristic-based portfolio at 195.52. The gain-to-loss ratio which measures the ratio of positive returns to negative return also heavily favors the Berkshire Hathaway portfolio with 66.77 as compared to 8.32 for the S&P 500 Index, 8.65 for the value-weight index, and 14.07 for the Fama & French characteristic-based portfolio.

Various measures of consistency presented in Table V Panel B also indicate better performance of the Berkshire Hathaway portfolio as compared to all of the benchmarks. The portfolio enjoyed a greater portion of positive returns and a higher average of for both positive and negative returns than each of the benchmarks.

Concentration exposes the Berkshire Hathaway portfolio to significant amounts of unsystematic risk. To determine if the high returns are driven by a high concentration strategy, we use a bootstrapping procedure to calculate the mean performance of 10,000 portfolios of from five to ten stocks each year from 1976 to 2006. The concentrated portfolios are created by randomly selecting compounded annualized monthly returns (including delisting returns) from all stocks in CRSP. We then use the annual time series of concentrated portfolio returns to conduct paired t-test, Wilcoxon rank-sum test, and calculate portfolio performance statistics. Table VIII compares the returns of the Berkshire Hathaway portfolio with those of the bootstrapped concentrated portfolios consisting of five to ten stocks. The 24.97% average annual return of the Berkshire Hathaway portfolio is significantly greater than the 15.37% to 15.80% returns of the concentrated portfolios at p-values < 0.008. The median returns are only slightly higher at 18.53% versus 16.67% to 17.48% for the concentrated portfolios. The nonparametric Wilcoxon rank-sum tests indicate significant difference between the returns of the Berkshire Hathaway portfolio and the nine and ten-stock concentrated portfolios with p-values < 0.099. The volatility of Berkshire Hathaway's portfolio is higher than the concentrated portfolios; however, the increased

variation is also due to the greater variation in large positive returns of the Berkshire Hathaway portfolio. The downside deviation is also less than half of the concentrated portfolios. While the 64.40 Sharpe ratio of the Berkshire Hathaway portfolio exceeds the concentrated portfolios' 51.24 to 52.03 by over 20%, the 856.37 Sortino ratio exceeds the concentrated portfolios' 198.44 to 202.28 by over four times. The gain-to-loss ratio of the Berkshire Hathaway portfolio also exceeds the concentrated portfolios' by four times. While the average positive returns are higher and negative returns similar in magnitude, the Berkshire Hathaway portfolio is more consistent with only two years of negative performance versus six to seven years for the concentrated portfolios. This is reflected in a higher geometric return for the Berkshire Hathaway portfolio.

Collectively, these results indicate that randomly formed concentrated portfolios are unlikely to produce performance of a magnitude similar to Berkshire Hathaway's investment record. In other words, the ability to pick the right stocks is needed to make such an approach deliver consistent superior results. While portfolio concentration increases unsystematic risk the high returns of Berkshire Hathaway's stock portfolio is not simply compensation for either higher market risk or higher unsystematic risk investment strategies. The success of Berkshire Hathaway's concentrated portfolio approach is consistent with evidence in Kacperczyk et al. (2005) who argue that skilled investors would hold more concentrated portfolios to better exploit their informational advantages.

2. Luck

At the start of our sample period in 1976 Buffett had established a reputation as a highly successful investor. However, if we simply decided to examine his performance due to the successful record, we should not be surprised to find his performance far exceeds the market. We also know after-the-fact some managers will have been lucky. So, the question becomes when is the performance of a manager so good that even after accounting for the bias associated with selecting an ex-post successful investor, pure luck is unlikely to account for the performance?

To evaluate whether the performance of ex-post selected successful investors was due to luck, the appropriate benchmark is therefore the best performing "lucky" manager. Using the method proposed by Marcus (1990) we derive an approximation of the probability distribution of the best performance of a sample of managers assuming that the market is efficient. We then compare the performance of Berkshire Hathaway's portfolio with that of the best performing manager to determine if abnormally good performance is evidence of an ability to beat the market and not due to luck.

Table IX provides the frequency distribution of the Monte Carlo simulations described in Marcus (1990) for 173, 1,407 and 2,591 managers.[19] The mean number of years the winning manager beats the market is 22.85, 24.52, and 24.94, out of 31 years, for contests with 173, 1,407 and 2,591 managers respectively. The average manager beats the market in 15.5 years out of 31 years in all the contests just as expected due to chance in an efficient market. In the experiment using 173 managers, the chance of a winning manager beating the market in more years than Buffett (27) over the 31-year period is 0.01%. Increasing the number to 1,407 managers, the probability of a beating the market more than 27 years increases to 0.37% and for 2,591 managers the probability is 0.64%.[20] While this test indicates the number of years Berkshire Hathaway beat the market over a 31-year period is still within the distribution indicated possible by chance, the "luck" interpretation becomes more unlikely if we were to include the results of the Buffett Partnership over the 1957 to 1968 when the reported performance exceeded the S&P 500 in all 12 years making the record 39 out of 43 years.[21] Therefore, even after we take into consideration that Buffett is not an investor chosen at random but one that has been identified as an ex-post winner, the frequency with which he beats the market suggests it is not due to chance.

