CI collective insight

EDITOR
Shaun Harris

CONVENOR
Anne Cabot-Alletzhauser — CIO, Advantage Asset Managers

EDITORIAL ADVISORY COMMITTEE
Tony Bell — Director, Peregrine iQ
Delphine Govender — Director and Portfolio Manager, Allan Gray
Petri Greeff — Research and Special Projects, RisCura
Heidi Raubenheimer — Graduate School of Business, UCT
Armien Tyer — MD, Sanlam Investment Management
Nerina Visser — Head of Beta Solutions, Nedbank Capital Global Markets
Muitheri Wahome — Head of Asset Consulting, Alexander Forbes

Contents

For e-mail, feedback and suggestions, please visit our website at www.collectiveinsight.co.za

Finweek publishes Collective Insight tri-annually on behalf of the South African investment community.

The use – and misuse – of numbers

NERINA VISSER
Nedbank Capital Global Markets

INVESTMENT PROFESSIONALS often envision an idealised process where effective data collection and meaningful analysis on both sides of a debate lead to well-reasoned judgments and logical decisions. Unfortunately, the reality proves that analyses aren't always well developed, theoretically founded, properly documented or appropriately applied.

This latest edition of *Collective Insight* brings you six reports that each evaluates a different angle on the use, or sometimes misuse, of numbers in investment analysis, measurement and management. Albert Botha, of Glacier, submitted an eloquent rendition of the history of the development of financial mathematics and I quote liberally from his writings.

Despite the complexity, the field of financial mathematics and the underlying science of statistics are still very young, especially when compared with the classical sciences of mathematics, physics or even biology. To understand how financial mathematics is used and what its shortcomings are we need to understand something of its history, its youth and the premises it's based on.

Some scholars put the birth date of statistics at 1662. That's the date John Graunt published a book on the analysis of human mortality in London. In his book he used statistics to estimate the population size of London as well as producing the world's first life table, which can be used to estimate probability of survival to each age. The important words here are "estimate" and "probability". It isn't an exact science. Also during the 17th Century Blaise Pascal and Pierre de Fermat built the mathematical foundations on which statistics was founded. They did that by studying games of chance.

Since its birth, many great minds made contributions to the field, including luminaries such as Albert Einstein, who used Brownian motion to indirectly confirm the existence of atoms. However, it was the advent of the computer that allowed people to perform large-scale statistical calculations that truly allowed statistics to be used – and abused – to its fullest potential. From the field of statistics grew the field of financial mathematics. It's also called financial engineering or financial risk management, yet the end result remains the same: it's using maths to allow individuals, corporations and funds to manage risk in the most efficient way.

By selecting your assets and liabilities and structuring your investment in a certain way you optimise your exposure to risk. That, in turn, allows you to take on more risk as you're more certain about the possible range of outcomes. But it's important to remember financial mathematics is a focused field of statistics and that statistics deal in probabilities, not in certainties. It analyses past data to try and estimate the risk inherent in certain combinations of investments. That means your predictions are only as complete as your data and the calculations you can make from them.

Risk and uncertainty don't come from knowable, quantifiable events: they spring from improbability and unpredictable events. It's exactly those events we didn't predict that cause problems – the problem of the "Black Swan"[1]. When users of models expect them to be perfect and to offer complete protection against uncertainty they become overly reliant on those models. When disaster strikes and the models don't perform as expected it's given rise to a distrust in models and even the word "quant"[2] is somewhat reviled.

However, the problem was never with the models. Models by their very nature are only an approximation of reality and are limited by their input data. They can't be perfect predictors of the future and they shouldn't be regarded as such. But they are, and should remain, an integral part in the decision-making process.

Currently there's just too much information and the systems too complex for a single person to assimilate. Quant models, ratios, summaries and graphs help process and simplify the information. However, what's

4 »

3 «

important is how that information is interpreted. Quant models aren't the Holy Grail and their outputs are not inviolate. It's when people forget that fact that problems start.

I conclude by quoting "The Modellers' Hippocratic Oath" by Emanuel Derman and Paul Wilmott.[3]

- I will remember I didn't make the world and it doesn't satisfy my equations.
- Though I will use models boldly to estimate value I will not be overly impressed by mathematics.
- I will never sacrifice reality for elegance without explaining why I have done so.
- Nor will I give the people who use my model false comfort about its accuracy. Instead, I will make explicit its assumptions and oversights.
- I understand that my work may have enormous effects on society and the economy, many of them beyond my comprehension.

References

1. *Fooled by Randomness* and *Black Swan*. Both written by Nassim Taleb. They deal with the impact of highly improbable/unpredictable events.
2. A "quant" is the short industry term for a quantitative analyst, a person who spends a lot of time doing calculations and building quantitative (quant) models.
3. http://www.wilmott.com/blogs/eman/index.cfm/2009/1/8/The-Financial-Modelers-Manifesto. ■

IN THE NEXT ISSUE···

THE TOPIC FOR OUR next *Collective Insight* is "Myth-busters: Do the value and small cap premia really exist?" Active investment strategies are predicated on the belief there are market inefficiencies that can be exploited. We're looking for articles that can address both sides of the debate as to whether those or any other similar inefficiencies exist in South Africa.

We'd like insights as to why they may or may not exist and what that means to investors. Articles can cover either one of the risk premia mentioned, both or introduce other potential inefficiencies not cited here. Our preference is for articles that can introduce both sides of the debate. However one-sided discussions are also welcome.

Articles can either be directed to the lay reader as an introduction to the topic or they can be directed to the professional who could benefit from a more substantive debate on the topic. Authors wishing to contribute should vet their topic choices with us first to minimise overlap. Please contact the advisory committee convener, Anne Cabot-Alletzhauser, at (011) 575-4333 with your topic ideas. Articles (approximately 1 200 words, plus illustrations) need to be submitted to matsholom@collectiveinsight.co.za by 9 October 2009.

Please remember this is a research publication and, as such, please no market commentary or marketing material. ■

The components of equity market returns

MATTHEW DE WET
Nedgroup Investments

DE WET *holds a degree in actuarial science and is a CFA charter holder. As head of investments at Nedgroup Investments he assumes overall responsibility for the Best of Breed fund range, investment strategy and product development.*

"After all, two data points make a line and three data points make a trend."
– **Financial guru on local radio**

MANY INVESTORS believe a good proxy for future equity returns is a mere extrapolation of the past. The fact that the South African equity market has provided returns of 8%/year above inflation over the past 50 years doesn't mean prospective returns will be similar. Equities aren't preordained to deliver returns of 8% above inflation. Investors are therefore better served by understanding the sources of equity market returns rather than by gazing in the rear-view mirror.

Let's examine the sources of equity market returns in more detail. The graph – for the period beginning in 1960 and ending in March 2009 – highlights the relationship between economic growth (GDP), company profit and the stock market over a long period.

It should be apparent from the graph that GDP, company profits and the level of the stock market have grown at comparable rates over time. The relationship between company profit growth and GDP growth is intuitive. Because the companies »

« that make up the stock market form part of the overall economy, the sales of those companies make up a portion of the annual sales of the economy as a whole (GDP).

But we need to compare like with like: GDP is a measure of revenue and not of profits. Profits are calculated once costs, interest and taxes have been deducted. Over time profit margins tend to expand and contract depending on the level of competition, interest rates and many other factors. That's why company profits follow a similar trend to GDP, but with greater volatility.

Now consider the relationship between the level of the stock market and company profits. They have also moved broadly in sync over time. Expressed differently, prices follow profits. It's no coincidence the profits of the companies listed on the JSE have, with dividends reinvested, grown by approximately 8% above inflation since 1960 – in line with the total return of the stock market over the same period. Those earnings and dividends are the more certain components of investment return offered by the market. Those components are relatively stable over time and are closely linked to the longrun potential of an economy.

Of course, over shorter periods we know the market return differs vastly from long-term averages. That's due to the speculative component of return that's driven by the changing mood of investors. The earnings multiple of the market – the value investors are willing to ascribe to the stream of profits that companies generate – is a good proxy for the current speculative element prevailing in the market. The returns that investors can expect from the market over time can therefore be broken up into components, as follows (ignoring changes in shares outstanding for simplicity):

Market return (above inflation) = Investment return + speculative return

= (real company profits + dividends) + p:e effect

By taking a few liberties we can simplify further by incorporating the fact that company profits and GDP are related (the difference, as discussed above, being primarily attributable to changes in profit margins over time). Now:

Market return
= (real sales growth + profit margin effect + dividends) + p:e effect
≈ (real GDP growth + profit margin effect + dividends) + p:e effect

The real GDP growth component of the market's return has been fairly stable over time (usually in the 2% to 5%/year region) and the dividend stream investors will receive is well explained by the current dividend yield available in the market (usually between 3% and 6%/year). The impact of both those components on total return can therefore be quantified with an acceptable level of accuracy.

