It's time for asset allocation

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Abstract
Despite repeated evidence that asset allocation accounts for a very large fraction of a portfolio return, the industry has never stopped favouring stock picking as the preferred form of active investment strategy. In this paper, we attempt to rehabilitate the importance of active asset allocation in the investment process. We review the benefits of traditional and alternative style management and provide evidence that optimal strategic and tactical asset allocation strategies are likely to significantly enhance the risk-adjusted performance of a multi-style multi-class portfolio. We finally argue that the future of hedge fund investing may very well lie in the opportunities such alternative investment vehicles offer in terms of improving the asset allocation process.

EDHEC is one of the top five business schools in France. Its reputation is built on the high quality of its faculty and the privileged relationship with professionals that the school has cultivated since its establishment in 1906. EDHEC Business School has decided to draw on its extensive knowledge of the professional environment and has therefore focused its research on themes that satisfy the needs of professionals.

EDHEC pursues an active research policy in the field of finance. EDHEC-Risk Institute carries out numerous research programmes in the areas of asset allocation and risk management in both the traditional and alternative investment universes.
Introduction

In recent years, the asset management industry has largely concentrated its research and investment efforts on the sophistication of asset selection tools and concepts. Portfolio management has been dominated by benchmarks. In that context, the only source of outperformance over the long-term was the manager's skill in selecting or overweighting the right assets (alphas) while respecting the portfolio's exposure to the benchmark risk factors (betas).

This situation may appear paradoxical in a discipline that emerged from the portfolio diversification research promoted by Markowitz from 1952. All the more so since the Nobel prize winner's successors strengthened the arguments in favour of asset allocation, notably by showing, at the beginning of the 1990s, that the main source of portfolio performance (97%) was the style (or styles) that characterised the portfolio (Sharpe, 1992).

However, in spite of this conceptual confirmation of the predominance of asset allocation, whether in styles or classes, the industry never stopped favouring stock picking. In fact, asset allocation has been the victim of real theoretical confusion. Considering that one of the practical consequences of the financial asset equilibrium models and their founding hypothesis, efficiency, was that it was difficult to beat the market portfolio over a long period, investment firms concluded that the best allocation was passive. This passivity led to the domination of indices in asset management.

The fact that the choice of index was itself a decision, and therefore a bet on the portfolio's exposure to the particular index risks (betas), was of little importance. Everybody behaved as if Roll's 1997 article had never been written, as if the chosen index represented the famous market portfolio that the author had described as being unobtainable. From then on, considering that the index represented 'equilibrium' allocation, the only value added possible, for those who wished to engage in active management without deviating from the equilibrium allocation, was from stock picking, which allowed managers to take advantage of very temporary inefficiencies in the securities market.

Stock picking itself, in this approach, comes under strict supervision. For the 'benchmarked' management 'fundamentalists' the only operations authorised are the over- or underweighting of the quantities of the securities contained in the benchmark. One therefore prefers to speak of 'stock timing'. It does not involve introducing, in searching for alphas, an unacceptable beta, i.e. a security that would not be exposed to the same risk factors as those of the benchmark. The dogma of 'doing nothing outside the indices' has given rise to constantly biased readings of academic or empirical evidence on the importance of asset allocation. A revealing example of these readings relates to comments made on the renowned Brinson, Singer, and Beebower survey (1991) by major investment firms who wished to promote passive allocation strategies and products. Even though this survey is only stating the obvious, namely that more than 90% of the evolution of portfolio return measured quarterly is the result of the evolution of the asset classes in which it is invested (in other words, when the water rises, the boat rises), three-quarters of the commentators concluded that the choice of asset allocation policy, and thus the choice of benchmark, explains 91% of the performance of the portfolio.

It is therefore pointless to practice active allocation management, notably by using 'market timing' or 'style timing'; let's leave the reference index or indices to look after the core performance of the portfolio.

Even though, in a recent article, Ibbotson and Kaplan (2000) acknowledged that the conclusions and interpretations of the Brinson, Singer, and Beebower survey were not relevant and showed that the difference in return between funds was principally due to market or style timing, benchmarks and stock picking are resilient. An analysis of European investment firms' sales arguments for
their institutional clients by Edhec (2001) shows that the 1991 survey is explicitly mentioned by a majority of firms to justify their ‘benchmarked’ management services, the acceptable active value added being stock picking.