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

[20] This result would hold even if we use the value-weight index or returns from the Fama & French characteristic portfolio as benchmarks since Berkshire Hathaway's portfolio also beats these benchmarks in 27 out of 31 years.

[21] This omits the results over the seven year period from 1969 to 1975 for which we could not find specific investment data.

The above test only considers whether or not Berkshire Hathaway beat the market in a particular year and does not take into account the magnitude by which they beat the market. In order to calculate a winning manager's performance in terms of excess returns one would need to have a measure of the volatility of the manager's investment strategy. High volatility strategies will result in winning managers with higher excess returns over the market so the expected return for the best performing manager is also a function of manager-specific risk. If we can estimate the standard deviation of the manager-specific risk, we can use it with the margin of the winning manager obtained from the simulations to derive the expected return benchmark for the best performing manager.

If the market is efficient, each manager will obtain a return equal to the market return plus a zero-mean random variable related to the standard deviation of the manager-specific risk. A standard deviation of manager-specific risk equal to 10% per year implies that about one-third of all managers would perform either better or worse than the market in any year by a margin of least 10%. Over a 31-year period this would imply the standard deviation of the average annual return is $10\%/31^{1/2} = 1.80\%$. We estimate the standard deviation of manager-specific risk in the market using the CDA/Spectrum Institutional Money Managers 13(f) Holdings data base over the 1979 – 2006. By merging the holdings with the returns from CRSP we calculate the performance of all managers over the entire period and estimate the manager-specific risk to be 13.65% indicating that one-third of the managers performed either better or worse than the market by at least this amount (Figure 2). Capital Resource Advisors (formerly SEI) estimate the median tracking error of fund managers is approximately 5% and from the concentrated portfolio simulations, the standard deviations of the 5-10 stock portfolios were about 15%. We therefore present various levels of manager-specific risk ranging from 5% to 15% including the 13.65% empirically estimated noise level.

Table X Panel A presents the results of a test of the performance of the Berkshire Hathaway portfolio exceeding the expected return of the best performing manager at noise levels of 5% to 15% in a market with 173, 1,407 and 2,591 managers. The mean annual excess performance of 11.14% for the Berkshire Hathaway portfolio exceeds the expected returns of the best performing investment manager at

p-values < 0.041 for all manager/noise combinations. After taking into account the frequency and magnitude by which Berkshire Hathaway beats the market it is unlikely the performance is due to chance or "luck." This is consistent with Kosowski et al. (2006) who conclude that the large positive alphas of the top ten percent of funds (net of costs) are extremely unlikely to be solely due to luck.

E. The mimicking portfolio

The preceding discussion suggests that Berkshire Hathaway's superior investment performance is not compensation for higher levels of risk or chance which are consistent with explanations under Efficient Markets Theory. How then can EMT explain the positive abnormal performance of Berkshire Hathaway's portfolio? Grossman and Stiglitz's (1980) interpretation allows for the presence of skilled investors (efficiency insurers that acquire better information and/or better interpret available information) who identify mispriced stocks and earn positive risk-adjusted returns as compensation for their information production.

Skilled investors will use their superior information to trade mispriced stocks quickly adjusting prices until equilibrium is reached. If we find that an investor who mimics Berkshire's investment portfolio after the investments are publicly disclosed earns positive abnormal returns it would suggest the information produced by skilled investors does not get transmitted quickly into stock prices and would appear to be inconsistent with interpretations of EMT. To determine if an investor can simply mimic the investments made by Berkshire Hathaway and earn positive abnormal returns we create a mimicking portfolio as discussed in Section III.B. and find the mimicking portfolio also experiences positive and significant abnormal risk-adjusted returns using the calendar time abnormal returns methodology (Table VI Panel B) and factor regressions using the Fama & French 3-factor and Carhart 4-factor models (Table VII). The CTAR of the mimicking portfolio is just slightly below Berkshire Hathaway's portfolio performance and beats the S&P 500 Index, the value-weight index, and the Fama & French characteristic-based portfolios by similar magnitudes as indicated in Table VI Panel B. Thus, a portfolio that mimics

Buffett's investments beginning the following month after they are made public in regulatory filings earns significantly positive risk-adjusted returns using various benchmarks.

Table X Panel B presents the results of a test of the performance of the mimicking portfolio against the expected return of the best performing manager at noise levels of 5% to 15% and number of managers of 173, 1,407 and 2,591. The mean annual excess performance of 10.75% for the mimicking portfolio exceeds the expected returns of the best performing manager at p-values < 0.08 for all manager/noise combination levels. Viewed collectively, the performance of the mimicking portfolio appears to exceed the performance of the best performing manager that can happen due to luck.

