Statistics Norway
Research Department

Erling Holmøy and Torbjørn Hægeland

Effective Rates of Assistance for Norwegian Industries

Discussion Papers No. 147 • Statistics Norway, July 1995

Erling Holmøy and Torbjørn Hægeland

Effective Rates of Assistance for Norwegian Industries

Abstract:
We measure the effective assistance to 17 Norwegian private industries in 1989 and 1991 caused by government budgetary subsidies, indirect commodity taxes, import protection through nominal tariffs and non-tariff barriers, and electricity market distortions. The assistance effects are measured by the change in the net-of-tax value added price due to a removal of the policy measures considered. Most industries were effectively assisted, but the effective assistance differs widely between industries indicating the overall distortive effect on the industry structure. Agriculture, Food Processing and Manufacture of Beverages and Tobacco stand out as the most assisted industries. Budgetary subsidies and non-tariff barriers had the strongest effective assistance effect.

Keywords: Effective Rates of Assistance, Industrial Policy

JEL classification: F13, H25, L60, L71

Acknowledgement: The authors have benefited from the work by Taran Fæhn, Andreas Grünfeld and Birger Strøm. We are grateful to Jan Ingvald Haaland, Victor Norman and Øystein Olsen for comments on earlier drafts. Financial support for this project was provided by the Norwegian Ministry of Finance and Norwegian Research Council.

Addresses: Erling Holmøy, Statistics Norway, Research Department, P.O.Box 8131 Dep., N-0033 Oslo.
Phone: +47 - 22 86 48 22. Fax: +47 - 22 11 12 38. E-mail: erl@ssb.no

1 Introduction

Governments support private firms through a number of instruments intended to improve their profitability. According to general equilibrium theory, such policy generated shifts in exogenous conditions will affect the allocation of resources among industries. Quantification of these reallocations and the deadweight loss associated with the distortions caused by various policy measures, have been major applications of Applied General Equilibrium (AGE) models. However, when used to assess changes in the industry structure due to a multitude of policy measures, the appropriate AGE-model has to be rather disaggregated in order to produce interesting results. In spite of considerable progress in AGE-modelling over the last 20 years, large scale models are still costly to construct. In particular, model builders very often have to rely on poor estimates or even pure guesstimates of substitution parameters which are key determinants of the equilibrium adjustments of the industry structure.

Given the costs of constructing relevant models and the uncertainty associated with the estimates of important parameters, it may be optimal to provide information about the distortive effects on the industry structure by less sophisticated and costly indicators. One such alternative to AGE-analyses is *Effective Rates of Assistance (ERA)*, which was first calculated for Australia, see Argy, Plunkett and Wilson (1992). This paper reports the results of ERA computations for 24 private industries in Norway[1]. ERA is a summary measure of how government subsidies, protection and other forms of assistance affect the unit factor income of an industry, sometimes referred to as the effective output price. ERA is a generalisation of the concept "Effective Rates of Protection" (ERP) which was introduced by Corden (1966). While ERP is restricted to the question of how nominal tariffs affect the allocation of primary production factors, ERA extends this idea to include other forms of government support as well. As a matter of fact, one important aspect of ERA calculations is to provide a framework which makes it endogenous what policy measures that are relevant to include in a study of industry assistance. Furthermore, the ERA framework describes in what form the policy measures should be presented when the focus is on their allocative consequences. Accordingly, ERA computations transform various policy measures so that they can be compared and added together.

The rationale for transforming industry assistance into shares of unit factor income is fundamentally the same as the reason for summarising nominal tariff rates into ERPs. Provided rather restrictive assumptions concerning market structures, industry technologies and mobility of commodities and factors in a small open economy, classical trade theory predicts that an increase in the effective value added price of an industry relative to that of other industries, induces an expansion of value added in this industry, see Woodland (1982). Thus, by observing the *direction* of relative price changes, one has qualitative information about the corresponding changes in industry structure and use of resources. From this result, one can infer that industries which are most heavily supported as measured by ERA, have attracted a larger share of primary resources than they would if their ERAs were lower. This theoretical background implies that conclusions about the allocative consequences of government policies can only be drawn from the relative distribution of assistance among all industries. Consequently, if the ERAs are to be used as indicators not only of industry assistance per se, but also of industry structure distortions, they have to be calculated for an exhaustive set of industries in the part of the economy where the allocation of labour and capital are likely to be determined according to the underlying neoclassical model of a small open

[1] A more comprehensive discussion of the calculations are given in Holmøy, Hægeland, Olsen and Strøm (1993) and Fæhn, Grünfeld, Holmøy, Hægeland and Strøm (1995).

economy. This is the reason why government production sectors and the heavily regulated petroleum sector have been excluded from the calculations

Unfortunately, the positive relation between price- and quantity changes is no longer unambiguous when the simple model is extended to include intermediate inputs, non-traded commodities and multiple outputs[2]. To analyse impacts on resource allocation in a more general setting, a complete general equilibrium model is needed. Thus, the rationale for using ERA as an indicator for distortions of the industry structure implicitly relies upon the assumption that there still is a positive correlation between the relative pattern of these price effects and the industry structure.

