In early 1990, a mathematical model for portfolio allocation was developed by Fischer Black and Robert Litterman at Goldman Sachs. Published two years later in the Financial Analysts Journal, the model introduced a framework aimed at overcoming shortcomings that institutional investors had encountered in practically applying Markowitz’s modern portfolio theory.

In this article we elaborate on the intuition behind the Black-Litterman framework. First, we provide a brief overview of the practical shortcomings of the Markowitz model in section I. The Black-Litterman model itself and its main elements are introduced in section II. The different steps involved in building the Black-Litterman model are discussed in sections III to V. Finally, in section VI we look at some of the practical aspects involved in using the Black-Litterman model in a real-life strategy—State Street Global Advisors’ (SSGA) Quantitative Active Emerging Markets Equity.

Section I: Shortcomings of the Markowitz Model
Our earlier 2012 article (The Efficient Frontier in Modern Portfolio Theory: Weaknesses and How to Overcome Them) discussed the shortcomings of the traditional Markowitz framework. Amongst the concerns over portfolios that are built on the Markowitz model are stability issues and turnover rates.

There is a rich literature on the consequences of estimation errors when portfolios are highly sensitive to input parameters. Moreover, it has been shown that when the Markowitz optimizer is run with a long-only constraint, the constructed portfolio becomes highly concentrated in a small number of (so called ‘corner solutions’ of the optimizer) assets and consequently highly exposed to the quality of forecasts of those assets. These concentrated portfolios are more likely to have high turnover rates. Such issues have made implementing the Markowitz model in practice challenging.

We go on to discuss the Black-Litterman model which introduces a framework that mitigates the shortcomings of the Markowitz framework and improves the quality of outcome estimates.

Section II: Introduction to the Black-Litterman Model
There are two sources of information available for investment decisions: public information and private information. By definition, public information comprises of historical data and widely used investment methods (such as the CAPM). Private information includes those sources, data and models which are unavailable to the public. The sources of private information can be quantitative analysis, trend analysis or even participants’ experience.

How does different public information and private information affect the performance of a portfolio? For this, we need to have a look at market efficiency. According to Eugene Fama, we can distinguish between three forms of market efficiency: the weak form of market efficiency refers to the idea that the current stock price is only based on past stock price data. If one believes that the market is weak form efficient, technical analysis cannot consistently produce excess returns above the market. The semi-strong form of market efficiency refers to the idea that the current stock price reflects all publicly available information. If one believes that the market is semi-strong efficient, neither fundamental nor technical analysis can consistently produce excess returns above the market. The strong form of market efficiency refers to the idea that the current share price reflects all publicly available information plus all private (= insider)
information. If one believes that the market is strong form efficient, not even insider information will result in excess returns. Usually, when one refers to a market being efficient, the person is referring to the semi-strong form of market efficiency. In this document we refer to the semi-strong form. As a consequence, a portfolio manager can only achieve higher performance (aside from pure luck), if he has reliable and appropriate private information that differs from the market’s views. For our purpose, we will refer to such private information as ‘private views’, meaning that the asset manager has his own opinion which he can frame mathematically within the Black-Litterman model.

In general, an investor can face two cases:

• He does not have any private views on some assets. For such cases, he inevitably relies on historical data or on market models like CAPM.

• He holds views on other assets. However, in practice, almost all views have some degree of uncertainty. Therefore, the goal of the investor is to take advantage of private views without ignoring public views, or market views. Therefore, it is in the investor’s interest to blend private and public views.

Example
Consider a portfolio manager who has closely analysed the performance of stock prices with the aim of deriving a reliable forecast for the stock return of asset ‘A’ for the next month. Assume that the following facts have been observed:

• Using the CAPM model, asset A would return 2% in the next month.

• Asset A and B show a correlation of 89% in the last quarter, and asset A outperformed stock B by 0.3%.

• The portfolio manager has developed a multi-factor model which provides high quality forecasts for asset B. The model forecasts that asset B will return 2.2% for the next month.

• The portfolio manager expects that, because of a potential regulation that might be enacted within the next few weeks, the volatility of the market is likely to rise.

Based on private information, modelling and analysis of the correlation, the manager might simply forecast a return of 2.2% + 0.3% = 2.5% for asset A, while the CAPM model, market view, indicates 2% for it.

Given that the portfolio manager predicts a higher volatility in the market and is not quite sure about the correlation between the prices of the two assets, should he rely on the market view, his view, or combine them? In the latter case, a further question is how to combine the market views and private views?