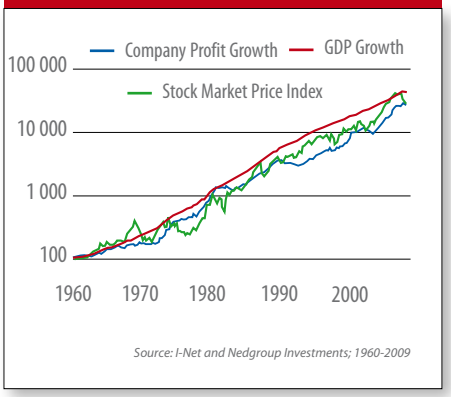
It's the other two components of return – namely, the profit margin effect and the p:e effect – that create the major uncertainty regarding future returns. As the investment community's mood shifts from exuberance to despair and all the way back again the impact that p:e changes have on total returns can easily overwhelm the investment return component – swings of 20% in any one year aren't uncommon.

That impact can be exacerbated, because it's often when profits are at their highest that investors are most willing to pay a high multiple for those profits. When profit margins inevitably mean – revert over time due to competitive forces in the economy, investors who have paid a high multiple for high profits will have a disappointing experience.

Interestingly, the impact of each return component changes over different timeframes. Over the short term, changes in the p:e multiple have by far the largest impact on return. As time progresses, the impact of that factor tends to diminish and the impact of the more predictable profit growth and dividend factors increase. Investors need to be aware that the investment component of return can be dominated by the speculative component for many years, particularly if investments were made when profit margins or the levels of speculation in the market were abnormal.

Of course, it's when profit margins and speculation in the market are at very low levels that the potential for above-average future returns is greatest. Unfortunately, it's at such times that news flows and sentiment will be poor. By training ourselves to ignore those emotional influences – and by focusing rather on the long-term sources of return – we may be able to make better investment decisions. ■

THE RELATIONSHIP BETWEEN GDP GROWTH, COMPANY PROFIT AND STOCK MARKET RETURNS



Source: I-Net and Nedgroup Investments; 1960-2009

It's when profit margins and speculation in the market are at very low levels that the potential for above-average future returns is greatest.

Do investment managers add real value?

JONATHAN KRUGER
Prescient Investment Management

***KRUGER** is a portfolio analyst at Prescient Investment Management. He's awaiting his CFA charter and is jointly responsible for managing the equity within the Prescient SA Balanced Quantplus Fund.*

HOW PROFESSIONAL are the professionals? How much real value are they adding to my retirement portfolio? Should I switch to a passive strategy and save on fees? Three provoking questions investors may be asking as they peer at their latest quarterly performance numbers. Wildly gyrating markets on the back of much economic uncertainly and scepticism have left managers delivering a plethora of mixed performance results. Though the argument between passive and active management will rage on, how do you interpret the numbers and where are the dangers?

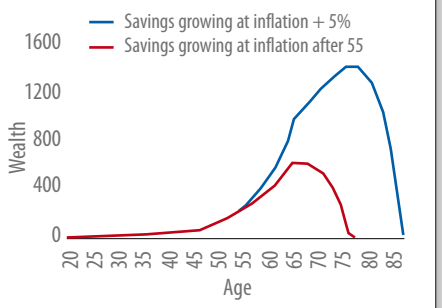
The need for real returns

First, you must determine what you're trying to achieve and what the risks are. Investors need to save in excess of inflation to retire comfortably. A simple illustration demonstrates the shortfall risk of not saving in excess of inflation after age 55.

> **The argument between passive and active management will rage on.**

SAVINGS

Graph 1

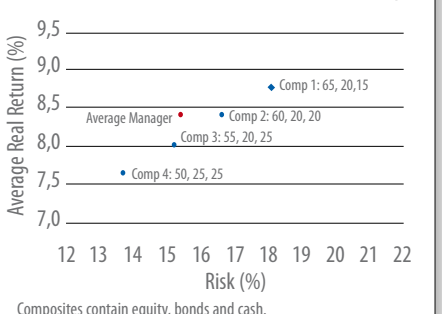


In graph 1 the blue line shows the result of an investor saving at inflation + 5% throughout his lifetime, while the investor in red grows his investments at inflation + 5% until age 55, after which he switches to assets that only deliver returns in line with inflation. The investor in red has significant risk of his money running out during retirement (see graph 1).

So as a starting point an investor saving for retirement should have a goal to achieve a return of inflation + 5%, while the risk isn't meeting that target over his investment horizon. If we examine the real returns provided by traditional asset classes between 1978 and 2009 equity has provided 11%, bonds 3,1% and cash 3%*. In order to achieve the goal of inflation + 5%, an investor will need to have a fairly high allocation in equities – the only asset class delivering a real return greater than 5%. However, the question is: Given the risk in equity how much should an investor's portfolio hold and should the asset allocation be actively or passively managed?

COMPOSITE AND AVERAGE MANAGER PERFORMANCE

Graph 2



Composites contain equity, bonds and cash.

Delivering real returns using active and passive strategies

To analyse the real performance of active and passive strategies four passive composite portfolios were constructed using a strategic asset allocation between equities, bonds and cash. Their real performance was compared to that of the average balanced fund manager* by analysing the returns over rolling, three-year quarterly periods from March 1978 to March 2009. The average real return and the standard deviation of returns are displayed in graph 2.

The results indicate that on average all the composites achieved real returns of between 7,5% and 9% and the average manager performed in line with Composite 2 (equities 60%, bonds 20%, cash 20%) with less risk. Looking at the return data from that averaging perspective it appears as if all the composites are achieving their goal of CPI + 5% and the average manager is fairing fairly well on a risk return basis.

Graph 3 plots the composites and average manager performance as a time series starting in 1978. Looking at the data from that perspective paints a different picture. While all the composites and the average manager outperformed the CPI + 5% target over the period, the passive composites are largely above that of the average manager for almost the entire period. At the end point in March 2009 the average manager (red) performs in line with the worst performing composite (navy blue), composite 4. That suggests the average manager

8 »

6 «

hasn't added value by deviating from a simple passive strategic asset allocation.

Avoid the dangers... look deeper into the data

We've now looked at the data from two perspectives: averaging of rolling periods and plotting time series over the full period. Each perspective leads to somewhat different conclusions. So where are the dangers? Are there embedded data biases leading to different outcomes?

First, averages can be strongly influenced by "outliers" in the data. One or two particularly good rolling periods could have made our real average significantly higher. Similarly, one or two particularly low numbers could have brought the average down significantly. Second, there's a danger in simple time series analysis because the starting and ending points can considerably influence the final performance outcome and the appearance of the interval performance.

So how do we avoid those pitfalls and potential data biases? We need to look at the data a bit closer. Graph 4 shows a plot of "real alpha" (performance above CPI + 5%) delivered by composite 2 (equities 60%, bonds 20%, cash 20%) and that of the average manager over three-year rolling quarterly periods.

Graph 4 reveals that between 1981 and 1984 the average manager struggled to beat both CPI + 5% and the passive composite. That shows how the initial underperformance in the Eighties created the picture in graph 3, where it appears as if active management performs worse than a passive alternative over the entire period. However, for most of the period 1986 to 2001 and from 2004 onwards the average manager beats the composite.

Graph 4 also exposes periods where both the passive composite and the average manager failed to beat the target of CPI + 5%. If we look at the periods marked by the green circles, the average manager performed better than the composite. It appears the average active manager was able to add some value in terms of real downside protection over those periods – although not avoid it completely. Some statistics will confirm that.

While the average manager outperformed the passive composite 64,9% of the time, in periods when the composite didn't beat CPI + 5% the average manager outperformed the composite 60,3% of the time. However, the average manager outperformed the composite 70,6% of the time during periods where the composite beat CPI + 5%.

Those numbers support the notion that active management can reduce volatility of returns and provide some protection during times when it's difficult to beat inflation. However, over the period under consideration managers were able to add more value during low inflationary periods and equity bull markets. Active decisions could include tactical asset allocation, offshore allocation, protection through derivatives and share selection. It's important to consider how your manager is aiming to deliver real returns and whether that's on a risk adjusted basis.