While the stock price reaction to the news of the initial investment by Berkshire Hathaway is positive and significant (Table IV) the market appears to under-react to the news since a mimicking portfolio strategy can also obtain significantly large positive abnormal returns. This indicates the full information associated with Buffett's investment does not get transmitted quickly into stock prices as suggested by EMT. Since the stock price reaction to the news of the initial investment is higher in the second half of the study the extent of under-reaction appears to be decreasing over time as more investors become convinced of Buffett's investment skill. The under-reaction of the market to news of Berkshire Hathaway's investment is consistent with Cohen, Coval, and Pastor (2005) who find that investors do not appear to be aware of the stock return predictive power that is contained in a measure that is obtained from publicly available information.

V. Conclusion

This paper provides the first rigorous examination of Berkshire Hathaway's investment performance. We analyze the investment style and explore potential explanations for its superior investment performance. Contrary to the popular notion of Warren Buffett being a traditional "value" or "contrarian" investor, Berkshire Hathaway's investment portfolio consists primarily of large-cap growth stocks. The performance does not appear to be driven by traditional "value" stocks (i.e. beaten down stocks) but rather by stocks whose growth is undervalued by the market.

We explore a number of potential explanations for Berkshire Hathaway's investment performance. Since Buffett has been identified ex-post as a successful investor, we should not be surprised to find his performance is far above the mean. However, even after taking into account ex-post selection bias, the magnitude and frequency with which Berkshire Hathaway's portfolio beats the market makes luck an unlikely explanation of its performance.

Berkshire Hathaway's high returns are not simply compensation for higher systematic (market) or unsystematic risk as measured by traditional portfolio performance statistics and measures. We find the portfolio is concentrated in relatively few stocks resulting in an undiversified portfolio. Using a bootstrapping routine we find that a concentrated portfolio approach where stocks are picked randomly is highly unlikely to produce an investment record like Berkshire Hathaway's.

Finally we evaluate the performance of an investment strategy that mimics Berkshire Hathaway's stock investments after they are publicly disclosed to evaluate how quickly information produced by skilled investors gets incorporated into stock prices. An investor who mimicked the investments from 1976 to 2006 after they were publicly disclosed in regulatory filings would experience statistically and economically significant positive abnormal returns using various empirical tests and benchmarks. This indicates the market under-reacts to the initial information that Berkshire Hathaway has bought a stock and is slow in incorporating the information produced by a skilled investor. While Grossman and Stiglitz (1980) provide an interpretation of Efficient Market Theory allowing for the existence of skilled investors who earn positive abnormal returns while ensuring the efficiency of markets, the slow incorporation of their information into stock prices appears inconsistent with this interpretation of EMT. The market reacts positively and significantly to the public disclosure of an initial Buffett stock investment so the information produced by such a skilled investor does appear to be incorporated rapidly into stock prices, however, the market under-reacts to this information since investors who mimic the portfolio after it becomes publicly known are still able to obtain significant positive risk-adjusted returns. The higher stock price reaction to Berkshire Hathaway's investments in the second half of the study suggests the

extent of under-reaction is decreasing over time as more investors are persuaded of Buffett's investment skill.

Collectively, our findings suggest that Berkshire Hathaway's exceptional investment record is due to investment skill and neither due to simply chance nor high risk. This is consistent with findings in a number of recent papers such as Chen, Jegadeesh and Wermers (2000), Cohen, Coval and Pastor (2005), Wermers (2000), Kosowski et al. (2005), and Kacperczyk, Sialm and Zheng (2005) who argue investment skill is more prevalent than previous research indicates. The Berkshire Hathaway triumvirates of Warren Buffett, Charles Munger, and Lou Simpson posses investment skill unlikely to be explained by the Efficient Market Theory.

