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The art of portfolio diversification

Rebalance and refresh

- Without rebalancing, a portfolio will eventually deviate from the allocation that delivers the optimal mix of expected return and risk for an investor.
- Rebalancing, which is an institutional investor's primary risk control technique, is also an important practice for individual investors who follow an asset allocation approach.

"Prolonged market declines will make rebalancing seem a frustrating waste of money; in the end however, asset prices almost always turnaround, and you usually will be rewarded handsomely for your patience." (W. J. Bernstein)

An asset allocation strategy reflects the risk an investor is willing to accept to generate a targeted or expected return. As markets move higher and lower, this original asset allocation will start to drift away from the investor's initial asset allocation and will eventually develop different risk and return characteristics. To avoid this, investors need to actively make use of portfolio rebalancing techniques.

After the price of risky assets plummeted throughout the financial crisis, there has rarely been a better time to reassess and refresh asset allocations. Although the financial crisis has left many investors doubting some more traditional techniques for managing investment portfolios, we feel that one of the most important tools to control risk, rebalancing, remains valid.

Throughout this note we will discuss some techniques for rebalancing portfolios and will conclude with the approaches we find to be most useful for individual investors. Investors will have to consider the performance characteristics of each of their assets, such as volatility, return potential and correlations with other assets. In addition, the time horizon of the investments and the costs of rebalancing play a role in choosing both the frequency and the type of rebalancing. While the success of the rebalancing technique depends on the market situation, we conclude that rebalancing is critical for keeping a portfolio within an investor's predefined risk-tolerance band, and can be done without materially sacrificing returns in the long term.

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The art of portfolio diversification

Rebalancing basics

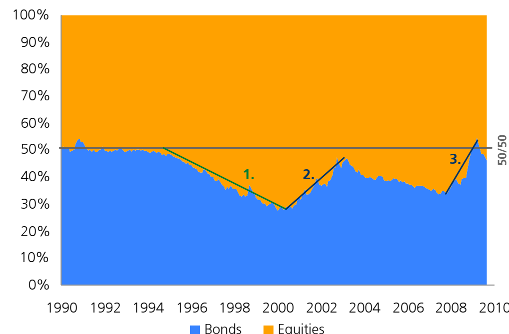
Before we deepen our discussion, first let's look at an example of what happens to a portfolio when it is not rebalanced. For the purpose of this note, we imagine an investor with a very simple asset allocation of only US stocks (S&P 500 Total Return index) and US bonds (JP Morgan US Government Bond Local Currency index). Split equally between the two asset classes at the time of the investment, in January 1990, this "balanced" portfolio matched our investor's risk and return profile and hence was "optimal". Yet without rebalancing the portfolio, the price developments of the two assets changed the portfolio allocation, with unintended consequences. Fig. 1 demonstrates how the asset allocation drifted without rebalancing over the past 20 years to 54% equities and 46% bonds as of 31 August 2009. At the time of writing, our investor is not far from the initial target allocation. However, when the subprime crisis began to affect US equities, in October 2007, the equity allocation of the portfolio was roughly 66%, only to move below the target allocation just before markets began to rally in March 2009.

We highlight three distinct phases for our example in Fig. 1 (tech boom, dotcom bust and the financial crisis).Throughout the dotcom bust and in the financial crisis, the exposure to the riskier asset classes decreased to the extent that the investor was unable to fully participate in the better times which followed. That is one of the risks that rebalancing mitigates. The other risk, is the build-up of riskier and more volatile assets in both the tech and now in the post-crisis rally.

Our second example, shown in Fig. 2, has the same initial asset allocation but a different starting point. Here the exposure to the riskier asset class exceeds the initial level. Rebalancing the portfolio is therefore not a function of reducing volatility of returns but staying within the defined limits, as we will show later in this note.

