

# Costs associated with large equity trades

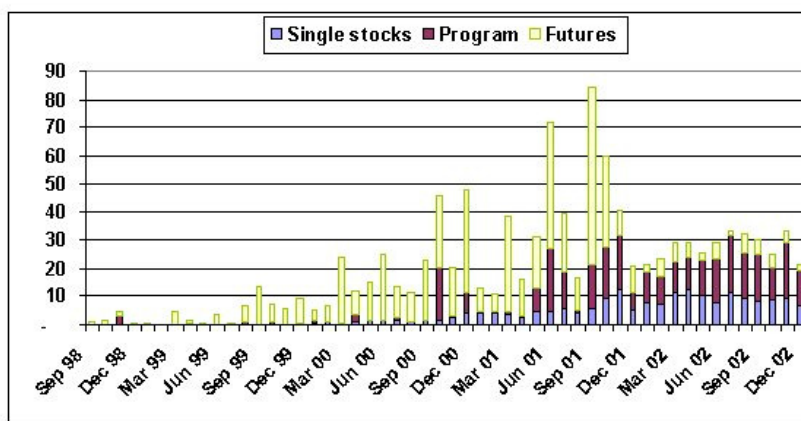
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Substantial transaction costs are associated with the transfer of petroleum revenues to portfolios of international securities. It is very important for Norges Bank to keep these costs as low as possible. This article reviews the systems and routines used to ensure that trading in equity markets is as efficient as possible. In 2002 Norges Bank traded equities for NOK 337 billion, equivalent to about 75 per cent of all trading activity on the Oslo Stock Exchange. For every trade carried out by Norges Bank, a benchmark cost is first established, against which the result of the trade is measured. Trading costs in 2002 were lower on average than these benchmark costs.

## Trading volume

Since the first share was traded in the Petroleum Fund in 1998, the trading volume has expanded considerably (see Chart 1). The size of the fund is an important explanatory factor for the volume traded, but much of the trading is also associated with the growth of the Fund as new capital is invested in equity markets. The large volumes traded in 2001 are due to the very large transfers of capital to the equity portfolio that year (see Chart 2).

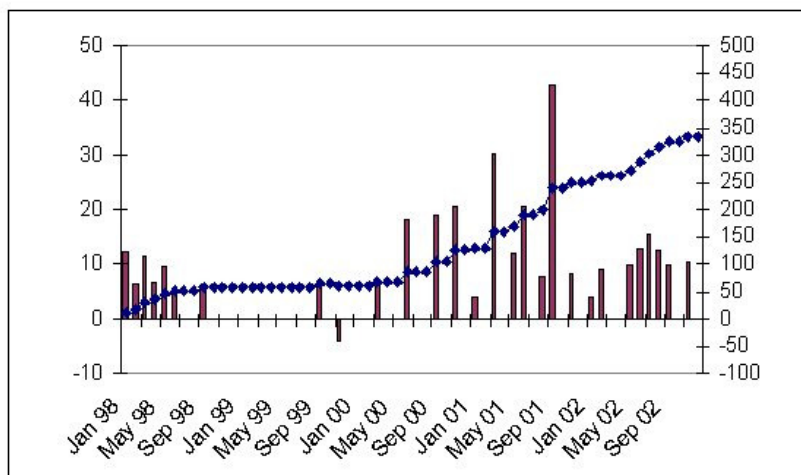
**Chart 1: Volume traded by Norges Bank in equity markets each month from 1998 - 2002. In billions of NOK**



\*The concepts 'program trading' and futures are explained in separate boxes.

Because of the large amount of new capital, the volumes traded are higher in the Petroleum Fund than in other funds of the same size. The Petroleum Fund thus has costs that comparable funds do not have. This makes the task of outperforming the Fund's benchmark index more difficult than in the case of a fund to which new capital is not being transferred.

**Chart 2: Transfer of new capital to the equity portfolio each month from 1998 - 2002 (left-hand scale) and cumulative transfers (right-hand scale). In billions of NOK**



Substantial costs may accrue in connection with equity trading. Norges Bank has placed emphasis from the start on

measuring these transaction costs and keeping them to a minimum. An Equity Trading Team has been built up to tackle these challenges. In addition, the costs associated with both external and internal portfolios are measured by an external consulting firm. Each quarter, Norges Bank receives a report in which the Bank's trading costs are compared with the costs of other investors. In 2002, Norges Bank was among the most cost-effective in the consulting company's peer group.