Table 1: Results of Nutall and Nutall’s survey (1998)

<table>
<thead>
<tr>
<th>Misquotation of Brinson, Singer and Beebower survey (1991)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of writers who misinterpret the Brinson survey as an answer to the relationship between asset allocation and the level of returns.</td>
</tr>
<tr>
<td>For example: ‘One study suggests that more than 91% of a portfolio’s return is attributable to its mix of asset classes.’</td>
</tr>
<tr>
<td>In this study, individual stock selection and market timing together accounted for less than 7% of a diversified portfolio’s return. Vanguard Group</td>
</tr>
<tr>
<td>Percentage of writers who misinterpret the Brinson survey as an answer to the impact of choosing one asset allocation policy over another.</td>
</tr>
<tr>
<td>For example: ‘A widely quoted study of pension plan managers shows that 91.5% of the difference between one portfolio’s performance and another’s is explained by asset allocation.’ Fidelity Investments</td>
</tr>
<tr>
<td>Other misquotations</td>
</tr>
<tr>
<td>Percentage of writers who accurately quoted Brinson (only one correct interpretation).</td>
</tr>
</tbody>
</table>

**Style management sacrificed**

Since the work of Fama and French (1992), who completed Sharpe’s analysis, the majority of institutional investors and the major investment firms have brought style management to the fore in answer to the difficulties posed by the irrelevance and instability of the CAPM’s beta. As early as 1977, Richard Roll stressed its extreme fragility, due to the impossibility of finding an index that is representative of market equilibrium and, as such, used as a reference for risk measurement of securities.

The style approach presented three advantages compared to other management methods:

- The decorrelation between the styles, much more stable than between sectors or financial market places, allowed strongly diversified portfolios to be built and thus significantly improved their efficient frontier.

- Style analysis is based on a small number of objective microeconomic attributes – such as size, profit growth, dividend distribution rate, etc – that facilitate the implementation of both stock selection and risk management tools. From a stock selection standpoint, making bets on styles leaves financial analysts within their comfort zone, as it is their core competency to be making recommendations based on companies’ attributes. From a risk management standpoint, using a small number of micro attributes tends to increase the statistical robustness of factor models, an important feature in a non-stationary environment. For once, financial analysts, happy to find interpretable factors about which they had something to say, and the quant, happy to find robust variables to explain risk and return, were in agreement.

- Finally, style management provided some academic evidence to a fledgling industry: multi-management. The question was how to sell value added based on selection of the best managers with researchers who, year after year, wishing to defend an almost ‘fundamentalist’ view of market efficiency, relentlessly tried to show that ‘winners do not repeat’!

*Figure 1: Percentage of variation between funds*

Source: Ibbotson, Kaplan (2000) and Edhec (2001)
It therefore seemed possible to get practitioners and researchers to agree to the idea that the worst managers are the least specialised and those who tend to change style frequently (Chan, Chen, Lakonishok, 1999). It did not signify that the style guaranteed performance persistence, but simply that the worst were more likely to repeat. It was not a major statement, but it was probably too much already.

From the multi-manager/multi-style approach, the asset management industry only adds value through ‘fund picking’. The paradigm that associated outperformance with asset selection alone persisted by adapting itself. While active managers seek to outperform their benchmark through their ability at detecting stocks with positive abnormal return, or alpha, multi-managers base their performance on their ability to detect managers with positive alpha in the hope that the alpha of diversified managed portfolios exhibit more persistence than that of individual stocks.

Arguing that it was impossible to forecast styles, multi-managers promoted the concept of stylistic neutrality as an asset allocation rule. In a way, having demonstrated the superiority of allocation by style, its promoters hurried to abandon it in favour of an approach that went back to favouring international diversification which, unfortunately, the herd-like behaviour of the stock markets had been doing its best to remove.

And the alternative class arrived...
In the last few years, alternative investments, and in particular hedge funds, have been growing very strongly. It is estimated that more than US $500 billion was invested in hedge funds at the end of 2000. Although hedge funds were initially held, for the most part, by private individuals, either directly or through funds-of-funds, it should be noted that today institutional investors contribute a significant share of their assets to this new asset class.

