Ranges and Rebalancing

Dr Frederic Methlow, *CAIA*
Al Futtaim Group

Abdulaziz Alnuaimi, *CAIA*
Harvard Business School

Institutional money managers develop asset allocation strategies which should represent their optimal risk tolerance. This asset allocation is expressed as a composite benchmark of a variety of underlying asset classes which is in usually rebalanced monthly. Monthly rebalancing in this regards means that the monthly returns are weighted each month by the initial asset allocation weights (neutral weights). The resulting time-series is then the basis of any return and risk calculation.

The literature of 'smart beta' or 'alternative beta' discusses a variety of rebalancing mechanism which are superior of capital weighted indices – mostly equity indices – and periodic rebalancing – mostly fixed income indices. We will abstain from this discussion but acknowledge that periodic rebalancing of asset allocation strategies has its advantages and disadvantages.

The advantages are

- Ease of calculation
- Lack of path-dependency which is often the case with more elaborate mechanism
- Ease of entry for new mandates due to frequent recalibration of asset weights

The disadvantage is

- Calendar based re-balancing does not take into account any underlying capital market characteristics such as valuations et cet. That makes this rebalancing mechanism 'inefficient' from a capital market perspective.

Asset class rebalancing aims to stay close the relative neutral weights of an asset allocation, which are the calculation basis of monthly rebalanced indices. The reason for the deviation is that asset classes perform differently over time. It is therefore interesting to see how a monthly rebalanced portfolio behaves in contrast to a portfolio where no rebalancing takes place (buy & hold portfolio).

Rebalancing versus 'buy and hold'

The starting point is the construction of an equally weighted portfolio of 4 asset classes, of which 2 are global equity indices (MSCI developed and MSCI emerging) and 2 are global fixed income indices (High Yield & Government Bonds). All 4 indices are total return indices which are unhedged. 15 years of monthly data are being used, starting in 2001. We are aware that the equal weights applied are not the result of an optimisation exercise. We address this point later in the analysis and concentrate for now on the aspect of periodic rebalancing versus no re-balancing ('buy & hold').

The chosen constituents of this asset allocation have the following risk return profiles over the 15 years horizon:

2001 - 2016	MSCI World Developed	MSCI World Emerging	Barclays Global High Yield	Barclays Global Government
Ann Return	4.15%	7.87%	8.34%	4.33%
Ann Volatility	15.54%	22.32%	10.15%	6.78%

Exhibit 1

We now construct 2 time series: one where the initial weights are applied every month and one where no adjustment to the initial weight is being applied. For both time series we calculate the annualised return and volatility. The result shows that the difference between the 2 portfolios is relatively small in terms of return but also in terms of volatility. Moreover, the return data do not take into account any rebalancing costs which would weigh

2001 - 2016	with monthly rebalancing	without monthly rebalancing
Ann Return	6.61%	6.43%
Ann Volatility	11.79%	12.44%

Exhibit 2

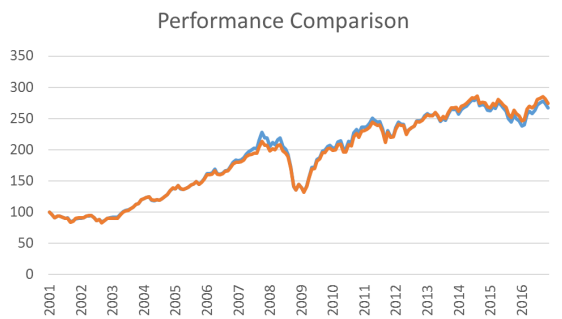

Exhibit 3

on the results of the monthly rebalancing portfolio.

Looking at the monthly return differences between the 2 portfolios one can easily see that the biggest differences occur in times of stress, like in the GFC of 2008. The tracking error

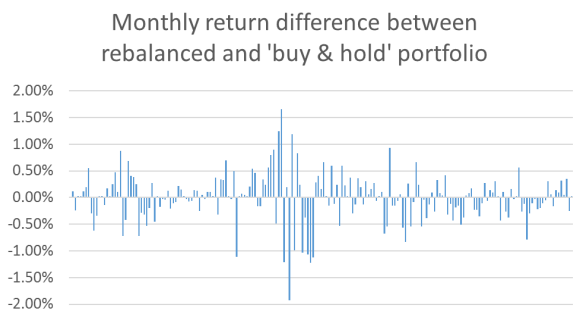

Exhibit 4

between the 2 portfolios is an annualised 1.5% over the last 15 years.

