

Einar Bowitz and Stein Inge Hove

Business cycles and fiscal policy: Norway 1973-93

Abstract:

Effects of fiscal policy on macroeconomic variables during 1973-93 are analysed using a disaggregated macroeconomic model of the Norwegian economy. Fiscal policy is measured as deviations from estimated trends for disaggregated policy variables. The policy effects are related to the cyclical situation of the economy. Variations in fiscal policy instruments have reduced output volatility during 1973-93 by approximately 10 per cent, according to our results. On average the behaviour of local government has been procyclical. Partial effects of various fiscal instruments are calculated. During certain episodes fiscal policy appeared procyclical, an effect that is due to the aim of stabilizing the current account.

Keywords: Business cycles, Fiscal policy, Macroeconometric modelling.

JEL classification: C53, E32, E37, E63, E65.

Acknowledgement: This paper is a part of Statistics Norway's project "History of Norwegian business cycles". Comments and discussions from Hilde Bjørnland, Ådne Cappelen, Torbjørn Eika, Per R. Johansen and Asbjørn Rødseth are gratefully acknowledged.

Address: Stein Inge Hove, Statistics Norway, Research Department,
P.O.Box 8131 Dep., N-0033 Oslo, Norway. E-mail: sih@ssb.no

1. Introduction

This study focuses on effects of fiscal policy on business cycles in Norway over a period of 21 years. In many countries, Norway included, fiscal policy has been actively used in order to reduce business cycles. The main question we address is to what extent deviations from trend in fiscal policy variables have helped reduce cyclical swings in macroeconomic variables during 1973-93. Our results suggest a certain, however limited stabilization effect.

Recent macroeconomic research has made the definition of business cycles as deviation from trend more problematic than was previously realized. The possibility of describing GDP and other macroeconomic aggregates as governed by unit root processes implies that the distinction between trend and cycles may vanish. At the same time periods of expansion and contraction of overall economic activity is still an important aspect of modern market economies. The debate over stabilisation policy implies that the concept of business cycles is very much alive. Recognizing the presence of different views on this topic, we conduct our analysis by defining trends in macroeconomic variables and define deviations from these trends as cyclical movements.

The Keynesian revolution triggered a view that it is possible by means of active policy to stabilize the movements in output and other important macroeconomic variables. In Norway this attitude has had strong support among most policy-makers of different political colours since World War II. However, along with the international development, the belief in fine tuning has been reduced also in Norway, though probably to a lesser extent than in many other countries. A study of the full role of stabilization policy and of government in a wider sense, is beyond our scope. We only analyse the effects of certain changes in the use of fiscal policy instruments, in a way that we define below. This means that other areas of stabilization policy, such as monetary, credit and exchange rate policy and income policy are not included in our analysis. The development of the welfare state and the increased relative size of the government sector has implied that the role of automatic stabilizers in the economy has increased, which has had important effects on how the economy responds to external shocks (e.g. oil price shocks and world market demand shocks). On the other hand, increased openness has reduced the multiplier effects of fiscal policy. A lower multiplier effects also results from the fact that the economy in 1993 (contrary to the early 1970s) contained a large resource-based sector (oil and gas) that is little responsive to traditional demand management, but very price-sensitive. Financial deregulation has changed the response of the private sector to fiscal policy changes. The macroeconomic model for the Norwegian economy - we have used - KVARTS of Statistics Norway, treats all these developments as given and are not a part of this analysis¹.

The macroeconomic model is used to simulate effects of deviations from smooth trajectories for fiscal policy variables. The effects are evaluated in light of the cyclical stance of the economy, to see whether policy has been procyclical or countercyclical. Chapter 2 outlines the methodology used, while chapter 3 gives a brief overview of business cycles and fiscal policy in Norway. Chapter 4 gives

¹ Financial deregulation is taken account of by dummy variables in the consumption function, the housing price, housing investment and interest rate equations. After deregulation of financial markets the GDP multiplier was slightly increased, cf. Hove and Eika (1994).

a closer description of the developments in policy instruments while the main results are reported in chapter 5. Chapter 6 concludes.

2. Methodology

Stabilisation policy takes place through a host of policy instruments, each having potentially different effects on the economy. Policy is executed through fiscal policy and monetary policy, as well as exchange rate policy. When trying to answer the question whether the authorities have succeeded in stabilizing output and employment (or any other interesting variable) one should in principle take account of all policy instruments. We have a more modest goal when we ask the question whether the use of a sub-set of policy instruments - which we label fiscal policy - actually has reduced or increased the deviations from trend in certain macroeconomic aggregates during 1973-93. We analyse the effects of the use of these instruments, given the historical development of the policy instruments within the realms of monetary and exchange rate policy. It is easy to find examples where this may not be a good description of historical events. For example, one might argue that if one had pursued a more contractionary policy in the booming years of 1984-85, the devaluation of the krone by 10 per cent in the wake of the oil price fall in 1986 could have been smaller or perhaps not necessary. Still, it is of interest to analyse the partial effects of certain policy instruments on major macroeconomic variables.

Indicators of fiscal stance have been increasingly popular, and are now being published both by national authorities (mostly finance ministries) and by OECD. Indicators of fiscal stance measure budget balances corrected for changes in expenditures and revenues that can be attributed to the fact that the economy deviates from a neutral cyclical situation. As such corrections are very difficult to make, in Norway the Ministry of Finance only publishes the annual changes - not the level - of this budget indicator. This underlines the short term nature of such indicators. As is recognised, budget indicators measure the initial demand effect of the budget, but does not account for the fact that 1 krone of increased government expenditure (or 1 krone reduced revenues) have very different effects on the economy depending on what fiscal instruments are actually being used. Such compositional effects can only be studied in a disaggregated economic analysis. The KVARTS model is suitable in this respect, since it specifies a disaggregated set of policy instruments.

Franz (1990) has undertaken an analysis of fiscal policy in Germany using estimated relationships instead of a macroeconometric model. As he used the official budget indicator of fiscal stance as the only indicator of fiscal policy, his analysis does not account for effects of using different policy instruments.

A model-based analysis slightly different from the present one, involving shocks from fiscal policy is Fair (1988). He utilized the Fair model of the US to analyse effects of stochastic shocks in all econometric equations and in estimated processes for exogenous variable. He used stochastic simulations to decompose the variance in GDP on these exogenous shocks, without directly trying to answer whether policy actually made GDP more or less volatile. It is still of interest to contrast his procedure for estimating processes for exogenous variables with our trending procedure. Fair estimated univariate

processes for the policy variables for the whole sample and undertook stochastic simulations of shocks to these processes. As he used the whole sample in estimating the processes, the secular parts of policy processes (trends) were influenced by the future development in this analysis as well. In this way his procedure resembles the one used in our analysis. The main difference is that we use deterministic simulations and use the HP filter to generate trends.

Model-based analyses may to a larger extent take account of the fact that different instruments may affect the economy differently, though the initial budget effects may be identical. In such analyses the common procedure is to simulate the effects of policy instruments' deviations from what has been defined as a "neutral" policy, cf. e.g. . Artis et al. (1984) and Bowitz et al. (1993) for applications on UK and Norway. In these analyses neutral policy for a variable was defined e.g. as a certain growth rate for government expenditures, and this growth rate was set equal to average growth over a period before the start of the analysis. A neutral policy usually was defined as unchanged aggregate tax rates relative to the starting year. No attempt was made to see whether this development was sustainable in the long run. This is justified by the short run nature of these analyses (up to 5 years). It is also possible to measure policy effects as deviations from explicit policy rules, as in e.g. Wallis and Whitley (1992), a procedure we have not followed in our study.

In analysing effects of policy over a relatively short period, it is not unreasonable to define neutral policy by constant growth rates. However, when the period of analysis becomes longer, such simplistic assumptions become less reasonable. During our period of study, government consumption has risen faster than GDP, and the share of transfers to GDP has risen significantly. In addition there seems to have been changes in the underlying growth rates for many policy variables during the period 1973-1993. This has motivated us to define trends in the instruments and interpret deviations from these trends as the effects of fiscal policy. However, as will be seen later, neither this approach is without problems.

There are several factors underlying the observed long term trajectories in policy instruments. First, large movements in instruments in short run stabilisation policy may prove to have turned into what appear as long-term trends, if the instruments do not return to their starting values or original trends after e.g. a countercyclical fiscal expansion. It has been argued that a factor behind the increasing role of government consumption has been continuous increases in government consumption as part of Keynesian countercyclical policy associated with an inability to reduce government consumption after the end of a recession, and that the net result has been an (unintended) increase in the government consumption/GDP ratio. Second, even an aim of a constant government consumption/GDP ratio may result in a slowdown in the underlying growth of government consumption if GDP growth declines. And a slowdown in GDP growth was actually what happened in OECD and also in Norway in (parts of) the 1980s. Third, long run structural/political/- economic factors may have caused the increased government consumption/GDP ratio, such as political attitudes in favour of increased government control over the economy, high income elasticities for government produced goods combined with a choice that certain goods and services (health services etc.) mainly should be produced by the government. Fourth, changing political and ideological attitudes have obviously influenced the

development of government consumption and taxes. The conservative and centre-right governments of the early 1980s in Norway had as a specific goal to reduce the government's role. And the Social democratic governments of the late 1980s and early 1990s certainly were less government-friendly than were the governments from the same party in the 1970s. Fifth, the long run trajectories for the development of fiscal policy variables in Norway have been heavily influenced by the prospects for and later actual realizations of large petroleum revenues. The resource discoveries in the early 1970s followed by the oil price rise of OPEC 1, raised the permanent income of Norway. These revenues were channelled into the rest of the economy through government budgets (via oil taxes), and surely contributed to increased expenditures in some areas, and reduced taxes for the non-oil sectors in some areas. It is however not our purpose here to analyse what would Norway looked like without the oil sector, neither what would have been the effects of other ways of channelling the oil revenues into the economy.

To sum up: There have been long run observed trends in all policy instruments, and for many of these the trends appear to change slowly. These developments have been governed by a multitude of factors summarized above. The actual movements in policy instruments have however not been smooth. In some periods increases have been large and in others the changes in the instruments have been small. We want to analyse the effects of the deviations from a smooth development of the instruments. The results will depend on how the smooth development is defined. Although in most cases we utilise a formal procedure for detrending, the credibility of our analysis depends on whether the trend is judged plausible or not by the reader. We report the actual development and the smooth trajectory for all instruments.

Interpreting business cycles as fluctuations in the overall level of economic activity, different parts of the economy may have different fluctuations. In business cycle analysis, GDP is often used as an aggregate indicator for the business cycle. In Norway, however, there are reasons to deviate from this choice. Our choice has been to use Mainland GDP (GDP exclusive petroleum extraction and ocean transport) as the reference indicator. The exclusion of the petroleum sector is done mainly because the rapid growth of this sector has been governed by other forces than the factors determining the development in the rest of the economy. Value added in the sector mainly consists of the extraction of crude oil and natural gas and is in the short run determined by the size of the sector (number of platforms etc.) and of how much oil and gas that eventually emerge in the developed oil and gas fields. Oil prices and discoveries of resources have been the main factors behind the growth of the petroleum sector. The development of that sector should thus to a large extent be seen as external to the development in the rest of the economy. The exclusion of ocean transport from our reference indicator is done because the activity in this sector takes place outside Norway and is mainly driven by factors determining trade between third countries.

One might have gone even further by analysing only the development of the private sector of the mainland economy. If one sees the private sector as the source of volatility and want to study to what extent fiscal policy has succeeded in stabilising output in that part of the economy, that would have been warranted. However, if we can not exclude the possibility that government is not particularly

directed at stabilizing the private sector output, but rather overall activity, it is relevant to include the government sector in the reference indicator.

As indicated above, the discrimination between trend and cycle is not a resolved issue, both regarding whether it actually is justified to define a trend and cycle at all, and if this is the case, what part of the series' development is trend and what part is cycle. According to Bjørnland (1995) most macroeconomic time series in Norway may be described as unit root processes, which indicates that it is not meaningful to split the development in the series into trend and cycle. However, the last word in this matter is hardly said, and we proceed under the assumption that the distinction is meaningful. Numerous procedures for de-trending are possible (an overview is given in Bjørnland (1995)). We have chosen to define the trend as the outcome of the Hodrick-Prescott (HP) filter. In a few cases this procedure yields a smooth policy that we found unreasonable, where we have defined smooth policy in different ways.

The data used are seasonally adjusted quarterly national accounts data². In graphs, a centred weighted average over 4 quarters of the seasonally adjusted series is used in order to facilitate visual inspection of the results (see appendix 1 for details). The macroeconometric model KVARTS is estimated and simulated on seasonally unadjusted data. Consequently the simulation results are also seasonally adjusted and smoothed.

It is important to recognize that the calculations of the trend take account of the whole development of the series. Thus, the trend in 1973 for e.g. government consumption takes account on the fact that the level was relatively high in the 1980s, which may have been a consequence of the oil revenues accruing in this period. The trends are both forward- and backward-looking. This might imply too much rationality for policy-makers. It implies full knowledge of future oil revenues and the future choice of policy mix to inject these revenues into the economy. However, there has been a significant element of forward-looking behaviour in policy-making, both with regard to future domestic and foreign economic growth and with regard to oil revenues. Already in 1974, a parliamentary report drew a picture of the rest of the decade which turned out to contain a fairly accurate estimate of government petroleum revenues 5-7 years ahead (Ministry of Finance (1974)).