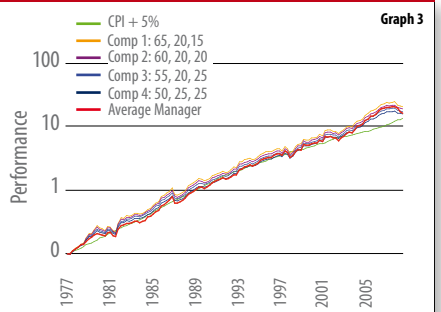
Another common pitfall investors should be aware of when conducting analysis on average manager performance data is survivorship bias in manager surveys. That bias generally occurs when a poor asset manager closes and the entire performance submission is removed from the survey. That results in the historical average manager performance numbers being biased upward. The table illustrates:

In the example, the survey was biased upward by 0,77% in this one-off occurrence, whereas in reality that happens numerous times and the upward bias is compounded over time. Another form of bias happens when new managers are included in surveys and a full year's history is included in

10 »

COMPOSITE AND AVERAGE MANAGER PERFORMANCE

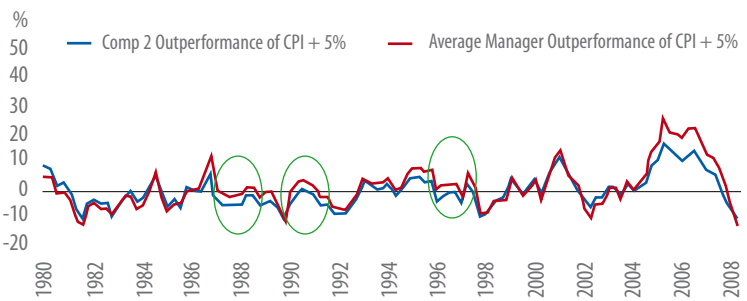
Graph 3



Composites contain equity, bonds and cash.

RELATIVE REAL PERFORMANCE

Graph 4



Composite 2 (equities 60%, bonds 20%, cash 20%) and average manager outperformance of CPI + 5% rolling 3-year quarterly periods.

the survey retrospectively.

Excluding survivorship bias from a performance comparison is a difficult task for the general investor and should be value added by consultants and survey providers. To create an unbiased survey, published monthly, surveys must be kept as the base and used in comparison, with terminated manager returns remaining in those months when they existed and new managers only being added from the first real month of inclusion.

PERFORMANCE COMPARISON

	Original survey	Survey after manager closes
Manager 1	5,2%	5,2%
Manager 2	4,9%	4,9%
Manager 3	1,3%	
Manager 4	4,5%	4,5%
Manager 5	6,0%	6,0%
Average performance	4,38%	5,15%

In our study of real returns against the average manager data from the Alexander Forbes Large Manager Watch Survey and Consulting Actuaries Survey was used. That performance data was the actual numbers released at each survey date, including discontinued funds' performance. As such, our comparison of real returns was against the actual average manager performance at the time with survivorship bias removed.

Conclusion

Just as a professional cinematographer captures an unfolding scene from multiple angles so too should an investment analyst consider performance results from multiple perspectives. Peering down the lens from one angle might conceal potential dangers. When assessing your investment manager you should look at the performance:

- Using multiple statistics.
- Over various static timeframes and rolling periods.
- Against an appropriate benchmark.
- Excluding manager survivorship bias.

As we enter a period of stubbornly high inflation and a volatile investment climate, it will be an increasing challenge to select managers who deliver real returns while managing downside risk. A closer look at the data from multiple perspectives will help you avoid some of the hidden dangers.

* Average of annualised rolling three-year returns between March 1978 and March 2009, quarterly data.

Data sources

- Bonds, Cash and Inflation: Inet from 1986, Triumph of the Optimists: 101 Years of Global Investment Returns (Dimson, Marsh, Stuanton) prior 1986.
- Equity: Inet. Average Manager: Alexander Forbes Large Manager Watch Prudential Medium Equity from 1997, Consulting Actuaries Survey prior 1997. ■

CLAIRE RENTZKE
RisCura

***RENTZKE** is a senior consultant and head of the manager selection team at RisCura. She's responsible for researching and making recommendations about South African investment managers to some of the country's largest retirement funds. Rentzke also consults to a number of RisCura's large and small clients. She joined RisCura in March 2004. Prior to this she worked for Citigate Financial Intelligence, responsible for researching international financial institutions.*

It's not all in the numbers...

IN THE investment industry there's often a fixation on performance numbers. Trustees are bombarded each month by numerous surveys listing the performance numbers for each manager. The press provides comparisons of performance numbers; and even the asset managers themselves are quick to show their recent numbers. In the search for asset managers who can deliver performance excellence the numbers can paint a multitude of different pictures. Some variations will be favourable while others may create an unfavourable picture. The way you choose to interpret and analyse numbers can become more important than the actual numbers themselves. By taking a closer look we can illustrate the range of conclusions that may be inferred and demonstrate why it's always important to consider performance beyond the numbers.

From the past to the future

One of the trickiest components of manager selection is determining whether past performance is any indication of future results. The key is to determine whether the manager has true skill or if any periods of outperformance are merely a result of luck. Conversely, if the manager has underperformed does it truly mean he lacks skill?

Timeframe

The first aspect to consider is timeframe. Graph 1 shows the rolling 12-month performance of an equity manager relative to the universe of equity managers. The shaded areas indicate the performance of the other managers in the universe, split into quartiles. The bars show the 12-month performance for each rolling period of the manager being evaluated. When we look at one manager over the timeframe shown we may decide to select that manager based on his consistent upper quartile performance.

Now consider graph 2, showing the same equity manager over an extended timeframe. If we look at that longer timeframe and what transpired in the subsequent periods a different picture emerges. If we'd selected the manager based purely on his past performance history and »

« allocated assets to him at the end of the first period shown, value would have been destroyed over the following year.

In this case there was more to the story than just the numbers and, without the full picture, a costly mistake could have been made. The asset manager in question underwent a fairly significant change to his team. As performance is primarily determined by the investment process and the people driving that process, any changes here may impact on future performance. In this case an evaluation of those qualitative factors prior to any appointment needed to be fully evaluated.

The timeframe is also of relevance when various product offerings are compared in relation to different economic climates.

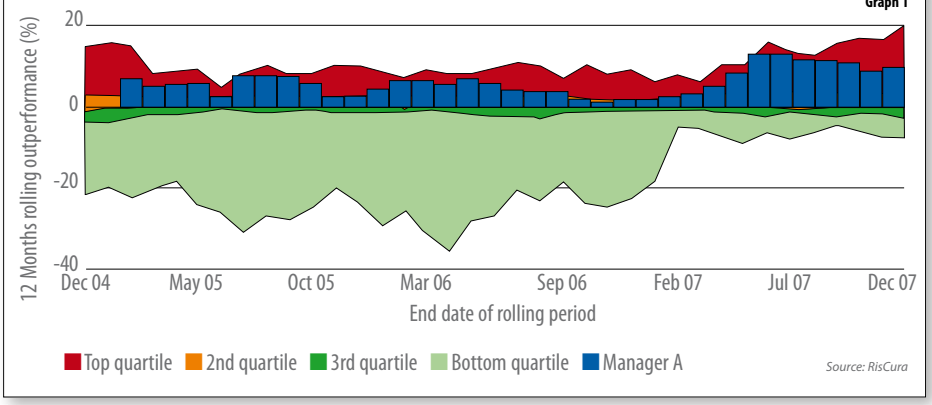
Consider the risk-return scatter plot in graph 3 of the performance and risk characteristics of guaranteed products against standard balanced funds. In this graph, we not only consider the level of return generated by a portfolio, but we also reflect the risk that was taken in the portfolio to achieve that level of return. Investment theory in the form of the capital asset pricing model infers that any additional risk taken by an investor should be rewarded with additional return. Graph 3 clearly demonstrates that over a 12-month period we would select a guaranteed product over a balanced product with certainty if we looked at the numbers in isolation.

While changing market environments may create opportunities within different areas that can be exploited at the time, retirement funds tend to have long-term horizons and that same comparison over an eight-year period gives a somewhat different picture (see graph 4).

Again, the numbers alone don't reflect the whole story. Guaranteed products aren't necessarily easy to move in and out of, as they often have expensive exit clauses if not held to maturity. When investing in longer-term products long-term performance needs to be considered and again just looking at the numbers won't necessarily tell the entire story. A different timeframe can show a very different, albeit incomplete, story.

