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Welfare effects of VAT reforms:
A general equilibrium analysis

Abstract:
Indirect taxes such as value added taxes (VAT) generate a substantial part of tax revenue in many countries. This paper analyses welfare effects of different reforms in the Norwegian system of indirect taxation. The main reform studied is the introduction of a uniform VAT rate on all goods and services. The Norwegian political VAT reform of 2001 is also analysed. The reforms are analysed by using an intertemporal CGE model for the Norwegian economy. A non-uniform VAT system gives a welfare loss compared to a uniform VAT system.

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1. Introduction

Indirect taxes such as value added taxes (VAT) generate a substantial part of tax revenue in many countries. In Norway, the VAT finances a quarter of government expenses. More focus on internationally mobile tax bases has drawn attention to levying more of the tax burden on indirect taxes as consumption taxes or VAT systems, and less on income taxes, especially capital income. During the harmonization of EU taxes, indirect taxes and VAT systems received much attention, Fehr, Rosenberg and Wiegard (1995). The current EU system is characterized by a general VAT law covering all private goods and services, but there are many exceptions from this general instruction. Such a VAT system also exists in Norway as a consequence of the Norwegian VAT reform in 2001. The reform introduced a general VAT law on services, but many exceptions are still specified.

There are several arguments in favor of a uniform VAT rate on all goods and services. Such a system may improve economic efficiency and welfare, reduce administration costs and rent-seeking activities and may have positive effects on the distribution of welfare between different households. Atkinson and Stiglitz (1972) showed that if the representative consumer's preferences are separable between goods and leisure and the utility function is homothetic, the optimal commodity tax structure is uniform. Other assumptions concerning preferences though imply that non-uniform rates are optimal, Ramsey (1927). A general VAT law covering all goods and services, irrespective of the rate structure, implies that the producers' net VAT rate on material inputs and investment goods equals zero. If producer behavior is characterized by constant returns to scale and perfect competition, Diamond and Mirrlees (1971) state that given optimal commodity taxation, a zero tax rate on producers' material inputs is optimal. The input decisions of a producer are distorted if not all goods and services are covered by the VAT area. A producer not covered by the VAT area may choose to produce the input within the firm instead of purchasing it in the market due to VAT on the market purchase. This problem particularly applies to the public sector since this sector traditionally is not covered by the VAT area.

A uniform VAT rate on all goods and services will imply a simple system with low costs of administration. In addition, no resources will be wasted on rent-seeking activities in order to obtain exemptions or exceptions from the VAT law. A uniform VAT rate on all goods and services may have a positive effect on the distribution of welfare between different consumers. If the initial situation is characterised by a VAT on most goods but only on a few services, introduction of a uniform rate on all

goods and services may improve the distribution of welfare between different households since services' share of consumption increases with income.

In this paper we analyse the effects on economic efficiency of three different reforms in the Norwegian system of indirect taxation. The main reform is introduction of a uniform VAT rate on all goods and services, including public goods and services. We call this the *general VAT reform*. New Zealand has introduced a VAT system generally covering consumption of all goods and services (including the public sector) and with only few exceptions. Both the EU reform and the Norwegian VAT reform of 2001 were a step in that direction. We also analyse the effects of the Norwegian VAT reform of 2001, called the *political VAT reform*.

The Norwegian system of indirect taxation has also been characterized by an investment tax that was attached to the producer's connection with the VAT system. This investment tax stands in sharp contrast to e.g. the US that previously offered an investment tax credit, Tanzi (1987). Both effects on efficiency and administration costs were arguments when the investment tax was abolished in 2002. The effects of *abolition of the investment tax* are also analysed, both separately and as a part of the general VAT reform.

The reforms are analysed by using an intertemporal disaggregated numerical general equilibrium model for the Norwegian economy. The model is well designed for analysing the described reforms since it distinguishes between many industries, input factors and consumer goods and services. The model has a detailed description of direct and indirect taxes. Specifically, net VAT rates on the input factors and gross VAT rates on the consumer goods and services are included in the model. We disregard effects on costs of administration, rent seeking and distribution of welfare between households. Nor the described input distortion between private and public production activities is taken into account.

The tax reforms are made revenue neutral by lump sum transfers. The amount of lump sum transfer differs between the reforms. In order to get a precise impression of the ranking of the reforms when both welfare and revenue effects are taken into account, we calculate excess burdens for the different reforms.

Ballard, Scholz and Shoven (1987) analyze welfare effects of different VAT reforms for the US. Initially (and still) there is no VAT system in the US. Among the tax reforms considered are a uniform

VAT and a differentiated VAT system. The VAT reforms are made revenue neutral by lowering the personal income tax. Both reforms generate a welfare gain, but the gain is substantially larger with the uniform VAT compared to the differentiated VAT system.[1]

We measure the welfare effects of the different tax reforms as deviations from a baseline scenario with a pre-reform non-uniform VAT system (including the investment tax). Compared to the pre-reform case, the lump sum transfers are reduced in all the policy alternatives. For the general VAT reform this is due to abolition of the investment tax that is part of the reform. For the political VAT reform, the revenue loss is mainly explained by the low VAT rate on food and non-alcoholic beverages. The general VAT reform generates a welfare gain, while the political VAT reform gives a welfare loss. As in Ballard et al (1987) a non-uniform VAT system (here exemplified by both the pre-reform VAT system and the political VAT reform) gives a welfare loss compared to a uniform VAT system. Only abolishing the investment tax generates a small welfare gain but a large revenue loss.

The paper is organised as follows; in section 2 we give an outline of the numerical model, in section 3 we elaborate on normative tax theory and its relevance for the employed numerical model and in section 4 we specify the policy alternatives. In section 5 the numerical results are presented and section 6 presents total welfare effects and excess burdens. Section 7 concludes.

2. Basic features of the computable general equilibrium model

To analyze the welfare effects of policy reforms, we use a numerical intertemporal general equilibrium model for the Norwegian economy.[2] The model gives a detailed description of taxes, production and consumption structures in the Norwegian economy. The model has 41 private and 8 governmental production activities, all listed in appendix A, and 26 consumer goods. The next sections briefly outline some of the important features of the model. A more detailed description of the model is found in Bye (2000) and Fæhn and Holmøy (2000).

2.1. Producer behavior and technology

The structure of the production technology is represented by a nested tree-structure of CES-aggregates given in figure B.1, appendix B. All factors are completely mobile and malleable[3]. The model of

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[1] Gottfried and Wiegard (1991) also obtain positive welfare effects of a uniform VAT rate compared to a differentiated VAT system.

[2] The model has been developed by Statistics Norway. Previous versions of the model have been used routinely by the Norwegian Ministry of Finance for long-term forecasting and policy analyses.

[3] Except in the production of electricity, see Holmøy, Nordén and Strøm (1994).

producer behavior is described in detail by Holmøy and Hægeland (1997). The model incorporates both the small open economy assumption of given world market prices, and avoids complete specialization through decreasing returns to scale. Producer behavior is generally specified at the firm level. All producers are considered as price takers in the world market, but have market power in the home market. Empirical analyses of Norwegian producer behavior support the existence of some domestic market power, see Klette (1994) and Bowitz and Cappelen (2001). The entry-exit condition requires that the after tax pure rents equal fixed costs for the marginal firm.

2.1.1. *User costs of capital*

The model of investment behavior is described in Holmøy, Larsen and Vennemo (1993) and Holmøy, Nordén and Strøm (1994). The starting point is a standard arbitrage equation where the risk-adjusted marginal return of investing in shares is equal to the marginal return of investing in bank deposits. Based upon this equation the value of the firm, as seen from the representative investor's point of view, is derived. The manager of the firm is then assumed to maximize this value with respect to real capital. This results in the expression for the user costs of capital. The dynamics due to intertemporal behavior are captured by model consistent capital gains in the user costs of capital. The investment tax is part of the purchaser price of new investments, which in turn is included in the user costs of real capital[4]. The model distinguishes between three endogenously determined kinds of real capital; buildings, machinery and transport equipment.

2.2. Consumer behavior

Consumption, labor supply and savings result from the decisions of an infinitely lived representative consumer, maximizing intertemporal utility with perfect foresight (the model of consumer behavior is described in more detail in appendix B.1). The consumer chooses a path of full consumption subject to an intertemporal budget constraint, which ensures that the present value of full consumption in all future periods does not exceed total wealth (current non-human wealth plus the present value of after tax labor income and net transfers). The distribution of full consumption on material consumption and leisure is determined by an Origo adjusted Constant Elasticity of Substitution function (OCES), Bye (2003). Total material consumption is allocated across 26 different consumer goods according to a nested OCES (see figure B.2, appendix B), Wold (1998). The OCES specification implies that the income elasticities are not identical and equal to 1.

