

## **Risk management for the Petroleum Fund**

**The risk associated with the management of the Government Petroleum Fund is determined primarily by the composition of the Fund's portfolio. This composition in turn is to a large extent determined by the strategy laid down by the Ministry of Finance, after submission to the Storting. The strategy is arrived at by striking a balance between risk and expected return, and considerable emphasis is placed on limiting risk by diversifying investments among a very large number of securities in many countries. The Ministry of Finance has also set a risk limit for Norges Bank's management operations, in the form of measured deviation from a given benchmark portfolio.**

**Norges Bank has to ensure that the composition of the Petroleum Fund at any time is within the established limits, and must also engage in risk monitoring. This means that a full overview of the composition of the portfolio is a fundamental requirement for satisfactory risk management. This article describes the complex network of suppliers and recipients of information that has been built up to make it possible to gain such an overview. Large quantities of data are exchanged daily through the network. The description is followed by an account of the other risk factors Norges Bank has to deal with in its management, and of how Norges Bank works to manage the total risk associated with management.**

### **Information flows**

The Petroleum Fund's market and credit risk are tracked using daily updated lists of holdings of the various financial instruments. The process for purchases and sales of financial instruments determines what settlement risk the Fund is exposed to. The quality of reporting and analytical routines will be a deciding factor for operational risk.

The Petroleum Fund is a large fund composed of many securities. The Fund is managed partly by Norges Bank, and partly by external managers under contract with Norges Bank. All internal and external managers enter into transactions on behalf of the Fund, which poses a considerable challenge as regards maintaining a full overview of holdings.

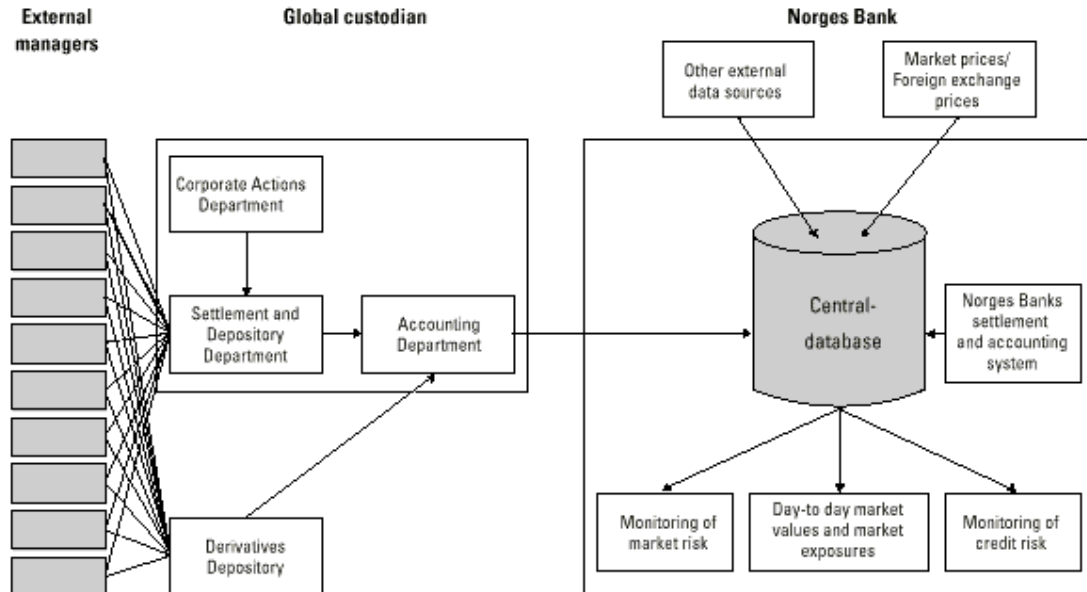


Chart 1 shows the information flows that must function and be correct on a daily basis in order for Norges Bank to know the exact composition of the Petroleum Fund. The most important operators outside Norges Bank are external managers and an external custodian for the whole equity portfolio, The Chase Manhattan Bank. The latter provides safekeeping of the securities in the Fund by acting as account manager in local securities depositories throughout the world. The custodian also keeps accounts of the Fund's assets, and submits daily reports to Norges Bank.

The managers can carry out transactions round the clock. Ideally, each transaction should be analysed immediately to determine its effect on overall risk. At present, this is not a realistic aim. Norges Bank now receives full overviews of the position of the Fund once a day.

The aim of a daily overview of risk exposure is ambitious in view of the large quantities of data to be reported. At the end of 1998, the Petroleum Fund owned equities in more than 2 000 different companies. A number of managers have the same equities in their portfolios, involving about 9 000 equity holdings in all. Furthermore, the Petroleum Fund owned about 500 different bonds, in addition to warrants, various types of money market instruments, futures contracts and pure foreign exchange positions. A full overview of all holdings is received every day.