Fig. 1: The market rebalances on your behalf

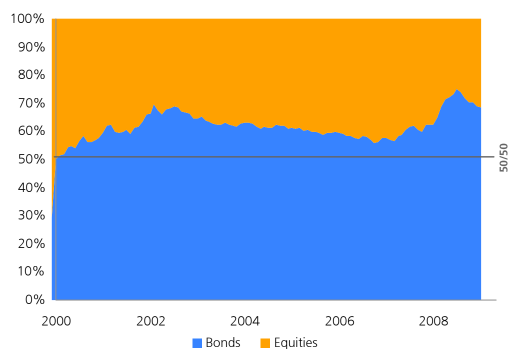
Effect of no rebalancing over 20 years on a portfolio initially set at 50% equities and 50% bonds



Source: UBS WMR as of 06 October 2009

1. Tech boom:
eurphoria, unwittingly taking on higher risk
2. Dotcom bust:
gloom, magnified by risk exposure
3. Financial crisis:
gloom and doom

Fig. 2: Effect of a different starting point to our asset allocation



Source: UBS WMR as of 06 October 2009

Asset allocation - assessing the status quo

Investors who do not rebalance their portfolios could have an optimal allocation as a matter of luck. However, this depends on many factors, of which one, the investment holding period, is crucial. But it is equally likely that many investors are not in line with their risk and return profile at this point in time.

That does not necessarily mean that every investor will or should go back to pre-crisis asset allocations. The crisis left many feeling less convinced about the long-run benefits of investing in risky assets. Instead we focus here on the risk variable in the asset allocation equation. With that, the required risk and return profile may have shifted during the crisis. If the profile has changed with a full understanding of how lower risk may eventually translate into lower returns, the crisis may have been a much needed wake-up call. However, we cannot emphasize enough that this decision has to be made consciously and must take into account the long-run risk and return outlook for financial markets not merely recent historical experience.

Structural markets and mean reverting assets

As mentioned in the introduction to this report, the financial crisis felt like freefall. In more technical terms, we experienced a structural downward market. Regardless of the direction, rebalancing comes at the temporary cost of performance in structural markets. Since rebalancing requires investors to reduce exposure to the outperforming asset and increase the

proportion of the underperforming asset. But while rebalancing in a structural market will hurt performance compared to a portfolio with zero rebalancing, the practice keeps the risk/return parameters in line with the investor's investment objectives. The downside to the strategy of no rebalancing in a structural market is that it is difficult to predict when it will revert. When it does, investors who have let their portfolios drift and will either be exposed to too much risk, much like our example when the financial system began to show cracks in 2007, or too little risk to be able to profit from a rise in the markets, as was the case in our example in early 2009.

While we refer to both markets and most assets as structural, that is, long-term in nature - in fact, they tend to fluctuate with the overall business cycle. During phases of economic expansion, risky assets generally trend higher and vise versa. Certainly, asset prices can fluctuate. However, we ignore short-term swings in asset prices, which we think is more or less consistent with an individual investor's approach to evaluating his or her own portfolio. Still, there are assets which at times show a different return pattern, namely mean reversion. Under mean reversion, the fortunes of assets will eventually turn. Accordingly, investors would be better off selling mean reverting assets in order to return their asset allocation to optimal levels whenever prices rise using the profit from the sale to finance investments in underperforming assets. This translates into a "rebalancing bonus," which can be seen as the excess return produced simply by selling high and buying low. While such a scenario is profitable, structural trends are more common. Rebalancing, therefore, is primarily used to control risk.

The emotional ride

In falling markets the focus is not to lose money, but in rising markets the best performing asset is where investors want their money to be. Fig. 3 shows that rebalancing does not generate dramatic, large returns over the long run. But the beauty of rebalancing is that it makes up for its costs by smoothing the volatility especially of returns and thereby reduces the stress of trying to have the optimal asset allocation for all market conditions. Still, investors have to be aware that rebalancing can be difficult on a purely emotional level as it requires us to set aside our natural anxiety of moving against the herd. Financial markets put investors through an emotional rollercoaster ride. Behavioral finance is the science that tracks how we react during the ride. Deeply rooted human behavior drives our reactions to both rising and falling financial markets. Therefore we believe that rebalancing has to be disciplined.

Fig. 3: Asset trend effects on rebalancing

(in %, p.a.)