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[4] There is no separate purchaser price of used real capital in the model.

2.3. Government and intertemporal equilibrium

The government collects taxes, distributes transfers, and purchases goods and services from the industries and abroad. Overall government expenditure is exogenous and increases at a constant rate equal to the steady state growth rate of the model. The model incorporates a detailed account of the government's revenues and expenditures. In the policy experiments it is required that the nominal deficit and real government spending follow the same path as in the baseline scenario, implying revenue neutrality in each period.

Intertemporal equilibrium requires fulfilment of the two transversality conditions; the limit value of the present value of net foreign debt and real capital respectively, must both be zero, as time tends to infinity. The model is characterized by a path dependent steady state solution. A necessary condition for reaching a steady state solution is equality between the net of tax interest rate and the consumer's rate of time preference, at least in the last part of the simulation period, see appendix B.2. The other transversality condition regarding the net foreign debt is fulfilled by adjusting the optimal level of full consumption for the representative consumer, see Bye and Holmøy (1997) for a description of the numerical solution procedure.

3. Normative tax theory, uniform VAT and the CGE model

The numerical dynamic general equilibrium model for the Norwegian economy used in the analyses incorporates both quasi-homothetic consumer preferences and elements from the new theories of imperfect competition in product markets. In this section we present some results from the normative tax theory and discuss whether these results are relevant for the numerical model used in our analyses.

In our model the representative consumer's preferences are weakly separable between goods and services on one side and leisure on the other. The aggregate of goods and services consists of a nested tree of quasi-homothetic CES-aggregates. This implies that uniform tax rates are not optimal. The result of Atkinson and Stiglitz (1972) that uniform tax rates are optimal is not relevant in our model. Rather, separate analyses of the demand system in use show that inelastically demanded goods and services should be taxed relatively harder than elastically demanded ones, implying a Ramsey rule tax setting.[5]

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[5] Decoster and Schokkaert (1990) analyse welfare costs of different *marginal* tax reforms in different demand systems. They find that the welfare costs do not differ much between the different demand systems, though.

The model of producer behavior is characterized by decreasing returns to scale in all variable input factors (including real capital). There is perfect competition in the export market, while there is monopolistic competition in the domestic market. The assumptions underlying the Diamond and Mirrlees (1971) result of a zero tax on material inputs are therefore violated in our model. With decreasing returns a zero input tax is optimal only if profits can be taxed at appropriate rates, Dasgupta and Stiglitz (1972). These appropriate tax rates are not present in our model. When imperfect competition is present, non-taxation of intermediate goods is not optimal, Myles (1989) and Konishi (1990). Konishi (1990) shows that taxation should encourage the use of intermediate goods that are demanded elastically and reduce the use of those with inelastic demand. This has been termed the production side Ramsey rule, Myles (1995).

These results indicate that some kind of Ramsey rule taxation is optimal both concerning commodity taxation and taxation of intermediate goods. The actual Norwegian tax system is included in the model. There are other indirect taxes than the VAT (and the investment tax) for both consumer goods and services and material inputs and investment goods. Examples of such taxes are tariffs and Pigou taxes[6]. In addition there is income taxation. Generally, the tax rates are not second best optimal.

Given the complexity of the numerical model and the non-optimal initial tax system, it is a priori not possible to argue whether a uniform and general VAT rate is welfare superior to the initial differentiated VAT system or the political VAT reform. The total welfare effects of the tax reforms are therefore left for the numerical simulations presented in section 5. When analysing the welfare effects of the different reforms we focus on the importance of the initial wedges created by the non-optimal initial system of direct and indirect taxation and by the different market structures. We employ the following rule of thumb; a reallocation of resources from a low-taxed activity to a high-taxed activity, ceteris paribus, will in most cases imply higher welfare.

4. Baseline scenario and policy alternatives

The VAT is a tax formally paid by the purchaser of a good or service. All the different stages in the production process are participating in the calculation and collection of the VAT, and the Norwegian VAT system is a so-called credit-method one. The company may either be a) covered by the VAT area which means that there is a VAT on the company's sales but the VAT paid on the company's purchases of material inputs and investment goods is in effect zero since the amount paid is refunded,

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[6] The model does not incorporate the environmental benefits, only the costs, of regulation through Pigou taxes.

or b) not covered by the VAT area. Then there is no VAT on the company's sales but the company must pay VAT on its purchases of material inputs and investment goods. Combinations of a) and b) also exist. For some goods and services, if they are covered by the VAT area, the VAT rate may deviate from the general rate and a special case is a zero VAT rate on sales. The Norwegian VAT system satisfies the destination principle, i.e. exports covered by the VAT area have a zero VAT rate while import of goods and services covered by the VAT area are subject to the domestic VAT rate.

We simulate three different policy alternatives, in addition to the baseline scenario. All policy alternatives are made revenue neutral compared to the baseline scenario by lump sum transfers. The *baseline scenario* is a simulation of the tax system in 2000. The system of indirect taxation was characterized by a general VAT law concerning goods. There were few exceptions. For services there was no general VAT law. Rather the VAT Act specified the kind of services that was covered by the VAT, and this was a limited amount. The public sector was not covered by the VAT area. The VAT rate was equal to 23 per cent. In some cases there were exemptions.

The indirect tax system was also characterised by an investment tax. Generally, if the producer was covered by the VAT area, and thereby in effect did not pay any VAT on her material inputs or investment goods, she had to pay the investment tax. In addition, the investment tax Act further limited in what instances the investment tax was to be paid. These exemptions mainly applied to manufacturing industries. The statutory investment tax rate was 7 per cent. This system of investment tax is part of the *baseline scenario*.

The average effective VAT rates on private consumption and average effective VAT and investment tax rates on material inputs and investment goods in the baseline scenario are shown in table 1 and 2 respectively. The average effective VAT rate on private consumption of goods is close to the statutory rate of 23 per cent, while the average effective rate on private consumption of services is only 4.5 per cent. The average effective VAT and investment tax rate on material inputs and investment goods is close to zero for manufacturing industries while it is considerably higher for service industries. The individual investment tax rates on buildings and machinery may be higher, though, since the investment tax mainly is levied on these capital types.

Table 1. Average effective VAT rates[1] (per cent) in the different policy alternatives. Private consumption. 1995

	Baseline scenario	General VAT reform	Political VAT reform
Goods	20.9	22.4	19.2
Food	22.4	22.9	12.9
Electricity	20.1	23.1	21.0
Fuels	21.0	23.0	21.9
Petrol and Car Maintenance	19.2	22.9	21.0
Other Goods	20.9	22.6	20.6
Durable Consumer Goods	20.7	21.1	21.7
Services	4.5	11.7	5.0
Gross Rents*	1.2	1.9	1.3
Other Services	7.6	20.7	8.4
Non-profit institutions serving households	0.0	0.0	0.0
Private consumption	12.8	16.5	12.0

* The positive VAT rate on Gross Rents is mainly due to VAT on fees charged on water supply and sanitary services. These fees are part of gross rents.

[1] The average effective VAT rate on private consumption is calculated by dividing public revenues from VAT on private consumption by private consumption excl. of VAT.

Table 2. Average effective VAT and investment tax rates[1] (per cent) in the different policy alternatives. Industries. 1995

	Baseline scenario	General VAT reform	Abolition of inv. tax	Political VAT reform
Total	4.0	0.6	3.3	4.1
Private Production Sectors	3.2	0.7	2.5	3.2
Primary Industries	1.6	0.0	0.1	1.7
Prod. and Pipeline Transp. of Oil and Gas	0.0	0.0	0.0	0.0
Manufacturing Industries and Mining	0.3	0.0	0.2	0.2
Production of Electricity	4.4	0.0	0.4	4.2
Construction	2.6	0.0	1.4	2.6
Wholesale and Retail Trade	3.6	0.0	1.4	3.6
Ocean Transp. and Oil and Gas Expl. and Dr.	0.0	0.0	0.0	0.0
Transport	5.3	0.0	4.0	4.8
Dwelling Services	17.2	17.2	17.2	17.9
Finance and Insurance	11.7	0.0	11.6	15.8
Other Private Services	7.5	0.0	6.4	6.8
Government Production Sectors	12.6	0.0	12.4	13.8

[1] The average effective VAT and investment tax rate on material inputs and investment goods is calculated by dividing the public revenue from VAT and investment tax on material inputs and investment goods by the purchase of material inputs and investment goods excl. of VAT and investment tax.

