Fundamental-driven and Tactical Asset Allocation: what really matters?

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Abstract

Asset allocation contribution to ex-post performance is of primary importance. Nobody denies its role, yet the subject of allocating assets remains controversial. To some contenders, the added value stems only from strategic asset allocation which aims at providing the long-term average exposure to the selected asset classes. On the other hand, proponents of active management have introduced several forms of tactical asset allocation.

In this paper, we will go a step further by distinguishing between 1) long-term strategic asset allocation, 2) medium-term strategic or fundamental-driven asset allocation and, finally, 3) tactical asset allocation. "Fundamental-driven" refers to the inclusion of slow business cycle components and structural changes in the economies. "Tactical", by contrast, exploits short term transitory mispricings in the markets.

When one takes into account various types of information, it leads to various conditioning processes and thus to the three levels of asset allocation mentioned above. As an example, we illustrate how models can be used for computing the asset expected returns related with different asset allocation levels. We show that error correction models are particularly useful in this context. Finally, using these concepts, we present simulations of two actively managed balanced portfolios – equity and bonds – in the US and Europe. The simulation results show the added value of allocation either Fundamental-driven or Tactical on the portfolios' return.

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Introduction

Asset allocation is usually defined as the process of determining the optimal allocations in a portfolio with broad asset categories (such as stocks, bonds, cash, real estate, ...) depending on the investment horizon, objectives, constraints and risk tolerance of the investor. By "optimal" we mean a portfolio that maximizes the expected return/risk ratio for the constraints defined by the investor.

This process can be performed on any portfolio with two or more "assets", however the term "asset allocation" most commonly refers to allocation of "asset classes", the single decision that has the greatest impact on the portfolio's return.

A distinction between levels of asset allocation can be made. Most often people refer to strategic asset allocation, which is based on long-term forecasts for expected returns, volatility and correlations between financial assets, and tactical asset allocation, founded on short-term forecasts.

In this paper, we will go a step further by distinguishing between 1) long-term strategic asset allocation, 2) medium-term strategic asset allocation, which we will call "fundamental-driven asset allocation" and finally, as before, 3) tactical asset allocation. We will see that each of these asset allocation levels are conditional upon different types of information[1], mostly related to economic cycles and market asset prices, as these factors strongly impact expected asset returns. We will, in particular, illustrate the use of models for dealing with information. We will show that the fundamental-driven asset allocation and tactical asset allocation, which are both deviations from the long-term strategic asset allocation, are both sources of performance.

This paper is organized as follows. The first part will describe the determinants of the three levels of asset allocation defined above.

The second part of this paper will explain how models can be used for computing the expected asset returns related with different asset allocation levels, by specifically conditioning these expected returns to different types of information. We shall show that error correction models are particularly useful in this context.

Finally, part three will apply these concepts for building expected returns for the bond and equity US and European markets, using two stylized valuation models for each asset class. We will present simulations of an actively managed global balanced portfolio – invested in equity and bonds – in the US, using alternatively calculated long-term, medium-term and tactical expected returns for bonds and stocks. We will repeat the exercise for the European market. The simulation results will show the strong positive impact of tactical allocation on the portfolio's return.

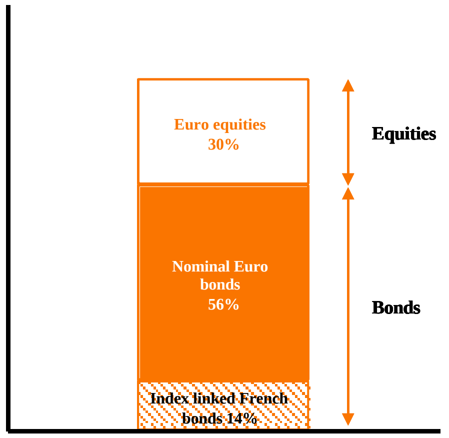
1 Levels of asset allocation

1.1 Long-term strategic asset allocation

The first and most important choice that a private or institutional investor must do when organizing his portfolio is the long-term strategic asset allocation. Long-term strategic asset allocation is the choice of the proportion of and within asset classes that the investor wishes to hold in the long run. This decision will be the result of the investor's goals and constraints, as well as its risk and return expectations for the portfolio assets, for the investment horizon, usually of 10 to 25 years.

Strategic asset allocation may materialize in a **constant mix** of and within different asset classes. Figure 1 exhibits an example of a long-term strategic asset allocation for a French complementary retirement scheme fund, with 70% Euro bonds – where 20% corresponds to French index linked bonds – and 30% to Euro equities. In some instances a known public benchmark can be implemented in the strategic portfolio.

Figure 1
Long-term strategic allocation of a hypothetical French complementary retirement scheme fund



In the French fund example, the European equity segment may be represented by the MSCI Euro index. In this case, although the strategic stock proportion to be held in the long run is 30%, the weights of the local European markets may change over time, following the time varying composition of the MSCI Euro index.

As mentioned above, the long-term strategic asset allocation choice derives from a certain number of parameters. A well-known answer for the strategic allocation decision is the Markowitz (1952) mean-variance analysis, applied to a world of risky assets and a risk-free asset. In this framework, for a given choice of risky asset classes, say, stocks and bonds, the first step is to calculate the efficient frontier: the set of optimal portfolios in terms of expected returns and risk, i.e. the different combinations of stocks and bonds that maximize the expected return of a portfolio for different risk levels. The theory shows that, given the existence of a risk-free asset, there is one optimal portfolio of risky assets, which should be combined with the risk-free asset according to the investor's desired risk level. It can be shown that this optimal risky portfolio is the one that maximizes the Sharpe ratio (the expected excess return/volatility ratio).

Of course, in the real world, things are more complex and strategic portfolios will reflect something rather different than the scheme presented above. Particularly, the fact that the risky asset portfolio is the same across investors will seldom be true, as investors views/expectations differ widely (indeed one of the key assumptions of the Markowitz mean-variance analysis is that risk and returns expectations are the same for all investors). Investment horizons are different across investors and expected risk and returns of assets may not be the same for different horizons. Complex tax systems, which penalize or favour in various ways different investors, have clearly an impact on the asset choice. Constraints also vary widely across investors, where an investor may have to build his portfolio for meeting particular liabilities (asset liability management: ALM).

The following point should be stressed: no matter what the optimization problem we wish to solve, there are a certain number of hypotheses that remain in any problem. Particularly, decisions about how much we wish to invest in, say, equity and bonds in the framework of the long-term strategic asset allocation will ultimately depend on their expected risk and returns, for a long-run horizon.

Long-term expected returns are often associated with constant values, based on average historical risk premiums (the excess return required from an investment on a risky asset over that required from a risk-free investment) computed for long periods. In this approach, the assumption is that the behaviour observed in the past will be reproduced in the future. The trouble is that there is a great deal of discussion about which of these historical values are good candidates for representing long-term expected returns. Indeed, historical average premiums for stocks and bonds may vary widely, depending on their computation periods. Table 1 presents historical compound returns for stocks, bonds and T-Bills for different periods in the US, with their resulting historical average risk premiums, as reported by different experts. Sometimes the computation period chosen by the expert depends on which statistics are readily available! According to Hunt and Hoisington (2003), another important issue in building expected returns based on historical returns, is to assess the inflation impact on premiums. They notice that periods of high inflation resulted in higher ex-post excess equity returns on long bond returns, as the latter perform badly during these periods, while the contrary was true during periods of low inflation. Table 1 also presents the average inflation registered for the historical periods analyzed. Lines 3 to 6 show compound returns for periods of significantly different inflation rates (1871-2001, 1871-1945, 1941-1961, 1928-1938), which coincided with periods of strikingly different premiums of stocks over bonds .

The historical equity risk premium in the United States with respect to a risk-free asset like a T-bill was 3.9% on average for the past two centuries (3.3% with respect to long bonds, see Table 1) according to Siegel (2001), more than 6% if we consider the period 1926-2002, following Ibboston and Sinquefield (2002, see Table 1). Concerning bonds, returns will depend on the bond duration. For 20-year bonds, the premium over T-Bills reached 1.7% for the period 1926-2002 (Ibbotson and Sinquefield, 2002), 1.1% for the period 1871-2001 (Siegel, 2001, the maturity of the long bonds is not specified).