### **Information about trading in equities and bonds**

In the contracts with the external managers, Norges Bank requires that the managers report all transactions continuously, and no later than at a set time on the trading date. The reason for this requirement is that the market risk associated with a security is transferred from seller to buyer as soon as the transaction is agreed.

Just as important as the reporting time are the format of the reports and the medium used. These may vary from one manager to another and from one transaction type to the next.

The international SWIFT electronic system is used for reporting ordinary purchases and sales of equities and bonds. A correctly completed SWIFT report means automatic, problem-free reporting.

### **Information about foreign exchange transactions and cash investments**

Foreign exchange transactions and cash investments are not reported using a standard electronic notification format. Consequently, it has been customary to fax information, which entails a considerable amount of manual work, and hence a higher risk of error. There is no standard for what information should be included, so it is customary only to include what is necessary for settlement of the transaction.

However, this is not sufficient to ensure correct accounts and risk classification. Work is in progress to establish more complete, efficient procedures.

### **Information about corporate actions**

The most common corporate actions are the issue of warrants, dividend payments and share splits. The Petroleum Fund's equities are held at a custodian bank, which is also responsible for monitoring corporate actions and updating the Petroleum Fund's holdings.

Corporate actions represent a twofold challenge. When a share is split into several units, this leads to a change in the Fund's holdings of the share in question. If this is not recorded on the correct date, the share value and contribution of the share to risk exposure will not be correct. Another type of corporate action is that the Fund receives warrants in addition to its own holdings of the share. There are a variety of warrants, and they can be very complex. Accurate, ongoing modelling of risk properties is therefore a demanding task.

### **Information about derivatives trading**

Futures contracts, ie agreements on the purchase or sale of securities at a future date, are used in management. The accounts for futures contracts in bonds are kept internally in Norges Bank. The accounts for futures contracts in equities have been centralised by Norges Bank at an external custodian bank. This custodian is a member of the local financial futures and options exchanges, and is obliged to make daily reports on futures contracts in equities to the global custodian.

The flow of information in connection with equity futures contracts is manual. Work on automating this process is under way.

### **Accounting information to Norges Bank**

Updated accounts of the Petroleum Fund's holdings of bonds and associated derivatives instruments are kept at Norges Bank. Equity accounts are mainly kept by the global custodian.

Data are transferred daily from the equity managers to the custodian, where the information is used to prepare accounts for each of the externally managed portfolios. The day after the trading day, the accounting reports are checked and reconciled to ensure that all information is correct. In the afternoon of the day following the trading day, reports are sent to Norges Bank. These reports are used in risk management.

### **Information flows in Norges Bank**

The daily accounting reports from the global custodian and from Norges Bank's own accounting system are kept in a central database in Norges Bank. Information about all the Petroleum Fund's holdings is thus centralised in one place. Norges Bank can extract the data from the database in various ways, depending on what these data are to be used for.

The accounting reports in the central database are supplemented daily with price information from external sources. As long as the securities holdings have universal

codes, this process is to a large extent automatic. However, it is not uncommon for different sources to use different codes for the same security, or for some securities not to be registered in all sources. In such cases, it is necessary to compare information from different sources to ensure that the information used is correct.

### **Market risk**

The value of the Petroleum Fund is constantly changing as a result of movements in interest rates, equity prices and exchange rates. The market risk associated with such movements is determined mainly through the Ministry of Finance's choice of benchmark portfolio. According to the Ministry's guidelines, the actual portfolio may only deviate to a limited extent from the benchmark portfolio. In addition, the Ministry of Finance has established absolute limits for factors such as interest rate risk, the proportions of the Fund that can be invested in equities and bonds, and the allocation by region. A ceiling of one per cent ownership has also been placed on holdings in individual enterprises.

Norges Bank uses a statistical model to calculate the tracking error relative to the benchmark. The model is based on actual securities holdings and the composition of the benchmark portfolio. It then uses historical price data to estimate the magnitude of the uncertainty associated with future price changes. Finally, the model calculates expected fluctuations in the Petroleum Fund's absolute return, and in the difference in return between the actual portfolio and the benchmark portfolio.

The model simplifies this analysis by assuming that most of the variations in the value of financial instruments can be explained by changes in a limited number of basic risk factors. The model makes no attempt to predict the future magnitudes of the risk factors, but uses historical data to estimate the magnitude of previous fluctuations in the factors. The model then calculates how sensitive the individual security is to the risk factors. Finally, the expected fluctuation in the return on the portfolio is calculated in absolute terms and relative to the return on the benchmark portfolio. This is done by weighting the sensitivity of the individual securities in relation to their share of the total market value, and by taking account of the historical fluctuation and covariation of the risk factors.

