JUNE 2011

NEW PARADIGMS IN INDEXING

STOXX

INNOVATIVE. GLOBAL. INDICES.

INTRODUCTION

Stock market indices have been developed in the late nineteenth century to measure the performance of the respective stock market. During the past century, best practice standards for calculating stock market indices have changed: While the oldest index, the Dow Jones Industrial Average was constructed as (and still is) a price-weighted index, the majority of today's stock market indices are capitalization-weighted indices that weigh companies according to their stock market size. The advantage of the latter methodology is the fact that the equity market is cap-weighted by definition. In recent years so-called free-float market-cap weighted indices became the best practice approach in most markets, which only take into account those shares that actually trade on the respective exchange, to ensure a sufficient level of liquidity of the index.

In the past decades, free-float market-cap weighted indices have been developed for practically all regions, industries and sizes and offer a comprehensive index universe to measure the performance of stock markets across the globe and hence have become the standard paradigm in performance measurement for fund managers.

However, in recent years the paradigm of market-cap weighted indices is being increasingly challenged by new and more sophisticated index concepts. Although many different types of these advanced methodologies are being developed with diverse calculation and weighting schemes, the key drivers for challenging the "old paradigm" can be summarized in two key words: risk and return. To be precise, academic research as well as research conducted by practitioners has shown that market-cap weighted indices typically show a relatively poor performance in relation to the risk they are exposed to.

A first piece of evidence for this finding is based on the Nobel-prize awarded modern portfolio theory of Harry Markowitz, who has shown with mathematical models that for each portfolio there is a set of optimal portfolio mixes that maximize the return of a portfolio for a given level of risk. This set of optimal portfolio mixes is called the efficient frontier. From a portfolio construction point of view, two portfolios on this efficient frontier are worth mentioning: The so-called minimum variance portfolio, that chooses the portfolio weights to minimize the overall volatility of the portfolio and the maximum Sharpe-ratio portfolio, that maximizes the Sharpe-ratio of the portfolio and has a very intuitive interpretation in the graphical illustration as the tangent portfolio, as shown in Figure 1.

Academic research has shown that market-cap weighted indices show a relatively poor risk-return profile, i.e. their volatility is in most cases even higher than the volatility of the tangent portfolio while returns are lower than the return of a minimum-variance portfolio (s. Figure 1).

The reasons for the higher level of risk and lower profitability of market-cap weighted indices is as follows:

- The higher degree of risk is due to the fact that stock correlations are not taken into account by market-cap weighted indices. Minimum-variance and Max-Sharpe portfolio are able to reduce the level of risk by shifting exposure form highly correlated stocks in the portfolio to stocks with lower correlation to reach a better level of diversification.
- The lower level of return of market-cap weighted indices is attributed by most academic researchers to the fact that large caps have a lower average return than small caps in the long run. Hence, over-weighting large-caps (which market-cap weighted indices do by definition) results in a sub-optimal performance.

