

Highest possible excess return at lowest possible risk

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Norges Bank's main objective in its management of the Petroleum Fund is to achieve an excess return compared with the benchmark portfolio defined by the Ministry of Finance. In the strategy for achieving the maximum return, considerable emphasis is placed on minimising risk. This has a substantial impact on how management is performed and how the management organisation is structured. This article examines the strategic basis for the active management of the Fund. The organisational structure and discipline developed in Norges Bank Investment Management are also described.

As described in the article "Results of six years of active management", the Ministry of Finance has defined a framework for Norges Bank's active management of the Petroleum Fund. One of the conclusions in the article was that Norges Bank has so far achieved a very high excess return in proportion to risk exposure. This article describes how Norges Bank manages the Fund with the aim of achieving the best possible performance.

The framework that has been defined for active management may be described as a risk quota. Norges Bank may use this quota to achieve the highest possible return. The key question in relation to how management is performed is therefore how the risk quota should be used.

It is important to distinguish between two types of risk: risk related to overall return and risk related to active management. It is the latter type of risk the Ministry of Finance has defined for Norges Bank. Even though Norges Bank takes active risk, this does not necessarily result in higher risk for the Petroleum Fund as a whole. So far, Norges Bank's active management of the Petroleum Fund has been conducted without increasing overall risk (cf. the article referred to above). Similar observations have been made for other comparable funds.

The management guidelines for Norges Bank set out intervals for the distribution of investments between equities and bonds and between regions. The share invested in equities, for example, may vary between 30 and 50 per cent. In practice, however, the interval does not exceed +/- 7 percentage points compared with the benchmark portfolio, given certain statistical assumptions. This is due to the risk limits that have been set for active management, expressed as limits in the tracking error.

A smaller equity portion implies lower risk for the Petroleum Fund, as equities carry higher risk than bonds. But Norges Bank's mandate is relative to the benchmark portfolio, and the active risk taken by the Bank therefore depends on whether the equity portion is higher or lower than in the benchmark portfolio.

A decision to change the equity share is only one of the many decisions Norges Bank may take within the limits that have been defined for active management. Is this then an appropriate way of using the risk limit, or are there indications that instead of such large-scale decisions, many smaller decisions of different kinds should be taken?

Like any other investor, Norges Bank would prefer a high excess return to a low excess return or a negative return. At the same time, low active risk would be preferred to high active risk. It is impossible, however, to achieve an excess return without using the risk limits. When Norges Bank chooses to use the risk limits to achieve an excess return, it is important that the best possible trade-off between the excess return and risk is achieved.

One of the key tasks is therefore to assess which types of active management involve a satisfactory trade-off between return and risk. Expectations must then be formed in relation to a large number of different types and forms of active management. The areas where the possibility of earning money is greatest in relation to the level of risk are obviously the areas where the largest resources should be concentrated.

How does one then form reasonable expectations of what will provide a satisfactory excess return relative to risk? A central academic contribution is the "Fundamental Law of Active Management", presented as an important part of the basis for Norges Bank's investment strategy in connection with the *Annual Report* for 1999. The review of the theoretical content is included in a separate box in the present article. The theory defines a relationship between how satisfactory the trade-off may be between return and risk, as expressed by the information ratio, and fundamental characteristics of active management. These fundamental characteristics are manager skill and the number of independent positions in management.

All active management involves implicit or explicit estimates of the relative return on various securities. The closer the correspondence between the manager's expectations and the actual outcome, the more "skilled" the manager may be regarded. An assessment of how skilled it is possible to be within one particular type of active management will depend on whether the manager is able to obtain better information or process it more successfully than competitors in the market.

Intuitively, it may also be said that the trade-off between return and risk is improved by increasing the number of positions. With a large number of positions random variables will cancel each other out, and the skill of the investor will be a deciding factor for the outcome. Independence is a key factor in the theoretical discussion about the number of positions a manager may achieve. The theory is based on positions that are independent in terms of both duration and breadth. The number of positions does not necessarily increase by taking frequent positions in the same security. Independence presupposes that the manager has obtained new information that changes the investment signal. If the same information is used to take positions in a number of securities, these positions cannot be regarded as independent since the information basis is the same. In other words, independence is a very demanding requirement. This means that a critical assessment of the possibility of taking independent positions is a key element in Norges Bank's evaluation of different types of management.