In 2002, Norges Bank's transactions comprised trading of single stocks, program trading (see explanation in separate box) and futures trading for a total of NOK 336.5 billion. Trading of single stocks amounted to NOK 110.6 billion, program trading accounted for NOK 169.6 billion, while futures contracts for NOK 56.3 billion were traded. The volume of futures does not include transactions in connection with rollover of contracts. Orders for single stocks came to 14 063, program trades to 304, and there were 870 orders for futures contracts. Compared with 2001, trading in single stocks increased by 65 per cent, while program trading increased by 58 per cent. Nevertheless, the total volume traded declined somewhat relative to 2001, because of the reduced volume of futures trading in 2002. In addition to this, Norges Bank's Equity Trading Team carries out all the foreign exchange trades required in the Petroleum Fund's equity portfolio.

In 2002, the Petroleum Fund's equity portfolio was distributed among about 50 different internal and external mandates. The mandates may be active or passive, and their management may be related to regional or sector-based benchmark portfolios. In the Fund's benchmark portfolio there are 27 countries with markets with differing trading restrictions, settlement and foreign exchange rules and degrees of liquidity. These factors also contribute to making Norges Bank's trading in equities a complex task.

## Liquidity

The average daily volume traded in a particular share or group of shares is a common measure of liquidity. In general, the less liquid a share or set of shares is, the greater the market impact and total transaction costs for a given traded volume will be.

The last column in Table 1 provides a picture of the average liquidity in the various countries in the Petroleum Fund's benchmark portfolio. The column shows the market value of the Petroleum Fund's benchmark as a share of average traded volume. The US is the most liquid market. The Petroleum Fund's benchmark in the US accounts for 36 per cent of the average daily volume traded. Considerably poorer is the average liquidity of the Petroleum Fund's portfolio in Turkey, where the Petroleum Fund's benchmark accounts for seven and a half times the average daily volume. However, there is wide variation between single stocks in the various markets.

**Table 1: Composition of the Petroleum Fund's benchmark portfolio (29 November 2002)**

The FTSE index					
Region	Country	No. of companies	Market capitalisation (NOK bn)	The Petroleum Fund's share. Per cent	Liquidity*
<b>North America</b>		<b>618</b>	<b>63 750</b>	<b>0.13</b>	
	Brazil	41	295		149
	Canada	88	2 337		58
	Mexico	19	405		220
	US	470	60 713		36
<b>Europe</b>		<b>557</b>	<b>31 251</b>	<b>0.40</b>	
	Denmark	21	309		164
	Sweden	36	986		102
	Switzerland	25	3 255		164
	Turkey	29	78		755
	UK	130	11 624		92
	Austria	23	86		312
	Belgium/Luxemburg	20	434		297
	Finland	9	880		80
	France	46	4 254		74
	Germany	37	2 837		73
	Greece	75	219		497
	Ireland	10	304		190
	Italy	43	1 860		84
	Netherlands	18	2 434		98
	Portugal	11	174		156
	Spain	24	1 516		68

<b>Asia and Oceania</b>		<b>605</b>	<b>13 851</b>	<b>0.33</b>	
	Australia	63	1 897		104
	Hong Kong China	50	1 079		212
	Japan	324	8 535		112
	Korea	33	953		54
	New Zealand	23	87		248
	Singapore	39	350		227
	Taiwan	73	949		62
<b>Total</b>		<b>1780</b>	<b>108 852</b>	<b>0.23</b>	

\*The Petroleum Fund's benchmark portfolio as a percentage of average daily market turnover in the ten days up to 29 November 2002.

## Transaction costs

Transaction costs comprise all the costs that accrue in connection with a transaction. They can be divided into direct and indirect costs. The direct transaction costs comprise commissions to brokers, taxes, fees and administration costs. In the UK, for example, tax costs comprise half a per cent (50 basis points) stamp duty; in Ireland they constitute one per cent on the purchase of shares, whereas in Hong Kong a stamp duty of 10 basis points must be paid on both purchase and sale of shares. Fees are also paid to the stock exchanges, and in the US a fee of 0.003 basis points of sales is also paid to the supervisory body, the SEC, while in Taiwan a tax of 30 basis points is paid on sales. The administrative costs cover the processing fees of the settlement functions and custodian institution used by Norges Bank. The direct transaction costs are easy to measure, but amount to an average of 25 per cent or less of total transaction costs.

The indirect costs consist of the bid-ask spread, i.e. the difference between what sellers in the market are willing to sell for and the price buyers are willing to pay. This spread is typically about 25 basis points in Europe and the US, while it may approach 50 basis points in Asian markets. Other types of cost are market impact, volatility and opportunity costs. These three costs are more difficult to quantify.