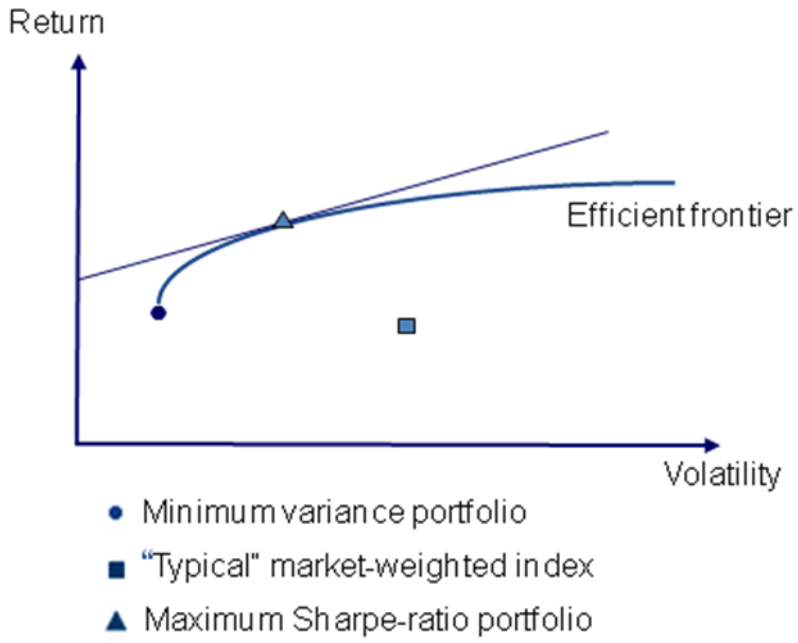

Figure 1. Risk-return chart and the efficient frontier of a portfolio. It is interesting to note that in most cases market-cap weighted indices show lower returns than the minimum variance portfolio and higher volatility (i.e. a higher degree of market risk) than the tangent portfolio.

ALTERNATIVE WEIGHTING SCHEMES

Based on these findings, various new index methodologies have been developed that use alternative weighting schemes. The most obvious and prominent index methodology based on the observations summarized in Figure 1 are indices that use a minimum-variance weighting scheme instead of a market-cap weighting. In other words, on a regular basis (typically monthly or quarterly) the minimum variance composition of the index portfolio is calculated based on the the-prevailing correlation structure between the shares and stock volatilities. The index is weighted according to these weights. Between these periodic re-balancings, the index is calculated in a similar way as market-cap weighted indices in terms of corporate actions, treatment of dividends etc. Minimum variance indices typically show a clear reduction in volatility compared to market-cap weighted indices with comparable or even slightly higher long-run returns.

The second candidate for an improved index methodology based on the above findings is an index that uses a period re-balancing to the Max-Sharpe portfolio (also known as tangent portfolio) to reach the optimal risk-return trade-off. From an academic point of view, this is the most desirable weighting scheme for constructing indices. However, from a practical point of view this type of indices are less common than minimum variance indices, because the latter methodology does not require expected return estimates as input parameters (as opposed to the calculation of the tangent portfolio) and therefore the minimum

variance methodology is considered to be more robust, since errors in the derivation of expected future stock returns has no influence on the index composition.

Some practitioners argue that the advantages of the minimum variance index methodology can be achieved by even simpler weighting schemes that do not require the estimation of a covariance matrix and therefore are even more robust since noise in the covariance estimator does not enter the weighting scheme. The most prominent methodology in this respect are equal-weighted indices, which avoid the large-cap bias of market-cap weighted indices by assigning the same weight to each share in the portfolio at every re-balancing date (typically monthly or quarterly) and therefore have a tendency to outperform comparable market-cap weighted indices in the long run. At the same time, they also show lower levels of volatility than market-cap weighted indices due to a better diversification by avoiding large weights in the portfolio composition. An advanced version of this methodology uses a "double equal-weighting", i.e. the shares are equal-weighted within each industry to form industry sub-indices and afterwards these sub-indices are equal-weighted to the market index. This methodology offers the additional advantage that any bias towards certain industries is avoided and thereby systematic risk is reduced. For example, during the financial crisis this double-equal weighting clearly outperformed both single equal-weighted indices and market-cap weighted indices due to a relatively smaller exposure to financial stocks, as illustrated in Figure 2.

