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**INFLATION TARGET – IMPLEMENTATION OF A CPI-ATE IN NORWAY\***

Supporting paper submitted by Statistics Norway

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\* This paper has been prepared by Mr. Lasse Sandberg, Statistics Norway, at the invitation of the Secretariat. Paper posted on Internet as received from the author.



## **Inflation target - implementation of a CPI-ATE in Norway**

Lasse Sandberg<sup>1</sup>

### ***Abstract***

In 2001, Statistics Norway published three new indicators derived from the Consumer Price Index. The publishing of these indicators was partially inspired by the mandate given to Norway's central bank, Norges Bank, to define monetary policy in relation to an inflation target. The growth in the CPI All-item Index is not necessarily the most relevant and meaningful measure. CPI adjusted for certain factors, for example changes in indirect taxes, can give essential additional information about the more general movements of price growth. This paper provides documentation of which adjustments are made in the three derived CPI series, the grounds for carrying out these derivations as well as the assumptions that the adjustments are built upon.

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<sup>1</sup> Head of Division for Economic Indicators, Statistics Norway. The paper is an updated version of Lilleås (2002)



## 1. Introduction

The Consumer Price Index (CPI) is an economic measure derived from prices on a selected sample of goods and services. Occasionally the price development on a limited number of goods will completely dominate CPI development and thereby impair the indexes' informational value concerning the more general price development. This happened in 1999 and 2000 when there was a particularly steep price increases on oil related products in addition to considerable changes in electricity prices. These changes contributed to the decision by Statistics Norway in the fall of 2000 to publish a Consumer Price Index excluding energy goods (CPI-AE). On March 29, 2001, Norges Bank received a new mandate for monetary policy, where the operational target is annual growth in consumer prices at 2.5 per cent over time. The regulations also specify some effects related to price growth whose influence must be discounted when the central bank assesses the monetary policy.

On October 10, 2001, Statistics Norway published, one series for consumer price growth adjusted for real changes in taxes (CPI-AT) and another series in which the consumer price growth is adjusted for both real changes in taxes and energy prices (CPI-ATE). In this paper's first section, the relationship between the monetary policy regulations and the Statistics Norway adjusted series is explained. In the second section, the principles behind the removal of tax change effects in CPI-AT are discussed. The approach to handle energy goods in CPI-AE is described in the third section. The fourth section explains how the real effects from tax changes and energy prices are incorporated into the indicator CPI-ATE.

## 2. New regulations for monetary policy

In the spring 2001, Norges Bank was given new guidelines for the monetary policy. In the regulations presented March 29th, the central bank was instructed to apply the instruments of monetary policy to establish stable and low inflation. The operational target is an annual growth in consumer prices that over time is near 2.5 per cent, see appendix A. There are however some circumstances which the central bank is not to incorporate into their monetary policy decisions:

*"In general, the direct effects on consumer prices resulting from changes in interest rates, taxes, excise duties and extraordinary, temporary disturbances shall not be taken into account."*

The regulations therefore go a long way towards defining a basis for a separate indicator that will be a guide for the exercise of monetary policy. Nevertheless the wording "extraordinary, temporary disturbances" gives significant room for interpreting which specific factors should be adjusted for in the formulated consumer price growth, and also how one should measure such direct effects. Even how those effects are handled in relation to changes in interest rate levels and taxes and excise duties, are far from obvious.

In Norges Bank's inflation reports after the new regulations were established the bank presented their interpretations of which direct effects the consumer price growth should be adjusted for. With reference to preliminary analysis, the bank estimated that changes in interest rates would normally have a negligible direct effect on CPI growth. This lack of effect is connected to the fact that interest does not enter directly into the housing cost component nor other components in the Norwegian Consumer Price Index as Statistics Norway use the rental equivalence approach for owner occupied housing. On the other hand, the central bank does want to adjust for the direct effects of changes in energy prices. Large changes in energy prices have made it complicated to assess general price growth tendencies. Lastly, the bank decided that they would adjust for the direct effects on the Consumer Price Index due to tax changes.