It turned out that the definition of trends using the HP filter was sensitive to the "window" utilized in the analysis. By only utilizing data from 1973 to 1993, data values in the first and last years seemed to exert a large influence of the resulting trends from the filter. In order to reduce this dependency, we have utilized historical data back to 1967. At the end of the period of analysis, it is very difficult to see from the data whether the economy will recover even more after 1993, or not. This has potentially large consequences for the estimated depth of the downturn in the early 1990s. The procedure here has consisted of using historical data for 1994 and 1995. In addition, we think that forecasts for the future also contain information that is relevant to include in the trends. We thus have linked

² In 1995, a main revision of the Norwegian national accounts was undertaken. This analysis is made on the pre-revision figures, since sufficiently long historical time series have not been available. As the revisions mainly affected levels rather than changes, this is likely to have only small effects on the description of Norwegian business cycles.

the historical series with a model simulation to 2010 before the trends are estimated³. This will further reduce the problem of end-point dependency.

A desirable property of the smooth policy is that it be sustainable. The definition of smooth policy just as a smoothed trajectory through the historical development of the policy variables makes the fulfilment of this property likely. Still, large budget deficits in the latest years of the period of analysis, might render fiscal policy unsustainable. The linking of the historical data with a model-based simulation that ensures fiscal balance until 2010, further ensures that fiscal policy is sustainable both under actual and under the smooth policy.

Our approach has consisted of the following elements. The starting point of the analysis is a full dynamic historical model simulation using the KVARTS model, which exactly reproduces the historical development according to quarterly national accounts data for 1973-1993. This is accomplished by letting all exogenous variables (policy instruments and other exogenous variables) attain their historical values. In addition, all econometric error terms are set equal to their historical values⁴. The next step was to construct a simulation with a smooth trajectory for the policy instruments. The simulated policy effects are measured as the difference between the historical simulation and the smooth policy simulation. Dynamic simulation is used since this allows the effects of the shocks to evolve over time.

The results are measured as Mean Absolute Deviation (MAD) and Mean Absolute Percentage Deviation (MAPD), where the deviation is defined as the difference between the historical value/simulated value and the trend. MAD/MAPD are reported for the sub-periods 1973-1982 and 1983-1993 and the whole period 1973-1993. If the actual policy was countercyclical, MAD/MAPD is larger in the simulation with smooth policy than in the simulation with the historical trajectories for policy variables, and vice versa in the case of a procyclical policy. As we look upon several policy instruments, we can assess which instruments contributed most to stabilizing GDP and which contributed least (or might even strengthen the cycles in GDP). In graphs, the deviations from trend (levels and per cent) are reported.

The procedure emphasises level effects in the definition of deviations from smooth policy. This may imply that even if e.g. government consumption grows with a high rate in a given year, it may still be below trend if the government consumption growth rates in the previous years were particularly low. In such a situation, many observers would say that policies were expansionary. According to a strict interpretation of our definition, there would be a negative shock to government consumption, and the model would surely predict a negative effect on GDP (at least in the short run). As we are concentrating on level effects on GDP, this distinction between interpretations should be borne in mind when looking at the results. In the description of the historical business cycles, we will use the term

³ The simulation was made by using Statistics Norway's macroeconomic model MODAG. The main properties of the simulation are described in appendix 2 in Bowitz et al. (1994).

⁴ The model is able to reproduce the main development of the historical data in a full dynamic simulation from 1973Q1 to 1993Q4 when all econometric error terms are set to zero, cf. Hove and Eika (1994). However, in this policy analysis, we prefer to work with a model simulation which exactly reproduces the historical data.

"contractionary" and "expansionary" with a view to growth rates in government demand and changes in tax rates, thus emphasizing change effects.

The limitations of the study must be acknowledged. First, all results depend on the premise that our model is a good replication of the economy. One necessary condition is that the model actually is able to reproduce the main developments of the macroeconomic variables in question. This is shown in Hove and Eika (1994). But still, the results hinge upon an unproved (which is impossible) premise that the model is "correct". The Lucas critique deals with autonomy regarding changes in policy regime. One important regime change, the liberalisation of domestic credit markets, has been accounted in the econometric equations in question. In the consumption function and housing investment equations current income plays a lesser role after deregulation than before, at the expense of wealth effects. And we surely want to simulate the economic effects of a change in policy regime.

Second, we do not address the feasibility of the assumed alternative development. Technical/-economic feasibility regards if it be possible in the government administrative system to smooth employment decisions or investment decisions to obtain our assumed smooth trajectories. Problems along these lines can be attributed to increasing or decreasing the capacity of the education system or the health system. Political obstacles regarding the possibilities of obtaining parliamentary support for such a policy is also disregarded. We just ask what would have been the effects of a smooth policy, assumed it would have been feasible.

3. Norwegian business cycles and fiscal policy 1973-1993

Our chosen reference indicator for the activity level is GDP mainland. Figure 1 and 2 show the results for this variable. Figure 3 below shows the unemployment rate, the current account and general government balance. Unemployment appears not to be characterised by a smooth trend at all, rather a break as unemployment rose in the late 1980s. The current account and government balance has been more volatile, with the former displaying the largest volatility. Below we will limit ourselves to a general description of the business cycles utilizing the reference indicator, GDP mainland. A more detailed description of the development of economic policy and macroeconomic fluctuations in Norway is given in e.g. Fagerberg et al. (1992).

The choice of the smoothness parameter λ in the HP filter is crucial in determining the trend. Figure 1 shows GDP mainland and trends using three different values of λ ; the internationally common value of $\lambda = 1600$, an intermediate value of 16000 and a high value of 100000. The per cent deviations from these trends are shown in figure 2. A value of 100000 generates a trend that changes relatively little over time, whereas a value of 1600 generates a trend that to a considerable extent follows movements up and down in activity in the 1980s and 1990s.

Figure 1. GDP mainland, actual and trend
Billion 1991-NOK

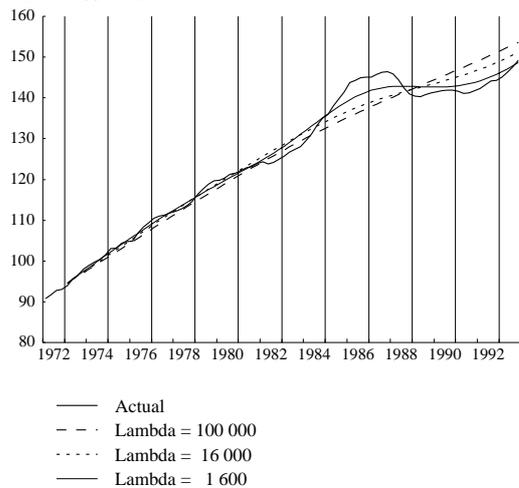
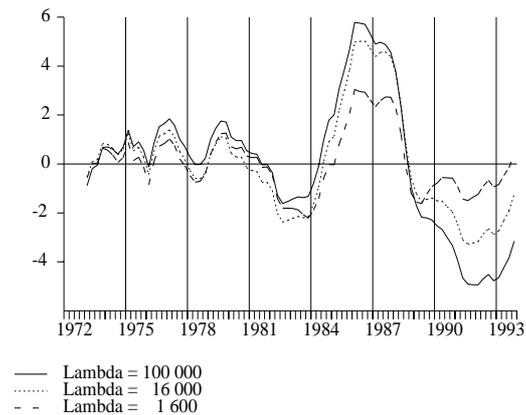


Figure 2. GDP mainland. Lambda = 100 000, 16 000 and 1 600
Deviation from trend, expressed in percentages



In Norway, the fluctuations in GDP mainland were small and unemployment was very low by international standards in the 1970s, while the period was characterized by strong economic growth. Slower growth occurred in the beginning of the 1980s partly as a consequence of the international recession following OPEC II. A period of unprecedented growth then followed from 1984 to 1986, after the deregulation of domestic financial markets. The upturn was brought to a halt by the falling oil prices in 1985/86, which threatened the external balance, and the economy went into a recession that had not ended until the end of our period of analysis (though GDP mainland was back on trend with a λ -value of 1600). The determination of the trend differs significantly between the three λ values, although the peaks and troughs occur approximately at the same time. However, the sizes of the up- and downturns still differ substantially, especially in the 1980s and 1990s. Our view is that a value of 1600 implies that too much of the short run movements in the series are reflected in the trend and thus underestimate the deviations from trend. This value is thus easily dismissed for our purpose. The differences between $\lambda = 16000$ and $\lambda = 100\ 000$ are smaller, though significant after 1990. Our choice is to use the value of 100 000, which implies a relatively rigid trend. Although this choice can be discussed, the choice should have little bearing on the results whether policy has been procyclical or countercyclical, since the qualitative picture is largely the same for these two values. Our choice of 100 000 is partly motivated by a view that the recession in 1989-93 was deeper than the one in 1982-83 using also other indicators such as unemployment. The results from using a λ -value of 100 000 is most in accordance with this view.

According to all definitions of the trend, GDP mainland was above trend most of the 1970s. The 1970s thus appear more or less as a period of continuous expansion. However, as unemployment on average was very low in Norway this period, it is not unreasonable to characterize the whole period more or less as a period with GDP mainland above trend.

Still, we can identify periods of change in the differences between trend and cycle in the 1970s, according to all three trend definitions. Although the size of the difference varies according to the

definitions of trend, the general picture regarding the movements are very similar. The differences in GDP from trend were small, in the magnitude 1-2 per cent in the 1970s. Upturns appeared in early 1975, in 1976-77 and in 1979. In the 1980s, GDP mainland became more volatile. Average growth was lower in the 1980s than in the 1970s. The Norwegian economy was below trend in the first half of the 1980s followed by an unprecedented upturn in the mid-1980s after the deregulation of financial markets. A clear picture of downturn after 1987 and a subsequent recovery is evident according to all definitions of trend.

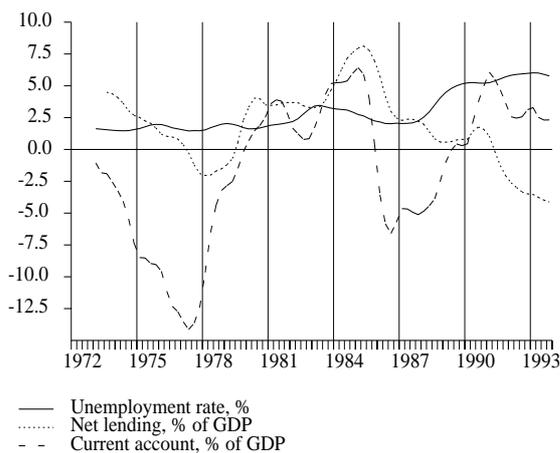
The overall aim of policy in Norway was traditionally to keep capacity utilisation high and unemployment low by means of a combination of a fiscal policy which implied surpluses on the government balance, income policy - and before the liberalisation of credit markets in the early 1980s - rationing of cheap credit. In Norway, more caution has often been attached to the current account than to the government balance. The increasing petroleum revenues have been channelled into the economy via oil taxes and direct government participation in the petroleum sector. These revenues have constituted an important contribution to Norway's disposable income and the general government financial balance.

With newly discovered petroleum resources, OPEC I resulted in rising expectations of future revenues in Norway. This caused booms both in private and public spending as well as an investment boom. In the OECD countries, however, OPEC I caused a severe slowdown of economic growth in 1974 and 1975. The Norwegian government attempted at pursuing a "bridge" policy over what was at first believed to be a temporary international downturn. Unprecedented high growth rates in government consumption in 1975-76 were a part of this policy. Increases in industrial assistance for export-oriented manufacturing industry was also prevalent. Fuelled by income expectations, the domestic economy went into a boom which resulted in a large loss of cost-competitiveness and worsening of the current account. When it became clear that the international economy was not recovering, a policy of halting the growth in domestic demand was imposed by late 1977. A more restrictive credit policy, a currency devaluation and a wage and price freeze were the instruments used. Fiscal policy also played a part of this austerity programme, but not in the initial phase. Growth rates for government consumption and investment seen together was reduced from nearly 6 per cent in 1978 to around 1.5 per cent in 1979.

Government net lending was reduced partly as a consequence of the expansionary bridging policy in 1975-1978. This, and more important, the increased current account deficit in this period were the main motivations for abandoning this policy in late 1977. The current account deficit, which increased from 2 per cent of GDP in 1973 to 15.5 per cent in 1977 was severely affected by imported deliveries of investment goods for building the capacity in the petroleum sector.

As policy was eased in 1980, growth in government demand rose again, fuelled by another increase in expectations of future petroleum revenues in Norway caused by OPEC II. However, the oil price rise produced another cyclical downturn for Norway's trading partners. In 1981-1982 the international recession fed into the Norwegian economy. Fiscal policy at the time did not seem to be actively used to counteract this impulse, although reductions in household taxes were implemented as a part of the newly elected conservative (later: centre-right) government programme; at the same time growth in

Figure 3. Macroeconomic variables
Unemployment rate, Net lending and Current account



government consumption was reduced. In this period unemployment rose and GDP fell below trend. The largest cyclical upturn since World War II then followed during 1984-86, following the liberalisation of domestic financial markets. By 1986, GDP mainland had risen to nearly 6 per cent above trend. Unemployment fell sharply and stayed low even longer due to adjustment lags and the shortening of the normal working week from 1987 (negotiated at the peak of the business cycle early 1986). Increases in petroleum revenues were the main factors behind the large surpluses on the government balance and the current account in the first part of the 1980s. Exclusive these revenues, both these balances

were negative.

