PORTFOLIO MANAGEMENT

INVESTMENT STRATEGIES

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1. Investment policy

An **investment policy** can be defined as a set of guidelines that identifies the action to be taken in order to satisfy an investor's objectives while complying with imposed constraints. The investment policy provides the necessary discipline to the investment process and reduces the possibility of inappropriate decisions. The investor's *investment objectives* are typically defined in terms of return requirements and risk tolerance. The *investment constrains* are different limitations, such as time horizon, liquidity, regulatory and legal matters, taxes, etc. Constraints can also be self-imposed by the investor.

Note that before one can begin investing several other needs must be satisfied. Cost of living and a minimal safety net for unexpected needs should be covered by an adequate income before one starts an investment program.

In order to come up with an adequate investment policy the financial advisor must investigate each investor's unique situation carefully. However, broad categorizations of investors can be identified, allowing for the definition of general investment strategies.

We will see that many portfolio investment considerations are qualitative, but all lead to a quantification of risk and return and ultimately to the development of an efficient portfolio satisfying the investor's needs.

We will also see in the following sections that there are noticeable differences between individual and institutional investors, be it in terms of risk perception, the way they can be categorized, the imposed constraints, etc. This is the reason why we will treat individual and institutional investors in different sections.

1.1 Individual investors

1.1.1 Investment objectives

To make the asset allocation decision, the average investor will seek advice from a financial advisor. The latter in turn will need to gather a lot of information about the investor's financial, fiscal, professional and personal situation to be able to provide any relevant advice. Because of its impact on performance, this phase in the investment process is definitely one where the financial advisor can add value.

Remember that performance does not only mean return, but also risk, so the advisor will have to assess the client's situation taking both aspects into consideration. This process requires both financial knowledge and psychological skills to determine what the optimal investment policy for any particular client is.

1.1.1.1 Assessing the investor's situation

To assess the investor's situation, the financial advisor will need to establish an on-going dialogue with his client. During interviews, lunches or other activities where the investor and the advisor are in contact, opportunities to discover new information will arise. The client's situation is not set once for ever, but evolves. Therefore, the relationship between investor and advisor should be viewed in a long-term perspective and the client’s situation should be analysed and appropriate actions taken at regular intervals.

There are various obstacles in exploring the investor's situation. One of them is that the client is not able to or does not want to provide all the information that could be useful for the asset allocation decision. For example, a client might have some wealth deposited somewhere else about which he does not want to let the advisor know or for offshore clients, the concentration of contacts during visiting trips might also limit the time the advisor spends with each client, requiring that he focuses on the essential elements while together.

The consequence of this is a state of incomplete information, based on which an important decision for the investor has to be made. Experience and interview skills can help the advisor to find out significant additional information, in particular for later adjustments of the investment strategy. However, the systematic preparation of the client visits is a key element for successful financial advice.

The initial stage of the investment process often does not receive all the care it should, which in turn can lead to disastrous results. The assessment of the client's actual and expected situation as well as the constraints he is subject to allows the advisor to help the client specify what his objectives really are. The advisor's knowledge of the financial markets' properties (before tax return and risk, taxation of capital gain and revenues of the various instruments, etc.) allows him to come up with an investment policy that matches the client's objectives in an optimal way.

In this chapter, we will focus exclusively on the assessment of the investor's financial situation. We will not address the exploration and analysis of the investor's fiscal situation, nor will we address the interview skills to establish preferences or utility, considering the professional and personal situation. However, we will briefly sketch various ways to approach this issue.

1.1.1.2 Asset and liability analysis

At an early stage of the relationship, the advisor needs to find out what the client's assets and liabilities are. This can be done in the form of a balance sheet with all assets on one side and the liabilities on the other. Every type of financial and real asset (property, equities, bonds, bank-insurance and pension products, human capital, etc.) as well as every type of liability (mortgage, debt, etc.) should be included[1]. This set-up allows the advisor to get a complete picture of the client's situation. Human capital and, in general, tax-advantaged pension products cannot be realised for financial investment. Therefore, they are often not presented.

Assets	Liabilities
Property	Mortgage
Securities and Commodities	Debt
Bank-insurance and pension products	Other liabilities
Human capital	Net Worth

Table 1-1: Assets and liabilities of an individual investor

The concept of human capital is briefly introduced in section 1.1.1.3 below. Introducing human capital in the balance sheet implies introducing the related liabilities, i.e. the present value of every future expense. This is addressed in section 1.1.1.5 below.

Although the valuation of the assets is not obvious for property, bankinsurance and pension products or human capital, conservative estimates should be used to get a reasonable picture. At the bottom line, the maximisation of the net worth is what should be focused upon with respect to value, cash flow, liquidity and taxation.

Property valuation is treated in a separate module. Let us just note at this stage that the development of hedonic pricing model allows analysing historical real estate performance in the same way as equities, bonds or other assets priced at market value. This means that real estate can be treated in the asset allocation decision with the same systematic portfolio approach as other traded assets. However, the liquidity issue is likely to remain critical for property.

Pension plan and bank-insurance products are evaluated using actuarial calculus. This subject is treated in a separate module. In the asset and liability analysis, the future pension payments should be accounted for at their present value.

1.1.1.3 Human capital

Human capital represents the investor's capacity to generate income by working. It can be seen as the sum of the discounted future income. A realistic scenario for the progression of the nominal income according to the professional situation of the investor needs to be established. The uncertainty about the scenario is taken into account by adjusting the discount rate.

Obviously, if one looks at the total income to assess human capital, one must in a similar way assess the liabilities as the sum of the discounted future expenses. Note that the uncertainty and therefore the discount rate are expected to be lower for expenses than for income.

1 There are alternative methods to represent a client's financial situation involving a balance sheet and a profit and loss statement.

Example[2]

Let us assume an annual income of CHF 70'000 at the age of 25 and a yearly nominal increase made of 2.5% inflation and 0.5% real increase in income within a class of activity. Until 37, the investor changes every three years for a higher class, which leads each time to a nominal increase of 20%. Afterwards, he gets two other jumps at the age of 42 and 47. The following table presents the nominal income at various ages:

Age	25	30	35	40	45	50	55	60	65	66
Income in 1000	70	95	149	201	271	367	425	483	533	0

Table 1-2: Nominal income in thousand CHF for a nominal growth rate of 5.4% p.a.

The scenario should be realistic for the client. One could stop or change the progression of the salary at any stage. The discount rate is set at its maximum value at the age of 25, when the uncertainty about the future career and thus future income is at its maximum. Afterwards, the discount rate is lowered asymptotically to a final value. The sum of all discounted future annual salaries is the human capital. See Figure 1-1.

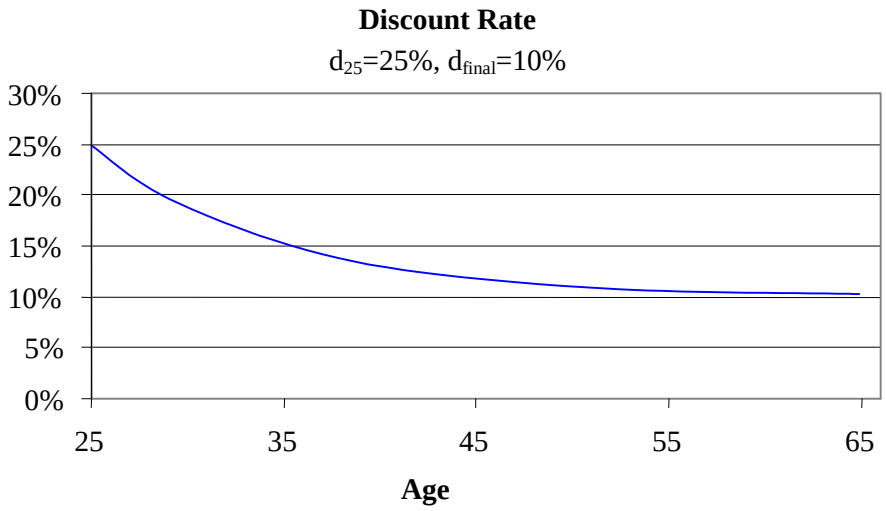

Figure 1-1: Discount rate decreasing asymptotically from 25% to 10%

The human capital, calculated using the above scenario's income and discount rate, is presented in Figure 1-2 below. We can see that although at the age of 25 the sum of all the nominal future salaries is the highest, the high uncertainty and thus the high discount rate reduces the value to CHF 1'092'000. It increases to reach its maximum of CHF 2'986'000 at the age of 49 to fall down to 0 when he retires.

2 See for example K. Spremann, S. Winhart, "Humankapital im Portefeuille privater Investoren", Zeitschrift für Betriebswirtschaft, Gabler (1997)

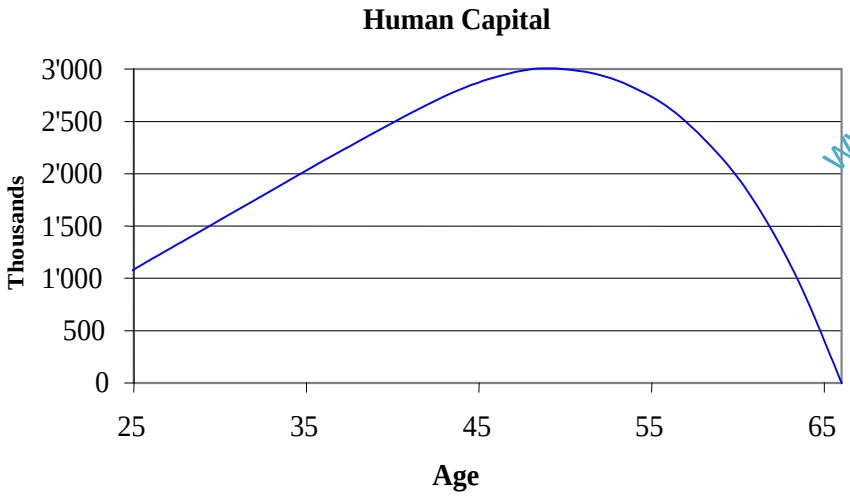

Figure 1-2: Human capital of an individual based on the evolution defined in Table 1-2.

Human capital cannot be realised. However, it definitely plays a significant role in the asset allocation decision, and in a limited way, human capital can be managed by decisions affecting both investments in human capital and flexibility in professional activities. On one hand, each individual can invest in his own human capital through new or continuing training programs. The required additional work and efforts can be seen as investments. On the other hand, uncertainty about future income can be reduced provided that the individual can show more flexibility with respect to professional activities. Reducing the uncertainty reduces the discount rate and therefore increases the human capital.

1.1.1.4 Financial capital and total capital

One can assume that a certain percentage of the annual income, the surplus, is used for savings. An inheritance would also be a contribution to savings. The accumulated savings represent the **financial capital**. The savings can be invested in various forms of assets to generate financial income. In the following examples, the income figures presented in Table 1-2 are used. It is assumed that the return on the savings is 4% p.a. and three scenarios are discussed: In the first one, the client starts with no savings at the age of 25 and receives no inheritance at all. In the second one, the client starts with no savings at the age of 25 and inherits 2 million at the age of 45. In the third scenario, the client starts at the age of 25 with a financial capital of 2 million.

