Positive Alpha Generation

Designing Sound Investment Processes

Dr. Claude Diderich, CEFA, FRM, NPDP

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Telephone (+44) 1243 779777

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Zurich, Switzerland
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DR CLAUDE DIDERICH, CEFA, FRM, NPDP

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Preface

The foundation for creating sound investment solutions was laid out when Markowitz introduced in 1952 the concept of modern portfolio theory in his seminal paper called 'Portfolio Selection'. The full significance of the relationship between return and risk, and with it the effects of diversification, was articulated. In the following years numerous models of financial markets, like the capital asset pricing model or the arbitrage pricing theory, were developed. A large number of theoretical as well as practical toolboxes have been introduced that directly or indirectly allow the quality of investment solutions to be enhanced.

However, little has been written on combining these investment models into successful investment products and especially customized solutions. In this book I take an engineering approach to portfolio management. I present the different models and toolboxes that have been developed in the past and compare their strengths and weaknesses. I especially focus on the process of combining them in order to build sound investment processes. Both modeling as well as organizational aspects are addressed.

Successful investment managers differentiate themselves along four key dimensions:

- They *deliver the promised performance*, whether relative to a benchmark or absolute.
- They implement an investment process that is *cost efficient in production*, but flexible enough to satisfy the specificities of the investor's needs.
- They offer a *transparent and trustworthy* investment management approach.
- They provide innovation in order to understand and *best satisfy the investor's needs*.

This book shows how an investment manager can provide investment solutions that maximize his or her opportunities along these four dimensions. Delivering the promised investment performance is essentially driven by the investment manager's forecasting skills. I describe techniques that can be used to develop these skills in a consistent manner and combine them to leverage their impact. I strongly believe that cost will become an even more important differentiating factor in the future, especially with the introduction of new pricing models. A very promising approach to achieve cost efficiency, especially when dealing with a large client base, is the value chain approach or a variation of it, such as value nets. The different constituents of an investment process, called modules, are presented throughout this book based on the value chain approach. From an investor's perspective, buying an investment solution or entering into a contractual agreement with an investment manager is accepting a promise into the future. Especially when the investor is not the actual owner of the funds, but only the trustee, it becomes very important that the proposed investment solution is transparent to a degree that the investor is capable and willing to trust it. This can be achieved through three elements, that is a structured investment process that can easily be communicated and understood, a clear definition of roles and responsibilities, and a quality or performance management approach. Finally, innovation can only be achieved if the investor's needs are well understood and translated into investment solutions that can be produced with the available skills.

I describe in this book numerous techniques that can be used to achieve investment management success. They are based on the experience of colleagues and me through designing and implementing numerous investment processes. However, they are only examples and should be considered as such. It is the role of each investment manager to combine and adapt the proposed techniques so that they fit with individual needs and are based on specific skills. My goal with this book is achieved if I have provided readers with ideas that they had not yet thought of or had thought of from a different perspective and that they believe could be relevant, or at least interesting, to adapt and implement in their own environment.

1 Introduction

The success of any actively managed investment solution depends on the investment manager's capabilities to consistently generate positive alpha. An *investment solution* represents an actively managed portfolio maximizing the investor's utility function. It has a medium to long term investment horizon[1] and differentiates itself from a short term oriented trading strategy. In this book I define *alpha* as the total return of an investment solution that can be attributed to the *skills* of the investment manager. During the lifetime of an investment solution, that is the investment horizon, the investment manager takes so-called *investment decisions*. These decisions are then transferred into the portfolio such as to generate positive alpha. I call this process the *investment process* associated with the investment solution. The existence of an investment process is a necessary condition for generating consistently positive alpha. It allows the separation of skills from luck.

Defining a successful investment process is not an easy task. It requires the combination of various distinct skill sets. First, the investor's needs have to be understood and translated into the investment process's framework. Second, markets have to be forecasted, that is successful investment decisions generated. Third, portfolio management skills are required to transfer or implement the investment decisions along with the investor's needs into the portfolios. Finally, engineering and project management skills are necessary to build the investment process end to end.

There exist many approaches for developing sound investment processes. The goal of this book is to present a set of methods and building blocks aiming at engineering successful investment processes. I present different theoretical concepts and illustrate how they can be applied. Theory is used as a means to an end, that is as a foundation on which a practical investment process is built.

