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Can index performance be achieved through index management?

Even if a manager consistently trades securities in accordance with a benchmark index, the return achieved will normally be lower than the index return because of the transaction costs. This article discusses the deviations that may be expected between the performance of the benchmark portfolio and the performance of the actual portfolios managed by Norges Bank Investment Management by index strategies.

The Petroleum Fund's benchmark portfolio

The Ministry of Finance is responsible for defining the strategy for the Government Petroleum Fund. This strategy is reflected in a benchmark portfolio that forms the basis for Norges Bank's management of the Fund. A substantial portion of the Fund is managed by approximating the compositon of the actual portfolio very closely to that of the benchmark portfolio. This is called indexing. The benchmark portfolio consists of an equity portfolio with a weight of 40 per cent and a bond portfolio with a weight of 60 per cent. Both the equity and the bond benchmark are based on internationally recognised market indices, which have been constructed to measure performance in the equity and fixed income markets.

FTSE equity indices

The equity benchmark is based on a widely used market index called the FTSE World Index. This index was established in 1987, and is constructed by FTSE International, in collaboration with the Institute of Actuaries and the Faculty of Actuaries. Goldman Sachs & Co. and Standard & Poor's were also involved originally, but in December 1999 FTSE International took over their participations. FTSE International is owned by the London Stock Exchange and the Financial Times.

At the end of 1999 the index consisted of 2140 companies in 29 countries. The Petroleum Fund's benchmark portfolio contains securities from 21 of these countries. At the end of 1999, there were 1880 equities in these 21 countries indices. This is somewhat lower than the number at the end of the 1998, largely because of the many mergers that took place in 1999.

The indices in the FTSE World Index series aim to cover around 80 per cent of the market value of the listed companies in each country, excluding equities with inadequate liquidity, equities that foreigners may not own and long-term government shareholdings in companies. The companies to be included in the index are selected by a committee according to well defined guidelines. The index is intended to be representative of the various countries in terms of sector composition and enterprise size.

The most widely used world index is the MSCI World Index, which is constructed by Morgan Stanley Capital International. This index differs from the FTSE World Index in that it only covers 60 per cent of the market value of the countries it includes, and thus contains fewer companies. Companies are nevertheless selected such that the index contains both large and small companies. A third widely used index, Salomon Brothers Broad Market Index, covers a full 95 per cent of market value. The index contains over twice as many companies as the FTSE World Index. In contrast to the other two indices, Salomon Brothers Broad Market Index includes only the market value of shares that are freely negotiable, so strategic holdings are excluded from their calculations. As a result, the index is more representative of the shares that are available to investors. The FTSE World Index will change to a similar selection criterion in mid-2001.

The equity benchmark for the Government Petroleum Fund is constructed by weighting the country indices in the FTSE index in a special way. The Ministry of Finance has fixed separate regional weights for Europe (50 per cent), North America (30 per cent) and Asia and Oceania (20 per cent). Within each region, countries are allocated weights on the basis of the market capitalisation of the country's stock exchanges. The weights are rebalanced quarterly. Both the movements of the FTSE index and the weights from the Ministry of Finance are publicly available information.

Salomon Smith Barney World Government Bond Index

The benchmark index for the Government Petroleum Fund's bond portfolio is based on indices produced by Salomon Smith Barney (SSB). SSB makes a selection of government bonds from each country and weights them to form a world index. The index composition is based on the market weights of the individual bond in the individual country. Bonds issued by private sector agents are not included in the index.

The world index (WGBI) is a relatively comprehensive government bond index, and information about the movements of this benchmark index, ie its performance, is readily available. The WGBI consists of some 750 bond series issued by states with relatively well developed, liquid bond markets. SSB has defined specific requirements regarding the bond series that may be included in the index, to ensure that it is a relevant market index. It is intended to be comprehensive, but at the same time investors in the market should be able to buy all the securities included in it. The composition should remain reasonably stable over time, and the rules for which bonds should be included in the index are intended to be simple and unambiguous. If a state issues a new bond that satisfies the requirements, this bond will be included in the index.

The return on the index is calculated on the assumption that coupon payments on bonds are invested in the money market

until the end of the current month. The changes that will take place in the benchmark index after new issues and maturing of coupons are then known. More generally, this means that the status of the benchmark index at any time is known, and it is possible to predict movements in the index as a result of new issues and maturing of coupons, etc. The WGBI is rebalanced at the end of each month, which involves calculating new weights for each bond series. All bonds in the WGBI have residual maturities of over one year at the beginning of each month.

