Over the last few years the focus on indexation in asset management has driven interest in new forms of indexation, also known as “advanced” or “smart” beta. Proponents of smart beta argue that the capitalisation-weighted index is inefficient, and that a more efficient portfolio can be constructed by applying some alternative stock weighting scheme based on relatively transparent quantitative methodologies. Over the last two years extensive research by the Financial Engineering group at BNP Paribas Investment Partners has shown that smart beta strategies are in fact driven by long established factor exposures. So, the alternative weighting schemes proposed by smart beta strategies are a new way of establishing exposures to classic factor premiums.

More significantly, the research shows that smart beta strategies have a number of significant disadvantages as a means of harvesting the factor premiums.

How then can we construct a portfolio in which the optimal strategies to harvest systematic factor exposures are combined? To what extent do we believe that identified factor premiums will continue to deliver alpha in the future? How can we optimally integrate real world constraints into our portfolio construction process? These are among the questions that drove the research and led to the results in this recently published white paper.

This white paper is the third in a series launched as part of the thought leadership initiative where BNP Paribas Investment Partners employs its internal teams and capabilities to produce proprietary research on topics of relevance to institutional investors.

For information on this and other white papers published by the Thought Leadership group please send an email to:

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Foreward and non-technical summary to the white paper “Multi-Alpha Equity Portfolios: An integrated risk budgeting approach for constrained robust portfolios.

It was in October 2010 at the dinner reception of the Inquire Conference in Berlin that I had the opportunity to discuss the hot topic of smart beta strategies with Bob Litterman, now editor of the Financial Analysts Journal, who sat next to me. I remember asking him what he thought about all these so talked about new smart beta strategies, in particular what did he think could be their source of excess returns and risk. His answer was very clear: “they must all be explained by factor exposures!” Shortly after, back at office in Paris, I came across the pre-print of a paper written by Bernd Scherer, Professor at the Edhec Institute in London, which showed just that for the case of minimum variance: the excess returns of the traditional minimum variance portfolios over the market capitalisation index can be explained by a very small number of factor tilts in particular that towards low risk stocks. Bernd wrote “My conjecture is that the portfolio construction process behind minimum variance investing implicitly picks up risk based pricing anomalies. If that is true, minimum variance investing will be a clumsy and indirect process to benefit from. Investor would be better advised to directly decide if, when and to what degree they want to invest into long/short anomaly portfolios on top of a market weighted benchmark.” And he then went on to prove it in the rest of the paper which was eventually published in the Journal of Empirical Finance in 2011, vol. 18, issue 4.

In the course of 2011, along with my colleagues Xiao and Pierre, we extended this line of research to other smart beta strategies. Besides Minimum Variance we also considered Maximum Diversification, two forms of Risk Parity (taking into account correlations or not) and Equally Weighting. We applied these strategies to the stocks in the MSCI World Index, MSCI USA Index, MSCI Europe Index and MSCI Japan Index. The results were staggering. In a paper we published in The Journal of Portfolio Management, Spring 2012 issue, vol. 39, no. 3, entitled “Demystifying Risk-Based Strategies: a Simple Alpha Plus Beta Description” we demonstrated that indeed all these smart beta strategies have pronounced factor tilts. Minimum Variance and Maximum Diversification can be almost fully explained by tilts towards low risk stocks. Equally Weighting can be almost entirely explained by tilts towards smaller capitalization stocks and Risk Parity by a blend of exposures to smaller capitalization stocks and low risk stocks. We confirmed that, indeed, not only minimum variance but also maximum diversification, risk parity and equally weighting strategies are just clumsy approaches which can be fully explained by their exposures to simple factor tilts.

If this is true when talking about risk-based smart beta strategies, the same applies to fundamentally weighted smart beta indexes where stocks are weighted in proportion to their fundamentals such as book-value or earnings. In a recent paper which appeared in the Financial Analysts Journal in 2011, vol. 67, no. 5, by Jason Hsu, Tzee-man Chow and Vitali Kalesnik from Research Affiliates, the creators of fundamental indexing, co-authored with Bryce Little from Cornell University, acknowledge that value factors play a key role in explaining almost entirely the performances and risk of their fundamentally weighted strategies.
Smart beta strategies are therefore nothing more than a new form of systematic active strategies where stocks are based on some alternative formula to determine how their underlying portfolios will deviate from the market capitalization portfolio. They are transparent in the sense that the formula tends to be made publicly available, but not all are simple. In fact, they can be quite complex, minimum variance being the typical example of a complex smart beta strategy. And their complexity, or sometimes apparent simplicity, hides a number of pitfalls. Minimum variance and maximum diversification, which rely on optimisation algorithms, suffer from over-sensitivity to error estimation in risk models and, as a consequence, can exhibit very large turnover, concentration in just a few stocks, sector biases, and others. Risk parity indices and the equally weighted strategy can be difficult to implement as they are over-exposed to the smaller capitalization stocks and can easily suffer from larger market impact as asset under management grow. And even fundamentally indexing can be too exposed to distress stocks which tend to under-perform.