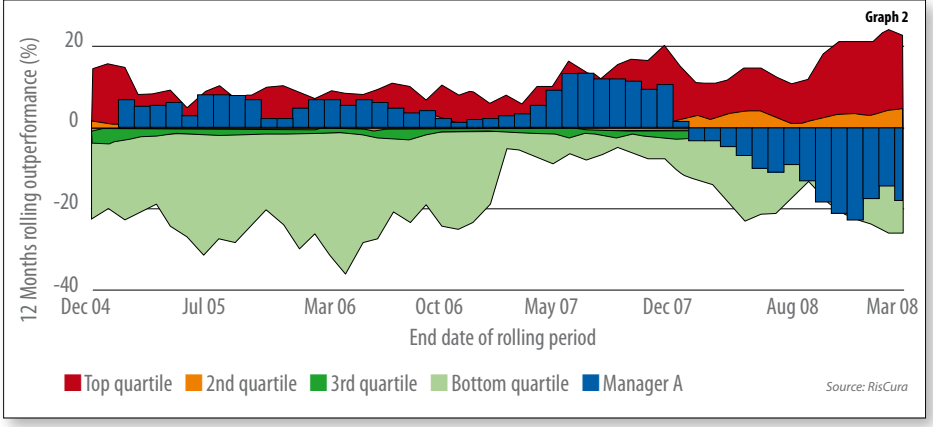
EQUITY: 12 MONTHS ROLLING OUTPERFORMANCE RELATIVE TO THE UNIVERSE AVERAGE FOR THE PERIOD ENDED DECEMBER 2007

Graph 1



EQUITY: 12 MONTHS ROLLING OUTPERFORMANCE RELATIVE TO THE UNIVERSE AVERAGE FOR THE PERIOD ENDED MARCH 2009

Graph 2



Non-stationary

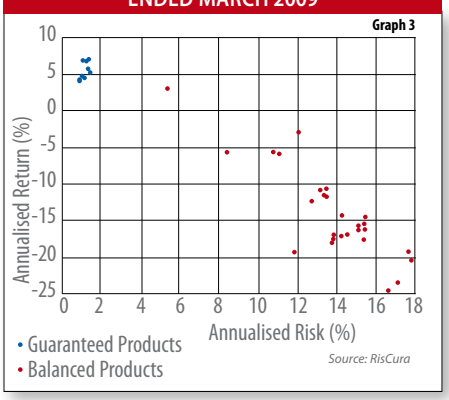
In looking at time series data we need to be aware of the statistical errors that can creep into the analysis and affect the conclusion reached. The nature of retirement fund investing is long term and in selecting asset managers it would make sense to look at performance data over as long a period as possible to ensure the manager has the ability to perform consistently.

Any manager may have a period in which he outperforms. That outperformance may well be as a result of the manager being lucky and making the right decisions – but luck only extends so far and to be lucky over long periods of time takes a level of skill. If the manager has no skill it's unlikely he'd be lucky and be able to outperform benchmark and peers over an

12 »

GUARANTEED VS BALANCED: 96 MONTHS SCATTER FOR THE PERIOD ENDED MARCH 2009

Graph 3



11 «

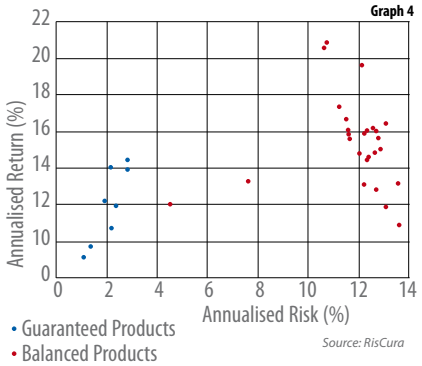
extended timeframe.

Extending the time period over which we analyse manager returns may help eliminate the short-term luck anyone managing money can experience but which isn't sustainable over long periods of time without the accompanying skill. However, when we do extend our time series we need to be sure there's been no change in investment style, philosophy or professionals over the extended period. Any change in the regime means the past history becomes irrelevant and shouldn't be factored into the decision-making process.

In looking at past returns there's a trade-off between looking at a period that's too short and may contain a significant proportion of luck (or bad luck. for that matter) and a longer period that may reflect skill but the reason that the skill was present no longer exists.

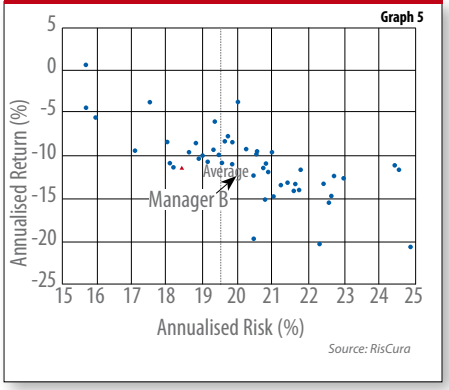
GUARANTEED VS BALANCED: 96 MONTHS SCATTER FOR THE PERIOD ENDED MARCH 2009

Graph 4



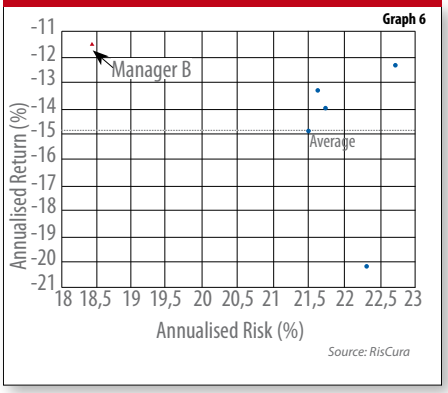
EQUITY: 24 MONTHS SCATTER FOR THE PERIOD ENDED MARCH 2009

Graph 5



EQUITY – GROWTH: 24 MONTHS SCATTER FOR THE PERIOD ENDED MARCH 2009

Graph 6



Framing

When we look at selecting managers from within a universe of their peers it's important to ensure we compare like with like and the decisions we take are made within the correct framework.

Universe

Markets move in cycles and during those cycles specific investment styles may outperform other investment styles. It's been found that over the long term, value will be the best performing style but over various cycles there may well be periods when growth will deliver superior performance. The outperformance of value as a style was uncovered in research conducted by Fama and French.

Let's again look at a risk return scatter plot of asset manager returns – graph 5. Over the period shown we wouldn't select Manager B on the numbers alone, as his return has been below average and it appears there are a variety of alternative managers we could select instead that would have delivered better performance.

However, if we're constructing a portfolio that requires a manager with a specific investment style then we have to compare like with like. If we want a value manager we should select a manager from within the value universe – and the same would apply for all other styles as well.

Graph 6 looks at Manager B over the same time period: but in this case within a universe in which the manager is compared with other products that are managed in a similar style. Now the picture is significantly altered and Manager B would be a natural pick on those grounds alone.

Lies, damn lies and statistics

The existence of any preconceptions also plays a role in decisions on manager selection. Various statistics can be used in the analysis of manager returns and if an objective analysis is to be conducted on the numbers alone then it needs to be done without any predeterminations that could lead to data mining. Data mining involves sifting through large amounts of data to find data that justifies any conclusions that may have been drawn before the analysis was even conducted.

The existence of any preconceptions also plays a role in decisions on manager selection.

With a large data set and a large range of statistics to choose from it's possible to match the most suitable statistics to a manager who is preferred rather than selecting a manager on a predefined set of criteria.

If we consider the Treynor and Sharpe ratios alone we see both of those measures are a risk-adjusted performance measure but they can give different results. For example, the manager who has the best Sharpe ratio might not have the best Treynor measure. Whereas the Sharpe ratio considers total risk the Treynor measure only con- »

«

siders systematic (or market) risk.

Even when we just consider absolute performance of various asset managers those numbers can be manipulated through a choice of comparing returns either on a gross (before fees) basis or on a net (after fees) basis. A manager might deliver great performance and be the top performer but if his fees are exorbitant compared to his peer group then the net of fees picture could be totally different.

Conclusion

Performance numbers have value, but the key is to understand how those numbers inform the bigger picture. This picture is one that needs to be developed in conjunction with the story that lies behind the numbers. The qualitative factors play a vital role in that bigger picture. Who are the people making the investment decisions, what is the investment philosophy and what it the investment process and how is it implemented? An analysis of the qualitative factors that power the product should be the key to performance, because the transfer of those factors ultimately drives performance.

Analysing performance numbers is inherently difficult as you're attempting to use the past to predict the future. There are also numerous pitfalls along the way that should be acknowledged and avoided if possible.

The numbers alone don't tell the whole truth. They need to be combined with an analysis of the qualitative factors mentioned above; but additionally there should be well-defined criteria for analysing the numbers, specified in advance and rigorously applied. As shown, the interpretation of the numbers involved is just as important as the actual figures.