The first policy alternative is the *general VAT reform.* In this reform all goods and services realized in Norway are covered by the VAT area. The VAT rate is equal to 23 per cent (the same rate as in the baseline scenario). The only exemptions from this are the banks' interest rate differential and non-profit institutions serving households where the VAT rate equals 0. In addition, there is VAT on the purchase of new investments in dwellings and cars, but there is no VAT on services from these consumer durables. The investment tax is also abolished in this policy alternative. Our second policy alternative is a separate simulation of the *abolition of the investment tax.*

The third policy alternative is the *political VAT reform*. The reform involved a general VAT law concerning services. There were many exceptions, though. Concerning goods the VAT rules were principally carried on. The VAT rate was increased from 23 to 24 per cent. For food and non-alcoholic beverages the rate was set equal to 12 per cent. In principle, the *political VAT reform* involved more companies to pay the investment tax. However, it was decided that they were exempted. The investment tax in this policy alternative is therefore as in the baseline scenario. Table 1 and 2 show that the most visible change in average effective tax rates following the political VAT reform is the reduction in the average effective VAT rate on food.

5. A comparison of policy alternatives: Results

The effects of the different policy alternatives are measured as deviations from the baseline scenario. The model is calibrated to the benchmark year 1995. We simulate the baseline scenario by keeping all exogenous variables constant at their benchmark values except the tax system, which is substituted by the tax code of 2000. The economy adjusts along a saddle point stable path, and in the long run the economy reaches a steady state solution with constant growth rate and relative prices.[7] The steady state solution of the model is path dependent. In the policy simulations both the path and the long run stationary solution differ from the baseline scenario. The different policy alternatives, including the abolition of the investment tax and the political VAT reform are all implemented in the first year of simulation (1995), disregarding any announcement effects.

5.1 Long run effects

The long run effects of the policy reforms may deviate from the short run effects and the transitional dynamics. To simplify the exposition we start with the long run effects given in table 3, while the transitional dynamics are analyzed in more detail in 5.2.

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[7] The steady state solution is reached after approximately 35 periods.

5.1.1 General VAT reform

The general VAT reform includes both abolition of the investment tax and an extension of the VAT area such that all goods and services are covered by the VAT rate of 23 per cent (the same rate as in the baseline scenario). This VAT reform is especially a tax relief on material inputs and investment goods in the service sectors that were not covered by the VAT area in the pre-reform system. The effective tax rates in the different policy alternatives are given in Tables 1 and 2 in section 4.

Table 3.   Long run effects. Percentage deviation from the baseline scenario

	General VAT reform	Abolition of investment tax	Political VAT reform
Full consumption	0.40	0.11	-0.12
Material consumption	0.65	0.44	-0.13
Leisure	0.02	-0.38	-0.10
Employment	-0.02	0.28	0.07
Housing capital	2.36	0.59	-0.36
Total stock of real capital	2.25	0.85	0.01
Trade surplus	9.29	3.41	-0.09
Wage costs per hour (price of leisure)	3.75	0.99	0.09
Domestic producer prices; Industries	[-0.60 - 0.99]	[-0.64 - 0.23]	[-0.16 - 0.16]
Private services	[-7.05 - -0.19]	[-1.09 - 0.27]	[-1.1 - 2.4]
User cost of capital, buildings: Housing	-1.07	-0.73	0.49
Other buildings	[-17.55 - -1.11]	[-7.20 - -0.73]	[-0.04 - 0.64]
Price of material consumption	2.69	-0.39	0.13
GDP: Purchaser prices	0.98	0.45	0.00

When interpreting the results of the general VAT reform, we start with the direct effects on costs and prices. For the service industries the reduction in effective tax rates on material inputs and investment goods reduces input costs, see table 2, having a positive effect on production of both home deliveries and export deliveries. The increase will be largest for export deliveries since export is assumed to be infinitely elastic in demand (fixed world market prices), whereas the domestic demand is less price elastic. Abolition of the investment tax and the VAT on some of the investment goods reduces the purchaser price of new investments, which has a positive effect on real investments and the stock of real capital. For manufacturing industries the direct effects on costs are negligible, see table 2.

For the representative consumer the general VAT reform leads to a considerable increase in the consumer price of services. Goods are substituted for services in consumption, and consumption of

most goods increases while consumption of most services falls. The general VAT reform increases the share of indirect taxation in the consumer prices, and the aggregate price index of material consumption rises. The consumer real wage rate falls.

Full consumption that indicates the representative consumers utility, increases by 0.40 per cent. The input cost reduction generated by the VAT reform leads to an increase in the demand for all input factors, including labor. The wage rate must increase to outweigh the positive income effect on leisure of higher full consumption and the negative substitution effect on labor supply of the fall in the consumer real wage rate following the general VAT reform. In the long run the net of tax marginal real wage rate increases (the wage rate increases more than the price of total material consumption), and the substitution effect approximately outweighs the positive income effect on leisure. Total employment is nearly unchanged, while material consumption increases by 0.65 per cent.

The higher wage rate does not outweigh the fall in input costs for all service industries due to abolition of the VAT and investment tax, and the total cost curves shift downwards. Export deliveries of services increase since export is completely price elastic in demand. Regarding manufacturing industries the pattern is not so clear. For many of these industries the cost curves shift upwards due to higher wage costs, and export deliveries fall. Fish farming and power intensive industries[8,9] are important exceptions, though. Total export increases.

Changes in home market deliveries depend on effects both on the production costs and the effects on domestic demand. In the service industries both lower costs and lower consumer demand contribute to the substantial fall in domestic producer prices for services following the VAT reform. This has a positive effect on demand for services as material inputs. Increased consumer demand for manufacturing goods outweighs the effect of an upward shift in the cost curves for many of the manufacturing industries and home market deliveries increase. For most service industries higher domestic demand for services as input in production outweighs the fall in domestic consumer demand for services, and deliveries to the home market also increase. Total production increases for nearly all industries. The export share in total production is higher.

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[8] Manufacture of pulp and paper articles, Manufacture of industrial chemicals and Manufacture of metals.

[9] Even though the price of electricity decreases due to abolition of the relatively large effective investment tax in this industry, power intensive industries do not gain directly from this since their electricity prices are fixed in long-term contracts. It is assumed that the electricity price (net of tax, including the transmission costs) is given in the world market and net import of electricity is endogenous.

The pre-reform VAT system generates initial tax wedges that differ between export deliveries and home deliveries, dependent on whether the industry initially is covered by the VAT area or not. In the pre-reform VAT system the manufacturing industries are covered by the VAT area, while most of the service industries are not. Therefore, in the pre-reform VAT system service industries pay a larger tax on input of material goods and investment goods than manufacturing industries, since manufacturing industries pay no VAT on material inputs (and not much investment tax). The Norwegian VAT system is also characterized by the destination principle that implies that exports of goods and services covered by the VAT area have a zero VAT rate. This mainly holds for manufacturing industries, while home deliveries from these industries are subject to VAT. For service industries not covered by the VAT area there is no VAT on either export deliveries or home deliveries. Therefore, when end sales are also included, the degree of taxation is larger for home deliveries of manufacturing goods than for services, while the opposite is the case for export deliveries.[10] Home deliveries of both manufacturing goods and services increase, but the increase is largest for manufacturing goods. Due to the distortions in the pre-reform VAT system, increased weight on home deliveries of manufacturing goods contributes positively to economic welfare. Regarding export deliveries, reallocation of exports from manufacturing goods to services, as is the result of this general VAT reform, is also welfare improving since export of services is more heavily taxed than export of manufacturing goods.

The general VAT reform generates a fall in the user costs of capital, giving a reallocation of savings from financial to real capital. Total savings, defined as the change in net national wealth increases by 16.4 bill NOK (the difference between the increase in the stock of real capital by 64.6 bill NOK and the increase in net foreign debt by 48.2 bill NOK). Taxation of returns from savings in real and financial capital implies a tax wedge in the consumption-savings choice. Increased total savings will therefore have a positive effect on economic efficiency, except from savings in dwelling capital. Due to the lenient taxation of dwelling capital this form of saving is subsidized, see Bye and Åvitsland (2003). Approximately 30 per cent of the increase in real capital is housing capital.

The main contributors to the long run positive welfare effect of the general VAT reform can be summarized as follows: Export is reallocated from manufacturing industries to service industries. Both manufacturing and service industries increase their deliveries to the domestic market, and the increase is largest for manufacturing industries. These effects contribute positively to welfare. In addition higher total savings have a positive effect on welfare, except for that part generated by increased savings in housing. Intertemporal efficiency is improved, partly through higher taxation of

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[10] This is so since material inputs and investment goods only constitute a fraction of total production costs.

consumption that postpones consumption and increases savings, but also through lower taxation of real capital due to abolition of the investment tax and the VAT on investment goods.

