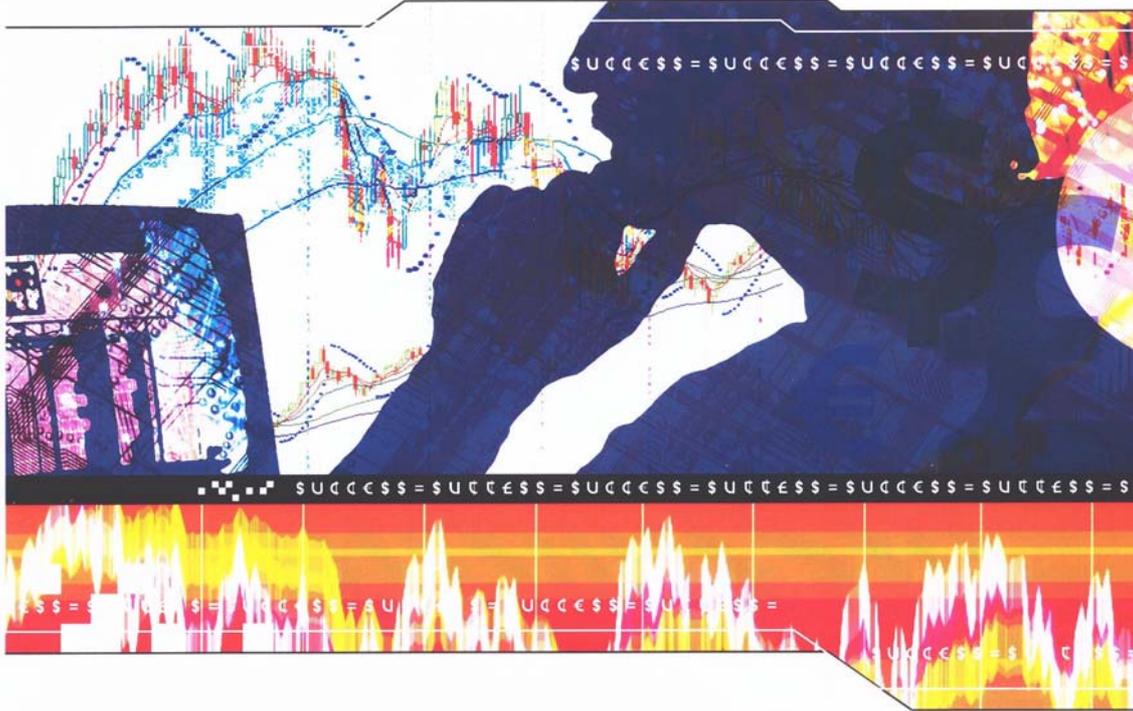




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Warren Buffett: Investment Genius or Statistical Anomaly?

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Abstract

Warren Buffett has been Chairman and CEO of Berkshire Hathaway, a general investment company, since 1965. Before that he headed various private investment partnerships. Over a period of 47 years, under Buffett's leadership, these companies have outperformed broad market indices by an average of 11.16% per year. In 42 of the 47 years he has outperformed the market.

Despite this record, rarely do any standard investment, finance or economics texts mention Warren Buffett. In this paper we look at possible reasons for this and examine the question posed in the title, namely whether or not Buffett is simply a statistical anomaly. We also describe some of the investment criteria used by Buffett and look at some historical studies implementing these criteria using the investment program Conscious Investor.

1. Warren Buffett: The Invisible Man

The life of Warren Buffett is well documented in a range of biographies and analyses including Lowenstein (1995), Kilpatrick (2001), Hagstrom (2000), and O'Loughlin (2002) while Miles (2002) considers the type of managers preferred by him. Warren Buffett began his investing career working for the Graham-Newman Corporation in New York in 1954. This was the company partly owned by Benjamin Graham, the author of *Security Analysis* (with Graham Dodd) and who had lectured Buffett at Columbia.