The Fundamental Law of Active Management

· A manager's competitive advantage can in principle be measured by the correlation between his predictions and the actual outcome. This variable is often referred to as the information coefficient (IC). A quantitative prediction model may have a measurable IC, which, for example, can be calculated by a simple regression. IC measurement is difficult for managers that do not use quantitative models.

· Assume that a manager has a subjective expectation of a return on an asset. This expectation has been formed on the basis of information in the form of a "signal" – for example a new earnings estimate for a company. This expectation is referred to as a conditional expectation. The deviation between this conditional expectation and the market's average expectation is referred to as a . In other words, a is the expected return differential in relation to the expected return on which the valuation of the asset at current prices was based.

It can be shown, under certain assumptions, that

$$\alpha = \text{volatility} \cdot \text{IC} \cdot \text{score}$$

Here, volatility is the standard deviation of the return on the asset, and score is the reading of the signal (for example the earnings estimate) minus the average signal divided by the standard deviation of the signal. In other words, score differs more widely from zero the more “unusual” the reading of the signal is. In general terms, it can be said that the equation above shows that the excess return a manager achieves over time will depend on the manager taking on risk (volatility) and being able to find relevant (IC) information that has not been taken into account in the market (IC and score).

· The information ratio, or IR, is a term commonly used to relate a manager’s excess return to the risk he has taken relative to the benchmark portfolio. We arrive at

$$\text{IR} = \frac{\text{excess return}}{\text{tracking error}}$$

· Tracking error is the standard deviation of the difference between the return on the manager’s portfolio and the return on the benchmark portfolio. An average IR is below 0 after transaction costs, i.e. there is no net excess return. An IR of 1 is an unusually good result.

· It can be shown that there is a relationship between the number of signals (i.e. sources of investment perceptions), the IC for each signal and the IR. The following applies under certain assumptions:

$$\text{IR} = \sqrt{\text{BR}} \cdot \text{IC}$$

BR denotes the “breadth” or number of (independent) investment signals. Intuitively, this may be regarded as showing that a greater number of investment signals provide a more accurate estimate for α . This applies in particular when the IC is low, which it typically is.

For further reading about all the concepts referred to here, see for example "Active Portfolio Management" by Richard C. Grinold and Ronald N. Kahn, Irwin Professional Publishing 1995.

Various types of active management

Norges Bank can use the risk quota for active management in four main types of investment decision.

Tactical allocation (TA) refers to management that involves over- or underweighting asset classes (for example equities in relation to bonds), taking currency positions or allocating between regions in equity or capital markets.

The information on which pricing in equity, fixed income and currency markets is based is available to everyone. This information includes economic data, earnings figures, valuation, tactical indicators, capital movements and other variables – all on an aggregate basis. The analysis will to a great extent be top-down. The manager must show how aggregated and readily available information can be analysed better than the market and lead to specific positions.

For this type of active management, the number of independent positions is limited. If the manager only allocates between equities and bonds, there will seldom be sufficient new information to allow the position to be changed. If there are a number of dimensions in management, for example regions and currencies, positions will

often be based on the same aggregated information. The number of independent positions will be low.

Implementation of positions will generally occur through various financial derivatives with high liquidity and may be highly cost-effective. The resources used for position-taking will often be limited, both in terms of number of persons and investment in systems. TA is therefore an inexpensive form of risk-taking.

Although Norges Bank's early experience of internal and external TA management was not positive, the external currency mandates have achieved considerable excess returns over the past two years.

As mentioned in the introduction, the limits set for Norges Bank's management allow a deviation for the equity portion of +/- 7 percentage points. It is important to note that a deviation of this magnitude presupposes that no other form of active management is being exercised. All portfolios must be compared with the benchmark portfolio. The full risk quota will be used in taking a decision.

In *factor-based position-taking*, positions are taken in aggregated value drivers in groups of securities, for example shares with a high dividend-price ratio or high-duration bonds in fixed income markets with a steep yield curve. Based on perceptions of similarities between securities, portfolios may be constructed that are exposed to such "factors". Factor-based positions will be quantitative or intuitive, rather than based on the fundamental conditions in an individual company.