The collapse of international oil prices in 1985/86 hit the Norwegian economy hard, and the current account was early in 1986 forecasted to go into deficit, and uncertainty about the authorities' ability to maintain the fixed exchange rate was mounting. The government surplus was also reduced, though still positive. With a still booming domestic economy, a policy contraction was necessary. The coalition parties could not agree on the policy change and was succeeded by a new labour government from April 1986, which implemented policy changes. The Norwegian krone was once again devalued (May) and fiscal policy was tightened. This policy and the ending of the expansionary effects from domestic credit deregulation, sent the economy into a slump with rapidly rising unemployment in 1988 and 1989⁵. As the increases in unemployment became clear, a traditional Keynesian expansionary policy of unprecedented size (according to the Ministry of Finance's budget indicator) was undertaken, weakening the government's finances further. Despite this, GDP mainland was below trend both in 1991 and 1992, while approaching trend somewhat in 1993. Unemployment effects seemed to appear more slowly than the effects on output, and unemployment first started to decline after 1993.

4. Definitions of policy shocks

Fiscal policy is executed through a detailed set individual decisions of parts of the government budgets. A model-based analysis can only account for aggregate effects. However, our model is more disaggregated than many other macroeconomic models, and we utilize the disaggregated model structure in our analysis. Thus, we have as a general rule defined smooth policy and constructed historical trends at the most detailed level possible.

⁵ Other factors such as demand impulses from the petroleum sector were also significant, cf. Cappelen and Eika (1996).

In Norway, government activity is decided at two levels - the central government level and the local government level (counties and municipalities). Important parts of government policy is implemented by the local government, such as most of health care and education as well as social care. Local government consumption was some 60 per cent of general government consumption in 1993.

The central government controls the activity level in local government by controlling most of their revenues. Local right to tax is regulated by a ceiling on local tax rates, and all municipalities apply the highest local government tax rate permitted. Local government tax rates are thus exogenous to the local government. The basic instrument for controlling the activity level in local government is transfers from the central government to local government. In 1993, net transfers constituted 40 per cent of the local government's revenues. The consequence of this system is that local government revenues has been to a large extent determined at the state level. The local government is obliged by the law to have balanced budgets, except for financing of real investment. Still, there seems to be some room for manoeuvre at the local government level⁶. One important aspect of this, has been the tendency for local governments gradually to increase fees for public services. Earlier, these services were often provided free or at a price well below average costs. Especially in the 1980's fees for these services were discovered to constitute an independent source of financing for the local government sector in Norway. Fees were increased significantly and services previously supplied free of charge were subject to fees. In our study, the increase in fee rates is analysed together with direct household taxes. The motivation behind this is that private households in practice had very small possibilities for substituting away from increased fees, so that the fees worked very much like a local government tax.

We now describe the details in the developments in the policy variables. We distinguish 10 sub-groups of fiscal policy variables. The policy variables are:

1. Central government employment
2. Central government purchases for consumption purposes
3. Central government real investment
4. Local government employment
5. Local government purchases for consumption purposes
6. Local government gross real investment
7. Household tax rates (incl. local government fee rates)
8. Payroll tax rates and VAT rates
9. Taxes and subsidies levied on products and industries
10. Transfers to households

As part of the description of the data, we report cross-correlations between the deviations from trend in the various policy variables and the deviation from trend in private GDP mainland. These are shown in table 1.

⁶ For an analysis of local government behaviour in Norway, see Langørgen (1994).

Table 1. Contemporaneous correlations of per cent deviations from trend for GDP mainland and various policy instruments. $\lambda = 100000$

Variable	1973-82	1983-93	1973-93
Purchases, centr. gov. civilian	0.11	-0.43	-0.34
Purchases, military	-0.03	0.10	0.05
Purchases, local government	0.07	0.03	0.04
Employment, centr. gov. civilian	-0.11	-0.17	-0.11
Employment, military	-0.19	-0.37	-0.35
Employment, local government	-0.02	0.25	0.17
Average payroll tax rate	-0.15	-0.52	-0.28
Average personal tax rate (incl. fees)	0.05	0.21	0.18
Real investment, central gov.	0.20	-0.33	-0.25
Real investment, local gov.	0.22	0.07	0.13

From the simple correlations in table 1 civilian central government employment appears countercyclical, while the opposite is the case for local government employment. Differences in correlations between central and local government was also seen for real investment. The strongest partial correlations between per cent deviations from trend was present for personal taxes, which appeared strongly countercyclical, especially in the second sub-period. Local government real investment was procyclical while there was a mixed picture was present for central government real investment. The correlation with the cycle will have varied over time, and this can be seen from visual inspection of the series. More details are given below.

4.1. Government consumption (employment and purchases)

Government consumption consists of central and local government employment, purchases of goods and services and depreciation. Depreciation depends on previous real investment. The composition of government consumption regarding employment and direct purchases has changed somewhat throughout the period. In 1973 wage costs in the government sectors constituted 68 per cent of government consumption, while this share had increased to 72 per cent in 1993. This is due to different trends in employment in man-hours and purchases in constant prices. As we construct separate trends for each variable, the changing long run composition of government consumption is not defined as a part of policy. However, short run composition effects may still be present. We distinguish three kinds of government employment: Military (including conscripts), central government civilian employment and local government employment. For consumption purchases the same distinction is present⁷. Trends and smooth trajectories for government employment are shown in figure 4. Figures 5 and 6 show per cent deviations from trend. More details are found in appendix 2.

⁷ A minor exception is that large imported military purchases (submarines, airplanes etc.) are separated out from other military purchases.

Figure 4. Public employment
Man-hours

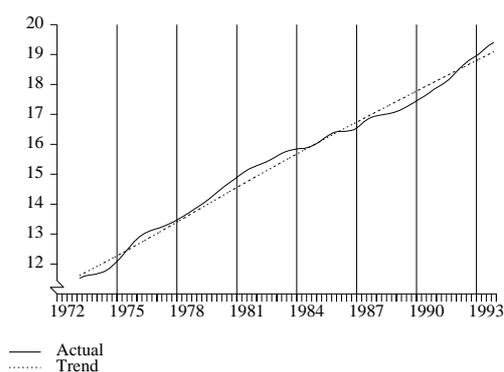


Figure 5. Public employment, man-hours
Deviations from trend, expressed in percentages

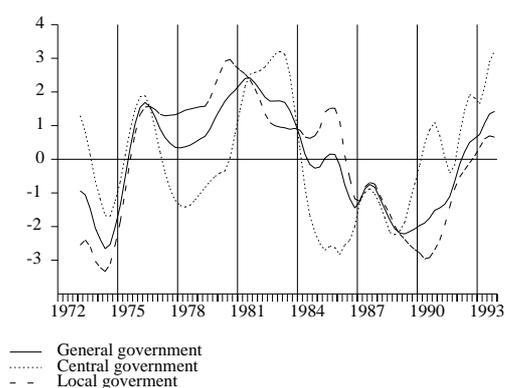
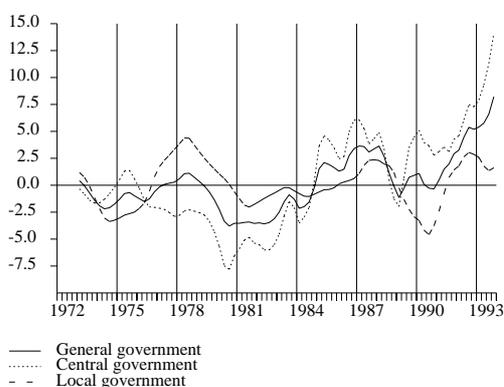


Figure 6. General, central and local government purchases
Deviations from trend, expressed in percentages



Starting below trend in 1973, general government employment was above trend the whole period from 1976 to 1984. The maximum positive deviation from trend was in 1981, and from then on government employment started to approach the trend from above, under the less public sector-friendly conservative government. Further restraints in government employment changes took place in the booming years in the mid 1980s and afterwards. We also see that increases in government employment played a part in the fiscal expansion from 1989 on, where government employment

approaches the trend from below and stays above trend in 1992 and 1993. There are some differences regarding local and central government employment. From table 1 we see that central government employment is countercyclical in both sub-periods. Local government was countercyclical during 1973-82, but seemed procyclical in the period 1983-93. Central government employment was significantly above trend in the recession years 1981-83 and after 1990. This seems like a strong use of central government employment in recessions. Parts of the specific temporary labour market programmes enacted in these periods were included in the central government employment variables. However, parts of these programs were registered as purchases as well, since parts of the training programs were run by private firms. Consequently we can not analyse directly the effects of labour market programmes.

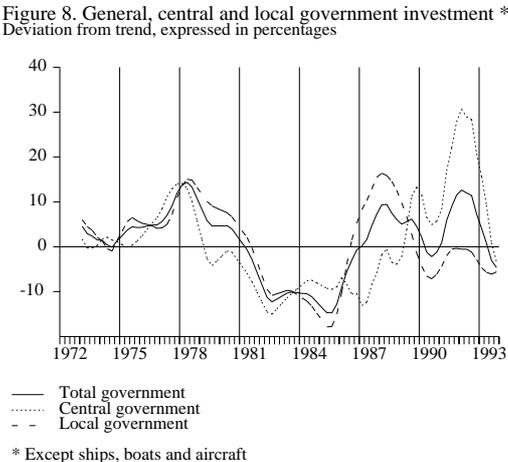
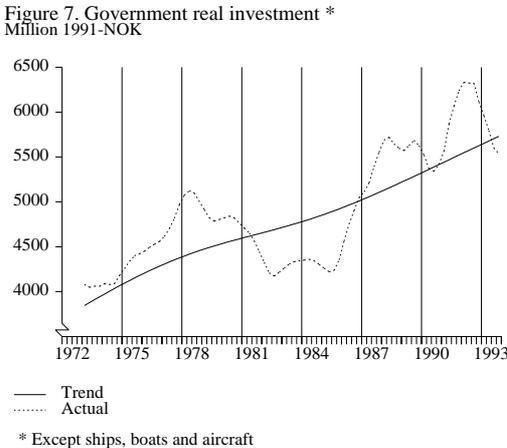
Contrary to central government employment, local government employment remained above trend in the booming years 1984 and 1985. Also, it seems that local government employment continued to decline relative to trend in the recession years of 1988 and 1989, when unemployment started to rise, leading to the procyclical fluctuations in this variable.

The pattern for general government consumption purchases deviates somewhat from the pattern for general government employment. It seems that it is easier to change consumption purchases than government employment; the deviations from trend are much larger for purchases than for employment. While general government employment was above trend from 1976 to 1984, general government consumption purchases were below trend in the period 1979-1984, and above trend in the booming years 1985-87. This pattern is mainly due to the variations in central government purchases relative to trend, whereas the deviations from trend in local government purchases were smaller.

According to table 1, local purchases and military purchases were acyclical or slightly procyclical, while central government purchases were countercyclical in the second sub-period. The sharp increase in central government purchases from 1989, is probably the single most important factor behind this. It is also of interest to note that both local government purchases and employment continued to decline relative to trend in 1989 and 1990, when the increase in unemployment was very apparent. The fiscal expansion of these years took place in central government employment and purchases.

4.2. Government investment

General government gross real investment has historically shown more variability than employment and consumption purchases, but is of a smaller magnitude than government consumption. Government investment declined as a share of GDP mainland from 5.2 per cent in 1973 to 4.4 per cent in 1992. The trend and actual development in gross public investment are shown in figure 7 while deviations from trend are displayed in figure 8.



General government investment were particularly high in 1978, 1988/89 and 1991/92, whereas particularly low from 1982 to 1985. In 1978, the peak was apparent both for central and local government investment, and of equal relative magnitude. Declining government real investment in the years 1979-1982 took place both at the local and central level, and investment both at the central and local level remained low until 1985. The rapid increase in general government investment from 1985 to 1988, was largely due to the development in the local government while central government continued below trend. This may seem to be another example of procyclicality of local government demand, since this

is the period of the largest boom in post-war Norway. From 1988 central government investment started to increase and was far above trend in 1991 and 1992, leading to an interpretation of counter-cyclical movements in this variable. Local government investment had an entirely different path: After the peak in 1988, it quickly returned to trend in 1990 and remained slightly below trend thereafter, again showing a procyclical pattern.

