Global
Equity Strategy

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The Gamblers' Fallacy

Perhaps the most bizarre argument for being bullish is the belief that markets can't go down for four years in a row. This is a prime example of the gamblers' fallacy. Surely the bulls can find something more compelling to stir investors, rather than relying on fooling them with such flawed thinking. Then again...perhaps not!

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- Imagine an unbiased coin is flipped three times, and each time the coin lands on heads. If you had to bet $1000 on the next toss, what side would you choose? Heads, tails or no preference?
- Anyone calling tails is suffering from the gambler's fallacy – a belief randomness mean reverts. Of course, it doesn't. The coin has no memory, on each flip it is just as likely to come up heads or tails.
- How does this relate to the equity market? Well, year on year returns in equities are essentially a random process, just like the coin toss (we show this inside). So saying markets can't go down four years in a row is just like calling tails in the coin tossing example above.
- The most frequent argument I've heard against this view is that normally after three years of declines markets are cheap. However, this misses the point, valuations dominate long run returns, not short run returns. For instance, since 1872 in the US there have been 32 years in which the earnings yield was below median, and the return over the subsequent year was above median. However, there have also been 34 years in which the earnings yield and the return were both below the median.
- The final nail in the coffin of this fallacious argument is an empirical one. In the 1870s, the market showed five years of back to back declines. In the 1880s, another four year period of such declines was witnessed. Surely the bulls can find a more convincing case. Then again perhaps not!

Equity asset allocation

Very Overweight	Overweight	Neutral	Underweight	Very Underweight
UK		Japan	US	Cont. Europe
Cash		Emerging mrkts		

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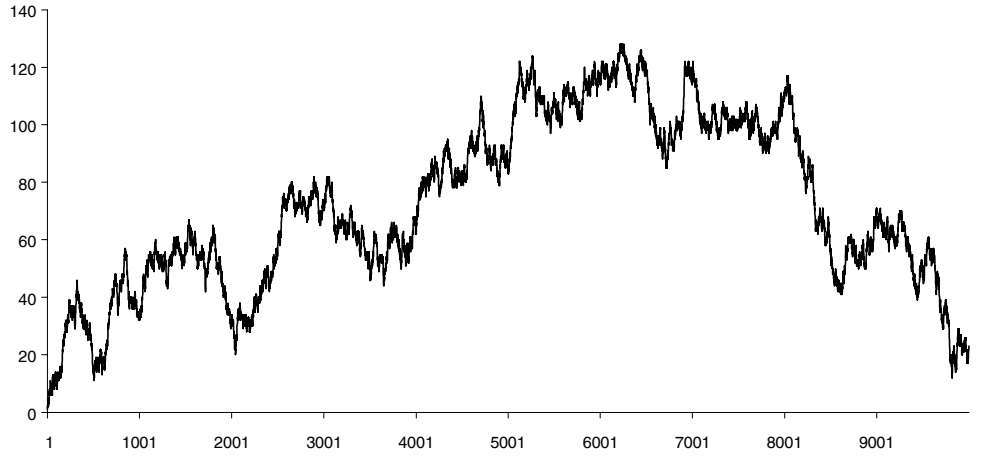
The Gamblers' Fallacy

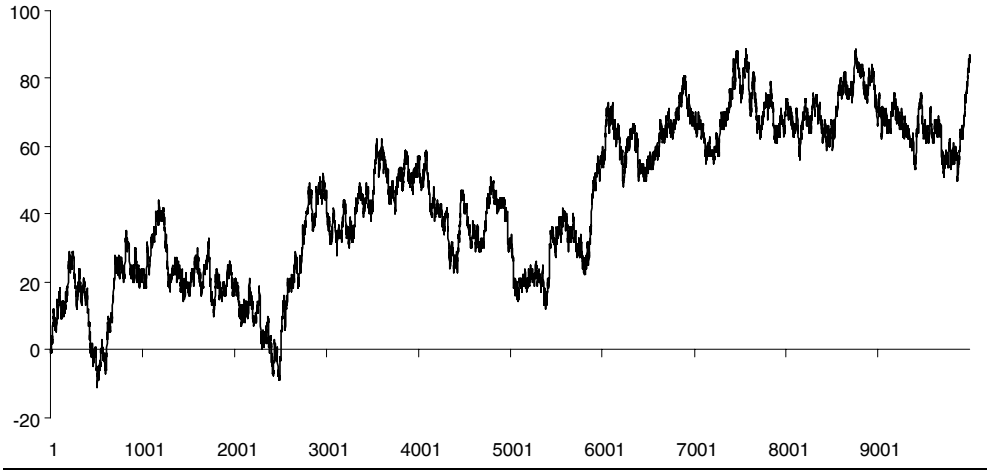
Take a look at the charts below, do you recognise the markets? I have altered the time scale and the prices, do the patterns look familiar?