Monthly return figures for the past ten years indicate that the return on the benchmark portfolio, assuming the same composition as at 1 January 1999 and measured in terms of the Fund's currency basket, can be expected to show a standard deviation of about 5 percentage points on an annual basis. This means that in two out of three years the return will lie within a band of plus/minus 5 percentage points around a normal return. This normal return is difficult to quantify, however.

In addition to fluctuations in the return on the benchmark portfolio, the value of the Petroleum Fund varies because the actual portfolio deviates from the benchmark portfolio. The fluctuation in the Fund's total return is determined by these two factors, and by the degree of covariation between them. If Norges Bank fully utilises the risk limit of 1.5 percentage points expected tracking error, the standard deviation of the Petroleum Fund's total return, measured in terms of the Fund's currency basket, will be approximately 5.25 per cent. It is assumed here that the return on the deviations made is not correlated with the return on the benchmark portfolio. We see that only a small portion of the total market risk in the Petroleum Fund is due to decisions made by Norges Bank as manager.

### **Risk limits measured by expected tracking error**

- The Ministry of Finance's limit on deviations from the benchmark portfolio takes the form of restrictions on fluctuations in the difference between the Petroleum Fund's actual return and the return on the benchmark portfolio.
- The limit is expressed as the expected tracking error (standard deviation of the difference between the return on actual investments and the return on the benchmark portfolio). The expected tracking error may not be higher than 1.5 percentage points on an annual basis. Roughly speaking, this means that in two out of three years the Petroleum Fund will have a return that does not deviate from the return on the benchmark portfolio by more than plus/minus 1.5 percentage points, assuming that Norges Bank makes full use of this margin.]

### **Credit risk**

As an owner of bonds, bank deposits etc., the Petroleum Fund is exposed to the risk that the issuer of the security will fail to meet its financial commitments, so that the whole or part of the capital invested is lost. The Petroleum Fund's exposure to credit risk is to a large extent restricted by the Ministry of Finance's investment guidelines. Supplementary internal guidelines laid down by Norges Bank also apply.

The degree of credit risk is reflected in the rating assigned to a bond by different rating agencies (Moody's and Standard & Poor's are the best known). The Ministry of Finance has set minimum requirements for bond ratings. A supplementary requirement is that securities without a government guarantee may not account for more than one tenth of the market value or interest rate risk of the bond portfolio. Norges Bank has drawn up detailed internal guidelines for approved bond issuers. The Petroleum Fund is also exposed to credit risk as an owner of bank deposits. The Ministry of Finance has authorised Norges Bank to invest up to one fifth of the Fund's value in bank deposits with a maturity of up to three months. Normally, less than five per cent will be invested in this manner (inclusive of cash collateral for futures contracts). In internal guidelines, Norges Bank has stipulated that deposits must only be made in the world's 200 largest banks, as measured by total assets. In addition to size, these banks must satisfy certain minimum rating requirements. Limits have also been placed on the amounts that may be invested in any individual bank, depending on the size and rating of the bank. As a result of these limits, deposits have to be spread among many banks, so that the credit risk associated with the individual bank is reduced.

Information from both internal and external managers is used to monitor compliance with the limits on bank deposits.

### **Other risk types associated with management**

In implementing the established investment strategy, the Petroleum Fund is also exposed to risks other than credit and market risk. There is no compensation for these types of risk in the form of a higher return, and the aim is therefore to reduce them to a minimum. There will nevertheless be a trade-off between the costs of limiting these risk factors and the benefit in the form of lower risk exposure.

### **Settlement risk**

When an agreement on the purchase or sale of a financial instrument has been concluded, there is a risk that the counterparty will not fulfil its part of the agreement. Breach of agreement may take place in the period before settlement takes place, or while settlement is taking place. Settlement risk consists of three main factors: the

counterparty may fail to fulfil its obligations in connection with settlement, so that the whole or part of the principal is lost (counterparty risk); the counterparty may be in breach of agreement before settlement, so that the transaction has to be replaced by another at the current market price (repurchase risk); the counterparty may settle accounts at a later date than the settlement date, so that any liquidity needs have to be met by raising a loan or selling assets (liquidity risk).