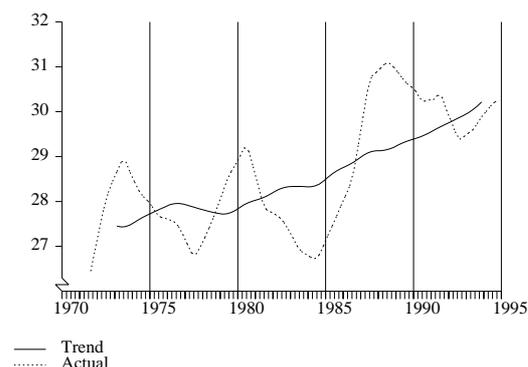
4.3. Household taxes

Direct *taxes* as a fraction of household taxable income have shown large variations during 1973-1993. For wage-earners, taxes have tended to increase significantly, whereas the opposite seems to be the case for pensioners. For self-employed, no long run tendency seems present, cf. appendix 3. Local government fees have increased significantly over the period, and if these fees are accounted for as equivalent to direct taxes (cf. below), the average household tax rate including local government fees in figure 9 emerges.

The model of course does not include the full details of the tax system. Our analysis is based on analysing effects on deviations from trends in observed average tax rates for the three socio-economic groups. We have not accounted for automatic increases in average tax rates in years when income growth became stronger than expected and moved taxpayers into higher income tax brackets than was expected when tax rules were decided on. In reality, different taxes are to some extent calculated with different tax bases, which we only to a limited degree can account for. From year to year, relatively minor changes in the taxation of firms have been done, in addition to the major tax reform in 1992. In our analysis, we have only considered effects of changes in personal taxation, which by far have been the most important.

There have been relatively long periods of declines and rises in the average tax rate. The summary correlation coefficients in table 1 indicate a significant countercyclical use of personal taxes in both sub-periods. From 1973 to 1977, average household taxes plus local government fees as a share of taxable income, was reduced from some above 29 per cent to 27 per cent. The austerity programme after the breakdown of the countercyclical "bridging policy" 1975-1977, implied a sharp tax increase, which halted in 1980. The newly elected conservative government residing from late 1981, had a change from direct to indirect taxation as an important policy goal. This policy involved reductions in direct taxes. However, a significant direct tax reduction was enacted already by the labour government in the 1981 budget. Tax reductions were implemented all years until 1984, although of a magnitude less than the first reduction in 1981. The tax reductions were accompanied by lower growth rates than in earlier years in government consumption, cf. above. As the boom in the domestic economy became apparent from 1985, small tax increases were enacted, but taxes were not much increased in the early stages of this cyclical upturn. The increasing average tax rates were also a result of higher-than expected growth in private incomes. It was only in 1986, after the world market oil prices had fallen, that domestic household taxes were really increased. Personal tax rates were reduced again when rising unemployment became evident, in 1989, and tax reductions were implemented until 1992. From 1992, a tax reform was legislated, intending to increase neutrality in taxation of different sources of income (capital income, labour income, operating surplus etc.). In addition to changing the relative tax rates of various assets and income types, the tax reform in 1992 also implied a reduction of average personal taxes, which is reflected in figure 9.

Figure 9. Household tax rate incl. local government fees
Per cent



Local government fees in per cent of household taxable income rose from 1.5 per cent in 1973 to 4.5 per cent in 1993. As most of the services delivered for the fees were of a kind that was not easily substitutable for households, the increase in local government fees had more or less the same effect on household real disposable income as an increase in income taxes. However, the immediate price effects were different since higher fees increased the consumer price index whereas higher income taxes only affect consumer prices by shifting of taxes onto wages that will later on result

in higher prices, according to the model. The increases in fees took place over the whole period 1973-93, but were particularly strong in the years 1988 to 1991, a period of austere fiscal policy in Norway. However, most of the increases in fees were captured by the trend and it was only in the years 1988-91 where there were significant differences between actual and trend fee rate. In 1991 the difference amounted to nearly 0.5 per cent-points of household taxable income. An interpretation of the development in 1988-91 is that the local government sector reacted to reduced transfers from the central government by an extraordinary increase of fees, thereby reducing the negative effects on their revenues. This took place at the expense of the private sector, who experienced an erosion of their purchasing power as a consequence of increased fees. Detailed figures for tax rates are shown in appendix 3.

4.4. Payroll taxes and value added tax

The introduction of the Norwegian national insurance system in 1967 was followed by a sharp increase in payroll tax rates until 1972. Until 1993, the only changes had been a reduction of the payroll tax rate in 1975 as a part of the government's participation in the nation-wide income settlements at that time, and some reductions of the payroll tax rate in certain regions as a part of regional policy. This reduced the average payroll tax rate somewhat. In 1993, the average payroll tax rate was reduced simultaneously with a general VAT increase as a part of what has been called an "internal devaluation". The intention was probably to reduce labour costs for the firms, while hoping that increased profitability and increased consumer prices would not increase wage claims proportionately. We have defined the trend for the payroll tax rate by the HP filter from 1973 to 1992. The trend value for 1993 is defined as the same as the 1992 value. This is because the actual change in 1993 was very large compared to all previous changes. Consequently, the whole reduction in payroll taxes in 1993 is defined as a policy shock. The VAT rate was unchanged at 20 per cent from 1973 to 1992 and increased to 22 per cent from then on. For the same reason as for payroll tax, we define smooth policy as 20 per cent VAT for the whole period. The calculated net effect of the combined policy of deviation from trend in VAT and payroll taxes are shown in appendix 4. The tax increase was positive during 1973-76 and slightly negative during 1982-1986, where some increases in the average payroll tax were enacted. The "internal devaluation" was on average contractionary by about 1 billion 1991-kroner in 1993.

4.5. Other indirect taxes and subsidies

Indirect taxes have played a significant role in financing the government sector in Norway. Various excise taxes (cars, alcohol, tobacco, fossil fuels, electricity and some other items) constituted 8 per cent of mainland GDP in 1993. In 1973 these figures were approximately the same. At the same time *subsidies* have been a relative large component on the expenditure side of the budget. Subsidies constituted 5.8 per cent of mainland GDP in 1973, increasing to 8.6 per cent in 1976. By 1993 subsidies had declined relatively to 7.6 per cent of mainland GDP. Industrial assistance to certain sectors has been and still is prevalent. Agriculture and food-processing manufacturing industry have been large recipients of such budgetary support. These subsidies have been a cornerstone in regional policy in Norway. From the mid 1970's, industrial assistance especially to ship-building (an activity that in Norway to a large extent has been transformed to oil platform-building) increased significantly. The support levels have only marginally been reduced during the 1980s. The state banks have provided loans to housing and education, at below market rates. As the interest rate differential increased during the 1980s, this resulted in increased government outlays to finance the state banks, and these outlays appeared as subsidies to the banking sector.

An appropriate analysis of important parts of government subsidies would probably require other tools than a macroeconomic model, since the subsidies often are given on certain conditions, not specified in the model. The subsidies also are given as a part of a more comprehensive policy package. Agricultural policy is a good example. During the 1970s agriculture policy was changed with the specific aim to raise the farmers' incomes to the average for industrial workers. This was attempted by changes in regulations and a massive increase in subsidies. The effects on production, employment, investment and incomes in agriculture were probably large, but a macroeconomic model where agricultural production and productivity are exogenous is hardly a good tool to analyse the effects. In order not to let assumptions on the effects on agricultural production and productivity that some might find arbitrary, affect the results, we have excluded these subsidies altogether from the analysis.

We have made similar considerations regarding the effects of subsidies to maintain low interest rates in state banks. The rising interest rate differential between market interest rates and interest rates in the state banks required increased subsidies. Although an alternative to the actual development might have been to raise interest rates in state banks with corresponding smaller increases in subsidies to the banking sector, we have chosen to exclude this area of policy from the analysis as well. This is partly motivated by the view that this may as well be seen as a part of monetary policy as a part of fiscal policy.

Some other indirect taxes and subsidies have also been excluded⁸. Our choice, which must be borne in mind when evaluating the results, was to include the following excise taxes: Taxes on electricity, gasoline and heating oils and on alcoholic beverages⁹. Furthermore we include deviations from trend

⁸ The most important were specific food subsidies that were given in the 1970s in order to limit wage increases in the central wage settlements, which we interpret as a part of income policy. Also oil taxes, which probably has had no noticeable direct effect on behaviour in the private sector in the mainland economy, are excluded.

⁹ These taxes are treated separately, because they are collected in the wholesale and retail trade sector according to the national accounts.

in the general investment tax and net sectoral taxes (taxes minus subsidies) to some sectors in the model used¹⁰. The average net tax revenues from these taxes and subsidies are shown in figures 10 and 11.

Figure 10. Net indirect taxes *. Actual and trend
Million 1991-NOK

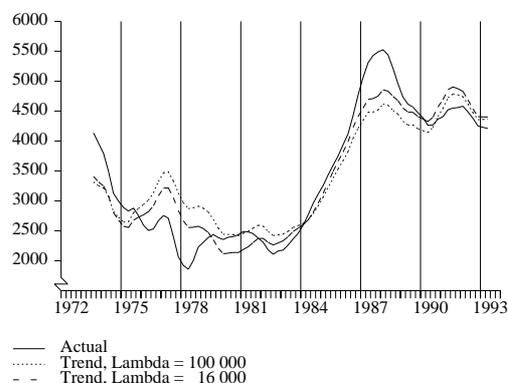
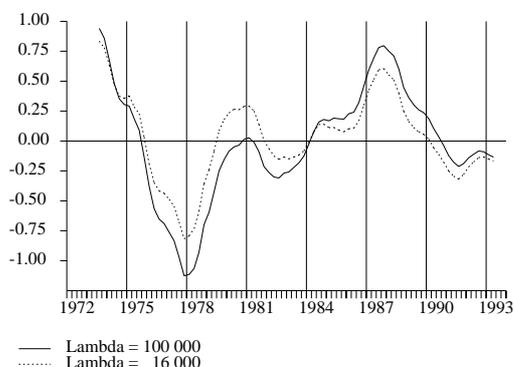


Figure 11. Net indirect taxes, per cent of GDP mainland
Deviation from trend



*Includes indirect taxes defined to be a part of fiscal policy. Excl. VAT

A picture of reduced net indirect taxes through the 1970s and rising net indirect taxes during the 1980s emerges. Net indirect taxes in per cent of GDP mainland private sector were particularly high in 1986-1988. The increased taxes from 1984 to 1987-88 arises partly through the gradual abolition of food subsidies introduced as a part of the income settlements of the 1970s. More important were increases in fuel taxes which played an important role in the fiscal contraction in 1986 and 1987.

From 1973 to 1975 and from 1985 to 1992, net indirect taxes were above trend. It is important to note that the trends are defined at a disaggregated level, where indirect tax rates have been subject to de-trending by the HP filter. The detailed data are shown in appendix 4.

A U-shaped picture of net indirect taxes as a share of GDP mainland during 1973-93 appears. It is the subsidy policy that is the main factor behind this. Large increases in subsidies to domestic transport and private services were also present in this decade, which helped reduce net taxes. In the 1970s, a number of excise taxes were not annually indexed to higher domestic prices, leading to lower real value of the tax. The fiscal contraction after the abandoning of the bridging policy marks the end of this regime. In the 1980s, both the labour and the conservative governments wanted to reduce subsidies and also started a policy of reductions in direct taxes and increases in indirect taxes. From the mid 1980s, the wish to increase fuel taxes as a part of environmental policy coincided with the need for fiscal contraction after OPEC III, thus prolonging the regime of increasing net indirect taxes. As the whole period can be said to consist of two policy regimes - one with declining net indirect taxes and one with increasing net indirect taxes - the definition of trends becomes especially difficult, which can be seen e.g. for net sectoral taxes in the consumption goods industry (cf. figure 3 in appendix 4). Our defined trend with a λ -value of 100 000, implies a strong negative tax impulse from

¹⁰ We include net sectoral taxes for the following sectors: Production of consumption goods, Petroleum refineries, Production of ships and oil platforms, Domestic transport and Production of miscellaneous services.

1975 to 1981, while the impulses from 1981 were modest, though positive on average. Before 1975, the tax impulse was positive. Net indirect taxes above trend was present in 1987 and 1988, but net taxes were reduced again in 1989. A less smooth trend (e.g. with $\lambda = 16000$), would have made the trend follow the U-shape of the series more closely, and have implied smaller policy impulses. But then the policy change from the late 1970s to the 1980s would have disappeared from our analysis. This is strongly counter-intuitive.

4.6. Transfers

Transfers to the household sector constituted some 15 per cent of GDP in 1973, rising to 26 per cent of GDP in 1992. However, the policy decisions for transfers do not concern the actual payments directly, but the laws and rules for granting benefit under the various transfer and pension systems. Annual parliamentary decisions regarding indexation are also important. Some transfers (especially unemployment benefit) are closely linked to the labour market situation. Unemployment benefits are endogenous in our analysis, determined by unemployment and the average hourly wage¹¹.

The most important transfers are retirement pension and disability benefits. In 1993 these benefits constituted 41 per cent of total transfers to households. We look upon retirement pension payments as driven by the number of elderly (the retirement age in the National Insurance system was reduced to 67 years in 1973 and has been unchanged since then) and annual budget decisions in Parliament of adjustments of current per capita pensions (the so-called Basic Pension Unit (BPU) and Minimum Pension (MP)). Similar effects are present in the system of disability benefits, although the inflow to this benefit is found also to some extent to depend on the labour market situation (Bowitz (1992)). However, to simplify the analysis, we consider the number of disability benefit recipients as exogenous.