Adding the human and the financial capital leads to **total capital** or total assets. For the sake of simplicity, we do not distinguish at this stage between asset classes, and pension savings are included in the financial capital. After retirement, the only source of income is therefore financial revenues.

$$\text{Total Assets} = \text{Human Capital} + \text{Savings}$$

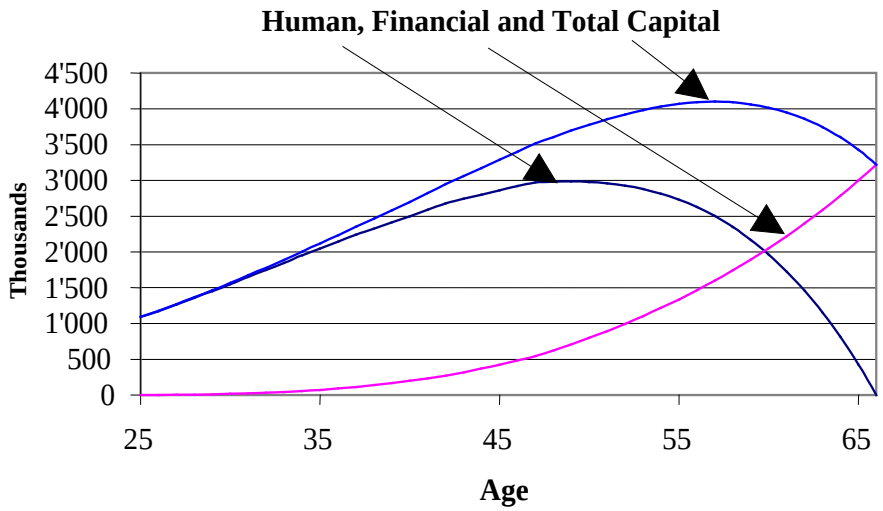

Figure 1-3: The client starts with no savings at the age of 25 and receives no heritage

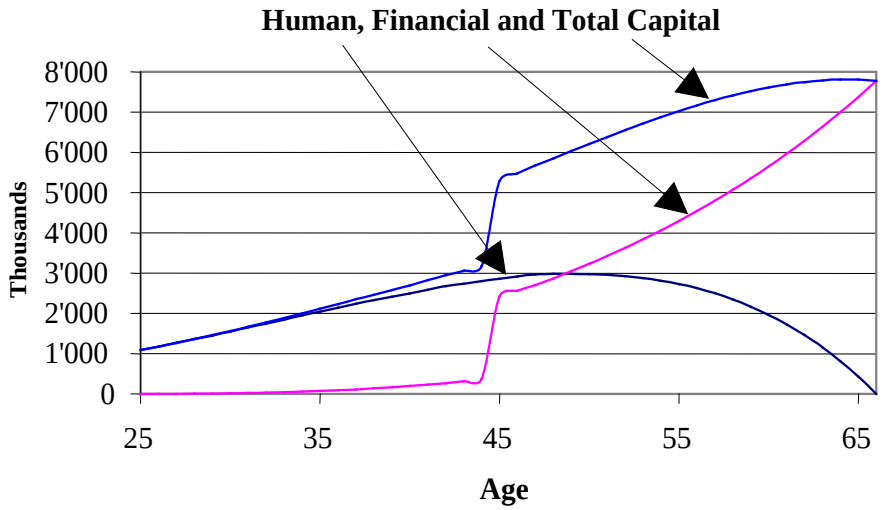

Figure 1-4: The client starts with no savings at the age of 25 and inherits 2 million at the age of 45

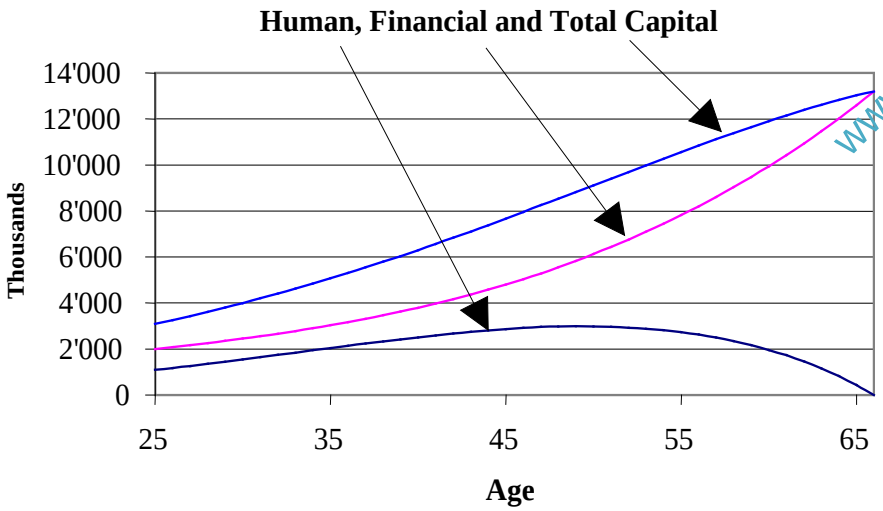

Figure 1-5: The client starts at the age of 25 with a financial capital of 2 millions

1.1.1.5 Liabilities

If we look at the balance sheet-type break-up presented in Table 1-1, we clearly want to separate the assets on one side and the liabilities, i.e. the method by which the assets are financed, on the other side. Next to a mortgage or to a specific debt, one also finds the other liabilities. As a counterpart to the human capital, these liabilities include every future expense discounted with an uncertainty-adjusted discount rate. So why can they not be netted off on a monthly, quarterly, semi-annual or annual basis? One reason is that it is easier to estimate both asset and liability scenarios individually. Another, more technical, reason is that the uncertainty-adjusted discount rates are likely to differ between income and expenses.

Furthermore, the fiscal treatment and legal constraints vary depending on the type of assets or liabilities, which will impact the optimal strategy aiming at maximising the net worth. To separate them provides a systematic and explicit discussion framework.

To explicitly identify the liabilities can also help to clarify the client's financial situation. Indeed, a client might not be aware of some optimisation techniques or of some services that the financial advisor could provide him. This approach can also provide an important input to the assessment of the client's objective risk aversion.

Finally, note that in this approach, when the client retires, the human capital has vanished and only financial capital is left[3]. On the other hand, the present value of the future expenses remains included in the liabilities.

3 So far, the bankinsurance and pension products were included in the financial capital which makes sense if one considers a single payment at the time of retirement. As an alternative, they could be treated as part of the human capital, where the expected pension payments could be discounted and summed. Whether added to the human or to the financial capital at the time of retirement, pension assets would have to be valued using actuarial calculus.

1.1.1.6 Return objectives

Individual investors often have difficulties in expressing their investment objectives. Statements like “to make as much money as possible” are too open-ended to provide any meaningful guidance and may not be appropriate for the investor. Such a statement is definitely not an appropriate investment objective to include in an investment statement. An important purpose of defining an investment statement is to help investors in understanding their own needs, objectives and constraints. This helps to prevent inappropriate investment strategies.

For individual investors the return requirements can be expressed in terms of goals they want to achieve. This can be a tangible goal such as a new car or a new home or an intangible goal, by definition difficult to quantify in a meaningful way, such as financial independence or status. The priorities of the goals and the time horizon to achieve those goals have large impact on the return requirements and on the risk that can be taken.

High priority goals. *Short-term* goals include the acquisition of a new car, a new home or the education of the children. These goals have typically a high emotional priority and the time to achieve them is typically short. The investment vehicles must therefore be of low volatility such as cash equivalent or fixed income instruments with maturity dates that are close to the goal’s realisation date. *Long-term* goals are often expressed as a form of financial independence that is typically measured in terms of available cash per year at a certain future date. Often the future date is around 65, when there is no income from salary anymore. The long investment horizon allows for more aggressive investment strategies focussing on capital gain, rather than income generating investments.

Lower priority goals. There are often a certain number of goals that are not so painful when not achieved. Examples include additional vacations, have extra funds to leave for the descendants, etc. The lower priority of these goals allow for aggressive or speculative investments.

1.1.1.7 Risk tolerance

We have just seen that depending on the types of goals an individual investor wants to achieve he must be willing to accept different amounts of risk. However the risk tolerance of an individual investor is a function of several factors, most of which are specific to individual investors (as opposed to institutional investors), such as the investors personal risk aversion, his insurance coverage, his family situation (number and age of children), his age, his net worth and cash reserves, his income expectations, and the investment time frame. All these factors have to be taken into account to determine the investor’s overall risk tolerance.

In addition to the risk-return investment objectives, investment constraints will also affect the investment plan.

1.1.2 Investment constraints

Human life is subject to many constraints set by the environment. Constraints in general are limiting the freedom of action. In terms of portfolio construction, constraints will reduce the investment opportunities by excluding or limiting certain strategies. This is why one should be cautious when comparing constrained portfolio performance with an unconstrained benchmark because it rarely makes any sense.

Investment constraints include time horizon, liquidity need, tax factors, self-imposed needs and preferences and operational factors:

1.1.2.1 Time horizon

The investor's time horizon is an obvious investment constraint. Generally we can say that in the case of a long time horizon the investor is able to bear more risk in the expectation of earning an above average rate of return. Note that there is a relationship between time horizon and liquidity needs. Investors with long time horizon typically require less liquidity and can afford more risky investment. This low liquidity is needed because funds will not be required for several years. Investors with shorter time horizon will typically favour less risky and more liquid assets because losses are harder to overcome during a short time-period.

1.1.2.2 Liquidity need

Liquidity can be defined as the speed at which an asset can be converted into cash at a price near market value. The liquidity depends heavily on the type of asset. It can range from a few hours for cash equivalent to a few days for listed stocks to weeks or months for real estate. The required liquidity can be split into different categories, like emergency cash, cash for taxes, cash allowing for investment flexibility.

Liquidity can be required in order to satisfy near-term goals or to cover forthcoming tax obligations etc.

1.1.2.3 Law and regulation

Law and Regulation typically are not as important to individual investors as to most institutional investors. However all investors must respect some laws such as insider trading prohibition for example. Insider trading involves the sales or purchase of securities based on relevant information that is not publicly known. Most often insider trading involves a firm's manager.

Other situations might arise where regulation plays an important role: A **fiduciary**, that is someone who supervises an investment portfolio of a third party (e.g. discretionary account), is generally constrained by regulations. The fiduciary is bound to make investments decision that are in accordance with the investors wishes. This makes a properly written investment statement essential for a fiduciary in order do his job.

1.1.2.4 Taxes

Taxes are increasing the complexity of the portfolio management process. This is particularity true in the case of international investing. The tax situation of each investor needs to be investigated thoroughly, due to the high potential impact on returns. In complex situations a tax adviser should be involved in defining the constraints and in finding tax-minimizing strategies.

1.1.2.5 Self-imposed needs and preferences

Some investors are reluctant to invest in some securities for various kinds of reasons, e.g. political, ecological, religious, etc. The investor's preferences have to be considered as constraints by the financial adviser.

1.1.2.6 Operational factors

It is essential for the investor seeking investment advice that the financial advisor understands his client's constraints and takes them into account in his assessment of the available assets and of the liabilities. These constraints are at the origin of the sometimes very complex and always different pictures that characterise each client. The constraining schemes are as a rule complex enough so that they can hardly be put in a model valid for each category of clients. As a consequence, the financial advisor has to analyse each client's situation individually to assess how the constraints might affect the asset allocation decision.

1.1.3 Base currency

In a multi-currency environment, the base currency is the currency in which the client wants to measure the performance of his investments. The performance analysis and the subsequent identification of the market and currency effect on the overall performance expressed in the base currency are presented in another section. In this section, we will only address the importance and the reasons why the choice of the base currency should be made before the investment process starts.

Currencies introduce an additional risk factor to the asset and liability analysis of a client. To make it short, if a client's liabilities are all labelled in USD and all his assets have a financial exposure to say CHF, there is an obvious additional uncertainty in the asset and liability analysis due to the uncertainty as to the future currency exchange rates. One can easily extend this argument to a mixed currency asset and liability portfolio.