This craving for hedge funds is not only American - it is also European. Recent surveys conducted by Watson/Wyatt and Golin/Harris Ludgate¹ bear witness to this considerable evolution in institutional allocation. According to the consultancy Golin/Harris Ludgate, 64% of European institutional investors have already invested in hedge funds (36%) or are prepared to do so (28%) in 2001, compared to 56% in 2000. This strong interest in hedge funds does not, however, explain certain factors:

- The decline of investment opportunities in traditional asset classes
This loss in attractiveness is not only due to traditional managers’ inability to take advantage of market inefficiencies, as they are too constrained by regulations and their adherence to the reference benchmark, but also to the low degree of diversification provided by purely geographical allotment of assets. Geographical diversification disappears when the manager needs it the most, i.e. when the markets fall sharply (Longin and Solnik, 1995).

Figure 2: Correlation between indices representing geographical zones (1990–2000)

Source: Schneeweis (2001)

• Hedge funds present very attractive risk-adjusted returns
The hedge funds' freedom to intervene in the markets, together with their manager's specialisation in a particular style, is a source of alphas. Not only can hedge funds easily carry out arbitrage operations and take advantage of temporary market inefficiencies, they can also easily implement dynamic trading strategies. This production of outperformance can also be increased by the leverage effect obtained from using derivatives, securities lending and borrowing operations and short selling.

Moreover, returns on alternative investments generally present a relatively low level of correlation with traditional asset returns and therefore resist in times of unfavourable market conditions (Schneeweis, 2001, Bernard and Schneeweis, 2001).

Table 1: Performance of EACM and traditional indices (1/1990-12/2000)

<table>
<thead>
<tr>
<th></th>
<th>Return</th>
<th>Stdev</th>
<th>Sharpe Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>EACM100</td>
<td>14.8%</td>
<td>4.3%</td>
<td>2.11</td>
</tr>
<tr>
<td>Relative value</td>
<td>10.2%</td>
<td>3.4%</td>
<td>1.37</td>
</tr>
<tr>
<td>Event driven</td>
<td>13.3%</td>
<td>5.2%</td>
<td>1.48</td>
</tr>
<tr>
<td>Equity hedge</td>
<td>19.7%</td>
<td>10.5%</td>
<td>1.34</td>
</tr>
<tr>
<td>Global macro</td>
<td>17.9%</td>
<td>10.5%</td>
<td>1.17</td>
</tr>
<tr>
<td>S&amp;P 500</td>
<td>15.4%</td>
<td>13.9%</td>
<td>0.71</td>
</tr>
<tr>
<td>Lehman Bros. Bond</td>
<td>8.0%</td>
<td>4.2%</td>
<td>0.58</td>
</tr>
</tbody>
</table>

Figure 3: Risk and return: bonds, equities, and hedge funds (1/1990-12/2000)

• Portfolio diversification based on alternative investment decorrelation with traditional asset returns is without doubt the main reason for investing in the alternative universe
Among the reasons cited by European institutional investors (Invesco, 2001) for increasing their allocations to alternative assets, the desire to implement an effective diversification policy seems to be the most important (40% of respondents). The investors' reasons are consistent with numerous academic studies which underline the effectiveness of the diversification that is obtained from their decorrelation compared to traditional assets (Amin and Khat, 2001). Since hedge fund styles are exposed to different risk factors, their insertion in a diversified portfolio allows a better efficient frontier to be obtained.

Multi-style multi-class active allocation decisions
The academic and empirical evidence on the qualities of hedge fund diversification should enable the financial industry to reconsider the portfolio management process using the multi-style/multi-class allocation concept. The multi-managers' value added, for example, should come not only from their selection and/or purchasing unit capacity. They should also be able to use the
independence that comes from their 'gate keeping' role to offer value added based on asset allocation, whether involving diversification or style timing (or both).

We present below the results of tests of implementation of Strategic Style Allocation and Tactical Style Allocation decisions that show the appropriateness of an active portfolio allocation process.

- **Strategic multi-style multi-class allocation**
  A classic way to analyse and formalise the benefits of multistyle multi-class allocation decisions is to note the improvement in the risk-return trade-off hedge funds allow when included in a traditional long-only stock and bond portfolio. Since seminal work by Markowitz (1952), it is well-known that this trade-off can be expressed in terms of mean-variance analysis under suitable assumptions on investor preferences (quadratic preferences) or asset return distribution (normal returns).