We utilize average pensions per recipient in constant prices for retirement pension and disability benefit, respectively, as indicators for changes in policy for these variables. For these variables trends and actual values are shown in appendix 5. Calculating deviations from trend in these variables, we can isolate shocks to transfer payments due to demographic changes (number of retirees) from changes due to changes in real per capita pensions. Changes in per capita pensions may occur both due to annual decisions on BPU and MP as well as changes in pension rights through the automatic working of the rules in the National insurance system, and we lump these factors together. The rest of transfers (exc. health transfers) are treated as one aggregate. These transfers include confinement benefit, family allowance, social care assistance, rehabilitation benefit and some other smaller components. We can identify some shocks to this variable, from 1979 to 1980 and in the late 1980s, cf. figure 3 in appendix 5. From 1979 to 1980 family allowance was significantly increased, while confinement benefit per birth was rapidly increased since the mid 1980s. The deviations from trend in total transfers exc. unemployment benefit are shown in figure 12.

¹¹ From 1979, unemployment benefit was subject to income taxation, while this was not earlier the case. To compensate the recipients, the per capita benefit was increased accordingly. Neither effects are considered parts of fiscal policy.

Figure 12. Transfers *. Deviation from trend
Million 1991-NOK



For both retirement pensions, disability benefit and the rest of transfers, the late 1970s saw a sharp increase. This partly was due to large increases in minimum pensions. In later years, deviations from trend have been smaller. The late 1980s and early 1990s saw above trend transfers especially for transfers other than retirement pension and disability benefit. One might argue that this might partly be attributed to effects of the rising unemployment, which exerts a pressure on benefits such as rehabilitation benefit and social assistance (note that unemployment benefit is not included in the figures for transfers). However, we treat this as deviations from smooth policy.

5. Main properties of the KVARTS model

The KVARTS model of Statistics Norway is in many respects a fairly traditional macroeconomic model. However, it is disaggregated by international standards (18 sectors and 25 commodities). It also specifies a disaggregated array of policy instruments. A description of the model and its properties as well a documentation of historical tracking performance is given in Hove and Eika (1994).

The model is heavily based on the national accounts and is built around an input-output core which describes the commodity flows. Consumer demand is determined in a macro consumption function, where current income and wealth are the main explanatory variables. Wealth consists of total financial wealth and the value of the housing stock. The price of the housing stock is negatively related to the real interest rate. The deregulation of financial markets in 1984 is captured by dummy variables. This affects the equations for private consumption and housing investment, that become more wealth-sensitive and less income-sensitive after deregulation. The equation for housing prices becomes more interest rate-sensitive after deregulation.

Interest rate effects are also present in the model via the value of housing in the consumption function and directly in the housing investment function. Real investment in the production sectors depend on production and profitability in each sector. No significant direct effects from changes in user costs of capital have been detected, except in the housing investment equation.

Production behaviour is based on monopolistic competition. Firms sell their goods both on the domestic and foreign markets. Price mark-ups over unit variable costs depend on changes in capacity utilisation and competitors' prices. Short-run demand for labour and intermediate inputs are based on cost-minimisation for a given level of production and capital stock, and depend on relative factor prices, real capital stock and trends. On average, the production functions exhibit increasing to scale

in all production factors. The average scale elasticity in the sectors where there are estimated factor demand functions is approximately 1.2.

Import prices and the exchange rate are exogenous in the model. In most of the period Norway pegged its currency to a basket of foreign currencies reflecting Norway's foreign trade. The domestic short run money market rate is assumed to be obey Uncovered Purchasing Power Parity in the long run. In the short run deviations due to adjustment lags are present. Also, increased surpluses on the current account exert a downward pressure on Norwegian interest rates, proxying expectations of exchange rate changes.

Both domestic and export prices of Norwegian goods and services are heavily influenced of production costs. Market shares on the domestic and export market are negatively related to the relative price between Norwegian and foreign goods.

Unit labour costs depend on import prices in domestic currency, wages and productivity, as well as indirect taxes and subsidies. Wages are determined by wage equations based on a bargaining model. Wages depend positively on consumer and producer prices with equal weights. Productivity has a unit long run elasticity, and payroll and indirect taxes (VAT and excise taxes) are passed through onto wages with the same weights as the producer price and consumer price index, respectively. Pass-through of direct household taxes on wages is also present in the model, as well as a separate effect of progressivity in the income tax system (increased progressivity implies lower wages, *cet. par*), along the lines in e.g. Lockwood and Manning (1992). Increased unemployment lowers wages, and the relationship is found to be highly non-linear. Consequently, at high levels of unemployment (5 per cent as in the early 1990s), changes in unemployment have little effect on wages. At low levels (less than 2 per cent) such as during most of the 1970s, the effects are strong.

The GDP multiplier of increased government demand is around 1.0 after 4 quarters rising to 1.2 after 8 quarters. Real wages increase much more in the case of low initial unemployment than in the case of high unemployment, but the GDP multipliers do not differ much in the two cases. However, competitiveness and the surplus on the current account is much more reduced by a fiscal expansion when unemployment initially is low than when unemployment is high.

6. Effects of deviations from smooth policy

This section shows the main effects of the policy shocks described above. An overall picture regarding the cyclical effects of fiscal policy is given in table 2, which shows mean absolute percentage deviation and mean absolute deviation (MAPD/MAD) under smooth policy and under actual policy. The main impression for most variables is that MAPD from trend for macroeconomic quantity variables were smaller under actual policy than under smooth policy, although this was not uniformly the case. However, the magnitude of the reduction of MAPD under actual policy compared to smooth policy is relatively modest. For example, MAPD for GDP mainland was reduced by almost 0.2 per cent-points- from 2.27 per cent to 2.09 per cent for the whole period, a reduction of average

volatility of 8 per cent. The reduction in MAPD appeared mainly in the first sub-period, while the reduction in the latter was much smaller. Surprisingly, MAD for the unemployment rate was higher under actual policy than under smooth policy, for the period 1973-1993 seen as a whole. More details regarding cyclical effects of policy in different periods, can be obtained by actual inspection of the series, under actual and smooth policy.

Figure 13. GDP mainland. Actual and with smooth policy
Deviation from trend, expressed in percentage

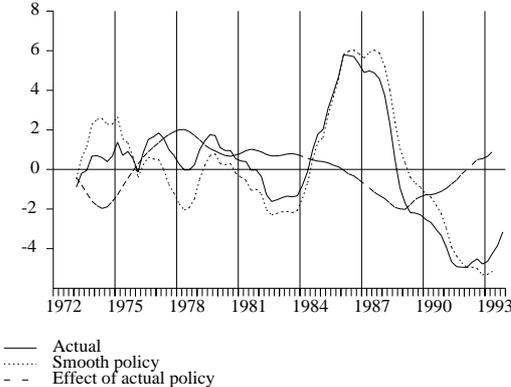


Figure 14. Unemployment rate. Actual and with smooth policy
Per cent

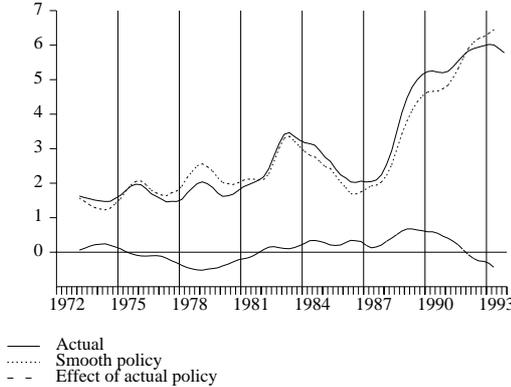
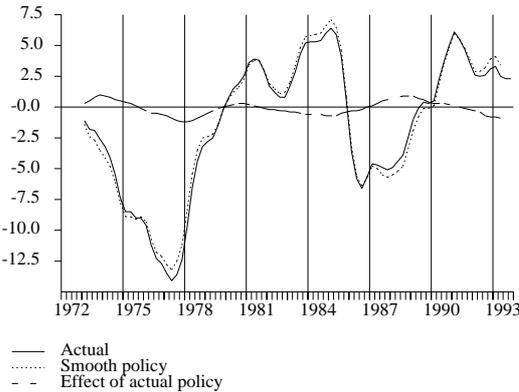


Figure 15. Current account. Actual and with smooth policy
Per cent of GDP



Figures 13-15 show GDP mainland, the unemployment rate and the current account under smooth and actual policy and the effect of actual policy. Note that in fig. 13 the deviation from trend is displayed while figures 14 and 15 show the variables themselves.

With smooth policy, the cyclical upturn in GDP mainland in 1973/74 would have been much larger (the peak would have been more than 4 per cent above trend while the actual peak was 2 per cent above trend). In the bridging policy years 1975-77, the aim of

policy was to counteract falling foreign demand by expanding domestic demand. The effect of policy measured as the difference between actual and simulated GDP mainland with smooth policy, moved from below -2 per cent to 2 per cent from 1974 to 1977. Still, we can register a cyclical trough (though above the trend here). The peak of the policy effect is at the trough - a clearly countercyclical effect. The policy effect on GDP mainland is positive a long period, although to a declining extent. Policy had a positive effect on this variable until 1985. The contribution from actual policy to GDP mainland was approximately constant at 1 per cent from 1979 to 1983. In 1981-1983, the Norwegian economy was in a recession. GDP mainland fell below trend and unemployment, which had been below 2 per cent in the 1970s, rose to above 3 per cent. Falling foreign demand in the aftermath of the

OPEC II oil price rise was one important factor behind the recession. According to our analysis, the effects of fiscal policy were approximately the same as in the previous years, or slightly less positive.

The domestically driven (financial deregulation and large petroleum investments, cf. Cappelen and Eika (1996)) upturn from 1984 to 1986, took place with only modest changes in the effects of fiscal policy. On level form, smooth policy and actual policy produced exactly the same deviation from trend in 1985. It was first in 1986, after the oil price collapse that fiscal policy was tightened. Policy was tightened further in 1987 and 1988. Actual policy raised GDP mainland by approximately 1/2 per cent in 1984, while it reduced this variable by the same magnitude in 1986.

Under the actual policy from 1986, the peak in the deviation from trend for GDP mainland was in 1986Q1 while the peak would first have occurred in 1987Q4 under smooth policy. Thus, the fiscal contraction in 1986 was clearly countercyclical. The effect on GDP mainland was approximately 1 per cent in 1987 and nearly 2 per cent in 1988. However, by 1988, GDP mainland had plummeted and was far below trend. Unemployment lagged somewhat in the cycle, but it was evident that unemployment was rising beyond numbers experienced since World War II in Norway. Still, the effect of fiscal policy in 1989 were only slightly less negative than in 1988. When the unemployment effects were visible, the government enacted a fiscal expansion from 1989Q2 with higher growth in government consumption and investment as well as lower taxes. However, as can be seen from the figures of policy parameters, government employment was still below trend, and this lasted until 1992. The negative impact from actual policy on the level of GDP mainland sector continued until 1992, but with a continuously smaller amount. In these years the Ministry of Finance budget indicator showed a large fiscal expansion. This indicator measures the change in the cyclically corrected budget balance, compared to the previous year. Our analysis gives a very similar result; the change from the previous year in the effect of deviation from trend in fiscal policy, was positive in from 1989 to 1993.

The unemployment rate is shown in figure 14. The policy effects on unemployment resemble very much the effects on GDP mainland, cf. above. The years 1973 and 1974 were characterized by high pressure in the labour market and actual policy increased unemployment by approximately 0.3 per cent-points in 1973. Unemployment started to rise in 1975, and unemployment under actual policy equalled unemployment under smooth policy in this period. Fiscal policy lowered unemployment during 1978-81, when the first period of rising unemployment in the 1980s started. But while fiscal policy had a positive effect on GDP mainland from 1981 to 1985, the simulated effects on unemployment were actually positive! This was due to negative employment effects in the simulation with actual policy. What happened was that actual policy increased labour productivity, and despite positive effects on output, higher productivity resulted in lower employment and higher unemployment. The reason why this result emerges is that since actual policy lowered unemployment during 1978-80, wages (both nominal and real wages) in this and the following years were higher than what would have been the case under the smooth policy. This initiated higher private consumption

and real investment which via the effects on the real capital stock, raised value added per man-hour in the private sector. The net result was an increase in value added per man-hour in the medium run¹².

During the booming years 1985 and 1986, unemployment effects of fiscal policy were modest but positive. This was a desired outcome both since unemployment was very low and the current account had to be improved. The change in policy from 1986 on had very similar effects on the unemployment rate as on GDP mainland. However, the unemployment-increasing effects of fiscal policy were clearly higher during 1988-90 than in 1986 and 1987. This may be due to the stronger contractionary fiscal stance but also lagged effects of the policy contraction in 1986/87. It is of interest to note that policy seemed procyclical in 1988 as it contributed to increasing unemployment at the same time as unemployment started to rise. The very expansionary policy from 1989 described above, reversed the positive level effects of policy on unemployment. At the end of our analysis period, unemployment was about 0.5 per cent-points below the level under smooth policy.