Concerning risk, expected stock market volatility will depend upon its degree of diversification. The US stock market, a well diversified stock market, exhibits a historical volatility of around 15% when calculated over the nineties – close to the Ibbotson 16% calculation for 1926-2001 –while the Finnish stock market, which is highly concentrated (Nokia represented 70% of its capitalization in December 2002), has a volatility higher than 40% for the same period. If we consider long-term data, the average volatility of the S&P for the period 1871-2001 was around 14%, with periods of very high volatility (1928-1938, see Table 1). Bonds exhibit significantly lower risk, the average recorded for 1926-2002 (Ibbotson and Sinquefield, 2002) was 9%, based on

20-year government bond returns, however it tends to decrease when more recent data is used in calculation. Correlation between stocks and bonds was estimated at 10% for the period 1926-2002 (Ibbotson and Sinquefield, 2002).

As long-term strategic asset allocation is often a function of these constant values (long-run historical means), *it may also be denominated unconditional asset allocation, in the sense that it is not sensitive to recent information.*

Table 1
Some long-term historical figures

Nominal compounded annual rates of return in the USA (Unless indicated otherwise)				**Historical risk premiums**				**Historical risk estimates**		
	Equities	Bonds	T-Bills	Equities Minus Bonds	Equities minus T-Bills	Bonds minus T-Bills	Inflation	Annual Volatilty equities (4)	Annual Volatilty bonds (5)	Correlation equity/bonds (6)
1926-2002 (1)	10.2%	5.5%	3.8%	4.8%	6.4%	1.7%	3.1%	16.1%	9% (5)	10%
1926-2002 real (1)	7.2%	2.4%	0.7%	4.8%	6.4%	1.7%	3.1%	16.2%		
1871-2001 (2)	9.3%	5.0%		4.3%			2.0%	14.3%		
1871-1945 (2)	7.2%	4.5%		2.7%			0.5%	15.9%		
1941-1961 (2)	16.9%	1.9%		14.9%			3.6%	11.1%		
1928-1938 (2)	-0.9%	4.6%		2.2%			-2.4%	30.6%		
1802-2001 real (3)	6.8%	3.5%	2.9%	3.3%	3.9%	0.6%				
1871-2001 real (3)	6.8%	2.8%	1.7%	4.0%	5.1%	1.1%	2.0%	14.4%(14.3%)		
1946-2001real (3)	7.0%	1.3%	0.6%	5.7%	6.4%	0.7%	3.7%	12.1%(11.8%)	7.4%(7.2%)	-2.6%(-7.6%)
1982-2001real (3)	10.2%	8.5%	2.8%	1.7%	7.4%	5.7%	3.2%	12.1%(12%)	8.4%(8.3%)	-7.6%(-10.4%)

1) Ibbotson and Sinquefield (2002), total returns from S&P stocks, 20-year US government bonds, and 30-days T-Bills
2) Calculations of total returns reported by Hunt and Hosington (2003), based upon the S&P index and long bond interest rates, using a collected by Shiller (2000) and Homer and Sylla (1991),
3) Returns calculated by Siegel (2001), based on data from Schwert (1990), Cowles (1938), and from the CRSP capitalization-weighted lexes of all NYSE, Amex, and NASDAQ stocks.
4) Own calculations, based on Shiller (2001) historical data for the S&P. The data in brackets for the 8th, 9th and 10 th lines rresponds to the volatility of nominal returns. The volatility reported corresponds to annualized monthly volatility.
5) 1926-2002 volatility reported by Ibbotson and Sinquefield (2002), based on 20 year government bond returns,1946-2001 and 82-2001 volatilities based on 10 year government bond yield monthly changes (source IMF), using an average duration of 7
6) 1926-2002 correlation reported by Ibbotson and Sinquefield (2002). 1946-2001 and 1982-2001 correlations between equity and nd returns were calculated using S&P equity returns and 10 year government bond returns. The values in brackets corresponds to minal returns.

Note that the choice of the constant values pertaining to expected risk and returns is of primary importance in the long-term strategic asset allocation process. Particularly, in a Markowitz framework, the allocation will be very sensitive to slight changes in these constant values. Also, in our explanations, we talked about stocks and bonds, where documentation about historical behaviour is relatively abundant. We can imagine the difficulty of building strategic portfolios when we are willing to introduce other asset classes, like alternative funds, real state, etc.

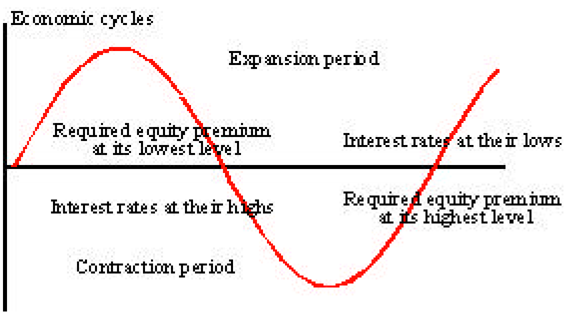
1.2 Fundamental-driven asset allocation

Investment committees can decide to modify the long-term strategic asset allocation in the medium-term – say 5 years – following the irruption of factors which have an impact on asset expected returns precisely in the medium-term. These factors can be structural changes in the investment environment and/or economic cycles.

For example, a long-term strategic international equity portfolio may have a proportion of 20% of its stocks invested in the Japanese market. However, news about, say, structural reforms in the Japanese banking system with a likely negative influence on domestic activity in the medium-term may have a negative impact on the Japanese expected equity returns for that time horizon. As a result, investment managers could decide to significantly reduce the strategic proportion of Japanese stocks for the medium-term horizon (i.e. 5 years).

Economic cycles are most often influencing deviations from the long-term strategic asset allocation in the medium term, as they have a decisive influence on asset returns. Interest rates change along the economic cycle. Figure 2 depicts the evolution of the economic cycle, expansion (contraction) periods being represented by the sinusoid when it is above (below) the horizontal line. Typically, as the level of economic activity and inflation rise, so too do interest rates, with short rates usually rising faster than long rates. Stock markets usually do well during this period, as companies' profits are well oriented, the market is optimistic (and wealthier) and the required risk premium of market participants tends to be low.

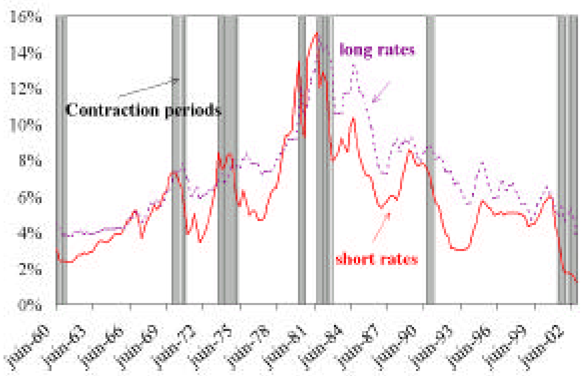
Figure 2
Financial markets and the economic cycle



At the end of the expansion period/beginning of the contraction period, interest rates will usually reach a relative maximum, while stock markets should start to turn bearish for a while, as profit expectations become less optimistic. Accordingly, at this moment of the cycle, it would be wise to raise the bond proportion with respect to stocks in a diversified portfolio.

Conversely, at the end of a contraction period/beginning of the expansion period, interest rates are at their lows, following the weak level of activity and lower inflation.[2] However, the most likely evolution on the medium-term is a rise of short rates and the whole term structure of interest rates. Concerning the stock market, after a long period of stagnation or fall, company profits should start to recover, while the required risk premium of market participants is at its highest, as people do not yet have a clear view of profit prospects. The conditions are established for starting a period of high equity returns and relatively low bond returns. Thus, during these times, it is convenient to raise the proportion of stocks to bonds.

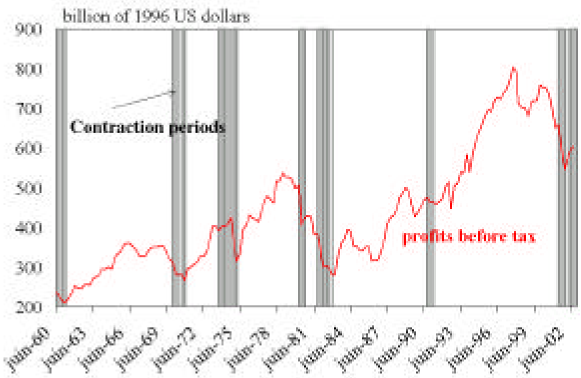
Figure 3
USA- Interest rates and the economic cycle



<u>Source</u> : Bloomberg

Figures 3 and 4 illustrate some of the points discussed above for the US market. Figure 4 shows the evolution of short rates (3-month T-Bills) and long rates (10 year government bond yields) since January 1960 until December 1992. The grey areas represent the contraction periods according to the business cycle dating committee of the National Bureau of Economic Research (NBER). The behaviour of interest rates is described quite closely by the pattern discussed above at every cycle.