A factor-based portfolio may seem well diversified when it comprises many securities, but since the same factors apply to all of them, the actual number of independent positions is low.

In equity management, Norges Bank has sought to avoid factor risk from the external mandates in the equity portfolio, but has taken a limited risk in sector strategies aimed at creating excess returns by predicating returns on groups of equities within the same economic sector relative to other sectors. The fixed income portfolio has, on the other hand, been heavily exposed, internally and externally, to "global value" strategies. We have so far had mixed experience of factor-based positions.

In *fundamental investment strategies*, the aim is to build up a better understanding of specific investments than the rest of the market. Emphasis is placed on analysts concentrating their efforts on understanding the company, the market the company operates in, the company's strategic challenges and management, analysis of future cash flows etc. The analysis is resource-intensive and to a considerable extent bottom-up.

When fundamental strategies are based on information about an individual company, the potential number of independent positions is high. It might therefore be argued that fundamental products should have a broad universe. The danger is that accuracy in position-taking will decline if the manager tries to gain a unique insight into an increasing portion of the market.

Fundamental products have accounted for most of the risk-taking in equity management. A substantial portion of the excess return in the Fund in the past five years derives from these investment strategies. Because of the expansion of the fixed income universe to include bonds with credit risk, fundamental analysis of bond issuer credit is a possible future strategy.

A *relative value strategy* seeks to buy a security with a particular set of characteristics while selling a security with similar characteristics. Enhanced indexing is a related strategy that seeks to exploit special pricing situations, but without the simultaneous buying and selling of similar securities.

Relative value strategies move one step away from the fundamental conditions of a company or issuer, focusing more on pricing situations within the capital market itself. A company may, for example, issue different classes of equities, they can be traded on different stock exchanges, be influenced by inclusion in regularly used benchmark indices etc. Different pricing of these instruments can create an arbitrage situation, where the information ratio will necessarily be very high since the risk is low.

Relative value products are based on finding individual securities in the market that are incorrectly priced. The existing opportunities will often be independent, but the number will vary considerably over time. Positions in companies that are merged or acquired, for example, will depend on finding a good selection of such possibilities. A further limitation in the strategy is that the size of the risk that can be achieved in the individual position is dependent on a certain degree of liquidity in the various securities. Prices will often move towards each other as the position begins to be implemented, and implementation costs can be substantial relative to potential earnings.

Table 1 summarises the above assessments of the attributes of the various strategies. The most important conclusion is that strategies based on fundamental or instrument-specific conditions have the greatest potential for a high information ratio, i.e. there is an attractive trade-off between return and risk.

Table 1: Management strategies and attributes

Management strategy	Tactical allocation	Factor-based strategies	Fundamental strategies	Relative value
Analytical ability	+	+	++	+++
Number of independent positions	-	-	+++	++
Implementation costs	+++	+	++	+
Experience	-		++	+++
Expenses	Low	Moderate	High	High
Expected information ratio	Low	Moderate	High	High

Organisation of active management

The above analysis implies that “relative value” and “fundamental” strategies should play a larger role in the overall management of the Petroleum Fund than “factor-based” strategies or tactical allocation. The results that have so far been achieved in the management of the Petroleum Fund have primarily been based on such fundamental and instrument-specific investment options. It will still be appropriate, however, to make use of the full range of opportunities in active management. The level of risk in the various main types of management strategy will follow the principles outlined in the "Fundamental Law of Active Management". Individual decisions or specific risk factors will then not dominate the overall result.