There is no steadfast answer to how one should distinguish between special and general price changes. One objection to permanently adjusting for the direct effects of energy price changes is that not all of these changes can be regarded as of 'extraordinary, temporary' character. A simple interpretation of the regulations is that it does not give room to remove any other price effects on a permanent basis than those that come from changes in interest, taxes and excise duties. However, if one looks at the variation in energy prices in relation to the average for the remaining goods and services in CPI, one can reasonably say that the development of these prices is of 'extraordinary, temporary' character. Table 1 gives a summary of Standard deviation for Consumption groups (COICOP). As seen in the table energy products and seasonal products are dominant and explain for some part the reasoning for exclusion in indicators for underlying inflation.

**Table 1. Standard deviation for consumption groups (COICOP).**

COICOP	Stdev <sup>1</sup>	COICOP	Stdev
Telephone equipments (1 <sup>2</sup> )	11.18	Paramedical services (8)	3.50
Heat Energy (2)	6.44	Shoes (6)	2.88
Electricity (10)	5.10	Fruit (7)	2.76
Vegetables (3)	3.90	Postal Services (15)	2.64
Garments (4)	3.88	Fuels and lubricants... (13)	2.53
Liquid Fuels (5)	3.81	Passenger transport by air (24)	2.49

1: Standard deviation based on series from January 1990 to February 2006

2: Ranking in 2001 based on series from January 1990 to December 2000

Source: Statistics Norway

After the alterations to the monetary policy, Statistics Norway developed an indicator for the Consumer Price Index purged of the direct effect of real tax changes (CPI-AT). The adjustments that are made in the indicator CPI-AT were then combined with the earlier derived CPI-AE into one indicator where the Consumer Price Index is accordingly adjusted for real changes in both taxes and energy prices. In the data on which the Consumer Price Index is based there is no explicit information on taxes. Calculation of the effects from tax changes on CPI is built therefore upon a line of assumptions.

It was argued that an inflation target that is about a half percentage point higher than the monetary policy objective of our main trading partners was justified on the basis of a generally more expansionary fiscal policy in Norway as a result of the new fiscal rule on the phasing in of petroleum revenues into the Norwegian economy. The rule was introduced at the same time as the inflation target. According to the rule, the central government will continue to save all current petroleum revenues, while the expected real return can be posted as income in the central government budget. In this way, the capital accumulated in the Petroleum Fund and remaining petroleum reserves will benefit all future generations. As part of the rationale behind the revision of the guidelines for economic policy in 2001, it was assumed that an extra half percentage point inflation in Norway relative to our trading partners, with a corresponding weakening in competitiveness, would be necessary and sufficient to achieve structural changes as a result of the somewhat more expansionary fiscal policy implied by the new guidelines. This implied that there would not be a need for a nominal appreciation of the Krone, more about this see Economic Survey (2003) and Johansen (2002).

For the implementation Norges Bank states:

*"Norges Bank operates a flexible inflation targeting regime, so that weight is given to both variability in inflation and variability in output and employment. Monetary policy influences the economy with long and variable lags. Norges Bank sets the interest rate with a view to stabilising inflation at the target within a reasonable time horizon, normally 1–3 years. The relevant horizon will depend on disturbances to which the economy is exposed and how they will affect the path for inflation and the real economy in the period ahead."*



### 3. Taxes and Duties in the Consumer Price Index

The regulations state that all direct effects on the consumer prices by tax changes should be removed from the monetary policy's consumer price measure. In this case Statistics Norway interprets direct effects as real changes in taxes and duties which are directly added to consumer goods and services; not tax and duty changes that first have an effect through prices on contribution factors or other products then later are to be added onto the retail prices on consumer goods and services. This interpretation implies that large portions of the total tax and duty system are not relevant for such adjustments. Even after this clarification, there are unclear challenges connected with identifying the effects that real changes in the actual taxes and duties have on consumer prices.