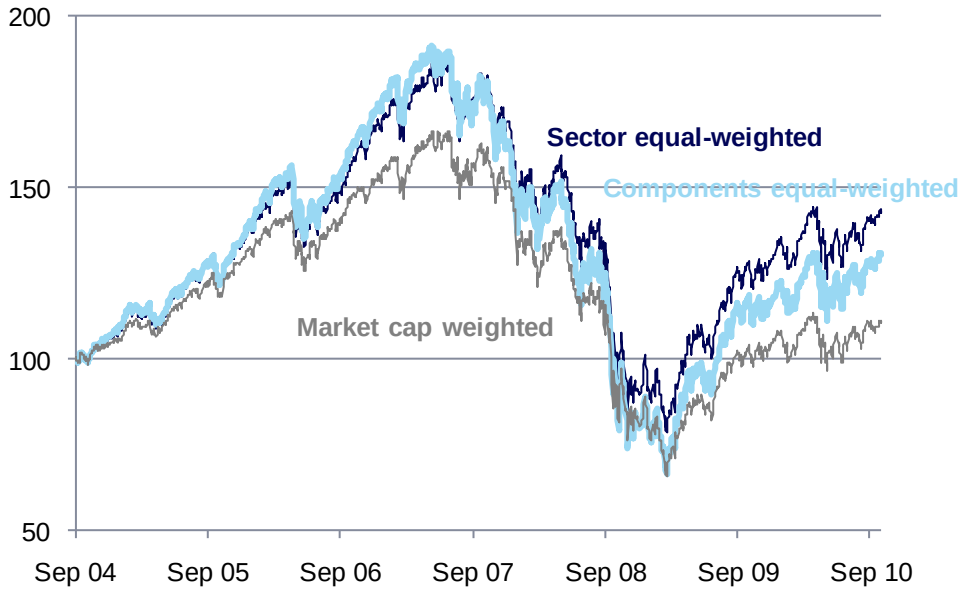

Figure 2. Performance of the double-equal weighted STOXX 600 Europe index compared to the component equal weighted and its market-cap weighted counterparts.

There are also more complex methodologies than minimum-variance indices that use more complex risk measures such as conditional value-at-risk in the risk-return optimization and which tend to improve the risk profile of the resulting index portfolios even further.

DYNAMIC METHODOLOGIES

So far we have considered alternative weighting schemes that improve the risk-return profile of index portfolios by applying a point-in-time optimization, based on modern portfolio theory. Hence, these optimizing methodologies are static in the sense that they do not optimize the portfolio allocation across the investment / business cycle and therefore leave an important degree of freedom to optimize the risk-return profile of the respective index unused.

To create even more advanced index methodologies that optimize the portfolio allocation across the cycle it is important to have suitable input factors at hand that indicate the state of the investment cycle as such or the exposure of a certain share to the business cycle.

The best-known approach to analyse the cycle of individual stocks are fundamental factors that assess the intrinsic value of companies and their corresponding market potential in comparison to other shares in the respective index universe. These fundamental indices are typically quite complex and very demanding in terms of underlying data required for the stock selection and weighting scheme.
A transparent and more robust approach is to use a simple risk-measure such as the volatility of equity market to determine the state of the investment cycle. This is a reasonable approach since empirical studies reveal that equity markets and the volatility of equity markets show a strong negative correlation, i.e. bull markets tend to coincide with low levels of volatility whereas market crashes are typically accompanied by high levels of volatility.

The basic idea of volatility based investment schemes is to shift part of the index exposure into the money market when volatility is rising to protect the investors from serious losses in bearish markets. On the other hand, when volatility is low the investor is mainly invested in equities. The most common example of this method are risk-control indices (also referred to as target volatility indices), that re-shuffle the portfolio consisting of a blue-chip equity portfolio and a money market exposure on a regular basis such that the mixed portfolio always stays at the same pre-defined volatility target level.

Backtests confirm that such risk-controlled investment schemes show a significant portfolio optimization across the cycle, i.e. the investor is highly invested in equities in bullish markets and is less exposed in bearish markets (s. Figure 3). Further, mathematical research shows that risk-controlled investment schemes always have a higher Sharpe-ratio than the underlying equity portfolio in the long-run, irrespective of the underlying equity index portfolio. Therefore, risk control indices are an excellent example for the value-added of advanced index methodologies.