The fluctuations around the neutral asset class weights have been substantial. In the case of emerging markets equities it was 20% before the 2008 crisis hit, while development market equities deviated a maximum of 12.8% from its neutral weight.

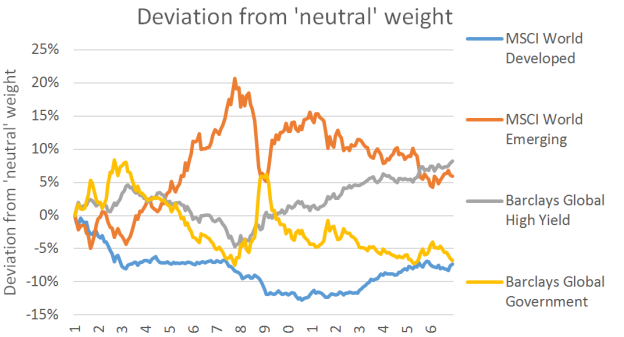

Exhibit 5

We have started this analysis with allocating an equal weight to each of the 4 asset classes for simplicity sake. In a next step we allocate randomly weights to these four asset classes and compare the annualised return and volatility of the monthly rebalanced one with the buy & hold strategy. We repeat this procedure 1000 times. With this step we want to avoid any bias in the analysis due to the allocation weights.

If we plot the results in terms of return on a scatter chart, we obtain the following results for two time periods, i.e. 2001 – 2016 and 2007 - 2009. Similar to the initial result where monthly rebalancing outperformed the 'buy & hold' strategy by a small margin, the performance difference between the 2 strategies over the 1000 iterations ranges between 0.1% to 0.4% on average.[1] As it can be seen from exhibit 6, the dispersion in terms of annualised return is also relatively contained for the entire period from 2001 – 2016 but three times less dispersed when looking at the time period between 2007 – 2009, the time of the GFC.

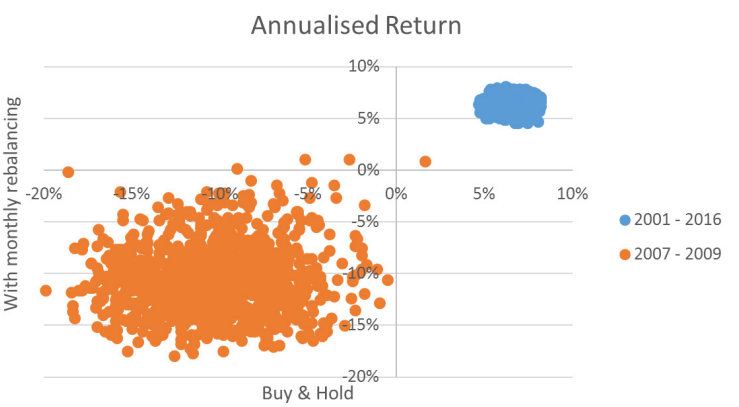

Exhibit 6

The picture is also in line with initial findings when comparing the annualised volatility between the 2 portfolios. The dispersion is first of all higher and the balanced portfolio displays between 30 and 50bp less annualised volatility on average over the 1000 iterations. The dispersion between the entire period 2001 – 2016 is slightly lower than the dispersion of the annualised volatility over the crisis period 2007 – 2009.