As fund trustees consider various manager performance numbers it's important to keep in mind the long-term nature of the fund and its mandate. It's worth taking the time to outline and define the criteria for performance excellence from the fund's unique perspective and use those criteria as an anchoring point for performance analysis. Use the numbers – but use them wisely. ■

Setting the record straight on absolute return

ROLAND ROUSSEAU
Independent researcher

ROUSSEAU *spent 14 years heading quantitative and investment strategy research at Deutsche Bank and, for the past two years, has been assisting CIOs of the largest pension funds, multi-managers, hedge funds and active funds in Europe, Britain, Scandinavia and Australia on matters concerning the implementation of smart portfolio construction and the design of new investment processes and better benchmarking. He presented to 10 000 plus professional investment managers during 2008 in over 14 countries and was invited to present at more than 10 international conferences. Rousseau has also written several international reports on portfolio construction and the future of the investment industry. He left Deutsche Bank earlier this year and now works in partnership with Professor Paul van Rensburg in designing intelligent indices for smarter institutional core portfolios.*

WHILE THE NOTION of absolute return (AR) investing is a noble and important way to control risk, we need to define the concept very specifically. AR typically refers to any type of investment approach that mandates the fund manager to take both long and short positions in an asset class (for example, equities) in order to reduce overall portfolio risk and potentially provide positive returns in both rising and falling markets.

Although there's no guarantee of a positive absolute return the ability to go long and short theoretically provides significant risk benefits to investors – that being the noble and exciting appeal of AR funds. Proponents of AR will correctly point out that long-only investing prevents active managers from utilising negative forecasts and profiting from those views through short selling.

A significant body of research now shows how constrained long-only investing is. All too often the way investment mandates are formulated also restrict the value add potential. Given those constraints the ability to more independently and flexibly invest with, in particular, dynamic short positions is enough reason to welcome new investment frameworks, such as AR.

Yet for reasons that are quite unfathomable, proponents of AR funds promote the notion that AR managers don't need benchmarks. Not having a benchmark is like having a society without laws. Major problems start occurring when you claim you don't need a benchmark.

Make up your mind: absolute versus relative returns

A benchmark is critical to (a) define the client's risk tolerance and return objectives and (b) be able to measure the value added by the manager. To further clarify that we need to formulate an appropriate framework for defining what a fair benchmark is for AR.

We view the adoption of cash returns or CPI + x% as "benchmarks" for AR funds as one of the biggest setbacks in the history of investing. That unfortunate development is also the root cause of a range of problems and misinterpretations associated with hedge funds and long/short investing.

By accepting cash or CPI + x% as benchmarks we've lost our bearings, because they don't reflect the true level of portfolio risk. Comparing an AR fund with volatility of 10%/year versus a cash benchmark with 0% volatility is like comparing Michael Schumacher with Lance Armstrong! Cash returns or CPI + x% can never act as benchmarks at all: those are merely return targets or hurdle rates, nothing more!

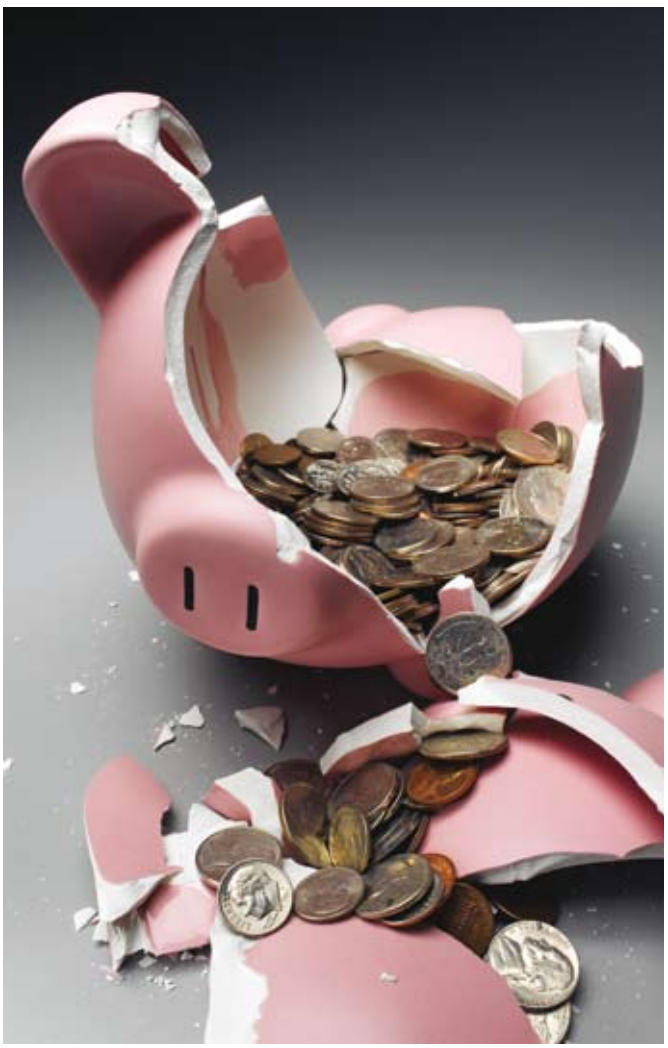
14 »

13 «

Thomas Schneeweis accurately summarises the problem in his seminal 1999 paper *Alpha, Alpha, Who's got Alpha?* "It is not appropriate to say that you have a positive alpha (net risk-adjusted return) simply because the return is greater than the risk-free rate, unless your portfolio is risk-free. Similarly, comparing the return of your fund to the S&P500 or any other benchmark is inappropriate unless your strategy responds only to the same return drivers that drive the S&P500 or the cited benchmark." – *Journal of Alternative Investments* , 1999

We need to match risks, not returns

So how do you benchmark an AR fund correctly? Well, the same way you benchmark any active fund. You need to identify with your client all the significant risk factors or betas upfront (eg, small caps, value, emerging markets, credit risk, etc) – also known as the risk budget. The active return generated by the fund manager will then be the residual return that remains after accounting for all those pre-defined beta returns. We assume, for lack of any other explanation, that residual return is skill (or alpha).



Some smart AR managers will correctly point out here their fund is market- or beta-neutral and therefore they aren't exposed to market risk. That is, of course, correct: but they must be exposed to other risks or betas because their fund has volatility. It's a misnomer to assume market neutral funds have no beta risks because they have a beta of zero to some arbitrary equity market index. For example, see Dopfel, F (2005).

All that market neutral really means is that the correlation to the market is low. It doesn't necessarily mean volatility is low or zero. The source of that volatility therefore needs to be explained. Managers may in some instances take the blame for lack of skill when actually it's unwanted risk in their process, despite them having excellent skills.

Precisely because there's some level of beta risk – other than market index risk – in AR funds and that this risk is most often unrelated to the skill of the active manager, explains why a non-volatile cash return or CPI + x% is such a poor "benchmark" for an AR fund. In particular, a cash benchmark is incapable of separating the manager's active risk from different market beta risks (credit risk, emerging markets, inflation, small caps, etc).

Barton Waring and Lawrence Siegel explain in their erudite paper *The Myth of the Absolute Return Investor* in the *Financial Analysts Journal* (CFA Publications, March/April 2006): "Sometimes, hedge funds are characterised as having a benchmark of cash. One certainly can imagine a hedge fund for which this is appropriate: The normal portfolio for a hedge fund with no net expected average exposures to any styles, markets or other beta factors could be correctly understood as a zero-beta portfolio and its benchmark would be cash.

"In fact, when data from actual hedge funds are evaluated most funds show persistent net positive beta exposures over time. On average, the equity beta of long/short equity hedge funds ranges between 0,3 and 0,6 and they also have some beta exposure to bonds. In effect, most hedge funds normally put fewer dollars into short positions than into long positions, and their net betas do not completely cancel and go to zero."

Every fund's true benchmark has to be a portfolio with the same generic risk drivers and risk profile of the active fund. If you outperform that "shadow portfolio" that has the same risk as your active fund then you have skill or alpha.

Below is a more colourful interpretation from Waring and Siegel, again about the fact all investors have to have a benchmark and therefore we are all relative return investors and that AR as a classification is very ill defined.

"Thus, all managers who make the effort to add special value to a portfolio, whether they want to admit it or not, must do the same thing: beat a benchmark (a normal portfolio or mix of betas). The challenge is the same for a hedge fund, a long-only manager, a market-neutral long–short manager, a traditional active manager, a quantitative active manager – whatever type of manager.