Figure 4
USA – Gross profits (1996 USD dollars) and economic cycles



<u>Source</u> : US National Economic Accounts-NIPA tables

Figure 4 exhibits the gross US profit evolution from January 1960 until December 2002. The profit pattern is less well defined than the bond pattern. In some cases profits began to fall just before the start of the economic contraction period, while in other cases, they started to decline well before, as it was the case before the last contraction period announced in March 2001 (profits started to decline more than two years before, though expectations for future profits were high).

Investment managers can monitor business cycles and assess expected returns accordingly. It is important to underline that this medium-term strategic asset allocation changes slowly, following the smooth changes of its underlying factors, and the resulting slow changes in the resulting equilibrium expected returns in financial markets. Note that we use the denomination of "equilibrium expected returns" meaning that expected returns are consistent with the underlying conditions of the economic/financial system. *Also, as this level of asset allocation is influenced by the evolution of the fundamentals, we shall call it fundamental-driven asset allocation.*

1.3 Tactical asset allocation

Tactical asset allocation is commonly defined as the change in the proportion of assets of a portfolio in response to significant expected returns which should be partly materialized in a relative short period of time, say, three to six months. Typically, these tactical expected returns are the result of a sudden and often a large change in the required risk premium of investors (translating into a large change in market prices), who may be overreacting to a particular piece of information arriving to the market. For instance, the Russian default in August 1998, followed by the September crisis of the huge hedge fund Long-Term Capital Management (LTCM) resulted in a sharp increase of the required risk premium of European markets, which fell by 20% during those two months. At that period, the economic situation in Europe was quite favourable, with company profits growing soundly. Eventually, it turned out that the market had overestimated the impact of the crisis on the European financial system and equity markets recovered significantly in October, though helped by the reduction of the US Fed Funds rate .

If the deviation between the actual required risk premium of market participants and the equilibrium risk premium – the last one consistent with the phase of the economic cycle and the structure of the economic/financial system – is too large, there are significant chances that the market required risk premium will move significantly towards the equilibrium risk premium in a relative short period of time. The translation of these tactical expected returns into tactical changes in the portfolio's allocation can be very rewarding.

Concisely, finding a suitable long-term strategic asset allocation for the investor will imply finding an optimal portfolio, given a set of constraints and liabilities, the investor's risk aversion and long-run expectations about risk and return, usually taken as constant values. The fundamental-driven asset allocation deviates from the long-tem strategic asset allocation, following the (smooth) evolution of equilibrium expected returns, along the economic/financial cycle and/or important structural changes of the financial/economic system. Finally, the tactical asset allocation deviates from the fundamental-driven asset allocation as a result of significant deviations in the required risk premium of the market with respect to the equilibrium risk premium – embodied in the equilibrium expected return defined above –, which are expected to translate in significant tactical returns.

2 Models and levels of asset allocation

2.1 The use of models in determining equilibrium and tactical expected returns

The discussion above suggests that the equilibrium expected returns of different asset classes are determined by the phase of the economic cycle and/or structural important changes to the economic/financial system.

Table 2

Economic cycle and/or structural changes

↓

State variables of the economy → EQUILIBRIUM EXPECTED RETURNS

↓

FUNDAMENTAL DRIVEN ASSET ALLOCATION

Official interest rates
Inflation
Expected earning growth
Fiscal balance
Current account
Investor's risk aversion
Economic growth
../..

Actually these factors influence the state variables of the economy – like interest rates, expected company earnings, fiscal balance, inflation, among many others – which in turn have an impact on the equilibrium expected returns of the different asset classes. Finally, these equilibrium expected returns may translate into a particular fundamental-driven asset allocation. Table 2 schematizes this process.

One way of assessing equilibrium expected returns is through the use of models that identify the economic and financial variables that explain them the best.

For instance, we may want to calculate the equilibrium expected return of a 10-year maturity US government bond. Based on the expectation hypothesis model (EH), which states that, given a bond which matures at t+n, the yield to maturity Y_{nt} will average the expected return of rolling over one period bonds for n periods, plus a required premium, we can consider the following simple model[3]:

$$LR_t = \underbrace{a + b\ SR_t + g\ INF_t}_{\text{equilibrium long rate}} + u_t \qquad (1)$$
$$u_t = r\ u_{t-1} + e_t$$

where LR_t stands for the 10-year bond yield rate, SR_t is a short-term rate and INF_t is the expected inflation rate, at end of period t. Expected inflation is the variable which will lead investors to adjust their required premiums. a, b and g are the model coefficients that will allow us to calculate the equilibrium long rate as a function of the short-term rate and the expected inflation rate. u_t is the deviation between the market long rate LR_t and the equilibrium long rate at end of period t. The value of u_t is equal to 0 on average, meaning that, on average, markets are efficient, reflecting the fundamentals. r is an autocorrelation coefficient, which varies between 0 and 1: a coefficient close to 0 indicates that interest rates adjust to their equilibrium value almost instantly, i.e. the deviations from the equilibrium are quickly retraced. A coefficient close to 1 indicates that deviations from equilibrium tend to persist. e_t is an error term iid.

Based on (1) we can write the following equation:

$$E(\Delta LR_{t+1}) = \underbrace{b\ E(\Delta SR_{t+1}) + g\ E(\Delta INF_{t+1})}_{\text{change in equilibrium}} + \underbrace{(r-1)u_t}_{\textit{mean}\ \text{reversion}} \qquad (2)$$

where E is the expectations operator and Δx_{t+1} for any variable x denotes the change of the variable from t to t+1.

The model behind equation (2) is known in econometrics as the error correction model (ECM)[4] : the error term u_t – the discrepancy between the market value and the equilibrium value – is a useful variable for explaining the next movement of the interest rate, resulting in a "correction" of the market. This equation states that the expected change of the long-term interest rate, denoted by $E(\Delta LR_{t+1})$ is explained by:

1) The expected change of the equilibrium interest rate, which in turn is explained by the expected change of short-term interest rates and inflation. Indeed the equilibrium interest rate changes over time, as a function of the evolution along the economic cycle of the state variables of the economy, in this case short-term interest rates and inflation. Note that the change in the equilibrium interest rate can be rather slow, as short-term interest rates and inflation present persistent trends. Thus, we can call the equilibrium interest rate as the <u>permanent or persistent component</u> of the observed interest rate.

2) The expected change of the interest rate is also explained by the absorption of the previous disequilibrium u_t. In other words, if the market is not in equilibrium, a movement of the market interest rate towards the equilibrium interest rate, what we call mean reversion, is expected to take place. The mean reversion speed is precisely measured by the r coefficient, as mentioned above. As this movement is expected to occur rather quickly, the deviation u_t is called the <u>transitory component</u> of the long rate.

Finally, using (2), the expected total return ER for an investor in the bond market is the actual market bond yield plus the expected change of the bond yield multiplied by the sensitivity $\boldsymbol{s}$ of the bond:

$$ER(\text{bond market}) = \underbrace{LR_t}_{LR_t^{EQ}+u_t} + s\,E(\Delta LR_{t+1})$$
$$= \underbrace{\underbrace{LR_t^{EQ} + s\,E(\Delta LR_{t+1}^{EQ})}_{\text{equilibrium ER}} + (1+s(r-1))u_t}_{\text{tactical ER}} \qquad (3)$$

where the upper script EQ stands for equilibrium value.

Note that if the market is at equilibrium, the tactical expected return of a bond bought at, say, the beginning of the year, is the equilibrium yield of the bond. For instance, if the equilibrium return of a bond is 4.5% (consistent with, for example, a short rate observed at 3% and an expected inflation level of roughly 2%, according to a particular model), and the market price is equal to the equilibrium price, this value corresponds roughly to the investor's expected return for the year.

On the other hand, if an important deviation between the market interest rate and the equilibrium interest rate is observed, the tactical return can be rather important. In our example above, if the market interest rate is, say, 5%, meaning a deviation of 50 basis points above the equilibrium rate, the investor's expected return of a 10 year bond with a sensitivity of 7.5 can reach more than 8% for the year ! (5% plus a capital gain of about 3.25%), if the investor sells the bond at the end of the year.