The fixed income benchmark for the Government Petroleum Fund is constructed by weighting the country indices in the WGBI index. The Ministry of Finance has fixed regional weights for Europe (50 per cent), North America (30 per cent) and Asia and Oceania (20 per cent). Individual countries within each region are weighted according to their gross domestic product. The weights are rebalanced annually, when new figures are available. Both the index changes from SSB and the weights from the Ministry of Finance are publicly available information.

Indexing strategy

The equity portfolio

About three quarters of the Petroleum Fund's equity portfolio is managed according to an indexing strategy. This is an inexpensive means of management, as it can be conducted fairly mechanically and without special market analyses. It is a cost-effective manner to invest money in the market. Up to the present, the management of the index portfolios has been conducted by external managers. Barclays Global Investors (BGI) and Deutsche Asset Management (formerly Bankers Trust, which was acquired by Deutsche Bank) manage global portfolios, while Gartmore Investment Management manages an exclusively British portfolio. BGI alone manages more than half of the equity portfolio, while Deutsche Asset Management and Gartmore manage smaller sub-portfolios.

The aim of indexing is to achieve a performance close to that of the benchmark that is being used. This means that the managers either buy all the equities in the benchmark portfolio, or a selection that can be expected to yield almost the same return. BGI aims to keep all the equities in the index at approximately the same weights as the equities in the benchmark portfolio, while both Deutsche Asset Management and Gartmore select a smaller number of equities for their portfolios. The selection is nevertheless made in such a way that they have the same country and sector weights as the benchmark portfolio. Efforts are also made to take account of other properties of the equities, with a view to finding equities that show strong covariation with the benchmark index of the market in question.

One advantage of only making a selection from the benchmark portfolio is that it is possible to avoid trading illiquid equities. Trading of illiquid equities is more expensive, because buying and selling will influence the market prices achieved, so a market operator must count on buying at an extra premium and selling at a discount in order to be able to execute the order at all. Another advantage is that with fewer securities it is easier to maintain an overview of the portfolio, and there are fewer dividend payments, share splits, warrant issues and other corporate actions to take into account. On the other hand, the performance of the portfolio will deviate more from the benchmark performance than a portfolio consisting of all the shares in the benchmark portfolio would do. Portfolio construction also becomes more dependent on a model. Assumptions regarding correlation of the performance of the various equities will have to be included in the model, and these assumptions may turn out not to hold true.

In managing the portfolios, the external managers are expected to ensure that the portfolios deviate only slightly from the benchmark portfolio in all respects. Strict limits are imposed on the size of deviations. In practice the deviations will be greatest around the times that changes are made in the composition of the benchmark portfolio.

The fixed income portfolio

Indexing of the fixed income portfolio is very largely done internally by Norges Bank. The aim is for indexing to be as efficient as possible. Keeping actual bond holdings identical to benchmark holdings at all times would entail significant transaction costs, however. Nor would it be entirely feasible, because the changes in the value of the benchmark portfolio are based on the offer prices of all the bonds concerned at a particular time (market closing time), whereas transactions actually have to take place throughout the day.

Norges Bank Investment Management places strong emphasis on the efficient execution of all indexing transactions. Each transaction is measured in relation to reference prices, in order to determine the effects of indexing on risk and results. Systematic efforts are made to achieve the most favourable bid and offer prices, while trading times are still chosen within strictly defined limits. Many of the bonds included in the benchmark are very closely correlated, so that changes in their value over time are roughly the same. This makes it possible to reduce the number of loans in the actual portfolio, and still achieve almost the same return as the benchmark portfolio. The advantage is that transaction costs are reduced. Allowing some difference between the benchmark portfolio and the actual portfolio is also a means of cutting costs. Effective indexing involves weighing up the risk of a deviation in performance on the one hand against transaction costs on the other. The balance arrived at is influenced by a subjective evaluation of relative risks and costs. In actual fact, indexing of the Petroleum Fund is accompanied only by very moderate deviations from the benchmark portfolio.

Transaction costs

Equities

The daily return on the FTSE index is calculated by dividing the value of all the shares in the index at the close of the stock exchange by the value at the close of the previous day, after adjusting for changes in index composition. In addition a total return is calculated by adding an estimate for dividends that is based on the assumption that dividend disbursements will be made steadily through the year. Since there are actually seasonal variations in dividend payments, the total return from month to month on an actual portfolio will deviate from the calculated total return on the index.