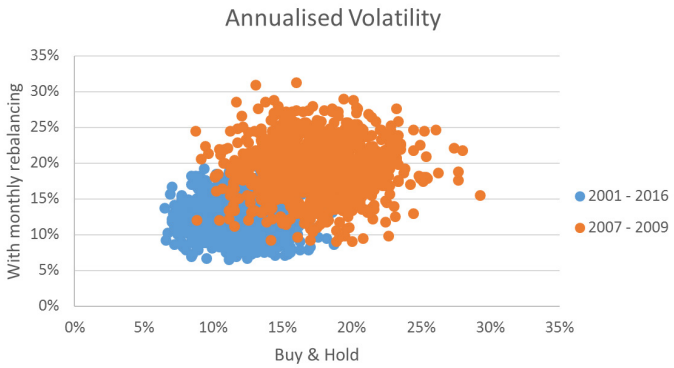

Exhibit 7

Does this imply that re-balancing does not matter? From Perold & Sharpe we know that 'buy & hold' pays off in times of trending markets, while in times of directionless markets, rebalancing makes more sense. In other words 'buy & hold' favours momentum, while rebalancing favours mean-reversion.[2] This would explain the results above that over a longer period where momentum and mean-reversion follow each other, the difference between 'buy & hold' and rebalancing converge. However, A Dayanandan and M Lam also showed in their analysis that the difference between 'buy& hold' and rebalancing is insignificant.[3] However one has to carefully distinguish between the merits of rebalancing and active portfolio management. Other studies are in favour of rebalancing and see value in certain times.[4] We can conclude that rebalancing is good for risk reduction but matter less for return enhancement. In this context one may argue that the lower risk budget could be used for increasing the return by adding leverage.

Why not 'buy & hold' then?

Investors have difficulties tolerating a 'buy & hold' approach as the underlying asset allocation of the portfolio changes substantially.

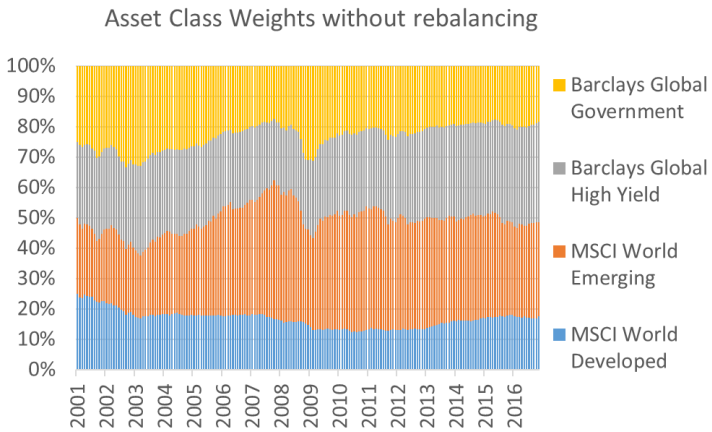

Exhibit 8

The problem is that each allocation point taken in isolation and used as a basis for a long-term allocation calculation would result in substantial differences vis-à-vis the neutral allocation. In order to illustrate that point we take 6 different allocation weights of the 'buy & hold' approach and use them as a basis for calculating risk and return numbers. The calculation is again based on a monthly rebalancing.

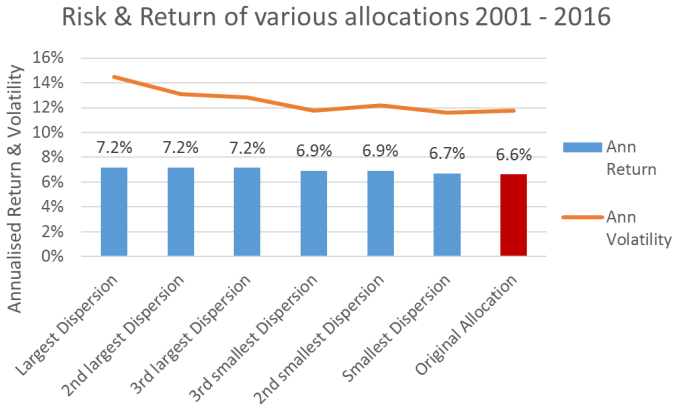

Exhibit 9

Range Settings

While we have discussed periodic rebalancing, a different approach would be to rebalance the portfolio if certain asset class thresholds are being met. Ranges are therefore set to trigger rebalancing. We leave aside the question whether it is preferred to re-establish the neutral weight if one of the ranges are met or if it is sufficient to get the allocation back within the ranges.

Range setting is often done by practitioners on a rule-of-thumb basis. We will argue that range setting is as much an optimisation exercise as it is the strategic asset allocation in itself. For this reason the first step is to identify the risk contribution of each asset class.