Market 1



Source: DrKW

Market 2



Source: DrKW

If you answered that you recognized either of these two, I'm afraid you were mistaken. They are purely the result of a random series. All I've done is take 10000 coin flips, if the coin came up heads a score of 1 was awarded, if it came up tails a score of –1 was awarded. The charts are simply the result of the cumulative scores over the 10000 flips! Shocking how much they look like share prices isn't it?

Now consider the following examples, and write down your answers.

i) The mean IQ of the population of eighth graders in a city is known to be 100. You have a random sample of 50 children for a study of educational achievements. The first child tested has an IQ of 150. What do you expect the mean IQ to be for the whole sample?

ii) A town is served by two hospitals. In the larger hospital about 45 babies are born each day, and in the smaller hospital about 15 babies are born each day. About 50 percent of all babies are boys. However, the exact percentage varies from day to day. Sometimes it may be higher than 50 percent, sometimes lower. For a period of 1 year, each hospital recorded the days on which more than 60 percent of the babies born were boys. Which hospital do you think recorded more such days?

iii) Suppose an unbiased coin is flipped three times, and each time the coin lands on Heads. If you had to bet $1000 on the next toss, what side would you choose? Heads, tails or no preference?

So what were the answers?

i) Most people reply 100. Actually the answer is 101. You know one of the students has a high IQ, assume the other 99 have an average IQ and you get 101 (0.01*150 + 0.99*100 = 101).

ii) An alarming number of people seem to think that the larger hospital is more likely to generate days of 60% boy babies. Of course, you are much more likely to see longer runs in shorter samples. In fact the probability of seeing a run of 60% boys in the small hospital is 0.2%, compared to a 7.4E-7% of seeing a 60% boy run in the larger hospital.

iii) You should have no preference. Each toss of the coin is an independent event. The coin has no memory, so each throw is totally independent. Those calling for a tail are suffering the Gambler's fallacy – a belief that chance must be mean reverting. But randomness is not mean reverting.

Now think about the ridiculous statement that markets can't go down for four years in a row. If the year by year changes in markets are independent (statistically speaking) then this is equivalent to saying a tail is more likely to follow three heads in question iii.

So are year on year stock market returns independent? Way back before the dawn of time I was trained as an econometrician (not something I admit to very often these days). One of the ways of checking to see if a series is statistically independent is to run a regression (stay with me now), so that's exactly what we did.

Return Year 1 = 5.21 + 0.07*Return Year 0

(0.81) (t stats in brackets) $R^2 = 0.005$[1]

[1] For the anoraks, year by year returns also pass augmented DF tests for stationarity

The regression shows that year on year returns are indeed statistically independent. Markets are as likely to go up as down on a yearly time horizon. That makes good sense to me. One of the key points I've tried to emphasise in the approach on these pages in the last year is that **valuations** dominate **long run returns** (see Global Equity Strategy 27 November 2002, The purgatory of low returns), but short run returns can be relatively arbitrary, as sentiment dominates over such time horizons[2].

This difference should not be dismissed as obvious. Indeed whilst writing this note, and discussing it with my colleagues a debate ensued as to whether stock years are independent or not. The main sticking point seemed to be the view that after three years of declines then the market would normally be cheap. This may be, in general true, but it misses the point. If markets are cheap, then your long run returns will be better than average, but it tells you nothing about your short term returns. Your benefits from buying a cheap market may or may not come in the first year, but they will come eventually.

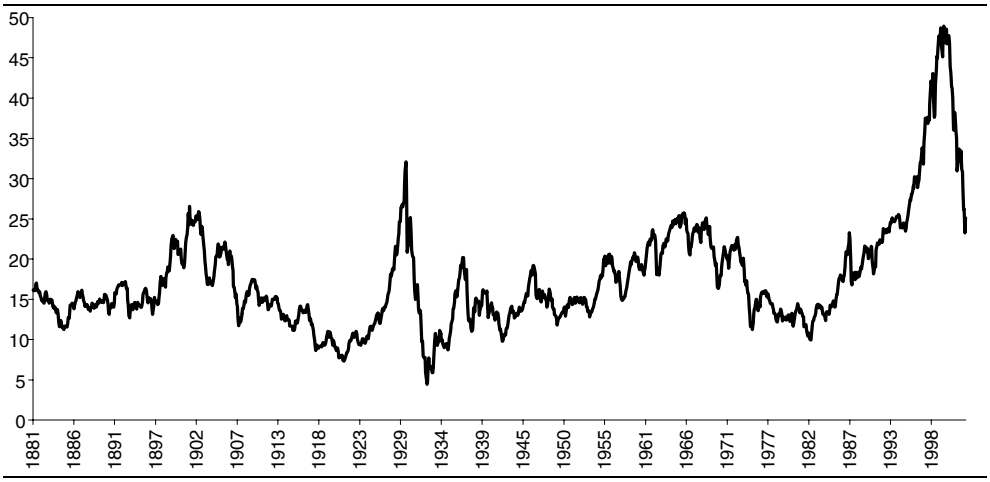
The table below shows an analysis of the relationship between earnings yields and one year equity returns. It shows the number of years in which the earnings yield has been below median and the return has been above median (32 years), and the number of years in which the earnings yield has been below median and the return also below median (34 years). Yet another demonstration that valuation is largely irrelevant for short term returns.

