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The Annual Report 2004 for the Research Department of Statistics Norway presents the main fields of research in 2004 with complete lists of publications and staff. The Research Department as presented in this report, includes the Social and Demographic Research Unit and the Statistical Methods and Standards Unit which administratively are placed in other departments in Statistics Norway. Other research activities within Statistics Norway are not included in this report.

The Research Department welcomes interest in our publications and activities in general. We are happy to provide information as well as publications to both individuals and institutions. Some of our publications, such as Discussion Papers, Economic Survey and Statistical Analyses, are available free at our website at www.ssb.no (English site: www.ssb.no/en). All paperpublications can be ordered from our Sales and subscription service or via Internet. Our website is also updated with other information about the research activities at Statistics Norway.

Oslo, March 2005

*Ådne Cappelen
Head of Research Department*

General research objectives

The general objectives of the research activities within Statistics Norway are to:

- **enhance empirical knowledge**
Statistics alone is an insufficient source of information for understanding social and economic development. Analysis of statistical data by means of relevant theory and analytical methods and the use of models give empirical insight and deeper understanding of the phenomena under consideration.
- **develop models for analyzing demographic, economic, environmental and social issues**
An important use of empirical insight gained is embodied in the design of tools for government planning, usually in the form of simulation models. Modelling activities are carried out in close contact with user interests and with emphasis on government planning needs.
- **give feed-back to the statistics**
Researchers in the Statistics Norway have a unique position close to the sources of data. This provides special opportunities for exploitation of the data expertise in Statistics Norway, for special organization of data material and links to other sources, and for influencing methods of collection of primary data. The analytic use gives feed-back effects to the statistical work and may improve the quality of official statistics.

Per 1 January 2005

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Tore Eig

IT Services (850)

Torgeir Vik

The research unit is focused on micro data methods and applications. The research falls into several areas, with the following as key activities:

- 1. Developing and applying the tax-benefit model system LOTTE and other static micro simulation models*
- 2. Understanding and application of methods for consumer behaviour*
- 3. Describing distributional effects of policy interventions*

Main findings

The tax-benefit model LOTTE is extensively used by the Storting (Parliament) and the Ministry of Finance, calculating effects on revenue and income distribution from changes in the scheme for direct taxation. Distributional effects of indirect taxes, and in combination with direct taxes from LOTTE, were analysed by LOTTE-Konsum. In 2004 we reached a new peak in terms of model use.

The revenue effects of indirect taxes were estimated by the Ministry of Finance using direct and cross-price elasticities for detailed commodities from KONSUM-G taking into account e.g. cross-border shopping. KONSUM-G is a new model for analysing effects of indirect tax rates on revenue and consumption patterns. It has been applied to analyse the effects of changes in taxes on alcohol and tobacco, taking into consideration cross-border shopping, tax-free shopping, smuggling and illegal home production.

The effects on inequality of revenue-neutral VAT reforms have been analysed combining a general equilibrium model (MSG) and a microsimulation model (LOTTE-Konsum). The Norwegian VAT reform of 2002 which reduced VAT on food and non-alcoholic beverages and introduced VAT on several services reduced inequality, a robust result whatever general equilibrium effects that was taken into account.

Røed Larsen collaborated with professor Timothy Beatty, University of British Columbia on a project designed to estimate the bias in the Canadian Consumer Price Index. The project was completed during 2004, and an article that describes the method and findings will appear in *The Canadian Journal of Economics*. The main result was that the CPI overestimated the costs of maintaining a given standard of living for most of the period during the last two decades. However, recently it seems as if

the CPI may underestimate the costs of living, possibly because of rapidly – and unaccounted for – prices for housing services for self-owners. We quantify these effects for several demographic groups.

An analysis suggests that self-employed, on average, have an actual income 17 percent higher than reported income. This is in line with other estimates based on independent sources of information. The analysis is a replication of a method originally applied on data from the UK. Some formal problems using this method were found but, as yet, the full consequence for the estimate of average under-reporting is unknown.

Means-testing of the child benefit is a much debated policy issue in Norway. An article published in *The Review of Income and Wealth* argues that such discussions must take into consideration that means-testing has adverse effects on female labour supply.

An article published in *International Tax and Public Finance* suggests that effects of tax policy changes to a particular trend in tax progressivity can advantageously be discussed in terms of contributions from components of the tax progressivity index. This method is employed in order to understand the relation between tax policy changes and the reduction in tax progressivity in Norway during the nineties.

Another paper “Tax Reform and the Demand for Debt” published in *International Tax and Public Finance* gives evidence that changes in the tax treatment of household debt affect household borrowing. Using various procedures to correct for endogeneity, the paper demonstrates how the lowering of the value of interest deductibility has reduced the amount of household debt among the households in the upper end of the income distribution.

Alstadsæter completed her PhD thesis at NHH titled "Tax Effects on Educational and Organizational Choice". She shows that there is a substantial willingness to pay for the consumption value of higher education. Taxes can in the presence of a direct consumption value of education induce the individual both to acquire more education than in the absence of taxes and to choose more of the educational type with the higher consumption value and lower wage return. In addition, she analyses the sole proprietor's income shifting incentives under the split model of dual income taxation.

Staff

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The energy research group focuses on studies of the development of energy markets and how national, international and natural external conditions influence the development and use of national energy resources, the environment, the market structure and economic growth. Studies of the behaviour of firms and households and their adaptation to environmental policy is essential, as is the development of partial energy market models and integrated energy market and general equilibrium models. The domestic energy market is dominated by hydropower production with stochastic inflow, which generates separate focused studies on production and transmission capacity limits, strained markets and owner concentration issues. Interlink with thermal markets in neighbouring countries makes international trade studies an important research area.

Water inflow shortage and high electricity prices have brought up several important subjects concerning the vulnerability of the Norwegian hydropower market. Closer evaluations of the price elasticity, volatility and market power are important for the understanding of the total risk for a close to a hundred per cent hydro based power production. We analyse how the electricity market responds to varying and extreme temperatures, precipitation, inflow and climate changes. In the studies of the flexibility in energy markets, the household sector and energy intensive industries are particularly emphasized. In interacting equilibrium models, we study the driving forces in the future energy markets.

We further study the particular role of the energy intensive industries' in the hydropower market, the interacting effects of the phasing out long-term electricity contracts, and the effect of the implementation of a permit market for greenhouse gases. These industries are exposed to multiple political goals with respect to greenhouse gases, stable energy prices and their contribution to a balanced long-term economic growth.