Market impact costs are due to share price movements because the order is in the market. This is explained in more detail in the example below. The table shows the supply of and demand for shares in the Greek company Hellenic Telecommunications (HTO GA) at a specific time. The upper part of the table (ASK) shows the number of shares on sale in the market at the different prices. Similarly, buy orders in the market (BID) for various prices are given in the lower part of the table.

HTO GA	Price	Size
<b>A</b>	11.04	13 740
<b>S</b>	11.02	26 570
<b>K</b>	11.00	25 280
	<b>10.98</b>	<b>1 730 035</b>
<b>B</b>	10.94	9 880
<b>I</b>	10.92	14 600
<b>D</b>	10.90	1 300

The bold line in the middle indicates the price last traded in the market and the total volume of turnover that day. The market last traded at a price of 10.98. If you want to buy 1 000 shares, you can do this in the market at a price of 11.00. If the purchase order is larger than 25 280 shares, there will be market impact. The larger the order in relation to the average volume traded in the market, the greater the market impact will be. Market impact also increases with the bid and ask spread.

Volatility costs are costs due to price fluctuations in the period of time it takes to execute the order. Even if there is no market impact, the share price may change for other reasons during the time it takes to complete the order. This exposes the trader to a risk that has a cost attached. The longer it takes to trade, the higher the potential volatility cost will be. The volatility of share prices varies from share to share.

The third indirect cost is the opportunity cost, which is due to the risk of the order not being completed. This may happen if unfavourable price movements in the market lead to the cancellation of the order, or if liquidity is so poor that price impact costs would be too high.

The trader will have to weigh the volatility cost against the price impact. The longer it takes to execute an order, the less the market impact and the higher the potential volatility costs will be.

The total direct and indirect costs are called the implementation shortfall. This shortfall is equivalent to the difference between the price when the order was given and when it was executed, with the addition of commissions, taxes and other charges.

## Organisation of tasks in equity trading

In Norges Bank's Equity Management unit a separate group is responsible for all trading. The Equity Trading Team's most important tasks are:

- Daily trading in equity markets trading single stocks
  - program trading
  - futures trading
  - trading portfolios
- Investment of new capital added to the equity portfolio (cash flows)
- Transfers between portfolios (transitions)

These tasks are described in detail below.

Norges Bank's Equity Trading Team consists today of eight traders. Half of them have cash flows and transitions as their main tasks, while the others trade in single stocks. Emphasis is placed on the traders' specialising and acquiring expertise in their fields of work. The tasks of a transition manager and a single stock trader are very different. Single stock traders specialise further in particular sectors.

Norges Bank has a common order processing system for equities, futures, cash and foreign exchange trading. Portfolio managers in other units of the Equities Department send their orders electronically to the Trading Team, who execute the transactions in the market. Norges Bank also has electronic links to a number of counterparties, and can send trades electronically to brokers. When the order is traded in the market, the price is entered in the order system and the trade will then be sent electronically for settlement and recording for accounting purposes in Norges Bank's custodian account.

The internal order processing system contains various types of data for the trader, including estimated market impact and the average trading volume, volatility and price for the past few days. All this information is stored in an internal database and makes it possible to analyse transaction costs down to a detailed level.

The prices brokers achieve for Norges Bank's orders are one of many factors taken into account in a quarterly evaluation of the brokers. There are separate broker evaluations for single stocks, program trading and futures. These evaluations are based on directly measurable criteria, and the results determine how large a share of the overall transactions a broker is allocated for the next quarter. In 2002, Norges Bank used 15 brokers for single stock trading, six for program trading and three for futures trading.

### Daily trading in equity markets

Equities are traded every business day in the Petroleum Fund. A trade may be initiated for a number of different reasons. The manner in which the order is traded in the market is closely related to the investment strategy and motive for placing the order. A transaction order may be placed because a portfolio manager has received new information about an single stock, or performed a new analysis of known information, or because there is a special pricing situation. Such information-driven orders must reach the market fast. In other cases, a transaction may be the result of a need to invest cash, for example from dividend payments, or from transfer of new capital.

The liquidity available in the market determines how long it takes to fill the order. For illiquid shares, it is particularly important to weigh the market impact against the volatility cost. Knowledge of the portfolio manager's motive for investing may influence how rapidly the trader wishes to execute the transaction, i.e. how large a market impact he or she is willing to accept in order to reduce the potential volatility cost of the transaction.

