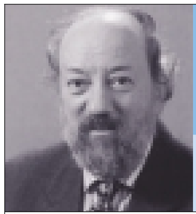

Bill Ziemba

The Great Investors, Their Methods and How We Evaluate Them: Theory

In the next three columns how great investors do it will be under discussion. Definitely an enormous topic, but we will conclude that principles and results will apply reasonably broadly

Winning has two parts: getting an edge and then betting well. The former simply means that investments have an advantage so $1 invested returns on average more than $1. The latter involves not overbetting, and truly diversifying in all scenarios in a disciplined, wealth-enhancing way.

This column begins with a categorization of the efficient market camps which is related to how various people try to get an edge. Some feel they cannot get an edge and this then becomes a self-fulfilling prophesy and they, of course, are not in our list of great or even good investors. Many great investors are Kelly or fractional Kelly bettors who focus on not losing. I will discuss the records of some great investors and conclude this column with a suggested way to evaluate them. In the next column I will evaluate the records of some great investors and the third column will review some recent investment books.

The various efficient/inefficient market camps: Can you beat the stock market?

Why Buffett wants to endow university chairs in efficient market theory

I divide market participants into five groups. There are other ways to do this categorization but my way is useful for our purpose of isolating and studying great investors and naturally evolves from the academic study of the efficiency of financial markets.

The five groups are:

1. Efficient markets (E)
2. Risk premium (RP)
3. Genius (G)
4. Hogwash (H)
5. Markets are beatable (A)

The first group consists of those who believe in efficient markets (E). They believe that current prices are fair and correct except possibly for transactions costs. These transaction costs, which include commissions, bid-ask spread, and price pressures, can be very large. A BARRA study made by Andy Rudd some years ago showed that these costs averaged 4.6 per cent one-way for a $50,000 institutional investor sale.

The leader of this school which had dominated academic journals, jobs, fame, etc. in the 1960s to the 1980s was Gene Fama of the University of Chicago. A brilliant researcher, Fama was also a tape recorder: you can turn him on or off, you can fast forward or rewind him, but you cannot change his views no matter what evidence you provide.

This group provided many useful concepts such as the capital asset pricing model of Sharpe, Lintner and Mossin which provided a theoretical justification for index funds which are the efficient market camp's favored investment mode. They still beat about 75 per cent of active managers. Index funds have grown and grown. Dimension Fund Advisors formed by Fama's students manages over $25 billion and others such as Barclay's in San Francisco manage over $100 billion. This is done with low fees in an efficient manner. The indices for these passive funds have grown to include small cap, foreign investments and a variety of exchange-traded funds as well as the traditional market index, the S&P500.

Over time the hard efficient market line has softened into a Risk Premium (RP) camp. They feel that markets are basically efficient but one can realize extra return by bearing additional risk. They strongly argue that if returns are above average, then the *risk* must be there *somewhere*; you simply cannot get higher returns without bearing additional risk, they argue. For example, beating the market index S&P500 is possible but not risk adjusted by the CAPM. They measure risk by Beta, which must be greater than one to receive higher than market returns. That is, the portfolio risk is higher than the market risk. But they allow other risk factors such as small cap and low book to price. But they do not believe in full blown 20-or-so factor models. Fama and his disciples moved here in the 1990s. This camp now dominates the top US academic journals and the jobs in academic finance departments at the best schools in the US and Europe.

The third camp is called Genius (G). These are superior investors who are brilliant or geniuses but you cannot determine in advance who they are. Paul Samuelson has championed this argument. Samuelson feels that these investors do exist but it is useless to try to find them as in the search for them you will find 19 duds for every star. This view is very close to the Merton-Samuelson criticism of the Kelly criterion: that is, even with an advantage, it is possible to lose a lot of your wealth (see Table 2). The evidence though is that you can determine them ex ante and to some extent they have persistent superior performance. Soros did this with futures with superior picking of futures to bet on; this is the traders are "made not born" philosophy. This camp will isolate members of other camps such as in 'A' or 'H'.