The computation of ERA for *Agriculture* has much in common with the calculation of producer subsidy equivalent (PSE) carried out regularly by the OECD, cf. OECD (1994). However, as will be pointed out in some detail in section 3 and 4, our ERA calculations differ in important ways from the PSE. From a conceptual point of view, the definition of PSE deviates from the share of assistance in the value added price. Moreover, our ERA calculations is based on an input-output framework which makes it possible to account consistently for the diffusion of assistance from industries where the output price is endogenous.

It is also instructive to contrast ERA with other indicators suggested to measure the distortive effects of government policies. Recently, Anderson, Bannister and Neary (1995) has developed a scalar index, the Trade Restrictiveness Index (TRI), which calculates the uniform tariff rate which would generate the same welfare loss as that created by the existing distortive policies. There are two essential differences between the ERA and the TRI approaches. First, TRI is a single indicator of the *welfare effects* of government policies. It is not constructed in order to indicate the reallocations of value added among industries, which is the rationale for the definition of ERA. Second, computation of TRI requires estimates of all substitution elasticities in all production sectors and in the household preferences. But if such estimates are available and reliable, the costs of constructing a relevant AGE model is dramatically reduced, and one may question why one should compute TRI rather than relevant model simulations. Because of the informational requirements and its purpose as a summary index of the total deadweight loss, TRI is closer related to the deadweight loss measures (such as the approximations of the Hicks-Boiteaux and the Allais-Debreu indexes) developed by Diewert, see e.g. Diewert (1985), than to the ERA concept.

Independent of whether one applies an AGE model or a simpler indicator such as the ERA, the effort associated with gathering the relevant data describing the policy measures will be basically the same. Thus, one may regard the computation of ERA as a necessary step towards a more complete model analysis. For some policy measures, such as transfers, indirect taxes and subsidies and nominal tariff rates, information is relatively readily available in budget documents or other official sources. Other forms of assistance, such as non-tariff trade barriers (NTBs) and regulatory practices, are less transparent. Consequently, a major outcome of ERA calculations is improved transparency with respect to industry assistance.

The results from ERA computations will of course depend on the policy measures included. In principle, all policy measures should be included. In practice, however, the costs of gathering the relevant data are in some cases prohibitive. In the current study, three main policy areas have been analysed for the years 1989

[2] In the original article of Corden (1966), fixed coefficients for intermediate inputs were assumed. Discussions of how the ERP concept is affected by more general forms of factor subsitution are provided by Jones (1971), Corden (1971) and Ethier (1972). Bruno (1973) and Woodland (1982) analyse the issue of tariff protection within a general equilibrium framework. A rather comprehensive discussion of the interpretation of the ERA concept and the relation to general equilibrium effects is given by Holmøy, Hægeland, Olsen and Strøm (1993).

and 1991: 1) Indirect taxes and subsidies imposed on industries over fiscal budgets, 2) trade policy executed through nominal tariffs and NTBs, and 3) price regulations, including price discrimination in the electricity market. Unfortunately, it was not possible to include direct taxation of labour and capital in the present calculations.

The rest of the paper is organised as follows. Section 2 presents the simulation model actually used for the ERA calculations, and the data for the various types of government assistance are surveyed in section 3. Section 4 presents the empirical results, by answering the following questions: 1) Which industries receive most assistance as measured by ERA?, 2) Are the ERAs stable between 1989 and 1991, or does the relative distribution among industries vary significantly over these two years?, 3) What policy measures have the strongest impact on unit factor income?, 4) To what extent do the ERA figures provide new information about assistance to Norwegian industries? and 5) To what extent does the input-output framework influence the ERAs? Section 5 concludes.

2 A framework for calculating ERA[3]

The model framework used for ERA calculations distinguishes between 41 commodities and 24 private industries[4]. The model specifies two primary factors of production, labour and capital. *T* of the commodities may be traded internationally, without any quantitative restrictions such as import and export quotas. These are included in the set **T** and will be referred to as *T-commodities*. **T** will also include commodities that are not produced domestically (non-competing imports). Domestic deliveries of *T-commodities* are assumed to be perfect substitutes for corresponding foreign deliveries. Consequently, arbitrage is assumed to eliminate any difference between the producer price and the import price of these commodities. The import price can be decomposed into three components: i) the world price including transport costs from the origin to Norway; ii) nominal tariffs; iii) costs associated with non-tariff barriers (NTBs) which take the form of increasing the costs of exporting to the Norwegian market. Examples of such kinds of NTBs are typically specific technical standard requirements and home preferences in government procurement. In the following the increase in the import price generated by such NTBs will be referred to as *penetration* costs. Penetration costs will have the same qualitative impact on the corresponding domestic producer price as a nominal tariff. These kinds of NTBs should be clearly separated from the NTBs that imply quantitative restrictions on the trade flows such as import quotas and voluntary export restraints. In an ERA context the fundamental difference is that quantitative restrictions, when binding, imply that the domestic price will be determined in the domestic market independently of the price of competing imports. When nominal tariffs and penetration costs are measured as ad valorem rates, the domestic producer price of a T-commodity, *i*, becomes

$$(1) \qquad P_i^*\left(1+t_i\right)\left(1+t_i^T\right)$$

where P_i^* is the exogenous world price of commodity *i*; P_i is the domestic producer price; t_i is the nominal tariff rate and t_i^T is the rate of penetration cost.