The Consumer Price Index is based on a sample of goods and services that covers a broad spectrum but is far from encompassing all goods and services. The sample is designed to be a representative list of goods and services for the private consumer, and can fulfil that purpose without covering all taxable products. This means that the measured consumer price growth does not necessarily detect the effects of all types of tax and duty changes tied to consumption. A comprehensive survey of taxes and duties in connection with the development of the CPI-AT indicator shows, however, that the most significant taxable products are represented in the Consumer Price Index goods sample.

Table 1 gives an overview of which taxes are adjusted for in the CPI-AT. The CPI-AT selection criteria are defined as taxes that can be directly connected to the measured prices on goods and services in the CPI sample.

**Table 2. Taxes, which are adjusted in CPI-AT**

Value added tax	Tax on Mineral products
Tax on Spirit, wine and beer	Tax on Chocolate and sweets
Tax on Tobacco	Tax on Non-alcoholic drinks
Tax on Sugar	Tax on Petrol
Tax on Air Travel	Tax on Autodiesel fuel
Tax on Tapes	Tax on Marine motors
Tax on Radio and television materials	Consumer tax on electricity
Tax on motor vehicles (from 2005)	

Source: Statistics Norway.

The Consumer Price Index is based upon retail prices where all taxes and excise duties are included in the retail price. Changes in tax rates do not imply an automatic price change on that tax-included product. The competitive market situation can cause merchants of a product to accept a reduction in profit margins instead of adding the entire tax increase onto the product price. There are also examples of the opposite occurring when tax increases are over-compensated in the prices. In addition, early announcements of tax changes can lead to price adjustments before the new tax rate is actually in force. Unfortunately the data available for CPI gives few pieces of information to detail further such relations. For practical reasons, it has therefore been assumed in CPI estimations that a tax change leads to full and immediate effect in the retail prices.

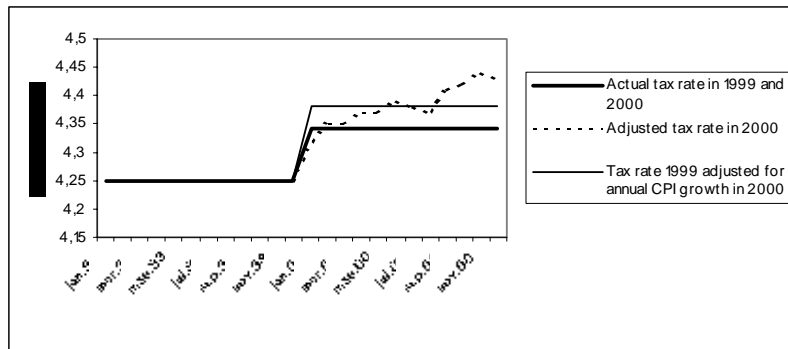
Except for the value added tax and taxes on radio and television materials, the taxes in Table 1 are taxes with a set tax amount per item or volume, independent of retail price. That such a tax is actually unchanged implies that the tax rate must be adjusted in line with the general price increase. The taxes are generally changed only once annually, most often with effects from the beginning of the year. The inflation adjustment for excise duties is based on the annual growth in CPI. As a result, the taxes in the calculation of monthly CPI-AT are adjusted with the CPI growth such that they, for the year, grow in alignment with the yearly growth in CPI.

The CPIAT and CPI have an identical weight basis and are calculated in the same way. The CPIAT is also based on actual, observed prices, but those are adjusted for real changes in taxes. There are many alternatives as to how to adjust for changes in taxes, and the choices that are made will influence the



indicators characteristics. A relatively simple method would have been to take out all nominal tax changes, i.e. correct for the entire kroner increase in the taxes. In periods of general price growth, this method would mean that taxes with zero growth remain as an “anchor.” An obvious alternative to this method is to adjust the taxes with the price growth. This is done on the basis of a desire to identify the impact of real tax changes, i.e. changes that deviate from the general price growth, on CPI growth. When calculating the CPIAT, a method is used whereby the taxes are adjusted so that the growth in the tax becomes equal to the annual growth in the CPI. Furthermore, the current tax level at the end of the year is what is adjusted with the price growth through the subsequent year. How this is done in practice can be illustrated with the following example.