5.1.2 Abolition of the investment tax

The general VAT reform includes abolition of the investment tax. Results of the separate simulation of abolition of the investment tax are also presented in table 3.[11] Only removing the investment tax leads to a fall in the price of new investments in building capital due to abolition of the relatively large effective investment tax rate in the Construction industry. The user costs of capital fall. This effect is strengthened for industries paying the investment tax in the baseline scenario. The total real capital stock increases by 0.85 per cent. The increase in housing capital and machinery each constitutes approximately 20 per cent of the total increase in the real capital stock. Higher domestic activity, especially in the Construction industry, increases the demand for labor. The wage rate and total employment increase.

Many industries experience reductions in costs due to lower user costs of capital and lower prices of material inputs that outweigh the increase in the wage rate. The cost reductions raise exports. Larger stocks of buildings and machinery generate higher imports of investment goods for replacement purposes. The export surplus increases. This is mirrored by a higher net national debt. Total savings increase by 6.1 billion NOK in the long run. Almost all industries experience higher gross product.

Full consumption increases by 0.11 per cent in the long run. Compared to the general VAT reform, the increase in employment is one of the main contributors to the positive welfare effect of only abolishing the investment tax. In the labor market the high marginal tax on wage income and the high level of indirect taxation (incl. VAT) generate a large tax wedge in the labor-leisure choice. Intertemporal efficiency is also improved since total savings increase, but less than with the general VAT reform.

5.1.3 Political VAT reform

The political VAT reform involves a general VAT law concerning services, but there are still many exceptions. The effects on macroeconomic key variables are small (see table 3), while the effects on the industry level are larger. For manufacturing industries and parts of some service industries that both before and after the political reform are covered by the VAT area, the VAT reform will not have any direct effect on the input costs of these industries. Service sectors that only after the reform have

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[11] Further details are presented in Bye and Åvitsland (2002).

their VAT paid on material inputs and investment goods refunded, experience a direct negative effect on their input costs. Service industries that neither before nor after the reform are covered by the VAT area, experience a direct cost increase due to the increase in the general VAT rate and the fact that some more services are liable to pay the VAT.

For manufacturing industries production costs are reduced due to lower user costs of building capital[12] and lower producer prices of deliveries to the home market. Export deliveries of such goods increase. Service industries that are not covered by the VAT area after the reform, experience an increase in production costs. Exports from these industries are reduced. For other private services increased reimbursement of VAT paid on material inputs and investment goods contributes to a negative shift in the cost curve and export deliveries increase. The total effect on export of services is negative, but this is outweighed by the increase in exports of manufacturing goods and total export is higher. Since gross production is nearly unchanged, the export's share of total production increases. Reallocations of production from domestic deliveries to export contribute negatively to welfare since there is imperfect competition and mark up pricing in the domestic market. The increased weight on exports from manufacturing industries as compared to export from service industries, also contributes negatively to welfare since manufacturing industries' production for export is initially more leniently taxed than exports from service industries. On the other hand, concerning deliveries to the home market there is increased weight on home deliveries from manufacturing industries compared to service industries. In the long run full consumption is reduced by 0.12 per cent. The small increase in employment and the reallocation of total capital away from dwelling capital, are not large enough to outweigh the negative effects of the political VAT reform, see Bye and Åvitsland (2002) for further details.[13]

The political VAT reform was characterized by the low VAT rate (12 per cent) on food and non-alcoholic beverages[14]. The elasticity of demand for food is smaller than the demand elasticity for services. According to Ramsey (1927) it is under certain assumptions optimal to levy higher taxes on goods that are less elastic in demand. To analyze the importance of the low VAT rate for the overall welfare loss of the reform, we have performed a test simulation. The partial demand system for material consumption in the general equilibrium model is simulated separately (see appendix B.3 for

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[12] The price of dwelling services increases with the political VAT reform and demand for dwellings is reduced. This gives a fall in the demand for deliveries from the construction industry and the producer price in this industry is reduced.

[13] We have also simulated the effects of the combination of the political VAT reform and abolition of the investment tax. The results of this reform are approximately equal to the results found by adding the results in percentage change of the political VAT reform and the abolition of the investment tax.

[14] The main reason for this low rate was an assumed positive effect on the distribution of welfare between households. Our analyses do not take such an effect into account.

further details). We find that the low VAT rate on food and non-alcoholic beverages has a negative effect on the utility of material consumption compared to a system without this low VAT rate on food and non-alcoholic beverages. On the other hand, in the general equilibrium model the low VAT rate contributes to reduce the welfare loss of the political VAT reform.[15] The reason for this is the so-called tax interaction effect[16]: A low VAT rate on food generates a smaller increase in the price of total material consumption. This contributes to a smaller reduction in the real wage rate and a less negative effect on labor supply, compared to the case with no reduction in the VAT rate on food.

5.2 Transitional dynamics

The policy reforms generate short run effects through the capital markets that differ from the long run effects. To illustrate the transitional dynamics we concentrate on the effects of only removing the investment tax since this is the most transparent policy reform with respect to the dynamics. The investment tax is a tax mainly levied on new investments in buildings and constructions and on machinery. The average effective investment tax rate is between 0 and 4 percentage points.

The tax reform is implemented in the first year of simulation. Removing the investment tax leads to a negative effect on the price of new investments in building capital due to abolition of the relatively large effective investment tax rate in the Construction industry. This price fall is strengthened for industries that pay an investment tax on buildings in the baseline scenario. Figure 1 illustrates the effects on the price of new investments in buildings in Manufacture of industrial chemicals. This industry experiences both the fall in the price of new investments in buildings from the construction industry and abolishment of a small investment tax on its own investments in buildings.

Increased demand for building capital has a positive effect on the domestic producer price in the construction industry that modifies the initial fall in the price of new investment goods from the construction industry. Investments in building capital increase. The increase is largest in the first years of simulation and diminishes along the path towards the new long run solution where the stock of

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[15] To decompose the effects of the political reform, we have simulated three different experiments: 1) Only the change in the tax base (levying a VAT rate of 23 per cent on more services and a VAT rate equal to zero where this is part of the reform) is implemented, 2) the combination of the change in the tax base (experiment 1) *and* the general increase in the VAT rate to 24 per cent is implemented, and 3) is the total political VAT reform. All alternatives result in a welfare loss. The loss is largest in experiment 2).

[16] Parry et al (1999) identify three components constituting the tax interaction effect. The first is the efficiency loss from the reduction in labor supply occurring when tax increases raise goods prices and reduce the real wage rate. Lower labor supply reduces the revenue from labor taxes, and the cost of replacing this revenue by increasing the formal tax rates is the second component of the tax-interaction effect. These higher taxes may rise the price of government spending. In order to keep government real spending constant it is necessary to raise more revenue. The third component is the efficiency loss from raising this additional revenue.

capital and thereby replacement investments are higher than in the baseline scenario. The price of new investments in buildings falls along the path as the positive demand effect on the producer price in the construction industry diminishes. The fall in the price of new investments implies negative expected capital gains and thus higher user costs of capital. As the price fall on new investments diminishes along the path, the price expectation term vanishes and the user costs of capital also fall. From figure 2 we see that the direct price fall of new investments outweigh the price expectation term along the whole transitional path, giving a reduction in the user cost of capital compared to the baseline scenario.