1.1 CHARACTERISTICS OF A SUCCESSFUL INVESTMENT PROCESS

From the perspective of an investor, an investment process is successful if it maximizes the utility function. Most of the time this means maximizing the realized alpha or the risk adjusted realized alpha. Other approaches are based on probabilistic definitions of success (Rabin, 2000; Samuelson, 1963; Stutzer, 2003, 2004).

In order to achieve this goal, a sound investment process must be designed around four key dimensions:

- *Investor needs.* The investment process must be designed in such a way that the resulting investment solution satisfies the investor's needs and expectations, especially maximizing the utility function.

[1] Usually the time horizon is at least one year, more often three to five years or longer.

- *Investment decision skills.* The investment process must be built around a set of investment decision skills. It is only through superior skills, especially in forecasting market returns, that positive alpha can be generated.
- *Transfer mechanism.* The best forecasts are useless if they cannot be transferred into a portfolio. The transfer mechanism should aim at minimizing information loss, that is translate the investment decision skills as precisely as possible into the portfolios.
- *Consistency.* To provide consistently positive alpha, the investment process must allow for a seamless execution. It must help separate skills from pure luck.

High performance along these four dimensions is ultimately the basis for success. Nevertheless, a process is only as good as the people executing it, that is

$$\text{success} = \text{process} + \text{people}$$

1.2 CHALLENGES TO BE SOLVED

Developing a successful investment process is hard and time consuming. This is especially true as the outcome cannot be directly tested for success. Only time can tell if an investment process is really successful. The two exogenous factors:

(i) investor needs and
(ii) investment decision skills

play a key part in the success. An investment process only provides a platform for the deployment of these needs and skills.

Some of the key challenges found during the development and introduction of a new or the refinement of an existing investment process are:

- *Matching investor needs with investment decision skills.* An investor may need a solution investing in BRIC[2] countries, but the existing investment strategists do not have any skills in forecasting these markets. Can these skills be built or bought?
- *Degree of sophistication.* Any investment process is based on one or more underlying theories or models, like, for example, the capital asset pricing model (CAPM) (Sharpe, 1964). Depending on the investor's sophistication and the investment professional's skills, more or less sophisticated theoretical concepts, models and qualitative techniques can and should be applied.
- *Process flexibility.* On the one hand, a very detailed investment process allows for an efficient and flawless execution as each and every step is clearly defined and documented. On the other hand, allowing for flexibility makes it easier to incorporate unforeseen stages and decisions. A reasonable trade-off must be found.
- *Change management.* The most difficult challenge, when introducing a new investment process, is the people aspect. The reasoning leading to a new or changed investment process must be described. Advantages on an individual basis have to be presented and put along with the associated changes. Changes have to be communicated internally and to existing investors affected. An overview of change management techniques can be found in Holmes and Devane (1999).

[2] Brazil, Russia, India and China.

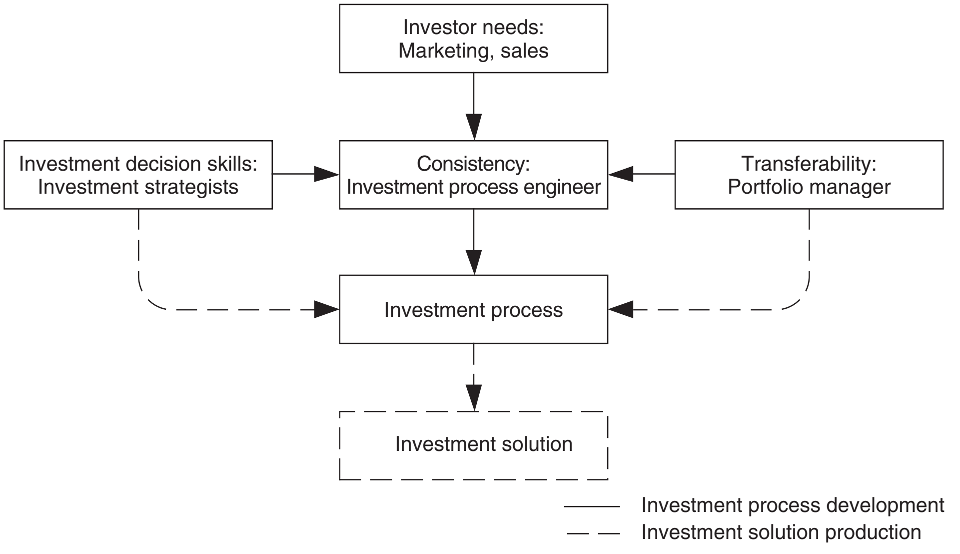

FIGURE 1.1 Interaction between different skills and capabilities during the design of a sound investment process

Figure 1.1 summarizes the four key dimensions on which a sound investment process and ultimately successful investment solutions are designed.