The index does not take account of tax on dividends, apart from in the UK, where the index is based on estimated after-tax dividends. Since the Petroleum Fund is state-owned, it is exempt from taxation in some countries. This means that in some countries the Fund is exempt from tax on dividends, while in other countries tax is deducted from dividends but is subsequently reimbursed. Since reimbursement takes place after 4-12 months, this implies a cost in the form of lost interest revenues on the amounts retained. However, this cost is very small.

Tax that is not reimbursed costs the Fund's equity portfolio around 0.08 per cent annually of the index return. Most of this is attributable to tax in European countries, but tax is also payable in Japan. In all these countries, the taxation rate (after reimbursement) is 15 per cent of dividend payments.

When index performance is calculated, account is not taken of transaction costs, either. Transaction costs are incurred through the purchase or sale of equities in connection with the establishment or liquidation of a portfolio, portfolio additions or disposals, changes in the index and reinvestment of dividends. In addition come the costs associated with currency trading.

Transaction costs vary substantially from market to market. In the UK, for example, there is a tax of half a percent on equity purchases. Transaction costs will vary slightly from year to year, depending on the size of the changes made in the index composition, and the countries in which changes occur. In an average year, the direct transaction costs (tax and brokers' commissions) associated with index management may constitute about 0.01 per cent of the value of the portfolio. Estimates for transaction costs are based on the assumption that adjustments are not made for each minor change in the index, but only for significant changes in the benchmark portfolio.

As a rule, the greatest cost associated with transactions is their impact on the market. Market impact is the difference between the price achieved and the price that would have been observed if the transaction had not taken place. It cannot be measured directly, and estimates of market impact vary considerably. Market impact is normally assumed to account for between 0.10 and 0.50 per cent of the transaction amount, but may be greater in the case of an attempt to trade a large volume within a short space of time. For this reason, transactions are normally spread over a long period. Since the prices used in daily calculations of index return are also influenced, market impact does not normally take the form of systematic differences between achieved return and index return.

Fixed income

For the fixed income portfolio, too, transaction costs are the main reason that the performance of an indexed portfolio may be lower than the performance of the market index against which the portfolio is indexed. Transaction costs are generally dependent on how the composition of the benchmark index is changed, since major changes under otherwise identical conditions entail substantial transaction costs. Moreover, costs are dependent on the type of paper concerned, because the spread between bid and offer prices (spread cost) sometimes varies considerably, depending on the issuer and liquidity of the bonds. Costs also tend to be higher at the times when it is necessary to rebalance the actual portfolio in line with changes in currency exposure in the benchmark index.

It is difficult to provide a general estimate of the transaction costs that would be incurred through perfect replication of the benchmark portfolio, ie when exactly the same market weights of the same securities as the benchmark portfolio are purchased. The transaction costs associated with perfect replication are a function of developments in fixed income markets, spread costs for the securities in the benchmark index that change market weights, spread costs in the foreign exchange market at month-ends with currency rebalancing, developments in the foreign exchange market in the period since indexing last took place, market conditions at the time of fixing reference prices in the foreign exchange and bond markets, etc. The transaction costs associated with (near) perfect replication of the benchmark portfolio are estimated internally by Norges Bank after the actual indexing has been carried out. Our estimates for indexing through 1999 show that the average cost of indexing to achieve perfect replication of the benchmark index was 0.02-0.06 per cent of the value of the fixed income portfolio.

As with equities, estimated index return is not adjusted for tax costs. However, this has very little effect on the Petroleum Fund's fixed income portfolio, because as a government investor, the Fund is exempt from tax in almost all markets. This means that withheld tax is virtually all returned to the Fund. Losses are thus limited to the loss of interest due to the delay associated with reimbursement of tax paid.

In bond markets, too, trading may influence market prices. In the bond markets of most countries, however, the effect is far smaller than that associated with trading of similar volumes in the equity markets of those same countries.

Strategies for minimising indexing costs

Index management is in itself a cost-minimising strategy; since efforts are made to minimise the costs associated with transactions, and fees to external managers are substantially lower than those associated with active management. However, it is possible to reduce costs even further by making a few simple, active choices.

When cash stemming from dividend payments is added to the portfolios, the external equity managers often buy futures contracts on equity indices. The value of these contracts depends on movements in the equity index in question up to a particular settlement date. The effect is that the external managers automatically achieve the same return as if they had bought all the equities in the index. At the same time, they avoid having to effect many small equity transactions. When a new company is to be included in the index, a cash holding with equity exposure through futures can be built up in advance, so that when the index changes, only futures contracts are sold, without it being necessary to sell equities evenly over the whole portfolio.