[3] The model presented in this paper is somewhat simplified with respect to the specification of indirect taxation compared to the actual simulation model. A detailed description of the model is given in Holmøy et al. (1993).
[4] Recall that government sectors and the petroleum sector are excluded from the analysis.

The prices of the remaining N commodities, contained in the set **N**, are determined in domestic product markets independently of world prices (N-commodities). **N** is the union of the subsets **P** and **S** where **P** contains P commodities which may be traded internationally but are protected by quantitative import restrictions (*P-commodities*), whereas **S** contains $S = N - P$ non-tradables (*S-commodities*). For P-commodities, the relative difference between the domestic price and the opportunity cost of marginal imports is defined as the equivalent tariff rate associated with the import quota.

Tariffs and NTBs are examples of policy measures affecting commodity prices. However, labour and capital move between industries, not between commodities. Therefore, industries rather than commodities represent the interesting concept in a resource allocation perspective. As a matter of fact, this argument was the basic motivation for the ERP concept. More precisely, the calculation of ERA measures the effect on unit factor income, which is an industry concept, from different policies. In order to undertake such a transformation, the ERA calculations, like the ERP calculations, requires input-output tables which link industry flows and commodity flows.

At any operational aggregation level, industries are in general multi-output producers, which implies that an industry may produce both *T-, P-* and *S-commodities*. The grouping of firms into the M=24 industries follows the «main commodity principle», which means that all firms where production of commodity j constitutes the largest output share belong to the same industry labelled j. An industry is labelled *exposed* if it is a main producer of a *T-commodity*. There are K such industries, where $K \leq T$ due to non-competing imports. An industry which is the main producer of a *P-commodity* is labelled *Protected*, whereas main producers of *S-commodities* are called *Sheltered*. The numbers of protected and sheltered industries are equal to the number of commodities contained in the sets **P** and **S**. Consequently, $M = K + P + S = K + N$. For each industry unit factor income, net of taxes on labour and capital, is defined by the following identity:

$$(2) \quad y_j = \sum_{i \in \mathbf{T}} b_{ij}^{O} P_i^{*}(1+t_i)\left(1+t_i^{T}\right) + \sum_{i \in \mathbf{N}} b_{ij}^{O} P_i + s_j$$
$$- \sum_{i \in \mathbf{T}} b_{ij}^{I} P_i^{*}(1+t_i)\left(1+t_i^{T}\right)\left(1+t_{ij}^{V}\right) - \sum_{i \in \mathbf{N}} b_{ij}^{I} P_i \left(1+t_{ij}^{V}\right) - b_j^{L} t_j^{L} w_j^{L} - b_j^{K} t_j^{K} w_j^{K} \quad , j = 1,2,\ldots, M$$

In (2) t_{ij}^{V} and t_{ij} is the net commodity tax and the nominal tariff rate on commodity i respectively; b_{ij}^{I} and b_{ij}^{O} are fixed input- and output coefficients. b_j^{K} and b_j^{L} are input coefficients expressing the capital and labour requirement per unit of total output. w_j^{K} and w_j^{L} are net-of-tax service prices received by owners of capital and labour in industry j, while t_j^{K} and t_j^{L} are effective tax rates on services from these primary inputs. s_j denotes net subsidies[5] to industry j and y_j is the net unit factor income in industry j. When y is divided by the share of real value added in gross production, the resulting variable can be interpreted as the effective value added price, which is the main concept in the ERP literature, see e.g. Woodland (1982). However, when the input coefficients are fixed and relative changes in net factor income are considered, such a transformation has no impact on the results.

The terms in (2) have the following interpretation: The first three terms constitute the unit revenue in industry j. The first term is the unit revenue from sales of tradables, and the second term represents the revenue from sales of protected and sheltered commodities. Taken together these two revenue terms

[5] In the national accounts, these are classified as "non-commodity" taxes and subsidies, see also section 3.

constitute a producer price index for industry j. Additional revenue may come from net industry subsidies, s_j. The cost components in (1) include expenditures on intermediate goods which are separated into tradables (the fourth term) and protected/sheltered commodities (the fifth term). The two last terms on the r.h.s. of (1) accounts for effective taxation of labour and capital. Thus, y_j is the factor income per unit of gross production net of taxes on labour and capital.

For protected industries a non-negative equivalent tariff rate associated with the import quota, t_j^E, is defined residually as the ratio between the domestic price and the corresponding world price including transport costs, penetration costs and the nominal tariff. In the computations the non-negativity constraint may be binding if unit costs of producing a protected commodity are drastically reduced due to changes in policy measures. t_j^E can also be interpreted as the quota rent in competitive quota market.

In the traditional model of a small open economy, the factor prices of labour and capital are assumed to be equalised between sectors in equilibrium. The equation system in (2) then determines the level of these factor prices and the prices of protected and sheltered commodities, i.e. N + 2 variables. Moreover, the model determines which sectors that will be active through specialisation. Normally, the equilibrium number of sectors will equal N + 2. These sectors are able to pay the maximum remuneration to labour and capital without violating (1).