1.3 APPROACH TAKEN IN THIS BOOK

A three step approach is taken in this book. First, the theoretical foundations of each concept are presented. Then, how the theory and models can be used or adapted in practice is shown. Finally, the different concepts are illustrated with real world examples. To avoid unfulfilled expectations, I would like to stress that this book is about the design of the investment process underlying an investment solution and not about developing the required investment decision skills that are required to generate positive alpha. The investment decision skills represent the core capabilities and competitive advantage of each individual investment manager. The interested reader may find insights into building alpha generating skills in Campbell *et al*. (1997), Cochrane (2005), Darst (2007), Edwards *et al*. (2007), Grinold and Kahn (2000) and Ingersoll (1987), to name just a few.

A simplified version of the standardized business process modeling notation (Object Management Group, 2006) to describe different process stages is used. A complete set of modules that need to be developed when designing a sound investment process is described. The methods presented are structured such that they can be applied directly. I believe that structured design methods are valuable for three reasons:

- First, they make the design process *explicit and transparent*, allowing the design rationale to be understood.
- Second, by acting as a *checklist* of the key steps, they ensure that important issues are not forgotten.
- Third, structured approaches are usually *self-documenting*.

Although the methods presented are highly structured, they are not intended to be applied blindly. Each investment process must adapt the presented methods to the specified investor, that is investment solution needs and the available skills.

Throughout this book, I use different examples to illustrate different methods and concepts. These example are based on existing or fictious investment processes and are adjusted or simplified. They are not intended to be historically accurate case studies.

1.4 STRUCTURE OF THE BOOK

I have structured the book along the different stages of the value chain underlying any investment solution. Each chapter focuses on a different topic and is as such independent. Nevertheless, it is only the interaction between the different modules, that is chapters, that expresses the full complexity of designing sound investment processes. Figure 1.2 shows which characteristics of a successful investment process are covered by each chapter:

- Part I focuses on the *concepts* on which any investment process should be based. Chapter 2 presents the key success factors for generating positive alpha. The risk–return framework used throughout this book is described. Chapter 3 defines the value chain of an investment process and describes it from both a process and an organizational point of view.
- Part II concentrates on *forecasting market returns*. In Chapter 4 the theory and practice for designing qualitative forecasting processes is illustrated. Chapter 5 presents an overview of traditional and nontraditional quantitative forecasting techniques. Chapter 6 is devoted to taking investment decisions through combining information and forecasts.
- Part III defines the *risk measurement and management* frameworks used. Chapter 7 focuses on modeling risk. Chapter 8 describes in detail the notions of volatility and tracking error as the most used risk measures and shows how to forecast or estimate their parameters. Chapter 9 is devoted to surveying other risk measures that are useful within the context of providing investment solutions.
- In Part IV of the book the focus is on models *translating forecasts into portfolios*. Chapter 10 describes classical mean-variance based portfolio construction models. Chapter 11 presents static factor based models whereas Chapter 12 focuses on dynamic, multiperiod models, which are especially relevant in an asset liability management context.
- Part V focuses on key issues that have to be addressed at the *portfolio implementation* level. Chapter 13 concentrates on market liquidity issues and transaction costs whereas Chapter 14 shows how to use derivatives in the context of an investment process.
- Part VI is devoted to providing *investment solutions*. Different types of products and solutions are described. Chapter 15 focuses on traditional benchmark oriented solutions whereas Chapter 16 illustrates the development of absolute positive return investment solutions. Chapter 17 shows how to develop capital protection and preservation approaches and combine them with benchmark or absolute positive return oriented solutions. Chapter 18 shows the similarities and dissimilarities between hedge funds and so-called traditional or long-only investment solutions. Chapter 19 focuses on liability driven investing.
- Finally, Part VII focuses on *quality management*. In Chapter 20 different approaches to performance measurement are presented. Their use as an integral part of an investment process is illustrated.