In order to minimise sales tax, particularly for the UK and Ireland, some equities are bought over the New York Stock Exchange in the form of American Depository Receipts (ADRs).

Strategies for enhancing indexing performance

Enhanced indexing of the equity portfolio

When the composition of the market index changes, the change should as a rule not be made in the actual index portfolios at exactly the same time, because a large number of other managers will be doing exactly the same thing with large volumes. As a rule, better prices can be achieved either by making adjustments before everybody else, or by waiting a little. This means that for a while the portfolio will have larger deviations from the benchmark index than it is supposed to have. There are no absolute rules for how best to adjust to changes in the index. Each case is analysed individually, with a view to finding a strategy designed both to minimise risk and to achieve favourable prices.

When an equity is included in the index just after a public issue, it may be a particularly good opportunity to buy the equity at a lower price than the one at which it will enter the index, because equities are normally priced at a discount for such issues. It is not unusual for issues to be 10-20 times oversubscribed. In connection with special issues, Norges Bank Investment Management subscribes for equities additional to those subscribed for by the external managers.

With particularly large issues, it is usual for the equity to be included in the index after at least a day on the bourse, and for listing to take place immediately after the allocation of the shares issued. In 1999, Contact Energy Limited (New Zealand), Banca Monte dei Paschi di Siena SpA (Italy), Eircom Plc (Ireland) and Enel SpA (Italy) were included in the index after new issues. On average, the value of these companies' shares rose by over 10 per cent from the issue price to the closing price on the day they were included in the index. These companies constituted 0.3 per cent of the Petroleum Fund's equity index, and their contribution to the excess return on the portfolio, through the equities allocated to the Fund in connection with the issues, was less than 0.01 per cent.

From time to time the index changes in such a way that it is difficult or impossible to achieve an index return for an actual portfolio. One such example is the merger between British Petroleum (UK) and Amoco (US) which took place on 31 December 1998. The weight of British Petroleum in the Europe index thus increased on a day when the European bourses were closed. Investors could buy the share (as an ADR) on the New York Stock Exchange, but the benchmark index changed in such a way that it was also necessary to sell other equities or future contracts in Europe in order to finance the purchase and avoid too much equity exposure.

At other times it is easy to beat the index. When Total Fina SA acquired Elf Aquitaine SA (France) in October 1999, an investor could beat the Europe index by 0.21 per cent by accepting Total's offer to buy Elf shares against payment in Total shares, instead of selling Elf shares and buying more Total shares in the market on the day when the index was adjusted for the merger.

Enhanced indexing of the fixed income portfolio

The performance of an indexed bond portfolio can be enhanced through systematic purchase and sale of bonds which for a brief period are under- or over-priced owing to special circumstances in the market. One example of such special circumstances is that bonds are normally priced high immediately after their issue, by comparison with older bonds with roughly the same residual maturity.

Various models are used to calculate prices and volatilities and to identify attractive bond series. This type of extended indexing entails a certain risk, but the risk will be limited, because many bond series are close substitutes for one another. The reason for choosing one bond series rather than another is normally to exploit certain factors or circumstances associated with the two series. The market risk associated with interest rate levels and the yield curve is only influenced to a lesser degree.

Funding costs

Equities

In addition to the transaction costs associated with day-to-day indexing come the costs of transferring capital to or from the Petroleum Fund. New capital is normally transferred to the Fund each quarter, and this coincides with the rebalancing of the distribution between equities and fixed income instruments, and among regions. The equity portfolio normally receives its share of the capital transferred by the Ministry of Finance to the Petroleum Fund, but sometimes it is necessary to sell down the equity portion in order to re-establish the correct distribution between equities and fixed income instruments. And even if capital is transferred to the equity portion of the Fund, it may be necessary to sell equities in some regions in order to restore the portfolio to the required regional weights.

The average costs for a global portfolio of buying equities with this new capital can be estimated at 0.25 per cent of the capital. If equities have to be sold, the costs are estimated at 0.20 per cent of outgoing value. Through active use of crossing (off-bourse trading) directly with other investors, purchase costs can be reduced to 0.15 per cent and sales costs to 0.10 per cent. Portfolio-crossing possibilities vary considerably, and the use of crossing has to be assessed constantly in the light of the extra market risk it may entail. Transaction costs are lowest in North America and highest in the UK and Ireland.

The effect in terms of underperformance depends on the size of the transfers of capital in relation to the total portfolio. Even without transfers to the Petroleum Fund, costs accrue when the regional and country weights in the portfolio are rebalanced. These costs are estimated to be around 0.04 per cent of the equity portion, if active use of crossing with other investors is assumed. For annual transfers with a value of about one fourth of the Fund, an underperformance compared to the index of about 0.05 per cent of the equity portion may be expected. With larger transfers, this underperformance will be even more pronounced.