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The fourth camp is as strict in its views as camps 'E' and 'RP'. They feel that the efficient markets hypothesis which originated in and is perpetuated by the academic world is hogwash (H). In fact the leading proponent of this view – and one it is hard to argue with as he is right at the top of the world's richest persons list – is Warren Buffett, who wants to give university chairs in efficient markets to further improve his own very successful trading. An early member of this group, the great economist John Maynard Keynes was an academic. We see also that although they never heard of the Kelly criterion, this camp does seem to use it implicitly with large bets on favorable investments.

This group feels that by evaluating companies and buying them when their value is more than their price, you can easily beat the market by taking a long-term view. They find these stocks and hold them forever. They find a few such stocks that they understand well and get involved in managing them. They forget about diversification because they try to buy only winners. They also bet on insurance when the odds are greatly in their favor. They well understand tail risk which they only take at huge advantages to themselves when the bet is small relative to their wealth levels.

The last group 'A' is made up of those who think that markets are beatable through behavioral biases, security market anomalies using computerized superior betting techniques. They construct risk arbitrage situations with positive expectation. They research the strategy well and follow it for long periods of time repeating the advantage many times. They feel that factor models are useful most but not all of the time and show that beta is not one of the most important variables to predict stock prices. They use very focused, disciplined, well-researched strategies with superior execution and risk control. Many of them use Kelly or fractional Kelly strategies. All of them extensively use computers. They focus on not losing, and they rarely have blowouts. Members of 'A' include Ed Thorp, Bill Benter, John Henry (the Red Sox owner), Blair Hull, Harry McPike and me. Blowouts occur more in hedge funds that do not focus on not losing and true diversification and over-bet; when a bad scenario hits them, they get wiped out, such as LTCM and Niederhofer, see Ziemba (2003) for details. My idea of using scenario dependent correlation matrices, see Geyer et al. (2005) is important here.

How do investors and consultants do in all these cases?

All can be multimillionaires but the *centimillionaires* are in ‘G’, ‘H’ and ‘A’ like the five listed before me in ‘A’ and Buffett. These people make more money for their clients than themselves but the amount they make for themselves is this huge amount: of course these people eat their own cooking, that is they are clients themselves with a large amount of their money in the funds they manage. (An exception is someone who founded an ‘RP’ or ‘E’ company, kept most of the shares and made an enormous amount of fees for themselves irrespective of the investment performance given to the clients because the sheer volume of assets under management is so large). But I was fortunate to work/consult with four of these and was also the main consultant to the Frank Russell Research Department for nine years which is perhaps the leading RP implementer. ‘A’ people earn money by winning and taking a percentage of the profits, Thorp returned 15.8 per cent net with $200 million under management; fees $8 million/year. ‘E’ and ‘RP’ people earn money from fees by collecting assets through superior marketing and *sticky* investment decisions.

Many great investors use Kelly betting including most in camp A. There are compelling reasons for this that I have discussed in previous columns. For long and mathematical survey papers, see MacLean and Ziemba (2006) and Thorp (2006) in the *Handbook of Asset and Liability Modeling* dueout about July. But there are critics and chief among them are Nobel Prize winners Bob Merton and Paul Samuelson. Their argument is that successful investing has a lot of luck in it and it is hard to separate *luck* from *skill*. Therefore while many Kelly investors will make huge gains, a few will have huge losses. Indeed they are correct. A good way to explain this is via the simulation Donald Hausch and I did in *Betting at the Racetrack* (1986). Consider the experiment – and the simulation of 700 bets done 1,000 times.

In support of Kelly, notice that 166 times out of the 1,000 simulated wealth paths, the investor has more than 100 times initial wealth with full Kelly. But this great outcome occurs only once with half Kelly. However the probability of being ahead is higher with half Kelly is much higher 87.0 vs 95.4. A negative criticism is that the minimum wealth is only 18. So you can make 700 bets, all independent, each with a 14 per cent edge and the result is that you still lose over 98 per cent of your fortune with bad scenarios.