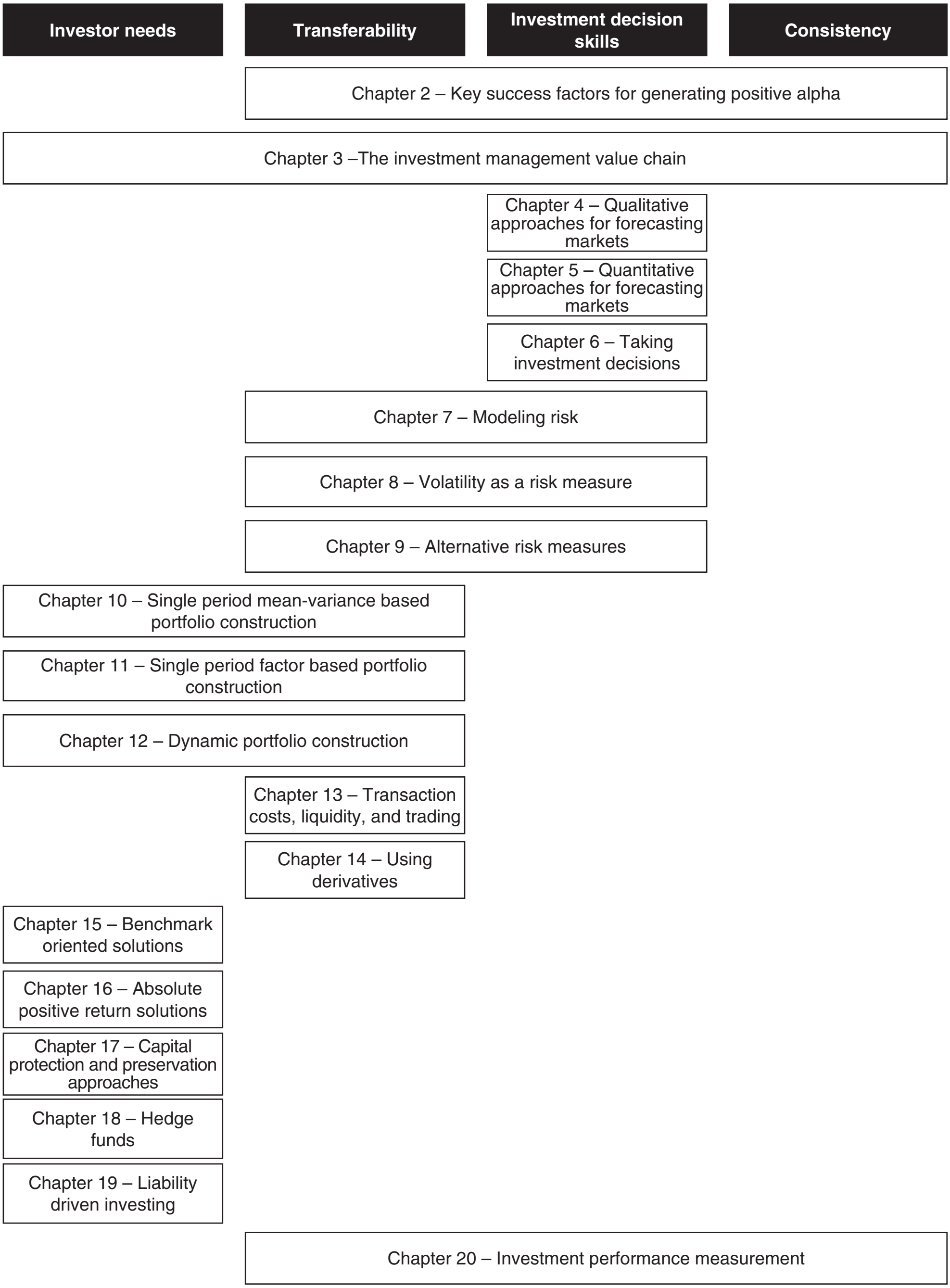

FIGURE 1.2 Mapping of the different chapters on to the four key dimensions of a successful investment process

Table 1.1 Typographical conventions used

Convention	Description
$\mathbf{v}$	Vector, represented by a bold lowercase letter
$\mathbf{M}$	Matrix, represented by a bold uppercase letter
x_a, $y_{a,b}$	Element of the vector $\mathbf{x}$, respectively the matrix $\mathbf{Y}$, represented by a lowercase indexed letter
$\mathfrak{R}$	Random variable, represented by a calligraphic letter
$\hat{p}$	Estimated value of a parameter, denoted by a hat