This is true at the strategic level. However, the client may require the advisor's services at another level, for instance limited to a portion of the client's assets. In such a situation, the choice of the base currency is less obvious and depends on the mandate the client is willing to give. Defining the benchmark for the mandate implicitly defines the base currency.

1.1.4 Risk aversion

Between investing all of one's assets in high yielding bonds in an emerging market or investing everything in short term government bills, there is a continuum of investment opportunities which modern portfolio theory helps to describe and analyse, both in terms of risk and return. In this section, we will discuss the definition and the perception of risk in terms of the asset allocation decision.

1.1.4.1 Forms of risk

The risk that at a given point in time one's assets do not cover one's liabilities, i.e. that the net worth is negative, is often referred to as **short-fall risk**. This might be temporary or definitive, in which case we are facing bankruptcy. To quantify this risk, probability calculus must be used and the shortfall risk is then defined as the probability that the net worth is negative. The asset allocation decision aims at minimising the shortfall risk given an expected return and a set of constraints.

There are other risks involved in the asset allocation decision, namely those that at a given point in time, constraints are not verified anymore. If this was to happen, since constraints cannot be removed by wishful thinking, the investment process will have to be altered so that the constraints are immediately respected. For example, the liquidity constraint requires that the surplus (income minus expenses) is positive. If, at any point in time the income does not cover the expenses, some assets must be sold to generate the needed cash, affecting the asset allocation. The risk here is that the sale might take place at an unfavourable moment, after prices have moved down.

1.1.4.2 Objective risk aversion

Before making the asset allocation decision, the objective risks a client can carry must be assessed. As we know, the risk of a portfolio can be assessed using forecasts of the assets return, volatility and correlation amongst them. For a large portfolio these calculations can become complicated and out of reach for the average investor. To quantify the objective risk aversion of a client, one must assess both the probability that a shortfall occurs and the consequences of such a shortfall.

Although there is not a clear and unique approach to this assessment, one can say that the higher the net worth (as a percentage of the total assets!), the higher the reserves, the more risk a client can objectively take.

Another criteria to assess risk aversion objectively is looking at the income surplus. The higher the client's capacity to save, the more risks he's capable of bearing. The cash matching constraint is definitely a critical one. During a period when the yearly surplus is expected to be large, savings can be invested in more risky assets since there is almost no chance that the client will need to sell investments to generate cash.

There have been various academic, theoretical and empirical researches in the field of optimal asset allocation to formalise risk aversion. Utility function is one of the key words[4]. It can help among academicians, but it fails when applied to clients. Nevertheless, these approaches have allowed the development of asset allocation models under some simplified formal assumptions[5].

Finally, to assess as precisely as possible a client's objective risk aversion, it is essential to have a complete and clear picture of the current and the expected financial, fiscal, professional and personal situation.

1.1.4.3 Subjective risk aversion

The analysis of risk aversion also requires addressing the investor's preferences and the more subjective aspects of decision-making. These are generally complex, often not explicit and might change over time. How does the client perceive and react to an unfavourable market move? The answer to this question could provide the advisor with some hints on the client's subjective risk aversion: The worse the reaction, the higher the risk aversion.

4 See chapter on „Modern Portfolio Theory I"

5 For an accessible contribution with references, see Klaus Spremann, "Asset-Allokation im Lebenszyklus und Vintage-Programm", Private Banking, 2nd Edition, NZZ Publications (1996)

Note that for the average investor risk is typically not measured in terms of volatility or standard deviation. Risk is more captured in an emotional way. Typically individual investors perceive risk as:

Loosing Money. This is probably the most common way how individuals express risk. Typically individuals recognize risk when they receive their deposit report or after a loss has occurred. Some do only recognise a loss when the value of the asset goes below its initial value or worse, when they have realized it.

Unfamiliar Instruments. This is the fear of the unknown. Individual investor's are reluctant to put money into something they do not know exactly what it is and how it is working. This is particularly true when they have heard something about how complex or risky this or that investment is. This is typically the case with derivative products or hedge funds.

Contrary Investing. Some individuals feel uncomfortable when they are not following the crowd. For them it seems foolish to invest in assets that have been loosing money for investors for some time. These investors feel much better when they can invest in popular and well-known securities. It can take a lot of energy for an investment adviser to convince such an investor to pursue a more value-oriented investment strategy.

Experienced Losses. Individuals are reluctant to reinvest in assets where they experienced a loss. Other than by the passage of time, this fear can only be reduced by education.

Good Companies vs. Good Stocks. Stocks of good companies, in the sense of well-known and fashionable companies are often perceived as being more profitable than other, more traditionally managed companies or companies with mediocre reputations. However, the return of the stocks is generally not correlated with the reputation of the company.

Good counselling skills are needed when dealing with an individual's risk perception. This starts with the ability of asking the right questions and listening to the individual's fears. It continues with the education of the client in order to modify his perception towards risk.

One possibility to assess the risk aversion of an individual is to use scoring systems. Typically these scoring systems consist of a number of questions asked to the investor on how he would react faced with a presented situation.

A less formal way is regular client contacts and performance presentations after bearish markets. This helps the advisor to form his opinion on this subjective component of the asset allocation decision.

How does the client appreciate being informed? Does he have the tendency to require to always being in control of the situation? What is his preference in the attribution of value added? In which area does the client feel that help would be most useful? These kinds of questions and many others can provide some additional clues for the assessment of a client's subjective risk aversion.

1.1.5 Investor categorisation

The combination of objective and subjective risk aversion together with the asset and liability analysis allows us to classify investors into various categories. However, practitioners also analyse their target clientele with respect to cultural, ethnic and socio-economical factors as well as the psychological characteristics of the investor. The purpose of such investor categorisation is to group their investments into larger funds with a strategy that is suited to each category, achieving a costs reduction without affecting the management quality.

The investment management can then be fine-tuned for each category and strategy. The investment statements proposed to the clients will reflect his risk-aversion and the various other criteria that suit him.

1.1.5.1 The demographics of the individual investor

1.1.5.1.1 The life cycle view

The individual's risk and return preferences tend to change with the age of the investor. Each investor has different capacities and feelings about his ability and willingness to support risk. However, the life cycle of an individual can typically be broken down into phases. These phases are important to understand because of the impact they can have on the individual's risk and return preferences.

We typically identify four phases within the life cycle of an individual investor.

1) **Accumulation phase**. In the accumulation phase or early-to-middle career situation the net worth of an individual is typically small compared to his liabilities, especially if there is a mortgage outstanding or other loans to pay back. The priority is to satisfy immediate needs like the education of the children or a larger house. However the individual's time horizon is very long and the earning ability is growing. This enables the individual to afford above average risk in the hope to achieve above average return.

2) **Consolidation phase**. In the consolidation phase, typically mid-to-late career the income exceeds expenses. This is due to a higher salary and lower expenses, the children having left the house and the mortgages having been reimbursed. The excess can be invested to provide for future retirement. Note that the investment horizon is still long, exceeding 20 years, therefore moderate-risk investment is still advised.

3) **Spending phase**. In the spending phase the living expenses are not anymore covered by an earned salary, but rather from the return of the accumulated assets, be it from pension fund or personal investments. The investor is to a large extent *financially independent*. With this heavy reliance on personal investments the focus is now on lower risk assets. However the time horizon may still be 10 to 20 years, making inflation protection an important factor to consider.

4) **Gifting phase**. This is the phase where the individual realises that he has accumulated more wealth than what he will ever be able to spend. In such a case, the excess assets can be used for example to provide financial assistance to relatives or friends or to make charitable donations.

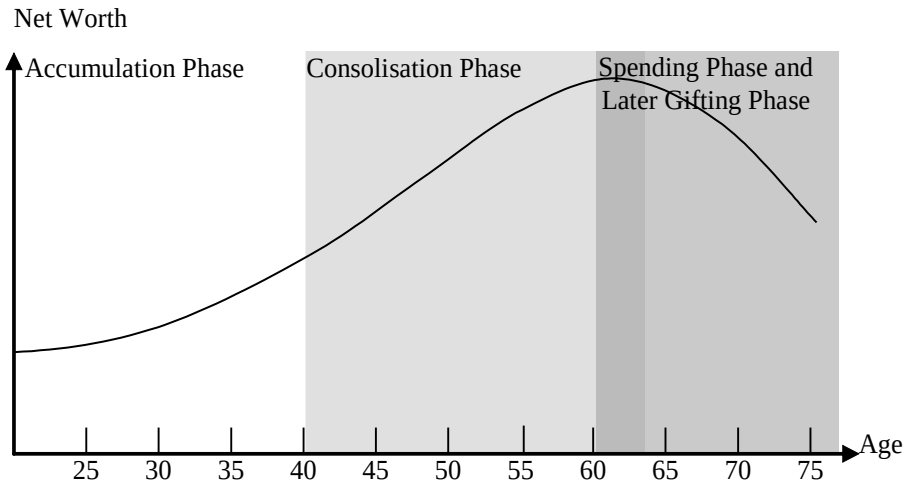

Figure 1-6: The life cycle diagram

1.1.5.2 Psychological characteristics of the individual investor

While the majority of research has focussed on a demographic or socio-demographic approach to categorize individual investors, it is also clear that two different individuals can act very differently when it comes to investing their money. Therefore classification schemata have been developed to address the different psychological characteristics of an investor. We will introduce only two of the most widely accepted schemata.

1.1.5.2.1 Barnewall two-way model

This is a simple, yet surprisingly useful, model that divides the investor's universe into active and passive investors.

Passive investors are defined as those investors that have not earned their wealth actively, but rather have become wealthy passively. This can be due to inheritance or by risking the capital of others rather than their own. Passive investors typically are corporate executives, politicians, bankers, journalists and small business owners who inherited the business. Further, the lower the financial resources of an investor, the higher the probability that the person is a passive investor. Passive investors have in common that they all require a high level of security and are unwilling to tolerate above average risk.

For a financial adviser passive investors are the easier clients in that they tend to delegate and to follow the given advice. Their risk aversion requires a broadly diversified portfolio consisting of quality investments. However because of their limited knowledge they tend to perceive the risk they are facing to be greater than it actually is. Additional education and counselling in unfamiliar investments areas are thus required. Another characteristic of passive investors is the need for approval by others; they tend to follow the herd.

Active investors are those investors who have earned their wealth in their lifetime. They have risked their own capital and have been actively involved in the creation of their wealth. The tolerance for risk of active investors is much higher than for the passive investors. In conjunction with their higher risk tolerance they tend to keep control over their own investments. This is because they believe in themselves. Typical active investors are self-employed consultants and advisers, surgeons, small business owners, independent lawyers.

The active investors are more challenging investors for a financial adviser in that they are unwilling to delegate and because if they finally do, they like to keep being personally involved in the management of their personal wealth. The financial adviser must constantly display his expertise and defend his performance. As a result of the willingness to assume higher risk, they are likely to prefer a focussed investment strategy rather than to diversify potential return away.

1.1.5.2.2 Bailard, Biehl & Kaiser five-way model

The Bailard, Biehl & Kaiser (BBK) Five-Way Model classifies the investors universe based on two elements of the personality into five different categories.