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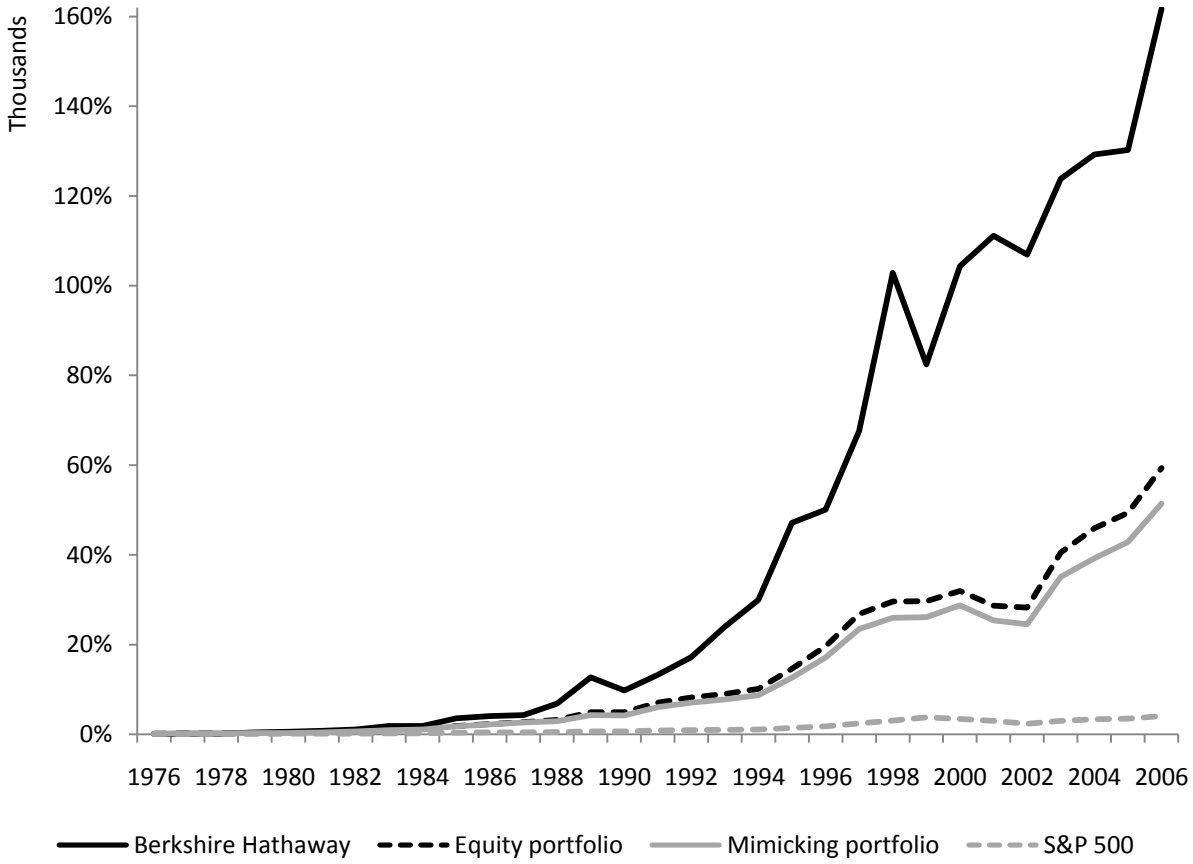

Figure 1. Cumulative returns from 1976 to 2007

This chart presents the cumulative (buy-and-hold) performance in thousands of percents for Berkshire Hathaway Class A shares, Berkshire Hathaway's stock investment portfolio, the mimicking portfolio, and the S&P 500 Index with dividends from 1976 to 2006.