Table 1.2 Commonly used functions

Function	Description
$\overline{\mathbf{v}}$	Arithmetic mean of the elements of vector $\mathbf{v}$, that is $\frac{1}{N} \cdot \sum_{i=1}^{N} v_i$
$\mathbf{v}'$, $\mathbf{M}'$	Transpose of vector $\mathbf{v}$, respectively matrix $\mathbf{M}$
$\mathbf{M}^{-1}$	Inverse of matrix $\mathbf{M}$
$\|\mathbf{M}\|_f$	Frobenius norm, that is $\sqrt{\sum_i \sum_j (m_{i,j})^2}$
diag($\mathbf{M}$)	Matrix containing the diagonal elements of matrix $\mathbf{M}$
trace($\mathbf{M}$)	Trace of matrix $\mathbf{M}$, that is $\sum_i m_{i,i}$
$E[\mathfrak{R}]$, $E_t[\mathfrak{R}]$	Expected value of the random variable $\mathfrak{R}$, respectively expected value of the random variable $\mathfrak{R}$ conditioned on all information available at time t
$O(f(\mathbf{v}))$	Big O representing the upper bound of magnitude of the function $f(\mathbf{v})$ (Knuth, 1976)
$N(\mu, \sigma)$	Normal distribution with mean μ and variance σ
$\mathfrak{R} \sim N(\mu, \sigma)$	Random variable $\mathfrak{R}$ following a normal distribution with mean μ and variance σ

Table 1.3 Constants, parameters and variables

Convention	Description
$\mathfrak{A}$	Set of all considered assets or asset classes
A	Number of assets or asset classes
T	Number of time periods
h	Time horizon between two time periods
H	Investment horizon
K	Number of factors in a linear factor model
C	Constant
$R_{a,t}$, R_t	Discrete total return of asset a or a portfolio between time $t-1$ and t
$r_{a,t}$, r_t	Log-return or continuous compounded return of asset a or a portfolio between time $t-1$ and t
$E_{b-a,t}$, $e_{b-a,t}$	Excess return between asset a and asset b between time $t-1$ and t, that is $E_{b-a,t} = R_{b,t} - R_{a,t}$, respectively $e_{b-a,t} = r_{b,t} - r_{a,t}$
$R_{F,t}$	Risk free rate at time t
$R_{M,t}$	Return of the market portfolio between time $t-1$ and t

Table 1.3 (*continued*)

Convention	Description
$R_{B,t}$	Return of a given benchmark portfolio between time $t-1$ and t
$\beta_{f,a}$	Exposure of asset a to factor component f
R_f	Return of factor component f
F_f	Sensitivity of factor component f
$\mathbf{d}$, $\mathbf{D}$	Vector, matrix of data
$\mathbf{\Sigma}$	Covariance matrix
$\sigma_{a,b}$	Covariance between assets a and b
$\rho_{a,b}$	Correlation between assets a and b
σ_a, σ	Volatility of asset a or portfolio
$\tau_{P,B}$, τ	Tracking error of portfolio versus benchmark
$\mathbf{w}$	Portfolio weights
μ_a	Expected return of asset a

1.5 NOTATION

To simplify the description of the models, algorithms, formulas and properties, a common notation is used throughout the book. I rely on frequently used typographical conventions for defining constants, vectors, matrices, as well as random variables, described in Table 1.1. Table 1.2 lists the most common functions used, such as the transpose, norm or the expected value. As most quantitative descriptions are related to assets, their returns over time, their decomposition, as well as their volatilities, a specific notation is introduced, described in Table 1.3.

Part I

The Value Chain of Active Investment Management

2
Key Success Factors for Generating Positive Alpha

When designing an investment process, the key goal is to define the most adequate process for the target investment solution or product satisfying the investor's needs. There does not exist a single investment process that fits all investment solutions, but there are three key requirements that any investment process must fulfill in order to be successful. These are the existence of investment opportunities, forecasting skills and a transfer mechanism.

Let me first define some terminology. An *asset* is a financial instrument (physical or contractual) that can be bought or sold in reasonable volume, within a reasonable time frame and at a reasonable price. I define an *asset class* as a collection of assets with similar properties, like stocks, bonds, but also property, currency forward contracts or total return swaps. A *portfolio* is defined as a collection of asset classes or assets combined or weighted according to a specified scheme. The scheme defines the assets belonging to the portfolio as well as their relative weights in the portfolio. A German equity portfolio could be composed of 20 companies from the DAX index equally weighted, each taking up 5 %. A key functionality of each investment process is to construct portfolios, that is to define schemes on how assets should be combined to generate positive alpha. I call *benchmark* a specific portfolio that is used as an input to an investment process. I assume that it is possible to invest in the assets of the benchmark, that is to replicate exactly the benchmark with a portfolio. For example, a benchmark could be defined as 43 % aluminum, 43 % copper, 7 % nickel and 7 % silver, the strategic metals[1] contained in the Reuters/Jefferies CRB index. A special case of a benchmark portfolio is the *market portfolio*, that is all existing tradable securities weighted proportionally to their total value. The market portfolio represents an equilibrium, that is an idealized situation where all market forces are perfectly in balance.