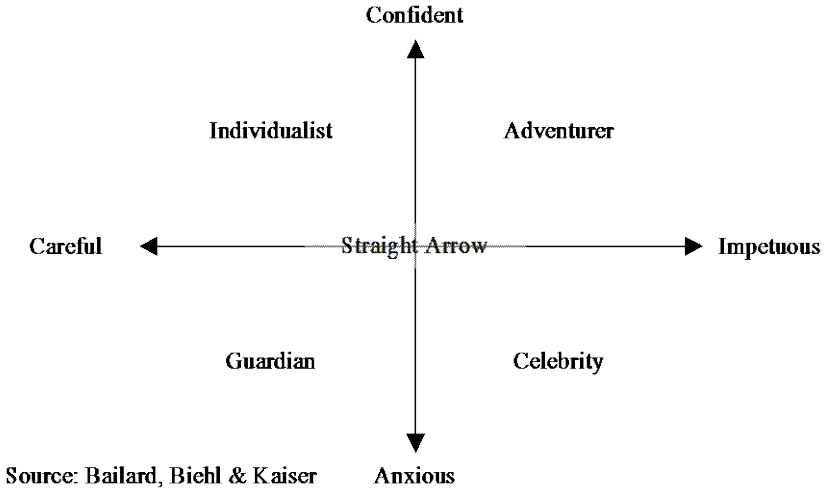

Figure 1-7: The Bailard, Biehl & Kaiser Five-Way Model

Adventurers are typically entrepreneurial and strong-willed persons. They are not afraid of putting all their eggs into to the same basket and just go for it. They are confident and impetuous. Adventures are difficult to advise, because they are unwilling to give away control over their personal investments and because a well-diversified portfolio is boring to them. They are likely to be volatile. One of the adviser's tasks is to persuade these persons that their portfolio should be managed in a more systematic way.

Guardians are careful and anxious people who try to preserve their wealth. They strongly dislike any form of risk and are particularly loss-averse. Guardians lack confidence in themselves, thus making them good clients for a financial adviser if they have chosen one. One of the adviser's challenges with Guardians is to persuade them that risk can be managed and that there are other solutions besides investing everything in sovereign bonds in order to reduce risk.

Celebrities are people who are typical followers and are afraid to be left out. They are where the action is and they are fashion followers. They are impetuous but rather anxious. Celebrities are difficult to satisfy with a contrarian investing style. However brokers love them because of the high transaction turnover they generate in the attempt to follow the latest news. Celebrities are often doctors and dentists, sport figures, entertainment figures.

Individualists are careful and confident, that is they are strong-willed individuals who know what they want. They are trying to make their own thoughtful decisions in life. They are ideal clients from the point of view of a financial adviser, because they tend to be constant, thoughtful, informed and rational. The problem is that they only look for advice when they have no time anymore to manage their own affairs. People found in this quadrant are independent lawyers, engineers, and small business people.

Straight-arrows are somewhere in the middle. The straight arrow represents the average investor, which does not fall into any of the personality extremes.

1.1.6 Deciding portfolio structure

The target now is to put all the information we collected from the investor into a sound and coherent portfolio policy, which will lead us to the portfolio structure of the investor.

The most widely followed "policy" is actually the absence of any policy. Supposedly "good investments" are selected without an overall plan. Some investors do follow what we call the traditional policy approaches that we will present shortly. However, following a multi-asset total return approach that takes into account the investors' risk tolerance allows for more flexibility than following strictly one of the traditional policy approaches.

1.1.6.1 Traditional policy approaches

1.1.6.1.1 Income

The idea behind an *income* portfolio policy is that only the income can be spent and any capital gains have to be reinvested. Note that nothing is said about the asset allocation that can range from a combination of very safe investments to one that consists primarily of high yielding stocks resulting in a higher risk/return potential, the risk here being a dividend cut. However, a typical income portfolio consists of a certain amount of fixed income investments and the focus lies on yield maximisation. Obviously, this policy does not allow for a lot of flexibility and are typically not well suited for individual investors. Often, however, income portfolio policies are chosen because of legal and regulatory constraints.

1.1.6.1.2 Growth

In a *growth-oriented* policy the focus is on stocks and real estate. Income generating investments play only a minor role in the portfolio. Pure growth portfolios typically assume a low risk aversion and low liquidity needs. This investment policy suits investors with a long time horizon since they can tolerate the higher risk of such a policy.

The advantages of the traditional policy approaches are that they are easy to understand and to conceptualise. However they are limited by the narrow definition of what is considered an appropriate investment, new areas of investment opportunities such as venture capital and real estate, being completely ignored.

1.1.6.1.3 Income and growth

The *income and growth (balanced) pol*icy consists of a mixture of income generating investments like bonds and capital appreciation investments like stocks or real estate. The idea behind this policy is that investors who only want to spend the income from the investment can also take advantage of a potential and moderate growth in income or assets in the long term.

1.1.6.2 Total return policy

In a *total return approach* all asset classes are included in the policy statement. This enables the portfolio manager to adapt more easily to anticipated changes in the economic environment. With such a policy the income generated by the portfolio will vary greatly. This requires that for people who have to finance their lifestyle from their investment the spendable income be defined as a percentage of the total wealth without distinguishing whether the income comes from income or the sale of principal. Under the total return approach the investor may not only spend current income but may also rely on liquidating a portion of the capital. We thus have:

$$\text{Total Return} = \text{Earnings} + \text{Capital Appreciation}$$

In the case of a total return approach the investment policy statement becomes very important. Following items should be explicitly stated:

Asset classes. It must be specified which assets classes can to be included or have to be excluded.

Investment flexibility. The flexibility given to the manager to switch between asset classes must be defined. Remember that often, the selected benchmark does not include transaction costs. In order to nevertheless beat the benchmark the portfolio manager is tempted to changes the asset allocation towards larger investments in high return asset classes than what is specified in the investment policy.

1.2 Institutional investors

The growth of the institutional investors over the last few decades and the continuous emergence of new products have increased the complexity of the management of institutional portfolios. In this section we will look at different types of institutional investors and their typical investment objectives and constraints. Institutional investors include pension funds, endowment funds, insurance companies, and commercial banks.

Note that there are some important differences between institutional and individual investors in that:

- Individuals typically define risk differently than institutions. Institutions tend to quantify risk in terms of probability and standard deviation, whereas individuals think of risk in more qualitative terms.
- Institutions are classified by the interest of the people they serve whereas the individuals are classified by their personalities.
- Institutions face more legal and regulatory constraints than individuals.
- Individuals pay taxes whereas institutions are often tax-exempt.
- The investment time horizon is typically indefinite for institutions whereas it is finite and varies according to the life cycle of an individual.

Let us now have a closer look at pension funds, endowment funds, insurance companies and commercial banks.

1.2.1 Pensions and employee benefit funds

A pension fund's objectives and constraints primarily depend on the type of plan offered to its beneficiaries, e.g. the employees and retirees. We have to distinguish between *defined benefit pension plans* and *defined contribution pension plans*. Note that defined benefit pension plans are more frequent than defined contribution pension plans.

A **defined benefit pension plan** promises employees to pay a specific income stream after their retirement. The employer (called the "plan sponsor") will regularly contribute a certain amount, defined using actuarial assumptions about the age and the composition of the workforce, to the pension fund. The risk clearly lies with the company, which has to increase its contribution in case of adverse performance of the plan, but can also reduce it in case of favourable performance. The key characteristic here, is that the pension benefits are set independently of the value of the plan's asset, the benefit being based on a formula usually taking the employees salary and the length of service into account, for example 80% of the average salary of the last five years. From a financing point of view the employer is issuing a pension debt to its employees that can be served on an ongoing basis or on a funded basis. In the second case, enough money has to be set aside each year in order to match the estimated present value of the debt accrued in that year.

The *minimum return objective* of a defined benefit pension plan is to meet the plan's actuarial rate of return, which is set by actuaries based on assumptions about current and future salary, about retirement patterns, life expectancy and the firm's benefit formula. The focus is on a balance sheet approach, e.g. a match between the cash flows of the pension assets and liabilities.

The *risk tolerance* of a defined benefit plan depends on the plan's funding status and the defined *actuarial rate of return as well as* the company's balance sheet. The actuarial rate of return is the rate used to find the present value of the plans future obligations.

For underfunded plans, this is when the present value of the plan's liabilities is higher than the plan's assets, a more conservative investment approach, focusing primarily on income generating investments, has to be chosen in order to close the gap over time.

For overfunded plans, this is when the present value of the plan's liabilities is less than the plan's assets, a more aggressive investment approach can be chosen in order to reduce the company's contributions to the plan. The investment focus is then on capital growth investments. In any case, inflation protection is vital to the long-term success of the pension fund.

In this context it is also important to realize that there is a clear economic interrelation between the plan sponsor and the pension fund. Typically the plan sponsor wants to limit the risk of increased contribution in the case of sector specific, economic difficulties. One way to lower this risk is to limit the pension funds investments into companies that are in the same industry than the plan sponsor.

The *time horizon* of a pension fund depends on the age of the employee base and on the status of the employer, whether it is a going concern or is in termination. Typically, however the time horizon is long. In case of young employee base there is more time available for wealth to compound before the payments have to be made.

The *liquidity constraint* of the plan is mainly a function of the average age of the employees. Less liquidity is required for a younger employee base than for an older one. Another factor is the percentage of the employee base that is already retired.

The *legal and regulatory constraints* are typically high. However, *taxes* are typically not a major concern as in many countries the pension funds are tax-exempt. As a consequence pension funds tilt their asset mix towards assets with the largest spread between pre-tax and after-tax rates of return.

A **defined contribution pension plan** does not promise the employees to pay a specific income stream; rather the benefits received by a worker is affected by the size of the contribution made by the employee to the pension fund and the returns earned by the fund's investments. The fundamental difference with a defined pension plan is that the employer has no financial obligation beyond making regular contributions on behalf of the employers into the pension fund. The employee's retirement income is not an obligation of the firm. Thus the employee carries the plan's investment risk. In effect, defined contribution plans are tax-differed retirement savings accounts established by the employer in trust for its employees.

Defined contribution plans remain largely an US phenomenon. The popularity of this kind of pension funds is increasing due to the increasing burden of legislation and regulation that makes the sponsorship of defined benefit plans costlier and riskier. Another reason is that, typically, younger employees dislike the fact that they get little benefit from defined benefit plans until they reach the status of long-service employees and prefer to know that the contributions remains their asset even if they change employer.

Typically the individual employee has some choice on how the contributions to his plan are to be invested. Objectives and constrains, thus, depends on the individual.

The investment policy of defined contribution plans is essentially the same as for tax-qualified individual retirement accounts. Indeed, many providers of defined contribution plans are the same institutions such as mutual funds and insurance companies that offer investment plans for individuals.

There is no *minimum return objective* for a defined contribution pension plan. As we already said, the employee is bearing all the risk.

The same is true for the *risk tolerance*. The risk tolerance boils down to the employee's own risk taking capacity and aversion. Note however that studies have shown that employees tend to choose extremely conservative asset allocations.

The *time horizon* and *liquidity needs* of the plan depend on the average age of the workforce and the degree of employee turnover within the company. Typically, however the time horizon is long and the liquidity constraint relatively well predictable.

As with defined benefit plans, the *legal and regulatory constraints* are typically high and *taxes* not a major concern.

1.2.2 Endowment funds

Endowment funds arise from the contribution made to a broad range of institutions and organizations chartered to use their money for specific non-profit purposes, e.g. charitable and educational institutions, professional and religious organizations, etc. or to carry out the fund's specific purposes. Rather than spending the funds immediately, the institutions invest in order to receive a future income stream. There is an inherent tension between the institution's need for current income and the desire to create a growing future income stream. This tension must be recognized when managing an endowment fund.

Often endowment funds investment objectives and constraints are compared to pension funds. But they actually have more dissimilarity than similarities. Similarities are limited to the fact that both are typically long-term in nature and are generally not taxable. Endowment funds resemble individual investors in the sense that the objectives of endowment funds are very broad and the objectives themselves are often highly qualitative in nature.

The *return objective* must be balanced between the need for high current income and the long-term protection of the capital. A total return approach is warranted. The fund's total return objective should be equal to the aggregate of the expected spending rate and the expected inflation. The spending rate represents the portion of returns that are allocated to the budget of the beneficiary. The main return objectives to include in the investment policy statement are the preservation of the purchasing power of the capital and the maintenance of a stable real income stream for current budgetary purposes.