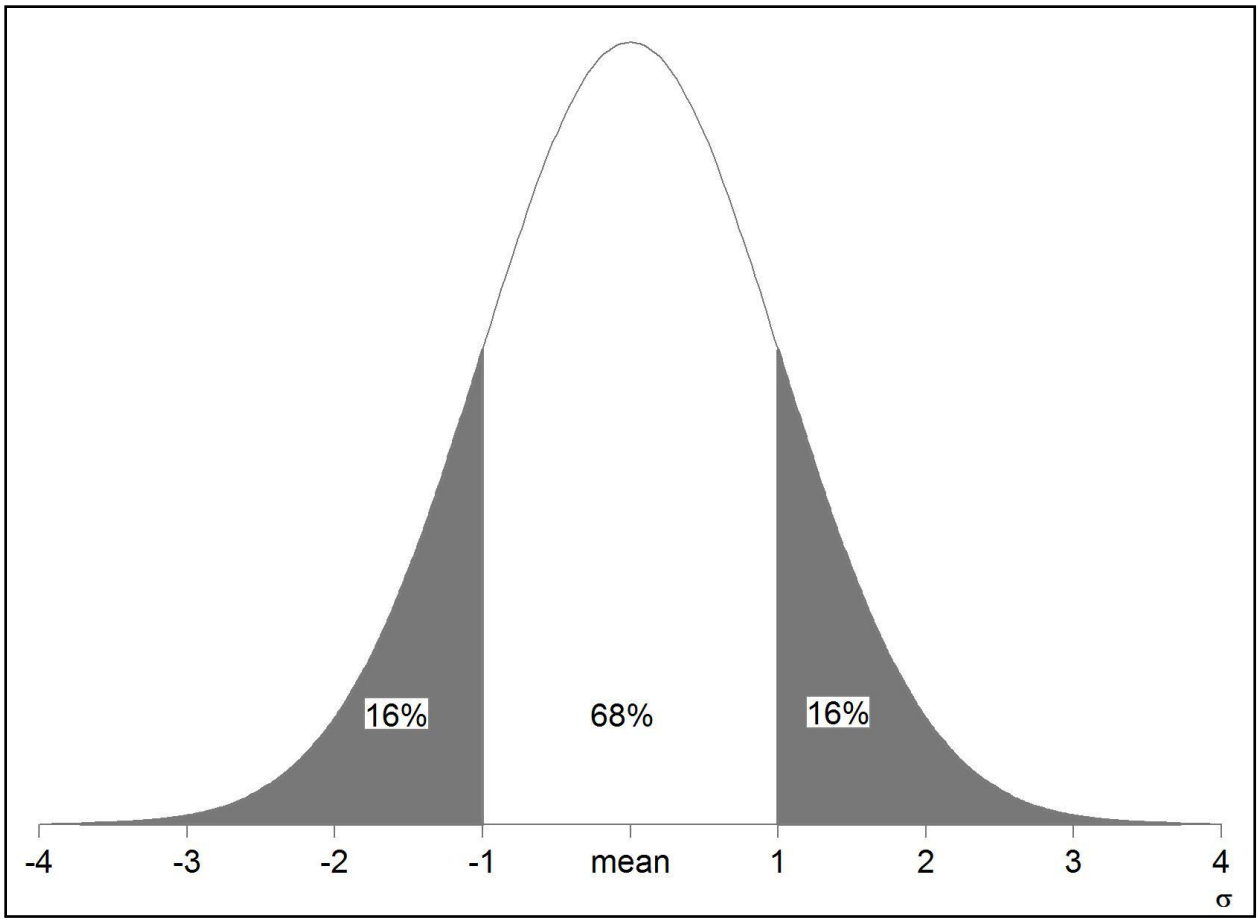

Figure 2. Manager-Specific Risk (Noise) under Efficient Markets

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

Table I. Characteristics of Berkshire Hathaway Common Equity Investments

Characteristics of common equity investments by Berkshire Hathaway from 1976 to 2006. Acquisition stocks are from firms in the process of being acquired by Berkshire Hathaway as operating entities, Long-Term Holding stocks are long-term investment holdings and Risk Arbitrage stocks are short-term risk arbitrage investments. Ownership percentages are calculated using reported shares owned and shares outstanding in the initial investment month, the average monthly percentage ownership by holding over the entire period, and the month corresponding to the maximum percentage ownership of the stock. Market capitalization is determined at the end of the month prior to the first date of holding. Total assets, Book equity, and Book-to-market are based on the latest reported values in the fiscal year end prior to the initial investment. Univariate tests are presented between Long-Term Holding and Risk Arbitrage investments. The top Test Statistic and corresponding p-value is based upon a parametric Satterthwaite t-test for samples of unequal variances and the bottom a normal approximation of a non-parametric Wilcoxon rank sum test.

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

Table II. Distribution of Berkshire Hathaway Investments by Industry and Firm Size

Distribution of Berkshire Hathaway investments from 1976 to 2006 by the SIC-based industry and portfolio size-based deciles. Industry is determined by SIC code partitioned into the SIC Division structure. Size deciles are based on market value of equity relative to NYSE firms in the CRSP database at the end of the month prior to the first date of holding. Chi-square test of proportions indicates at least one size based deciles (χ^2 = 321.99, p-value = <.0001) and one industry classification (χ^2 = 370.27, 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	7	4	-	1	1	1	-	-	-	-	-
15 - 17	Construction	1	-	-	-	1	-	-	-	-	-	-
20 - 39	Manufacturing	140	66	18	22	7	5	9	5	1	3	4
40 - 49	Transportation, Communication, Electric, Gas & Sanitary Services	55	17	12	10	7	2	2	-	3	2	-
50 - 51	Wholesale Trade	3	-	-	1	-	-	-	1	1	-	-
52 - 59	Retail Trade	24	12	3	3	1	2	-	1	1	1	-
60 - 67	Finance, Insurance, & Real Estate	72	18	14	4	3	4	6	7	4	5	7
70 - 89	Services	33	7	3	6	2	2	-	5	3	2	3
	Total	335	124	50	47	22	16	17	19	13	13	14

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

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

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

Table IV. Abnormal Returns of Initial Public Disclosure of Berkshire Hathaway Investments

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

Panel A. Abnormal Returns by Announcement Type

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

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

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

Table V. Berkshire Hathaway, Equity Investment, and Mimicking Portfolio Returns vs. Benchmarks.

Performance of Berkshire Hathaway, Berkshire Hathaway's equity investment portfolio, and a mimicking portfolio with various benchmarks from 1976 to 2006. Annual returns are compounded monthly returns from CRSP with equity and the mimicking portfolios calculated using investment weights at the beginning of each month. The return on the 1-Year US Treasury is from the Federal Reserve Statistical Release (http://www.federalreserve.gov/releases/h15/data.htm). 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 represented by the five largest holdings. Turnover Ratio is calculated as the minimum of total purchases and total sales divided by average portfolio value. The S&P 500 Index return is reported in the 2006 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. Panel B presents performance statistics on the portfolios and benchmarks.