In the academic and practitioner literature on the benefits of alternative investment strategies, examples of enhancement of long-only efficient frontiers through optimal investments in hedge fund portfolios abound (see for example Schneeweis and Spurgin, 1999 or Karavas, 2000).

One problem is that these studies only focus on in-sample diversification results and standard sample estimates of hedge fund return covariance matrix. In a recent paper (Amenc and Martellini, 2001), we extend existing research by evaluating the out-of-sample performance of an improved estimator of the covariance structure of hedge fund index returns, focusing on its use for optimal portfolio selection.

- **Methodology**
  We choose to focus on the issue of estimating the covariances of hedge fund returns, rather than expected returns, as there is a general consensus that expected returns are difficult to obtain with a reasonable estimation error. What makes the problem worse is that optimisation techniques are very sensitive to differences in expected returns, so that portfolio optimisers typically allocate the largest fraction of capital to the asset class for which estimation error in the expected returns is the largest (Michaud, 1998).

Therefore, we focus on the one portfolio on the efficient frontier for which no information on expected returns is required, the minimum variance portfolio. More specifically, we consider the following two investment universes: a portfolio invested only in hedge funds (AI only) and an equity-oriented portfolio invested in traditional equity indices and equity-related alternative indices (AI/TI). The return on Credit Suisse First Boston/Tremont indices (Convertible arbitrage, Dedicated short bias, Emerging markets, Event driven, Fixed-income arbitrage, Global macro, Long/short equity, Market neutral, and Managed futures) and S&P indices (S&P 500 growth, S&P 500 value, S&P 400 mid-cap, and S&P 600 small cap) are used as proxies for the performance of alternative and traditional investment styles, respectively.²

Our methodology for testing minimum variance portfolios is similar to the one used in Chan et al. (1999) and Jagannathan and Ma (2000). We use the previous 48 months of observations to estimate the covariance matrix of the returns of the style indexes. For each universe (AI only and AI/TI), we form a global minimum variance portfolios. These portfolios are held for 6 months, their monthly returns are recorded, and the same process is repeated again. The means and variances of these portfolios are used to compare minimum variance portfolios to value-weighted and equally-weighted benchmarks.

- **Results**
  In the AI only investment universe, we find that the ex-post volatility of the minimum variance portfolio generated using implicit factor-based estimation techniques is almost 3 times lower than

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that of a naively diversified equally-weighted portfolio, and almost 7 times lower than that of the value-weighted Global Tremont Index, such differences being both economically and statistically significant. This indicates that optimal variance minimisation can achieve lower portfolio volatility.

Differences in mean returns, on the other hand, are not statistically significant (t-stat = 0.11 and 0.16, respectively), suggesting that the improvement in terms of risk control does not necessarily come at the cost of lower expected returns.

<table>
<thead>
<tr>
<th>Mean Return</th>
<th>Std Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Variance Portfolio</td>
<td>12.16%</td>
</tr>
<tr>
<td>Equally Weighted Portfolio</td>
<td>9.13%</td>
</tr>
<tr>
<td>Global Tremont Index</td>
<td>12.50%</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Mean Return</th>
<th>Std Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum variance portfolio</td>
<td>12.46%</td>
</tr>
<tr>
<td>Equally weighted portfolio</td>
<td>12.66%</td>
</tr>
<tr>
<td>S&amp;P 500</td>
<td>13.16%</td>
</tr>
</tbody>
</table>

As an illustration, Figure 4 displays the evolution of US $100 invested in January 1999 in the Global Tremont Index, an equally-weighted portfolio of Tremont indices and the minimum variance portfolio. As can be seen from the figure, the minimum variance portfolio has a much smoother path than its equally-weighted and value-weighted counterparts.

Similar results are obtained in the AI/TI equity oriented universe. The ex-post volatility of the minimum variance portfolio generated using implicit factor based estimation techniques is almost 5 times lower than that of a naively diversified equally-weighted portfolio, and almost 9 times lower than that of the S&P 500.

A confirmation of these results can be found in Figure 5, that displays the evolution of US $100 invested in January 1998 in the S&P 500, an equally-weighted portfolio of traditional and alternative equity-oriented indices, and the minimum variance portfolio.