Figure 1. **Price of new investments, buildings, Manufacture of industrial chemicals**
Percentage deviation from the baseline scenario

Abolition of the investment tax — — — General VAT reform

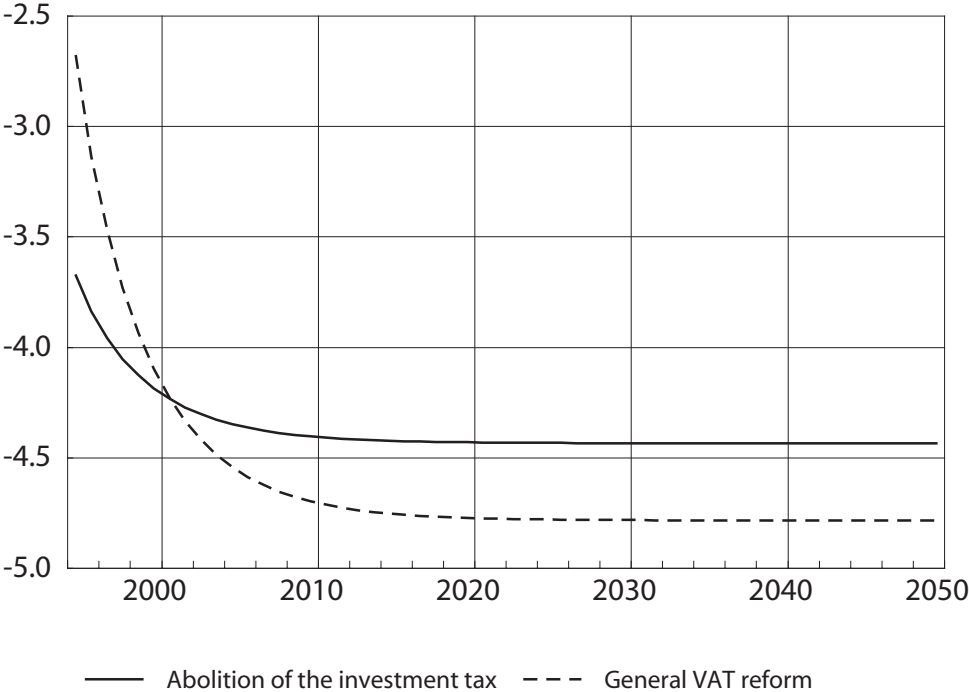**Figure 2.** **User cost of capital, buildings, Manufacture of industrial chemicals**
Percentage deviation from the baseline scenario

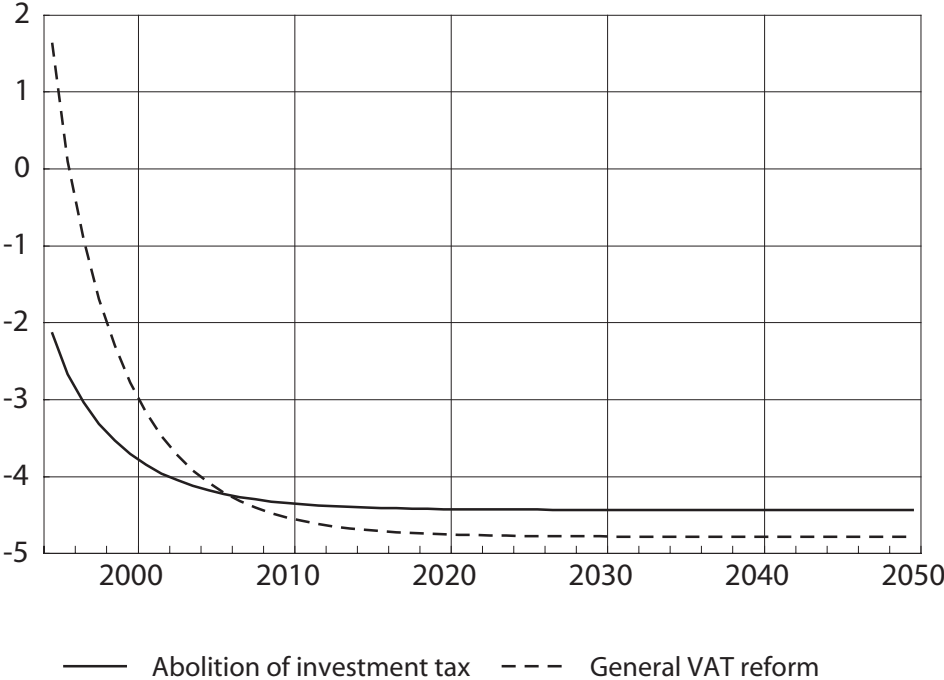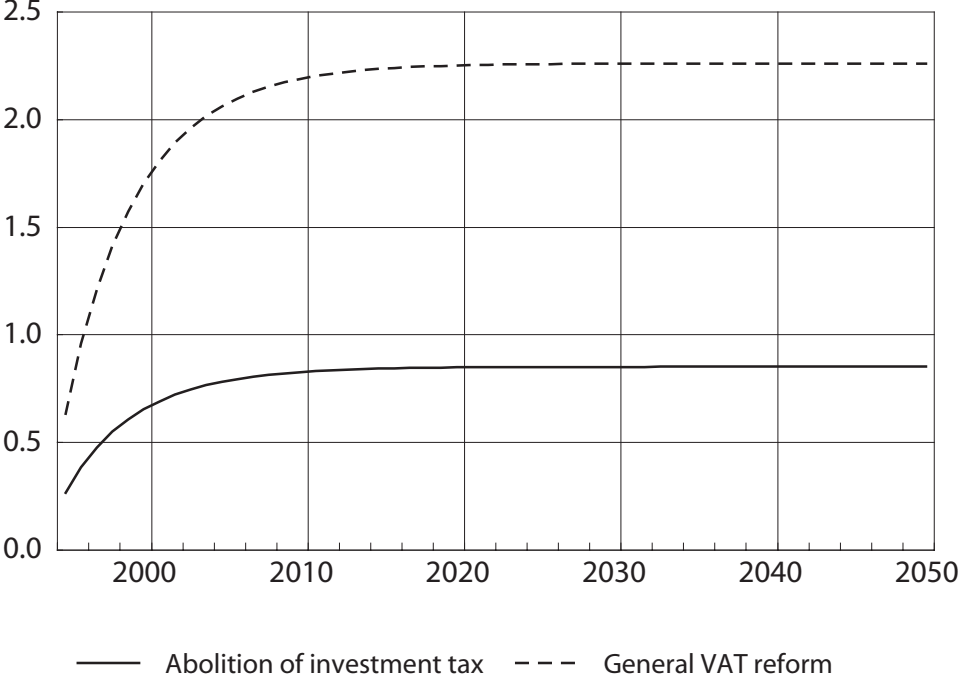——— Abolition of investment tax   – – – General VAT reform

Figure 3. **Total stock of real capital**
Percentage deviation from the baseline scenario

——— Abolition of investment tax   – – – General VAT reform

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Higher activity in the construction industry has a positive effect on labor demand, and the equilibrium wage rate immediately increases. The cost curves shift upwards and export deliveries fall in nearly all industries. Import increases due to higher investment demand. Net foreign investments are reduced (net foreign debt increases). Along the transitional path the demand for labor falls from the new higher level due to lower demand for investments after the initial increase in the stock of building capital and the corresponding increase in the activity in the construction industry. In the long run the equilibrium wage rate is higher while the user cost of capital is lower. The total cost effect is negative and export is higher compared to the baseline scenario. An increase in the long run trade surplus is necessary to cover the interest payment on the higher level of net foreign debt. Total savings are higher, but there is also a reallocation from savings in financial to savings in real capital along the path. The change in the total stock of real capital is given in figure 3.

The effect on full consumption along the transitional path is composed of an income effect, measured by the marginal utility of wealth, that is constant along the whole path, and an intertemporal substitution effect generated by the dynamics in the price of full consumption. In this case the income effect is positive (the marginal utility of wealth is lower, see appendix B.1 for further details of the modeling of household behavior). The price of full consumption immediately increases following the policy reform due to an increase in both the price of material consumption and price of leisure (the wage rate). Along the path the price of full consumption falls, which through the intertemporal substitution effect contributes to postpone consumption. The sum of the income and substitution effects is an increase in full consumption along the path. With the general VAT reform the main pattern is approximately the same as with only abolishing the investment tax.

6. Welfare effects and excess burden

As a measure of the total welfare effect in the different policy alternatives, we use an adjusted measure of full consumption, see appendix B.4 for further details. Figure 4 reports deviations from the pre-reform case in million NOK, measured as constant annuities. With the general VAT reform total welfare increases by 4.03 billion NOK, measured by a constant annuity. However, the general VAT reform collects less revenue than the pre-reform alternative, and the reduction in lump sum transfers amounts to 3.45 billion NOK, measured as a constant annuity, see figure 4.[17] Only abolishing the

[17] Public revenue neutrality is ensured in each period by the following rule: The nominal deficit and real government spending in both the central and local government follow the same paths as in the baseline scenario. With the general VAT reform the local government is also covered by the VAT area. This implies that the necessary transfers from the central to the local government are lowered. There are, though, some uncertainties concerning the public revenue calculations.

investment tax gives an increase in the welfare measure of 0.89 billion NOK, but an even larger reduction in the lump sum transfer than in the general VAT reform case, 6.55 billion NOK. The political VAT reform gives a reduction in both welfare, 0.67 billion NOK, and lump sum transfers, 4.37 billion NOK.