After Graham-Newman was wound up in 1956, Buffett returned to his native Omaha, Nebraska and started his remarkable investing journey. He established a number of private investment partnerships. Even though just a young man, he had very definite ideas how he wanted to run them. He made it clear that he would only provide a summary of his results once a year to the investors in his partnerships and that he would not disclose where he was investing the money. In an early letter to the partners he wrote, "All I want to do is hand in a scorecard when I come off the golf course. I don't want you following me around and watching me shank a three-iron on this hole and leave a putt short on the next." Furthermore, any investors could only add or withdraw capital on one day a year, December 31. (See Lowenstein (1995, p. 152).)

Warren Buffett closed down all his partnerships in 1965 when he took charge of Berkshire Hathaway, at the time a textile company with headquarters in New Bedford, Massachusetts. If anyone had invested \$10,000 with one of the original Buffett partnerships in 1956 and then nine

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years later reinvested in Berkshire Hathaway stock, that investment would now be worth around \$270 million after all fees.

Despite this exceptional record, as far as references to either the man or his methods in standard finance or economic texts, Buffett is virtually invisible. As documented in Kelly (2004), in a search of 23,000 pages of finance only 20 pages referred to Buffett. Similarly, a search of the leading academic journals for references to Buffett and Berkshire Hathaway located only a handful of articles.

Even more, many of the references to Buffett are there simply to dismiss his results as a statistical anomaly.

Nobel Laureate, William Sharpe described Buffett as a “three-sigma event” (see p. 312 of Lowenstein (1995)). Michael Lewis (1989) states “The reason [Buffett] is so rich is simply that random games produce big winners”. Noble Laureate, Merton Miller explains “if there are 10,000 people looking at the stocks and trying to pick winners, well 1 in 10,000 is going to score, by chance alone, a great coup, and that’s all that going on”. Burton Malkiel (1999) says “In any activity in which large numbers of people are engaged, although the average is likely to predominate, the unexpected is bound to happen. The very small number of really good performers we find in the investment management business actually is not at all inconsistent with the laws of chance.”

In the next two sections we try to find out whether Buffett’s performance can be explained in statistical terms—or whether there really is a contribution to investing knowledge from his methods.

2. The Orangutan Coin Tossing Competition

In 1984 Columbia Business School hosted a celebration of the fiftieth anniversary of Graham and Dodd’s book *Security Analysis*. The two principal speakers were Rochester’s Michael Jensen, an academic who had come out strongly in favour of the Efficient Market Hypothesis and Warren Buffett. Jensen stated that it was hard to tell if any of the followers of Graham and Dodd were really superior investors. He argued:

If I survey a field of untalented analysts all of whom are doing nothing but flipping coins, I expect to see some who have tossed two heads in a row and even some who have tossed ten heads in a row.

This was a perfect entry for Buffett who envisaged a national coin-tossing contest. Each day, everyone in the United States flipped a coin with only those who continually flipped heads staying in the contest. After twenty days only around 215 flippers would remain.

Buffett continued (Buffett, 1984):

But then some business school professor will probably be rude enough to bring up the fact that if 225 million orangutans had engaged in a similar exercise, the results would be much the same—215 egotistical orangutans with 20 straight winning flips.

Buffett then argued that there were important differences. What if, for example, all the orangutans came from the same zoo? When you replace head-flippers with “superinvestors”, he argued that this is precisely what happened. Buffett declared that there was an unusually high concentration of successful coin flippers, that is, “superinvestors”, in the investment world that “came from a very small intellectual village that could be called Graham-and-Doddsville”.

Buffett put forward the view that a “concentration of winners that cannot simply be explained by chance can be traced to this particular intellectual village.”

Continuing with this theme, let us see how we can apply coin tossing to analyze Buffett’s investing performance. (More details are contained in Kelly (2004).) We will take a simplistic view and only measure whether or not Buffett outperformed the market or not in any specific year. In the years from 1957 to 2003 either the Buffett partnerships (years 1957 to 1964) or Berkshire Hathaway outperformed the market in 42 of the 47 years. (For the Buffett Partnerships and Berkshire Hathaway the growth each year is measured as book value. The market performance is measured as the Dow Jones Industrial Average from 1957 to 1964 after which it is measured as the S&P 500 with dividends reinvested.)