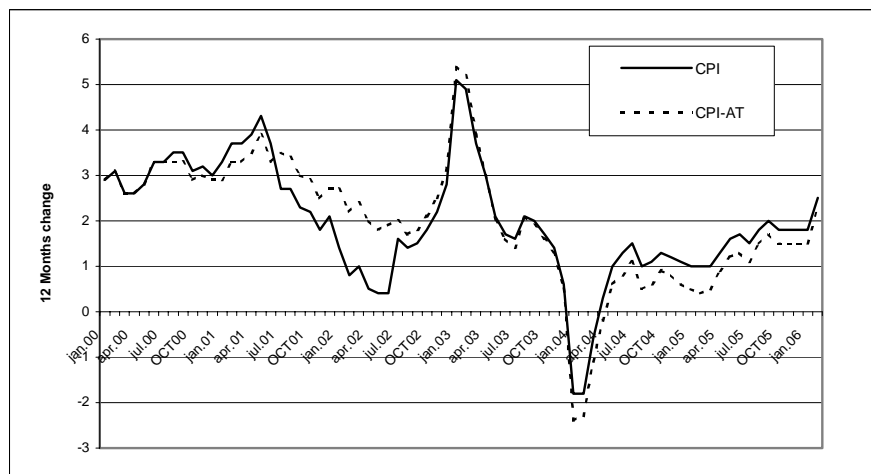
**Figure 1. Adjusted tax rates for petrol**



Source: Statistics Norway

Figure 1 shows an example of how the price adjustments for the taxes are carried out. In this example the petrol tax in 1999 is examined and during which the tax was 4.25 NOK per litre. In 2000, the tax was actually adjusted upwards to 4.34 NOK with the expectation that the annual growth in CPI would be 2.1 per cent. The expectation in the end, underestimated the actual price growth (3.1 per cent) in 2000, implying that petrol taxes actually decreased in proportion from 1999 to 2000. The dotted line in Figure 1 shows the adjusted tax that is included in the calculations of CPI-AT in the individual months of 2000. The fluctuations reflect the monthly variations in the Consumer Price Index for 2000 in relation to the average index for 1999.

**Figure 2. CPI and CPI-AT. January 2000 - February 2006.**



Source: Statistics Norway

The value added tax and a special excise duty on radio and television materials are value taxes that require a slightly different method of price adjustment calculation in the CPI-AT than the price independent duties. Value added taxes are a last addition into the consumer price, whereas other taxes



are included in the base price. The value added amount is calculated on the basis of the adjusted, price-independent excise duties. This is to avoid the situation where real changes in the price-independent taxes influence the value added tax. The effect of real changes in the value taxes, that is to say the percentage change, is adjusted out completely in the CPI-AT.

It follows from the example that tax changes are fully reflected in the retail prices and that this occurs immediately after the tax change. A possible drawback in price-adjusting the taxes this way as opposed to using a constant deflator, is that the taxes contribution to the price growth will vary in periods where no actual tax changes have occurred. The advantage is that the taxes are adjusted with the actual annual growth in the CPI at the end of the year, and that the tax rates have reflected the variations in CPI growth throughout the year. It should be emphasized that this is a matter of choice of methods, and that there are arguments favoring the use of other price indexes and other "rules" for correcting the taxes.

#### 4. Energy Goods

In the fall of 2000, Statistics Norway began to publish a Consumer Price Index without energy goods. This decision was based primarily upon the strong fluctuations in petrol, paraffin and heating oil prices experienced from the end of 1999 and throughout 2000. Significant swings in the electricity prices throughout earlier experiences were additional reasons for publishing this new indicator. The prices on the products that were removed represented a substantial portion of the variation in the All-item index and as a result were problematic in the illumination of the more general price development.

Technically the calculation of CPI-AE is carried out in the same manner as the calculation of the ordinary Consumer Price Index. The only difference is that the price material and the weight to energy goods are taken out. The weight of all that we have designated as energy products, amounts to 8.29 per cent of the current Consumer Price Index. In CPI-AE, the weights for the remaining goods and services of the CPI are scaled such that they continue to add up to 100 per cent. This gives the same result as if all energy goods are assigned a price development equivalent to the average of the remaining goods and services in CPI. Table 2 gives an overview of the energy goods that are removed in the calculation of CPI-AE. These energy goods are listed with their appropriate weights in the usual Consumer Price Indexes' goods and services sample.