ERA calculations answer a question which is quite different compared to those motivating a solution of the small open economy model. Now both the actually observed industry structure and the net-of-tax service prices received by owners of capital and labour are taken as exogenously given. The endogenous variables to be determined by (2) are the net unit factor income in exposed industries and the producer prices of protected and sheltered commodities. The computed relative changes in net factor incomes due to changes in specified policy parameters are defined as the ERA-*effects* of these measures. ERA is defined as the ERA-effect of a complete elimination of all policy instruments introduced in (1).

From the definition of unit factor income in (2), we can identify the ERA-effects of the following categories of policy measures: 1) nominal tariffs, 2) NTBs measured by equivalent tariffs, 3) indirect taxes and subsidies levied on commodities[6], 4) direct industry taxes and subsidies (net non-commodity taxes), 5) price regulations such as maximum prices and price discrimination in the electricity market, 6) effective taxation of labour, 7) effective taxation of capital. Unfortunately, all relevant data required for calculation of effective taxation of labour and capital, have not yet been available. Consequently, this paper is confined to the ERA effects of the policy categories 1) - 5).

A noteworthy aspect of the model (2.5) is that changes in costs in a protected or sheltered industry are shifted forward to changes in the price of its main commodity, leaving net unit factor income unchanged. It follows that the ERA-effect of any policy change is bound to be zero for these industries. However, due to the simultaneous input-output structure of the economy, these industries play a potentially important role in the ERA calculations by transmitting assistance effects to the exposed industries through the deliveries of intermediate commodities. For example, assistance of domestic transport services will have no effect on net factor income in this sheltered industry, but reduced prices of transport services will increase the ability to remunerate labour and capital in exposed industries. The ERA effects in the exposed industries of this policy will depend on the share of direct and indirect input of transport services in total costs. Although

[6] Indirect taxes considered not to affect the profitability of private industries are excluded from the analysis, see section 3.1.

there will be no ERA-effects in sheltered and protected industries, the changes in the producer prices provided by our model summarise the net profitability effect in these industries of the policies considered. This measure may be used as an indicator of the effective assistance of sheltered and protected industries, but, contrary to ERA, such an indicator has no theoretical backing as bearer of information about the distortive effects on resource allocation.

When calculating the ERA-effects from policy measures other than import quotas, one can make a case for two distinct closure rules of the price model in (2), differing in the treatment of the equivalent tariff rates. The reason is that there are two plausible ways of defining what is meant by constant protection through NTBs working like import quotas. One definition (A) is to let the underlying quantitative restrictions be constant. In this case the quota rents adjust reflecting the endogenous changes in the domestic producer prices of the protected commodities. The alternative definition, (B) interprets constant protection as constant value of protection in the sense that the quota rents are kept constant. In this case the underlying quantitative restrictions are supposed to adjust. Closure rule A implies that the prices of protected commodities are endogenous while the net unit factor incomes in protected industries are exogenous as in sheltered industries. Thus, the ERA-effects in protected industries of all policy measures, except abolition of the quantitative restrictions, are bound to be zero. Under the alternative closure rule, B, the two sets of variables take on the opposite status. This paper includes calculations of the joint ERA-effects from all specified policy categories, in which case both closure rules are equivalent. In addition, we decompose the total ERAs into contributions from different categories of policy measures. In these calculations, we have found it instructive to apply closure rule B.

3 Data and empirical implementation

3.1 Indirect taxes and subsidies

The major conceptual framework for the ERA calculations is the Norwegian National Accounts (NNA), which provide base year data for input-output coefficients and prices in the formal model. The NNA also forms the data basis for indirect taxes, subsidies and nominal tariffs included in the model.

Two main categories of indirect taxes and subsidies are distinguished in the NNA; commodity taxes and non-commodity taxes[7]. While commodity taxes are related to commodity flows in the accounts, non-commodity taxes are imposed on industries. Differences in the latter type between industries thus indicate government assistance. On the other hand, commodity taxes are neutral, in the sense that they do not discriminate between source of delivery, either domestically or between Norwegian or foreign producers. However, changes in commodity taxes have *indirect* effects in the ERA calculations, via intermediate deliveries, see (1) above.

In Norway, the proceeds from non-commodity taxes and subsidies show substantial amounts, as seen from table 1. The total value of state subsidies to industries reported in the NNA constituted 5.6 percent of GDP in 1989 and 6.1 percent in 1991. At the same time, industries paid non-commodity taxes equal to more than 2.5 percent of GDP to the central government. While commodity taxes totalled 4.6 percent of GDP in 1989 and 4.8 percent in 1991, commodity subsidies were almost insignificant.

[7] As a matter of convenience, we will use the word "taxes" for both positive and negative magnitudes, i.e. covering also subsidies, in the following.