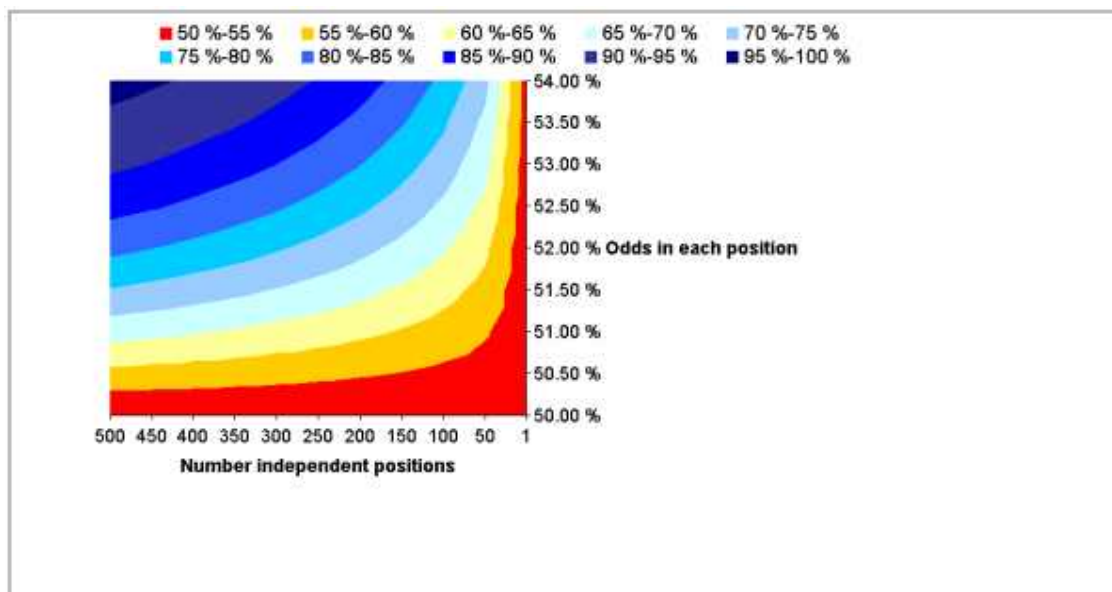
For Norges Bank, it is important to deliver an excess return as consistently as possible. The risk of losses is a fact of life in investment management. Management can, however, be organised so that the probability of an excess return is as high as possible.

According to the theory, the potential information ratio depends on investor skill and the number of independent positions. A positive information ratio, however, is no

guarantee of a positive result in any one year. Any given information ratio may be assigned a probability that management will lead to a positive result.

Chart 1 shows this theoretical probability of an excess return in any one year. The probability of an excess return rises with the number of independent positions and with the probability of gains in particular positions (odds).

Chart 1: Probability of an excess return in any one year



The odds in each position are an estimate of the skill of the investor. The Petroleum Fund is invested in very efficient capital markets. This means that the average odds in individual positions are only a little higher than 50 per cent. The probability of an excess return increases when there is a large number of independent positions, but the level of independence required is very high. The chart illustrates the issue raised in the introduction. If Norges Bank decides to use a large portion of the risk limit in a decision such as changing the equity portion, the probability of underperformance in the relevant year will be high.

The clear guidelines provided by the investment philosophy must be given an operative framework. Norges Bank assumes that a high level of information in a position requires specialisation, and that a large number of positions requires broad diversification. In other words, the aim of the Bank is to build a very comprehensive management structure. This is only possible through extensive delegation of investment authority and depends on maintaining a continuous focus on cost effectiveness in implementation. The following section describes how Norges Bank's investment philosophy has defined the organisation of management in Norges Bank Investment Management.

Delegation

The management task has been delegated by Norges Bank's Executive Board to the executive director of Norges Bank Investment Management, with a structure involving defined risk limits and a close follow-up of performance. A characteristic of Norges Bank Investment Management activities is that investment decisions are delegated further in the organisation. The executive director allocates limits for risk-taking to the chief investment officers for equity and fixed income management. Based on their own assessments of expected performance and risk, these officers then

distribute their risk limits between external and internal management. Risk-taking is in turn delegated to individual persons within these groups.

There are no committees directing the individual investment decisions. Each decision concerning the purchase or sale of securities, or choice of external managers or termination of contracts with external managers is delegated to responsible portfolio managers. Naturally, there are important processes before a decision is taken in which alternative investment decisions are discussed. Nonetheless, each person has the authority within his or her clearly defined mandate to take the decision.

The system of extensive delegation is paired with processes involving close follow-up and reward systems. The follow-up is a continuous process applied to each individual position taken in internal management and to the investment choices made by external managers. Trades are checked to ensure that they are within the guidelines and that overall risk is within the risk limits. The contributions to the final result are also measured.