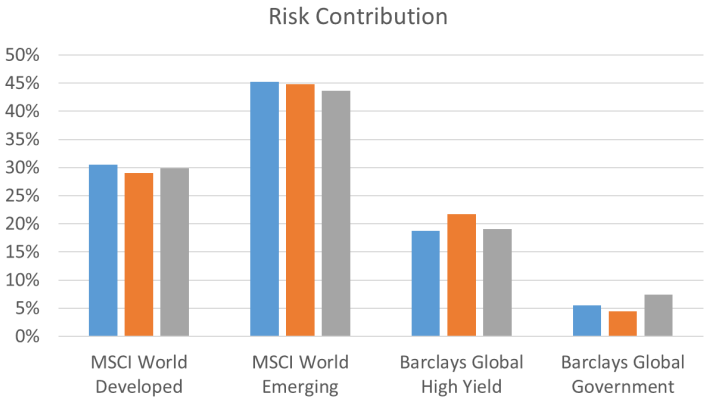

Exhibit 10

The risk contribution analysis compares a variety of time periods in order to see whether there are material differences. At this point it is obvious that emerging market equity dominate the risk contribution with a value close to 45%, while global government added only 5% to the overall risk of this portfolio. This result is consistent in each of the three time periods chosen. Again the calculation is based on time series which have been monthly rebalanced.

The setting of ranges around the 'neutral' weights is seen as pivotal when establishing a tracking error target. The tracking error provides then an indication of the information ratio, which is the outperformance of the portfolio versus the 'neutral' composite benchmark, divided by the tracking error. Assuming a manager wants to outperform the benchmark by 2% per annum,

a 4% tracking error would be sufficient if the manager assumes that he is able to achieve an information ratio of 0.5. This analysis assumes that only asset allocation decisions are the source of outperformance and no security selection within the various asset classes.

Therefore ranges which are too tight would jeopardise the ability of the manager to achieve his outperformance target. Opposite ranges which would be too wide, would allow the manager to divert too far from the 'neutral' weights without being necessarily being compensated by a sufficient outperformance. As a consequence the exercise of setting asset class ranges warrants full analytical attention as tracking error targets combined with asset class ranges often represent a crucial element of investment management agreements (IMA).

We are now going to offer a variety of optimisation techniques each of them designed to gauge the deviation from the 'neutral' weight of each asset class.

Maximum Information Ratio

The first optimisation maximises the information ratio while increasing the tracking error at each step by 25bp. The optimisation exercise should provide us with a sort of optimal portfolio indicating at which tracking error the highest information ratio can be achieved. We perform this optimisation again over three time periods, one covering the period from 2001 – 2016, the next one from 2007 – 2009 (March) and finally from 2009 – 2016. The reason is to see whether the 'optimal' tracking error is substantially differs among these three periods.

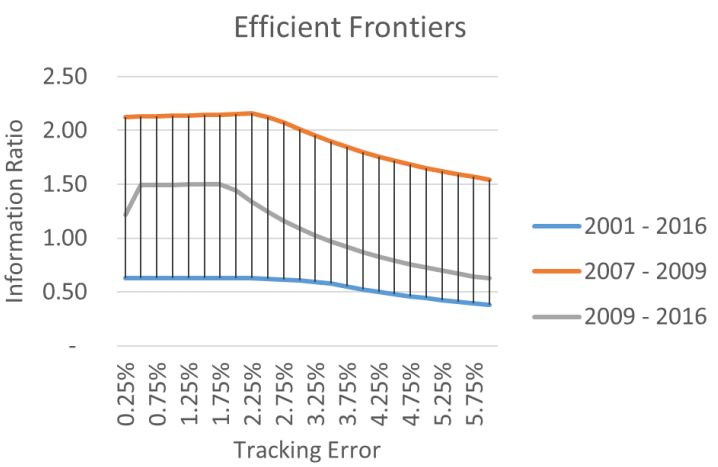

Exhibit 11

Over the longest time period, the information ratio starts to decline when the tracking error is around 3%. Based on a time period between 2007 and 2009, the point where the efficiency of the portfolio expressed in terms of information ratio declines already when the tracking error is around 2.5%. The 'optimal' tracking error is around 2% when looking at monthly data over the last 7 years. This very simple analysis vividly shows how sensitive any optimisation results are vis-à-vis changes in the underlying time periods.