Let us assume a null hypothesis that in any given year Buffett has a 50-50 chance of outperforming the market. Assume also that the performance is independent of the corresponding year. Under these assumptions the likelihood of someone outperforming the market in 42 or more years over 47 years is $0.000000012 = 1.2 \times 10^{-8}$.

Another way of saying this is that if we had around 100 billion “random” investors, then one of them would be likely to obtain Buffett’s record or better.

3. Measuring the Level of Outperformance

Another way of examining Buffett’s performance is to regress the annual growth of the Buffett Partnerships and Berkshire Hathaway against the annual growth of the general market. The actual results are displayed in the following chart.

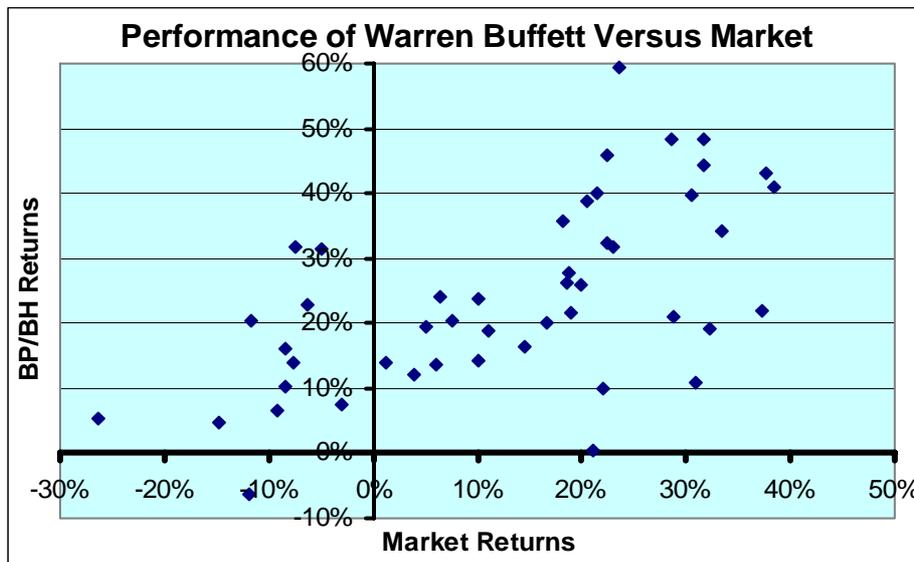


Chart 1: Performance of Warren Buffett as measured by the annual growth of the Buffett Partnerships from 1957 to 1964 and then Berkshire Hathaway from 1965 to 2003 compared to the annual growth of the market as measured by the Dow Jones Industrial Average from 1957 to 1964 and the S&P 500 with dividends reinvested after that.

The equation of the regression line is $Y = 17.37\% + 0.5176 \times X$. In mean reversion form the equation of the regression line is:

$$Y = 24.03\% + 0.5176 \times (X - 12.86\%)$$

The conclusion is that Buffett's average performance is 24.03% compared to the market’s average performance of 12.86% and the speed of mean conversion is 0.5176. In other words, on

average by whatever amount the market underperforms or overperforms its long-term average, then Buffett underperforms or overperforms his long-term average by approximately half that amount. Another way of saying this is that in bull years, on average Buffett also has a bull year (as measured against his long term average) but by not such a large margin. Conversely, in a bear year, Buffett also has a bear year, again by not such a large margin.

The R square goodness of fit is 0.36 and the 95% confidence interval for the speed of mean conversion is [0.31, 0.73].

4. Warren Buffett's Methods

Even though Buffett has written hundreds of pages on the stock market, it is in quite general terms. For example, he once said, "Rule No. 1 is never lose money" and "Rule No. 2. is never forget rule No. 1." (Lowe (1997), p.85) Or, "All we want is to be in businesses that we understand, run by people whom we like, and priced attractively relative to their future prospect." (Fortune, October 31, 1994.)