**Table 3. Energy goods in the CPI. Weights 1999-2006, per thousand**

	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06
<b>Electricity, gas and other fuels</b>	44.4	41.9	40.2	39.4	41.1	44.5	46.8
<b>Fuels, lubricants, pers.trans.equipment</b>	36.2	34.3	35.1	34.1	34.7	31.9	32.0
<b>Misc. energy products</b>	2.4	2.2	2.2	2.8	3.2	3.8	4.1
<b>total weights of energy products</b>	83.0	78.4	77.5	76.3	79.0	80.2	82.9

Source: Statistics Norway.

CPI-AE has been calculated back to 1995 and is published on the index level with one decimal place together with a year-to-year growth series.

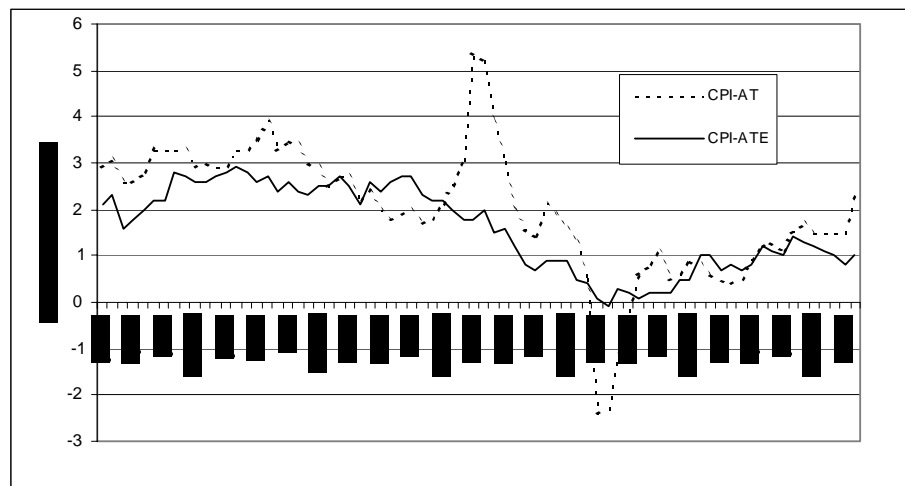
#### 5. The Consumer Price Index adjusted for taxes and energy prices

The CPI-ATE indicator is built upon the main components of CPI-AE and CPI-AT. Basically the indicator uses the same calculation approach as for CPI-AT, but the price material and the weights on energy goods presented in Table 2 are removed first. When the energy products are taken out, the taxes



that are added on to these products will no longer have a direct influence on these calculations. Nevertheless the changes in energy taxes will indirectly influence this indicator. As it is the CPI is used as the adjustment's base, so tax changes on energy products will influence CPI. The direct effect that real tax changes have on CPI growth is equal to the difference between the year-to-year growth in CPI and the year-to-year growth in CPI-AT. Accordingly, the direct effect of price changes on energy goods is defined as the difference between the year-to-year growth in CPI and CPI-AE. Due to heavy taxes on energy goods, the total tax contribution to consumer price growth cannot be derived from the difference between CPI-AE and CPI-ATE. The tax system is regularly adapted causing the list over which taxes are included in the calculations of CPI-AT and CPI-ATE to potentially vary over time. Revised taxes or eventual new taxes will be taken into the calculations on the condition that these can be connected to the price material in CPI. The same principle can be applied if new energy products should come into or fall out of the CPI goods sample.

**Figure 3. CPI-AT and CPI-ATE. January 2000 - February 2006.**



Source: Statistics Norway

## 6. Alternative measures for underlying inflation

There are two common ways of obtaining a measure of underlying inflation. One approach is to exclude certain items from the price index (*exclusion approach*) like in CPI-ATE, usually because they are volatile or subject to administrative price setting. The other is to exclude all extreme individual price movements (*statistical approach*).