Table 1: Indirect taxes and subsidies in Norway

	1989		1991	
	Billions NOK	Percent of GDP	Billions NOK	Percent of GDP
Non-commodity subsidies	35.2	5.6	41.7	6.1
Non-commodity taxes	16.4	2.6	19.2	2.8
Commodity subsidies	1.4	0.2	1.1	0.2
Commodity taxes	28.5	4.6	33.0	4.8

Source: Norwegian National Accounts, Statistics Norway

Although the NNA is an indispensable data source when distributing indirect taxes and subsidies to industries, the national accounting conventions will in some cases produce misleading figures in an ERA context. First, one significant practical problem is that not all the items listed as taxes or subsidies in the NNA should be counted as support to specific industries. To take some examples, the NNA figures comprise outlays on labour market measures and support to cultural institutions. Moreover, to some extent, general funding of research is also placed under the heading "subsidies". Second, some subsidies are distributed to other industries than those effectively receiving them.
Given these problems of classification and the purpose of the present study, it is necessary to undertake a detailed evaluation of all items for non-commodity taxes and subsidies. In result, for both 1989 and 1991, nearly 20 percent of the non commodity subsidies were redistributed to other industries compared to the original NNA. The redistributions followed three main lines[8]:

i) For a number of measures, the aggregation level was not sufficiently detailed to fully capture the selectivity of the measures. An important example is interest subsidies, aimed at specific industries, given through cheap loans in state banks. State banks are grouped in the model sector *Finance and Insurance*. In the NNA the interest subsidies were received by this sector, as if all industries buying services from *Finance and Insurance* benefited from these selective measures. We therefore redistributed interest subsidies to the industries actually receiving subsidised loans.

ii) Some «general measures» are likely to benefit certain industries more than others. An example of this is subsidies to «general research purposes». In the NNA these are placed in the sector *Other Private Services*. After a detailed study, a fraction of the amounts, placed as «general research purposes» was redistributed to specific sectors, likely to benefit from this kind of support. Subsidies to research projects that were financed partly by companies, were redistributed to the sector where the companies in question belong.

iii) A large fraction of the support to *Agriculture* is paid through the channels of distribution for agricultural products, which are grouped in the sectors *Processed Food* and *Retail Trade*. In the NNA, these subsidies are posted to these sectors, but the agricultural sector benefits from them through higher prices of their deliveries. It is not straightforward to calculate the ERA effects of these measures. The simplest way to capture the effects of such subsidies in the ERA calculations is to redistribute the subsidies to the sectors finally receiving them prior to the calculations.

Agriculture receives the major part of the net non-commodity subsidies which we classify as industry assistance. But also *Fishing and Breeding of Fish* and *Building of Ships* receives substantial amounts. In the ERA calculations for 1989, we have removed non-commodity subsidies, non-commodity taxes and

[8] A detailed overview of all reclassifications and changes in tax flows is given in Holmøy et al (1993).

commodity taxes constituting 3.0 percent, 1.0 percent and 2.7 percent of 1989 GDP, respectively, compared to the actual situation in 1989. For the 1991 calculations, the corresponding figures are 3.1 percent, 0.9 percent and 2.8 percent of 1991 GDP.

3.2 Trade policies

Nominal tariffs

The NNA data reveal that protection via nominal tariffs has become gradually less important in the Norwegian economy[9], see table 2. The rates in table 2 are based on tariff rates on the 7-digit commodity level, calculated from tariff revenue and c.i.f. values of imports. These rates are aggregated to the model commodity level using production weights. Production weights, rather than import weights, are appropriate because it is the effect of tariffs on the price of perfect domestic substitutes which is to be measured. However, the tariff rates at the most detailed commodity level are average rates, based on an observed composition of imports from different countries. Nominal tariffs on imports from specific countries may be significantly higher than indicated by these average figures. Thus, if commodities of different country origin are close substitutes, the fall in domestic prices following a removal of tariffs may be stronger than expressed by the estimated average rates.

Non-tariff barriers

To include *NTBs* in ERA calculations involves a number of both conceptual and computational problems. First, there are major problems of identification[10]. Internationally, the UNCTAD classification scheme has become the de facto accepted definition of NTBs. Second, the existence of NTBs must be translated into equivalent tariff rates consistent with the ERA framework described in section 2. In order to identify and estimate equivalent tariff rates for Norwegian industries, data on domestic producer prices and world prices of corresponding commodities are necessary but not sufficient. In addition, information on industry and commodity characteristics and various kinds of trade policy regulations motivating differences between Norwegian and corresponding world prices is required. Our strategy has been to collect existing relevant information, including results from available industry studies. We have then classified the policies faced by a sector into quantitative restrictions or penetration costs. The estimated equivalent tariff rates have been aggregated to the model level using production weights. A detailed discussion of these results on NTBs and equivalent tariff rates are given in Holmøy et al. (1993) and Fæhn et al. (1995). Here, only some major areas of government regulations and principles guiding our choices are presented. Estimates for the various commodity groups in our ERA model are shown in the last two columns of table 2.