Long-term, medium-term and market required risk premium.

When we mention the expected return of a particular financial asset, we are actually referring to the required risk premium of this financial asset over the risk-free asset. The discussion in section II.1. can be redefined in terms of risks premiums.

As with most models, the model depicted by equation (1) uses a reduced number of variables that are expected to explain fairly complex phenomena. As we have already mentioned, the model discussed in (1) could be based on the Expectations Hypothesis model. Our guess is that the linear combination of the variables on the right hand of equation (1) – the short rate and the expected inflation rate – is a good representation of the average of the expected short rates and the required risk premiums until the end of the life of the 10-year US government bond.

In order to simplify the following explanation, let's, for a moment, make the strong hypothesis that the yield curve, i.e. the difference between the long rate LR_t and the short rate SR_t, roughly represents the required risk premium of the market, denoted by p_t (this would almost be true if the expected short rates were constant and equal to the observed short rate until the end of the life of the bond). Equation (1) could then be rewritten as:

$$LR_t = SR_t + p_t \qquad (4)$$

with

$$p_t = a + (b-1)SR_t + g\ INF_t + u_t$$

We can decompose p_t into what we shall call the "fair" (or equilibrium or medium-term) required risk premium p_t^*, a function of the level of the short rate SR_t and the expected inflation rate INF_t, and the deviation between the market interest rate and the equilibrium interest rate, u_t.

$$\begin{aligned} p_t &= p_t^* + u_t \\ p_t^* &= a + (b-1)SR_t + g\ INF_t \end{aligned} \qquad (5)$$

Indeed, u_t can be interpreted as the difference between the required risk premium of the market p_t and the equilibrium risk premium p_t^*, a function of the state variables of the economy.

We can go a step further by identifying the long-term required risk premium p^{LT}, consistent with long-term levels for the short rate and the expected inflation rate (SR^{LT} and INF^{LT}). Let's define:

$$p_t^{LT} = a + (b-1)SR^{LT} + g\ INF^{LT} \qquad (6)$$

From (5) and (6) we can write:

$$p_t = p_t^{LT} + w_t + u_t \qquad (7)$$

with:

$$\begin{aligned} w_t &= p_t^* - p^{LT} = (b-1)(SR_t - SR^{LT}) + g\,(INF_t - INF^{LT}) \\ u_t &= p_t - p_t^* \end{aligned}$$

The term u_t, i.e. the deviation between the observed risk premium and the equilibrium (or medium-term) risk premium, is expected to disappear rather quickly. On the other hand, the term w_t, the deviation between the equilibrium risk premium and the long–term risk premium, is expected to fade slowly, following the slow evolution of the economic cycle and the resulting state variables (short rates and inflation rates in this example).

3 Asset allocation: where do we add value ?

In Section 1, we showed that different levels of asset allocation (long-term, fundamental-driven and tactical) are a function of the expected asset returns conditioned to different types of information, mostly related to economic cycles, structural changes of the economic/financial system and market prices. We made a distinction within long-term asset expected returns, medium-term or "equilibrium" expected returns and tactical expected returns. In Section 2, we illustrated how models, particularly error correction models, could be used for computing expected returns based on that information.

In this section, we will apply the ideas discussed above to build expected returns for the US bond and stock markets, using monthly data ranging from January 1980 to December 2002. We will use a stylized valuation model for each asset type, presented in Sections 1.1 and 1.2, respectively for bonds and for stocks. In Section 1.3 we will present simulations of an actively managed US global balanced portfolio – equity and bonds – alternatively using the computed long-term, medium-term (equilibrium) and tactical expected returns. We will repeat the exercise for a global balanced portfolio invested in Euro bonds and European equities.

3.1 The US bond model

For the bond market we followed the specification discussed in Section II. We have chosen to "write" the parameter coefficients of equation (1), based upon long-run elasticises and risk premium estimates reported from different experts' studies, instead of doing an econometric estimation. The advantage of this approach is that we will be able to identify more closely the equilibrium required risks premiums implied on the presented equations. Indeed, an econometric estimation would insure a better fit to the data, and a fine-tuning of the parameters would theoretically result in a better model, but the interpretation of the results should be less clear for our purposes.

Table 3 presents the equation coefficients[5] chosen for the model, partly based upon the long-run values presented in Table 1. In addition, we have tested the validity of the imposed coefficients on the long-run equilibrium relationship described by the model[6].

Table 3
The bond model coefficients

On the equation:

$LR_t = a + b\, SR_t + g\, INF_t + u_t$

$u_t = r\, u_{t-1} + e_t$

	a	*b*	*g*	*r*
1980-2002	1.5%	0.85	0.2	0.9

LR_t stands for a 10 year US monthly bond yield, SR_t is represented by the yield of a US 3 month t-bill, and INF_t is represented by the actual 12 month observed inflation, based on the US CPI.

We assume an equilibrium required risk premium of long bonds over T-Bills to be equal to a constant component of roughly 1.5% – the *a* coefficient of the equation – plus a time varying component which will increase by 20 basis points for an increase in inflation of 100 basis points, this element being taken into account by the *g* coefficient. Short rate movements will also partially explain the time varying component of the required risk premia, and of course the movements of long-term interest rates. The *b* coefficient was chosen to be slightly lower than 1, which allows for the representation of the flattening and steepening yield curve phenomena along economic cycles discussed in Section I.2[7].

Concerning the mean reversion parameter, embodied in the autocorrelation coefficient ρ, we have set it equal to 0.9 on average[8], meaning that on average for a deviation between the long rate and the equilibrium long rate of, say, 100 basis points, it will take approximately 6 months for half the disequilibria to disappear.

Figure 5
The US long rate vs. the equilibrium long rate

Source : *Bloomberg and own calculation*

Figure 5 compares the monthly observed long-term interest rate with the monthly equilibrium interest rate, which was calculated using equation (1) and the values presented in Table 3 for January 1980-December 2002. The historical interest rate visibly hangs around the equilibrium rate, the deviation between both series at every month (the variable u_t), representing tactical opportunities for the investor.

Figure 6 compares equilibrium expected excess returns with tactical expected excess returns, computed at the end of each quarter for the following quarter, using equation (3) minus the expected return of the money market, measured by the short-term interest rate. Clearly, tactical expected excess returns are more volatile than equilibrium expected excess returns.

Figure 6
The US bond model: Tactical vs equilibrium expected excess returns

Source : own calculation

3.2 The US equity model

The dividend discount model states that the fair value of a stock (or group of stocks) should be a function of the future expected dividends adjusted by a "normal" required rate of return, a mirror of a "normal" stock risk premium. Using expected earnings instead of dividends and assuming a constant long-run payout ratio and a constant annual expected earning growth rate, we can derive the following simple dividend discount model:

$$k\,(\mathrm{E/P}) = r + p - g \qquad (8)$$

where E is the one period forward looking earning yield – which determines the expected dividend – , P is the market price, k is the long-run pay out ratio, r is a risk-less rate, p is the required equity risk premium and g is the expected long-term growth of earnings.

Using (8), we can write the following statistical model for the US stock market[9]:

$$\underbrace{e_{t+12}/p_t}_{\text{market forward earning yield}} = \underbrace{m + d\,LR_t}_{\text{equilibrium earning yield}} + \underbrace{j_t}_{\text{deviation between the earning yield and its equilibrium value}}$$

with

$$j_t = n j_{t-1} + w_t$$

(9)

where the 12-month forward earning yield of the market, denoted by e_{t+12}/p_t , will be a function of the 10 year bond yield LR_t, and a residual term j_t.

We define the equilibrium earning yield as $m + dLR_t$[10]. j_t is the deviation between the market earning yield and the equilibrium earning yield. This deviation j_t is correlated with past deviations though the coefficient n, i.e. deviations are autocorrelated. w_t is an error term iid. As in the bond case, we can calculate at any time the expected change of the earning yield from t to t+1:

$$E(\Delta(e_{t+13}/p_{t+1})) = \underbrace{d\ \mathrm{E}(\Delta LR_{t+1})}_{\text{change in equilibrium}} + \underbrace{(n-1)j_t}_{\text{mean reversion}} \quad (10)$$

where E and Δ are defined as before.