Figure 1: The record of the Chest Fund, King’s College, Cambridge, 1927-1945 (Keynes): source Ziemba (2003)

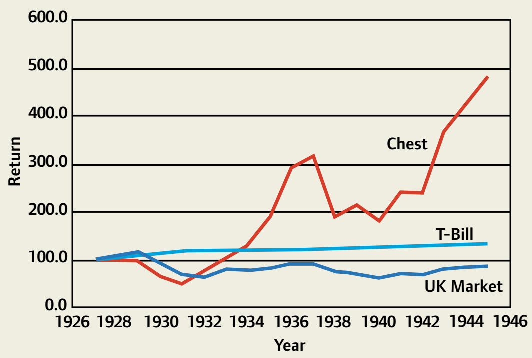
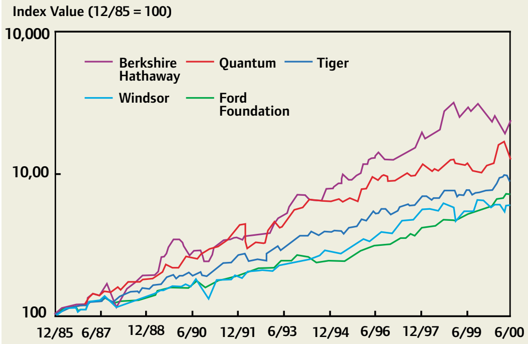


Figure 2: The records of some great investors: source Ziemba (2005)



Let’s now look at the records of wealth over time of some great investors and then discuss a way I propose to evaluate them. Of these wealth records, the smartest, nicest ones are Thorp’s, Benter’s and mine (of course at a lower level of total gains, but ... with my own and clients' money I am making progress) of camp A, Keynes, Buffett and Soros (Quantum) of camp G, and Ford of camp RP. Ford gains the least but has a very smooth wealth path. By law they must pay out in gifts five per cent of their wealth each year. Their expenses are about 0.3 per cent so their goal, which they have been quite successful in achieving, is to make 5.3 per cent in real terms. So they have less wealth but a high Sharpe ratio.

In Ziemba (2003) I argue that Keynes is a –w-0.25 (80 per cent Kelly, 20 per cent cash) bettor.

Table 1: Simulation 700 investments, 1000 simulation runs W_0 = $1000

Probablility of winning	Odds	Expected return	Likelihood of being chosen in the Simulation	F*
0.57	1-1	1.14	0.1	.14
0.38	2-1	1.14	0.3	.07
0.285	3-1	1.14	0.2	.0475
0.228	4-1	1.14	0.2	.035
0.19	5-1	1.14	0.1	.028

Figure 3: The record of Bill Benter, the world’s greatest racetrack, a well-known fractional Kelly bettor: source Ziemba (2005)

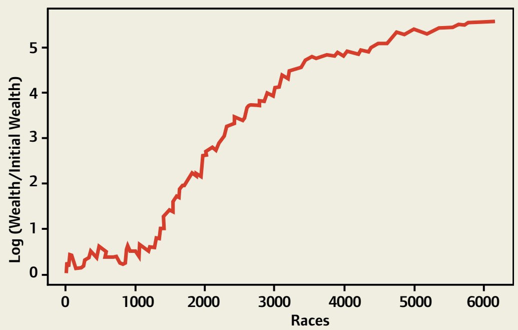
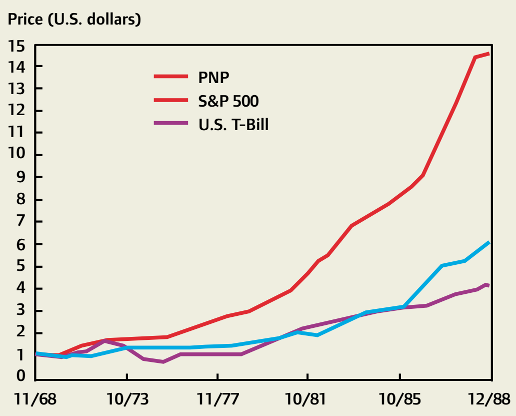


Table 2: Summary statistics from the simulation

Final Wealth					Number of times the final wealth out of 1000 trials was				
Strategy	Min	Max	Mean	Median	>500	>1000	>10,000	>50,000	>100,000
Kelly	18	483,883	48,135	17,269	916	870	598	302	166
Half Kelly	145	111,770	13,069	8,043	990	954	480	30	1

Figure 4: The record of Princeton Newport Partners, LP, cumulative results, Nov 1968-Dec 1998 (Thorp): source Ziemba (2003)



Thorp (2006) shows that Buffett through his fund Berkshire Hathaway acts as if he was a fully Kelly bettor.