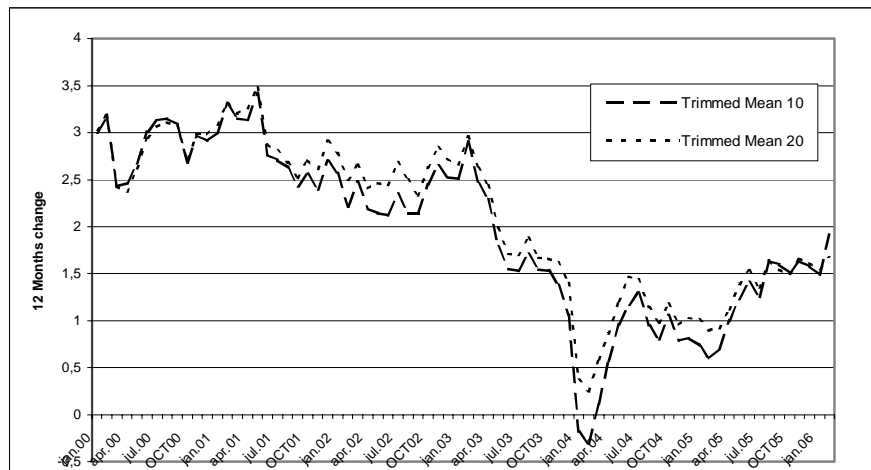
*Statistical measures* are calculated using the whole CPI. The two most common measures are the trimmed mean and weighted median. To calculate the trimmed mean, the CPI components and their weight in CPI are ranked by the size of their price movement in the month. A X per cent trimmed mean is then calculated as the weighted mean of the central (100-X) per cent of monthly price change distribution in that month. Hence, X/2 per cent of the top and X/2 per cent of the bottom distribution are removed. The weighted median is the inflation rate for the item which is in the middle of the total distribution of price changes. The median is also calculated for each month. In that sense, it trims away all but the midpoint of the distribution.

Statistics Norway does not publish statistical measures of underlying inflation on a regular basis but calculate three measures of underlying inflation; the 10 per cent trimmed mean (10TMEAN), 20 per cent trimmed mean (20TMEAN) and the weighted median. As a basis for these statistical adjustments the CPI excluding tax changes (CPI-AT) is used, measured monthly and on an annual basis.



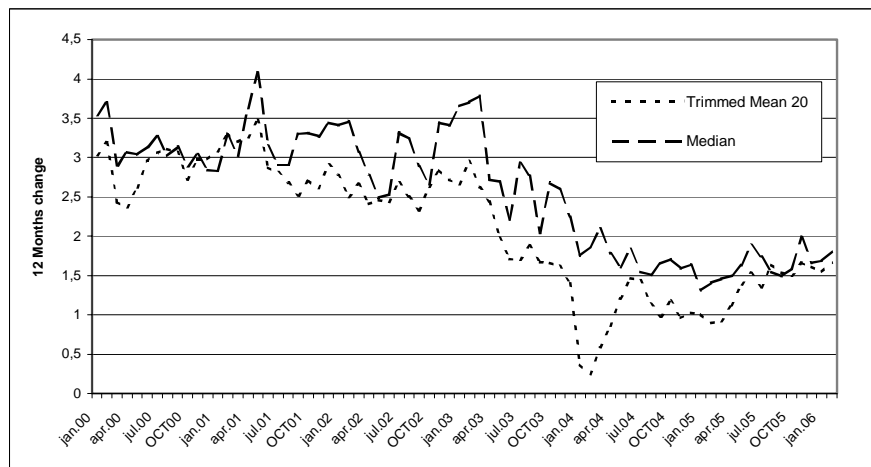
Figure 4 shows that except for the start period, 10TMEAN lies systematically below 20TMEAN, which implies that large negative price signals dominate in the most volatile price indexes and are therefore removed first. The fact that the median (Figure 5) lies above the 20 per cent trimmed means throughout most of the period, emphasizes further that the price distribution is skewed to the left. Hence, there is a stronger downward pressure on prices than upward.