Table 4
The equity model coefficients

On the equation: $e_{t+12}/p_t = m + d\,LR_t + n\,j_{t-1} + w_t$						
				Hypothesis retained for variables in equation (8)		
	m	*d*	*n*	*k*	*p*	*g*
1980-1994	-9%	2	0.9	0.5	4%	8.5%
1995-2002	-6%	2	0.9	0.5	4%	7%

We present the value coefficients retained for equation (9) on Table (4). We distinguish two periods (1980-1994 and 1995-1992) based on different assumptions about the expected nominal long-term earning growth[11]. As in the case of the bond model, the autocorrelation coefficient n, has an average value of 0.9[12].

Figure 7
The US market earning yield vs the equilibrium earning yield

Source: I/B/E/S, MSCI and own calculation

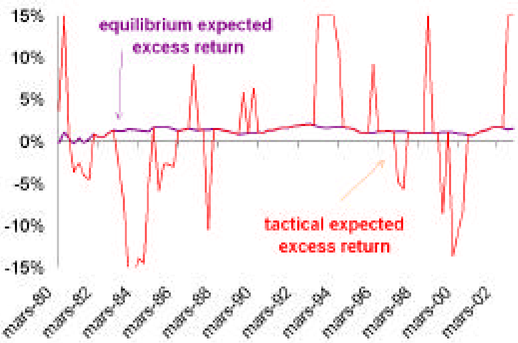
We have computed the forward-looking earning yield of the US stock market using the MSCI US index universe. This forward looking earning yield is broadly a MSCI cap weighted average of forward looking earning yields provided by the I/B/E/S[13] consensus data[14]. Equilibrium earning yields were calculated using 10-year bond yields .

Figure 7 compares the monthly historical earning yield of the US equity market with the equilibrium earning yield for the period January 1980-December 2002. Significant positive (negative) deviations are pointing out an undervalued (overvalued) market. This figure gives strong indication of overvaluation at end 1981, 1983-1984, October 1987 and 2000. On the other hand, the US market appears to be undervalued at the beginning of the 80's, in 1986, 1988-1989, 93-95, September 1998 and end 2002.

$$
\begin{aligned}
ER(\text{equity market}) &= \frac{d_{t+12}}{p_t} + E\left(\frac{\Delta p_{t+1}}{p_t}\right) \\
ER(\text{equity market}) &= k\frac{e_{t+12}}{p_t} + E\left(\frac{\Delta p_{t+1}}{p_t}\right) \\
ER(\text{equity market}) &= \underbrace{\underbrace{k\frac{e^{EQ}_{t+12}}{p_t} + E\left(\frac{\Delta e_{t+13}}{e_{t+12}}\right) - \left(\frac{p_t}{e_{t+12}}\right) E\left[\Delta\left(\frac{e^{EQ}_{t+13}}{p_{t+1}}\right)\right]}_{\textit{equilibrium}\ \text{ER}} + \left[k - \left(\frac{p_t}{e_{t+12}}\right)(n-1)\right] j_t}_{\text{tactical ER}}
\end{aligned}
\qquad (11)
$$

The calculation of the expected total return *ER* of the equity market is presented in equation (11), where the expected dividend yield d_{t+12}/p_t is obtained through the product of the payout ratio k and the forward-looking earning yield e_{t+12}/p_t.

Figure 8
The US equity model – Tactical vs. equilibrium quarterly expected excess returns



Source : *own calculation*

Note that if the market is in equilibrium, the expected return is the expected dividend yield plus the expected growth of earnings in the medium term $E(\Delta e_{t+13}/e_{t+12})$ plus the expected change of the equity market price following the expected change of the equilibrium earning yield – which should be rather smooth. The tactical expected return will be the equilibrium expected return plus the difference between the observed dividend yield and the equilibrium dividend yield plus the expected change in price due to the fact that the market is in disequilibrium.

Finally, Figure 8 exhibits equilibrium and tactical expected *excess* returns, computed on a quarterly basis, based upon the formula (11).

Once again, this figure clearly shows the greater variability of tactical excess returns when compared with equilibrium expected excess returns.

3.3 Tactical asset allocation vs. fundamental-driven asset allocation

In this section, we present simulations of actively managed global balanced portfolios (equity and bonds), for the US and the European markets.

The active allocation process presented in these simulations lies on the expected quarterly returns derived from the models described in the precedent section and on risk estimates for the bond and the equity markets using a historical variance covariance matrix based on 5-year monthly trailing returns.

For each of the global balanced portfolios – the US and the European portfolios, which definitions are presented below –, two simulations are performed:

a) the first one uses the ***equilibrium expected excess returns*** for determining the ***fundamental-driven asset allocation***. In this context, the market price level is not taken into account, only the equilibrium expected return which is a function of the phase of the cycle and the resultant state variables of the economy. It is interesting to note that many investors use this approach when allocating in their portfolios.

b) the second one uses the ***tactical expected returns***, resulting in the ***tactical asset allocation***. As we have discussed before, the price level of the market is an important determinant of these tactical returns (impact of the observed deviation between the market price and the equilibrium price on the expected return).

The portfolios are optimised and re-balanced on a quarterly basis. An optimal portfolio is built at the end of each quarter, based on the bond and equity expected excess returns for the following quarter, under the following constraints:

a) a tracking error inferior or equal to 3% with respect to the investor's benchmark , i.e. the investor's long-term strategic asset allocation.

b) the maximum exposure allowed is 110% (a exposure higher than 100% may be implemented with a loan or the use of futures), the minimum exposure is 90% (a maximum of 10% of cash is allowed).

A. Simulation of an actively managed US balanced portfolio.

The benchmark – denominated in US dollars – is defined as a constant mix 60% US government bonds, with an average duration of 5, with the remaining 40% invested in equity, represented by the MSCI US equity index (no dividend reinvestment). Such a choice of a long-term strategic asset allocation is justified by a Markowitz optimization, with the hypothesis of long-term values for volatility, correlation, and expected excess returns of bonds and the stock market in the US, presented in Table 5.

These long-term values are based on historical averages reported by Ibbotson and Sinquefield (2002), for the period 1926-2002 (see Table 1). The volatility of the bond market reported by this source refers to 20-year government bonds, with an average value of 9%; we modified this figure for taking into account that the duration of the bond segment in the simulated portfolio is 5[15].

Table 6 exhibits the Sharpe ratio of the portfolio for different constant mixes. Indeed this ratio is maximized with the mix 60% bonds and 40% equity.

The simulation period for the fundamental-driven and tactical asset allocation runs from the second quarter of 1980 until end 2002-IV.

Table 5

Expected excess returns and risk for the US bond and equity markets

	Annualized expected excess return	Annualized expected volatility	Expected Bond/equity correlation
US Bonds	1.1%	5%	10%
US Equities	6%	16%	

Table 6

The efficient frontier for the US bond and equity markets

ALLOCATION BONDS	EQUITIES	Portfolio expected volatitlity	Portfolio expected excess return	Sharpe ratio
100%	0%	5.0%	1.1%	0.22
90%	10%	4.9%	1.6%	0.32
80%	20%	5.4%	2.1%	0.39
70%	30%	6.2%	2.6%	0.41
60%	40%	7.3%	3.1%	0.42
50%	50%	8.6%	3.6%	0.41
40%	60%	10.0%	4.0%	0.40
30%	70%	11.4%	4.5%	0.40
20%	80%	12.9%	5.0%	0.39
10%	90%	14.5%	5.5%	0.38
0%	100%	16.0%	6.0%	0.38

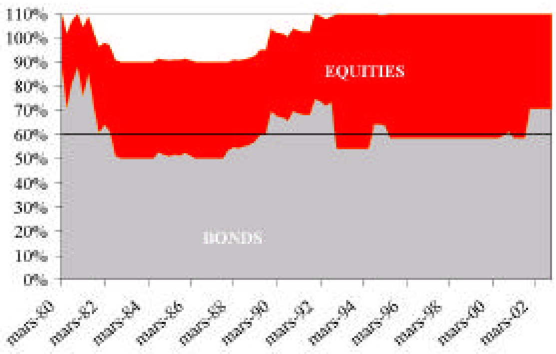
Figure 9 exhibits the portfolio weights at the end of each quarter for the fundamental-driven asset allocation.

Since 1992, the fundamental-driven portfolio overweighs equity, reflecting the market participants' prevailing optimism in stock markets. Prior, the stock market is underweighted, particularly in 1988- 1989 (the market is anticipating the 1990-91 recession?).