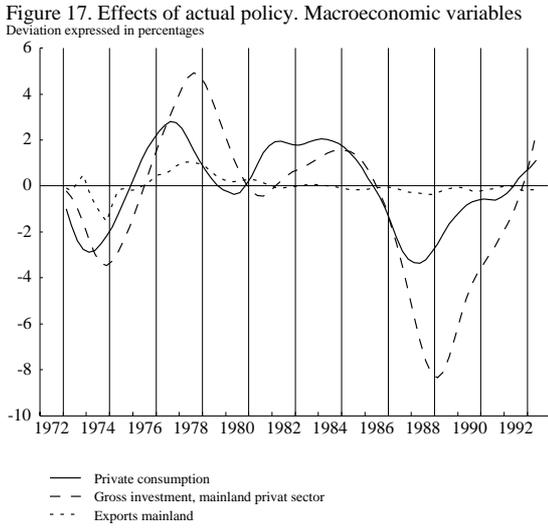
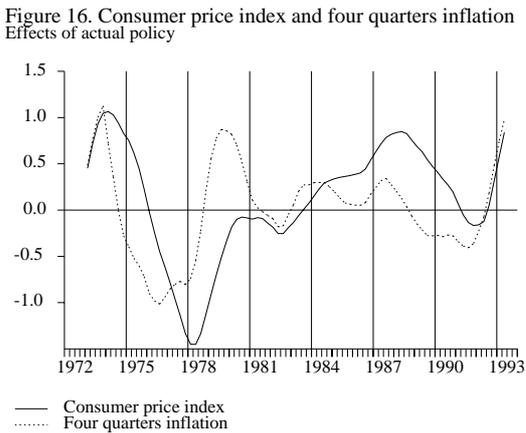
One of the important motives for changes in fiscal policy has been to stabilize the current account. The current account under the two fiscal policies and the effect of deviations from smooth policy are shown in figure 15. Positive effects of policy on the current account were apparent where the effects on domestic demand and production were negative. The worsening current account balance during 1973-77 was initially not regarded as critical because everyone in Norway expected large future petroleum revenues. Significant parts of the current account deficits were also a consequence of imports of investment goods to increase the capital stock in the petroleum sector. But finally the deficits were considered too large and policy was directed at restoring the external balance. We see, however, that fiscal policy only contributed marginally to the improvement of the current account balance from 1978 to 1981. The currency devaluation and later wage and price controls may have been important, but the rising petroleum prices from OPEC II and higher petroleum production were the most important factors behind the improvement in the current account. From 1977 to 1980, petroleum exports as a share of GDP rose from 4 per cent to 14 per cent. The policy effect of the current account/GDP ratio changed from -2 per cent to 0 from late 1977 to 1980, while the actual development of this ratio was from -20 per cent to + 4 per cent.

The current account showed comfortable surpluses during the first part of the 1980s. Rising petroleum revenues prevented the domestic boom to bring the current account into deficit during 1984-85. The sudden worsening of the current account in 1986 as a consequence of OPEC III undermined the credibility of the currency. But still we see that the partial effects on the current account of the fiscal policy measures were small, though clearly present in 1987-89. The sources behind the actual improvement of the current account must be sought elsewhere, such as the currency devaluation, and income policy through legislation of wage increases. And the self-regulating mechanisms of the economy were probably also important. Later, increases in the volumes of petroleum production were the main factors behind the increase in the current account surplus from 1989 on. The policy

¹² The factor demand equations are documented in Bowitz and Cappelen (1994).

expansion from 1989 on to curb rising unemployment meant a halt to the positive contribution from fiscal policy to the current account/GDP ratio.

The main effects of policy on *domestic prices* came through indirect taxes and subsidies, and of factors influencing the prices of production factors in the economy. Wage formation is crucial in analysing the wage and price effects of fiscal policy. In the KVARTS model both product prices and consumer prices influence the actual outcome of the wage bargain. As wage-earners are interested in the purchasing power of their wages, both consumer prices and direct income taxes are important. Thus an increase in direct taxes as well as an increase in indirect taxes such as VAT or fuel taxes that increase consumer prices, will increase the wage level. According to the model, lower unemployment corresponds to a higher wage level in the long run. In an interval, wage increases will be higher, but in the long run, the wage level will settle at the higher level. The wage-unemployment locus is according to the model highly non-linear, implying large wage effects of changes in unemployment at low initial levels of unemployment and small effects at unemployment levels above 4 per cent. Figure 16 shows the effects on the consumer price index and on four quarters inflation from the deviations from smooth policy.



The major changes in the price level between actual and smooth policy can be traced back to the impulses from net indirect taxes. The peak of the effect on consumer prices during 1973 was some 1 per cent. However, during the 1970s, subsidies increased significantly and several excise taxes were not indexed fully, thus shifting the positive consumer price effect to a negative effect in 1978. From the late 1970s and especially in the 1980s, net indirect taxes were reduced, but this has to a large amount been included in the trends. Not until 1984-88, indirect taxes started to rise, and this was the main factor behind the simulated positive effect from actual policy. The declining impulse from indirect taxes after 1988 reduced this cost-push effect. The rapid policy effect of higher consumer prices in 1993 was almost solely due to the increase in VAT. Although the VAT increase was accompanied by a significant reduction in payroll taxes, the net effect was a significant increase in consumer prices. This was probably due to the model property that increases in VAT are assumed to be passed fully through into consumer prices in the short run, while the price reductions as a

consequence of lower payroll taxes take time to work through. The effects on inflation, which is defined as the per cent increase in consumer prices over four quarters, were less permanent.

Effects on some demand components are shown in figure 17. The effects of policy on domestic demand (in per cent) were stronger than the GDP effects, because some of the changes in demand partially resulted in changes in imports. Imports were mainly affected through the effects on domestic demand. Effects on private consumption resemble the effects on GDP mainland, although larger in magnitude. The initial negative effects from 1973 to 1977 were present, as were the positive effect in the early 1980s. One difference was that the positive effect of policy was strengthened from 1982 on, unlike the case for GDP mainland. In this period, the international recession hit Norwegian exports, which also negatively affected real investment in the private sector. The stimulus from policy to private consumption increased in this period, although the net effect from fiscal policy to GDP mainland private sector increased only little. One reason was that the stimulus of the domestic economy had a - though small - negative effect on exports from the mainland economy via crowding out due to cost increases.

Table 2. Mean Absolute Percentage Deviation¹⁾ (MAPD) in the historical data and simulated with smooth fiscal policy for all fiscal policy variables changed simultaneously. Per cent

Variable:	1973-1982		1983-1993		1973-1993	
	A	S	A	S	A	S
GDP	1.49	1.06	2.44	2.39	1.97	1.74
GDP mainland	0.82	1.14	3.29	3.34	2.09	2.27
GDP mainland private sector	1.14	1.49	3.92	4.00	2.56	2.77
Private consumption	1.72	1.26	4.07	4.56	2.92	2.95
Real investment private, mainland	3.64	2.84	15.92	16.09	9.93	9.63
Exports mainland	4.44	4.45	2.53	2.50	3.46	3.45
Imports	8.38	8.33	4.28	4.40	6.28	6.31
Employment	1.41	0.82	2.02	2.26	1.72	1.56
Unemployment rate ²⁾	0.21	0.23	1.00	0.95	0.62	0.60
Consumer prices	4.11	4.02	3.43	3.10	3.77	3.55
Current account/GDP ²⁾	4.08	3.82	3.62	3.82	3.85	3.82
Government balance/GDP ²⁾	1.69	1.32	1.80	1.91	1.75	1.63

¹⁾ Average of absolute value of per cent differences from trend ($\lambda = 100\ 000$) in smoothed values of seasonally adjusted series.

²⁾ MAD (Mean Absolute Deviation)

Use of fiscal policy measures in the booming and busting years of the 1980s had larger percentage effects on private consumption than on GDP mainland. The magnitude of the effects on private mainland investment were even larger. While the negative effect on private consumption reached its maximum of -3.4 per cent in 1988Q2, the corresponding number for investment was nearly -8 1/2 per cent in early 1989. We find negative yet small tracks of crowding out from policy on exports from the mainland economy, caused by the cost-push effects from increased taxation. Increased unemployment as a consequence of policy moderated the wage increases caused by this, however.

While cycles in GDP mainland have been dampened as an effect of deviations from smooth policy, this turns out not to be the case for several other macroeconomic variables. Data for other macroeconomic variables are shown in table 2. For 1983-1993 seen as a whole, volatility was larger for all major macroeconomic sub-aggregates under actual policy than under smooth policy (private consumption, real investments mainland private sector, exports mainland). The reduction in volatility for GDP mainland have been caused by the increased cyclical movements in the GDP components to a larger extent were counteracting each other.

In the first sub-period, cycles for private consumption were larger under the actual policy than under the smooth policy, but the opposite effect was present during 1983-93. Cycles for real investment mainland private sector were smaller under smooth policy than under actual policy in the first sub-period, while smaller in the second sub-period. Exports from mainland Norway were slightly more volatile under actual policy than under smooth policy in both sub-periods. Total employment was more volatile under actual policy than under smooth policy in the years 1973-82, while some dampening effects of the actual deviations from trend in fiscal policy variables were present in the second sub-period. This picture is also reflected in the results for unemployment.

Although it is the composite effect of fiscal policy that is the focus of our interest, it might be of relevance to study the partial effects of the individual policy instruments. It turned out that the effects were different both regarding different instruments and regarding time period. The changes in mean absolute percentage deviation due to deviations from trend in the individual instruments are shown in table 3.

The single most output-stabilizing instrument during 1973-93 as a whole were household taxes and central government real investment. Deviations from trend in household taxes reduced mean absolute percentage error for GDP mainland private sector by almost 0.4 per cent-points in 1973-82, which implies almost one half the actual MAPD in this period. In the second sub-period, however, taxes contributed to higher MAPD, thus making the 1973-93 reduction of MAPD more modest. Similarly, central government real investment appeared procyclical in the first sub-period and strongly countercyclical in the second. The degree of cyclicity differs over time for other instruments as well.

Tax policy seemed quite countercyclical in the 1970s while not so in the recession of the early 1980s. It also played a part of the fiscal contraction after 1986 and the policy expansion after 1989. However, as we measure level effects both in policy variables and GDP, tax rates were still above trend until 1992, and thus taxes appeared to have a negative impact of GDP mainland private sector in the whole period after 1987. The policy expansion was manifest by reducing the negative deviation from trend in GDP.

Table 3. Change of Mean Absolute Percentage Deviation (MAPD) for GDP Mainland by deviations from trend in policy variables. Per cent-points

Effect of non-smooth trajectory for:	1973-1982	1983-1993	1973-1993
1. Central gov't employment	-0.04	-0.05	-0.05
2. Central gov't purchases for consumption	0.00	0.00	0.01
3. Central gov't real investment	0.03	-0.18	-0.07
4. Local gov't employment	0.06	0.13	0.09
5. Local gov't purchases for consumption	0.01	0.01	0.02
6. Local gov't real investment	0.12	-0.16	-0.02
7. Household tax rates (incl. fees)	-0.38	0.18	-0.09
8. Payroll taxes/VAT changes	-0.05	0.02	0.01
9. Other indirect taxes	0.00	0.09	0.07
10. Transfers	0.00	-0.17	-0.08
11. All of above	-0.32	0.00	-0.18
Memo:			
Central government ¹⁾	-0.33	-0.11	-0.21
Local government ²⁾	0.14	0.03	0.09
Actual development	0.82	3.29	2.09

¹⁾ Effects of deviations from trend in central government employment, purchases for consumption, real investment, all direct and indirect tax rates exc. local government fees, and transfers.

²⁾ Effects of deviations from trend in local government employment, purchases for consumption, real, investment and local government fees.

Local government employment contributed to increase volatility in overall economic activity in the private sector in both sub-periods. This was particularly apparent for local government employment in the second sub-period. The negative deviations from trend in local government demand contributed negatively to GDP mainland from 1986 to 1992. Reductions in local government expenditures were clearly a part of the fiscal austerity package after OPEC III and this negative contribution was a desired development. It is probably correct to say that the development of the government balance were never considered as critical in stabilisation policy as the current account during 1973-93. The effects of deviations from smooth policy are displayed in figure 18. Policy reduced the government surplus during in periods of fiscal expansion and increased the surplus during periods of fiscal expansion. As can be seen, except perhaps in the early 1970s, the magnitude of the policy effects were small compared to the actual development of the government balance.

It is also of interest to see what were the separate effects of local government and central government behaviour. This is also shown in table 3. All effects from transfers and all tax policy except effects of deviations from trend in local government fees are assumed to be central government policy. It appears that central government was countercyclical in both sub-periods, while demand from local government actually was procyclical in the period 1973-1993 as a whole. In the second sub-period this procyclical effect was weaker. Figures 19 and 20 outline the detailed effects of impulses from central and local government, respectively. It is useful to compare the effects of policy with figures 1 and 2 which display the historical business cycles.