Even Warren Buffett has a benchmark, a cost of capital or blend of beta payoffs that he must beat if he wants Berkshire Hathaway to go up more than the rest of the market. So the »

« most famous AR investor in the world is, in fact, a relative-return investor – as are all AR investors. Relative return investing may seem timid and constrained to those who do not understand the difference between beta and alpha but it is the only means through which real value can be added to portfolios. Relative return investing is the only kind of value-added investing that really exists. Get over it!"

'Absolute alpha': snake oil?

Now we've addressed how AR funds should be benchmarked and how not to, we'd like to clarify a cottage industry burgeoning within the AR universe. There's a curious sub-category of the AR universe that has the penchant and the nerve to call itself "Absolute alpha". Here are some of their registered names: "Absolute Alpha Fund", "European Alpha Absolute Fund", "Currency Absolute Alpha", "Diversified Absolute Alpha", "UK Absolute Alpha Fund," etc.

Though we haven't found any such funds by name in SA yet, AR managers also often talk about their alpha here. As mentioned earlier, the concept and philosophy of combining long and short positions are a gallant one but care must be taken in appropriately defining the fund benchmark.

Specifically, to claim you can deliver "absolute return" as well as "alpha" is simultaneously indicative of a complete lack of understanding of the basic tenets of investing, prudent benchmarking and sane investment practice. That's marketing black magic at its worst.

"Absolute alpha" is a complete absurdity. Alpha and beta have to be, by definition, relative return concepts, where alpha is the residual excess return above an appropriate risk-adjusted benchmark and beta is some representation of a benchmark. So how can alpha simultaneously be an absolute and a relative return?

Schneeweis rather snidely declares there are two types of alpha: a relative performance alpha versus a marketing alpha. The latter being conjured up to sell a product rather than being based on sound theory.

"Managers must know which path they wish to take; that is, alpha as a marketing device or as a measure of comparable risk/return performance. If managers wish to define alpha to fit their own marketing purpose and use alpha to sell a product it is understandable. However, one should never mistake a 'marketing' alpha from a relative-performance alpha.

"If the manager can choose asset positions with a higher return (but the same *ex ante* risk) to some comparable naive investment position then that person can be said to achieve a positive alpha. Managers may say that investors never care about relative return but only absolute return. But performance alpha is all about properly measured relative return."

The challenge therefore goes out to anybody who can prove – theoretically, empirically or otherwise – how you can generate an "absolute alpha". Almost all absolute managers claim alpha but the only alpha that exists is a relative one.

So the next time an AR manager tries to sell a pension fund "alpha", the pension fund can be confident the fund manager is selling a marketing alpha, not a performance alpha. AR managers publicly denounce all traditional benchmarks yet they claim, with a straight face, some form of alpha relative to a benchmark. Indeed, "absolute return" might exists and "alpha" also exists but they can never coexist!

The clouds are gathering

Investors and the industry will ultimately pronounce on how valuable long/short AR investing is conceptually. There's good logic and reason to support the view that every active manager will end up as a long/short manager one day. But the regulator will have the last word on how AR funds benchmark and market themselves! GIPS will have to step in and create new rules governing the "fair representation" of those funds.

Standard & Poor's press release, London 8 July 2008: "S&P Fund Services warns investors against seeking absolute return 'magic bullet'. S&P said no two absolute return funds were the same and that the risk of widespread mis-buying among investors is high." – Jeff Prestridge.

London *Daily Telegraph* 9 September 2008: "FSA eyes Absolute and Target return funds. FSA spokesperson: We want to better understand what consideration is given at the product development phase to risk management and treating customers fairly; to learn more about the marketing distribution of ARFs; and to assess the role of ARFs within the asset management industry as a whole."

Summary

While the philosophy of AR is a noble one and is most valuably expressed in a market-neutral way, most AR funds are far from market – let alone risk-neutral and therefore require careful benchmarking and risk management. Cash and CPI + x% benchmarks just don't cut it.

In general, the benefits to go long and short are being able to generate returns in rising and falling markets and to manage total portfolio risk more effectively than some constrained long-only mandates. That much we can salvage from the AR philosophy.

So by definition every active investor (both long-only and long-short), are relative return investors, not absolute. Absolute return – like the phrase "hedge fund" – is a complete misnomer, probably for marketing reasons, even if the principles of being able to go long and short are incredibly valuable. ■

EVAN GILBERT
University of Stellenbosch

GILBERT *joined the University of Stellenbosch's economics department as Associate Professor (Finance) in July 2008 after six years at the University of Cape Town's Graduate School of Business. He completed his PhD at the University of Cambridge and also holds a BCom in accounting, economics and law from Rhodes University, a BCom (Hons) in economics from UCT and an MCom in economics from Wits University.*

DAVE STRUGNELL
School of Management Studies, UCT

STRUGNELL *is a lecturer in actuarial science and quantitative finance at the School of Management Studies, UCT. Before that he spent some time as a pricing and product development actuary at Momentum and as an actuarial consultant to Aon Consulting in Britain and Alexander Forbes in Cape Town. He holds a BA (Economics) degree (Hons) from Unisa and is a Certified Financial Planner and fellow of the Actuarial Society of SA.*

Does survivorship bias matter?

MOST INVESTMENT strategies are either based on relationships identified from the analysis of data series containing historical share returns (and other explanatory factors) or "back tested" against those series in order to establish their empirical validity. However, one of the most common challenges facing investors and financial researchers in South Africa is the lack of a clean and comprehensive data set of price and accounting data for listed firms. Though there may be some historical data available for currently listed companies, the lack of availability of historical data for previously listed shares is always a challenge.

It's well established in financial research that ignoring delisted companies when conducting research based on historical data leads to what's commonly called "survivorship bias". That bias results from the use of a data set that consists of the survivors over a period not the full set of companies listed over that period. As the characteristics of the survivors are likely to differ systematically from those who have delisted the results of such a study will be biased. Given that collecting data for delisted companies is a time-consuming and expensive process, obvious questions are: Does it really matter and should investors, researchers and asset managers attempt to correct this problem?

A review of international evidence suggests survivorship bias does matter: in other words, if you use only currently listed shares in your analysis you'll get different results to those coming from the use of a more complete sample of investments. This article presents the results of a study that tested for the importance of survivorship bias in the South African case by testing for the existence of mean reversion of share returns on the JSE when adjusted for liquidity constraints. Extensive efforts were made to include all delisted shares in the study. In this article we quantify the impact of survivorship bias by comparing the results using the complete data set against those of an equivalent study based on a data set of currently listed shares only.

A study by Cubbins, Eidne, Firer and Gilbert (2006)[1] was the first to comprehensively establish the presence of mean reversion of share returns in SA. Their "winners" represented firms with high earnings multiples and their "losers" companies with low p:es. Bailey and Gilbert (2007)[2] extended those results by applying liquidity caps to "high p:e" and "low p:e" portfolios in an attempt to evaluate the economic reality of the abnormal returns seemingly offered by the presence of mean reversion.

Ignoring delisted companies when conducting research based on historical data leads to what's commonly called "survivorship bias".

That study tested for effects of liquidity constraints on the presence of mean reversion in multiple portfolios by applying liquidity caps. Depending on the value of a portfolio, a share would only be considered for inclusion if its average monthly traded volume was sufficiently large. The authors concluded that, although dampened, mean reversion persists after application of liquidity constraints.

In this article we apply the same methodology to two separate universes of shares: those listed in September 2007 and those listed at any point from 31 October 1984 – a 23-year period[3].

Historical data for shares traded on the JSE at each month end was obtained from I-Net Bridge[4]. Month-end closing price, earnings yield (from which a p:e multiple was derived) and dividend yield data were collected for all shares listed on the all-share index (Alsi) on the JSE for the period 31 October 1984 to 31 September 2007. A list of delisted shares was obtained from I-Net Bridge[5] and all the data for those shares included in the dataset for this period. In total, 1 631 shares were included in the analysis, of which 841 had either been delisted or were removed due to some other type of corporate action.

The data presented in graph 1 highlights the existence and size of the difference in the two groups of shares. The dark shaded area represents the shares currently listed (the "current" list) and the light shaded area indicates all the shares listed (the "complete" list). The area between the two parts represents the shares that would have been excluded from the analysis if only the currently listed shares were included in the analysis. The relative variation of the two lists ranged from 0% (in the final month, by definition) to 80% (in late 1992).

The existence of survivorship bias in this study can be seen clearly in graph 2. That figure presents the mean return for the low and high p:e portfolios for each of the liquidity caps. The mean reversion effect is present for both groups of shares. The dampening effect of liquidity caps on the size of the mean reversion effect previously »

« reported[6] is also confirmed here, indicating liquidity constraints do, as expected, limit portfolio managers' attempts to outperform the market.