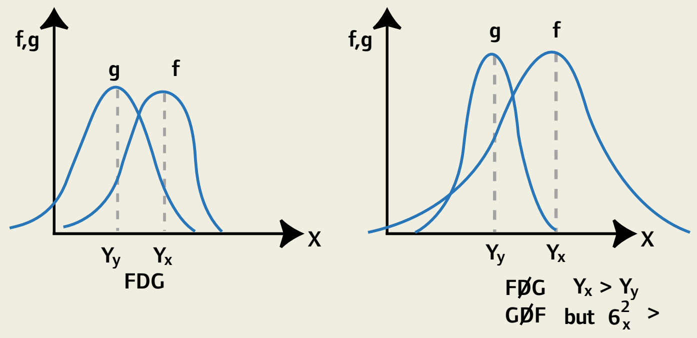
The importance of getting the mean right

The mean dominates if the two distributions cross only once.

Theorem: Hanoch and Levy (1969)

If $X \sim F(\,)$ and $Y \sim G(\,)$ have CDFs that cross only once, but are otherwise arbitrary, then F dominates G for all concave u. The mean of F must be at least as large as the mean of G to have dominance. Variance and other moments are unimportant. Only the means count.

Figure 6: The main theorem of mean-variance analysis



With normal distributions X and Y will cross only once if the variance of X does not exceed that of Y. That's the basic equivalence of Mean-Variance analysis and Expected Utility Analysis via second order (concave, non-decreasing) stochastic dominance.

Observe that the mean-variance problem is mean - (risk aversion) variance/2.

Table 3 shows that the errors in means are about 20 times the errors in covariances in terms of CEL value and the variances are twice as important as the covariances. So roughly, there is a 20:2:1 ratio in the importance of these errors. Also, this is risk aversion dependent with t=(RA/2)100 being the risk tolerance. So for high risk tolerance, that is low risk aversion, the errors in the means are even greater. Hence for utility functions like log of Kelly with essentially zero risk aversion, the errors in the mean can be 100 times as important as the errors in the other parameters. So Kelly bettors should never overbet. See Table 3.

Conclusion: spend your money getting good mean estimates and use historical variances and covariances.

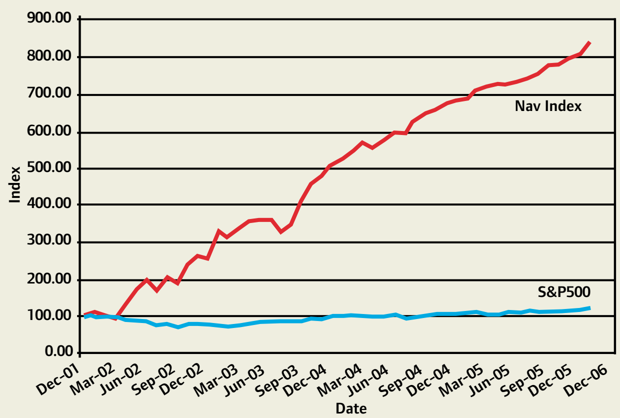
Chopra (1993) shows that the same relationship holds regarding turnover but it is less dramatic than for the cash equivalents, see Figure 8.

The results here apply to essentially *all* models. You must get the means right to win!

If the mean return for US stocks is assumed to equal the long run mean of 12 per cent as estimated by Dimson et al. (2002), the model yields an optimal weight for equities of 100 per cent. A mean return for US stocks of 9 per cent implies less than 30 per cent optimal weight for equities. This is in a five-period ten-year stochastic programming model.