The *risk tolerance* of endowment funds depends primarily on the return objective set, which can range from total income to total growth. Another factor to be considered is the overall importance of the endowment fund in the beneficiary's budget. If the endowment income is relatively small in the budget the risk tolerance might be higher than if the endowment funds income plays an important role in the budget.

The *time horizon* is normally very long, as most endowment funds have no specified end, that is, their expected life is infinite.

Liquidity requirements are low due to the fact that income requirement are generally well known in advance and thus the fund can be managed accordingly. There might be however some level of liquidity required for emergency cases or if large outlays are planned such as large capital contributions to a specific project.

Taxes consideration plays a second role because most of the time endowment funds are tax-exempt. Thus tax-exempt bonds and other tax-exempt products are not particularly attractive to endowment funds.

The *legal and regulatory constraints* are generally minimal for endowment fund and thus play a minor role in the establishment of the investment policy. However the tax situation of the donors and the beneficiaries might influence the investment policy.

The broad array of trustees and committees, each with different levels of investment skills and knowledge, that typically control endowment funds result in a broad range of *unique needs, circumstances, and preferences*. Reasonable and logical approaches to investment management of endowment funds are often overwhelmed by personal prejudice, fears and other emotional elements. Note however that a number of endowment fund include constraints that are not considered rational from a pure investment point of view, such as social and environmental issues, but which makes sense in the endowment's context. This is particularly true for religious and educational endowment funds.

1.2.3 Insurance companies

The institutions considered so far can be characterized as two major private, non-profit institutional investors. We will consider now two major financial institutions that operate for profit - insurance companies and commercial banks. This requires the policy statement to include competition and tax considerations. We will also see that asset and liability management is the dominant factor guiding the investment policy of these two institutional investors.

The insurance industry can be divided into three broad product categories: life insurance, health insurance and property and liability insurance. For investment purposes however, we better distinguish life from non-life insurances.

The cash value of the life policies represents a liability to the **life insurance**. A life insurance company collects the premiums over the lifetime of a person that has to be invested until death occurs and the benefit is paid to the beneficiaries. The target for the life insurance company is to earn a positive spread between the rates of return it promises its policyholder and the rate of return of the investments. This is, from a conceptual point of view, the same as for a defined benefit pension fund that tries to earn a rate of return in excess of the actuarial rate of return.

If the insurance manages to earn a positive spread, then the surplus reserve will increase which represents a competitive advantage for life insurances. If however the spread is negative the surplus account will decline by an amount reflecting the negative spread. Needless to say, that the adequacy of the funds relative to the liabilities is closely monitored by management, regulatory commissions and rating agencies. We will see that the surplus reserve can be managed in a more aggressive way than the minimum required reserve fund.

Increased competitiveness has increased the importance of asset/liability management in the insurance industry.

When talking about *return objectives* we need to differentiate between minimum required reserve fund and the surplus reserve. For the minimum required reserve fund the return objective is based on actuarial assumptions and managed in a conservative way. The surplus reserve, however, is managed in a more aggressive way in hope to earn excess return that allows the insurance to strengthen its competitive position.

The *risk tolerance* is relatively low. Often insurances are considered as quasitrust funds. Imposed conservative fiduciary principles limit the risk exposure that a life insurance company can undertake. In order to limit risk exposure, management often imposes limits on cash flow volatility, credit quality (only investment grade debt), types of assets, etc.

The *liquidity requirements* are generally low. The cash outflows of a life insurance are typically quite well predictable, because based on mortality tables. However, in case of an increase of the interest rate volatility, investors are more inclined to surrender their policies to retrieve the cash value and invest the proceeds in higher returning assets. This adds some complexity when evaluating liquidity needs.

The *time horizon* is long, but it tends to get shorter. This is because policyholders are now more prone, in the search of the most competitive rates and/or policy benefits, to exercise their option to surrender. Mortality rates are easier to predict than the surrender rates that are due to interest rate changes and thus, increase the difficulty of the asset and liability management of an insurance company.

The *legal and regulatory constraints* in the insurance business are heavy, thus limiting investment flexibility and typically are the primary constraints affecting investment policy. In order to comply with the laws and regulation, insurance companies define internal audit procedures.

Taxes are typically high making them a key consideration for the investment policy.

The *unique needs, circumstances, and preferences* evolve around the different products offered by the various investment companies. Other factors to consider are the size and the amount of its surplus positions.

Non-life insurances (casualty insurance) include health, property and liability, surety, etc. From an investment policy point of view casualty insurances are quite similar even though they are selling different products. However, the investment policy of a casualty insurance company is in many aspects different from that of a life insurance. Differences are significant because liabilities and risk factors are definitely different than from life companies. Casualty liabilities for example are exposed to inflation risk but not directly to interest rate risk.

For life insurances the cash outflows, based on their mortality tables are somewhat predictable. This is not the case for non-life insurances. The cash outflows required by major disasters, accidents, and lawsuit settlement are not predicable.

The *minimum return objective* is to meet potential claims. As with life companies, the insurance reserve is, for safety reasons, typically invested in low risk investments, such as investment grade bonds. The surplus funds, however, are generally invested in equities in the hope of earning excess returns. Property and casualty companies have a competitive advantage when they have a surplus account larger than their competitors'.

The *risk tolerance*, due to the fiduciary responsibility to claimants, is low to moderate. Premiums are affected by the probability of a claim and the investment return earned by the firm. If asset and liability duration matching cannot be an objective because of the uncertainty of the claims, management of the mismatches certainly is.

The *liquidity* is a very important point for non-life insurances. The requirements are relatively high due to the uncertainty of the liabilities. This forces the non-life insurance to maintain a portfolio of short-term securities and to maintain a laddered maturity schedule of their fixed-income investments.

The *time horizon* of investments is typically shorter than that of life insurance companies, because of the shorter duration of the liabilities.

The *legal and regulatory constraints* for property and casualty insurance companies are lower than for life insurances, but remain high compared to other institutional investors.

Taxes are typically high making them a key consideration for the investment policy.

Same as for life insurances, *the unique needs, circumstances, and preferences* evolve around the different products offered by the various investment companies. Other factors to consider are the size and the amount of its surplus positions.

1.2.4 Commercial banks

Unlike the other institutional investors we have seen, banks do not easily have access to cash in order to fund their loans they are offering to their clients. In order to obtain some capital they have to offer competitive rates of returns to potential depositors.

The *return objective* of a bank is to match the risk of the assets with the risk of the liabilities while maximizing the spread between the lending and the borrowing rates. This spread, or margin is the banks gross return.

Risk tolerance. Money is a commodity and, thus, to a large extent, an undifferentiated product. This means that it is highly price sensitive. The price here is the interest rate. The fluctuation of the interest rate made and the effort to maximize profit in terms of the interest spread between borrowed liabilities and investable assets has lead to careful management of asset and liabilities. Banks were, in fact, early pioneers in asset/liability management. The interest rate sensitivity, the short time horizon and the high liquidity requirements severely limit the risk tolerance of banks.

Time horizon is short term due to the nature of the business. In order to generate an adequate spread between interest revenue and interest expenses, they invest in generally shorter-term investments to avoid interest rate risk and to avoid being locked in for a longer time. Further, because banks generally offer short-term deposit accounts they need to closely match the maturity of their assets and liabilities in order to lower the risk. The strong need for liquidity also lowers the time horizon.

Liquidity requirements are high in order to meet possible deposit withdrawals. A bank has two sources of liquidity. The first is the *internal liquidity* that comes from the highly liquid assets in the bank's investment portfolio that can be sold to raise cash. The second source, the banks *external liquidity*, is the possibility to borrow funds from the central bank.

The *legal and regulatory* constraints are heavy. Numerous bodies and agencies are controlling the banks functioning, i.e. Central Bank. The focus typically lies on the asset and liability relationship.

Unique needs, Circumstances and Preferences revolve primarily around the size of the bank, its location, the structure of the liabilities and their individual skills in managing asset and liabilities.

2. Asset allocation

2.1 Asset allocation overview

2.1.1 Definitions

2.1.1.1 Asset classes

When one considers the huge universe of assets available, it is not difficult to observe that certain subsets of assets, usually defined through some financial or economic characteristics, can exhibit return behaviours through time that are simultaneously characterised by:

- some coherence within each subset, and
- some significant differences between each subset.

This empirical evidence leads to the idea that each asset return can be described:

- first by the return of the subset as a first proxy, and
- then by its relative return within the subset.

This view and the idea of partitioning the asset universe in these different subsets (classes) is useful as it brings some organisation to the process of managing portfolios by providing an analytical vision for explaining the asset returns and their volatility.

2.1.1.2 Asset allocation

By recognising that asset returns can be better explained by their asset class returns as a first proxy and then by their intra-class relative returns, a global asset selection process, for a portfolio, can be organised into a useful two-steps procedure:

- First, the weight of the different asset classes in the portfolio must be determined. This is the *asset classes' allocation* process.
- Second, the assets must be selected within each asset class. This is the *(within class) asset selection* process.

This two-steps procedure is not without danger in terms of portfolio construction, because risk management is broken down between the two steps. Portfolio managers must be sure that the risk characteristics of each asset class portfolios are compatible with the ones that were used for the asset allocation process. In addition, it is usually not possible to take diversification at the asset level into account between asset classes.

2.1.2 Partitioning criteria

2.1.2.1 General criteria

Of course there is no single way to partition the asset universe. The tendency has been to focus on the obvious financial characteristics of the assets as the partitioning criteria. As we will show later these seemingly clear criteria are murkier in reality. If one focuses on domestic securities the first criteria for partitioning which come to mind are the usual:

- Cash and equivalent,
- Bonds,
- Stocks.

This list can, of course, be completed by real estate, private equity, venture capital, hedge funds, …. If one needs to go into further details, the bonds can subsequently be subdivided, for example, between:

- government and corporate bonds,
- short, intermediate and long-term bonds.
- …

There is no lack of criteria to also further partition stocks, for example, between:

- Small versus common stocks,
- Industries and/or sectors.
- Value versus growth oriented stocks
- …

All these criteria are based on simple characteristics of the assets. However the situation is more ambiguous than it seems at the first glance. For example, take the initial breakdown of the assets between cash, bonds, and equities. According to the modern view of finance, all these asset types can be defined as different baskets of risk-free zero-coupon bonds, and options (call, put) on the real assets owned by the firms. This is why distressed firms' bonds behave in a way that reveals some of their equity features.

We defined asset classes as subsets of the asset universe that exhibit, at the return level, enough coherence intra-class and enough difference inter-classes. Here again the reality fits loosely with the concept. There is an enormous dispersion of return within some of the asset classes. Equities are a good example.

Finally let us mention that, if an investor has an international scope, the bonds and stocks can further be divided by currencies, respectively by countries.

2.1.2.2 Value versus growth

Because of differences in long-term performances, investors have partitioned the universe of stocks into diverse sub-universes often referred to as styles. The two main styles are large versus small cap stocks and value versus growth stocks.

Defining criterion for partitioning stocks between large and small ones is usually done using an arbitrary market capitalisation.

It is more difficult to distinguish between value and growth stocks. We will see that the underlying concept for such partitioning has not always been well defined.