Frequency		20 year period	Tech boom	Dotcom bust	Financial crisis
	Return	7.1	15.0	-4.3	-17.4
Monthly	Vola	12.1	7.8	9.5	11.2
	Return	7.2	15.1	-4.3	-16.8
Quarterly	Vola	12.1	7.8	9.6	11.2
	Return	7.3	15.1	-3.8	-15.1
Yearly	Vola	11.5	8.0	9.4	10.6
	Return	6.9	16.6	-11.6	-21.0
Never	Vola	13.2	9.8	13.2	12.5

Vola = volatility

Source: UBS WMR as of 06 October 2009

Is there an optimal rebalancing frequency?

While a disciplined approach to rebalance a portfolio may sound straightforward, the way assets behave in different market environments, as well as asset-specific circumstances, means that there is no one-size-fits-all approach when it comes to finding an optimal rebalancing frequency. That said, both academic literature and our own example suggest that the costs of more frequent rebalancing can weigh on performance. This means that investors who can accept having their asset allocation drift for a period of time are better off rebalancing at longer intervals.

The time and cost aspects of rebalancing

When discussing rebalancing frequency, cost is an important factor to consider. Too frequent rebalancing results in high transaction costs, and, depending on the tax regime, it may also result in higher taxes.

Greater trading activity involves costs. Rebalancing over a longer period, on the other hand, puts the portfolio at higher risk of not meeting expectations. Comparing the merits of monthly, quarterly and annual rebalancing over the past 20 years (see Fig. 4), we find the optimal period for rebalancing in our simple two asset case to be yearly, taking trading costs of 0.25% of the trade value for every bond trade and 0.5% of the value for every equity trade into account.

We note that we base our conclusion on the assumption that the investor has a long-term investment horizon. For investors with a shorter-term investment horizon, the conclusion may be different. Rebalancing may make little sense when the investment horizon is short. Rather, investors in this camp may find that the best approach is to allow the portfolio to drift.

How institutional investors approach rebalancing

If annual rebalancing is the best choice in our case, why do professional investors often rebalance more frequently? One reason is that a professional investor invests on behalf of others, with strict guidelines on how far from the benchmark the portfolio may deviate without violating stated risk and return objectives. And since professional investors place large orders, they can usually trade at lower costs than individual investors.

Professional investors, as well as many individual investors, do not necessarily utilize a calendar-based approach, such as the one discussed above. Instead they make use of so called "contingent" rebalancing approaches, rebalancing based on pre-set triggers. Trigger-based approaches often increase trading frequency. One version of contingent rebalancing would be to act when a portfolio weight deviation has exceeded a certain pre-defined threshold, such as when equities are 10% above/below the initially defined optimal weight. And in the real world, investors are typically exposed to more than two asset classes, making the process of rebalancing even more complicated especially as more assets would likely involve more transactions and associated costs.

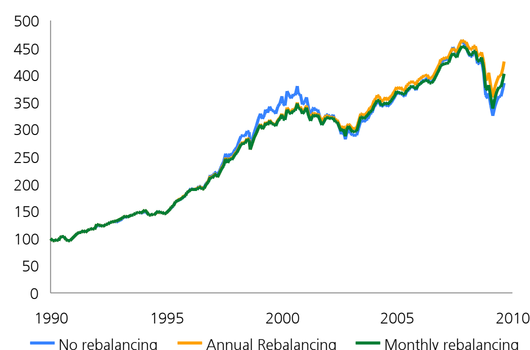
Rebalancing - more art than science

So far our discussion has focused on two asset classes, US equities and US government bonds, which tend to exhibit low correlations with each other (in other words, they behave differently over time). Putting more than two assets into the portfolio mix changes the picture as each asset has a different return and risk expectation and correlate differently with each other. Factors such as volatility of portfolio returns, transaction costs but also individual constraints may as well play a role when deciding on a rebalance strategy.

There are many rebalancing frequencies and techniques. Here we explore some of the most widely used techniques, which may be used singularly or in combination.