2.1 KEY SUCCESS FACTORS

Many different approaches exist for systematically generating positive alpha. All successfull approaches have three properties in common:

- They are based on a well defined set of *investment opportunities*.
- They show *forecasting skills* or capabilities matched to investment opportunities.
- They include a methodology that translates the expressed skills on investment opportunities into portfolios, that is a sound *transfer mechanism*.

Although the forecasting skills form the core of active management, they are not sufficient. If the opportunity set is not well defined, opportunities may be missed and the opportunity

[1] Strategic metals are metals that are judged essential for defense and for which the US is almost totally dependent upon foreign sources (Sinclair and Parker, 1983).

costs paid may by far outweigh the value added. Consider an investment universe aiming at generating alpha through investing in strategic metals. It is not clear whether the investment manager, for example, is allowed to hold any gold or not, as gold is not considered a strategic metal. In addition, the best forecasting skills are worthless if they cannot be transferred into actual value. For example, correctly forecasting the number of rain days in the city of London is only relevant if a reward for that forecast exists.[2] Let me now elaborate in more detail on the three key success factors: (i) investment opportunities, (ii) forecasting skills and (iii) transfer mechanisms.

2.1.1 Investment opportunities

The investment opportunities available to an investment manager are defined by:

(i) an *investment universe* and
(ii) a *decomposition* of the investment universe into asset classes or assets.

The fundamental law of active management states that the expected alpha of a portfolio is, under certain assumptions, proportional to the square root of the number of available investment opportunities (Grinold, 1989). Therefore, having a large number of assets defined increases the opportunities for generating high alpha.

If the individual assets are actual securities, I talk about a *security selection approach*. For example, the investment universe may be the universe of stocks in the S&P 500 index and the assets the individual stocks. If the assets are a combination of homogeneous securities, I talk about an *asset allocation approach*. For example, consider all developed equity markets as defined by the index MSCI world as the investment universe and consider Europe excluding the UK, UK, North America, Japan, Asia excluding Japan and Australia/New Zealand as asset classes. This forms a possible set of investment opportunities using the asset allocation approach. A different subdivision of the same universe would be to define sectors, like utilities, financial services, etc., as asset classes. If the asset classes are characterized by a set of exogenous properties, I talk about a *factor model approach*. For example, the investment universe defined by all UK government bonds and the asset classes by buckets of modified durations, modified duration being the exogenous factor, represents a factor model approach. Many of the investment opportunities used by hedge funds, such as, for example, arbitrage strategies, are based on the factor model approach. A *style based approach* subdivides the investment universe according to specific characteristics of the securities, for example between growth and value stocks, large capitalized and small capitalized stocks. Style based approaches are special cases of factor models where the characteristic defining the style corresponds to the factor of a factor model. In the definition of value and growth used for determining the constituents of the two indices Russell 1000 value and Russell 1000 growth the price-to-book ratio is used as the factor. Finally, if the asset classes are characterized by an individual, a team or a company managing the asset class, I talk about a *manager selection approach*. Most prominent candidates of this approach are funds of fund based investment

[2] There actually exists such a weather derivative financial market. According to the Weather Risk Management Association, the total trade volume of weather contracts was about $45.2 billions of notional in 2005/2006.

products. The investment opportunities of all these approaches have three properties in common:

(1) *Homogeneity.* The securities forming a given asset class are homogeneous with respect to their expected return and their properties on which the skills or forecasts are based. For example, in an asset allocation approach on equity regions or countries, US securities exhibit similar expected return characteristics, for example, when compared to Japanese equities.
(2) *Distinguishable.* The asset classes exhibit times of significant relative differences in expected return and properties on which the skills or forecasts are based. In an asset allocation based approach, expected returns between US and Japanese equities are potentially significantly different due to the difference in the underlying economy.
(3) *Mutually exclusive.* Individual securities belong to exactly one asset class. A security is classified either as a US based or a Japanese based company. Mutual exclusion is needed to avoid redundancies.

A well defined investment universe is ideally constructed of a large number of asset classes. The returns of the asset classes should exhibit low correlations and thus allow a large number of independent forecasts to be expressed, which, by the fundamental law of active management, as I will show in the last section of this chapter, is beneficial to the overall portfolio performance.