A traditional way[6] to define value and growth stocks is to rank all considered stocks in descending order by their book to price ratio. All stocks with a higher book-to-price than the median stock are considered as value stocks, while all others, with a lower book-to-price than the median stock are considered as growth stocks. This view is attractive because it is very simple to implement. However it suffers from an initial misconception because it opposes value to growth. There is not too much discussion[7] for considering high book-to-price stocks as cheap value stocks because one gets above average (book) value per unit of price. Symmetrically low book-to-price stocks should be considered as expensive value stocks. Although growth stocks may be correlated with low book-to-price stocks, it is not true that all low book-to-price stocks are stocks with high growth. In other words, the criterion used for this style definition is a value criterion and not a direct growth criterion. The short cut considering expensive value stocks as growth stocks is far-fetched.

One can see that in reality two criteria (or sets of criteria) are necessary to distinguish between cheap and expensive value stocks and between high and low growth stocks. These criteria for the value theme can be chosen between the following stock ratios:

- Earnings yield,
- Book-to-price,
- Dividend yield,
- Current earnings yield to an historical average in earnings yield.

For each of these ratios, high (low) values mean cheap (expensive) value stocks. In terms of growth criteria, the following stock data can be considered:

- Historical earnings growth,
- Expected earnings growth,
- Change in earnings growth.

Again, high positive (low or negative) values for these statistics mean high (low) growth stocks.

Salomon Brothers[8] has proposed another interesting approach. They first defined two sets of stocks that were considered, given multiple criteria, as pure (cheap) value stocks and as pure (high) growth stocks. Then, using statistical techniques, they were able to determine for each of the stocks in the analysed universe a probability (p) for being a value stock. The inverse of this probability (1-p) gives the same stock its probability for being a growth stock. These two probabilities can be interpreted as the distance of a stock with respect to two sets of stocks previously described. A value of 1 for p means that the considered stock is a pure value stock. A value of 0 is the characteristic of a pure growth stock. Finally, a value of 0.5 is an indication that the considered stock is in between a pure value stock and a pure growth stock. This approach has the advantage to recognise that each stock has both a value and a growth content at the same time.

6 Such as for the definition of the S&P – BARRA Value and Growth sub-indices.

7 Except than considering only one value criteria.

8 See “Segregating Growth From Value: It’s Not Always Either/Or”, Sergio Bienstock & Eric H. Sorensen, Salomon Brothers, July 1992.

2.1.3 Returns and risk

2.1.3.1 Historical facts

The following table presents the average annual nominal returns for several asset classes of the US financial market:

Asset Classes (1926-1998)[9]	Geometric Mean	Arithmetic Mean	Standard Deviation
Common Stocks	11.2 %	13.2 %	20.3 %
Small Company Stocks	12.4 %	17.4 %	33.8 %
Long-Term Corporate Bonds	5.8 %	6.1 %	8.6 %
Long-Term Government Bonds	5.3 %	5.7 %	9.2 %
Intermediate-Term Government Bonds	5.3 %	5.5 %	5.7 %
U.S. Treasury Bills	3.8 %	3.8 %	3.2 %
Inflation	3.1 %	3.2 %	4.5%

Table 2-1: Average annual nominal returns in the US financial market

Two major points should be mentioned:

- First, the last column, which presents the annual standard deviation of these asset classes returns, illustrates the short-term volatility of the different asset classes. In other words, in the short run there is no simple answer to the question of the best performing asset class. Sometimes bonds are over-performing stocks; sometimes they aren't. Sometimes small stocks are under-performing large cap stocks; sometimes they aren't. These volatilities show that the stocks are riskier than bonds.
- Second, the first two columns, which exhibit the average returns of the asset classes over the full time period, show more significant long-term return differences between asset classes, especially between stocks and bonds. Notice also that all asset classes have long-term returns higher than the inflation rate. In other words, they all experienced positive real returns over the 1926-1998 period, although just for the U.S. Treasury Bills.

Notice that these statistics are underlying many strategic allocation processes in the sense that at least the ranking of the asset classes in terms of long-term returns are thought to be the same in the future.

9 Source: Stocks, Bonds, Bills, and Inflation: 1999 Yearbook, Ibbotson Associates Inc, Chicago, 1999

2.1.3.2 Strategic and tactical asset allocation

These two previous points are indications that the asset classes' allocation problem expands over both the long-run and the short-run:

- The fact that asset classes have significantly different long-term returns suggests that an investor should be concerned by his average asset classes' holdings over the long run. Since both short-term and long-term portfolio risks are not invariant to the asset classes' allocation, there is a trade-off between the portfolio risks and long-term return. *Strategic asset allocation* is related to the study of this trade-off and the choice of an efficient long-term asset classes' allocation, i.e. of the average asset classes' positions that the investor wants to hold over the long term. The optimal chosen asset allocation is called strategic and usually represented by a strategic benchmark.
- If one thinks that it is possible to forecast asset classes short-term returns, it opens the possibility to actively manage the asset classes allocation in the short run. The goal is to improve the portfolio return with respect to the strategic benchmark return. It is implemented in terms of deviation from the strategic asset classes' allocation. This return improvement should of course take into account the short-term active risk it induces. *Tactical asset allocation* refers to all active investment processes that take care of the short-term allocation activity of the asset classes.

So, the asset allocation process is usually divided into two distinct processes, i.e. the strategic asset allocation process that focuses on the long term and the tactical asset allocation process that tries to exploit opportunistically the short run.

2.1.4 Participants in asset allocation

It should now be evident that many different groups of people are involved in asset allocation because it is not a single homogeneous problem and process:

- The strategic asset allocation problem ultimately is the responsibility of the pension fund board. In order to make decisions in this area, the boards usually needs the expertise of actuarial experts to get the best picture of the pension plan liabilities and from consultants specialised in the so-called asset/liability management, which is a better designation for strategic asset allocation.
- Specialised portfolio managers usually handle the tactical asset allocation. Of course, pension plan executives, often with the help of consultants, are active in selecting and monitoring these portfolio managers.

For most part the full asset allocation process is decentralised.

2.1.5 Evolution of strategic asset allocation

Before reaching the point to be described in section 2.2.1, strategic asset allocation was often perceived differently in the past. The focus was more on the asset side. The pension fund risk was thought of in terms of the trade-off between risk and return of the assets of the pension fund. This attitude, which was often indirectly encouraged by regulations[10], was popular because it was simple and convenient. It was however unrealistic as the liability side of the pension fund was neglected. It can be financially dangerous to define the risk only on the asset side. Because, with this view the less risky asset is the cash, being cautious means that one would hold a low duration asset while the liability side of the balance sheet is characterised by very long duration. Such discrepancy in duration, touted as being cautious, is a clear indication of faulty perception.

Through time, the view changed to recognise[11] that the risk of a pension fund was at the surplus[12] level and not only on the asset side. In other words, the liabilities of the pension funds were to be taken into account at full economic, and not as before actuarial, value. With this view, liabilities are also risky, as their evaluation would fluctuate with the movements of interest rates. If one takes this better but still limited short-term view on liabilities volatility, bonds become the less risky assets because they can match at least partially the liability side in terms of duration. If such a change in perception was positive in terms of better defining pension fund's risk, it is nevertheless not the end of the story. The liability side is usually not defined in fixed nominal terms but is, at least partially, linked to the evolution, expected or unexpected, of consumer prices and real wages. Within this new framework, bonds, which are defined in nominal terms, present some definitive risks in the long run with the possibility of unexpected increases in inflation and real wages because they offer no hedge against such events. Stocks, with their higher expected long-term returns, are a partial solution to this long-term risk. Notice that this is the case despite the fact that stocks are not a good hedge against inflation in the short run. Finally, by taking into account all relevant risks affecting the pension fund surplus, one ends up with a strategic asset allocation process that is described in 2.2.1.

10 For example in Switzerland, the liabilities of the pension funds were fixed at a given rate of 4% between 1985 and 2002. January 1st, 2003, this rate has been changed to 3.25%.

11 Changes in regulation, like the introduction of FASB 87 in the U.S. sometime help change the view

12 For a definition of surplus see section 2.2.1.2

2.2 Type of asset allocation

2.2.1 Strategic asset allocation

2.2.1.1 Assets and liabilities

The only reason to hold assets is the existence of liabilities. For example, for an individual the fact that his income flow is not synchronised with his flow of consumption pushes him to accumulate assets through most of his/her working life in order to finance his/her consumption (liabilities) at retirement. Similarly, pension funds receive premiums from each member so that they can meet their liabilities in terms of pension payments to each member. In both examples, there is a transfer of resources from a time period to another time period in the future. This transfer is made through the accumulation of assets, which, together with the returns they will generate, will finance future liabilities.

Depending on the nature and the timing of these liabilities, different assets should be chosen for this financing. If, to simplify, the liability consists of a single fixed payment in one year or in thirty years, choosing a thirty-year discount bond is risky for the one year liability but safe for the thirty year liability. In other words, the management of assets can only be done properly if careful consideration is given to the incurred liabilities.

For the remainder of this section, we will focus on the case of a pension fund with a defined benefit plan. In terms of long-term strategy, a pension fund must decide on three sets of interrelated issues:

- The schedule of the benefits that will be granted to the retirees,
- The schedule of the contributions of both the employer and the employees,
- The long-term asset classes allocation of the pension fund assets.

These decisions must be made considering:

- The regulatory environment,
- The long-term expected returns and volatilities of the asset classes.

The primary goal is, of course, to be able to finance the granted benefits through the contributions and the asset returns. This budgetary constraint is what creates the interrelation between these three issues.

2.2.1.2 Notion of surplus

As already mentioned, the main long-term goal of a pension fund is to finance without disruption the benefits through the contributions and the asset returns. In order to state this goal with more precision, we need to define a new concept, the one of the *pension fund's surplus*. The surplus of a pension plan is equal to the difference between the value of its assets and the present value of its net liabilities. In other words:

$$S = A - L$$

where:

S pension fund's surplus,
A value of the pension fund's assets,
L present value of the pension fund's net liabilities.

The net liabilities are defined by:

$$L = B - C$$

where:

B present value of the pension fund's benefits,
C present value of the pension fund's contributions.

This surplus can be interpreted as the net wealth of the pension fund and it can be estimated at any point in time. When it is positive, it means that the pension has enough assets and projected contributions to finance the projected benefits. If it is negative, then the pension plan is under-funded. In this case, regulations usually require that the pension fund, and/or the firm it is related to, take measures[13] to restore a positive surplus as soon as possible. Also note that the surplus is subject to short-term volatility because both assets and the net liabilities are subject to short-term volatility. There is also uncertainty about the long-term evolution of the net wealth of the pension fund because both the long-term returns of the asset classes and the projections of the contributions and the benefits are not known for sure.

The main long-term goal of a pension fund can now be restated as having the lowest but always positive surplus through time, i.e. both in the short-term and in the long-term. In other words, the goal is to have the pension plan never under-funded in the future without using too many resources. This must occur taking into account both the short-term surplus volatility and the uncertainty about its long-term evolution.

2.2.1.3 Defining the surplus risk

The management of the surplus risk requires that we carefully define the surplus risk because of the very specific time frame of the pension fund goal. Both short-term and long-term risks must be integrated into the decision process. If this is not done, the pension plan will have to face risk misspecification and is likely to make inappropriate asset classes' allocation decisions, which are and will usually prove to be costly in the future.

Risks are present at many levels. On the liability side, in nominal and in present value terms, there are several sources of uncertainties and risks:

- The present value of the liabilities is subject to an interest rate risk because of the involvement of the term structure of interest rate through the discounting mechanism, which is used to compute present values.
- Another source is linked to the unknown life expectancy of the members of the pension plan. It is unknown to the pension fund how long[14] it will have to pay an annuity to each retiree.

13 Such as an increase in contributions and/or a decrease in benefits.

14 Notice that the first source of uncertainty is alleviated if the pension plan includes numerous members so that the principles underlying life insurance can be applied internally. For small pension funds, an external solution can always be found through explicit life insurance.

