



Rebalancing of asset allocation portfolios

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Rebalancing – why is it important?

When following an asset allocation strategy, the aim is to achieve the best possible relationship between risk and return by investing in several different asset classes. The objective is to exploit the fact that – due to their divergent behaviour patterns – there is a low correlation between the returns produced by these different asset classes and therefore, by combining them selectively, it is possible either to get a higher return at a given risk level or to operate at a lower risk level to achieve a given return.

Consequently, this strategy allows investors to manage risk – which is why it is extremely important that investors do not stray too far from their optimal asset allocation. If that happens, their portfolio exposure will not match the investment horizon and risk profile that laid the foundation for the allocation in the first place. Finally, it is important to seek to stay on the ‘efficient frontier’, thereby taking full advantage of the correlations between the asset classes available.

By adopting a disciplined approach at all times (including when rebalancing) it is possible counter an unfortunate weakness of human nature: the inclination to invest more in an asset class performing well and less in an asset class that is underperforming. Asset allocation and rebalancing strategies facilitate automatic selling – and thereby the realisation of gains – in asset

classes that have risen in value. Conversely, you will invest more – and achieve a lower average buying price – in those asset classes that have performed poorly.

This mechanism helps to maximise the risk-adjusted return, but it is very important to remember that if you rebalance too often, the trading costs will eat into the excess return and thus potentially damage your long-term returns. Therefore – once the asset allocation strategy has been determined – the key question is: when and how often should a portfolio be rebalanced?

The answer is: rebalance when the expected benefit – in the form of a higher risk-adjusted return – is greater than the trading costs involved.

What are the rebalancing strategies available?

Rebalancing is a quite complex matter which has recently been the subject of many academic studies. When your asset allocation has been implemented, you can basically choose between the following rebalancing strategies:

- 1) No rebalancing
- 2) Dynamic programming with cost function minimisation
- 3) Fixed frequency (monthly, quarterly or annual)
- 4) Fixed tolerance band for maximum deviations

Most professional investors opt either for a 'tolerance' or for a 'frequency' strategy, but actually – even though they are both quite close – neither of these strategies is optimal.

According to leading academic researchers, the best solution is to quantify the costs of rebalancing in the form of both lost risk-adjusted return – i.e. the costs of not having the best possible portfolio if the rebalancing does not occur – and the applied trading costs if it does. Whether it is more favourable to rebalance in a given period also depends on the potential benefit of waiting and rebalancing in a later period. Therefore, it is necessary to use dynamic programming and so-called 'Monte Carlo simulations' to determine whether it is advantageous to restructure the portfolio.

This is a very complex strategy and not many – even institutional investors – use this method. Luckily, a much simpler tolerance or frequency strategy will produce comparably good results.

Academic findings

As mentioned above, many economists have examined which rebalancing strategies produce the best results. In 2006, in the Journal of Portfolio Management, Walter Sun and his colleagues at M.I.T. in Boston concluded that significant excess returns can be generated by rebalancing your portfolio¹.

Among other things, they tested a portfolio comprising five different asset classes and examined the performance generated after 20 years when adopting four different rebalancing techniques. The trading costs were assumed to be between 0.4% - 0.6% for the different asset classes.

In the table below, the optimal portfolio has been compared with six different rebalancing strategies of which the bottom three are all variations of the frequency strategy. In this survey, total costs comprise: 1) Trading costs and 2) Costs in the form of lost risk-adjusted return as deviations from the optimal allocation.

The optimal portfolio is always perfectly balanced in relation to the desired asset allocation and the calculation of the optimal portfolio's return excludes the impact of trading costs. Hence, the optimal portfolio's total costs are always zero.