Fixed income instruments

Transaction costs associated with the indexing of the fixed income portfolios normally accrue in the days around month-end, and depend generally on the changes taking place in the various country indices. Examples of changes are that a bond series drops off an index, or that a new bond series is issued. The composition of the country indices may be substantially altered, so that major transactions have to be carried out in the index portfolios in order to neutralise the risk exposure against the country indices that would otherwise have arisen.

The transaction costs around month-ends are also higher if transfers of capital make transactions in the fixed income portfolios necessary. The volume of these transactions will depend, among other things, on the volatility of the markets around the time of transfers, because large market movements in the period up to this time normally mean that major adjustments have to be made in connection with (or after) the actual transfer of capital. New capital is normally transferred to the fixed income portfolios quarterly. Some of the transaction costs associated with fixed income management have been carried elsewhere than in the fixed income portfolios in the Government Petroleum Fund.

Transaction costs consist in practice of spread costs (difference between bid and offer prices) in the foreign exchange and bond markets. In consequence, the costs generally depend on which currencies and bonds are actually involved in transactions. So far, we have estimated that the costs associated with the fixed-income portfolios around month-ends with transfers of capital have been about one basis point higher (annually) than the transaction costs associated with other month-ends.

Securities lending

Equities

The Petroleum Fund has an arrangement for the lending of equities from the portfolio. Equities are loaned out for a charge, and against collateral in cash, government paper or bank guarantees. The lender normally retains all rights except voting rights. The lender will thus be credited with the dividend after tax as though the equity had not been loaned out. An equity that is loaned out can be sold at any time, but it will then be recalled from the borrower. This makes it more attractive to borrow from stable portfolios. As a result, index portfolios have higher lending revenues than active portfolios.

The revenues from lending of equities fluctuate from month to month and from year to year. They depend, for example, on the tax rules of the various countries. They will also depend on the type of lending arrangement. The lending arrangement of the Petroleum Fund means that we can expect lending revenues of between 0.06 and 0.10 per cent of the value of the index portfolios.

Fixed income instruments

Repo trades consist of exchanging fixed income instruments in the Petroleum Fund's portfolio for other fixed income instruments with the same credit rating for a period. This exchange activity is an important source of excess return on the fixed income portfolio. The Fund gains revenues generated by the difference between the interest rates of the two forms of investment, while the counterparty normally has other reasons for exchanging instruments. For example, the counterparty may have agreed to sell a fixed income instrument that he currently does not have in his portfolio. The amount of revenue that can be created through the lending of securities depends on the resources used, expertise and market conditions.

With the resources currently used for this the activity, lending associated with the fixed income portfolio can be expected to generate an income of 0.01-0.04 per cent of the fixed income portfolio.

Total underperformance of the Petroleum Fund as a result of only buying the benchmark portfolio

An account has been provided above of many reasons why the performance of an actual portfolio that is indexed to a benchmark portfolio will deviate from the benchmark performance, even if the manager attempts to buy exactly the same securities as those in the benchmark portfolio. Estimates for how much each individual component contributes are uncertain, and depend quite a lot on factors that vary over time. Consequently, it is not possible to give a definite answer to what relative return can be expected from purely passive index management. Nevertheless, some rough estimates are given in the table.

Best estimates for percentage deviations between benchmark performance and actual performance with pure index management

Source of deviation	*Equities*	*Fixed income instruments*
Non-reimbursable tax	0.08	
Transaction costs other than rebalancing of regional and country weights and supplies of new capital	0.01	0.04
Transaction costs in connection with rebalancing of regional and country weights and supplies of new capital	0.05	0.01
Total	**0.14**	**0.05**
Potential income from securities lending	0.06-0.10	0.01-0.04

Tax and transaction costs are the most important factors for the equity portfolio. The total of all cost components amounts to between 0.10 and 0.20 per cent. The costs vary with the size of the quarterly capital transfers, the scale of the rebalancing of regional and country weights that is necessary, and crossing possibilities. The transaction costs alone dominate in the case of

the fixed income portfolio, and the overall costs can be expected to be decidedly smaller than those of the equity portfolio. For the Petroleum Fund as a whole, the actual return with passive indexing can be expected to be between 0.05 and 0.10 per cent lower than the return estimated for the benchmark portfolio. Some of this loss can be compensated for by the lending of securities.

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