Main findings

After quadrupled prices in the Norwegian electricity market two years ago, politicians have considered the implementation of price differentiation. In an analysis of the effects on energy use and income distribution of introducing a differentiated electricity tax on a revenue-neutral basis, we find that the average high-income households would face higher tax payments than low-income households. However, some low-income households have high electricity consumption and would thus be strongly affected.

Fluctuating prices in the electricity market increase the concern for market power. In a theoretical analysis of the relationship between variations in

inflow and the extent to which major producers can influence prices, we found that uncertainty in inflow increased the opportunity of dominant producers to exercise market power. This can increase the price fluctuations.

The possibility of exercising market power depends on the market concentration, but is also depending upon the elasticity of demand. In a separate project we have developed a simultaneous demand and supply model for two countries to estimate the short term flexibility of demand based on high frequent market clearing data. Demand elasticities varies hour by hour and over days in a week. Low and systematic variation in estimated elasticities imply a potential of abusing market power.

It is a common view that environmental regulations hamper productivity growth. In a study of the relationship between environmental regulations and productivity growth for some of the most polluting manufacturing industries in Norway, we find that a positive relationship between regulatory stringency and productivity growth, when we include emissions as an input. With a traditional productivity measure without emissions, the relationship is not significantly different from zero.

The Integration Pollution and Prevention Control (IPPC) directive from EU is under implementation in Norway. The directive implies regulation caps in accordance with best available techniques. This system involves less economic efficient environmental regulations than in the present Norwegian system. In a study of the consequences of the Norwegian manufacturing industry, we find that implementing the IPPC principle gives substantial emission reductions while the total abatement costs are higher than in the present system for the given abatement level.

Relocation of dirty production and environmental pressure to economies with laxer abatement regimes can be one of many explanations to environmental improvements in rich countries. We do not find support for such relocation in the Norwegian economy the last decades, but using a forecasting model, we find that such relocation may take place in the future, mainly to our neighbouring, rich countries. When increasing the carbon taxes, environmental benefits fall and the economic costs rise when a global rather than a national perspective is employed.

A new instrument in energy policy is the so called green certificate system or just electricity certificates. In theory this instrument is a market based combined tax and subsidy instrument. The Government issues certificates to entitled technologies and introduces a purchaser obligation to buy certificates in accordance to the amount of purchased electricity. In an analysis we show that introduction of such certificates in Sweden and Norway may have a limited effect of prices and volumes since most technologies introduced will be introduced anyway. The most important effect then is a redistribution of income effect besides a minor efficiency loss.

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The unit is engaged in empirical studies of the Norwegian economy - structure and development - in a macroeconomic perspective. The research is based on Statistics Norway's short-term statistics and national accounts data, and development and use of econometric time series methods and models. Important external users of the models are Ministry of Finance, Ministry of Labour and Social Affairs and Stortinget (the parliament).

Business cycle analysis

Economic surveys and forecasts are published quarterly in parallel editions in Økonomiske analyser (ØA) and Economic Survey (ES). ØA is a paper publication and is also available on the Internet, while ES is only published electronically. The forecasts are constructed using the quarterly macroeconomic model KVARTS. The Research Department is a member of AIECE (Association d'Institutes Européens de Conjuncture Economic) and the UN-based Project LINK, linking several national macro models to a global model.

Documentation: ØA 1/2004, 3/2004, 4/2004, 6/2004, ES 1/2004, 2/2004, 3/2004, 4/2004, [39], [73], [74], [75], [89], [90], [91], [92].

Macroeconomic models and econometric analysis

The development and use of the two large macroeconomic models - the quarterly model KVARTS and the annual model MODAG. Except from the difference in data frequency, the economic content in the two models is almost identical. The KVARTS model is used for forecasting and economic analysis in our business cycle reports. The model is also used to provide alternative scenarios for the Government appointed Expert Committee for Income Settlements in connection with the annual nation wide wage and income negotiations. The MODAG model is mainly used by the Ministry of Finance for forecasting and policy analysis, and by the unit itself in assisting fractions in the Standing Committee on Finance and Economic Affairs in the parliament. Both models have been central tools in various historical/counterfactual studies of the Norwegian economy.

The models comprise at the moment 28 sectors of production and 48 commodities. Although many of the parameters in the models are econometrically estimated, several coefficients, including the in-

put-output structure, are each year calibrated to the most recent final national accounts data.

For most production sectors (22) a set of factor demand equations are specified based on Cobb-Douglas production functions. The factors specified are labour, energy (nested CES-elements for electricity and fuel), other material inputs, and three components of fixed capital (machinery, transport/equipment, and structures). Separate prices of imports, exports and domestic production for the domestic market, are specified for each commodity. The price formation is according to the theory of monopolistic competition. Import prices are determined as functions of a limited number of world market prices and the exchange rate. The exchange rate may be determined by a combined PPP and UIP approach. The modelling of export volumes and import shares are based on the Armington approach.

Households' supply of labour is disaggregated by gender and age to take account of large differences in labour market behaviour for various groups. There are substantial "discouraged worker effects" and moderate after tax real wage effects in the aggregate labour supply. Household demand is specified using a macro-consumption function and a housing investment equation. Both depend on household real income and after-tax real interest rate. Allocation of household demand on consumer categories is based on a dynamic version of the AIDS system.

Based on the input-output structure and the commodity classification, indirect taxes and subsidies are specified in great detail. This is also the case for direct personal taxation, where the tax rates are aggregated from a microeconomic model which links the actual tax structure to the large micro-database of recent individual tax forms. The Norwegian economy is characterised by a comprehensive public transfers system and the link between labour market variables and parts of the transfers

to old age pensioners are modelled in a simpler way.

In 2004 both models were reestimated, based on the revised national accounts data published for 2002 in 2004. As part of the reestimation, the macro consumption function and the equation for investments in housing have been significantly changed. In addition, work has been centred around the following topics: Exchange rate and financial sector modelling, forward looking expectation in inflation targeting, and methodological problems related to testing trend breaks in time series.

Documentation: [13], [16], [40], [51], [52], [65], DP391, 395, Reprints 287, NOT 2004/85.