Black and Litterman provide an elegant framework to provide an answer for such questions. The model was introduced in their Global Portfolio Optimization paper and developed in the context of asset allocation. The basic intuition behind the model is that an investor holds the market view in the first instance. Whenever he has a view on any assets that is different to market views, he updates the market view according to his view. The resulting composite view may well be different from the original view.

The Black-Litterman model can be explored further based on its principal components which are:

1. Market views, or market equilibrium expectations, which come from publicly available information.

2. Investors’ views or subjective expectations, which often come from a model which is developed by investors and contain private information.

3. The combination of market views and investors’ views which gives the revised expectations.

We’ll now go on to examine these components in a little more detail.

Section III: Market Views
In the Black-Litterman model, the CAPM equilibrium provides a neutral reference point for expected returns. The model assumes that expected returns might move away from their equilibrium values, but they will be pushed back to it.

Equilibrium, according to Litterman, is an idealized state in which supply equals demand. He stresses that this state never actually occurs in financial markets. There are ‘natural forces’ in the economic system— in the form of arbitrageurs—that function to eliminate deviations from the equilibrium. Hence, even though the markets are not assumed to be in static equilibrium, equilibrium is viewed as a ‘centre of gravity’.

Equilibrium provides a neutral reference point, leading to more reasonable and more stable optimal portfolios than portfolios that are based on historical mean and variance. Similarly, Fischer Black, in his Universal Hedging, paper suggests that the incorporation of CAPM equilibrium in to the mean-variance optimizer might make it more stable.

Why Should Investors Take Market Views into Consideration Even When They Have Different Views?
Suppose that a portfolio manager holds some private views, or private information. There are several strategies that he can take:

• Attribute zero-expected return and volatility when he does not have any private information and take into account his views when he has private information.

• Attribute market implied return and volatility when he does not have any private information and take into account his views when he has private information.

• Attribute market implied return and volatility when he does not have any private information and combine market-implied return and volatility with his views when he has private information.
The first and second strategies differ for the cases when the portfolio manager does not have any view, or private information, and the third strategy differs from the second strategy for the cases where the portfolio manager has views. Comparing the strategies would give a valuable insight about the market equilibrium used in Black-Litterman framework. Manually excluding assets from the universe, especially when there is a market view on such assets, is inefficient in many cases and therefore the second approach is more reasonable than the first one.

The second and third strategies mainly differ in terms of how views resulting from private information are factored in. By saying that the portfolio manager proceeds purely with his views when he has private information, we are implicitly assuming that at first he is completely certain about his private views. As mentioned before, this is not the case in practice.

The third strategy indicates the idea proposed by Black and Litterman. No matter whether there is private information about a certain asset, the portfolio manager bases his first insights on the return and volatility implied by the market. At the next step, he would update his expectation based on his private information. In the Black-Litterman model, both sources of information are assumed to be uncertain.

**Section IV: Investors’ Views**

A portfolio manager achieves a higher return when he has skills. These skills are expressed via his views. For example, a portfolio manager may have skill in analysing a balance sheet very thoroughly and can turn this skill into a view on the stock’s expected return whereby this view is superior to the market consensus. Another example is an investor who has superior information about some economic factors, which means that his prediction for such factors, more specifically in terms of their return and volatility, is different and more precise than publicly available information (i.e. the market consensus). The investor can therefore build multi-factor models, whose outputs are returns and volatilities that are different from the returns and volatilities implied by market views.

The source of the private information can be quantitative models, fundamental analysis or even a belief. Views can be expressed in either absolute or relative terms.

**Example**

Let’s focus on XYZ stock, which is a mid-sized automotive company and consider a commodity, for example oil, which is relevant to the XYZ stock price. Clearly, the oil price can be considered as one of the relevant economic factors. Now, suppose the investor has some private information that there will be political turmoil that will affect the oil price.

Assume that the investor knows that the European Union is due to have an urgent meeting to evaluate imposing sanctions on a significant oil supplier, here, Iran. The information regarding the meeting is not publicly available. Further assume that he is not confident about the outcomes of the meeting but estimates with a probability of 70% that the meeting would result in sanctions being imposed.

In the case of sanctions, a key supplier would be removed which, barring a new entrant in its place, would raise the oil price. Assume that the following simplified argument holds. A significant increase in the oil price might result in lower demand for cars, lowering the profitability outlook for car producers like XYZ, in turn lower demand for its stocks would push the XYZ stock price down.