"Fresh money" - an allocation of new capital (for example a through a bonus payment or inheritance) is a further approach to rebalance a

Fig. 4: Performance difference between monthly, yearly an no rebalancing



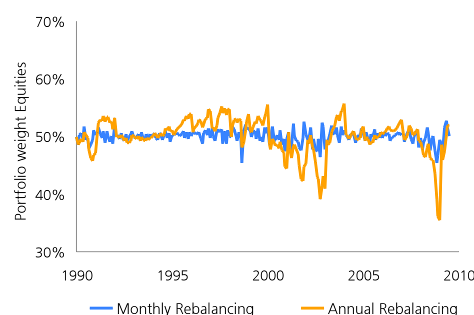
Source: UBS WMR, as of 06 October 2009

portfolio. This allows an investor to bring a portfolio back to its initial risk profile without much effort but can also be a tax-efficient approach. A similar approach would be to **rebalance over time by using cash flows from invested assets** (i.e. dividends or coupons) to invest in underrepresented asset classes.

The two approaches believed to be the most practical are the **calendar-based** and **contingent rebalancing.** Both build on the notion of rebalancing by actively selling asset classes that have outperformed and allocating the proceeds to buy securities in asset classes which are underweight, that is, "buy low and sell high." Of the two, the calendar-based approach is easier to follow, and investors who do not want to be very active with their investments are well advised to use yearly rebalancing. They must be able to live with the drift in assets over a one year time period. Perceiving the risk of one year asset drift as too high, a more frequent calendar-based approach could be an option, but at higher costs (see Fig. 5). The contingent approach can be simple as well, just as in our example with a 10% rebalancing limit. As rebalancing based on limits better controls the asset drift than calendar-based rebalancing, investors who are very concerned about their risk can consider such an approach. However, depending on the asset class and volatility of the market, such a fixed limit may be either too broad and result in too little, or too narrow and result in too much rebalancing, and again, overly high trading costs. Professional investors therefore often use a combination of different limits for different asset classes. However, such an approach may be too complicated and time consuming for private investors.

Fig. 5: Monthly vs. yearly asset drift

US equities vs. US government bonds



Source: UBS WMR, 06 October 2009

The downside of these two approaches is that both a straightforward contingent or calendar (of less than a year) based rebalancing technique would not have been able to prevent investors from buying assets which kept falling and as a result left rebalancing investors at an even greater loss during the financial crisis. On the other hand, at the time of the equity market rally, only investors who did rebalance were able to profit from it. In our recent report "UBS life themes: investing in volatile times," we concluded that a **tactical asset allocation** (TAA) rebalancing technique is a good solution to the rebalancing puzzle. Investors adopting a tactical rebalancing strategy normally combine rebalancing with an assessment of financial markets and do not adjust weights completely back to the initial levels but rather deviate at predefined targets depending on the short- to medium-term outlook of the asset classes. Combining our example with TAA, we currently expect equities to outperform government bonds on a relative basis, at a time where investors' portfolios may be over exposed to bonds. The tactical asset allocation approach would allow investors to reduce their government bond exposure in favor of equities at a favorable point, as it combines tactical trades with rebalancing. This we find to be a logical extension of both rebalancing and tactical asset allocation.

Discipline to control risk and emotions

To conclude, we find rebalancing an important risk control tool. We further believe that investors should be guided by a decision rule for rebalancing and not take a passive approach using an extreme buy-and-hold strategy. Rebalancing is a discipline that can be used to control costly behavioral biases.

Investors who are very concerned about letting the portfolio drift from its defined asset allocation weights at any point in time are well advised to rebalance frequently, bearing in mind that this will involve higher trading costs. However, rather than using a calendar-based approach, these investors should consider using a contingent approach, with limits on how far an asset allocation is allowed to drift from the benchmark, as it smoothens the volatility of returns.

We believe that a simple annual calendar-based approach can be optimal for investors who do not have a lot of time to devote to the rebalancing process. For investors who follow a tactical asset allocation, we advise rebalancing in line with the recommended tactical asset allocation framework, which takes valuation of assets and cross-asset considerations into greater account than a simple rebalancing approach.

Ultimately, we are strong supporters of rebalancing as it controls volatility at little or no long-term expense to the portfolio return and grants private investors greater peace of mind.

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