There is now a consensus in empirical finance that expected asset returns, and also variances and covariances, are, to some extent, predictable. Pioneering work on the predictability of asset class returns in the U.S. market was carried out by Keim and Stambaugh (1986), Campbell (1987), Campbell and Shiller (1988), Fama and French (1989), and Ferson and Harvey (1991). More recently, some authors started to investigate this phenomenon on an international basis by studying the predictability of asset class returns in various national markets (see, for example, Bekaert and Hodrick (1992), Ferson and Harvey (1993, 1995), Harvey (1995), and Harasty and Roulet (2000).

The use of predetermined variables to predict asset returns has produced new insights into asset pricing models, and the literature on optimal portfolio selection has recognised that these insights can be exploited to improve on existing policies based upon unconditional estimates. For example, Kandel and Stambaugh (1996) argue that even a low level of statistical predictability can generate economic significance and abnormal returns may be attained even if the market is successfully timed only 1 out of 100 times. While Samuelson (1969) and Merton (1969, 1971, 1973) have paved the way by showing that optimal portfolio strategies are significantly affected by the presence of a stochastic opportunity set, optimal portfolio decision rules have subsequently been extended to account for the presence of predictable returns (see in particular Barberis (2000), Campbell and Viceira (1998), Campbell et al. (2000), Brennan, Schwartz, and Lagnado (1997), Lynch and Balduzzi (1999), and Lynch (2000), for a parametric approach in a simple setting or Brandt (1999) and Ait-Sahalia and Brandt (2001) for a non-parametric approach in a more general setting). Practitioners have also recognized the potential significance of return predictability and started to engage in tactical asset allocation strategies as early as the 1970s.

In a recent paper, Amenc, El Bied, and Martellini (2001) provide evidence of predictability in hedge fund index returns, and discuss the implications in terms of tactical style allocation decisions.

- Evidence of predictability in style index returns
  Given that we are searching for evidence of predictability in hedge fund returns with the goal of implementing a style allocation strategy, we have attempted to find the best possible trade-off between quality of fit and robustness. With a focus on attempting to avoid the pitfalls of data snooping, rather than trying to screen hundreds of variables through stepwise regression techniques, which usually leads to high in-sample R-squared but low out-of-sample R-squared (robustness problem), we have opted to select a short list of meaningful variables. These variables were selected on the basis that they had proven predictive powers, natural influence on asset returns, and fall within the following categories:
  - Volatility indicators
  - Liquidity indicators
  - Business cycle indicators
- Credit risk indicators
- Inflation and monetary policy indicators
- Equity and fixed-income market indicators

For each index, we selected a very limited number of variables (less than 5) that allow for a good trade-off between quality of fit and robustness. We systematically test for evidence of heteroscedasticity and multi-collinearity and correct for these when needed. We also test for the robustness of the model by dividing the calibration period into two sub-samples of equal duration, and using a Chow test to test for stability of regression coefficients between two periods. Models with relatively high in-sample R-squared that clearly fail the Chow test are discarded in favour of models with lower R-squared but higher stability.

In Table 4, we provide information on the in-sample and out-of-sample performance of the predictive models for the Tremont hedge fund indices, as well as traditional equity indices. The second column contains the in-sample R-squared of the regression. The third column contains the hit ratios of the model, i.e. the percentage of time the predicted direction is valid, i.e. the index goes up (resp. down) when the model predicts it will go up (resp. down).

Table 4: In- and Out-of-Sample performance of predictive models for alternative and traditional style indices (1994-1998)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Convertible Arbitrage</td>
<td>51.8%</td>
<td>87.5%</td>
</tr>
<tr>
<td>Emerging Markets</td>
<td>25.1%</td>
<td>50.0%</td>
</tr>
<tr>
<td>Equity Market Neutral</td>
<td>14.8%</td>
<td>95.8%</td>
</tr>
<tr>
<td>Event Driven</td>
<td>15.7%</td>
<td>79.2%</td>
</tr>
<tr>
<td>Fixed-Income Arbitrage</td>
<td>53.4%</td>
<td>62.5%</td>
</tr>
<tr>
<td>Global Macro</td>
<td>22.0%</td>
<td>54.2%</td>
</tr>
<tr>
<td><strong>Traditional Indices</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S&amp;P 500 Growth</td>
<td>17.7%</td>
<td>59.3%</td>
</tr>
<tr>
<td>S&amp;P 500 Value</td>
<td>9.7%</td>
<td>54.2%</td>
</tr>
<tr>
<td>S&amp;P 400 Mid-Cap</td>
<td>7.8%</td>
<td>58.3%</td>
</tr>
</tbody>
</table>

Source: Amenc, El Bied, Martellini (2001)

We find very high hit ratios, all above 50% and one at 95.8%, signalling the presence of statistically significant predictability in hedge fund returns.