Only abolishing the investment tax implies a substantial fall in the net tax revenue. The difference between the loss in tax revenue of only abolishing the investment tax and the revenue effects of the general VAT reform, gives an approximation of the tax revenue effect of only implementing the VAT part of the general VAT reform, keeping the investment tax unchanged. This net revenue effect is approximately 3 billion NOK. The VAT part of the general VAT reform implies both a positive welfare effect and a positive effect on net tax revenue. As in Ballard et al (1987) a non-uniform VAT system (here exemplified by both the pre-reform VAT system and the political VAT reform) gives a welfare loss compared to a uniform VAT system.

Figure 4. Deviation from the baseline scenario. Million 1995 NOK. Constant annuities.
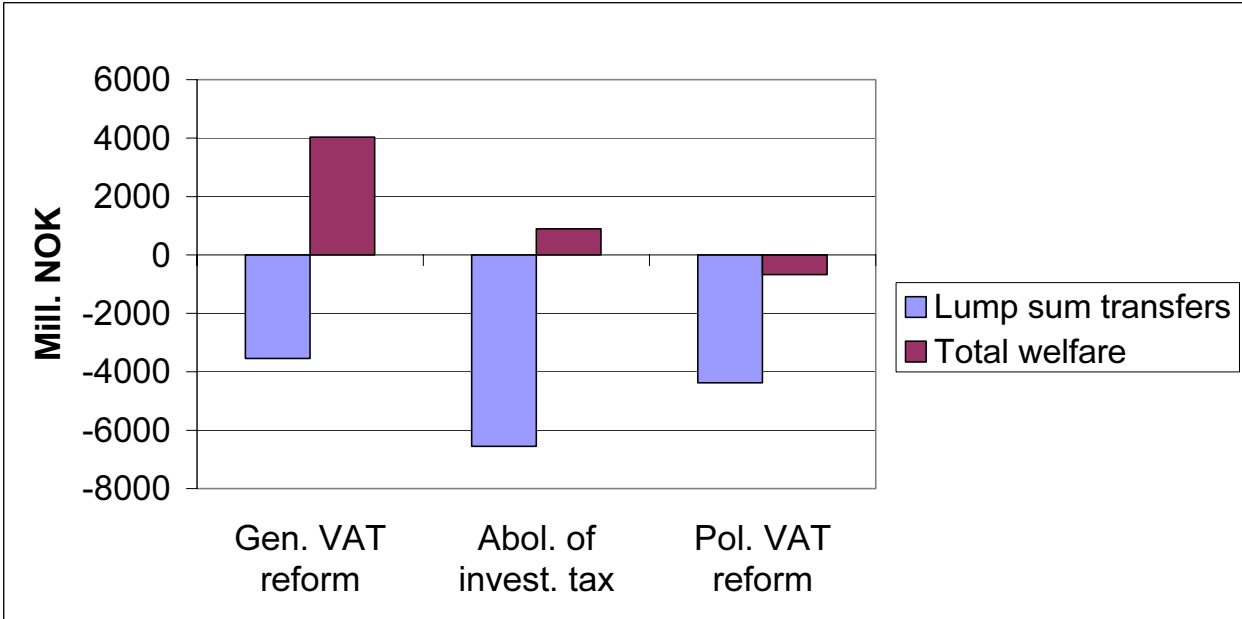
To be able to rank the different tax reforms with respect to both welfare effects and revenue raising device, we calculate a measure of the marginal excess burden (MEB) of the different tax reforms, MEB = (Change in welfare in NOK, annuity/Change in tax revenue in NOK, annuity).

Table 4. **Marginal excess burden of the tax reforms**

	General VAT reform	Abolition of investment tax	Political VAT reform
MEB	-1.17	-0.14	0.15

The general VAT reform is both better than abolition of the investment tax and the political VAT reform since the general VAT reform both implies a larger welfare gain (the political VAT reform implies a welfare loss) and a smaller reduction in lump sum transfers than each of the other two reforms. In addition, abolition of the investment tax is better than the political VAT reform since the former implies a welfare *gain* per NOK lost in revenue while the latter implies a welfare *loss* per NOK lost in revenue.

Increased lump sum taxation does not seem realistic from a political point of view. If lump sum taxation is not available distortionary taxes must increase to obtain public revenue neutrality. The welfare gain (loss) of a reform will then generally be smaller (larger). The marginal cost of public funds of e.g. wage taxation is calculated to be approximately 1.2, Holmøy and Strøm (2001) who use the same model as we do. If the public revenue loss had to be financed by a higher marginal wage tax, the positive welfare effect of the general VAT reform would be approximately neutralized since the MCF approximately outweighs the MEB, while the other two reforms would give an overall welfare loss.

7. Concluding remarks

Indirect taxes as value added taxes generate a substantial part of the tax revenue in many countries. More focus on internationally mobile tax bases has drawn attention to levying more of the tax burden on indirect taxes as consumption taxes or VAT systems, and less on income taxes, especially capital income. In 2001 there was a VAT reform in Norway that involved a general VAT law including services as in the EU, but many exceptions were still specified. There are several arguments in favor of a uniform VAT rate on all goods and services. Such a system may improve economic efficiency and welfare, reduce administration costs and rent-seeking activities and have positive effects on the distribution of welfare between different households.

In this paper we analyse the welfare effects of three different reforms in the Norwegian system of indirect taxation. The main reform is introduction of a uniform VAT rate on all goods and services, including publicly produced goods and services. We call this the general VAT reform. The Norwegian

VAT reform of 2001 was a step in that direction. We also analyse the effects of this reform, called the political VAT reform. The initial Norwegian system of indirect taxation was also characterized by an investment tax that was attached to the producer's connection with the VAT system. Both effects on efficiency and administration costs were arguments when the investment tax was abolished in 2002. The effects of abolition of this investment tax are also analysed, both separately and as part of the general VAT reform.

The tax reforms are analysed by using an intertemporal disaggregated numerical general equilibrium model for the Norwegian economy. The tax reforms are made revenue neutral by lump sum transfers. We measure the welfare effects of the different tax reforms as deviations from a baseline scenario with a pre-reform non-uniform VAT system (including the investment tax). Compared to the pre-reform case, the lump sum transfers are reduced in all the policy alternatives. For the general VAT reform this is due to the abolition of the investment tax that is part of the reform. For the political VAT reform the revenue loss is mainly explained by the low VAT rate on food and non-alcoholic beverages. The general VAT reform generates a welfare gain, while the political VAT reform gives a welfare loss. As in Ballard et al (1987) a non-uniform VAT system (here exemplified by both the pre-reform VAT system and the political VAT reform) gives a welfare loss compared to a uniform VAT system. Only abolishing the investment tax generates a small welfare gain but a large revenue loss.

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Table A.1: Production Activities in MSG-6

MSG-6 Code	Production Activities
11	Agriculture
12	Forestry
13	Fishing
14	Breeding of Fish
21	Fish Products
22	Meat and Dairy Products
16	Grain, Vegetables, Fruit, Oils, etc.
17	Beverages and Tobacco
18	Textiles, wearing Appeal and Footwear
26	Furniture and Fixtures
27	Chemical and Mineral Products, incl. Mining and Quarrying
28	Printing and Publishing
34	Manufacture of Pulp and Paper Articles
37	Manufacture of Industrial Chemicals
41	Gasoline
42A	Diesel Fuel
42B	Heating Fuels, Paraffin, etc.
43	Manufacture of Metals
46	Manufacture of Metal Products, Machinery and Equipment
47	Hired Work and Repairs
48	Building of Ships
49	Manufacture and repair of oil drilling rigs and ships, oil production platforms etc.
55	Construction, excl. of Oil Well Drilling
60	Ocean Transport - Foreign
63	Finance and Insurance
66	Crude Oil
67	Natural Gas
68	Services in Oil and Gas Exploration
69	Pipeline Transport of Oil and Gas
71	Production of Electricity
72	Power Net Renting
73	Sales and Distribution of Electricity
75	Car and Other Land Transportation
76	Air Transport
77	Railroads and Electrical Commuters
78	Ocean Transport - Domestic
79	Post and Tele Communication
81	Wholesale and Retail Trade
83	Dwelling Services
85	Other Private Services
89	Imputed Service Charges from Financial Institutions
	Government Input Activities
	Central Government
92C	Defense Exclusive of Military Submarines and Aircraft
92U	Military Submarines and Aircraft
93S	Central Government Education and Research
94S	Central Government Health-Care and Veterinary Services etc.
95S	Other Central Government Services
	Local Government
93K	Local Government Education and Research
94K	Local Government Health-Care and Veterinary Services etc.
95K	Other Local Government Services