When it comes to specific details, Buffett is quite secretive. Each year in the annual report of Berkshire Hathaway he writes,

Despite our policies of candour, we will discuss our activities in marketable securities only to the extent legally required. Good investment ideas are rare, valuable, and subject to competitive appropriation just as good product or business acquisitions are.

Notwithstanding this secrecy and the general nature of most of his remarks, there are still clear guidelines to be gleaned from his writings. The following is a collection of some of these.

Invest in businesses "The basic ideas of investing are to look at stocks as businesses, use market fluctuations to your advantage and seek a margin of safety. That's what Ben Graham taught us... A hundred years from now they will still be the cornerstones of investing." (New York Society of Security Analysts, December 6, 1994.)

Circle of Competence "Draw a circle around the businesses you understand and then eliminate those that fail to qualify on the basis of value, good management, and limited exposure to hard times."

Return on equity "The primary test of managerial economic performance is the achievement of high earnings rate on equity capital employed (without undue leverage, accounting gimmickry, etc) and not the achievement of consistent gains in earnings per share." (Berkshire Hathaway Annual Report 1979.)

Debt levels "We do not wish it only to be likely that we can meet our obligations; we wish that to be certain. Thus we adhere to policies—both in regard to debt and all other matters—that will allow us to achieve acceptable long-term results under extraordinary adverse conditions, rather than optimal results under a normal range of conditions." (Berkshire Hathaway Annual Report 1987.)

Quality of management "We do not wish to join with managers who lack admirable qualities, no matter how attractive the prospects of their business. We've never succeeded in making a good deal with a bad person." (Berkshire Hathaway Annual Report 1989.)

Be wary of formulas "It is better to be approximately right than precisely wrong." (Berkshire Hathaway Annual Report 1989) "Read Ben Graham and Phil Fisher, read annual reports and

trade reports, but don't do equations with Greek letters in them." (Berkshire Hathaway Annual Report 1993.)

Return "We love owning common stocks – if they can be purchased at attractive prices. Unless, however, we see a very high probability of at least 10% pre-tax returns (which translate to 6½-7% after corporate tax), we will sit on the sidelines. With short-term money returning less than 1% after-tax, sitting it out is no fun. But occasionally successful investing requires inactivity." (Berkshire Hathaway Annual Report 2002.)

Margin of safety "You have to have the knowledge to enable you to make a very general estimate about the value of the underlying business. But you do not cut it close. That is what Ben Graham meant by having a margin of safety. You don't try and buy businesses worth \$83 million for \$80 million. You leave yourself an enormous margin." (Buffett, 1984.)

Economic moat "Look for the durability of the franchise. The most important thing for me is figuring out how big a moat there is around a business. What I love, of course, is a big castle and a big moat with piranhas and crocodiles."

Earnings forecasts "Your goal as an investor should be simply to purchase, at a rational price, a part interest in an easily understandable business whose earnings are virtually certain to be materially higher, five, ten, and twenty years from now." (Berkshire Hathaway Annual Report 1996.)

Of course, choosing businesses "whose earnings are virtually certain to be materially higher" in the next year or two is difficult enough, let alone making forecasts for any longer periods. We look at this in the next section.

5. Reliability of Earnings Forecasts

There have been numerous extensive studies of the accuracy of analysts' forecasts. In each case, the results are similar: the forecasts are of limited accuracy. We mention one study by Bulkley and Harris (1997). They looked at forecasts of earnings growth for five years ahead and found that there is virtually no correlation between forecast growth and actual growth. Specifically they found that eg_a , the actual average growth rate of earnings over five years, was related to eg_f , the analysts' average forecasts over the same period, by

$$eg_a = 0.19 \times eg_f$$

with $R^2 = 0.0$ and $t = 1.56$.

The conclusion is that the analysts forecasts for the next five years are no better than simply taking the average earnings growth of the market.