Globally, the portfolio moves softly. The simulation using tactical returns offers a different picture. Figure 10 exhibits the sharp reallocations at the end of each quarter for this second simulation, i.e. the tactical asset allocation, following the recommendations of the tactical signals.

Figure 9

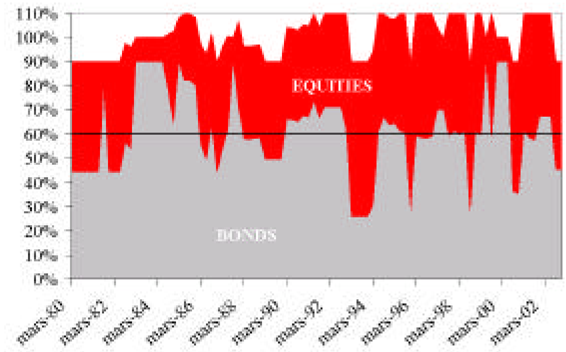
US - Fundamental-driven asset allocation



The results of the two simulations are presented in Table 7. The fundamental-driven asset allocation adds 30 basis points per year to the benchmark performance (i.e. the long-term strategic asset allocation performance), while the tactical asset allocation exceeds the benchmark performance by 140 basis points per year. The information ratios are respectively 0.20 and 0.50, which illustrates the US portfolio's performance enhancement in terms of return/risk with the use of tactical signals.

Figure 10

US - Tactical asset allocation



The tactical movements are mainly determined by the equity tactical returns, what can be easily understood by watching Figure 8. The price movements of the equity markets are at the origin of the opportunities presented in this simulation.

Figure 11 shows the cumulated performance of both strategies against the benchmark performance[16].

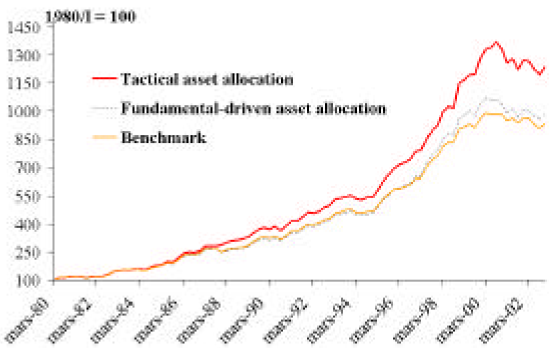
Table 7

US simulation results. Fundamental-driven and tactical asset allocation vs. the benchmark (transaction costs are not considered)

	Benchmark	Fundamental driven asset allocation	Tactical asset allocation
Annualized volatility	8.4%	8.7%	8.8%
Annualized return	10.3%	10.6%	11.7%
Tracking error on benchmark		1.4%	2.6%
Information ratio on benchmark		**0.2**	**0.5**

Figure 11

US – Fundamental-driven and tactical asset allocation vs. the benchmark



<u>B. Simulation of an actively managed European balanced portfolio.</u>

In this section, we repeat the exercise for a global balanced portfolio (equity and bonds) denominated in Euros (French francs before 1999)[17]. The benchmark is defined as a constant mix 50% Euro government bonds, with an average duration of 5, with the remaining 50% invested in equity, represented by the MSCI European equity index (no dividend reinvestment, unhedged against the currency risk). We assume that such a choice of a long-term strategic asset allocation derives from the particular preferences and constraints of the investor.

The simulation period for the fundamental-driven and tactical asset allocation runs from the first quarter of 1989 until end 2002-IV. We computed equilibrium and tactical expected returns using the same models as in the US case. We used the French 10-year government bond rates and the European market forward earning yield based on the European MSCI index universe for calculating these returns.

Figures 12 and 13 exhibit the simulated fundamental-driven and tactical asset allocations. Particularly, we note the quite sharp movements of the fundamental-driven asset allocation at the end 1991 and 1992. This is due, on the one hand, to a decrease of the estimated risk, which lead the optimizer to raise the portfolio's risky asset exposure at the end of 1991. The sharp reduction of the exposure to the risky assets at the end of 1992 is the consequence of the impact of the rise in short-term interest rates during the year (monetary crisis) on the equilibrium expected excess returns.

Figure 12
Europe - Fundamental-driven asset allocation

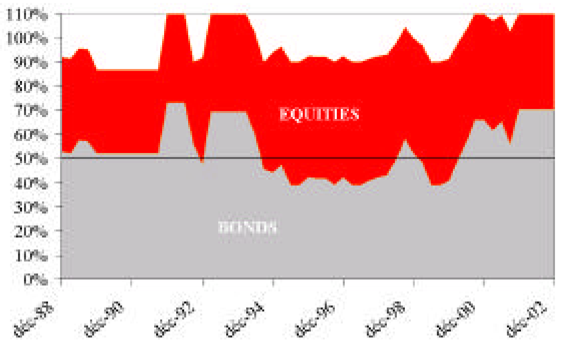


Figure 13
Europe - Tactical asset allocation

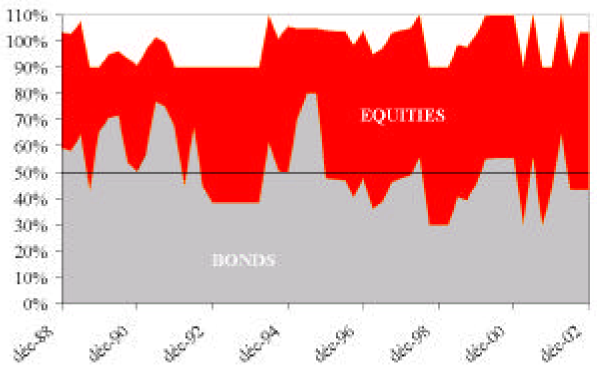
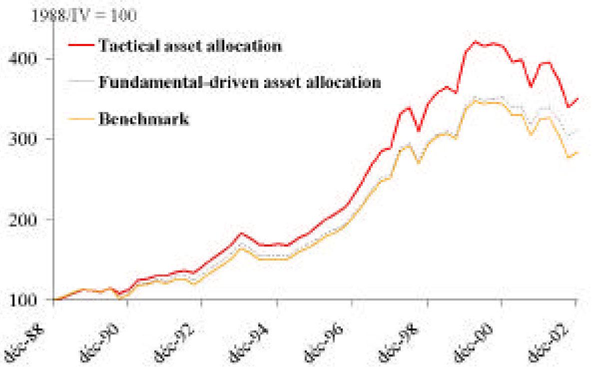


Table 8 presents the simulation results[18]. Again the enhancement of the portfolio's performance using tactical returns is quite significant: the tactical asset allocation adds 100 basis points per year to the fundamental-driven asset allocation and 170 basis points to the benchmark, with a highly significant information ratio.

Table 8
European simulation results. Fundamental-driven and tactical asset allocation vs. the benchmark (transaction costs are not considered)

	Benchmark	Fundamental driven asset allocation	Tactical asset allocation
Annualized volatility	10.6%	9.3%	10.3%
Annualized return	7.7%	8.4%	9.4%
Tracking error on benchmark		1.8%	2.2%
Information ratio on benchmark		**0.4**	**0.7**

Figure 14
Europe – Fundamental-driven and tactical asset allocation vs. the benchmark



4 Summary

Different levels of asset allocation can be defined, which will depend mainly on the information used in the allocation decision process . More precisely, we made the distinction between:

1) long-term asset allocation: the benchmark of an investor, function of the investor constraints and his long-term vision for returns and risk of the financial assets.

2) the fundamental-driven asset allocation, conditional on the equilibrium expected returns in the medium term. Typically defined for a period of around 5 years, these returns are the mirror of the "normal" expected premiums of the financial assets, consistent with the economic cycle and/or structural changes of the economic/financial environment. By their nature they are persistent, resulting in slow changes in the asset allocation in the medium-term.

3) the tactical asset allocation, conditional on tactical asset returns. Tactical asset returns are typically defined for the short-term (3/6 months) and are mainly the consequence of important deviations between the market price and the equilibrium price of the financial asset, i.e. periods of significant market over/under valuation. Tactical asset allocation exploits short-term transitory mispricing in the markets.

We simulated expected returns for the US bond and stock markets since 1980, using valuation models issued from the financial theory (the Expectation Hypothesis theory and the Dividend Discount Model) We illustrated the three levels of asset allocation defined above through a simulation of an actively managed global balanced portfolio (equity and bonds) denominated in US dollars, for the period 1980-2002. We repeated the exercise for a global balanced portfolio denominated in Euros, for the period 1989-2002. Both simulations underline the importance of the fundamental-driven asset allocation, and, overall, the tactical asset allocation as sources of value.