Obviously the composition of the portfolio changes also dramatically with the choice of different time periods.

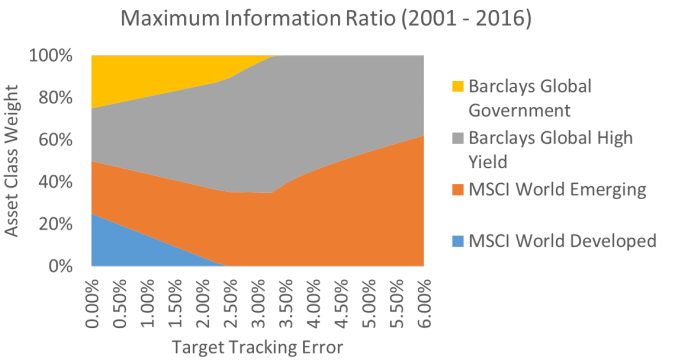

Exhibit 12

Looking at the asset weight development based on a calculation period of the last 15 years, the portfolio becomes a 2 asset class portfolio when the tracking error is higher than 3.5%, with emerging market equities and high yield bonds, both the asset classes with the highest returns over this period in almost 50/50 split when the tracking error reaches 6%.

For the next period (2007 – 2009 March) the allocation development is completely different. As this period is dominated by the events of the Great Financial Crisis (GFC), where risky assets underperformed, government bonds are becoming fast the most dominant asset class as it has performed by far best during these months. Due to its correlation behaviour emerging market equities maintain a 40% weight when the tracking error is higher than 2%.

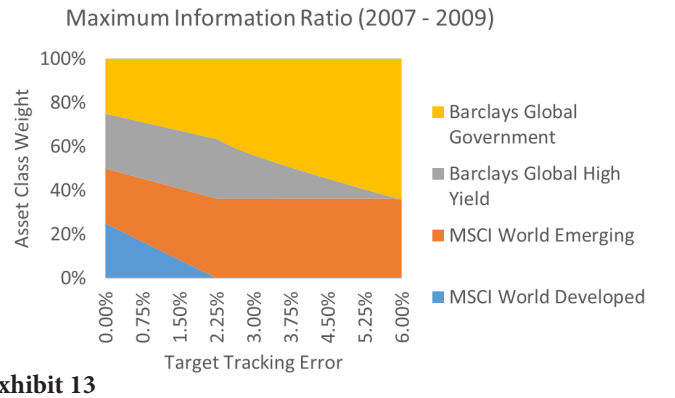

Exhibit 13

Finally when looking at the time period over the last 6 years, where global high yield and developed markets gained the most, these two asset classes are quickly dominating the portfolio, when the tracking error becomes greater than 2%.

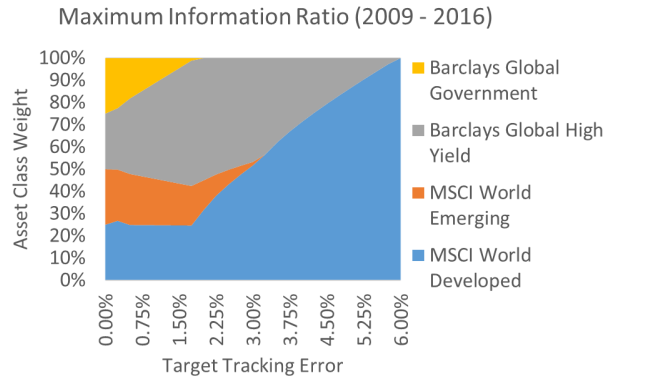

Exhibit 14

All three examples show that a tracking error in excess of 1.5% to 2% will result in asset weights which range from 0 to 100%, which is partly a result of the quadratic nature of the tracking error calculation. However, as also indicated this threshold is also more or less the frontier where the information ratio of any additional increase in tracking error starts to decline. In summary it means that the setting of tracking error in conjunction with the setting of ranges should be done prudently and being seen as an optimisation exercise.