2.1.2 Forecasting skills

The second important success factor is the ability to formulate forecasts on the opportunity set. I define forecasting as the act of expressing an expectation regarding the total return of one or more asset classes. This expectation is for a specific explicitly or implicitly defined time horizon. Grinold and Kahn (2000) wrote in their seminal work that 'active management is forecasting. The consensus forecast of expected returns, efficiently implemented, leads to the market or benchmark portfolio. Active managers earn their title by investing in portfolios that differ from their benchmark. As long as they claim to be efficiently investing based on their information, they are at least implicitly forecasting expected returns.' It is important to have systematic forecasting capabilities on the defined opportunity set. Otherwise expressed, the opportunity set must be matched to the available forecasting skills. It is useless to define, for example, the investment universe in a selection based approach as all Icelandic stocks, if no research capabilities exist about Iceland and its companies.

Many different approaches exist for forecasting. The most common approach, but also one of the most difficult ones, is forecasting expected total returns for the individual asset classes. Another approach is to rank the different assets according to their expected returns. Even combining asset classes into a portfolio is a way of forecasting as the relative weight of each asset class expresses a relative preference or expectations. The forecasting methodology should be selected such that the forecasting skills are maximized. The citation from Albert Einstein 'make it as simple as possible, but not simpler' should be applied. There is no need to add complexity to the forecasting process if it cannot systematically improve the forecasting skills.

A forecasting methodology exhibiting the investment manager's skills needs to adhere to three basic principles:

- Each forecast must be quantifiable.
- Forecasts must be consistent among each other.
- All forecasts must be over an explicitly or implicitly defined time horizon.

2.1.3 Transferability

The third success factor for generating positive alpha is the ability to transfer the forecasts on the opportunity set into portfolios. The transfer mechanism must ensure that the performance of the constructed portfolio is consistent with the forecasts and their timing. It must especially be defined such that for all portfolios to be constructed:

- each individual investor's utility function, that is the tradeoff between risk and return, is maximized,
- any general and specific requirements and restrictions are taken into account and
- all portfolios are constructed fairly, that is no single portfolio is preferred.

Usually maximizing the investor's utility function translates into maximizing the expected return of the portfolio, given the forecasts, such that a certain risk tolerance is not exceeded and all specific requirements and restrictions are met. In addition, market liquidity or other exogenous restrictions may influence the resulting portfolios. It goes without saying that if a given position cannot be implemented in one portfolio because of exogenous restrictions, like for example market liquidity, it must not be implemented in any portfolio in order to assure that all portfolios are treated fairly and no single investor is preferred over others.

2.1.4 A comprehensive example

First, I define my investment opportunity set by using as the investment universe the 19 commodities contained in the Reuters/Jefferies CRB index (CRB index). These are aluminum, cocoa, coffee, copper, corn, cotton, crude oil, gold, heating oil, lean hogs, live cattle, natural gas, nickel, orange juice, silver, soybeans, sugar, unleaded gas and wheat. I implement an asset allocation approach and subdivide the investment universe into the six asset classes of grains, industrial metals, soft commodities, precious metals, energy and livestock. It can be shown that the six asset classes satisfy the properties of homogeneity, distinguishability and mutual exclusiveness.

Then, I define the forecasting skills as ranking the different asset classes in decreasing order of their expected return, with a time horizon of the date where the future with the shortest time to expiration on the CRB index expires. Usually the time horizon is three months, the time between the expiration dates of two futures. To actually come up with the proposed ranking I use analysis of supply and demand of the individual commodities and aggregate that information for each of the asset classes.

Finally, I use a simple transfer mechanism that states to over- and underweight the different asset classes by 5 % for the best and worst asset classes and by 3 % for the second best and second worst asset classes. No relative weights are attributed to the asset classes

Table 2.1 Ranking of the different asset classes, absolute and relative weight in a sample commodity universe asset allocation based investment process

Asset class	Ranking	Initial weight (%)	New weight (%)	Relative weight (%)
Grains	4	13	13	±0
Industrial metals	3	13	13	±0
Soft commodities	5	21	18	−3
Precious metals	2	7	10	+3
Energy	1	39	44	+5
Livestock	6	7	2	−5

Source: Reuters/Jefferies CRB index, author's calculations.

ranked third or fourth. I assume that the portfolio from which I over- and underweight the commodities is initially weighted according to the weighting of the CRB index at the beginning of the month. The relative weight determined for each asset class is then distributed proportionally according to the initial weights on all the securities of that asset class. Table 2.1 shows the resulting asset allocation. This transfer mechanism allows a consistent transfer of the forecasts into the portfolio. Risk is controlled through maximal possible relative weights. In addition, by construction, no single commodity position in the portfolio can become negative.