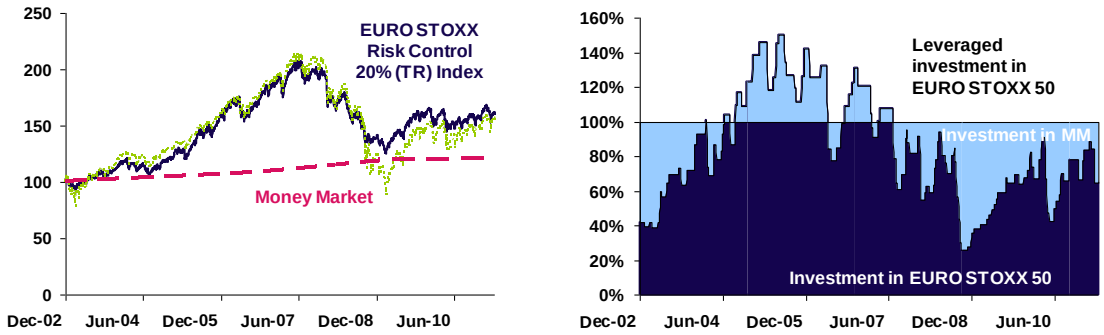

Figure 3. Left chart: Performance of a 20% target volatility index compared to its underlying EURO STOXX 50 index and a rolling money market investment: The risk control index shows a comparable long run performance as the EURO STOXX 50 index but suffers less severe losses during market turbulences. Right chart: Equity weight used by the risk control index over time – the index is highly invested in equities during bull markets (i.e. 2003 to 2007) and highly invested in money market in bear markets (i.e. 2002 and 2008 to 2009).

RISK MITIGATION TECHNIQUES

The recent financial crisis has triggered a reassessment of existing risk management techniques across the financial industry, including the index business. To be precise, investors are increasingly interested in indices that represent the desired market or investment style, but at the same time incorporate certain risk mitigation techniques that limit the impact of crisis situations on the respective index portfolio.

The most prominent source of risk that investors are concerned about is the general market risk, which can be partially mitigated or controlled with the above mentioned index methodologies that explicitly reduce or control the volatility of the index portfolio, i.e. minimum variance or risk control index strategies.

However, there are other sources of risk that are relevant for investors, in particular liquidity risk and the default risk of single names in the index portfolio, which are also dealt with in modern index methodologies.

In fact, liquidity is not only an important issue during market turbulences where liquidity typically shifts away from mid- and small caps towards blue-chip equities, but also during normal market, since the liquidity of the index components determines to a large degree at what cost the index can be replicated or tracked by passive investment vehicles. To mitigate the risk of illiquid index components (especially during a market crisis) and to facilitate a cost-efficient replication of the index, so-called liquidity optimized index methodologies have been created, that exclude illiquid shares from the index portfolio and/or tilt the index weights from a pure market-cap weighting towards the more liquid shares in the index portfolio. Advanced versions of liquidity optimized index methodologies even screen for the availability to borrow of shares such that shares that are hard to borrow are excluded from the index to ensure the index can also be replicated easily in the short sense.

Another risk category investors are increasingly concerned about is the default risk of single names in the portfolio, because the financial crisis has shown that even large companies that were assumingly too big to fail can actually default. Therefore, modern index methodologies limit the exposure to single issuers in the index portfolio to avoid any risk concentration in certain companies. These risk mitigation techniques typically go beyond the regulatory diversification rules for indices and fund managers prescribed by the so-called UCITS regulation.

CONCLUSION

Traditionally the objective of market indices is to measure the performance of the respective market or market segment. This has led to the development of market cap weighted indices as the standard methodology to measure equity markets and to benchmark portfolios against the market. Recent progress in both academic and practical research has shown that the risk return profile of indices can be improved significantly by using advanced component selection and component weighting schemes.

Moreover, the financial crisis has shown the importance of creating advanced index methodologies that mitigate various sources of risk (in particular market risk, default risk and liquidity y risk) without losing the property of tracking closely the market under consideration.

Advanced index methodologies have a wide range of possible applications: For investors in index-based financial products these indices offer the advantage of achieving an improved risk-return profile, especially in crisis situations where the investors' exposure to general market risk and/or credit risk is reduced compared to standard market-cap weighted indices. Further, liquidity optimized index techniques enhance the liquidity of financial products, allowing for smaller bid-asks spreads in index-based investment products.

For the buy-side industry that use indices for defining their investment universe and/or for benchmarking actively managed mandates, advanced index methodologies offer a guideline to portfolio managers to include certain aspects of risk mitigation in their active portfolio construction, in particular in the selection of securities and their decision to overweight or underweight certain securities.

LITERATURE

» STOXX Index Guide, www.stoxx.com/download/indices/rulebooks/stoxx_indexguide.pdf
» Efficient Indexation: An Alternative to Cap-Weighted Indices, EHDEC-Risk institute publications, January 2010.

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