In the next column, I will use a slight modification of the Sharpe ratio to evaluate great investors. The main idea is that we do not want to penalize investors for superior performance so we will focus only on losses. But to use the Sharpe ratio, we must have a full standard deviation over the whole range of possible

Figure 5: WTZ's futures account at Vision Securities, January 1, 2002 to January 30, 2006



Errors in means, variances and covariances: empirical

Replace the true mean μ_i by the observed mean $\mu_i(1+kZ_i)$ where Z_i is distributed N(0,1) with scale factor k = 0.05 to 0.20, being the size of the error. Similarly, replace the true variances and covariances by the observed variances $\sigma_i^2(1+kZ_i)$ and covariances $\sigma_{ij}(1+kZ_i)$. We use monthly data from 1980-89 on ten DJIA securities which include Alcoa, Boeing, Coke, Dupont and Sears. See Chopra-Ziemba (1993) which updates and extends Kallberg and Ziemba (1984).

The certainty equivalent, CE, of a portfolio with utility function u equals u^{-1}(expected utility of a risky portfolio).

Assuming exponential utility and normal distributions, yields exact formulas to calculate all quantities in the

$$\text{certainty equivalent loss (CEL)} = 100\left(\frac{\mathrm{CE}_{\mathrm{opt}} - \mathrm{CE}_{\mathrm{approx}}}{\mathrm{CE}_{\mathrm{opt}}}\right).$$

>

Table 3: Mean Percentage Cash Equivalent Loss Due to Errors in Inputs (Source: Chopra and Ziemba, 1993)

Risk Tolerance	Errors in Means vs Covariances	Errors in Means vs Variances	Errors in Variances vs Covariances
25	5.38	3.22	1.67
50	22.50	10.98	2.05
75	56.84	21.42	2.68
	↓	↓	↓
	20	10	2

The error depends on the risk tolerance but roughly

Error Mean	Error Var	Error Covar
20	2	1

Figure 7: The effect of errors in means, variances and covariances on optimal portfolios: source Chopra and Ziemba (1993)

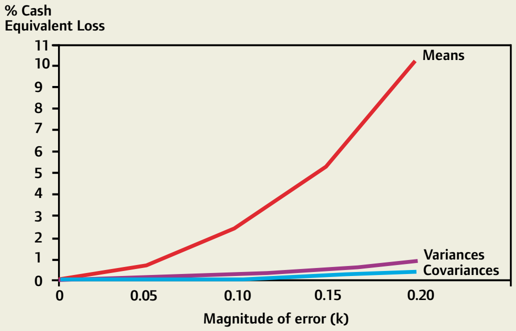
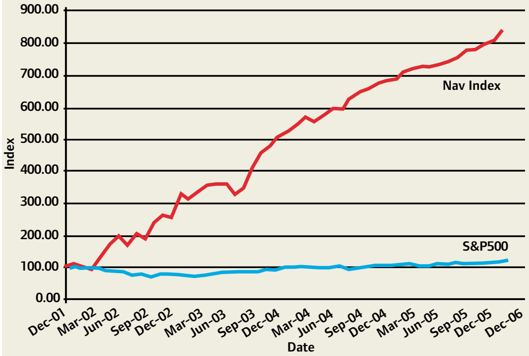
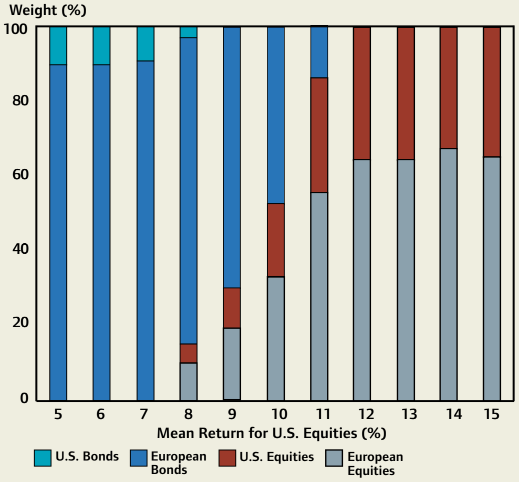


Figure 8: Average turnover: percentage of portfolio sold (or bought) relative to preceding allocation: source Chopra (1993)



return outcomes and that I make $\sqrt{2}\sigma_{x-}$ where σ_{x-} is the downside standard deviation. That is we artificially create gains which are mirror images of the losses. These gains are less than the real gains so penalize the investor less using the Sharpe ratio.

Figure 9: Optimal asset weights at stage 1 for varying levels of US equity means in a multiperiod stochastic programming pension fund model for Siemens Austria: see Geyer et al. (2005)



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