Main Findings

In all four economic surveys in 2004, our forecasts predicted inflation below or on target for the next 3 years without any significant increase in Norwegian signal rates. During 2004 Norway has been in a pronounced cyclical upturn, and the GDP-level were expected to be above trend in the whole period. Increased integration of China in the world economy, moderate growth in the euro-area and moderate domestic wage growth together with large increases in oil investments, were some main factors behind these predictions.

An often-used approach in estimating factor demand systems is to (implicitly or explicitly) assume that there is a stationary relationship between the use of an input factor and the relative price of this input factor (plus maybe some additional variables). In the Cobb-Douglas case this implies assuming that the budget shares are stationary. Empirical tests on a Norwegian production sector indicate that this is a too strong assumption. The rejection of the hypothesis of stationary budget shares is interpreted as effects of technological changes.

Many time series exhibit shifts in their level or trends. However, in economic interpretable (long-run) relationships these shifts may cancel out. If that is the case, the economic relationship is said to

co-break. To analyse such properties, we decompose the structural shifts in a cointegrating multivariate model. By doing this, we can test the hypothesis in a maximum likelihood framework. To illustrate the method we apply to analyse German money demand during the re-unification. The re-unification clearly led to structural shifts in the GDP and M3, and the empirical results indicate that there is also some evidence of structural breaks in the long-term money demand relationship.

Actual portfolios of Norwegian households seems to be close to estimated optimal portfolios indicated by a mean-variance frontier. To induce a substantial change from housing to equity, taxation of the consumption stream from housing is needed. An alternative; taxation of capital gains from housing investment could actually increase the relative holding of housing.

Exchange rate pass-through to Norwegian consumer prices is not complete in the short and medium term. The pass-through to Norwegian import prices is swift, but far from immediate. Prices of domestic produced intermediate and final goods react gradually. The distribution sector delays the pass-through by letting their trade margins act as cushion in the short run.

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The central aim of the unit is to obtain new knowledge of the functioning of the labour market and firms' behaviour through econometric analyses of Statistics Norway's microdata, and to use this knowledge in analysing economic issues. In connection with this work, the unit also contributes to the development of relevant theories, methods and databases.

Our main fields of analysis include

The relation between labour supply and business cycle conditions

Technological change and workers' retirement decisions.

The returns to and choice of education

Education and inequality: Sorting, resources and outcomes

Barriers to increasing female employment

Measurement of capital and innovations

Effects of fiscal incentives to R&D

Efficiency, growth and firm exit

Price index methods

Econometric methods

Main findings

Based on a new method for estimating tangible fixed assets in current prices at the firm level, we have established a database for tangible fixed assets for Norwegian manufacturing firms, covering the years 1993-2002. Book values, which are based on historic prices, on fixed tangible assets from the accounts statistics for joint-stock companies in the Norwegian manufacturing industry are

combined with investments in tangible fixed assets from the manufacturing statistics. The capital estimates in current prices are calculated using price indices for new capital goods to adjust the book values on tangible fixed assets. The database is available for researchers.

We have established a framework for calculating indicators the contribution of schools to pupil learning, taking into account that pupil composition varies between schools.

During 2004 work on quality-adjusted price indexes has continued. For automobiles, results show that both the hedonic method and a quality-adjustment method based on discrete choice theory give a price level considerably lower than the conventional index.

Staff

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The aim of the unit is to analyse the most important factors behind the development in public revenues and expenditures. Growth in tax revenues, transfers and demand for public services are strongly dependent on demographic factors, development in supply of labour, economic growth in general and its allocation. Economic consequences of long run fiscal imbalances and policies to reduce these imbalances are a natural part of the analyses.

An important objective for the research is to provide quantitative information. The research activities at the unit may be grouped in two main categories:

1. The analyses of the effects on transfers to households and income distribution as a consequence of demographic development, supply of labour, and pension regulations are mainly based on development and use of a dynamic micro simulation model, MOSART. Specific micro based analyses of behavioural effects and in particular analyses of saving behaviour are currently going on.
2. The interaction between the general economic development and fiscal sustainability is subject to analyses by general equilibrium models. For the time being our most appropriate CGE-model is the MSG-model. Effects of changes in the pension system, taxation and the level of public services are central areas of research. The sustainability in public finances, effects of using petroleum revenues, excess burden of taxation and Dutch disease are also given attention.

Main findings

Conclusions from analyses for the Norwegian Pension Commission include:

- Changes in the pension system towards higher proportionality between pension entitlements and former labour income in addition to making the yearly pension benefit dependent on the retirement age, may increase employment and reduce public expenses.
- A shift in this direction keeping average pensions unaltered, however, favours those with higher incomes and is unfavourable for women.

- Pension reforms that are based on a higher degree of prefunding, must be followed up by adjustments of the industry structure. In particular, increased national savings will take place through increased net exports, which warrants an expansion of the traded goods sector.

To shed new empirical light on the fiscal sustainability problems facing Norway, a detailed micro-econometric model of labour supply has been integrated with a large scale CGE model. Taking this detailed response on labour supply into account the estimated required increase in the future tax burden is reduced. Moreover, labour supply responses reduce the pressures on public finances much more significantly if the present taxation of personal income is replaced by a flat tax rate.

New micro data on household saving has made it possible to analyse Norwegian saving behaviour along three dimensions; age, period and cohort. The main findings are 1) the propensity to save increases steadily with age, most likely due to a combination of precautionary savings and bequest behaviour, 2) there are no significant generational differences in saving behaviour, and 3) household saving over time responded to credit liberalization with a temporary decline, and responds less to revaluations of real assets than is previously assumed on the basis of macro data.

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The research group is preoccupied with analyses that include a geographic or administrative dimension on the subnational level. The focus is on the behaviour of local governments and their priorities between different service sectors and different recipients. Local public finance is combined with analyses of distribution and efficiency. Moreover, the behaviour of individuals is studied in the setting of migration, labour market mobility and regional competition. Economic models have been developed to provide future scenarios for employment and labour force in different regions, and for local government service production by service sector.

The research group is preoccupied with analyses that include a geographic or administrative dimension on the subnational level. The focus is on the behaviour of local governments and their priorities between different service sectors and different recipients. Local public finance is combined with analyses of distribution and efficiency. Moreover, the behaviour of individuals is studied in the setting of migration, labour market mobility and regional competition. Economic models have been developed to provide future scenarios for employment and labour force in different regions, and for local government service production by service sector.

In analysis of local government production a macro model MAKKO is used to project employment and the number of clients in local public services in Norway. MAKKO contains submodels for services provided by local governments, like kindergartens, primary and secondary education, health care and care for the elderly.