These transactions require considerable attention from the trader, and are dependent on skilled traders with extensive knowledge of the share in question, the industry sector, the stock exchange on which the share is being traded and the investment strategy that is being pursued. For orders in illiquid shares, the trader's challenge is often to find the other side of the trade, outside the liquidity in the market one sees on the screen in open information databases such as Bloomberg and Reuters.

On the other hand, a number of liquid shares will be less demanding to trade. For example, a portfolio manager may wish to carry out major or minor restructuring of the portfolio at the lowest possible cost. The portfolio manager may not necessarily have any particular view on how the share price is going to move that day. This will more often be the case for index portfolios than for active portfolios, but it may also occur when structural changes are made in active portfolios. If the shares are liquid, it will be advisable to use program trading. Brokers typically price program transactions at approximately a tenth of the commission for single stocks.

#### Program trading

In contrast to trading in single stocks, program trading involves trading a portfolio of equities. The purpose of program trading is to achieve lower transaction costs through reduced broker commissions and efficient implementation. Program trading is used for trading in liquid shares about which the trader does not possess any special information. A program trade may consist of both buy and sell orders and of shares in different countries and may relate to different portfolios. In 2002, Norges Bank had 98 equities on average in each program trade, but some program trades may encompass up to 500-600 different lines. The average value of a program transaction in 2002 was NOK 558 million, while single stock transactions had an average size of about NOK 8 million. Program trades are measured in relation to pre-determined benchmark prices in the same way as transactions in single stocks.

So far we have only talked about trading of physical equities. Norges Bank also trades substantial volumes of equity index futures. Equity index futures are futures contracts on equity indices, as described in a separate box. Futures are a quick and inexpensive way of achieving exposure to the market. Futures contracts are often traded as part of the risk management of the whole equity portfolio, or in order to achieve market exposure for cash held by external managers.

The Equity Trading Team itself has two portfolios where traders can act on current market information. These positions are of a different type from the more long-term evaluations of the portfolio managers. The positions in the trading portfolios take advantage of special pricing situations, and in many cases the traders can be out of the positions again by the end of the day. Norges Bank attempts to create an excess return through these portfolios by making use of information that the traders obtain through other trading activities, while gaining even better access to market information.

#### Futures contracts

A futures contract is an agreement to deliver an asset or its cash value at a predetermined date for a predetermined price. Norges Bank trades futures on equity indices. This means that the underlying asset is an equity index. All equity index futures are settled in cash, so there is no physical delivery of the underlying shares in the index on maturity. The contracts are traded on stock exchanges, and settlement for most of them takes place daily after the market closes. This means that the customer must have a margin account which is credited or debited according to the price changes in relation to the previous day's closing prices.

Futures contracts are constructed in such a way that they provide the same return and risk as the equities represented by the contract. There are many situations in which it is appropriate to use this instrument. The transaction costs associated with trading in futures contracts are low compared with trading in the underlying equities. When new capital is invested, the liquid futures contracts offer rapid exposure to the market, and futures also provide easy access to short sales. It is not necessary to own the underlying shares in order to sell the futures contract.

One disadvantage of futures contracts, however, is that they result in a greater variation in the return differential against the benchmark portfolio. This is because the equities in the Petroleum Fund's benchmark portfolio do not correspond exactly to the equities in the underlying indices for the liquid futures contracts. Moreover, futures contracts have a limited maturity. Thus rollover costs accrue with long-term futures positions. These are transaction costs associated with the sale of the maturing contract and purchase of the next liquid contract. Most contracts are quarterly.

#### Cash flows

In the course of 2002, NOK 83.9 billion in new capital was transferred to the Petroleum Fund's ordinary equity portfolio. This is a substantial amount in relation to the size of the equity portfolio, which was NOK 245.8 billion at the beginning of 2002. According to the investment strategy for the Petroleum Fund, 40 per cent of the Fund shall be invested in equities. When the equity market falls, the share of the Fund in equities is reduced. In order to bring it up to 40 per cent again, all, or most of the new capital was accordingly transferred to the equity portfolio. Conversely, the fixed income portfolio receives most of the new capital when bond prices fall. In 2002, two third of all capital transferred to the Petroleum Fund went to the equity portfolio.

Table 2 shows that the total costs of investing new capital in equity portfolios in external or internal risk mandates amounted to 0.258 per cent of the value of new capital added in 2002. The total costs are the change in value during the transition period measured against the benchmark portfolio's return in the period. These costs cover both trades to establish equity exposure for new capital and any trading that takes place subsequently in order to adapt the portfolios to the specific mandates they are to form part of. The costs in the table may also cover more than one transaction for each krone invested.