Domestic production of a number of commodities is protected from foreign competition by *quantitative import restrictions. Agricultural Commodities* stands out as the by far most protected commodity group. There are restrictive import quotas on all major agricultural products. This is combined with strict price regulations, in particular for dairy farm products. For most agricultural products, our estimates of equivalent tariffs are mainly based on the OECD calculations of "Producer Subsidy Equivalents" (PSE). However, for some important products, such as milk and other dairy products, we have preferred to use comparisons of Norwegian and Danish prices[11], rather than the PSE estimates. This is because Denmark is likely to be the main exporter of such commodities to Norway under a free trade regime. Based on this

[9] Due to the implementation of the Uruguay round in 1995, all kinds of protection except tariffs are prohibited. Our study deals with the years 1989 and 1991, when there were no such rules against non tariff protection.

[10] A comprehensive overview of NTBs is given in Laird and Yeats (1990).

[11] This material was provided by the Norwegian Agricultural Research Institute and other Norwegian sources.

information, we have estimated an average equivalent tariff rate on agricultural commodities of 67 percent in 1989 and 71 percent in 1991.

Table 2: Nominal and equivalent tariff rates by commodity group. Percent.

Commodity group	Nominal tariff rates 1989	Nominal tariff rates 1991	Type of NTB	Equivalent tariff rates 1989	Equivalent tariff rates 1991
Agricultural Commodities	0.16	0.41	Q	69	71
Commodities from Forestry	0.08	0.01		-	-
Commodities from Fishery	-	-		-	-
Processed Food	2.90	3.02	Q	44	49
Beverages and Tobacco	1.62	2.75	P	35	30
Textiles and Wearing Apparels	0.03	0.03	Q	2	1
Wood and Wood products	6.32	0.05		-	-
Chemical and mineral products	0.36	0.45	Q/P	10	8
Commodities from Printing and Publishing	-	0.01		-	-
Mining and Quarrying	-	-		-	-
Pulp and Paper Articles	0.01	-		-	-
Industrial Chemicals	0.37	0.37	Q	3	3
Petrol	-	-		-	-
Fuel oils	-	-		-	-
Metals	0.05	0.07		-	-
Metal Products, Machinery and Equipment	0.68	0.66	P	2	2
Repair	-	-		-	-
Ships	-	-		-	-
Oil Production Platforms	0.02	-	P	3	3

«-» means nil, «Q» means quantitative restrictions, «P» means penetration costs.

Imports of many of the commodities included in the group *Processed Food* are also subject to extensive regulations through quotas. Important sources of information have been the official Norwegian industry statistics and trade statistics, providing producer prices and import prices at the 8-digit commodity level. Extensive use has also been made of Purchasing Power Parity (PPP) calculations, documented in Statistics Norway (1990). These data enable us to use consumer prices net of indirect taxes from nine member countries of EU (excluding Spain, Portugal and Greece), or alternatively, one of these countries individually, as a reference of measurement. To minimise problems of transportation costs included in the price estimates, we have chosen the price levels in Denmark as a basis for assessing the differences between Norwegian and international prices of food and beverages. As revealed from table 2, this has resulted in an implicit tariff of 48 percent in 1989 and 53 percent in 1991 for this commodity group as a whole.

Trade in textiles and clothes (included in the commodity group *Textiles and Wearing Apparels*) is limited by voluntary export agreements organised through the Multifiber Agreement. However, these agreements primarily apply to imports from low-cost countries in the third world. Based on Melchior (1993), the average equivalent tariff rate on such commodities is estimated to 13 percent in 1989 and 8 percent in 1991. The equivalent tariff on the commodity group as a whole is then 2 percent in 1989 and 1 percent in 1991.

For important manufacturing products in Norway, such as fertilisers (included in the commodity group *Industrial Chemicals*) and cement (included in *Chemical and Mineral Products*), the domestic market is de

facto monopolised. For these products there are no formal barriers to trade. However, in the cement market there are clear indications of trade being restricted by implicit agreements between major producers in different countries to supply their respective domestic market. For fertilisers, Norsk Hydro supplies more than 90 percent of the domestic market, and has a significant share of the European market as well. For both these manufacturing products, price regulations prevent the Norwegian producers to exploit all of their potential monopoly power. The presence of imperfect competition complicates the interpretation of implicit tariffs. For fertilisers, an implicit tariff rate of 80 percent in 1989 and 81 percent in 1991 is estimated, based on information in Sørgård (1992). Information provided in Gabrielsen (1989), combined with time series of changes in domestic and world prices, justifies an implicit tariff rate on cement of 16 percent for both 1989 and 1991.

Several studies indicate that a number of Norwegian industries are favoured through the fact that foreign producers have to undertake penetration costs in order to export to the Norwegian market. For *Beverages and* Tobacco, extensive standard requirements have led to a significant price differential between Norwegian and international prices. The tariff equivalent is estimated to 35 percent in 1989 and 30 percent in 1991. According to Norman (1990), specific commodity standards and technical design are the main sources underlying the estimated equivalent tariff rates on pharmaceutical products (included in *Chemical and Mineral Products*) and on various commodities constituting the group *Metal Products, Machinery and Equipment* in table 2. Regarding government procurement, focus is frequently on industries producing equipment for use in the petroleum sector. At this point, the official policy was that Norwegian firms should be preferred if their prices were competitive. Still, investigations and comparisons between prices offered by Norwegian and foreign suppliers indicate a price differential equal to 3 percent in 1989. Although major uncertainties exist, we impose an implicit tariff of 3 percent also for 1991 on imports of the commodity group *Oil production platforms*.