- A third source is linked to the fact that the contributions are usually defined in terms of the current nominal wages and that the future growth in nominal wages is not certain.
- Another source is linked to the fact that the benefits are usually defined in terms of the prevailing nominal wages at retirement age and that, again, the future growth in nominal wages is not known for sure.

Future inflation, productivity growth and the success of the pension fund's firm are the main factors underlying the future nominal wage growth of the plan members. These three factors are important sources of uncertainty and risk at both the contributions and the benefits level.

On the asset classes' side, there are the usual short-term risks measured in terms of volatilities. There are also uncertainties for the long run, because the asset classes' long-term returns are not clearly known. Note also that the net liabilities extend in the future beyond the longest maturities available in the bonds markets. It means that there is a reinvestment risk linked to the bond class.

2.2.1.4 Managing the surplus risk

As suggested in the previous section, both the assets and the net liabilities sides are characterised by short-term and long-term risks. Notice that there is a trade-off between short-term and long-term risks. Taking both projected contributions and benefits as given, any increase in the stock percentage in the asset classes' allocation is likely to:

- Increase the short-term volatility of the surplus because stocks are less correlated than bonds with the projected net liabilities.
- Decrease the risk for the pension fund to be under-funded in the long run because the asset classes' allocation is tilted toward a class characterized by higher long-term expected returns.

Stated another way, to unilaterally seek to limit the short-term volatility of the surplus, through a weight increase in bonds in the asset classes' allocation, can be more risky[15] in the long run because it leaves the pension's plan more vulnerable to unexpected increases in inflation or in real wages. As most pension plans are providing some, at least implicit, protection against inflation, these increases are likely to trigger some unexpected increases of the projected net liabilities through partial or complete inflation indexation.

2.2.1.5 Asset classes' optimal allocation

The final allocation between the assets classes should take into account the following parameters:

- The level of risk aversion decided by individuals responsible for the pension fund,
- The expected long-term returns of the asset classes,
- The variances and covariances between all asset classes and the net liabilities returns,
- The long term risk of being under-funded.

15 Or more costly through an increase in the contributions schedule.

Determination of an optimal asset classes' allocation should include these inputs. However it is not easy to give any precise algorithm in order to achieve such a goal. One possible way to handle this problem is to find the optimal point, given the risk aversion, on the trade-off between the short-term volatility and the long-term return of the surplus. In addition and in order to manage the problem of the long-term risks, this optimisation should be subject to the constraint of a minimum long-term expected return. This minimum expected return should be chosen so that the risk for the pension plan of being under-funded in the future is acceptable.

The search for the optimal point mentioned before is likely to involve the use of an optimiser. When using an optimiser to allocate between asset classes, two concerns must be present in the mind of the asset classes' manager:

- First, optimisers are very sensitive to the expected returns used, especially when dealing with asset classes. Small changes in expected returns can sometimes dramatically alter the asset classes' optimal allocation in a non-intuitive way. Therefore most of the time, it is necessary to check the consistency in terms of investment of the optimised allocation. More sophisticated optimisation techniques alleviating this problem can be used.
- Second, it is not obvious that the processes underlying the asset classes returns are stationary through time, especially when there are big changes in the regime of macroeconomic policies[16]. With such changes, it is possible to doubt that the forecasted covariance matrix for the asset class returns should remain unaffected. But, because most statistical methods will leave this forecast unchanged, it may not be relevant anymore and sometimes should be "corrected" on a more ad hoc basis. For example, if a central bank changes its operating procedure from controlling the money stock growth toward pegging short-term interest rates, it is likely that the volatility of the cash return will be affected by this change.

Notice that within this framework there is not too much scope for holding cash at the strategic level. To hold cash is a risky proposition both for:

- short-term considerations because the cash duration is so out of line with respect to the duration of the net liabilities, and
- long-term considerations because the cash returns is so low with respect to bonds and stocks long-term returns.

Within these conditions, it is clear that cash holding should be low in the strategic[17] asset classes' allocation.

16 Such as structural changes in monetary (targeting money stock growth instead of short term interest rate) or fiscal policies or in the exchange rate regime.

17 It does not preclude holding more cash for tactical reasons, such as expecting negative returns for both bonds and stocks in the near future.

2.2.2 Tactical asset allocation

2.2.2.1 Definition

As already mentioned, *tactical asset allocation* relates to active[18] investment management techniques all of which seek to create an over-performance with respect to the strategic asset classes mix (strategic benchmark). These techniques aim to do so by successfully forecasting asset class returns and then tilting the managed portfolio asset classes mix from the strategic one so that the investor can expect a higher return than that of the strategic benchmark. This expectation is implemented by over- (under-) weighting the asset classes expected to over- (under-) perform the strategic benchmark.

As suggested in the preceding paragraph, there are many tactical asset allocation techniques. They differ in their underlying methods of forecasting the asset class returns, in the time horizon of the forecast, and in the techniques used to build the active portfolio, and in the way to implement the active asset classes mix.

In terms of underlying techniques of forecast, they can be judgmental or more formalised, i.e. quantitative. When we will present the basic general ideas behind these forecasting methods, we will focus on the more formalised approaches. The reader should simply be aware that these ideas are also the underlying backbone of the more judgmental techniques. In the next section we will also concentrate on the case of the asset classes of a single country and restrict ourselves to the usual cash, bonds, and stock asset classes.

The time horizons associated with tactical asset allocation are of short- to intermediate-term nature. The explicit or implicit forecasts of asset class returns can vary from a few weeks to several months.

The portfolio construction can involve sophisticated techniques like mean-variance optimisation or more simply mapping on an ad hoc basis the asset class forecasts into asset classes over- or under-weights.

Finally, buying and selling assets from the appropriate asset classes can achieve the implementation at the portfolio level. Another way to do it is to use an overlay of futures in order to get the adequate portfolio exposures to the different asset classes.

2.2.2.2 Basic principle

2.2.2.2.1 Risk premium

At the heart of most tactical asset allocation models is the idea that the future relative performances of asset classes are driven by some measure of the relative evaluation of these asset classes. The idea is that there is an equilibrium level governing the relative evaluation of asset classes. In case of the relative misevaluation of asset classes, market forces will generate relative price movements that will restore relative evaluation equilibrium. It means that the more expensive (cheaper) the evaluation of an asset class is relative to another asset class, the more likely it is that the first asset class will under- (over-) perform the other one in order to restore a more balanced relative evaluation. In other words, the richer (cheaper) an asset class is relative to another one, the more likely is that the expected return of the first class will be lower than that of the other.

18 For a definition of active and passive management, see chapter on “Equities management” 1.2.1 and 1.2.2.

One can avoid evaluating the different asset classes explicitly and concentrate directly on determining their respective long-term expected returns[19]. The long term expected return indicators, usually retained for the three main asset classes, are:

- A short term interest rate for the cash,
- A long term expected equity return[20] of the stock market,
- The yield to maturity of a long-term government bond.

For example, for a US domestic tactical asset allocation model, one can use the 3-month Treasury bill, the S&P 500 earnings yield, or the 20-year current coupon Treasury bond. From here, one can define three risk premiums as differences in the previous expected returns. They express the expected relative returns and therefore relative attractiveness between certain pairs of the three asset classes:

- Stock/Cash risk premium: long-term expected equity return minus the cash short-term interest rate.
- Bonds/Cash risk premium: long-term government bond yield to maturity minus the cash short-term interest rate.
- Stock/Bonds risk premium: long-term expected equity return minus the long-term government bond yield.

Given these indicators, one must now determine what is their predictive power in terms of subsequent relative performance. In order to do so, we will use the concept of the information coefficient, i.e. the correlation between a forecasting indicator (the risk premium) and the actual forecasted variable (the subsequent relative return). In order for the tactical asset allocation model to perform one needs at least positive information coefficients. In our case, a positive information coefficient means that above (below) average risk premiums are followed by above (below) average relative returns. In other words and for example, above (below) average stock/bond risk premiums tend to be followed by a better (worse) performance of the stock relative to the bonds. A value of one for an information coefficient is indicative of a perfect predicting ability. A value of zero is indicative of no forecasting power.

The following table[21] summarises these information coefficients for the three risk premiums and for different time horizons as far as the subsequent relative returns are concerned:

Risk Premium	**Stocks/Cash**	**Bonds/Cash**	**Stocks/Bonds**
Relative Return	**Stocks/Cash**	**Bonds/Cash**	**Stocks/Bonds**
1 Month Horizon	0.18	0.15	0.15
3 Months Horizon	0.27	0.22	0.25
12 Months Horizon	0.37	0.37	0.43

Table 2-2: Information Coefficients: Risk Premiums versus Subsequent Relative Returns, the case of the US Markets (1951 – 1989)

The above table deserves two comments:

19 For the cash, one is limited to a short term horizon.

20 Such as, for example, the earning yield (inverse of the price-to-earnings ratio) of the stock market. Other approaches use either a bottom-up or a top-down appreciation based on the dividend yield and the forecasted future growth in earnings or dividends.

21 The underlying material is adapted from "Tactical Asset Allocation: A Review of Current Techniques" by Charles H. DuBois in Active Asset Allocation, edited by Robert D. Arnott and Frank J. Fabozzi, Irwing Professional Publishing.

- First, all information coefficients are positive[22] and confirm the predictive power of the risk premiums on the respective subsequent relative performance of the two selected asset classes.
- Second, notice the longer the time horizon, the better the forecasting power.

This last comment should be interpreted carefully in terms of investment consequences. It does not mean that a yearly investment strategy will deliver better performances, because, with a monthly strategy, one can successfully exploit the intra-year ups and downs of the different asset classes relative performances.

2.2.2.2.2 Other forecasting indicators

Even if risk premiums are quite useful in predicting relative performances of asset classes, it is possible to further improve the forecasting power of tactical asset allocation models by adding some other indicators. The idea behind this is that, even if there is some long-term equilibrium in the risk premiums, these risk premiums could predictably deviate in the short-term. One intuition is that there are cycles in the relative performance of asset classes linked to some extent to the business cycle. It is not the purpose of this material to exhaustively mention all these short-term indicators. We will only mention a brief typology of the indicators that have been used with some success:

- Macroeconomic indicators: change in retail sales, price indices, unit labour costs, the level of unemployment
- Sentiment indicators: institutional cash holdings, investor sentiments survey, …
- Technical indicators: recent trends in risk premiums, stock market return variance, market price momentum, market breadth, …

Notice that there is a risk of data mining when looking for these additional indicators through statistical procedure only. If one tries more and more indicators, it is likely that, at some point in time, the statistician will uncover some spurious correlation between a potential indicator and the subsequent relative performances. It is always good practice to back up any statistically detected correlation with a sound and sensible investment reason. It is even better to start initially with a sensible investment scheme and test it statistically to see if the data supports it, instead of beginning with statistical analysis and looking afterwards for investment justifications.

2.2.2.3 Portfolio construction

The rules of portfolio construction for asset classes are the same as those expressed for building a stock portfolio[23] whether judgmental or quantitative techniques are used. Implementing the expected risk premium, i.e. the expected relative asset classes returns, must follow the same rules including the maximisation of the information ratio. For example, asset classes that are expected to over- (under-) perform the benchmark should be over- (under-) weighted. Similarly, risk controls can be imposed through the use of maximum weight deviations or of an ex-ante tracking error provided by a risk model.

22 In this case, an information ratio of 0.06 (0.08) is statistically significant at the 10% (5%) level.

23 See chapter on “Equities management” 1.2.1.1.

In the next paragraphs, we will outline the major differences:

- Often, the benchmark does not encompass cash. If the portfolio manager cannot borrow and use leverage, then it cannot implement the desired bet of over-weighting both stocks and bonds if it believes that these two asset classes will do better than cash[24].
- When using an optimiser to build portfolios, one must remember the concerns stated in section 2.2.1.5. In the case of tactical asset allocation, the portfolio manager can use the technique of the maximum weight deviations to get more sensible solution for his optimal asset allocation.