A microeconomic model KOMMODE has been developed to analyse the fiscal behaviour of local governments. A linear expenditure system has been applied to the estimation of price and income elasticities for eight service sectors. Budget deficits and expenditures in different service sectors are endogenous variables. Moreover, the model accounts for heterogeneity in local tastes and production costs. A number of projects that applies KOMMODE in analyses of income distribution, efficiency and municipality mergers are in progress. The model has also been applied to derive a classification of municipalities.

The regional macroeconomic model REGARD is used to support the analyses and projections of the development in regional labour markets and migration. The present economic part of the model is

a simple submodel to the macroeconomic models MODAG, KVARTS and MSG. A demographic model block takes care of internal migration and labour force participation. The model provides projections of labour market imbalances, illuminating the implications for regional employment, labour force and population growth of a given macroeconomic scenario and from changes in economic policy. In 2004 the model was used in the preparation of economic surveys for a Norwegian region.

A project investigating urban and regional labour market mobility in Norway was completed in 2004. This project is included in the Norwegian Research Councils' programme "Urban development - driving forces and planning challenges". A Nordic co-operation project on labour market mobility, analysing regional economic renewal and demographic change in Denmark, Finland, Iceland, Norway and Sweden, was also completed in 2004. The project was directed by Nordregio (Nordic Centre for Spatial Development) in Stockholm.

In an ongoing project the purpose is to construct household data files on the basis of family registers from 1993-2001 as well as the census of 2001 and 1990. Such household panel data are valuable in empirical analysis of income distribution and poverty.

Main findings

We are able to identify a large share of cohabitant households by tracing family histories in panel register data and censuses.

The incidence of poverty in Norway is relatively high in the capital city Oslo, especially when regional variation in housing prices has been taken into account.

There is generally a higher gross mobility in the knowledge-based service industries compared with the total economy.

The level of gross mobility to job is generally lower among Norwegian citizens compared with all other main citizen groups in Norway.

There is a clear tendency that non-mobile employed had a weaker income growth compared with employed persons that were mobile within or between the regional labour markets.

Staff

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The purpose of the research activities in this unit is to contribute to increased understanding of long-run adaptation of the Norwegian economy to changes in policies with special attention to impacts of taxation, industrial policy, trade policy, innovation policy and environmental policy on macroeconomic efficiency and economic growth processes. Our main tools are general equilibrium models.

The most recent version of the numerical general equilibrium model (MSG-6) has endogenous labour supply, intertemporal consumer and producer behaviour based on perfect foresight, an integrated emissions-to-air module linked to the economic activities, a detailed description of the electricity market and a specified representation of the link between firm and industry behaviour, where heterogeneity between firms and imperfect competition are accounted for. This year's work has been concentrated on completing the re-formulation of the model of public revenue and expenses, and completing the re-estimation of the elasticities of substitution in the production technology for the different industries.

The unit has also started on a new project where the main aim is to get a better understanding of the main growth mechanisms present in a small, open, oil- and gas producing economy as the Norwegian. The project puts especially emphasis on the development of new environmental friendly technologies. Interactions between innovation policies and abatement policies have impact on the abatement costs of achieving and maintaining a given environmental emission target.

Main findings

We empirically address two interlinked hypotheses on growth and the environment. The *delinking hypothesis* claims that in rich economies emissions tend to fall along with economic growth. The *load replacement hypothesis* predicts that growth in rich countries cause emissions to move abroad. By using a dynamic computable general equilibrium (CGE) model for the Norwegian economy we are able to isolate and quantify the different growth-environment links, and simultaneously compute the replacement of emissions abroad due to altered trade. Projections indicate that technological development, compositional changes in economic activity, and endogenous policy, will bring about a delinking so that in the next decades several local

pollution problems will diminish, while climate gas emissions will grow slower than GDP. However, when accounting for foreign emissions linked to our growth, the picture is less optimistic. This result seems robust to various climate policy assumptions.

Documentation: DP 384, Bruvoll, A and T. Fæhn (2005): Økonomisk vekst - medisin mot dårlig miljø? Forthcoming in Økonomisk Forum (In Norwegian, only); Bruvoll, A and T. Fæhn (2005): Rett i hodet på naboen? Økonomisk vekst, miljøpolitikk og utslipp innenfor og utenfor grensene, forthcoming in Økonomiske Analyser (In Norwegian, only)

The effects on the degree of equality of reforms in indirect taxation are analysed by using a microsimulation model of the Norwegian economy subsequent to the CGE model. The two main reforms studied are substitution of a uniform VAT rate on all goods and services and substitution of the non-uniform Norwegian VAT reform of 2001 for the previous, differentiated system. A main characteristic of the non-uniform reform is the halving of the VAT rate on food. All reforms are made public revenue neutral by changes in the VAT rate. The non-uniform VAT reform leads to a clear increase in equality, while the change in equality concerning the uniform reform is close to 0. The halving of the VAT rate on food contributes to increased equality with the non-uniform VAT rate. With the uniform VAT reform, as opposed to the non-uniform, decompositions show that taking CGE effects into account has a large impact on the degree of equality.

Documentation: DP 392, ØA 6/2004

Efficiency-enhancing energy tax reforms tend to be difficult to implement due to strong political resistance from powerful industries. The major energy- and pollution-intensive industries of Norway are today exempted from paying consumer tax on electricity. Two different CGE studies quantify the welfare potential of equalizing the tax. The first

study investigates the social costs of compensating for subsequent equity losses borne by the energy-intensive industries, while the second study investigates the costs of compensating by production dependent subsidies (can be interpreted as transport subsidies) when employment is assumed to be fixed in the energy- and pollution intensive industries. We find that the welfare gains of equalizing the tax rates are positive and only falls by 15 percent, when combined with the compensation of equity losses. This modest compensation cost is mainly explained by the possibility of the industries to shift part of the tax burden on to suppliers of electricity. It also hinges on the ability of the compensation scheme to stimulate entrance of new firms and products, which enhance productivity and welfare. The second study finds that it is more efficient to save jobs by implementing sector specific production dependent subsidies than subsidizing electricity.

Documentation: DP 387 and Bjertnæs, G.H. Avoiding Adverse Employment Effects from Energy Taxation: What does it cost? manuscript, Statistics Norway.