In the Black-Litterman model, the portfolio manager specifies not only views, but also a degree of confidence on the views, which are expressed in terms of the inverse of the standard error around the expectation.

In this example, there is uncertainty about the private view or outcome of the meeting. With a probability of 30% that his superior information would be useless.

Logically, if an investor feels confident in one view, the standard deviation should be small and vice versa. In the example, the investor is quite confident that the meeting would result in an embargo. Hence, his prediction of a future increase in the price of oil would be quite realistic.

Quantifying the degree of confidence in practice might be challenging and some researchers believe that parameter settings are one of the limitations of the Black-Litterman model. Again, in our example, it is clearly hard to quantify the probability of the possible outcomes.³

**Section V: Combining Market Views and Private Views**

Black and Litterman provide a method to combine the expected return implied by the market equilibrium with private views. In its simplest case, the Black-Litterman model can be regarded as the weighted average of the market capitalization equilibrium portfolio and the private views portfolio, where the weights are primarily determined by the confidence in each portfolio or equivalently the variance of each portfolio.⁴ Weights are inversely proportional to the variance of the respective model. Assigning a high variance to a certain portfolio indicates that there is high uncertainty about the performance of the portfolio. Therefore, less weight would be attached to it.⁴

Figure 1 summarizes section III to section V of this article, and illustrates how the Black-Litterman model can be incorporated into the investment process.

**Figure 1: Black Litterman Model and Investment Process**

---

The example contained above is for illustrative purposes only.
1. In this project SSGA:

   - Explored using reverse optimization from benchmark weights as well as CAPM-based expected returns as two different alternative inputs to serve as equilibrium returns in the Black-Litterman framework.

2. Investigated a variety of alternatives to identify the precision (or uncertainty) of both equilibrium returns and our private views.

3. Ran portfolio simulations to measure the in-sample performance and trading characteristics (to establish the stability of solutions as well as to avoid corner solutions) of the various Black-Litterman implementations. The purpose of these simulations was to establish whether using Black-Litterman shrunk alphas in our EMCS mean-variance optimizer was superior to the use of our pure private view model-driven alphas.

The main conclusion from the research was that even though the application of a full blown Black-Litterman methodology under most circumstances leads to increases in in-sample portfolio performance, the increases were not large enough to compensate for the substantial increase in model complexity required by the methodology.

SSGA research found that many parameters needed to be jointly identified that involved subjective judgments since the literature is very unclear in guiding the practical application of the framework. Furthermore, the improvement in in-sample Information Ratio was also sensitive to the combination of parameters and the estimation method for the different model components was not accompanied by a clear pattern of improvement in the optimized trade characteristics and was not strongly consistent over time (improvement was observed only a little under half of the months).

**Summary**

This article was allocated to explain the Black-Litterman model. The model can be applied to improve the performance of the Markowitz model. A review of major components of the model was given and the intuition behind the model was explained in simple terms. As described in the article, the Black-Litterman model shrinks the weights of the views portfolio towards the market portfolio which reduces the turnover of the views portfolio. Moreover, compared to the market portfolio, the Black-Litterman portfolio implies more reliable estimates and, in many cases, outperforms the market portfolio and views portfolio. However, it should be emphasized that the performance of the Black-Litterman model is highly dependent on the quality of views.

However, we find that, when it comes to the practical implementation of the Black-Litterman model, the requirement for subjective judgments makes it difficult to apply this model in asset management practice. So, while the model is theoretically superior to the traditional Markowitz approach, the latter, with all its inherent shortcomings, is superior to Black-Litterman for practical use.

*For Institutional Use Only. Not for use with the public.*
IQ Insights | Can the Black-Litterman Framework Improve Asset Management Outcomes?

References

1. Fischer Black (1938–1995) was an American economist, best known as one of the authors of the famous Black-Scholes equation. Black graduated from Harvard College in 1959 and received a Ph.D. in applied mathematics from Harvard University in 1964. In 1971, he began to work at the University of Chicago. He later left the University of Chicago to work at the MIT Sloan School of Management. In 1984, he joined Goldman Sachs.

2. Robert Litterman is an American economist. He was assistant vice president in the Research Department of the Federal Reserve Bank of Minneapolis and an assistant professor in the Economics Department at the MIT Sloan School of Management. In 1986 he joined Goldman Sachs and became Chairman of the Quantitative Investment Strategies group of Goldman Sachs Asset Management.