Electricity market distortions

More than 99 percent of Norwegian electricity consumption is produced by domestic hydro power plants. The studies by Johnsen (1991) and Bye and Johnsen (1991) show that large price differentials, which cannot be accounted for by corresponding cost differentials, exist in the Norwegian electricity market. This price discrimination is a result of an explicit government policy, since the Norwegian electricity market traditionally has been highly regulated[12]. Individual hydro power producers sell their electricity (competitively) to regional distribution companies and to some large firms within the energy intensive industries *Manufacture of Metals, Manufacture of Industrial Chemicals* and *Manufacture of Pulp and Paper Articles*. The presumably most important kind of price discrimination on (hydro power) electricity was due to favourable long-term contracts between the producing plants and these firms.

The quantification of rates of price discrimination in the electricity market in 1989 is based on Johnsen (1991). In short, the method decomposes the purchaser prices of electricity to different sectors into i) a uniform producer price on homogenous electricity, ii) various sector specific cost components reflecting qualitative differences between deliveries to different sectors and iii) a residual price-cost margin, which is interpreted as a measure of price discrimination. Regarding qualitative heterogeneity of the hydro power deliveries to different sectors, observed differentials in purchaser prices are corrected for the following elements: First, energy intensive industries have a higher utilisation time than other users[13]. Second,

[12] In 1992, implementation of a new "Energy Law" implied substantial deregulation of the Norwegian electricity market.

[13] The Norwegian Water Resources Administration has calculated that the long-run marginal cost on deliveries of hydro power to energy intensive industries equals 89 percent of the average long-run marginal cost on deliveries to other sectors.

distribution costs (including power losses) differ. Third, security of delivery differs between different categories of electricity. Surplus power is inferior to contracted deliveries, and this is reflected in the price structure. Fourth, indirect taxes on electricity differ between sectors.

Table 3: Rates of price discrimination on electricity (in percent of the producer price) by industry

Industry	**1989**	**1991**
Exposed industries		
Agriculture	36.4	55.8
Forestry	36.4	55.8
Fishing and breeding of Fish etc.	36.4	55.8
Food processing	29.5	58.1
Manufacture of Beverages and Tobacco	29.5	58.1
Manufacture of Textiles and Wearing Apparel	29.5	58.1
Manufacture of Wood and Wood Products	-9.1	-18.9
Manufacture of Chemical and Mineral Products	-9.1	-18.9
Printing and Publishing	-9.1	-18.9
Mining and Quarrying	-9.1	-18.9
Manufacture of Pulp and Paper Articles	-61.9	-69.2
Manufacture of Industrial Chemicals	-12.8	-46.2
Petroleum Refining	-39.2	-57.0
Manufacture of Metals	-40.1	-47.6
Manufacture of Metal Products, Machinery and Equipment	8.9	8.9
Building of Ships	43.2	43.2
Manufacture of Oil production Platforms etc.	43.2	43.2
Sheltered industries		
Construction, (excl. Oil Well Drilling)	73.6	81.5
Finance and Insurance	62.0	30.7
Production of Electricity	-	-
Domestic Transport	-14.4	-16.9
Wholesale and Retail Trade	54.3	72.0
Dwelling services	43.7	30.6
Other Private Services	52.2	30.7

"-" means nil.

Table 3 reports the computed rates of price discrimination on electricity in 1989 and 1991. The industries *Manufacture of Pulp and Paper Products, Petroleum Refining* and *Manufacture of Metals* were relatively heaviest subsidised through favourable prices of electricity these years. The implicit subsidies were slightly lower for the sectors *Manufacture of Industrial Chemicals* and *Manufacture of Intermediate Inputs and Capital Goods*. On the other hand, *Construction* and *Other private services* paid higher prices than implied by cost pricing. The price differentials were larger in 1991 than 1989, because the equilibrium price in the electricity market was higher in 1991, thereby increasing prices on non-contracted deliveries.

4 Computed of Effective Rates of Assistance

Relative distribution of effective assistance between industries

The interest in the relative distribution of ERA is of course motivated by the allocative consequences of industry assistance. The relative ERAs can be interpreted as a measure of the distortive effects on the structure of relative effective output prices. From this perspective, it is interesting to compare the ERAs for different industries with an average ERA. Our measure of average ERA has been defined as an average of industrial ERAs with initial shares of factor income as weights. (In a calculation with large policy changes, such as in table 4, the choice of *initial* factor income shares as weights may of course be highly

misleading.) The problem of finding the relevant weights points to the fundamental shortcoming of the ERA indicator compared to model simulations; it does not capture the equilibrium reallocations.

Table 4 shows the ERA effects of a simultaneous removal of all the policy measures considered in this study[14]. Almost all - 14 out of a total of 17 - of the exposed industries in the model benefited from net government assistance in 1991, measured by ERA. The industries *Agriculture*, *Food Processing* and *Manufacture of Beverages and Tobacco* were the ones with ERAs above the average level which was 30.5 percent in 1991. For *Agriculture*, the ERA figure indicates that the remuneration of labour and capital would be reduced by 102.3 percent after a removal of the policy measures considered in this study. This provokes a reminder of caution when interpreting the results: The ERA figures are average numbers that may hide large differences in profitability and dependency of government assistance within industries. In particular, our result does not necessarily indicate that all agricultural production in Norway would be unprofitable in an unassisted situation.