In Conscious Investor² we take a different approach. We limit the universe of stocks to those that have already exhibited consistent growth rates in earnings. This is done via a measurement called STAEGR. Roughly speaking, STAEGR measures how well an exponential curve can be fitted to the data with greater weight on more recent data, allowances for outliers and adjustments for negative data. If the data lies on an exponential curve a value of 100 percent is given with lower values resulting from less stable data.

Using the Valueline universe of stocks, we calculated STAEGR for earnings for the years 1991 to 1995 inclusive. We selected those stocks with the highest 10 percent of STAEGR levels and from this group we removed four outliers with average growth rate of earnings above 30 percent

² Conscious Investor is software developed by John Price for screening stocks in the Australian, USA and Canadian Markets based on the methods of Warren Buffett. Conscious Investor® contains various registered proprietary tools including STAEGR® and HGROWTH®.

per annum. This left 96 stocks. (Average annual growth rate was measured using HGROWTH. This is a measure of the growth of the exponential curve used in the calculation of STAEGR.)

The growth rates gr_f for the years 1996-2000 inclusive were regressed against the growth rates gr_h for the years 1991-1995. The regression line was

$$gr_f = -.04\% + 0.77 \times gr_h$$

with $R^2 = 0.1167$ and $t = 3.52$ (for the gr_h coefficient).

Even though the fit is still not high, it is a marked improvement on the results of analysts looking at the entire market as described above by Bulkley and Harris above. It is also high enough to be useful in developing profitable investment strategies as we shall see in the next section.

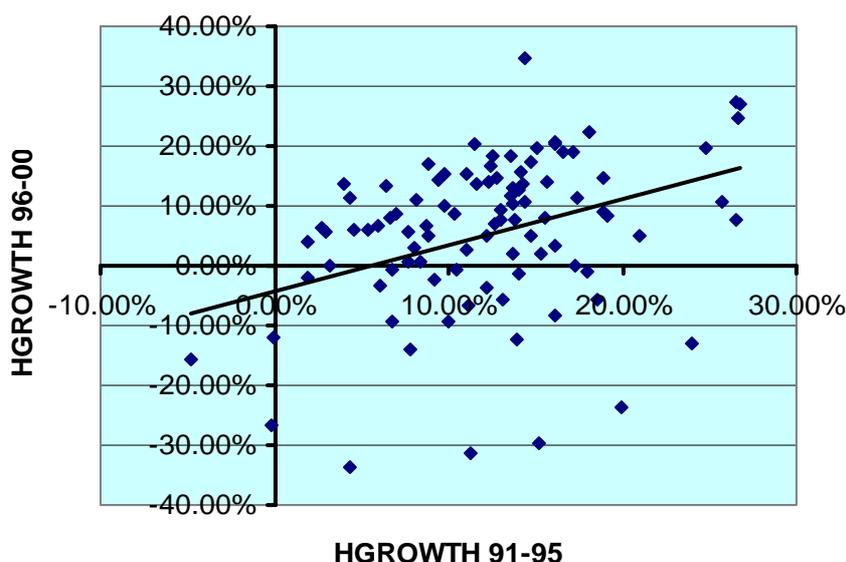


Chart 2: Scatter diagram of average annual growth in earnings per share over the years 1996-2000 as related to the average annual growth in earnings per share over the years 1991-1995. Only stocks with STAEGR in the top decile over 1991-1995 are considered.

6. Putting It Into Practice

Conscious Investor is a screening program that attempts to include the quantifiable aspects of Buffett's methods into a stand-alone package for individual investors. These include things like a high and consistent return on equity, low debt levels, and secure quick and current ratios. It also includes consistent growth in sales and earnings. Other quantitative criteria are based on formulas involving historical growth, PE ratios and dividend payout ratios. On top of this the software provides systematic steps to alert users to other Buffett criteria such as a strong and durable economic moat.

Because of these latter criteria it is not recommended to use Conscious Investor as a 'black box' by simply accepting any stocks that pass through the quantitative filters. Nevertheless it is tempting to examine the performance of portfolios that are selected in this manner. One of us (EK) carried this out in the following way.