Pay for employees with the authority to take investment decisions is partly performance-based. The main portion of this variable pay element is determined by the performance of the individual person. Some emphasis is also given to group performance and to other, less quantifiable contributions to management and the investment environment.

Diversification

Management of the Petroleum Fund is distributed among a large number of external and internal management mandates. At end-2003, the portfolio comprised approximately 50 external and 30 internal mandates. Table 2 provides an overview of the distribution of internal and external management in the two asset classes and Value at Risk (VaR) in these portfolios. In relation to the return on the benchmark portfolio, a manager can in a normal year earn the VaR amount, or more, with a probability of 16 per cent. The probability of losing the VaR amount, or more, is also 16 per cent.

Table 2: Risk in billions of NOK

	Market value	Value at Risk (VaR)
Equities, internal	197.8	2.116
Equities, external	148.6	4.369
Total equities prior to diversification gains	359.6	6.485
Total equities after diversification gains		1.640
Fixed income, internal	441.4	1.542
Fixed income, external	42.7	0.651
Total fixed income prior to diversification gains	484.1	2.193
Total fixed income after diversification gains		1.198
Total Petroleum Fund prior to diversification	845.3	8.678
Total Petroleum Fund after diversification		2.009

The right-hand column in the table indicates expected risk for each mandate in isolation – measured in billions of kroner (here defined as expected tracking error against the respective benchmark indices multiplied by the size of the mandate). The sum provides an estimate of gross risk before the effect of diversification is taken into

account: each mandate has risk properties that are different from any other. These differences result in an even spread of overall risk. The effect of diversification, for example, reduces the risk associated with the equity mandates from gross NOK 6.5 billion to NOK 1.6 billion. For the portfolio as a whole, the risk is reduced from NOK 8.7 billion to NOK 2 billion. This diversification effect is not only the result of dividing management among a number of managers. The allocation of management to the various managers is based on systematic analyses of correlations between existing and potential mandates. In addition, a management style is usually decided on for each mandate that focuses on a large number of independent decisions rather than a few major decisions. Charts 2 and 3 illustrate how the equity and fixed income portfolios are divided.

Chart 2: Value at Risk distribution in the Petroleum Fund's equity portfolio

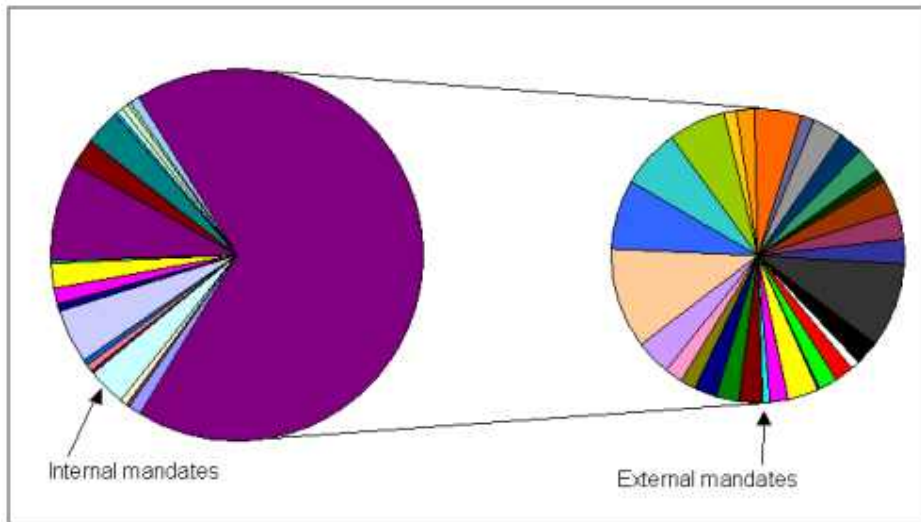
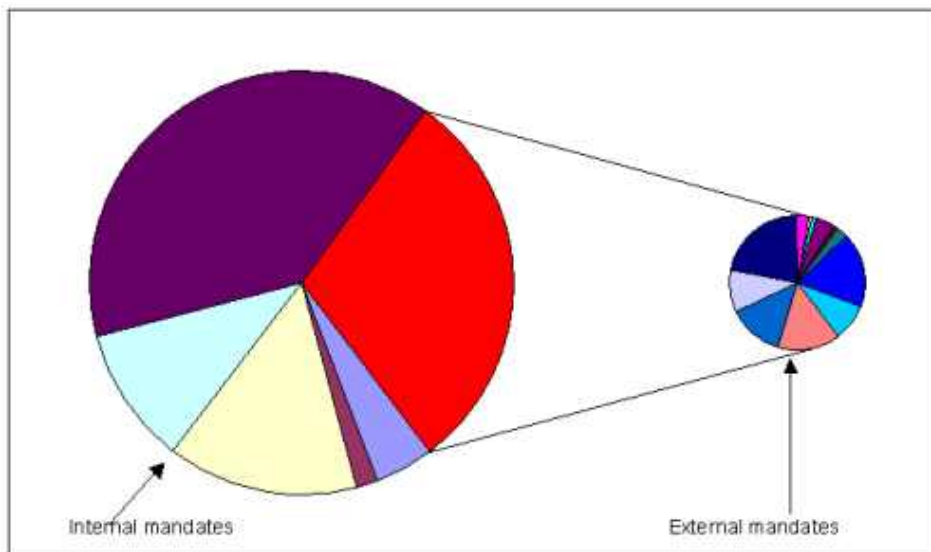