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The aim of this research unit is to investigate how national and international policies and other conditions affect the value of Norwegian natural resources, the environmental state in Norway and internationally, and the interactions between the economy and the environment. A central part of the research work is to develop and maintain model tools that enable us to consider important natural resource and environmental issues related to economic development.

The oil market is very important for Norway, and is investigated by e.g. econometric analyses. Moreover, a simulation model for the international energy markets, with special attention to the supply side of the oil market, has been developed. The model is used to analyse the future development of the oil market, and will be used to analyse other oil market issues as well as gas market and climate policy issues.

The European gas market is also important for Norway, and the supply of Russian gas and LNG from distant sources is crucial for the future gas prices in Europe. Both these sources of gas supply are examined in separate studies (econometric analyses and simulation models), and the effects on the gas market is analysed within a simulation model for the European energy market (developed together with the Frisch centre). This model is also used to analyse the effect of liberalization and environmental policy in the European energy market. A simulation model for the Nordic power market is also developed and used to analyse various policy scenarios and market behaviour (cf. Unit for Energy and Environmental Economics). Sustainable development of the national wealth in Norway, with emphasis on natural resources, has also been analysed.

The Kyoto Protocol and international climate policy are also examined within a simulation model for CO₂ abatement in different regions. The effects of the protocol without the U.S. have been analysed, and the position of Russia as a big player in both the quota market and the European gas market is investigated. Moreover, the potential for CDM projects in the agricultural sector of developing countries, as well as energy projects in China, are analysed. The market effects of different allocation rules in national quota markets are also examined. Economic activity in the Arctic, and impacts of climate change, will be analysed in a new project.

To achieve long-term climate targets, carbon-free energy technologies have to be further developed, and the innovation and learning processes in this respect are analysed within theoretical and numerical models. We examine the effects of innovation and abatement policies on the technological development and economic welfare. The market structure of the R&D sector is also important here, and the Porter hypothesis is examined under various assumptions.

Firms' behaviour with respect to the environment is investigated in several projects. First, we study how the risk of environmental policy and the demand for green or ethical funds affect firms' investments decisions. This question is analysed both theoretically and empirically. We have also investigated how firms act in accordance with their pollution regulations, and how the authorities act in accordance with violations of these regulations. Consumers' behaviour is also investigated through experimental analyses, focusing on how social norms affect consumers' actions.

Main findings

The relationship between industrial competitiveness, adaption of cleaner production techniques and environmental policy has been analysed, focusing on an up-stream market for new pollution abatement technology. A strong environmental policy is found to benefit industrial competitiveness through its effect on the price on pollution abatement. However, the incentive for a stringent policy may partly disappear if there is a global market for pollution abatement solutions.

Documentation: DP 371.

The effects of regulatory inspections on compliance and emissions of energy intensive manufacturing plants in Norway have been investigated. Regression analyses show that increased probability of

inspection reduces the probability of violation. On the other hand, the analyses reveal a *positive* relationship between the probability of an inspection and emissions, which may question the usefulness of current inspections.

Documentation: DP 381.

Different empirical studies of the oil market have revealed that 1) oil demand is fairly inelastic with respect to the oil price, particularly in the short-run but also partly in the long-run; 2) oilrig activity responds fairly quickly and strongly to oil price changes in most countries in the Western Hemisphere, but only slowly and weakly in other parts of the world; 3) OPEC does not behave like an efficient dominant producer in the oil market, but clearly neither like a competitive producer.

Documentation: DP 372, DP 373, DP 385.

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The general aim of methodological statistical research is to improve the quality in collection, production and analysis of statistics. The research encompasses the following areas:

- **General survey design and estimation in survey sampling**
- **Nonresponse and imputation**
- **Variance estimation**
- **Small area estimation and registers**
- **Census methodology**
- **Time series and seasonal adjustment**
- **Disclosure control**
- **Statistical standards and metadata**

Nonresponse and imputation

All sample surveys face the problem of nonresponse, resulting in incomplete data. As in many other countries, the response rates in Norway have shown a declining trend. Research on theoretical studies of imputation methods is a continuing activity, mainly concerned with developing model-based methods for reducing the bias due to nonresponse, using weighting adjustment for unit nonresponse and imputation for item nonresponse. Also nonparametric approaches have been studied. The basic imputation method considered is random draws from the estimated distribution given nonresponse.

Documentation: DP 297 (2001), NOT 2001/50, 2003/57, 2003/58, [29]

Variance estimation

Statistics Norway is increasing its efforts in giving estimates of uncertainty in official statistics, taking into consideration sampling design, nonresponse and imputation method. The research aims at developing variance estimates and related confidence intervals, of different types, not only the usual estimated sample variance (s.v.) of the population total estimator. Other measures of uncertainty are estimated conditional s.v. for poststratified and calibrated estimators, estimated model variance and estimated method variance. The Division for Statistical Methods and Standards has participated in an EU funded three-year research project ending in 2004, DACSEIS (Data Quality in Complex Surveys within the New European Information Society), with two main contributions, (i) how nonresponse and imputation methods affect variance estimation and (ii) developing a new multiple imputation method. In this project a recommended practice manual for variance estimation has been developed. The project team consisted of University of Tübingen, University of Southampton, Swiss Federal Institute of Technology, Johannes Kepler University Linz, and the national statistical institutes in Finland, the Netherlands, Austria, Switzerland, Germany and Norway.

Documentation: DP 311 (2001), NOT 2003/46, 2003/56, 2004/86, DOC 2004/10, [70]

Small Area Estimation

Small area estimation has been the subject of a number of studies throughout the years. A wide range of methods has been investigated including synthetic estimation, empirical Bayes methods, model-based approach and neural network.

Current research has been connected with the three-year EURAREA project ending in 2004, under the 5th Research Framework of EU, where Statistics Norway participated together with the Office for National Statistics (UK), Statistics Finland, Istituto Nazionale de Statistica (ISAT, Italy), Statistics Sweden and Instituto Nacional de Estadística (INE, Spain). These are joined with the academic researchers at the University of Southampton (UK), Jyväskylä (Finland), and Poznań (Poland). It had four major themes, namely, use of time series data, use of geospatial information, survey data with complex sample design, and small area cross-classifications.