A small subset of Conscious Investor financial hurdles (see Table 1) were applied to the Standard & Poor's 100 index (S&P 100) in 1993. The motivation for the first hurdle (10 years of financial history) is that in the "acquisition criteria" stated in each annual report of Berkshire Hathaway Buffett states that he seeks companies with a "demonstrated consistent earning

power” and that he is not interested in “turnaround situations”. The motivation for the second hurdle, a return on equity of at least 20 percent, is also based on these acquisition criteria.

The third and fourth hurdles combine to give some degree of confidence that earnings will grow strongly in the future based on the research on STAEGR described in Section 5 above. The requirements are that earnings per share have grown strongly for the past 10 years (HGROWTH above 20 percent per annum) and that this growth has been stable (STAEGR above 70 percent).

Table 1: Hurdles for the CIP	
1	10 Years of financial history
2	Return on equity: 20%
3	Earnings per share: HGROWTH: 20%
4	Earnings per share: STAEGR: 70%

Of the 100 S&P stocks, 7 stocks passed the financial hurdles. We refer to these stocks as the Conscious Investor Portfolio (CIP). (See Table 2 for a list of the stocks.) No attempt was made to understand the businesses, nor was any attempt made to buy these stocks building in a margin of safety.

Tale 2: Conscious Investor Portfolio					
		Ten Years of Data	Return on Equity	HGROWTH of EPS	STAEGR of EPS
1	Altria GP	Yes	31%	21%	85%
2	Coca Cola	Yes	48%	18%	96%
3	Johnson & Johnson	Yes	32%	18%	80%
4	Limited Brands	Yes	20%	23%	83%
5	Medtronic	Yes	25%	17%	72%
6	Merck	Yes	22%	23%	87%
7	Wal Mart	Yes	23%	30%	93%
Average			29%	21%	85%

The performance of the CIP was then compared with the S&P 100 from 1993-2003 (ten years). All 7 stocks were bought in June 1993 and sold again in June 2003. Over the period of ten years, the S&P100 index had an average return of 10.22 percent while the CIP had an average annual return of 17.13 percent.

Admittedly this is just a single study. However, other back testing studies done within the company show similar results.

7. Conclusion

Warren Buffett has applied a consistent methodology to the stock market for over 40 years. The results of his methods as measured first by his performance in the Buffett Partnerships and later by Berkshire Hathaway cannot be dismissed as a statistical anomaly. Finally, indications are that even a simple buy and hold strategy using hurdles based on Buffett’s ideas in the framework of Conscious Investor will generate portfolios that outperform the market.

Bibliography

- Warren Buffett (1984), The Superinvestors of Graham-and-Doddsville (Hermes, the Columbia Business School Magazine)
- George Bulkley and Richard D. F. Harris (1997), Irrational Analysts' Expectations as a Cause of Excess Stock Price Volatility (*Economic Journal*, 107, 359-371)
- Robert Hagstrom (2000), The Warren Buffett Portfolio (Wiley, New York)
- Edward Kelly (2004), Is Warren Buffett a Statistical Anomaly? (*School of Business Studies University of Dublin, Trinity College*)
- Andrew Kilpatrick (2001), Of Permanent Value: The Story of Warren Buffett (McGraw-Hill, New York)
- Roger Lowenstein (1995), Buffett: the Making of an American Capitalist (Doubleday, New York).
- Michael Lewis (1989), Liars Poker (Norton, New York).
- Janet Lowe (1997), Warren Buffett Speaks: Wit and Wisdom of the World's Greatest Investor (Wiley, New York)
- Burton Malkiel (2003), A Random Walk Down Wall Street (Norton, New York, 8th Ed.)
- Robert P. Miles (2002), The Warren Buffett CEO (Wiley, New York).
- Merton Miller (2000), The Trillion Dollar Bet (Transcript of PBS Nova Special).
- James O'Loughlin (2002), The Real Warren Buffett (Nicholas Brealy, London)