- Performance of tactical style allocation portfolios
  We also examined whether there is any economic significance in the predictability of hedge fund returns by investigating the implications in terms of a tactical asset allocation model.

- Tactical style allocation in the AI only universe
  The benchmark used is an equally-weighted portfolio in the 6 Tremont indices under consideration. The objective is to maximise the information ratio, i.e. the excess return per unit of tracking error. The performance of the portfolio is measured in terms of the ex-post information ratio, and in terms of a portfolio hit ratio (denoted as hit ratio 2), which is the percentage of time that the return on the tactical style allocation portfolio is greater than the return on the benchmark.

3 - A Chow test consists of dividing the sample into two groups, estimating the model separately for each of the two sample groups and computing the error sum of squared residuals for each sample group. Then assume that the regression coefficients are the same over the entire period by estimating the model again but with the pooled sample. A Chow statistic is then obtained based on the restricted error sum of squares to test the null hypothesis that there is no structural change using the F-distribution tables (Chow, 1960).
- **Tactical Style Allocation in the Al/TI Equity Universe**

We consider the following two tactical style allocation portfolios:

**P1:** benchmark is a given strategic allocation (25% S&P Growth, 25% S&P Value, 20% S&P Mid-cap, 15% Equity market neutral, and 15% Event driven); objective is maximisation of the information ratio.

**P2:** benchmark is the S&P 500; objective is maximisation of excess return with a 2% tracking error constraint.4

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4 - The presence of a tracking error constraint is consistent with current practice in the industry. The performance of the unconstrained portfolio is even more spectacular (1.7 ex-post information ratio with 15.6% excess return and 9.3% tracking error).
Conclusion
In addition to the results presented in this paper, further evidence in support of the proposition that strategic and tactical asset allocation can generate superior risk-adjusted performance can be found in the fact that the amount of investment engaged in global asset allocation funds has been growing very rapidly since the mid-1990s in the United States, a trend expected to extend to Europe.

Because the returns on alternative investment strategies exhibit in general low correlation with those of standard asset classes, it is expected that hedge funds will take on a more significant role in active allocation strategies. While in its infancy, the world of alternative investment strategies consisted of a disparate set of managers following very specific strategies. Significant attempts at structuring the markets have occurred over the last decade, which now allow active asset allocation models to be applied to hedge funds, as well as to traditional investment vehicles. In particular, investible portfolios replicating broad-based hedge funds indices are today available with relatively high liquidity.

We actually believe that the future of hedge fund investing lies as much in the betas of alternative investment vehicles (systematic exposure to rewarded risk factors including market risk, but also volatility, credit, and liquidity risks) as in their alphas (abnormal performance emanating from managers' specific skills).

Appendix 1
Definition of hedge fund investment styles according to:

<table>
<thead>
<tr>
<th>Category</th>
<th>Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convertible Arbitrage</td>
<td>Invest in the convertible securities of a company. A typical investment is to be long in convertible bonds and short in stock of the same company.</td>
</tr>
<tr>
<td>Dedicated Short-Bias</td>
<td>Maintain consistent net short (or pure short) exposures to the underlying market.</td>
</tr>
<tr>
<td>Emerging Markets</td>
<td>Equity or fixed income investing in emerging markets around the world.</td>
</tr>
<tr>
<td>Market Neutral</td>
<td>Exploit equity market inefficiencies by being simultaneously long and short matched equity portfolios of the same size within a country.</td>
</tr>
<tr>
<td>Event-Driven</td>
<td>Equity-oriented investing designed to capture price movement generated by an anticipated corporate event (merger, acquisition, distressed securities, etc.).</td>
</tr>
<tr>
<td>Fixed-Income Arbitrage</td>
<td>Profit from price anomalies between related interest rate securities.</td>
</tr>
<tr>
<td>Global Macro</td>
<td>Leverage views on overall market direction as influenced by major economic trends and/or events.</td>
</tr>
<tr>
<td>Long/Short Equity</td>
<td>Equity-oriented investing on both the long and short sides of the market, with an objective different from being market neutral.</td>
</tr>
<tr>
<td>Managed Futures</td>
<td>Systematic or discretionary trading in listed financial and commodity futures markets and currency markets around the world.</td>
</tr>
</tbody>
</table>

Source: CSFB/Tremont

Appendix 2
• Strategic style allocation
Several methods have been introduced to improve asset return covariance matrix estimation, needed as an input into an asset allocation optimisation.