Documentation: Reprints 251, NOT 2004/5, [30], [31]

Use of Administrative Registers

Use of administrative registers often improves surveys by reducing the sampling variance, reducing the bias caused by noncoverage and nonresponse, and imposing consistency between the various sources of data. Instead of considering single surveys, recent research has focused on the effects of registers for measure of changes. The current research aims at methods beyond post-stratification and calibration, which may be more suitable and flexible for certain types of data, such as the household income and wealth. Research in this respect is closely linked to that on combining data sources and integrated statistics.

Time Series and Seasonal Adjustments

Statistics Norway uses the X-12 ARIMA seasonal adjustment program developed by the Time Series Staff of the Census Bureau's Statistical Research Division to make seasonal adjustments of economic time series. It has been necessary to make adds-on to make correct adjustments for Norwegian holidays.

Documentation: NOT 2004/14, 2004/29, 2004/30

Disclosure Control

Disclosure control is relatively new as a research topic in Statistics Norway. Work done so far has dealt with confidentiality problems in frequency tables. Methods for stochastic controlled rounding have been extended to multiple two-way marginals for higher dimensional tables (unpublished). The Web StatBank Norway poses new research challenges in this field.

Statistical Standards and Metadata

General aspects

Work concerning statistical standards in Statistics Norway is decentralised so that each division is given the responsibility for classifications within their own statistical field. This concerns all aspects of the classifications unless otherwise decided by the Director General. For the purpose of coordination a Standards Committee is established. The committee acts as a catalyst and supervises statistical standards. The Division for Statistical Methods and Standards serves as the secretariat of the Standard Committee and is responsible for the central work connected to standards.

Classification database

Statistics Norway, in cooperation with Statistics Denmark, has established a database for statistical classifications. The database became available on the Internet in 2004. In connection with this work, Statistics Norway has participated in the Neuchâtel group (also consisting of Statistics Sweden, Statistics Denmark, Statistics Switzerland and Run-Software from Germany) where the aim has been to establish a common terminology for classification databases.

Metadata

An important part of the standardization work is connected to metadata. A strategy for metadata in Statistics Norway was made in 2004. A metadata system for documenting all important/central variables has been developed. This will be used as a tool for standardization of variables, and will improve accessibility to variable information for all users inside (and eventually outside) Statistics Norway. Work in 2004 concentrated on developing functionality and documenting variables in cooperation with a selection of divisions. This system is a first step in an effort to coordinate and link the different metadata systems in Statistics Norway. Statistics Norway has also developed a dissemination database for ag-

gregate data, StatBank Norway. Structured metadata is an important part of the database.

Documentation: DOC 2004/14, [88]

Main findings

Statistics Norway has developed methods for estimation of small area cross-classifications in the EU funded project EURAREA. The proposed methods has been tested based on the data from Sweden and Italy. Properties of the alternative approaches have been compared based on a large-scale simulation study. Outcomes of the project include documentation of the related theories, recommendation for practice and software packages for implementation.

The frequentist method of simultaneous estimation for a large number of small areas has been extended to regression models. In general, estimators that are optimal for area-specific prediction may have unsatisfactory ensemble properties. The simultaneous estimator substantially improve the estimation of the ensemble characteristics of the small area parameters, without losing much of the precision of the area-specific prediction.

A nonparametric Markov chain bootstrap for multiple imputation has been developed. This approach is useful when parametric settings are inappropriate or difficult.

In variance estimation with imputed data, it is important to separate out the component due to the imputation uncertainty. A new method for dealing with this problem has been developed as part of the DACSEIS project.

Multiple imputation for estimating variance in the presence of nonresponse has become a widely used method outside the national statistical offices (NSI). It is at present not suitable at the NSIs because it assumes a Bayesian method for imputation. A general approach for non-Bayesian methods of multiple imputation has been suggested and will be studied further.

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The general objective of the division is to analyse demographic development and changes in economic and social living conditions of the population. The research activities combine micro- and macro analytic approaches to the analyses of demographic and socioeconomic processes. On-going activities are divided into four areas: (a) Population development, migration and mortality, (b) Fertility, nuptiality and changes in family structure, (c) Immigration and social change and (d) Living conditions and social participation. Research results from demographic analyses also serve as input for revising model structure and parameters of forecasting and simulation models in Statistics Norway. The division is responsible for BEFREG (Statistics Norway's model for national and regional population projections).

Demographic research

Population projections, population development, migration and mortality

The migration module for regional population projections introduced in 2002 was evaluated and found to improve the results. Projections were also made to analyse the sensitivity of changes in mortality and immigration on the future ageing. Preparations were started for new projections to be published at the end of 2005. The division has a general responsibility for monitoring and analysing trends in population development, both at the national level and in a comparative context, regionally as well as internationally. The division is involved in cooperation with the other Nordic countries on the projection of mortality in population forecasts. We represent the Ministry of Foreign Affairs in international advisory bodies on population issues (United Nations Commission for Population and Development and the Population Committee of the Council of Europe) and participate in international advisory activities.

Documentation: DP 386, DOC 2004/2, ØA 1/2004, 5/2004, [14], [43], [45], [71], [93].

Fertility, nuptiality and changes in family structures

In recent years a substantial part of the research has focused on structural changes in central demographic processes, in particular fertility, nuptiality (marriage and cohabitation) and family formation, including the effects of changes in female labour force participation and in family policies. Analyses of recent fertility trends are based on an extension of earlier analyses of register data for the period 1935-1990. For more complex analyses of fertility trends and new patterns of family formation, population register information are linked to various sources containing possible explanatory variables. The doctoral project "Fertility, education and social change: Increased diversity in life strategies?" focuses on differences in fertility patterns between women with different types of educational background. The family formation process in a gender perspective is focused. We analyse the family formation of men, based on register data of regis-

tered births (recognized fatherhood) for selected male cohorts. Increased diversity in life course strategies is a key feature in the fertility as well as the nuptiality analyses of the division. Taking different kinds of diversity in family formation under consideration, we also analyse registered partnerships (same-sex couples). The doctoral project "Cohabitation 1970-2000: a silent revolution?" focuses on the growth, types and reactions of cohabitations in the different decades. In another doctoral project "The Family Dynamics of Contemporary Norway" two of four problems examined are related to divorce determinants: How do spouses' social background affect their divorce risk, and is divorce risk affected by the spouses' supply and quality of alternative partners? In addition, the project studies cohabitants' commitment to their partnership, their propensity to marriage, and the interrelations between first birth and first union formation. The division is involved in the Generations and Gender Programme coordinated by UNECE in Geneva. The division also participates in several collaborative networks with other research institutions, including a Nordic network on register data analyses of family formation and effects of family policies; two networks use interview data to compare family formation in Sweden and Norway and in European countries, respectively. We also take part in a network on same-sex partnerships in Europe.