Summary of the empirical findings of Sun et al. (2006)

Rebalancing strategy	Trading costs (bps per year)	Costs of suboptimal portfolio (bps per year)	Total costs (bps per year)
Optimal	0.00	0.00	0.00
Dynamic programming	3.97	1.49	5.47
No rebalancing	0.00	30.18	30.18
5% tolerance band	7.29	0.70	7.99
Monthly	23.67	0.00	23.67
Quarterly	13.69	0.28	13.96
Yearly	6.84	1.55	8.39

Source: Sun, W., A. Fan, L. Chen, T. Schouwenaars and M. Albot, 2006, "Optimal Rebalancing for Institutional Portfolios", Journal of Portfolio Management, 32, 33-43

1) In our book Strategic Asset Allocation – in short (2003) we wrote that there is no rule governing when and how often a portfolio should be rebalanced. In the meanwhile, however, the amount of research in the field has increased, resulting in a general acceptance of the findings of Walter Sun et al. (2006), stating that the optimal rebalancing strategy is found through a utility function, weighing the excess risk-adjusted return to the increased trading costs. This trade-off is optimised by means of dynamic programming.

Immediately below the optimal portfolio, it can be seen that by using dynamic programming, it is possible to keep the loss as low as 5.5 basis points annually (1 basis point = 0.01%). The 5% tolerance band is almost equally good as it only produces a loss of an annual 8 basis points. This strategy means that you rebalance the portfolio every time one of the asset classes makes up 5% more or less than in the optimal portfolio.

If you do not rebalance, the cost is an annual 30 basis points, equalling a lower total return of 18% over 20 years, assuming that a balanced portfolio produces an annual return of 6%.

If you rebalance the portfolio every month, it will cost you an annual 24 basis points. However, if you only rebalance once a year, you will lose as little 7 basis points on trading costs, and the total loss of approximately 8 basis points will be among the smallest losses.

Testing Sparinvest's model portfolio

Internally at Sparinvest, we have also analysed the consequences of rebalancing. We have done so by testing a portfolio consisting of three asset classes:

- 50% Global stocks
- 15% corporate bonds from the High Yield segment
- 35% Danish bonds

Hence, this test portfolio would be appropriate for an investor with a medium risk tolerance and a long investment horizon². The test period runs from 1992 to 2008 and the three asset classes are represented by the indices MSCI World, Credit Suisse First Boston Global High Yield and EFFAS 3-5 measured in Euro³.

The table below shows the results of applying all the rebalancing strategies described above (with the exception of dynamic optimisation for which we are currently finalising our model).

However, the conclusion of our preliminary analysis is the same. It is possible to achieve significant improvements by applying a 10% or 15% tolerance band. Also, an annual rebalancing or a three year rebalancing frequency produces good results.

As can be seen, the 15% tolerance band delivers the highest return of the eight strategies analysed in this section, with an annual return of 6.31%. In fact, one could be led to believe that the higher the tolerance band, the higher the return. However, this is a dangerous pitfall. During the 16 years that we included in the analysis, the equity component of the model portfolio did not deviate by more than 17 percentage points from the optimal 50% of the target portfolio. Therefore, if the tolerance threshold had been fixed at 20%, there would have been no rebalancing at all, bringing the return to an annual 5.55%. Then again, in a different historic period, we might have seen a portfolio imbalance never exceeding 14%. In such a scenario, a 15% tolerance band would have wiped out the entire rebalancing gain.

Therefore it is important to stress that the results to a very high extent depend on the given test period and the test portfolio chosen. If the test period of the analysis was 1970-1990 instead, for example, the results would probably differ slightly. The overall conclusion, however, would remain the same: That rebalancing pays.

2) We examine only one period, and the portfolio analysed is not necessarily the optimal one in the period. The portfolio described in the following is an example of what return an investor following different rebalancing strategies would have received for the period. There is no proof that one strategy is superior to another. For more evidence, simulations equivalent to those made by Sun et al. (2006) should be made.