2.2 DECOMPOSING RETURN

Up to now, I have described the key characteristics of a successful investment process to generate positive alpha. However, I have actually not yet given a formal definition of what I understand by *positive alpha*.

I denote by $R_{P,t+1}$ the total return of a portfolio P between time t and $t+1$. If the time horizon is obvious the notation is simplified to R_P. Assume an exogenously defined benchmark portfolio B, that is whose definition is independent of the underlying investment process. Denote by R_B the return of the benchmark portfolio. Furthermore, assume that R_F is the risk free rate, that is the return that is achievable without bearing any risk of loss. Usually this return is approximated by the LIBOR[3] or similar rates. Then the return of any portfolio P can be decomposed into three components, as shown by

$$R_P = \underbrace{R_F}_{\text{risk free rate}} + \underbrace{(R_B - R_F)}_{\text{risk reward return}} + \underbrace{\alpha}_{\text{skill based return}} \tag{2.1}$$

I define by $R_B - R_F$ the *risk reward return* of the portfolio P. It is the excess return over the risk free rate that is due to the selection of the benchmark B and can be interpreted as the risk premium the market pays to an investor for holding a specific portfolio B. The return α is called the residual return, *alpha return*, or skill return. It is the portion of the return of the portfolio that can be attributed to the investment manager's skills. It is specific to the portfolio P. Active management is the process, some call it art, to construct portfolios

[3] London Interbank Offered Rate – interest rate at which banks lend and borrow funds among themselves.

such that, over the specified time period, the realized alpha is positive. Equation (2.1) can be interpreted in an ex-ante, which is a forward looking context, as well as an ex-post, which is a backward looking context. In an ex-ante context, the alpha is the forecasted residual return over a specified period. It represents the expected excess return due to the investment decisions taken. In an ex-post context, it is the realized residual return, positive or negative, due to the investment manager's skills.

2.2.1 Timing versus selection

Some authors decompose the portfolio return R_P as $R_P = R_F + \beta \cdot (R_B - R_F) + \alpha$. This decomposition can be interpreted as the result of a regression of the portfolio return on the benchmark's excess return; β is called the *market timing return* coefficient and α the *selection return*. However, as both α and β are due to active investment decisions taken, there is no need to distinguish between them when extracting the return portion that is attributable to skill. Indeed, I can write

$$R_P = R_F + \beta \cdot (R_B - R_F) + \alpha = R_F + (R_B - R_F) + \underbrace{\alpha - (1-\beta) \cdot R_B + (1-\beta) \cdot R_F}_{\alpha'}$$

where the portfolio is underweight in the benchmark by $1 - \beta$ and overweight in the risk free asset by the same quantity. Combining these over- and underweights with the selection return defines the α' due to skills.

2.2.2 Benchmarks

Up to now, I have assumed that the benchmark is given. As the benchmark, per definition, is a portfolio, its return can also be decomposed according to Equation (2.1). Assume that, for the definition of a benchmark, the used benchmark is the risk free rate. Then equation (2.1) can be written as

$$R_B = R_F + \alpha \tag{2.2}$$

where α represents the return due to the skill of selecting the benchmark. What is important to understand is that the subdivision of return into a risk–reward part and a skill part according to equation (2.1) depends on the context of the decisions taken. At the end, any return in excess of the risk free rate is due to some sort of skill, whether it is through selecting a benchmark portfolio or through under- and overweighting specific asset classes. I consider the process of constructing or defining a benchmark portfolio as a specific investment process. An opportunity set must be selected. The benchmark constituents are selected out of this opportunity set. The transfer mechanism associates weights to the selected constituents and assures the investability of the benchmark portfolio. For example, selecting the Dow Jones Euro STOXX 50 index or the MSCI EMU index as a benchmark for a Euroland equity investment solution is an active decision and has an impact on the absolute performance of the portfolio managed against it. Usually the time horizon for the forecasts underlying the benchmark selection is different and much longer than for the alpha generating forecasts. In traditional benchmark oriented investment solutions $R_B \gg \alpha$ and $R_B \gg R_F$, where $\gg$ means very superior, as defined in equation (2.1). Therefore the selection of the benchmark