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Endnotes

[1] We follow a similar approach to the one presented by Dahlquist and Harvey (2001).

[2] Indeed, interest rates, like inflation, are lagging indicators of the economic cycle, and even at the beginning of the expansion period interest rates may remain low for a while as long as inflation keeps to a low level.

[3] The Expectation Hypothesis (EH) model is based on the belief that the whole term structure is determined by market expectations about future spot interest rates. In one of its versions, the EH model states that the period yield Y_{nt} will average the expected return of rolling over one period bonds for n periods, plus a premium τ, which can be constant or time varying over time:

$$(1+Y_{n,t})^n = E_t\left((1+Y_{1,t}+t_t)(1+Y_{1,t+1}+t_{t+1})\ldots(1+Y_{1,t+n-1}+t_{t+n-1})\right)$$

where Y_{nt} is the period yield of an n-period bond, which should equal – under the EH – to the geometric average of the expected return from rolling over one period bonds for n periods plus a risk premium τ. A model such as the one defined in equation (1) is "projecting" market expectations about future short rates and risk premiums on the spot short rate SR_t and the expected inflation INF_t.

[4] Equation (1) describes an "equilibrium relationship": an average (linear) relationship, structurally stable in the long run, between the level of a variable y_t and a (group of) variable(s) x_t, say $y_t = a + b\, x_t$. If $(y_t - a - b\, x_t)$ is different from 0, meaning that the system is not in equilibrium, the system will tend to move towards that equilibrium relationship. In statistical terms, an equilibrium relationship is given by:

$$y_t = a + bx_t + u_t \qquad \text{(a.1)}$$

where a and b are the coefficients of the equilibrium relationship, and u_t is the error term : the deviation between the variable y_t and its equilibrium level $a+b\,x_t$. The equation above describes an equilibrium relationship if the deviations $u_t = y_t - a - b\, x_t$ are zero mean and stationary (mean reverting).

Actually the stationarity of the error term holds automatically if y_t and x_t are stationary. The interesting case arises when y_t and x_t are not stationary, say for instance integrated of order 1, denoted I(1) (a series is said I(1) if, although it is itself non-stationary, the changes in this series result in a stationary series). Usually linear combinations of I(1) processes are also I(1). On the other hand, if a stationary linear combination of the variables exists, (the linear combination is I(0)), the variables are said to be co-integrated. In this case, we are in presence of a "true" equilibrium relationship: a set of variables that share a common trend in the long run. Equation (1) is a good example of this type of relationship: the long rate, the short rate and inflation are often I(1) processes (or at least long-memory processes), however it is possible to find a linear combination of these variables which tends to hold in the long run.

The error correction model (ECM) in the context of model (a.1) takes into account the impact of disequilibrium on the evolution of y_t:

$$\Delta y_t = b\Delta x_t + (r-1)(y_{t-1} - a - b\Delta x_{t-1}) + e_t \qquad \text{(a.2)}$$

where r is the autocorrelation coefficient of u_t and e_t is an error term iid. This equation explicitly describes the way y_t is subject to a mean reversion force or "error correction mechanism" that pushes it towards its long-run equilibrium. The concepts of cointegration and error correction models were first introduced by Granger (1981), Granger and Weiss (1983) and Engle and Granger (1987).

[5] Our own calculations of long bond and money market returns, using 10-year government bond monthly yields and 3-month Treasury Bills for the period January 1957 to December 2002 (source: IMF International Financial Statistics), show an average compound annual excess return for long bonds of 1.1% (6.9% for bonds vs. 5.8% for T-Bills), while the average of the difference of long bond yields and T-Bill rates was 1.4%. According to Ibbotson and Sinquefield (2002, see Table 1), the compound average annual US government bond return for the period 1926-2002 reached 5.45% against 3.79% for monthly Treasury Bills, giving an historical bond excess return of 1.66% (though these figures are based upon 20-year government US bonds), while Siegel (2001) reports a premium of 1.1% for the period 1871-2001 (see Table 1). Using these results concerning historical bond premiums, we may assume the long-run required premium of 10-year government bond yields on the

risk-free asset (monthly T-Bills) to be around 1.3%/1.5% . On the other hand, the inflation risk premium, i.e., the part of the bond premium which is due to the uncertainty of expected inflation, have been estimated by some experts to be 60 basis points on average (Buraschi, Jiltsov, 2002), while others estimate the inflation risk premium to be around 100 basis points (for a 5-year horizon, Ang and Bekaert, 2003), with a high degree of variation following the level/volatility of inflation. Another stylized fact about the term structure of interest rates reported by experts is that "…long rates rise less than short rates during business expansions and fall less during contractions…" (Fama, 1990).

[6] More precisely, we have tested for the existence of cointegration between the variables of equation (1). We started by investigating the nature of the series LR_t, SR_t, and INF_t. The computed t-statistics for the Augmented Dickey Fuller test for these series in levels and first differences suggest that these variables in levels are I(1). To assess for the existence of cointegration, we need to test the null hypothesis of the presence of a unit root in the calculated residual u_t, of equation (1): if the null is rejected, the cointegration relationship is valid. We tested this hypothesis once again using the Augmented Dickey Fuller test. We conclude to the presence of cointegration. For further details of these tests, see Banerjee et al. (1993).

Unit root tests for the US bond model variables and *the long run relationship* –1980-2002

Variable	ADF	
LR_t	-1.38 1)2)	1) Though in the long run, these series are not expected to exhibit a drift, they do so during the period of study (a period of desinflation). For that reason, under the null, we assume that these series follow an AR(p) with drift and a unit root.
SR_t	-1.49 1) 2)	
INF_t	-1.91 1) 2)	
ΔLR_t	-13.01 3)4)	2) The ADF statistics does not reject the Ho at a 1% and 5% significance levels.
ΔSR_t	-13.45 3)4)	
ΔINF_t	-15.33 3)4)	3) Under the null, we assume that the series follows an AR(p) without drift and a unit root.
u_t	-3.07 3)4)5)	

[7] We have calculated the US equilibrium long rate and the implied equilibrium required risk premium based upon the coefficients of the model for a 10-year bond using historical data for different periods and data issued from market consensus expectations concerning inflation and short rates. These values are exhibited in the following table.
The line "Consensus expectations" calculates the equilibrium long rates and required risk premium using long-term consensus expectations about short rates and inflation (for 2009/2013, this data was published in the October 2003 Consensus Forecast)
The "observed long rate" in this case corresponds to the long-term consensus expectation about long rates. We can see that the long rate expected by the market consensus and the equilibrium long rate calculated by the model (using consensus expectations about short-rates and inflation) are identical in this case. The other lines exhibit calculations using Ibbotson data for the period 1926-2002, IMF data for 1954-2002 and Bloomberg/OECD data for the period 1980-2002.

Long rate, equilibrium long rate and equilibrium risk premium implied by the bond model

Average values	Short rate	Inflation rate	*Equilibrium long rate*	Equilibrium required risk premium	*Observed long rate*
Consensus expectations	4.0%	2.3%	*5.4%*	1.4%	*5.4%*[1]
Ibbotson (1926-2002)	3.8%	3.1%	*5.3%*	1.5%	*5.8%*
IMF (1954-2002)	5.6%	5.7%	*7.4%*	1.8%	*7.0%*
Bloomberg, OECD (1980-2002)	6.4%	4.2%	*7.8%*	1.4%	*8.1%*
Average	5.0%	3.8%	*6.5%*	1.5%	*6.6%*

[1] corresponds to the long-term expected long rate

We can see that the average long rates of those periods are quite close to the equilibrium long rate implied by the model.

[8] This value lies in the 95% computed confidence interval of the estimated autocorrelation of the residual u_t. We introduced a non linearity in the model in an ad-hoc way. The r coefficient is allowed to vary at each period t, as a function of the magnitude of disequilibria at period t-1, mean reversion being stronger the higher the disequilibrium value – measured in standard deviations –, and absent for very low disequilibria. This approach is based on the use of a threshold autoregressive model (TAR), see Tong (1983). The values of the r coefficient in the bond market model are the following :

	r
If $\|u_{t-1}\| =< \sigma_u$	1
If $\sigma_u < \|u_{t-1}\| =< 2\sigma_u$	0.9
If $\|u_{t-1}\| > 2\sigma_u$	0.8

[9] This approach is similar to the one used by the Federal Reserve (Greenspan, 2002).