In fact, when looking in more detail at the formulas used in most Smart Beta indices we appreciate that risk is in general poorly controlled. The tracking error risk relative to the market capitalisation index is often at the mercy of markets and can change wildly over time, being extremely large in some cases. Similarly, the factor exposures can fluctuate and are in general poorly controlled. Finally, not all known factor-based market anomalies are available in the Smart Beta indexes available today. We often find Value, Low Risk and Smaller Capitalisation but Momentum, for example, is much less ubiquitous. Factor-based anomalies based on Analyst Revisions, Profitability or Earnings Quality are seen even less, if at all.

The question is then what is the alternative to smart beta indexing? The answer is to go back to behavioural finance, to the literature on factor mis-pricings, to identify the sources of alpha which can be generated from systematic factor exposures, to improve those strategies designed to capture alpha, and to find more efficient ways of combining them into portfolios. Academic literature offers a good starting point when it comes to factor mis-pricing. The literature on mis-pricing may have started in 1972 when Bob Haugen and A. James Stein in their working paper available from the library of the University of Wisconsin-Madison showed that risk itself had been mis-priced by the US market between 1926 and 1969, with low risk stocks typically having higher returns than expected from the low beta and high risk stocks having lower returns than expected from their large beta. This has been confirmed by many authors since and not only for US stocks but for stocks in almost all markets as Bob Haugen himself showed again in a recent pre-print, 2012, co-authored by Nardin Baker entitled “Low Risk Stocks Outperform within All Observable Markets of the World”. Other mis-pricings are well known. The value anomaly can be traced back to at least 1977 in a paper by Sanjoy Basu in the Journal of Finance, the earnings revision anomaly to 1979 in a paper by Lakonishok and Givoly in the Journal of Accounting and Economics, the small capitalisation stock anomaly to 1981 by Banz in the Journal of Financial Economics, the short-term reversal anomaly to 1990 by Jagadeesh in the Journal of Finance, the momentum anomaly by Jahadeesh and Titman to 1993 in the Journal of Finance and the Accruals anomaly in 1996 by Sloan in the Accounting Review. Just to cite a few.
In this paper we go back to basics proposing that portfolio construction of equity portfolios should start from the exercise of allocating risk to sources of alpha rather than from unnecessarily complex and clumsy portfolio constructs. Gaining exposure to the anomalies above mentioned is a question of confidence: to what extent one believes that those sources of active risk will continue to deliver alpha in the future. For most, we expect so, but that is for each investor to decide. The exercise of risk allocation needs a forecast in terms of the amount of alpha per unit of risk and cross-correlations of these alphas. If these are available then mean-variance could be used to build an optimal risk allocation. But these are not likely to be known with sufficiently accuracy. The good news are that we show empirically that simply allocating the same risk budget to a selection of those anomalies would have generated a similar result to that obtained from in-sample mean-variance optimisation. A simple sensible allocation to a multi-alpha combination is therefore likely to suffice.

We also discuss the possibility of adding other sources of alpha than just systematic stock tilts derived from factor exposures. In the first example in the paper we show how to combine alpha expected from a forward looking fundamental stock picking investment process where company returns are forecasted based on company analysis with alpha generated systematically from value stocks, small-cap stocks, positive trending stocks and a momentum alpha capture strategy applied to sectors. We use this same example to show in detail how the framework can be applied. Our aim is to demonstrate that once risk has been allocated to alpha sources then the steps to build the portfolio are straightforward.

The portfolio construction framework proposed can be divided into three steps. The first is the allocation of active risk to sources of alpha, as just discussed. The second is the construction of an unconstrained active allocation from those alpha sources and risk budgeting and the third is the application of constraints to generate the optimal constrained allocation which is the least impacted by the constraints. Regulatory constraints, the long-only constraint, liquidity constraints and limits to the maximum allocation to a stock are often unavoidable.

The second step in this framework requires only basic arithmetic. The target unconstrained active allocation is just the risk weighted average of the active allocation determined by each strategy designed to capture alpha at a given point in time. For example, in the case of a systematic alpha capture strategy like value the active allocation can be a simple a tilt towards stocks with lowest price-to-book and away from either the market index or from stocks with the highest price-to-book.

The third step is the less straightforward but we show that the final result can be easily understood and remains transparent. We propose that implied returns are calculated from the unconstrained target allocation and then used in mean-variance optimisation applying constraints. Implied returns are the returns for each stock in the investment universe which render the unconstrained allocation efficient, i.e. solution of the mean-variance optimisation problem in the absence of constraints. It happens that these are the returns which accurately reflect our views and therefore can be used in mean-variance constrained optimisation without expecting the usual problems of corner solutions for example. In fact we show that when optimising from implied returns the final constrained portfolio remains as close as possible to the starting target unconstrained allocation.
We show with numerical examples that constrained portfolios do retain as much of the risk budget allocation to active risk as constraints allow. We also demonstrate that the exposure to systematic risk in our target unconstrained portfolio is retained as much as possible. It is the exposure to stock specific risk which pays for the impact of constraints and flattens the efficient frontier.

To our knowledge, this is the first report that discusses comprehensively the problem of portfolio construction starting from a risk allocation to alpha sources and showing how to build constrained portfolios which retain as much as possible those chosen active risk exposures, with a particular focus on analysing the impact of constraints on the final portfolio stock and risk allocation. The approach here proposed, although inspired in the well-known Black-Litterman model, does contain a number of important differences which we try to make clear in the appendices.

We strongly believe that our findings are presented at an important time for investors and hope that this helps them to better build their portfolios and to navigate the world of smart beta with more insight.

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June 2013

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