Panel A. Annual Performance Summary

			Berkshire Hathaway Equity Portfolio						Benchmarks		
Year	Berkshire Hathaway	1-Year US Treasury	N	Value	Largest 5 Holdings	Return	Turnover Ratio	Mimicking Portfolio Return	S&P 500 Index	Value Weight	F&F 25 Size-BE/ME
1976	32.35%	5.88%	11	$125	77.2%	121.12%	15.50%	134.01%	23.6%	26.77%	44.41%
1977	57.22	6.08	19	196	55.4	16.43	12.20	15.50	-7.4	-2.98	13.52
1978	10.95	8.34	22	290	56.5	12.99	19.08	14.07	6.4	8.54	12.98
1979	110.19	10.65	96	534	45.5	24.64	44.64	20.08	18.2	24.41	24.37
1980	31.06	12.00	110	665	49.1	13.34	56.21	9.47	32.3	33.23	34.54
1981	30.64	14.80	29	748	64.2	26.63	82.94	23.10	-5.0	-3.98	2.93
1982	38.50	12.27	25	1,162	71.5	46.50	27.62	48.95	21.4	20.42	22.57
1983	69.33	9.58	15	1,405	85.8	34.78	20.71	36.69	22.4	22.65	26.34
1984	-2.83	10.91	18	1,394	76.6	10.13	80.23	11.15	6.1	3.16	2.14
1985	91.84	8.42	14	1,467	83.3	71.95	106.73	66.04	31.6	31.41	34.61
1986	14.17	6.45	11	2,115	95.4	21.46	24.82	22.79	18.6	15.56	12.16
1987	4.61	6.77	15	2,499	95.3	18.56	19.43	17.48	5.1	1.82	5.11
1988	59.32	7.65	20	3,730	87.4	18.53	24.43	11.01	16.6	17.55	10.36
1989	84.57	8.53	12	5,741	93.0	50.20	27.14	45.13	31.7	28.43	31.80
1990	-23.05	7.89	13	5,819	91.6	0.00	15.31	-1.24	-3.1	-6.08	4.91
1991	35.58	5.86	16	10,295	85.0	43.36	5.67	42.60	30.5	33.64	43.35
1992	29.83	3.89	18	12,890	78.3	15.70	5.41	17.03	7.6	9.06	7.56
1993	38.94	3.43	24	13,652	70.8	9.73	14.06	9.78	10.1	11.59	1.49
1994	24.96	5.32	29	16,045	70.6	12.20	66.80	11.84	1.3	-0.76	2.74
1995	57.35	5.94	27	23,221	73.3	44.54	40.60	43.77	37.6	35.67	38.84
1996	6.23	5.52	34	28,840	71.0	33.69	10.42	35.45	23.0	21.16	23.44
1997	34.90	5.63	35	37,908	71.2	36.87	11.46	37.20	33.4	30.33	33.13
1998	52.17	5.05	35	38,450	77.5	10.17	9.23	10.64	28.6	22.29	37.69
1999	-19.86	5.08	48	38,188	76.9	0.18	11.95	0.57	21.0	25.26	23.25
2000	26.56	6.11	55	39,796	73.8	7.76	18.28	9.87	-9.1	-11.04	-8.17
2001	6.48	3.49	51	31,196	71.8	-10.33	29.31	-11.68	-11.9	-11.27	-10.34
2002	-3.77	2.00	45	31,295	68.7	-1.44	15.65	-3.30	-22.1	-20.84	-20.41
2003	15.81	1.24	44	39,807	66.3	43.34	19.71	42.99	28.7	33.15	27.76
2004	4.33	1.89	42	43,284	62.3	13.32	22.24	11.76	10.9	13.00	8.86
2005	0.82	3.62	43	47,808	64.3	7.50	20.32	9.18	4.9	7.31	4.66
2006	24.11	4.94	50	62,785	57.9	20.21	20.24	19.97	15.8	16.23	12.17

Table V. Berkshire Hathaway, Equity Investment, and Mimicking Portfolio Returns vs. Benchmarks (con't)

Panel B. Performance Statistics

Alpha, Beta, and R-square are the intercept, coefficient estimate, and goodness of fit of the regression of the excess portfolio return minus the return of the 1-year US Treasury bill on the return of the S&P 500 Index with dividends minus the return of the 1-year US Treasury bill. Upside deviation is calculated as $\sqrt{\frac{\sum[max\,(r_t,0)]^2}{n-1}}$ and downside deviation $\sqrt{\frac{\sum[min\,(r_t,0)]^2}{n-1}}$. The Sharpe ratio is the geometric mean return less the geometric mean return of the 1-year US Treasury bill divided by the standard deviation and Sortino ratio the excess geometric mean return less the geometric mean return of the 1-year US Treasury bill divided by downside deviation. The gain-to-loss ratio is (# years with positive returns / # years with negative returns) x (average positive return / average negative return).