Conclusion

We have shown that the fact that most strategic asset allocation calculations are based on an implicit rebalancing assumption in terms of periodic rebalancing – we have focussed on monthly rebalancing – is not capital market efficient. However the obvious practical advantages of this approach outweighs the deficiencies. Furthermore an entire industry around the 'smart beta' tries to identify smarter and more capital market efficient ways. We also showed that rebalancing is best suited for risk reduction purposes rather than return enhancements when a 'buy &n hold' is confronted with rebalanced portfolio.

We have further concluded that the setting of ranges around the neutral weight – which should represent the optimal allocation weight – should be seen as an optimisation exercise rather than just a rule-of-thumb practice. This makes intuitively sense as it is difficult to explain why so much effort goes into the definition of the neutral weight and so little in the definition of any deviation from it.

One way of approaching this optimisation exercise in a useful manner is to optimise the portfolio vis-à-vis predefined tracking errors. The most important conclusion out of our analysis is that there is an optimal tracking error level when the optimisation has to identify an optimal balance between tracking error and information ratio, which is the outperformance divided by the tracking error. Due to its quadratic nature the deviation from the neutral weights becomes exponentially higher with a higher degree of tracking error. We compare the optimisation result under various regimes in order to identify an 'optimal' region of tracking errors

Endnotes

1. We have run the iterations several times over a variety of time horizons.

2. A Perold and W Sharpe, Dynamic Strategies for Asset Allocation, Financial Analyst Journal (1995).

3. A Dayanandan and M Lam, Portfolio Rebalancing – hype or hope?, Journal of Business Inquiry (2015).

4. W Bernstein, The rebalancing bonus, theory & practice, Efficient Frontier (1996).

References

W. Bernstein, The Rebalancing Bonus: Theory & Practice, Efficient Frontier, (1996).

A. Dayanandan, M. Lam, Portfolio Rebalancing – Hype or Hope?, The Journal of Business Inquiry, (2015).

R. Grinold, R. Kahn, Active Portfolio Management, Irwin Library of Investment & Finance, second edition, (1999).

R. Lovell Jr., R. Arnott, Monitoring and Rebalancing the Portfolio, The First Quadrant Corporation, (1989).

A. Ineichen, Absolute Returns, Wiley Finance, (2003).

S. Masters, Rebalancing, Establishing a Consistent Framework, The Journal of Portfolio Management, (Spring 2003).

B. Scherer, Portfolio Construction & Risk Budgeting, Risk Books, second edition, (2004).

W. Sun, A. Fan, L. Chen, T. Schouwenaars and M. Albota, Optimal Rebalancing for Institutional Portfolios, The Journal of Portfolio Management, (Winter 2006).

Authors' Bios

Dr Frederic Methlow, *Ph.D., CAIA*

Frederic started his career as a Rating Analyst at Standard & Poor's in London. Later he became the Chief Investment Strategist for Commerz International Capital Management, the institutional asset manager arm of Commerzbank/ Germany. In 1996 he joined Credit Suisse, working as an asset allocation analyst. He built up the fund research department for Credit Suisse and became head of investment strategy for Credit Suisse Private Banking in 2002. In 2006 he moved to Geneva to become the Chief Investment Officer at the Swiss Social Security Fund. In 2012 he started as the Chief Investment Officer with Emirates Investment Authority in Abu Dhabi, the federal sovereign wealth fund of the UAE. In 2016 he became Chief Investment Director for Al Futtaim Group with the task to build up the investment office for the group. He holds a PhD in Economics from the Economics University in Vienna and is a CAIA charterholder.

Abdulaziz Alnuaimi, *CAIA*

Abdulaziz started his career at the UAE sovereign fund investing in alternative assets. He later moved to a private office for the government focused on high-tech investments. He is a CEO and GP of a government-affiliated venture fund in Abu Dhabi. He is also a director at a Boston-based satellite company, Analytical Space. Abdulaziz is an MBA student at Harvard Business School, a Chartered Alternative Investment Analyst, and a member of the Brookings Institute Society.