Chart 3: Value at Risk distribution in the Petroleum Fund's fixed income portfolio



Specialisation

Investment decisions in the Petroleum Fund are taken, internally or externally, on the basis of highly specialised expertise. The markets in which the Petroleum Fund invests are efficient: it is not possible to achieve an excess return without having a competitive advantage in the gathering, analysis or use of information. Gaining a competitive advantage requires focus and the continuous development of knowledge. In external management, mandates have been increasingly allocated to managers with a clearly delimited investment focus, such as investment management within the global health sector or energy and water supplies in the US. "Sectioning off" management in this way avoids a situation where managers take "opposing" positions. This is described in more detail in the article concerning experience of external equity management.

Efficiency

Investment management is characterised by substantial economies of scale. Norges Bank places considerable emphasis on exploiting all the opportunities size provides to keep down overall costs in investment management. One important technique is to distinguish between management of broad market portfolios (index management, also referred to as beta management) and specialised mandates designed to achieve an excess return (active management, alpha management).

Considerable attention is also paid to transaction costs, both in fixed income and equity management. For the Petroleum Fund, to which substantial new capital is regularly transferred, transaction costs are of considerable importance for the net return over time. We refer to the article "Costs associated with large equity trades" (published on Norges Bank's website (under Petroleum Fund) June 2003).

Index management is far less expensive than active management. External active management is more expensive than internal active management. When purchasing services from external active managers, a contract is usually drawn up where fees are performance-based.

In view of the expected return in relation to the costs incurred in active management, it is important to avoid a situation where the managers' positions to a great extent cancel each other out. Many overlapping mandates will over time result in a return close to the index. A model in which the Petroleum Fund assigned a large number of similar mandates for active management would result in high management costs without a corresponding excess return.

The larger the Petroleum Fund becomes, the greater the challenge will be to ensure that the active positions in the various parts of management do not cancel each other out. An advanced form of central risk management, such as that in use today, enables the investment universe to be divided so as to ensure independent risk-taking and the best possible result that active management can achieve. The size of the Petroleum Fund provides a unique opportunity to develop sound management systems and the necessary specialist expertise.

For Norges Bank, management by the Bank is essential to effective risk management and cost-effective management of a complex portfolio structure. It is an important task to ensure that the Fund's total exposures are consistent with the investment strategy, i.e. to ensure that the total portfolio is not overly exposed to specific underlying risk factors. In these cases, Norges Bank Investment Management must secure the desired level of exposure and, in some cases, take over the portfolio from the external manager.

An alternative model for management of the Petroleum Fund might be to divide the Fund into different sub-funds. For the owner, this might easily result in a set of overlapping mandates. The consequences of a model without centralised portfolio management may therefore result in high-cost management with a total return that over time is very close to the index return.