One solution is to impose some structure on the covariance matrix to reduce the number of parameters to be estimated. Several models fall within that category, including the constant correlation approach Elton and Gruber (1973), the single factor forecast [Sharpe, 1963] and the multi-factor forecast (e.g. Chan, Karceski and Lakonishok, 1999). In these approaches, sampling error is reduced at the cost of some specification error. Several authors have studied the optimal trade-off between sampling risk and model risk in the context of optimal shrinkage theory. This
includes optimal shrinkage towards the grand mean (Jorion, 1985, 1986), optimal shrinkage
towards the single-factor model (Ledoit, 1999). Also related is a recent paper by Jagannathan
and Ma (2000) who show that imposing weight constraints is actually equivalent to shrinking the
extreme covariance estimates to the average estimates.

We have chosen to favour a best-of-both-worlds approach consisting in imposing endogenous
structure through a principal component analysis that transforms a set of correlated variables
 RETURNS ON K INDEXES Rj) INTO A SET OF ORTHOGONAL VARIABLES, OR IMPLICIT FACTORS, WHICH
reproduces the original information present in the correlation structure. Implicit multi-factor
forecasts of asset return covariance matrix can be further improved by noise dressing techniques
and optimal selection of the relevant number K of factors by applying some explicit results from
the theory of random matrices (Marchenko and Pastur, 1967).

\[ R_j(t) = \sum_{k=1}^{K < K} b_{jk} F_k(t) + \sum_{K < K} b_{jk} F_k(t) = \sum_{k=1}^{K < K} b_{jk} F_k(t) + o_j(t) \]

Some structure is imposed by assuming that the residuals \( \varepsilon_j \) are uncorrelated one to another.

\[ \begin{align*}
    \sigma_{ij} & = \text{cov} (R_j(t_i), R_j(T)) = \sum_{k=1}^{K < K} b_{jk} b_{jk} \sigma_{Fk}^2 \text{ for } i \neq j \\
    \sigma_{ii} & = \text{cov} (R_i(t_i), R_j(T)) = \sum_{k=1}^{K < K} b_{jk} b_{jk} \sigma_{Fk}^2 + \sigma_{i}^2 \text{ for } i = j 
\end{align*} \]

This method involves low specification error (because of the 'let the data talk' type of approach)
and low sampling error (because some structure is imposed).

- **Tactical style allocation**

In the context of tactical style allocation, an investor is faced with a relative optimisation problem,
i.e. maximise the excess return of a portfolio with respect to a benchmark, subject to a tracking
error constraint, where the tracking error is defined as the volatility of the excess return on the
portfolio with respect to the benchmark.

\[ TE = \sqrt{\text{Var} (R_p - R_B)} = \sqrt{w^T \Sigma_{rr} w + b^T \Sigma_{rr} b - 2 w^T \Sigma_{rr} b} \]

where \( R_B \) is the return on the benchmark, \( b \) is the vector of weights of instruments in the
benchmark, \( \Sigma_{rr} \) is the variance-covariance matrix of the assets in the benchmark portfolio, \( R_p \)
is the return on TSA portfolio, \( w \) is the vector of weights of instruments in the TSA portfolio,
and \( \Sigma_{rr} \) is the variance-covariance matrix of the assets in the TSA portfolio. \( \Sigma_{rr} \) is the covariance
matrix between assets in the benchmark and TSA portfolios. When the investor does not have a
specific target on relative risk one may obtain a unique optimal portfolio (which is the equivalent
of the tangent portfolio in an absolute optimisation universe) through the maximisation of the
Information Ratio, i.e. the portfolio excess mean return per unit of relative risk measured through
the tracking error.

\[ \max_{w_1, \ldots, w_9} IR = \frac{E (R_p - R_B)}{\sqrt{\text{Var} (R_p - R_B)}} \]

Expected returns in this program are to be understood as conditional estimates of the expected
returns, based on the information contained in the predictive variable used to forecast index style
returns.
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