Figure 18. General government surplus* in per cent of GDP
Actual and with smooth policy

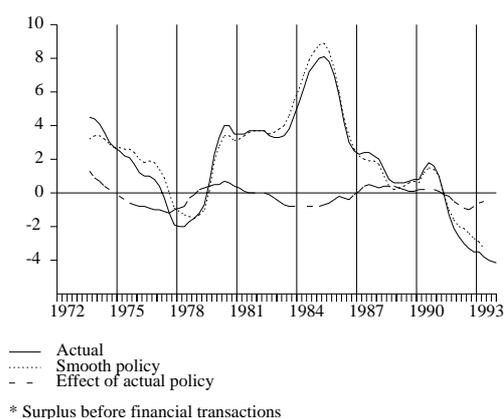


Figure 19: GDP mainland. Effect of actual policy
Deviation expressed in percentages

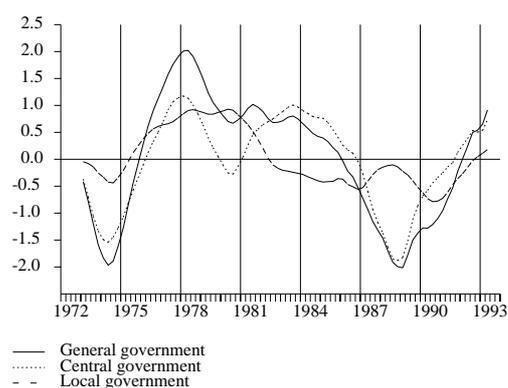
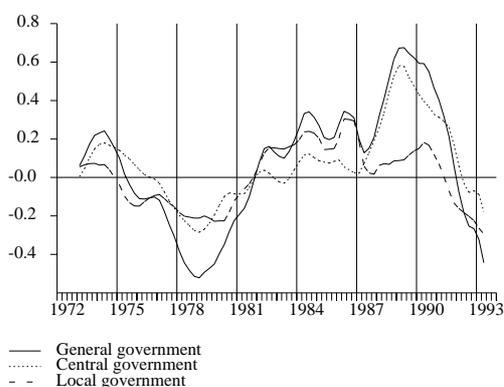


Figure 20. Unemployment rate. Effect of actual policy
Deviation expressed in percentage-points



Output effects of deviation from trend in local government were small until 1975, while central government exerted a significant negative effect on GDP mainland. In this period, GDP mainland was above trend. After 1975, effects of both central and local government were positive, which means that the countercyclical "bridging policy" of 1976-77 took place both in central and local government. The halt in this policy in 1978/79, however, took in its entirety place in central government. The effects from deviations from trend in local government variables were positive and stable in these years.

From 1981 to early 1984, GDP mainland was below trend. This was the first period of high unemployment in Norway since World War II. Again, it was central government policy that exerted a positive effect on GDP mainland, again being countercyclical. Especially central government employment displays a large increase in the early 1980s (can be seen in figure 1 in appendix 2), which partly reflects the extensive use of specific labour market measures. Local government changed from exerting a positive effect on GDP mainland until 1981, to having a negative effect from 1982, prevailing virtually unchanged until 1987. This reflects partly the policy change of the early 1980's, where growth reductions in government - especially local government - consumption, were offset by reductions in the tax level which is classified as central government policy.

It is also of interest to register differences in the effects of central and local government in the aftermath of the peak in 1987. Current account imbalances were the motivation behind the fiscal contraction. However, again the change in policy was carried out by central government, while the negative GDP-effects originating from local government demand actually were reduced in absolute value (although the effects were still negative). Then negative effects from central government were

quickly eliminated and became positive, while the effects from local government actually became more negative. Only from 1991 on, the simulated effects from both central and local government changed in the same direction. The situation of differing tendencies of central and local government was also apparent during 1988-89, when unemployment was seen to rise sharply. The effects on unemployment to a large extent mirrored the effects on overall activity, with the exceptions mentioned in the discussion of effects on unemployment above.

7. Conclusion

We have analysed the effects on the variability of macroeconomic aggregates from the actual use of fiscal policy instruments in Norway in the period 1973-93, compared to a smooth development of these instruments. A general conclusion is that on average, deviations from trend in these instruments have contributed to stabilize overall economic activity in Norway. The resulting reduction in the variability of GDP mainland, was according to our estimates less than 10 per cent of the actual variability. For overall activity in the private sector, the stabilizing effect was smaller, which indicates that variations in the size of the government sector itself has played a role in the overall reduction in volatility.

Stabilization of output in a small open economy is not the sole purpose of stabilization policy. During the period 1973-93, changes in fiscal policy have several times been directed at the current account and international competitiveness, although current account imbalances often have occurred simultaneously with cyclical booms (such as in 1985/86). Consequently, fiscal policy has appeared procyclical at some occasions.

Another interesting finding is that most instruments seem to have exerted a partial output-stabilizing role. Personal taxes seems to have been the most output-stabilizing instrument, although central government real investment has also been extensively used for this purpose. It is however interesting to note that the local government sector has been pro-cyclical rather than counter-cyclical on average during 1973-93. It is also of interest to notice that according to our analysis, the effects on output and unemployment may be different than what one would expect. On at least one occasion, fiscal policy exerted a positive effect on GDP mainland while at the same time affecting unemployment positively (and employment negatively). The mechanisms in the model generating this effect do not seem very controversial. The dynamics through earlier effects on unemployment, wage formation and factor substitution explains this result.

References

- Artis, M. J., R. Bladen-Hovell, E. Karaktisos and B. Dwolatzky (1984): The effects of economic policy 1979-1982. *National Institute Economic Review* **108**, 54-67.
- Bjørnland, H. C. (1995): *Trends, Cycles and Measures of Persistence in the Norwegian Economy*, Social and Economic Studies 92, Statistics Norway: Oslo.
- Bowitz, E. (1992): *Offentlige stønader til husholdninger (Government transfers to households)*. Social and economic studies 80, Statistics Norway: Oslo (in Norwegian).
- Bowitz, E., A. Rødseth and E. Storm (1993): Fiscal Expansion, the Budget Deficit and the Economy: Norway 1988-91, Discussion papers 91, Statistics Norway: Oslo.
- Bowitz, E. and Å. Cappelen (1994): *Prisdannelse og faktoretterspørsel i norske næringer (Price formation and factor demand in Norwegian production sectors)*, Social and Economic Studies 85, Statistics Norway: Oslo (in Norwegian).
- Bowitz, E., T. Fæhn, L. A. Grunfeld and K. Moum (1994): Norsk medlemskap i EU - en makroøkonomisk analyse (Norwegian AEU membership - a macroeconomic analysis), Reports 94/25 from Statistics Norway: Oslo (in Norwegian).
- Cappelen, Å. and T. Eika (1996): Konjunkturimpulser fra oljevirkosomheten 1973-93, kommer i serien Sosiale og økonomiske studier fra Statistisk sentralbyrå: Oslo (in Norwegian). Forthcoming.
- Fagerberg, J., Å. Cappelen and L. Mjøset (1992): Structural change and economic policy: the Norwegian model under pressure, *Norsk Geografisk Tidsskrift* **46**, 95-107.
- Fair, R. C. (1988): Sources of economic fluctuations in the United States, *The Quarterly Journal of Economics*, May, 313-332.
- Franz, W. (1990): Fiscal Policy in the Federal Republic of Germany, *Empirical Economics* **15**, 17-54.
- Hove, S. I. and T. Eika (1994): KVARTS: Modellen bak prognosene (KVARTS: The model behind the forecasts), *Økonomiske Analyser* 9/94, Statistisk sentralbyrå, 33-46 (in Norwegian).
- Langørgen F. A. (1994): A Macromodel of Local Government Spending Behaviour in Norway, Discussion Papers no. 117, Statistics Norway.
- Lockwood, B. and A. Manning (1993): Wage Setting and the Tax System - Theory and Evidence for the United Kingdom, *Journal of Public Economics* **52**, 1-29.
- Ministry of Finance (1974): Parliamentary report No. 25 (1973-74): Petroleum Industry in Norwegian Society.
- Wallis, K. F. and J. D. Whitley (1992): Counterfactual analysis with macroeconomic models: The UK economy 1979-84, ESRC Macroeconomic Modelling Bureau, Discussion paper No. 29.

Appendix 1. Generation of trend. Smoothing of series

All series are quarterly national accounts data. Originally unadjusted data are adjusted sequentially in 3 sub-periods, due to distinct differences in the seasonal pattern in the original series. The periods are 1967Q1-1977Q4, 1977Q4-1985Q4 and from 1986Q1.

The seasonally adjusted series (lower case letters indicate logarithmic transformation) y_t can be represented as the sum of a trend, cycle and a stochastic component:

$$y_t = c_t + g_t + s_t$$

where g_t is the trend component, c_t is the cyclical component and s_t is the noise (stochastic) component.

The Hodrick-Prescott (HP) filter extracts a stochastic trend that moves smoothly over time and is uncorrelated with the cycle. The trend values, g_t , are found by minimising the following expression:

$$\min_{(g_t)_{t=1}^T} \left[\sum_{t=1}^T (y_t - g_t)^2 + \lambda \sum_{t=3}^T ((g_t - g_{t-1}) - (g_{t-1} - g_{t-2}))^2 \right]$$

The first element is the squared sum of actual deviations from trend and the second term is proportional to the sum of squared changes in the trend between two periods. The parameter λ indicates how large weight should be attached to the consideration of having a smooth trend. A small value of λ indicates that changes in the changes of the trend are not much penalized in the maximization. A small value of λ implies that the trend to a large extent will follow the actual variations in the data.

Contrary, a large λ implies that changes in the trend value will be penalized hard, and consequently implies a trend that is closer to a linear trend.

The seasonally adjusted data were compared to the estimated trends. Still, there was present a significant amount of noise in these data, and this made inspection of the series difficult. In order to facilitate a visual impression of the actual deviations from trend, we report in the figures smoothed values for the actual (seasonally adjusted) series. The smoothed series, z_t , is defined as:

$$z_t = \frac{1}{8} y_{t-2} + \frac{1}{4} (y_{t-1} + y_t + y_{t+1}) + \frac{1}{8} y_{t+2}$$

This smoothing procedure, which must not be confused with the HP filter, is carried out on the seasonally adjusted series. The procedure implies that z_t is a 5 quarter moving average of y_t

In determining the trend in the HP filter, the data window we utilize, was important for the determination of the trend, as mentioned in the text.

The national accounts data available for us, go back to 1967Q1. National accounts data for 1994 and 1995 are used, and extrapolated with a model-based simulation to 2010, cf. chapter 2.

The HP filter assures that the average trend value equals the average value of the actual series (in the logarithmic transformation) over the maximisation period. But since we only analyse the period 1973-93, average historical value during 1973-93 does not necessarily equal to average value for the trend in this period. Thus we have adjusted the trend additively by requiring that average value of the trend 1973-93 be equal to average actual value in this period.

Appendix 2. Detailed data for government employment, consumption purchases and real investment

Figure A2.1: Central government employment

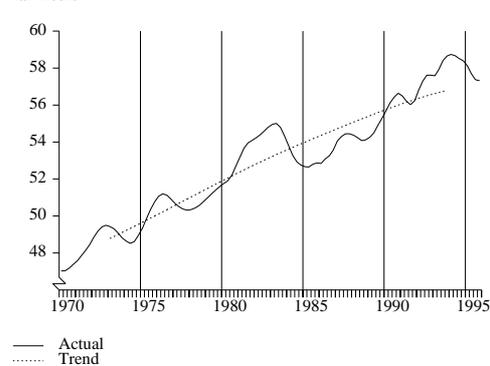


Figure A2.2: Central government consumption purchases

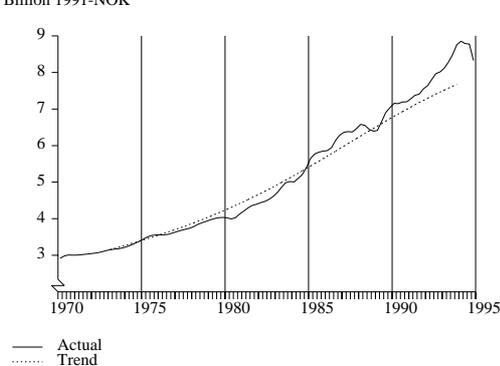


Figure A2.3: Local government employment

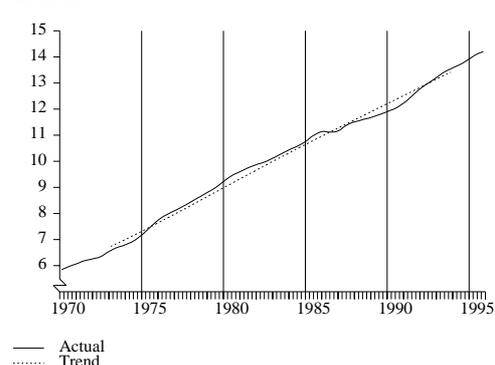


Figure A2.4: Local government consumption purchases

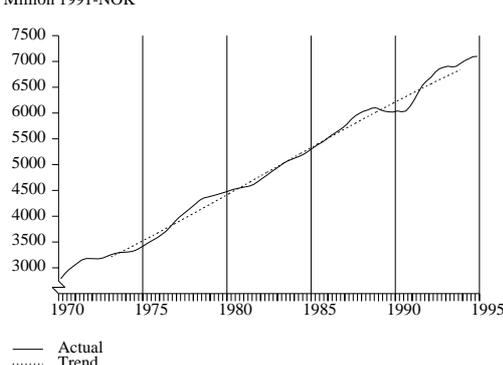


Figure A2.5: Central government real investment

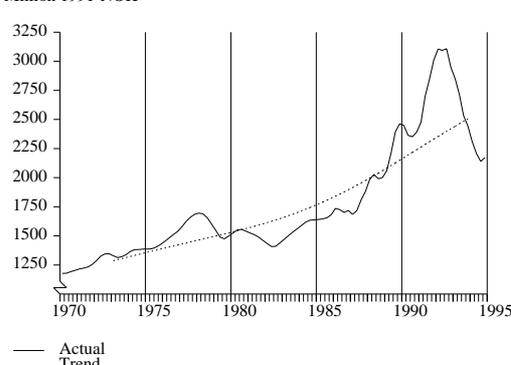
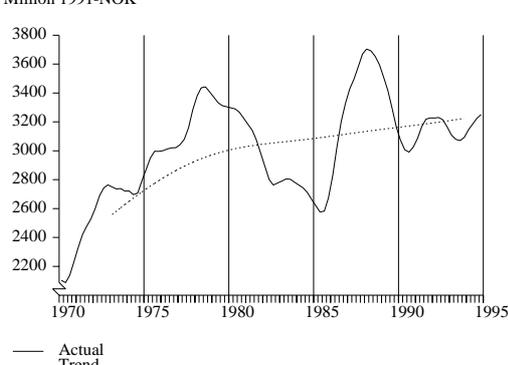