3) The benchmarks in question were selected to get the longest possible test period

Sparinvest's performance test for a three-asset portfolio from 1992-2008

Rebalancing strategy	Annual return (%)	Volatility	No. of rebalances	Total costs in the period ⁴	How did an investment of EUR 100 perform?
No rebalancing	5.55	10.02	0	0.00	247.1
5 % tolerance	5.82	9.46	7	1.44	257.8
10 % tolerance	5.93	9.65	3	0.91	262.3
15 % tolerance	6.31	9.59	3	1.41	278.8
20 % tolerance	5.55	10.02	0	0	247.1
Quarterly	5.77	9.41	68	3.59	255.9
Annually	5.98	9.39	17	2.14	264.6
Ever three years	6.06	9.28	6	1.40	267.9

Source: Sparinvest analysis, November 2008.

Conclusion and recommendations

Academic findings – as well as Sparinvest's own analysis – suggest that considerable gains can be achieved by applying a rebalancing strategy. Academic research shows that the biggest gains are made when using advanced mathematical models to determine the best time to rebalance. However, the findings also reveal that almost equally large gains can be achieved when using a relatively simple frequency strategy or tolerance strategy, designed to facilitate rebalancing as soon as the portfolio deviates from the optimal asset allocation by a certain percentage – typically 5 - 15% – depending on the number of asset classes invested in.

The findings also illustrate that it is important to be aware of conflicting factors when choosing the rebal-

ancing strategy. First and foremost, it is important to keep trading costs low, meaning that the rebalancing frequency should not become too high.

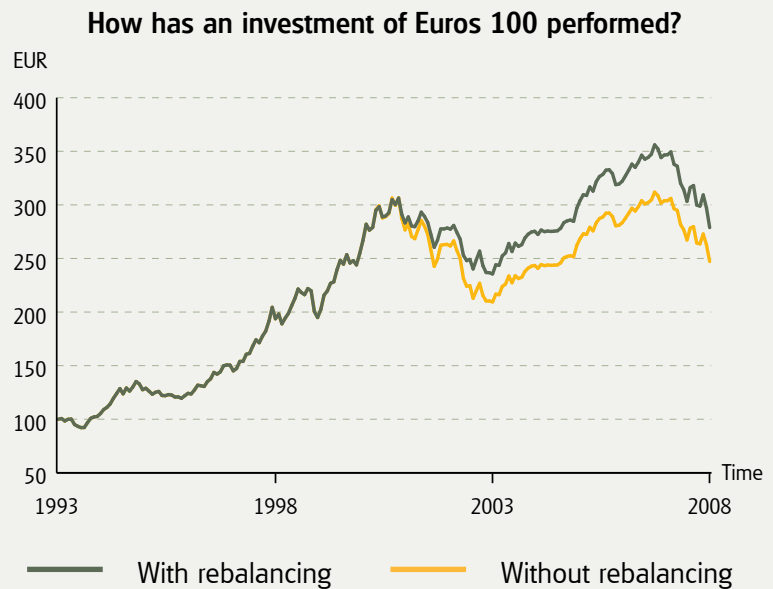
If a tolerance strategy is chosen, it is important not to set the threshold too low as the result will be too much rebalancing activity and high trading costs. Conversely, the threshold cannot be set so high that the portfolio imbalances are never large enough to trigger automatic rebalancing. If that is the case, it is not possible to realise gains and buy up more cheaply in asset classes that have depreciated in value.

This brings us to what we at Sparinvest recommend for our investors. Our recommendation is to rebalance once a year or to apply a tolerance strategy with a

4) Trading costs are assumed to be 1% of the portfolio value for equities and 0.5% for Danish bonds, respectively.

threshold of 10 percentage points for deviations in the equity component of the target portfolio.

The figure to the right shows the performance of the portfolio when using a 15% tolerance band. In fact, the first rebalancing does not take place until the end 2000 – after eight years with the portfolio. Consequently, the graph demonstrates one of the advantages of the tolerance band strategy: The portfolio is only rebalanced if the portfolio composition strays too far from the original starting point and, in that way, trading costs are saved.



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