			Berkshire Hathaway Equity Portfolio					Mimicking	Benchmarks		
Year	Berkshire Hathaway	1-Year US Treasury	N	Value	Largest 5 Holdings	Return	Turnover Ratio	Portfolio Return	S&P 500 Index	Value Weight	F&F 25 Size-BE/ME
Return:											
Mean	30.43	6.62	33	17,527	73.15	24.97	28.98	24.58	13.83	14.05	16.41
Median	29.83	5.94	27	10,295	71.80	18.53	20.24	17.03	16.60	16.23	12.98
Min	-23.05	1.24	11	125	45.50	-10.33	5.41	-11.68	-22.10	-20.84	-20.41
Max	110.19	14.80	110	62,785	95.40	121.12	106.73	134.01	37.60	35.67	44.41
Geometric mean	26.91	6.57				22.88		22.31	12.76	12.99	15.25
Alpha	18.15	0.00				11.75		11.29	0.00	0.32	2.84
Risk:											
Beta	0.78	0.00				0.92		0.92	1.00	0.99	0.96
R-square	0.16					0.31		0.28	1.00	0.96	0.83
Market risk	12.37					14.18		14.26	15.40	15.12	15.02
Unsystematic risk	28.82					20.98		22.76	0.00	2.90	6.83
% Market risk	15.56					31.37		28.19	100.00	96.46	82.87
% Unsystematic risk	84.44					68.63		71.81	0.00	3.54	17.13
Standard deviation	31.36	3.20				25.32		26.85	15.40	15.39	16.50
Upside deviation	43.69	7.45				35.80		36.61	20.20	20.40	23.04
Downside deviation	5.62	0.00				1.90		2.23	5.17	4.98	4.44
Upside/downside	7.77	∞				18.80		16.44	3.91	4.09	5.19
Efficiency:											
Sharpe ratio	64.85					64.40		58.61	40.19	41.68	52.57
Sortino ratio	361.82					856.37		706.83	119.70	128.70	195.52
Gain/loss ratio	20.05					66.77		48.00	8.32	8.65	14.07
Consistency:											
Years	31	31				31		31	31	31	31
# Positive	27	31				29		28	25	24	28
% Positive	87.10	100.00				93.55		90.32	80.65	77.42	90.32
Avg. positive return	36.77	6.62				27.10		27.79	19.50	20.53	19.56
# Negative	4	0				2		3	6	7	3
% Negative	12.90	0.00				6.45		9.68	19.35	22.58	9.68
Avg. negative return	-12.38	0.00				-5.89		-5.40	-9.77	-8.14	-12.97
Correlation:											
w/1-Yr Treasury	0.34	1.00				0.17		0.13	0.14	0.11	0.19
w/S&P 500 index	0.44	0.14				0.57		0.54	1.00	0.98	0.91

Table VI. Calendar-Time Returns of Berkshire Hathaway and Mimicking Portfolios

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

Panel A. Berkshire Hathaway's Portfolio

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

Panel B. Mimicking Portfolio

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

Table VII. Factor Regressions of Berkshire Hathaway and Mimicking Portfolios

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

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

Table VIII. Berkshire Hathaway Portfolio vs. Concentrated Portfolios

Portfolio performance comparison of Berkshire Hathaway's equity investments and randomly chosen concentrated portfolios of various sizes from 1976 to 2006. The concentrated portfolios are created by calculating annualized compounded returns (including delisting) from CRSP for each stock and using a bootstrapping procedure to create 10,000 portfolios of n stocks each year from 1976 to 2006. Alpha, Beta, and R-square are the intercept, coefficient estimate, and goodness of fit of the regression of the excess portfolio return minus the return of the 1-year US Treasury bill on the return of the S&P 500 Index with dividends minus the return of the 1-year US Treasury bill. Upside deviation is calculated as $\sqrt{\frac{\sum[max\,(r_t,0)]^2}{n-1}}$ and downside deviation $\sqrt{\frac{\sum[min\,(r_t,0)]^2}{n-1}}$. The Sharpe ratio is the excess geometric mean return less the geometric mean return of the 1-year US Treasury bill divided by the standard deviation and Sortino ratio the excess geometric mean return less the geometric mean return of the 1-year US Treasury bill divided by downside deviation. The gain-to-loss ratio is (# years with positive returns / # years with negative returns) x (average positive return / average negative return).