Documentation: REP 2004/16, Reprints 278, 279, 280, 281, 282, ØA 6/2004, SSP 3/2004, 6/2004, [21], [26], [27], [60], [62], [94], [97], [98].

Social research

The activities concerning social research are increasingly focusing on more specialized analyses and research projects and less on general social reporting. Most of this research is financed as commissioned research, which presents special challenges. We do both cross-sectional and longitudinal analyses, based on surveys as well as administrative registers, including generational changes in the level of living over the life course, differences between various population groups, and gender differences in the outcomes of social

processes. The level of living is studied both in terms of material conditions such as income, housing and labour market participation, and in terms of social integration and isolation, and as time use patterns, often with a focus on the effects of social welfare policies on particular population groups.

Immigration and social change

The living conditions and integration process of immigrants and refugees are studied in several projects, including an analysis of people's attitudes to immigrants and immigration, an analysis of changes in residential patterns of immigrants in Oslo from 1988 to the present and one of social and economic integration of single-year cohorts of refugees settled in Norway 1987-1999. In 2004 we also finalized several analyses for the Ministry of Local Government and Regional Development in connection with a white paper on "the Multicultural Norway", and took part in the preparation of a new survey on the living conditions among immigrants.

Documentation: NOT 2004/65, 2004/66, 2004/75, SSP 2/2004, Reprints 284, [6], [108], [109] http://www.ssb.no/magasinet/slik_lever_vi/ 16. juni 2004, http://www.ssb.no/magasinet/slik_lever_vi/ 11. august 2004, http://www.ssb.no/magasinet/slik_lever_vi/ 8. oktober 2004.

Living conditions and social participation

A substantial part of the ongoing research focuses on various aspects of the living conditions of parents and children, including parents' working time arrangements, as well as the division of labour at home. We are also engaged in a project evaluating the new regulations of alimony contribution for children, in projects exploring the living conditions among farmers and among various groups of offenders, as well as in a project investigating the living conditions in the inner city of Oslo. In 2004 we finalized an analysis on the causes and characteristics of various types of part-time employment, and also a project on trends in various indicators of people's living conditions as well as of people's perceptions of society and their own well being.

Documentation: SA 64, REP 2004/6, 2004/15, 2004/29, Reprints 277, 283, SSP 2/2004, 3/2004, 4/2004, 5/2004, 6/2004, [15], [44], [59] http://www.ssb.no/magasinet/slik_lever_vi/art-2004-03-08-01.html, http://www.ssb.no/vis/magasinet/slik_lever_vi/art-2004-09-15-01.html http://www.ssb.no/vis/magasinet/slik_lever_vi/art-2004-12-01-01.html.

Main findings

- There is no age "wave": The Norwegian population is going to age strongly from about 2010 to about 2040 or longer, almost regardless of the development of fertility, mortality and net migration, and the proportion of elderly will stay at a high level thereafter.
- Both spouses' educational attainment has a strong negative impact on divorce risk in Norwe-

gian first marriages, but parental education shows the reverse effect. If either spouse acquires further education during the marriage, the divorce risk increases.

- Parent's level of education has an independent effect on the transition to first marriage or first cohabitation. Norwegian men and women with a low social background enter their first unions at a younger age than persons with a higher social background.
- In spite of many positive features of the social development in Norway in recent years, such as for instance higher incomes, more wealth, higher education and better housing, a large proportion of the population think that society has become worse to live in.
- One out of four employed Norwegians work part time, and one out of four part timers are underemployed. Involuntary part time (underemployment) is mainly caused by conditions in the demand side of the labour market, whereas voluntary part time is equally predicted by supply and demand side characteristics. The distribution of part-time work is strongly gendered, and the impact of supply side characteristics, such as age, education and family phase, differs significantly between women and men.
- The current survey on attitudes to immigrants and immigration reveals less support for a liberal asylum policy than at the end of the 1990s, while there is a positive evaluation of the immigrants' contribution to employment and cultural diversity.

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***** From April 1st

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Personnel and budget

The total staff in the Research Department in 2004 was 75 in total number of persons. From 2002 the Research Department has been organized in 8 thematic groups.

The financial resources of the research activities stem partly from the government budget as allocated within Statistics Norway. About 40 per cent of total expenditures in 2004 are project financed. The bulk of the project revenues comes from research grants from the The Research Council of Norway and from contracts with Ministries, primarily the Ministry of the Environment, the Ministry of Finance, the Ministry of Petroleum and Energy, the Ministry of Local Government and Regional Development and the Ministry of Foreign Affairs.

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Distribution of operating costs in 2004. 1000 Nok

	Government Budget ¹	Project ²	Total
Research Department	22 799	23 024	45 823
Social and Demographic Research	3 309	6 176	9 485
Statistical Methods and Standards	5 343	1 574	6 917

¹ Infrastructure not included.

² Infrastructure included.

Statistics Norway monographs are published in the series *Social and Economic Studies and Statistical Analyses*, other research reports and documentation in the *Report series* or as *Documents/Notater*. The *Discussion Papers* series comprises research papers intended for international journals or books. There is also a *Reprint series* of journal articles and book chapters by staff employees. The Research Department publishes two periodicals: *Økonomiske analyser*, in Norwegian with 6 issues a year, and *Economic Survey*, in English with 4 issues a year.