**Table 2: Transaction costs of investing new capital in the Petroleum Fund's equity portfolio in 2002. Per cent of amount invested**

Direct costs	
- Brokers' commissions	0.060
- Taxes and fees	0.044
Indirect costs (market impact and volatility costs) 0.154	0.154
<b>Total transaction costs</b>	<b>0.258</b>

The loss or gain on the implementation of a transaction is an important component of the indirect costs. The costs associated with trade execution are measured as deviations from benchmark prices. These prices depend on the volumes to be traded and the liquidity of the shares. Benchmark prices may be volume-weighted average prices on the date the transaction is executed, or they may be prices generated by a model involving liquidity and price volatility.

Table 3 shows the trading performance, i.e. the price achieved compared with the benchmark price, for different types of trades. In 2002, Norges Bank achieved better prices on average than the benchmark prices set for the traders. The difference for single stock trading was 0.22 per cent, whereas in the more liquid markets for program trading and futures contracts the difference was 0.02 per cent.

**Table 3: Norges Bank's trading performance in 2002**

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	Single stocks	Program trading	Futures
Transaction volume (NOK bn)	110.6	169.6	56.3
Performance (%)	0.225	0.023	0.021

### Transfer of capital between portfolios

Transitions involve transfer of equities and/or cash between different managers and mandates. These include cases where capital for new mandates is transferred to external or internal managers, or where existing mandates are terminated. Norges Bank purchases portfolios itself before transferring them to external managers. Transfers may take place between index portfolios and active portfolios, or between two active portfolios or two index portfolios.

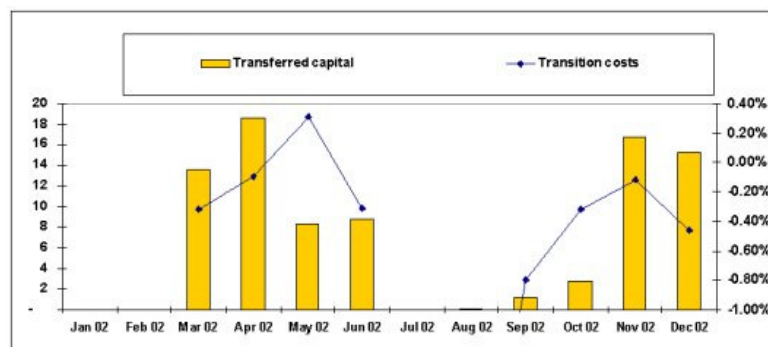
In 2002, Norges Bank carried out 47 transitions in the equity portfolio, equivalent to a total of NOK 85.3 billion, of which NOK 17.5 billion in the foreign exchange reserves. There were eight transitions between internal index portfolios (NOK 5.1 billion), while 39 transitions involved external active mandates (NOK 80.2 billion). Four external mandates were terminated, while 37 transitions involved the transfer of new capital to external mandates. Chart 3 shows how the transitions were distributed through the year.

Virtually all external managers received capital in the form of equities. The manager receives the agreed portfolio after it has been traded by Norges Bank's traders. The fact that Norges Bank carries out these trades means that there is better control of market exposure and transaction costs during the whole transition period. The task of the transition manager is to convert an existing equity holding into the portfolio specified by the new portfolio manager at the lowest possible cost. Before the purchase and sale of equities begins, the transition manager makes an analysis of the liquidity and the market and sectoral composition of both the desired and the existing portfolio. On the basis of this analysis, a trading plan is drawn up consisting of program, single stock and foreign currency trading transactions.

When the trading strategy is drawn up, the number of trading days planned will depend on what is necessary in order to execute the order with the least possible market impact. The trading plan takes account of exposure to various countries and sectors. The aim is to ensure a market exposure as close as possible to that of the benchmark portfolio throughout the transition period. Different combinations of futures contracts may be traded in addition, in order to achieve the desired market exposure. The objective is secure management of the various risks.

The transition costs are measured through the implementation shortfall. The total transition costs express the change in value during the transition period measured against the benchmark portfolio's return in the period. The contributions of the various components to the total transition cost are calculated and analysed. The total transaction costs are calculated for all transitions, as is the case for each equity transaction and each program transaction.

**Chart 3: Transitions between sub-portfolios in the Petroleum Fund's equity portfolio in 2002 in billions of NOK, and transition costs as a percentage. A positive transition costs means a gain.**



The points in Chart 3 show the transaction costs associated with the transitions executed by Norges Bank in 2002 compared with the calculated benchmark costs. There was no transition cost for transitions in May, but on the contrary, a gain. The transition cost on the small transition amounts in September was relatively large. The average transition cost was 0.204 per cent of the transition sum.

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