The Petroleum Fund will be exposed to settlement risk through the transactions made. The type of settlement risk the Fund will be exposed to will depend largely on the type of transaction. A distinction can be made between five main types of transaction: purchase/

sale of securities, foreign exchange market transactions, collateralized transactions, purchase/sale of listed derivatives and purchase/sale of derivatives traded over the counter. The last type of transaction is not used by Norges Bank. A summary is given below of the types of transaction types mainly used in the management of the Petroleum Fund.

### Purchase/sale of securities

Transactions are agreed between a portfolio manager (internal or external) and a counterparty. Bond transactions are normally agreed directly between buyer and seller. For transactions in the equity market a broker is often used as an intermediary between buyer and seller. All equities in the Petroleum Fund are listed, and the brokers used are either direct members of the local stock exchanges, or they use local agents. Buyer and seller send instructions to their custodians. On settlement day, the transaction takes place in the settlement system of the country where the security is registered.

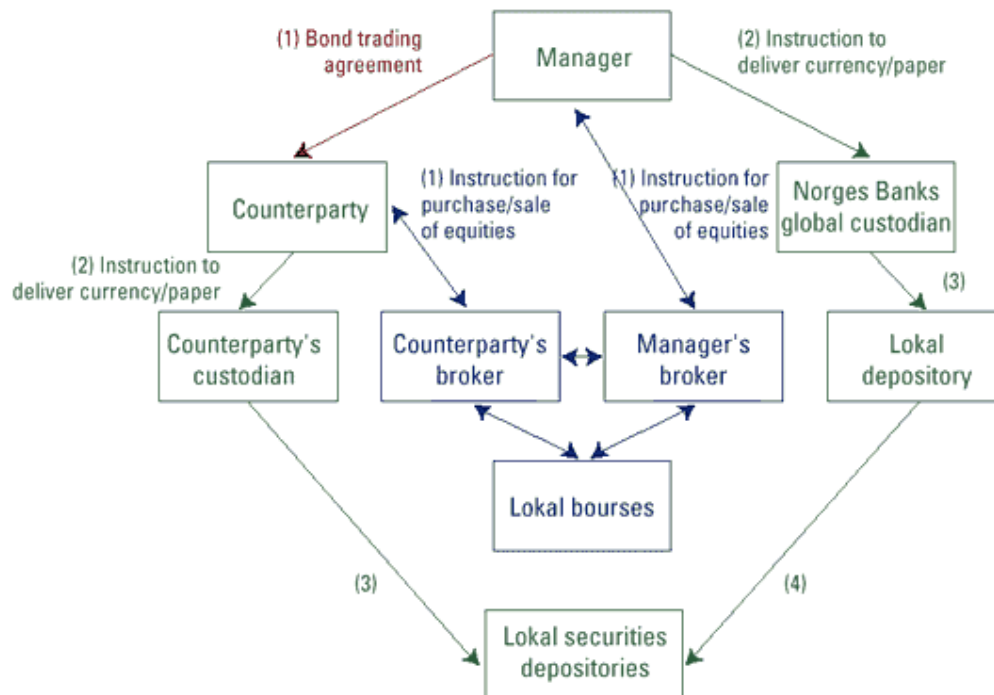


Chart 2 presents a somewhat simplified example of the course of events in a transaction involving the purchase/sale of a security. What is common to equity and bond dealers is marked green, while what is particular to equities is marked blue and what is particular to bonds is marked red.

With simple purchases/sales of securities, the best protection against loss of payment or securities is to require that payment and security are exchanged simultaneously. Countries with well developed capital markets have such mechanisms which protect investors against failure on the part of counterparties after the transaction has been agreed, but before it is settled. Counterparty risk associated with the settlement of security trades is therefore limited.

Since some days pass between the transaction and settlement dates, the Petroleum Fund will always be exposed to some repurchase and liquidity risk. Norges Bank therefore continuously evaluates the financial strength of the counterparties and dealers used in securities transactions.

### **Foreign exchange transactions**

Foreign exchange transactions (spot and forward) do not provide the same degree of certainty as to the simultaneous exchange of assets as securities transactions. Because the transactions do not involve collateral, there is a risk that counterparties will not deliver the agreed sum at the same time as the corresponding amount of currency is delivered.

The counterparty risk of the Petroleum Fund is limited by imposing certain requirements regarding the choice of counterparties and contracts. The maturity of forward contracts is limited to a maximum of six months to reduce repurchase risk. Monitoring procedures have been established to ensure that the terms of the forward contracts entered into are in accordance with the guidelines, and that counterparties satisfy credit rating requirements.