Statistical Analysis (SA)

- 62 **Melby, Ingrid, Odd Erik Nygård, Thor Olav Thoresen, Aud Walseth (red.):** *Inntekt, skatt og overføringer 2003* (Income, tax and transfers 2003). (158 sider)
- 64 **Barstad, Anders og Ottar Hellevik:** *På vei mot det gode samfunn? Om forholdet mellom ønsket og faktisk samfunnsutvikling.* (153 sider)
- 65 *Naturressurser og miljø 2004.* (237 sider)

Reports (REP)

- 2004/6 **Kitterød, Ragni Hege og Randi Kjeldstad:** *Foreldres arbeidstid 1991-2001 belyst ved SSBs arbeidskraftundersøkelser, tidsbruksundersøkelser og leveårsundersøkelser* (Parents' work hours 1991-2001. An analysis based on Statistics Norway's Labour Force Surveys, Time Use Surveys and Level of Living Survey). (84 sider)
- 2004/8 **Haug, Trond Espen:** *Eierkonsentrasjon og markedsrett i det norske kraftmarkedet.* (39 sider)
- 2004/9 **Kalvarskaia, Maria and Audun Langørgen:** *Capital costs in municipal school buildings.* (29 sider)
- 2004/11 **Hægeland, Torbjørn, Lars J. Kirkebøen, Oddbjørn Raaum and Kjell G. Salvanes:** *Marks across lower secondary schools in Norway. What can be explained by the composition of pupils and school resources?* (54 sider)
- 2004/15 **Kitterød, Ragni Hege:** *Foreldreskap på tvers av hushold. Ansvar og omsorg for barn blant foreldre som ikke bor sammen. Resultater fra Undersøkelsen om samvær og bidrag 2002.* (85 sider)
- 2004/16 **Lappegård, Trude:** *Valg av livsløp i det flerkulturelle Norge. Forløpsanalyse av giftermål og barnefødsler blant kvinner med innvandrerbakgrunn.* (34 sider)
- 2004/18 **Heide, Kim Massey, Erling Holmøy, Lisbeth Lerskau and Ingeborg Folløy Solli:** *Macroeconomic Properties of the Norwegian Applied General Equilibrium Model MSG6.* (55 sider)
- 2004/29 **Kjeldstad, Randi og Erik H. Nymoen:** *Kvinner og menn i deltidsarbeid. Fordeling og forklaringer.* (126 sider)

Discussion Papers (DP)

- 366 **Holtmark, Bjart J. and Knut H. Alfsen:** *PPP-correction of the IPCC emission scenarios - does it matter?* (15 sider)
- 367 **Aaberge, Rolf, Ugo Colombino, Erling Holmøy, Birger Strøm and Tom Wennemo:** *Population ageing and fiscal sustainability: An integrated micro-macro analysis of required tax changes.* (46 sider)
- 368 **Røed Larsen, Erling:** *Does the CPI Mirror Costs-of-Living? Engel's Law Suggests Not in Norway.* (34 sider)
- 369 **Skjerpen, Terje:** *The dynamic factor model revisited: the identification problem remains.* (12 sider)
- 370 **Dagsvik, John K. and Astrid L. Mathiassen:** *Agricultural Production with Uncertain Water Supply.* (26 sider)
- 371 **Greaker, Mads:** *Industrial Competitiveness and Diffusion of New Pollution Abatement Technology - a new look at the Porter-hypothesis.* (38 sider)
- 372 **Børnes Ringlund, Guro, Knut Einar Rosendahl and Terje Skjerpen:** *Does oilrig activity react to oil price changes? An empirical investigation.* (40 sider)
- 373 **Liu, Gang:** *Estimating Energy Demand Elasticities for OECD Countries. A Dynamic Panel Data Approach.* (27 sider)
- 374 **Telle, Kjetil and Jan Larsson:** *Do environmental regulations hamper productivity growth? How accounting for improvements of firms' environmental performance can change the conclusion.* (19 sider)
- 375 **Wangen, Knut R.:** *Some Fundamental Problems in Becker, Grossman and Murphy's Implementation of Rational Addiction Theory.* (13 sider)
- 376 **Holtmark, Bjart J. and Knut H. Alfsen:** *Implementation of the Kyoto Protocol without Russian participation.* (22 sider)
- 377 **Røed Larsen, Erling:** *Escaping the Resource Curse and the Dutch Disease? When and Why Norway Caught up with and Forged ahead of Its Neighbors.* (34 sider)

- 378 **Andreassen, Leif:** *Mortality, fertility and old age care in a two-sex growth model.* (36 sider)
- 379 **Sagen, Eirik Lund and Finn Roar Aune:** *The Future European Natural Gas Market - are lower gas prices attainable?* (33 sider)
- 380 **Langørgen, Audun and Dag Rønningen:** *Local government preferences, individual needs, and the allocation of social assistance.* (36 sider)
- 381 **Telle, Kjetil:** *Effects of inspections on plants' regulatory and environmental performance - evidence from Norwegian manufacturing industries.* (19 sider)
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- 383 **Bjørnstad, Jan F. and Elinor Ytterstad:** *Two-Stage Sampling from a Prediction Point of View.* (38 sider)
- 384 **Bruvoll, Annegrete and Taran Fæhn:** *Transboundary environmental policy effects: Markets and emission leakages.* (28 sider)
- 385 **Hansen, Petter Vegard and Lars Lindholt:** *The market power of OPEC 1973-2001.* (33 sider)
- 386 **Keilman, Nico and Dinh Quang Pham:** *Empirical errors and predicted errors in fertility, mortality and migration forecasts in the European Economic Area.* (115 sider)
- 387 **Bjertnæs, Geir H. and Taran Fæhn:** *Energy Taxation in a Small, Open Economy: Efficiency Gains under Political Restraints.* (29 sider)
- 388 **Dagsvik, John K. and Steinar Strøm:** *Sectoral Labor Supply, Choice Restrictions and Fintional Form.* (64 sider)
- 389 **Halvorsen, Bente:** *Effects of norms, warm glow and time use on household recycling.* (33 sider)
- 390 **Aslaksen, Iulie and Terje Synnestvedt:** *Are the Dixit-Pindyck and the Arrow-Fisher-Henry-Hanemann Option Values Equivalent?* (17 sider)
- 391 **Bjønnes, Geir Høidal, Dagfinn Rime and Haakon O.Aa. Solheim:** *Liquidity provision in the overnight exchange market.* (36 sider)
- 392 **Åvitsland, Turid and Jørgen Aasness:** *Combining CGE and microsimulation models: Effects on equality of VAT reforms.* (42 sider)
- 393 **Greaker, Mads and Eirik Lund Sagen:** *Explaining experience curves for LNG liquefaction costs: Competition matter more than learning.* (28 sider)
- 394 **Telle, Kjetil, Iulie Aslaksen and Terje Synnestvedt:** *"It pays to be green" - a premature conclusion?* (25 sider)
- 395 **Harding, Torfinn, Haakon O.Aa. Solheim and Andreas Benedictow:** *House ownership and taxes.* (29 sider)
- 396 **Holmøy, Erling and Birger Strøm:** *The Social Cost of Government Spending in an Economy with Large Tax Distortions. A CGE Decomposition for Norway.* (25 sider)
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