B.1 Consumer behavior

In year *t* the representative consumer chooses a path of "full consumption", *F*, by maximizing intertemporal utility given by

$$\text{(B.1)} \quad U_t = \sum_{s=t}^{\infty} (1+\rho)^{t-s} \frac{\sigma_F}{\sigma_F - 1} F_s^{\frac{\sigma_F - 1}{\sigma_F}}$$

subject to the intertemporal budget constraint, see Bye and Holmøy (1997) for further details. σ_F is the intertemporal elasticity of substitution in full consumption. The intertemporal utility maximization gives the demand for full consumption

$$\text{(B.2)} \quad F_s = \left[\frac{1 + r(1 - t^D)}{1 + \rho} \right]^{\sigma_F t} (\lambda PF_s)^{-\sigma_F},$$

where *r* is the world market interest rate on financial wealth, t^D is the tax rate on capital income, λ is the marginal utility of wealth and *PF* is the ideal price index of full consumption. Full consumption is a CES-composite of material consumption, *C*, and leisure, *LE*. The corresponding ideal price index is given by

$$\text{(B.3)} \quad PF_s = \left[\alpha_C PC_s^{(1-\sigma_C)} + (1 - \alpha_C) \left(\frac{PLE_s}{1+g} \right)^{(1-\sigma_C)} \right]^{\frac{1}{1-\sigma_C}},$$

where *PC* is the price index of material consumption and *PLE* is the price of leisure (net of tax wage rate) measured in efficiency units such as labor, implying that the price of leisure must be adjusted with *g*, the factor augmenting technical change. σ_C is the elasticity of substitution between material consumption and leisure, and α_C is the intensity parameter for material consumption. In each period full consumption is distributed between leisure and material consumption, see Bye (2003) for further details.

B.2 Intertemporal equilibrium

A necessary condition for reaching a steady state solution is

$$\text{(B.4)} \quad 1 + r(1 - t^D) = (1 + \rho)(1 + g)^{\frac{1}{\sigma_F}}$$

which is a "razor's edge" condition since r, t^D, ρ and g which determines the long run (steady state) growth rate of the economy, are all considered as exogenous. In the analyses, equation (B.4) is assumed to hold at all points in time.

B.3 Separate simulation of the demand system for material consumption in the CGE model

Traditionally, when the demand system for material consumption in the CGE model is simulated separately, either the aggregate private consumption expenditure in current purchaser prices (VCB) or the utility of material consumption (CUTIL) is exogenous. The consumer prices are exogenous and the demand for different goods and services is endogenous. We want to analyse the effects on CUTIL of different VAT reforms. As a first point of departure it is therefore reasonable to choose the variant having endogenous CUTIL and exogenous VCB. However, when simulating separately the demand system for material consumption a VAT reform consisting of an increase (decrease) in taxes will, in most cases, lead to a decrease (increase) in CUTIL, given the level of VCB. In order to overcome this problem, we have undertaken the separate simulation of the demand system for material consumption in a different manner. We assume that total material consumption in constant purchaser prices C_t^{base} is exogenous, given from the baseline scenario. When implementing a VAT reform, VCB is then simultaneously adjusted in order to ensure that the demand for different goods and services satisfies the restriction on total material consumption. Given the value of C_t^{base}, we are then able to measure whether another allocation of total material consumption between different consumer goods and services, generated by another VAT system, leads to higher or lower utility of material consumption CUTIL.

Technically, the following two equations are added to those already in place in the demand system for material consumption:

$$(B.5)\ C_t^{base} = \sum_{i=1}^{26} C_{t,i}$$

$(B.6)\ VCB_t = VCB_t^{base}(1 + CJUST_t)$

Equation (B.5) states that the sum of the 26 consumer goods and services in constant purchaser prices ($C_{t,i}$) must be equal to C^{base} (for dwellings and cars, the stocks' services and not the purchase of dwellings and cars are included). Equation (B.6) states that VCB_t must be equal to VCB_t's value in the baseline scenario (VCB_t^{base}) plus an adjustment term, where $CJUST_t$ is the adjustment factor. Together with the consumer demand system, equations (B.5) and (B.6) determine the values of the two new endogenous variables VCB and CJUST.

The demand system for material consumption is then simulated for the stationary solution by substituting the consumer prices from the CGE simulation of the political VAT reform for the consumer prices in the baseline scenario. This is repeated for the CGE simulation of the political VAT reform without the low VAT rate on food and non-alcoholic beverages. The results show the two reforms' effect on CUTIL through a new allocation of material consumption between different consumer goods and services generated by another set of consumer prices, given the restriction of unchanged total material consumption.

B.4 Risk-adjusted welfare measure

We have chosen the following procedure to derive the welfare measure in section 6. As the welfare measure we have used full consumption measured as constant annuities (the interest rate is 5 per cent), adjusted for the effects of the risk premium. The risk adjusted level of full consumption FR is given by

(B.7) $FR_t = \left(F_t - \dfrac{0.025 * VK_t}{PF_t} \right).$

VK is the value of the endogenous stock of real capital and 0.025 is the risk premium associated with the endogenous capital stock. The risk-adjustment is implemented in both the baseline scenario and the policy scenarios, see Bye and Åvitsland (2003).

B.5 Data and parameters

The model is calibrated to the 1995 national accounts. For the production functions the elasticities of substitution between machinery and energy, the elasticity of substitution between the energy-machinery aggregate and labor and the elasticity of substitution between the modified real value added and various material inputs (see figure B.1.), are adjusted to parameters of a Generalized Leontief (GL) cost function estimated on time-series data from the national accounts, see Alfsen et al (1996). The elasticities of substitution between electricity and fuel oil in the energy aggregate are based on CES-function estimates on time series data by Mysen (1991). Most of these elasticities of substitution are smaller than 1. The elasticities of substitution between non-polluting and polluting transports, and the corresponding elasticities between the modified real value aggregate and various material inputs are set to 0.5, for all industries.

In the model of producer behavior the elasticities of transformation between deliveries to the domestic and foreign market are set equal to 4. The elasticities of scale in different industries are then calibrated to 0.83, given the elasticities of transformation. The elasticities of substitution between domestic products and imported goods are partly based on estimated parameters (see e.g. Svendsen (1990)), but

adjusted upwards such that all are around 4. For further details of the calibration of the model of producer behavior, see Holmøy and Hægeland (1997).

In the consumer model the intertemporal elasticity of substitution, σ_F, equals 0.3, Steigum (1993). Econometric estimates of σ_F vary considerably between different sources, and 0.3 is in the lower end of the range of the estimated parameters. The uncompensated wage elasticity of labor supply is 0.1 percent, which is based on estimates of labor supply for married women and men on micro-data by Aaberge, Dagsvik and Strøm (1995). This is consistent with the calibrated elasticity of substitution between material consumption and leisure of 0.6, and the share of leisure in the full consumption aggregate of 0.4, see also Bye, Holmøy and Strøm (1999) for details. The calibration of the parameters in the complete demand system for material consumption is based on detailed econometric studies using both micro and macro data, see Wold (1998).

Figure B.1. Production technology

Gross Production (X)
→ Variable Input (VF)
→ Other Input (S) / Services from Structures (B)

Services from Structures (B) → Buildings and Constructions (KB) / Heating (U)

Heating (U) → Heating Oils (FO) / Electricity for Heating (EB)

Other Input (S) → Various Material Inputs (V) / Modified Real Value Added (RT)

Modified Real Value Added (RT) → Labor and Machinery Services (R) / Transport Services (T)

Labor and Machinery Services (R) → Machinery Services (N) / Labor (L)

Machinery Services (N) → Machinery (KM) / Energy (EM)

Energy (EM) → Electricity (E) / Fossil Fuels (F)

Transport Services (T) → Polluting Transport (P) / Non-polluting Transport (TN)

Polluting Transport (P) → Polluting Commercial Transport (TP) / Own Transport (O)

Own Transport (O) → Transport Oil and Gasoline (FT) / Transport Equipment (KT)

Figure B.2. Material Consumption

Total consumer demand (CB)

Other goods and services (OGS)

Housing (HO)

Food (00)

Clothing and footwear (21)

Beverages and Tobacco (11)

Goods for recreation activities (25)

Furniture and durable consumer goods (41)

Health (64)

Other goods (22)

Gross rents (50)

Other services (60)

Direct purchases abroad by resident households (66)

Heating (HE)

Electric Goods (EG)

Health services (62)

Medicines and medical goods (63)

Fuels (13)

Electricity for heating (12HE)

Electricity for electrical household equipment (12EG)

Electrical household equipment (42)

Communication (CO)

Electricity (12)

Long-distance communication (DCO)

Local communication (LCO)