	Berkshire Hathaway Portfolio	**Concentrated Portfolios**					
		5-Stock	**6-Stock**	**7-Stock**	**8-Stock**	**9-Stock**	**10-Stock**
Return:							
Mean	24.97%	15.80%	15.66%	15.63%	15.49%	15.37%	15.39%
t-test p-value		(0.008)	(0.007)	(0.007)	(0.006)	(0.006)	(0.006)
Median	18.53%	17.48%	17.11%	16.97%	16.67%	17.07%	16.98%
Rank-sum p-value		(0.135)	(0.129)	(0.129)	(0.112)	(0.099)	(0.092)
Min	-10.33%	-16.14%	-16.89%	-16.94%	-17.05%	-17.02%	-17.37%
Max	121.12%	47.34%	45.96%	44.91%	43.50%	43.44%	43.08%
Geometric mean	22.88%	14.71%	14.61%	14.60%	14.47%	14.36%	14.39%
Alpha	0.1175	0.0315	0.0298	0.0293	0.0274	0.0258	0.0256
Risk:							
Beta	0.9151	0.8352	0.8396	0.8425	0.8495	0.8543	0.8613
R-square	0.3137	0.6335	0.6630	0.6847	0.7086	0.7272	0.7407
Market risk	0.1418	0.1263	0.1271	0.1276	0.1290	0.1296	0.1308
Unsystematic risk	0.2098	0.0960	0.0906	0.0866	0.0827	0.0794	0.0774
% Market risk	31.37%	63.35%	66.30%	68.47%	70.86%	72.72%	74.07%
% Unsystematic risk	68.63%	36.65%	33.70%	31.53%	29.14%	27.28%	25.93%
Standard deviation	25.32%	15.86%	15.60%	15.43%	15.32%	15.20%	15.20%
Upside deviation	35.80%	22.20%	21.92%	21.78%	21.61%	21.44%	21.46%
Downside deviation	1.90%	4.10%	4.04%	3.97%	3.96%	3.92%	3.93%
Upside/Downside	18.80	5.42	5.43	5.49	5.46	5.46	5.46
Efficiency:							
Sharpe ratio	64.40	51.31	51.47	52.03	51.54	51.24	51.40
Sortino ratio	856.37	198.76	198.82	202.28	199.61	198.44	198.96
Gain/loss ratio	66.77	12.99	13.45	13.95	13.61	13.46	13.67
Consistency:							
Years	31	31	31	31	31	31	31
# Positive	29	25	25	24	24	24	24
% Positive	93.55%	80.65%	80.65%	77.42%	77.42%	77.42%	77.42%
Average positive return	27.10%	21.22%	20.97%	21.74%	21.60%	21.44%	21.45%
# Negative	2	6	6	7	7	7	7
% Negative	6.45%	19.35%	19.35%	22.58%	22.58%	22.58%	22.58%
Average negative return	-5.89%	-6.80%	-6.50%	-5.35%	-5.44%	-5.46%	-5.38%

Table IX. Monte Carlo Simulation of Best Performing Manager in an Efficient Market

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

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

Table X. Hypothesis Test of Berkshire Hathaway and Mimicking Portfolios Exceeding the Winning Manager's Portfolio at Various Levels of Managerial Noise

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

Panel A. Berkshire Hathaway Portfolio (Mean excess return = 11.14%, σ = 20.74%)

Manager Noise	Implied Risk	Number of Managers in Contest								
		173 (σ = 2.65)			1,407 (σ = 3.24)			2,591 (σ = 3.39)		
$\hat{\sigma}$	$\hat{\sigma}/\sqrt{31}$	E(r)	*t*	p-value	E(r)	*t*	p-value	E(r)	*t*	p-value
5%	0.90%	2.38%	5.41	<.001	2.66%	14.91	<.001	2.83%	19.83	<.001
10	1.80	4.76	3.64	<.001	5.32	9.48	<.001	5.66	12.11	<.001
13.65	2.45	6.50	2.46	<.015	7.26	4.79	<.001	7.72	7.01	<.001
15	2.69	7.14	2.06	<.041	7.97	4.65	<.001	8.49	5.27	<.001

Panel B. Mimicking Portfolio (Mean excess return = 10.75%, σ = 22.60%)

Manager Noise	Implied Risk	Number of Managers in Contest								
		173 (σ = 2.65)			1,407 (σ = 3.24)			2,591 (σ = 3.39)		
$\hat{\sigma}$	$\hat{\sigma}/\sqrt{31}$	E(r)	*t*	p-value	E(r)	*T*	p-value	E(r)	*t*	p-value
5%	0.90%	2.38%	4.76	<.001	2.66%	13.11	<.001	2.83%	17.42	<.001
10	1.80	4.76	3.19	0.002	5.32	8.24	<.001	5.66	10.48	<.001
13.65	2.45	6.50	2.12	0.035	7.26	4.96	<.001	7.72	5.84	<.001
15	2.69	7.14	1.75	0.081	7.97	3.84	<.001	8.49	4.24	<.001