[10] Note that the discount or required rate of return is represented by the bond yield plus an equity risk premium over the bond yield. The constant term m embodies the expected long-term earning growth and the long-run required risk premium of the equity market on the bond market multiplied by the inverse of the long-term payout ratio k. The coefficient d is precisely the inverse of the payout ratio k.

[11] These values are based on the assumption of a expected payout ratio of 0.5, which corresponds to a long-run observed average (based on Shiller, 2002). We assume a long run required risk premium over bonds of 4% (based on Ibbotson and Sinquefield, 2002, and Shiller, 2002, see Table 1), the expected long-term earning growth is assumed higher before 1995, as it includes higher inflation expectations than after that year. The expected long-term earning growth figures are based on the historical average growth of the earning per share of the S&P index following Shiller (2002), which reached almost 4% for the period 1946-1980 in real terms, and 8.4% in nominal terms. For the period 1871-2002, average earning growth was significantly lower (1.3% in real terms), but we think that post-war values were nearer from the investor's expectations during the 80s and the 90s about future corporate productivity and profits.

Unit root tests for the US equity model variables and *the long run relationship* –1980-2002

Variable	ADF	
LR_t	$-1.38^{1)2)}$	1) Though in the long run, these series are not expected to exhibit a drift, they do so under the period of study (a period of desinflation). For that reason, under the null, we assume that these series follow an AR(p) with drift and a unit root.
e_{t+12}/p_t	$-2.16^{1)\,2)}$	2) The ADF statistics does not reject the Ho at a 1% and 5% significance levels.
ΔLR_t	$-13.01^{3)4)}$	3) Under the null, we assume that the series follows an AR(p) without drift and a unit root.
$\Delta\, e_{t+12}/p_t$	$-15.34^{3)4)}$	4)The ADF statistics rejects the Ho of existence of a unit root on the series at a 1% and 5% significance levels.
f_t	$-3.38^{3)4)5)}$	5) We use the tabulated values of the Dickey-Fuller tests as the cointegrating relationship is based on imposed coefficients.

In addition we tested this hypothesized long-run relationship. We have tested for the existence of cointegration between the variables of equation (9) : e_{t+12}/p_t and LR_t. The computed t-statistics for the Augmented Dickey Fuller test for these series in levels and first differences suggest that these variables in levels are I(1). The null of the presence of a unit root in the residual f_t on equation (9) is rejected, i.e. the hypothesis of cointegration between the variables is not rejected..

[12] This value lies in the 95% computed confidence interval of the estimated autocorrelation of the residual j_t. As in the US bond model, we introduced a non linearity in the model. The coefficient n is time varying and depending on the level of disequilibrium at t-1.

	n
If $\lvert j_{t-1}\rvert =< \sigma_\varphi$	1
If $\sigma_\varphi < \lvert j_{t-1}\rvert =< 2\,\sigma_\varphi$	0.9
If $\lvert j_{t-1}\rvert > 2\,\sigma_\varphi$	0.8

[13] I/B/E/S is one of the leading companies which, among other things, collects earnings expectations data from more than 4000 analysts, covering more than 27,000 US an international companies.

[14] This calculation was made since 1987. For problems of data availability, we calculated the forward looking US earning yield before 1987 using the backward looking MSCI US earning yield, multiplied by (1+g).

[15] It is interesting to note that the values reported in Table 5 in terms of volatility are quite close to the averages registered for the period 1998-2002.

[16] US portfolio simulation details

Year	Bench	Fundamental driven asset alloc performance	Surperformance	Tactical asset allocation performance	Surperformance
1980	**16.2%**	**14.4%**	-1.8%	**17.9%**	1.6%
1981	**0.4%**	**1.5%**	1.0%	**2.0%**	1.5%
1982	**22.7%**	**22.7%**	0.1%	**20.8%**	-1.9%
1983	**9.7%**	**10.1%**	0.4%	**8.3%**	-1.4%
1984	**8.4%**	**8.3%**	-0.1%	**11.5%**	3.0%
1985	**23.1%**	**21.9%**	-1.2%	**24.9%**	1.8%
1986	**17.1%**	**15.9%**	-1.2%	**16.8%**	-0.3%
1987	**2.4%**	**3.0%**	0.5%	**12.9%**	10.5%
1988	**10.2%**	**9.9%**	-0.3%	**10.4%**	0.3%
1989	**19.7%**	**18.8%**	-0.9%	**19.0%**	-0.8%
1990	**2.2%**	**2.7%**	0.6%	**2.8%**	0.7%
1991	**18.3%**	**17.6%**	-0.7%	**18.5%**	0.2%
1992	**7.2%**	**7.9%**	0.7%	**7.8%**	0.6%
1993	**11.3%**	**11.3%**	0.0%	**10.8%**	-0.4%
1994	**-2.2%**	**-2.4%**	-0.2%	**-1.6%**	0.7%
1995	**25.2%**	**27.8%**	2.7%	**27.4%**	2.3%
1996	**9.3%**	**11.2%**	1.9%	**12.9%**	3.6%
1997	**18.9%**	**21.9%**	3.0%	**18.2%**	-0.7%
1998	**18.6%**	**21.4%**	2.8%	**24.3%**	5.7%
1999	**6.5%**	**8.5%**	2.0%	**11.8%**	5.3%
2000	**2.0%**	**-0.4%**	-2.4%	**3.6%**	1.6%
2001	**-1.6%**	**-3.1%**	-1.6%	**-4.3%**	-2.7%
2002	**-3.2%**	**-2.0%**	1.2%	**-2.2%**	1.0%

[17] We implemented similar models to those of the US market. The imposed cointegrating long-run relationships are not rejected by the tests :

Unit root tests for the European bond and equity model variables and *the long-run relationships* –1989-2002

Variable	ADF
LR_t	-0.60[1)2)]
SR_t	-1.08[1) 2)]
INF_t	-1.90[1) 2)]
e_{t+12}/p_t	-1.90[1) 2)]
ΔLR_t	-11.33[3)4)]
ΔSR_t	-16.60[3)4)]
ΔINF_t	-12.59[3)4)]
$\Delta\ e_{t+12}/p_t$	-9.87[3)4)]
u_t	-2.32[3)5)6)]
j_t	-2.42[3)5)6)]

1) Though in the long-run, these series are not expected to exhibit a drift, they do so under the period of study (a period of desinflation). For that reason, under the null, we assume that these series follow an AR(p) with drift and a unit root.

2) The ADF statistics does not reject the Ho at a 1% and 5% significance levels.

3) Under the null, we assume that the series follows an AR(p) without drift and a unit root.

4)The ADF statistics rejects the Ho of existence of a unit root on the series at a 1% and 5% significance levels.

5) The null of no cointegration is rejected at a 2.5% and 5% significance levels.

6) We use the tabulated values of the Dickey-Fuller tests, as the cointegrating relationship is based on imposed coefficients.

[18] European portfolio simulation results

Year	Bench	Fundamental driven asset alloc performance	Surperformance	Tactical asset allocation performance	Surperformance
1989	**12.2%**	**10.9%**	-1.4%	**11.8%**	-0.4%
1990	**-5.5%**	**-1.2%**	4.3%	**1.0%**	6.5%
1991	**13.5%**	**13.3%**	-0.2%	**14.9%**	1.4%
1992	**5.8%**	**7.4%**	1.6%	**10.3%**	4.5%
1993	**29.0%**	**27.8%**	-1.3%	**27.7%**	-1.3%
1994	**-7.8%**	**-8.3%**	-0.5%	**-7.2%**	0.5%
1995	**13.1%**	**12.3%**	-0.8%	**12.8%**	-0.3%
1996	**18.5%**	**17.9%**	-0.6%	**19.7%**	1.2%
1997	**23.6%**	**23.3%**	-0.3%	**26.1%**	2.5%
1998	**16.7%**	**16.2%**	-0.5%	**19.0%**	2.4%
1999	**14.7%**	**15.1%**	0.4%	**18.4%**	3.6%
2000	**2.2%**	**2.9%**	0.7%	**2.0%**	-0.2%
2001	**-5.7%**	**-4.0%**	1.7%	**-5.5%**	0.2%
2002	**-12.4%**	**-7.6%**	4.9%	**-10.6%**	1.8%