### **Collateralized transactions**

Repurchase agreements and loan of securities are agreements with underlying collateral. Loans of securities take place through custodian institutions. Repurchase agreements are made by both internal and external managers. A repurchase agreement is a sale of securities with an agreement to repurchase them later at an agreed price. Norges Bank can be on both sides of such an agreement. Common to the agreements is that Norges Bank lends out money or securities for a limited period to an approved counterparty against acceptable collateral. Bank guarantees, securities and cash, which is reinvested, are accepted as collateral.

In an agreement with underlying collateral, the risk of losing the principal is associated mainly with the actual settlement. During the contract period, the risk will be limited to one party being left with securities/cash that have been provided as collateral if the counterparty fails to fulfil its obligations. Because of market movements in the intervening time, the value of the collateral may not be sufficient to repurchase the original security.

The management of risk in agreements involving collateral takes place by imposing restrictions when selecting counterparties. As a rule the collateral provided by a borrower will exceed the market value of the loan by a certain margin. The market value of the collateral is normally evaluated and cleared on a daily basis.

### **Purchase/sale of listed derivatives**

Norges Bank uses equity index and interest rate futures contracts in its fund management. The contracts in question are traded on stock exchanges and are standardised with respect to quantity, quality and delivery terms.

The following is a slightly simplified illustration of a futures transaction: An agreement is made for the purchase/sale of a listed contract, and collateral deposited

with the clearing house. The contract is cleared daily at market price. The clearing house functions as counterparty to both buyer and seller for the duration of the contract. Because of the daily clearing at market price, any credit risk arising will be limited to one day.

As part of futures contracts Norges Bank must make margin payments to brokers, with an associated counterparty risk. In addition, the Bank is exposed to a custody risk in relation to the settlement broker's custodian bank because of the securities that have to be provided as collateral for the initial margin.

The futures contract itself will hold a repurchase risk for Norges Bank in the event that the financial futures and options exchange does not meet its obligations. In the period between the actual transaction by a dealer and its transfer to the settlement broker, the Bank is exposed to a credit risk in relation to the dealer. The exposure is a matter of minutes, and the risk can be regarded as marginal.

The risk associated with futures transactions is considered marginal provided the trade takes place on stock exchanges in well functioning capital markets, with satisfactory regulation and supervision. Norges Bank manages the risk associated with futures activity through guarantee requirements, restrictions with respect to which agents can be used, and continuous monitoring of the initial margin.

### **Operational risk**

Operational risk includes the risk of financial loss as a result of error or irregularities in the execution of transactions, deficient internal control (on the part of either Norges Bank or the external managers) or through interruptions in IT systems (including information, transaction processing and payment transfer systems). Reputational risk, legal risk, and risk associated with inadequate qualifications, ethics or personnel attitudes are also operational risk factors.

### **Internal control**

The degree of operational risk will depend on the organisational structure chosen, the procedures and technical systems used and the expertise in the organisation. Norges Bank places emphasis on managing this type of risk by establishing sound internal control procedures, a sound organisation of activities with clear authorisations and a clear distribution of responsibility, recruitment of specialists with practical and theoretical qualifications, satisfactory training of personnel, technical standby solutions and a sound set of legal agreements.

In the selection process for external managers, emphasis is placed on managers having a clear, well documented investment process, where it is made explicitly clear who is responsible for the individual decisions. Emphasis is also placed on high-quality current risk management, and on the integration of risk management and the investment process.

### **Ethical guidelines**

The Regulation on the Government Petroleum Fund stipulates that external managers used in the management of the Fund must have adequate internal ethical guidelines for their activities. An important part of the process of selecting external managers is precisely an evaluation of the measures the management organisation has implemented to prevent losses due to operational weaknesses. Norges Bank's Executive Board has laid down stringent guidelines for the financial transactions employees in Norges Bank Investment Management are permitted to make, and for the employees' relationship with existing and potential business partners.

**Legal risk**

Legal risk is the risk that the agreements Norges Bank has entered into do not protect the Bank's rights adequately in the event of a legal process, for example if agreements are not formulated in a manner that makes them legally binding. In managing the Petroleum Fund, Norges Bank has made extensive use of its own legal expertise, and has also used a recognised international firm of lawyers which specialises in the type of legal issues involved.

**Control structure**

In addition to the standard control routines which are part of the line responsibilities in Norges Bank Investment Management, a control system has been established outside the Investment Management unit. The primary objective of this external system is to ensure that the internal control system functions satisfactorily. External audits are performed by a unit in another department in Norges Bank, the Auditing Department, by the Office of the Auditor General and by the Ministry of Finance. As delegating authority, the Ministry uses the independent consultancy Bacon & Woodrow to evaluate the results of Norges Bank's management. See also Section 7 of the report proper for a further presentation of the external control bodies evaluating Norges Bank's Investment Management.