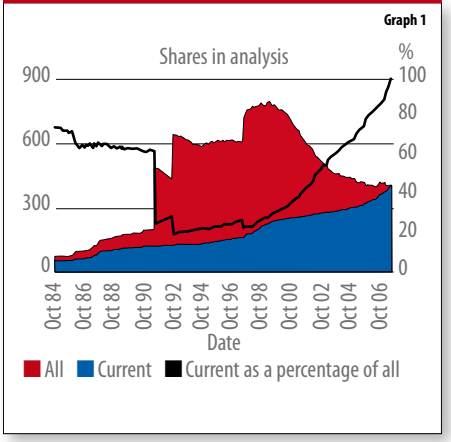
The presence, and importance, of survivor bias is demonstrated by the difference of returns between the two (complete and currently listed) share universes. The mean levels of returns from the share portfolios drawn from currently listed (for both high and low p:e shares) are significantly higher than those generated from the portfolios of the complete data set.

That's exactly the sort of bias that would be expected if the characteristics of the delisted firms were systematically different from those listed at each point in time. That highlights the need for managers and researchers to take the survivorship bias problem seriously – you'll get incorrect answers if you don't.

However, the results of this study don't challenge the conclusions that mean reversion of share returns exists on the JSE. In other words, in this case the same overall conclusion would have been reached even if a non-survivorship bias corrected data set had been used. That suggests mean reversion of returns is a robust phenomenon, as it applies to both groups of shares examined. However, the presence of survivorship bias would have led to incorrect conclusions about the size (ie, the economic importance) of that effect. 18 »

NUMBER OF LISTED AND DELISTED FIRMS INCLUDED IN THE ANALYSIS

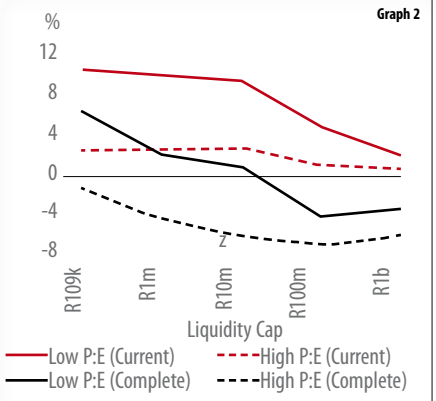
Graph 1



The presence, and importance, of survivor bias is demonstrated by the difference of returns between the two share universes.

IMPACT OF LIQUIDITY CAPS ON THE GEOMETRIC MEAN EXCESS RETURNS OF HIGH AND LOW P:E PORTFOLIOS

Graph 2



References

1. See Cubbins, E., M. Eidne, C. Firer and E. Gilbert "Mean reversion on the JSE Securities Exchange", Investment Analysts Journal, No. 63, 2006: 39-47.
2. See Bailey, G. and E. Gilbert "Liquidity and Mean Reversion on the JSE", Investment Analysts Journal, No. 66, 2007: 19-29.
3. We excluded preference shares ('P' series) from both universes of shares, because they have a different dividend risk profile.
4. While I-Net Bridge was the most complete and accurate data source that we were able to use, we still encountered significant data incompleteness and quality issues. The presence of the discontinuous jumps in the number of total shares in September 1991, November 1992 and September 1997 as highlighted in Figure 1 suggests that the list of 'dead' shares provided by I-Net Bridge is still not completely accurate. The reasons for these errors have not been fully resolved and one of the conclusions of the exercise is that we need to consolidate and clean this historical database through comparisons with other sources (eg, McGregor BFA Net, Datastream or Reuters).
5. We have used the old code list from I-Net Bridge to identify the delisted shares. While this is the most complete and accurate list of 'dead' shares that we were able to obtain, the jumps in the number of firms covered by our analysis (see Figure 1) suggest that we still do not have a comprehensive list.
6. See Bailey and Gilbert (2007) referenced above. ■

Managers and researchers have to take the survivorship bias problem seriously.

Modelling financial time series

DIMITRIS MELAS
MSCI Barra

MELAS *is executive director and head of EMEA equity and applied research at MSCI Barra. Melas and his team are responsible for conducting research to support, develop and promote the firm's equity indices and portfolio analytic products. Prior to joining MSCI Barra in 2006, Melas spent eight years with HSBC Asset Management as head of both research and quantitative strategies. He holds an MSc in electrical engineering and an MBA in finance and has published research in the areas of asset allocation and portfolio optimisation. He's also a CFA charter-holder.*

TRADITIONAL MODELS in finance rely heavily on the use of the normal (Gaussian) distribution. For example, value at risk (VaR) measures are often calculated under the assumption the underlying return series are normally distributed. Implied volatilities are calculated from option prices based on geometric Brownian motion, which is another manifestation of the normal distribution.

The implication of normality is that abrupt changes in asset prices have a very low probability. Graph 1 shows a price series of a large pharmaceutical company and a simulated series that assumes normality (using the same mean and standard deviation). Could you tell by looking at the chart which one is which?

While the two price series may look similar, the answer is clearly revealed when we plot the time series of actual and simulated returns in graph 2. Though both series have the same variance, the simulated Brownian motion series achieves it by generating returns that always have roughly the same amplitude. The actual return series of Merck are more widely dispersed in their amplitude and manifest a few large peaks corresponding to jumps in the price.

The largest price drop at end-September 2004 corresponds to the period when the company was forced to withdraw its blockbuster arthritis drug Vioxx from the market about concerns over its side effects.

The comparison of the simulated Gaussian return series and the empirical series illustrates the distribution of price changes often has fat tails relative to the normal distribution. This means

20 »

OLEG RUBAN
MSCI Barra

RUBAN *is a senior associate in applied research at MSCI Barra, where he works on portfolio management and risk-related research for asset owners and investment managers. Ruban started his professional career as a graduate trainee in derivative sales at the Royal Bank of Scotland and later worked as an emerging market economist and a quantitative strategist at Dresdner Kleinwort in London. Ruban holds a degree in economics and management from Oxford University and MSc degrees in economics and finance from Warwick University and Manchester Business School respectively. He's currently working towards his PhD in finance at Manchester Business School, where his topic is the pricing of financial instruments in incomplete markets.*

large negative and positive returns have a higher empirical probability of occurring than the normal model would postulate. This same phenomenon is observed at the level of factor and index returns, as well as for individual securities.

Graph 3 shows the estimate of the distribution of the daily returns to the momentum factor in the Barra global equity model (GEM 2) over the course of 2007 and compares it to a normal distribution with the same mean and variance. We observe that while the core of the empirical distribution is more condensed both tails are fatter.

In particular, we can see large negative daily returns occur far more often than the normal distribution suggests. The largest negative daily return to the momentum factor occurred during the August quant crisis: the daily factor return of –0,7% corresponds to a Z-score of –5,5 (or a probability of occurring approximately once in every 200 000 years under the normal distribution).

Large losses may occur due to a general rise in volatility; or they can occur as isolated events (jumps); or as a combination of the two. In general, financial time series are characterised by both changing volatility dynamics and a non-trivial probability of returns of several standard deviations in magnitude.

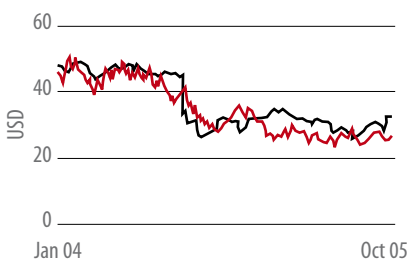
Graph 4 illustrates that, using the example of losses (returns with the sign changed, so negative returns take positive values in the chart) in the MSCI world index. Graphically, we can think of volatility as a thickness of the cloud around zero and isolated extreme gains and losses as the points outside that cloud.

The crash of 1987 was characterised mainly by a few extreme events. Then, through the early Nineties, volatility declined – the cloud shrank. The events surrounding the Asian and Russian crises of 1997-1998, as well as the technology bubble, can be seen mostly as an increase in volatility with few true extremes. Between 2003 and 2007 volatility declined again, with almost no extreme returns. The latest volatile episode is clearly a mixture of a substantial rise in the general level of volatility – the cloud widens aggressively – as well as some well-pronounced extremes.

The discussion above highlights the fact investors can't rely on a single risk measure. If returns followed a normal distribution then volatility would be a complete measure of risk. However, we see with examples of asset, factor and index-level returns that the assumption of normality doesn't capture the empirical properties of returns – so volatility alone doesn't capture all aspects of portfolio risk. The number of empirically observed extreme events far outnumbers the number of events forecast by the normal distribution.