Figure A2.6: Local government real investment



Appendix 3. Detailed data for direct household taxes

Figure A3.1: Average tax rate wage earners
Per cent

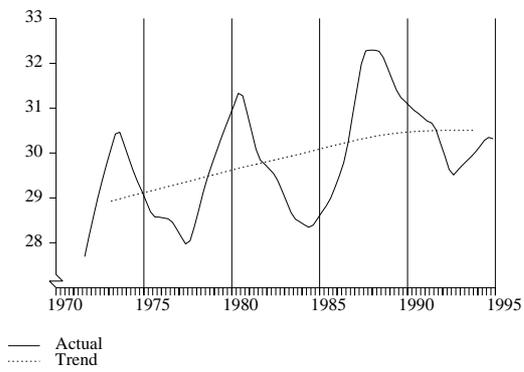


Figure A3.2: Average tax rate self-employed
Per cent

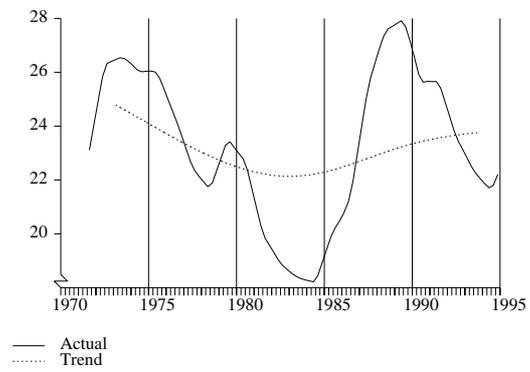


Figure A3.3: Average tax rate pension receivers
Per cent

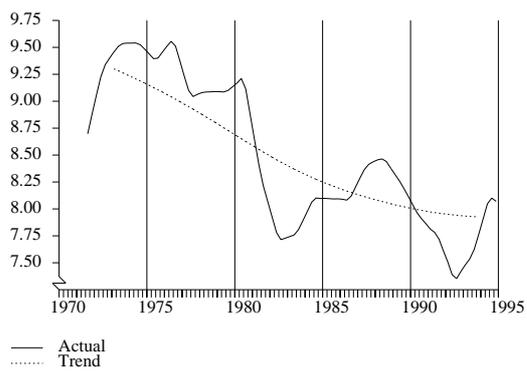
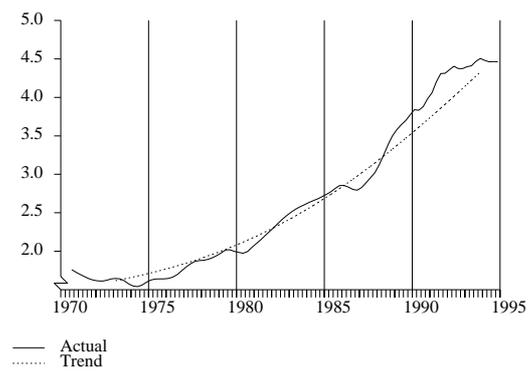


Figure A3.4: Local government fees
Per cent of household sector taxable income



Appendix 4. Detailed data for indirect taxes

Figure A4.1: Sum of payroll taxes and VAT
Deviation from trend. Million 1991-NOK

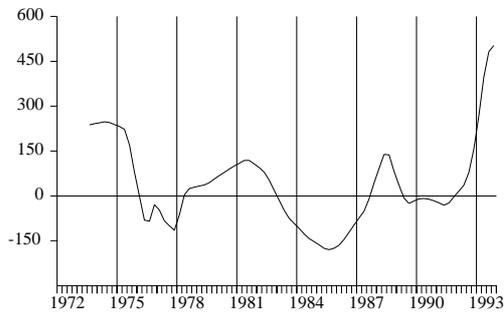


Figure A4.2: Average payroll tax rate
Payroll tax in per cent of total wage payments

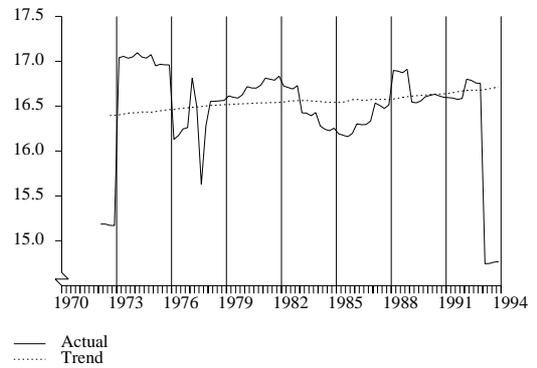


Figure A4.3: Net sectoral taxes *, share of value added
Manufacturing of consumer goods

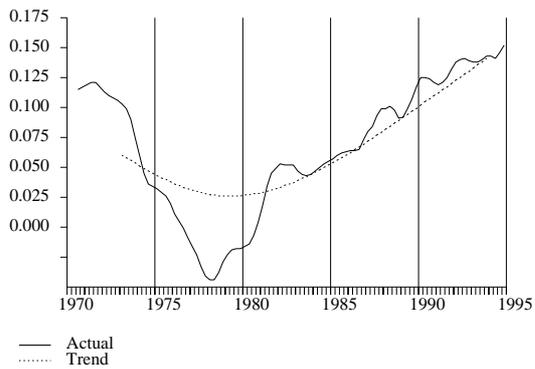


Figure A4.4: Net sectoral taxes, share of value added
Manufacturing of ships and oil platforms



* Including wine and liquor taxes

Figure A4.5: Net sectoral taxes, share of value added
Domestic transport

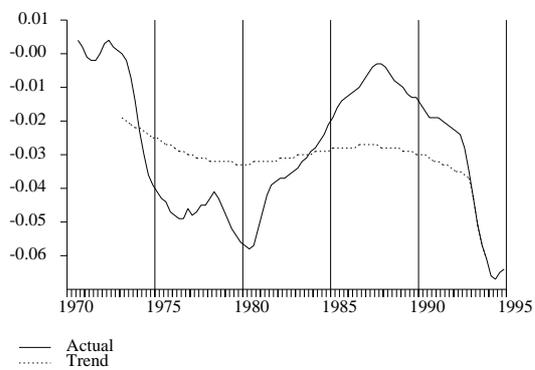


Figure A4.6: Net sectoral taxes, share of value added
Production of miscellaneous services

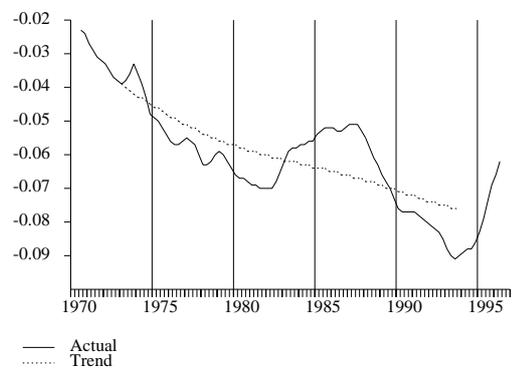


Figure A4.7: Gasoline tax. 1991-NOK per litre
Index 1991=1

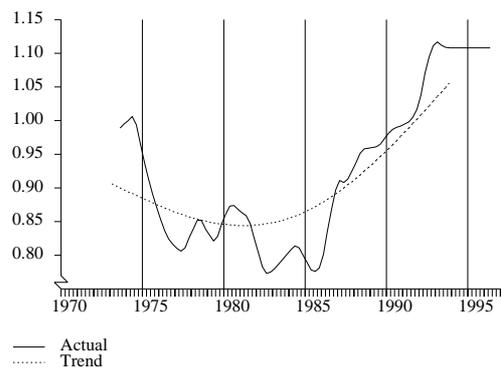


Figure A4.8: Mineral oil tax. 1991-NOK per litre
Index 1991=1

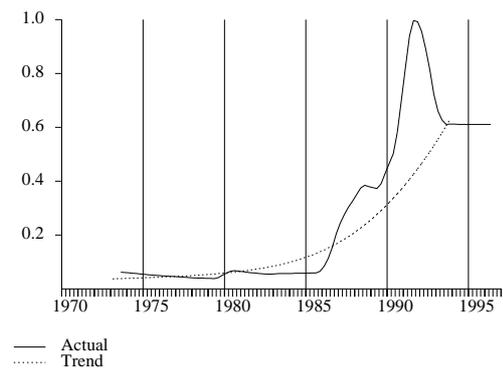


Figure A4.9: Excise tax on electricity. 1991-NOK per GWh
Index 1991=1

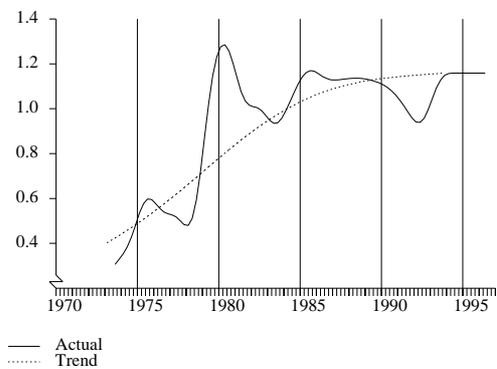
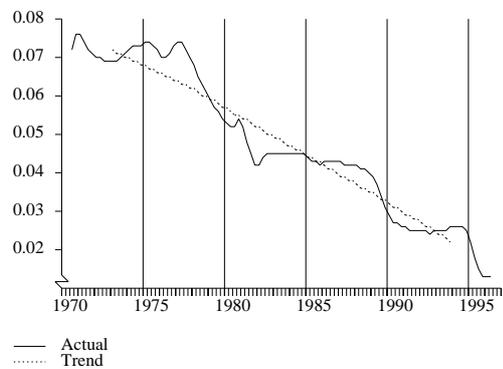


Figure A4.10: Investment tax
Share of private sector real investment where investment tax is levied



Appendix 5. Detailed data for transfers

Figure A5.1: Retirement pensions per person 67 and above
Thousand 1991-NOK

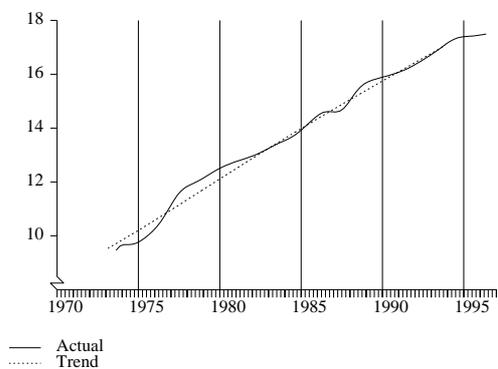


Figure A5.2: Disability benefits per beneficiary
Thousand 1991-NOK

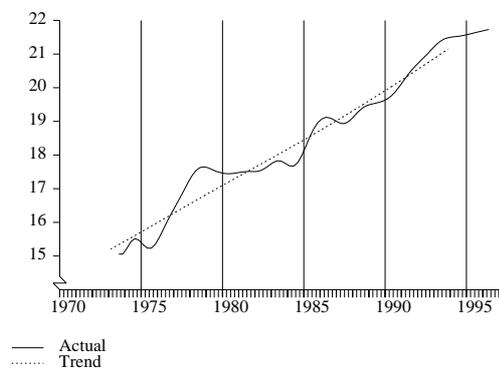


Figure A5.3: Transfers. Billion 1991-NOK
Exclusive unemployment benefits, health transfers,
retirement and disability pensions

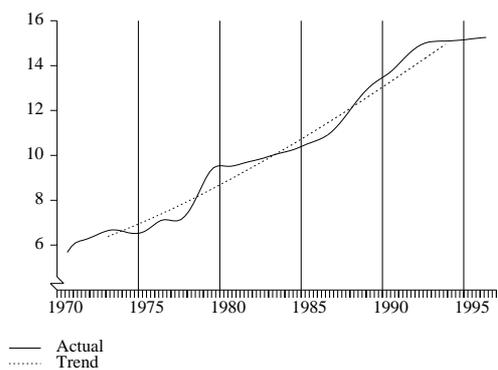


Figure A5.4: Total transfers. Billion 1991-NOK
Exclusive unemployment benefits and health transfers