Relationship between valuation and one year returns (1872-2002)

	Below median return	Above median return	Total
Below median E/P	34	32	66
Above median E/P	32	33	65
Total	66	65	131

Source: DrKW

Graham and Dodd PE



Source: DrKW

[2] Incidentally, this is one reason we are not great believers in market forecasts. They are an exercise in pure randomness.

In addition, as we have repeatedly shown over the last few months, valuations on the US market are simply not cheap. On the contrary, they remain at, what would prior to the recent bubble have been considered, peak levels. The chart above shows a Graham and Dodd PE (a PE based on ten year moving average earnings) demonstrating that valuations remain very demanding.

The table below shows data on secular market conditions. Of course, such analysis is only ever ex post, i.e. bull and bear markets can only be identified after the fact, which makes the interpretation of the data somewhat hard. However, note the number of positive and negative years during the bear markets below. Roughly speaking they are in line with our general finding that year on year stock market returns are random.

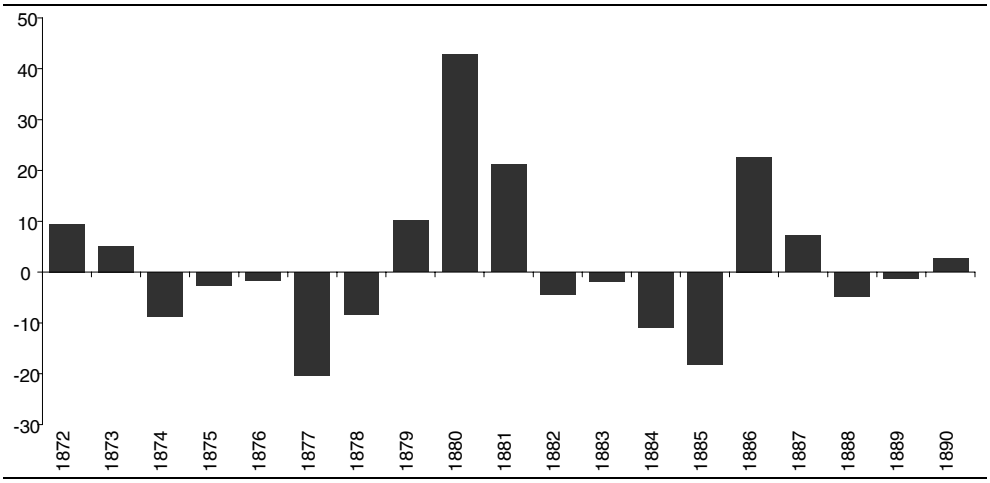
Secular market conditions

Category	Dates	Starting G&D PE	Ending G&D PE	Duration	Positive years	Negative years	Negative %
Bear	1871-1897		15x	26	12	14	54
Bull	1898-1907	15x	18x	10	8	2	20
Bear	1908-1920	18x	10x	13	5	8	62
Bull	1921-1929	8x	25x	9	7	2	22
Bear	1930-1942	21x	11x	13	4	9	69
Bull	1943-1965	12x	24x	23	18	5	22
Bear	1966-1982	25x	11x	17	11	6	35
Bull	1983-1999	12x	44x	18	15	3	17

Source: DrKW, Shiller

The final nail in the coffin in the fallacy that markets can't go down for four years in a row, is an empirical one. The dataset made available by Robert Shiller allows us to examine a very long run series of returns. In contrast to the bullish proclamations, the US market has gone down for four years in a row. Indeed in the 1870s, the market showed five years of back to back declines. In the 1880s, another four year period of back to back declines was witnessed.

S&P500 YoY returns 1872-1899



Source: DrKW

The bulls had better find a more convincing reason to buy equities than simply trying to trick investors into the gambler's fallacy.

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Buy	10% or greater increase in share price	Reduce	5-10% decrease in share price
Add	5-10% increase in share price	Sell	10% or more decrease in share price
Hold	+5%/-5% variation in share price		

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	All covered companies		Companies where a DrKW company has provided investment banking services (in the last 12 months)	
Buy/Add	362	53%	78	62%
Hold	230	34%	40	32%
Sell/Reduce	93	14%	7	6%
Total	685		125	

Source: DrKW