2.2.2.4 Implementation

Tactical asset allocation can be implemented in three different ways:

- Using cash, bonds, and stocks directly,
- Using cash, bond futures and stock futures,
- Using cash, bonds, and stocks directly to build a portfolio along the strategic benchmark weights together with a bond and stock futures overlay to implement the active weight deviation given by the tactical asset allocation model.

The use of futures for the two last options present several advantages linked to their low transaction costs[25], their good liquidity, and the ease and quickness they provide in terms of execution. In addition, for the third option, their use does not disrupt the management of the underlying assets, i.e. of both the stock and bond portfolios set at benchmark weight. In terms of drawbacks, the use of futures implies daily back office operations and the creation of liquidity reserves[26]. The futures are also sometimes mispriced and are subject to a tracking error with respect to the underlying assets.

2.2.3 Dynamic asset allocation

2.2.3.1 Definition

Dynamic asset allocation refers to investment techniques that alter the asset classes' allocation in direct and mechanical response to the change in the market levels of the different asset classes. The most well-known dynamic asset allocation process is portfolio insurance, which will be presented in some detail in the next section. In a subsequent section we will then describe another dynamic asset allocation technique, i.e. the constant weight rebalancement.

24 For more details, see chapter on "Equities management" 1.2.1.6.

25 This advantage is not negligible because tactical asset allocation is often characterised by high turnovers.

26 These reserves penalise the active return of both the bond and stock portfolios in the case of the third option.

2.2.3.2 Portfolio insurance

The purpose of portfolio insurance is to reshape the entire return distribution of a portfolio by breaking its usual symmetry and providing a floor to negative returns. The goal, for example, is to limit losses on an equity portfolio to a maximum of, let's say, -15%. A detailed description of portfolio insurance techniques will be given in another chapter of this program. The reason for mentioning it here is that portfolio insurance can be implemented through dynamic asset allocation methods. For example, the implementation of portfolio insurance on an equity portfolio can be done through dynamic asset allocation between cash and equities[27]. The rules are to increase the proportion of stocks when the stock market moves up and to reduce this proportion when it declines. In other words portfolio insurance is a trend following strategy. The trigger to change the asset allocation between cash and stocks are the changes in the stock market level[28].

Such portfolio insurance is subject to several costs that are related to:

- The trading between asset classes. This trading depends on the ex-post volatility of the stock market.
- The fact that the portfolio is never fully exposed[29] to the stock market. This is costly in the long run as the long-term stock return is positive and larger than that of cash.

There is a risk associated with this dynamic implementation of portfolio insurance. In case of a sudden and significant drop in the stock market (crash), it may not be possible to change the asset allocation quickly enough or to make the necessary trades at a fair price. If this happens, the portfolio insurance can fail. This is called the gap risk. One way to alleviate this potential problem is to, at least partially, implement the portfolio insurance through options.

2.2.3.3 Constant weight rebalancement (or constant-mix strategy)

The constant-mix strategy is based upon maintaining an exposure to stocks that is a constant proportion of wealth.

It is a dynamic strategy in the sense that when asset prices change, purchasing or selling is required in order to return to the desired mix. Generally, the strategy implies purchasing stocks when they fall in value, and the selling stocks as they rise in value. As we will see, this represents the sale of portfolio insurance. The reason of the strategy is that the relative performance between the two asset classes exhibits some reversion toward the mean. In other words, when one of the asset classes over-performed it is an indication that it will under-perform in the future. As, after an over-performance, the rebalancement implies a decline in the weight of the previously over-performing asset class, the timing of this decline of the weight of this asset class is providing additional returns if, indeed, this asset class under-perform thereafter.

> **Example:**
> An investor has 1 share with an initial value of 100 CHF. He wants to engage in a 60:40 constant mix strategy for two years. The risk-free rate is 5% (zero-coupon bond with 2 years to maturity). We have: $S_0 = 100$ CHF, $r = 5\%$, $T = 2$, $V_0 = 100$ CHF. The following table illustrates the 60:40 constant-mix strategy over 2 years in the case of a bear market.

27 Usually represented through a future.

28 Given the stock market volatility and the risk free rate.

29 The beta (delta) of the portfolio is always lower than 1.

t	$P_{stock,t}$	$P_{bond,t}$	$A_{t-1,t}$	$B_{t-1,t}$	V_t	A_t	B_t
0	100	90.48			**100**	60.00	40.00
1	97.06	90.86	58.24	40.17	**98.40**	59.04	39.36
2	94.85	91.24	57.70	39.53	**97.22**	58.33	38.89
3	94.08	91.62	57.86	39.05	**96.91**	58.15	38.77
4	90.73	92	56.08	38.93	**95.00**	57.00	38.00
5	87.58	92.39	55.02	38.16	**93.19**	55.91	37.27
6	83.22	92.77	53.13	37.43	**90.55**	54.33	36.22
7	78.23	93.16	51.08	36.37	**87.45**	52.47	34.98
8	74.97	93.55	50.28	35.13	**85.41**	51.25	34.16
9	73.19	93.94	50.03	34.31	**84.33**	50.60	33.73
10	70.29	94.33	48.60	33.87	**82.47**	49.48	32.99
11	66.52	94.73	46.83	33.13	**79.96**	47.97	31.98
12	64.84	95.12	46.76	32.11	**78.88**	47.33	31.55
13	63	95.52	45.98	31.68	**77.67**	46.60	31.07
14	59.41	95.92	43.94	31.20	**75.14**	45.08	30.06
15	57.24	96.32	43.44	30.18	**73.62**	44.17	29.45
16	54.36	96.72	41.95	29.57	**71.52**	42.91	28.61
17	52.64	97.13	41.55	28.73	**70.28**	42.17	28.11
18	50.42	97.53	40.39	28.23	**68.62**	41.17	27.45
19	48.86	97.94	39.90	27.56	**67.46**	40.48	26.98
20	45.53	98.35	37.72	27.10	**64.82**	38.89	25.93
21	42.99	98.76	36.72	26.03	**62.75**	37.65	25.10
22	39.02	99.17	34.18	25.21	**59.38**	35.63	23.75
23	35.64	99.58	32.54	23.85	**56.39**	33.84	22.56
24	33.33	100	31.64	22.65	**54.30**		

The following conventions were adopted:

- $P_{stock,t}$ denotes the stock price at time t
- $P_{bond,t}$ denotes the bond price at time t
- $A_{t-1,t}$ denotes the value of the stock portfolio when arriving at time t, before rebalancing
- $B_{t-1,t}$ denotes the value of the bond portfolio when arriving at time t, before rebalancing
- A_t denotes the value of the stock portfolio at time t, after rebalancing
- B_t denotes the value of the bond portfolio at time t, after rebalancing
- V_t denotes the total value of the portfolio at time t.

As the strategy implies the purchase of stocks when they fall in value, the result is a dramatic loss. Also note that **there is no floor**.

In a bullish market, the strategy performs well, but a buy and hold strategy would perform better as the constant mix implies the sale of stocks as they rise in value.

t	$P_{stock,t}$	$P_{bond,t}$	$A_{t-1,t}$	$B_{t-1,t}$	V_t	A_t	B_t
0	100	90.48			**100**	60.00	40.00
1	103.59	90.86	62.15	40.17	**102.32**	61.39	40.93
2	106.62	91.24	63.19	41.10	**104.29**	62.57	41.72
3	110.26	91.62	64.71	41.89	**106.60**	63.96	42.64
4	113.67	92	65.94	42.82	**108.75**	65.25	43.50
5	117.52	92.39	67.46	43.69	**111.15**	66.69	44.46
6	120.37	92.77	68.31	44.64	**112.95**	67.77	45.18
7	125.35	93.16	70.57	45.37	**115.94**	69.57	46.38
8	128.79	93.55	71.47	46.57	**118.05**	70.83	47.22
9	132.3	93.94	72.76	47.42	**120.17**	72.10	48.07
10	137.2	94.33	74.77	48.27	**123.04**	73.83	49.22
11	141.77	94.73	76.28	49.43	**125.71**	75.43	50.28
12	146.53	95.12	77.96	50.49	**128.45**	77.07	51.38
13	150.69	95.52	79.26	51.60	**130.85**	78.51	52.34
14	152.75	95.92	79.59	52.56	**132.15**	79.29	52.86
15	154.94	96.32	80.42	53.08	**133.50**	80.10	53.40
16	159.19	96.72	82.30	53.62	**135.92**	81.55	54.37
17	161.26	97.13	82.61	54.60	**137.21**	82.33	54.89
18	164.77	97.53	84.12	55.11	**139.23**	83.54	55.69
19	166.64	97.94	84.49	55.93	**140.41**	84.25	56.17
20	168.15	98.35	85.01	56.40	**141.41**	84.85	56.56
21	170.38	98.76	85.97	56.80	**142.77**	85.66	57.11
22	173.53	99.17	87.25	57.35	**144.59**	86.76	57.84
23	177.36	99.58	88.67	58.08	**146.75**	88.05	58.70
24	181.48	100	90.09	58.95	**149.04**		

The payoff diagram (portfolio performance over a certain period of time to the performance of the stock market over the same period) is shown below.

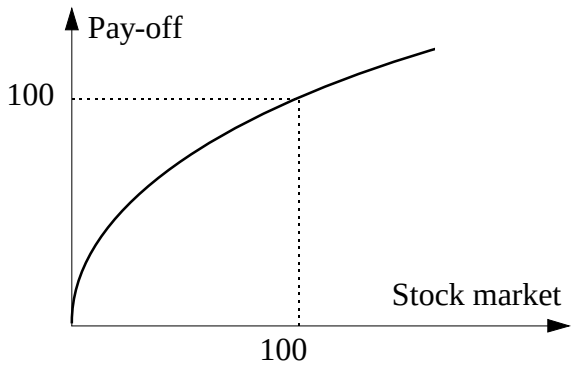

Figure 2-8: Constant Mix strategy payoff

Thus the constant-mix strategy is often referred to as a concave strategy (its payoff is concave).

By opposition a buy and hold strategy has a linear payoff:

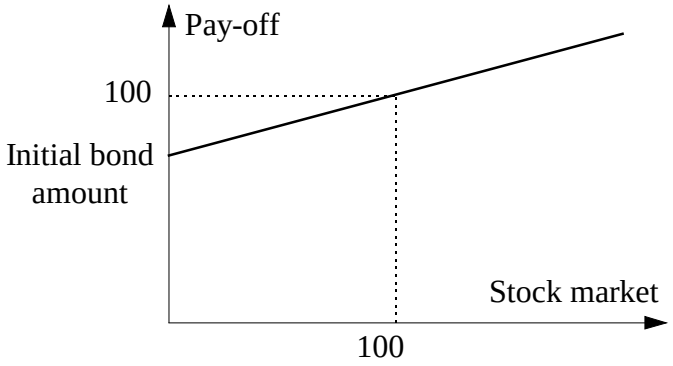

Figure 2-9: Buy and hold strategy payoff

Finally, one can argue about what the rules for rebalancement should be. Should it be done periodically[30], or when the weight imbalances reach a pre-specified level[31]? Should this pre-specified level be determined in absolute terms or be based in terms of the volatility of the relative returns of the different asset classes? The answer to these questions is essentially empirical. Back testing can show what were the best rules in the past. However, it is not clear that the same rules would be the best in the future.

30 Monthly, quarterly or yearly.

31 For example, when the stock class weight reaches 55% or 65%.