ACTUAL AND SIMULATED SHARE PRICE SERIES

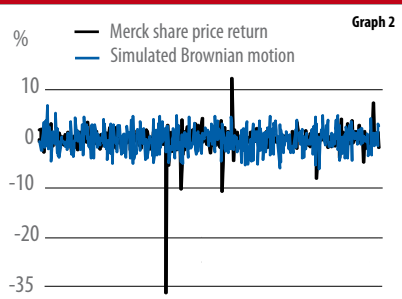
Graph 1



Source: MSCI Barra

ACTUAL AND SIMULATED RETURN SERIES

Graph 2



Source: MSCI Barra

Extreme value theory and the estimation of tail risk

Non-Gaussian distributions aren't unique to financial markets. Researchers in diverse fields – such as hydrology and structural engineering – have also modelled non-Gaussian distributions using extreme value theory, which describes the probability of extreme events. A direct approach to estimating the tail of the distribution is a semi-parametric procedure known as "peaks over thresholds".

This method takes the core of the distribution from historical data and fits the tails parametrically: illustrated in graph 5, taken from Goldberg, Miller and Weinstein (2008).

Under mild assumptions, given independent identically distributed data, the distribution of events beyond a certain threshold tends to follow a generalised Pareto distribution, as the threshold becomes large. The formula for the generalised Pareto distribution is:

$$G_{\alpha,\beta}(x) = \begin{cases} 1-\left(1+\dfrac{x}{\alpha\beta}\right)^{-\alpha} & \text{if } 1/\alpha \neq 0, \\ 1-e^{-x/\beta} & \text{if } 1/\alpha = 0, \end{cases}$$

where

$$x \in \begin{cases} [0,\infty) & \text{if } 1/\alpha \geq 0, \\ [0,-\alpha\beta) & \text{if } 1/\alpha < 0. \end{cases}$$

A Pareto distribution is specified by a scale parameter $\beta > 0$ that adjusts the scale of the excesses, and a tail index α that can be positive, negative or infinite but not zero. The value of $\alpha = \infty$, which is a limiting case of the distribution for a large, positive α, corresponds to a diverse collection of initial distributions, including the normal.

Positive α indicates the initial distribution follows a power law, while negative α corresponds to an initial distribution with a finite upper limit. As a consequence, this approach can be used to estimate both heavy- and light-tailed distributions. This is illustrated in »

« graph 6, where the dotted line corresponds to $\alpha \to \infty$.

Accounting for extremes: a practical example

Extreme value theory is a broader statistical theory than that specified by a normal distribution, while still covering normal as a special case. Let's consider a practical example, further described in Goldberg, *et al* (2008), of how extreme value theory can provide a better reflection of the tail risk.

We'll compare the relative robustness of the traditional VaR and Barra extreme VaR (xVaR) for a variety of portfolios composed of US equities. Barra extreme risk offers a robust method for estimating tail risk by relying on a long history of factor returns from Barra equity models. Daily returns are taken from December 1996 to October 2007, a period that covers major events, including the Asian crisis, LTCM, the "Tech Bubble", 11 September and the Quant meltdown in August 2007.

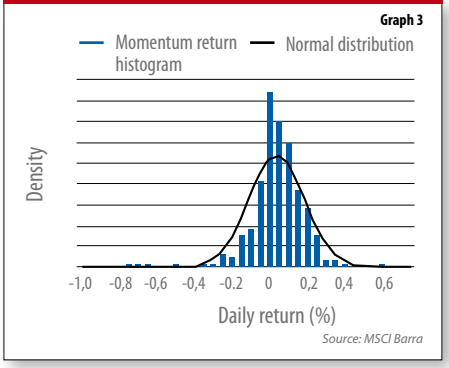
VaR figures are generated using two methods: the traditional way, in which returns are assumed to be normally distributed and exponentially weighted across time, as well as using the Barra extreme risk methodology. We choose a confidence level of 99% and a time horizon of one day, which implies the resultant VaR forecasts should represent the maximum daily loss that would be incurred with 99% probability.

In order to compare the two measures over a variety of different portfolios, a collection

22 »

DISTRIBUTION OF DAILY MOMENTUM FACTOR RETURNS IN GEM 2 VS NORMAL DISTRIBUTION

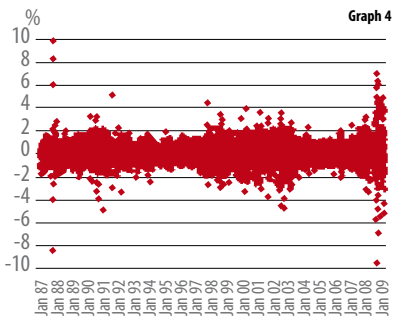
Graph 3



Source: MSCI Barra

ONE-DAY LOSSES IN MSCI WORLD INDEX

Graph 4



Source: MSCI Barra

21 «

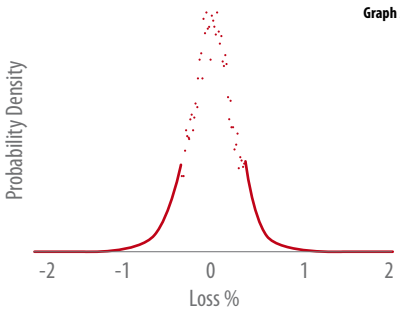
of 74 factor-tilted portfolios are created. It's important to note the VaR numbers generated here are forecast values.

Graph 7 shows a histogram of portfolios by percentage of VaR violations. The horizontal axis shows the percentage of days in which actual losses are greater than the VaR, while the vertical axis displays the number of portfolios (out of the 74 in our sample) within each interval.

Ideally, all portfolios should be to the left of the broken line. This is true for the majority of the portfolios when using xVaR but doesn't hold in the case of the traditional VaR. While around 75% of the portfolios meet that criterion under xVaR, only 3% do so in the case of the traditional VaR. This evidence demonstrates the relative robustness of Barra extreme risk methodology in determining tail risk.

MODELLING LOSS INNOVATION TO S&P 500 (1980 - 2005)

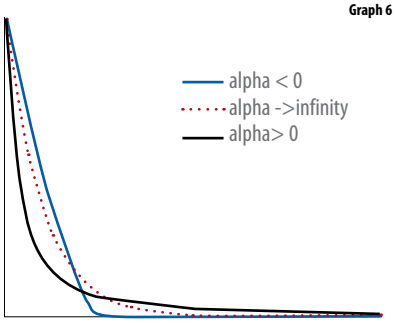
Graph 5



Source: MSCI Barra

THE PROBABILITY DENSITY FUNCTION OF THE GENERALISED PARETO DISTRIBUTION FOR VARIOUS VALUES OF ALPHA

Graph 6

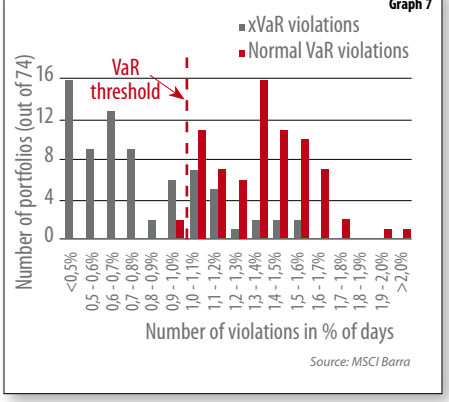


Source: MSCI Barra

> **Extreme value theory can help to more accurately model the tails of the return distribution.**

HISTOGRAM OF PORTFOLIOS BY PERCENTAGE OF VAR VIOLATIONS

Graph 7



Source: MSCI Barra

Conclusion

If returns followed a normal distribution, then volatility would be a complete measure of risk. In this paper we used examples of asset, factor and index returns, where the assumption of normality doesn't capture the empirical properties of returns and volatility alone isn't a reliable measure of portfolio risk.

We also outlined how extreme value theory can help to more accurately model the tails of the return distribution. Finally, we illustrate how using extreme value theory can improve estimates of VaR for a collection of factor-tilted portfolios using data between 1996 and 2007.

This is the second in a series of three bulletins outlining the use of extreme value theory in risk management and portfolio construction. The first bullet in Managing Risk Beyond the Normal Distribution (May 2009,) and the third bulletin, Shortfall in Portfolio Construction, (June 2009) are available from www.mscibarra.com.

Reference

L Goldberg, G Miller and J Weinstein (2008) *Beyond Value at Risk: Forecasting Portfolio Loss at Multiple Horizons, Journal of Investment Management*; 6(2) (pp: 73-98). ■