Local transport (LT)

Long-distance transport (DT)

Postal and telecommunication services, long-distance (79D)

Postal and telecommunication services, local (79L)

Private transport, local (LPT)

Public ransport, local (LOT)

Postal and telecommunication services (79)

User cost of cars, local transport (31L)

Public transport, long-distance (DOT)

Private transport, long-distance (DPT)

User cost of cars, long-distance transport (31D)

Petrol and car maintenance, local transport (14L)

Petrol and car maintenance, long-distance transport (14D)

User cost of cars (31)

Petrol and car maintenance (14)

Road transport, long-distance (75D)

Air transport (76)

Railway transport, long-distance (77D)

Water transport, long-distance (78D)

Water transport, local (78L)

Railway transport, local (77LR)

Tramway and subway transport (77LT)

Motor bus transport, local (75LB)

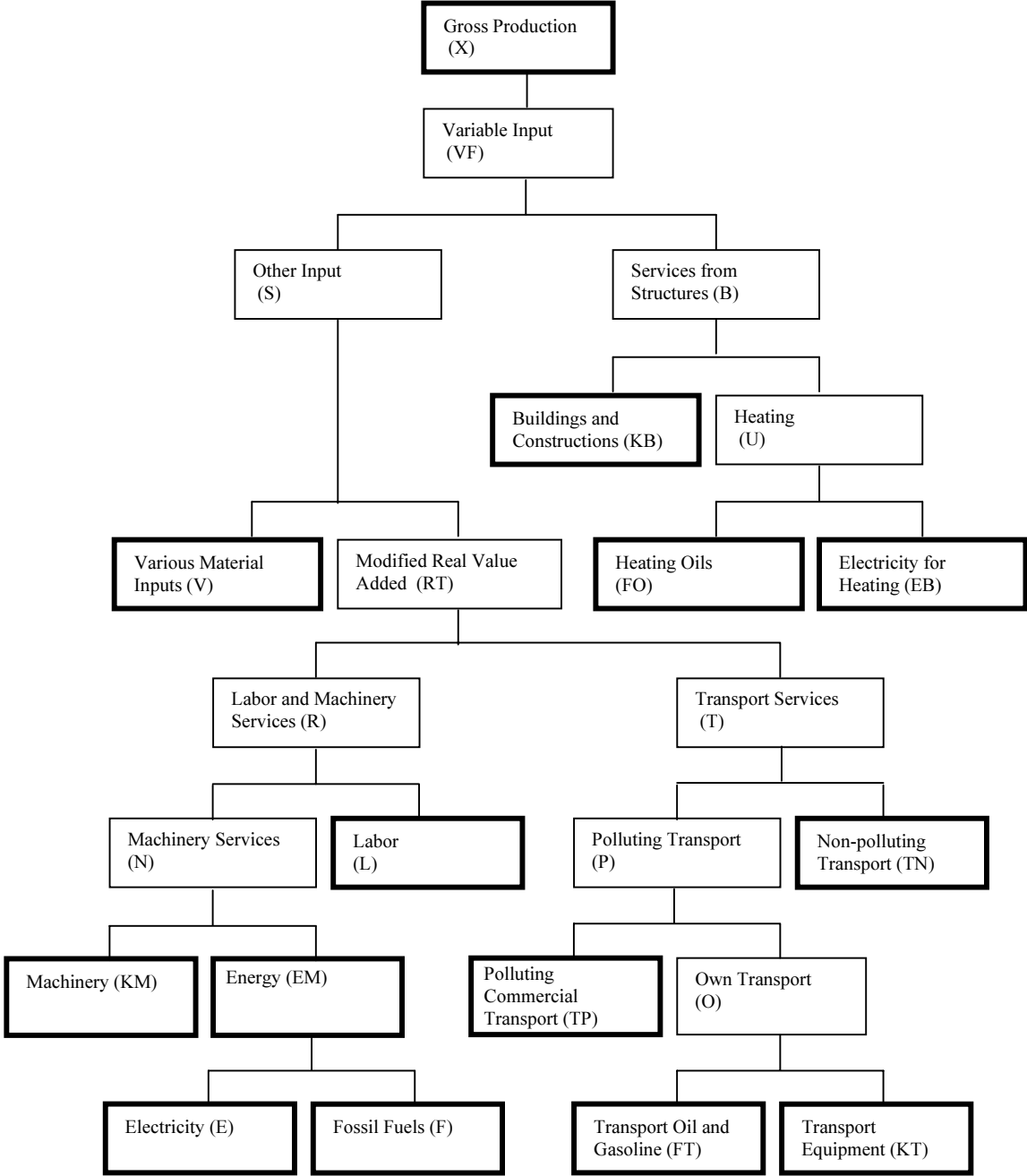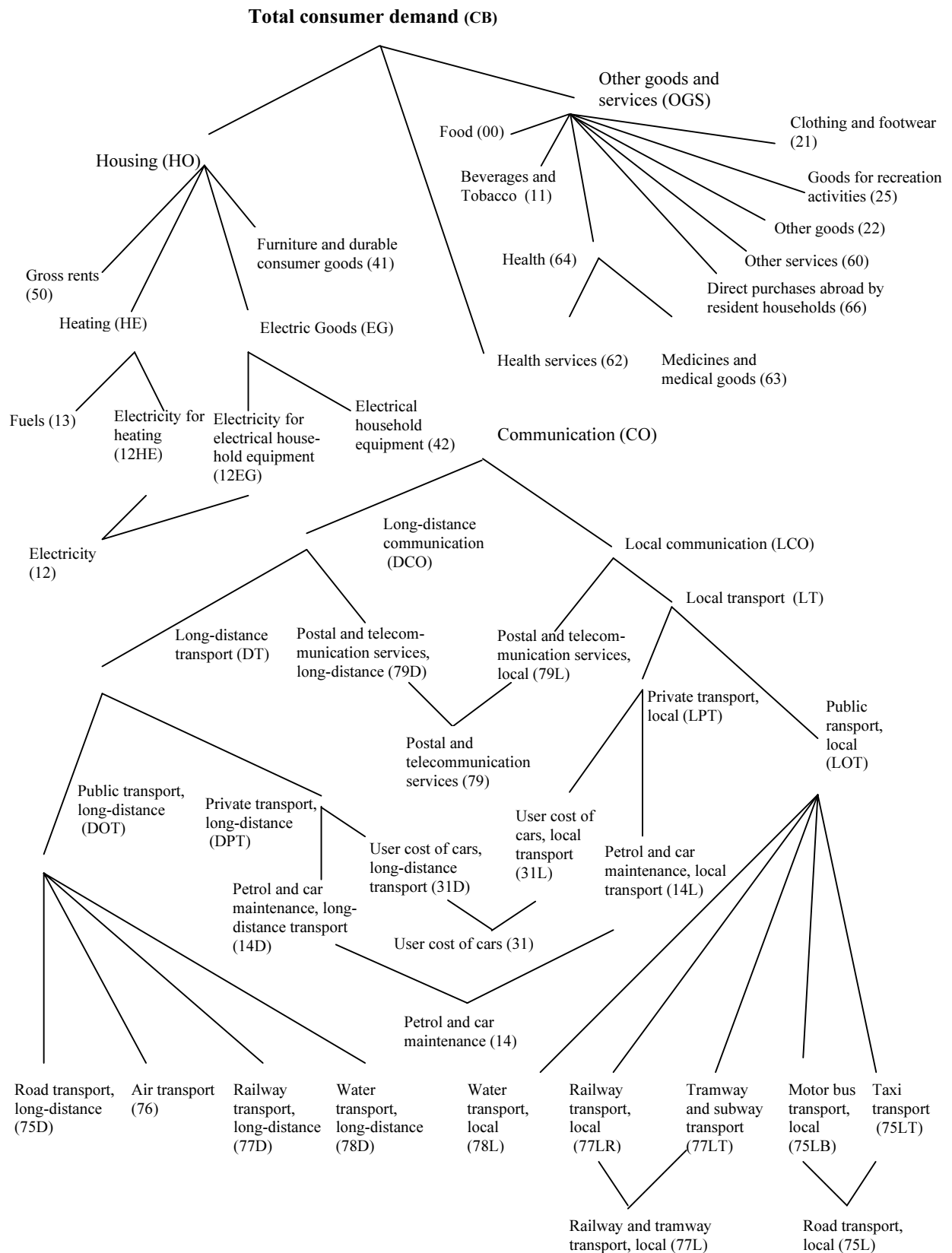Taxi transport (75LT)

Railway and tramway transport, local (77L)

Road transport, local (75L)

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