**Figure 4. Trimmed Mean 10 and 20. January 2000 - February 2006**



Source: Statistics Norway

**Figure 5. Trimmed Mean 20 and Median. January 2000 - February 2006**



Source: Statistics Norway

Figure 6 compares CPI-ATE and the 20TMEAN. The two measures seem to capture the same trend in inflation but there are some significant differences. In 2003 it is clear that underlying inflation falls at a much faster rate based on CPI-ATE than 20TMEAN, before the 20TMEAN makes a drop in January 2004. From March 2005 to February 2006 it seem to be a positive trend in the 20TMEAN while CPI-ATE is somewhat unstable around 1 per cent yearly increase. In particular, all the statistical measures suggest that underlying inflation is higher by the beginning of 2006 than CPI-ATE inflation suggests. This further underscores the risk of narrowly focusing on one measure for underlying inflation. For more analysis see Norges Bank Watch (2004).

**Figure 6. Trimmed Mean 20 and CPI-ATE. January 2000 - February 2006**



Source: Statistics Norway



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## **Appendix A**

### **Regulation on Monetary Policy**

Established by Royal Decree of 29 March 2001 pursuant to Section 2, third paragraph, and Section 4, second paragraph, of the Act of 24 May 1985 no. 28 on Norges Bank and the Monetary System

#### **I**

##### **§ 1.**

Monetary policy shall be aimed at stability in the Norwegian krone's national and international value, contributing to stable expectations concerning exchange rate developments. At the same time, monetary policy shall underpin fiscal policy by contributing to stable developments in output and employment. Norges Bank is responsible for the implementation of monetary policy. Norges Bank's implementation of monetary policy shall, in accordance with the first paragraph, be oriented towards low and stable inflation. The operational target of monetary policy shall be annual consumer price inflation of approximately 2.5 per cent over time. In general, the direct effects on consumer prices resulting from changes in interest rates, taxes, excise duties and extraordinary temporary disturbances shall not be taken into account.

##### **§ 2.**

Norges Bank shall regularly publish the assessments that form the basis for the implementation of monetary policy.

##### **§ 3.**

The international value of the Norwegian krone is determined by the exchange rates in the foreign exchange market.

##### **§ 4.**

On behalf of the State, Norges Bank communicates the information concerning the exchange rate system ensuing from its participation in the International Monetary Fund, cf. Section 25, first paragraph, of the Act on Norges Bank and the Monetary System.

#### **II**

This regulation comes into force immediately. Regulation no. 0331 of 6 May 1994 on the exchange rate system for the Norwegian krone is repealed from the same date.



## Appendix B

*Example:*

The petrol tax in December 1999 was NOK 4.25. In the state budget the tax was adjusted for inflation (2.1 per cent) to NOK 4.34 in 2000. The actual annual growth in CPI from 1999 to 2000 was 3.1 per cent. The annual index of the CPI in 1999 was 102.3. The CPI in January 2000 was 104.1. The increase from 1999 to January 2000 was thus 1.76 per cent. In calculating the CPIAT in January, NOK 4.34 is taken out from the observed price (excl. VAT) and NOK 4.32 is added ( $\text{NOK } 4.25 \times 104.1 / 102.3$ ), which is the adjusted tax. The base prices contain a tax rate of NOK 4.25 throughout 2000.

Price-adjusted petrol tax in 2000<sup>1</sup>

Month	Petrol tax in 2000	Adjusted petrol tax in 2000	Percentage change
January	4.25	4.32	1.7
February	4.25	4.35	2.4
March	4.25	4.35	2.4
April	4.25	4.37	2.8
May	4.25	4.37	2.8
June	4.25	4.39	3.3
July	4.25	4.38	3.1
August	4.25	4.37	2.8
September	4.25	4.41	3.8
October	4.25	4.42	4.0
November	4.25	4.44	4.5
December	4.25	4.43	4.2
Average	4.25	4.38	3.1

<sup>1</sup> Any minor deviations are caused by rounding off the figures.