Table 4: A decomposition of total ERA effects into shifts in income and cost components, 1991

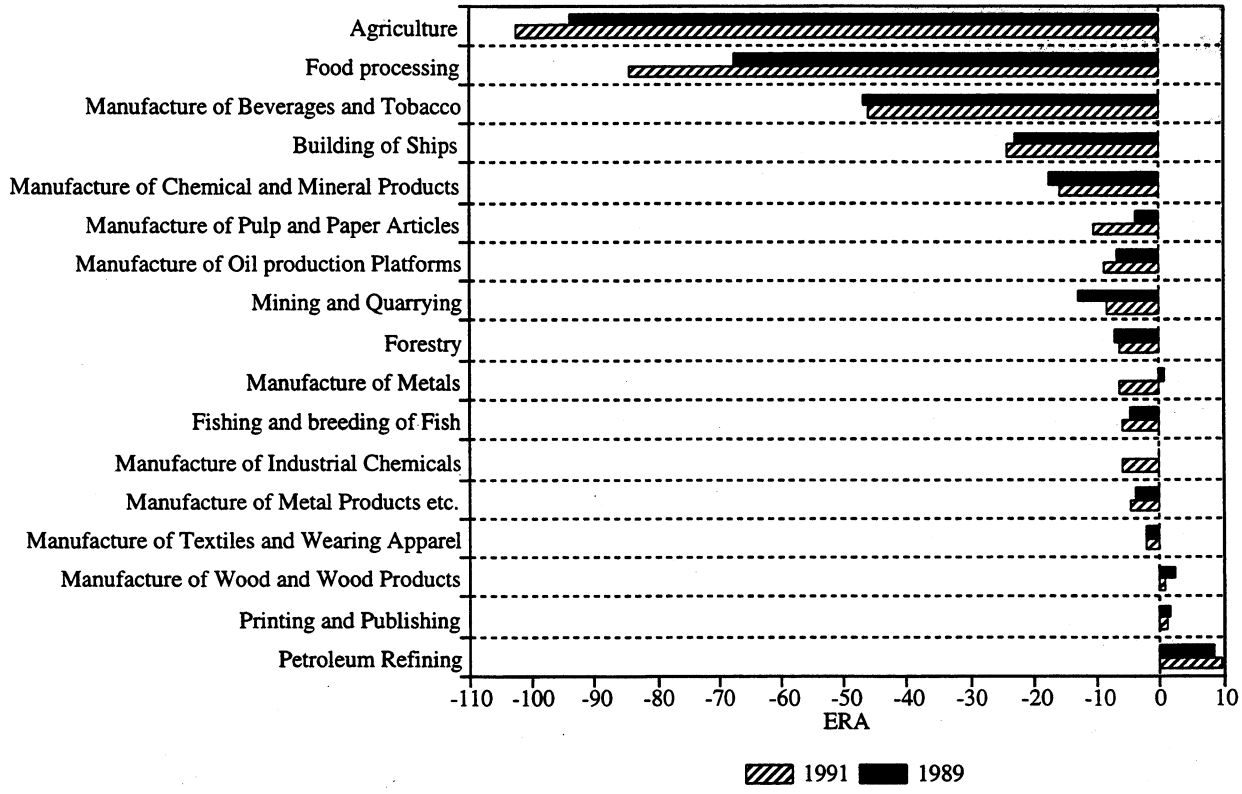
	Change in net sector taxes, percent of gross production value	Change in producer price, percent	Change in input price, percent	ERA
Potentially exposed industries				
Agriculture	42.8	-33.3	-26.6	-102.3
Food processing	0.6	-33.3	-24	-84.3
Manufacture of Beverages and Tobacco	-0.4	-24.3	-9.9	-46
Building of Ships	6.7	-1.1	-2.7	-24
Manufacture of Chemical and Mineral Products	1	-7.1	-4.4	-15.6
Manufacture of Pulp and Paper Articles	0.2	-0.1	3.2	-10.5
Manufacture of Oil production Platforms etc.	0.8	-2.7	-2.7	-8.8
Mining and Quarrying	6.8	-0.3	-4.6	-8.3
Forestry	5.1	-0.2	-11.7	-6.4
Manufacture of Metals	0.4	-0.4	1.2	-6.3
Fishing and breeding of Fish etc.	11	-0.1	-16.6	-5.9
Manufacture of Industrial Chemicals	0.1	-3.3	-2.6	-5.8
Manufacture of Metal Products, Machinery and Equipment	0.9	-2.7	-3	-4.8
Manufacture of Textiles and Wearing Apparel	1.4	-3.5	-6.4	-2.3
Manufacture of Wood and Wood Products	1.1	-0.2	-2.2	0.8
Printing and Publishing	1.1	0	-2.6	0.9
Petroleum Refining	0	-0.8	-2.5	9.9
Average ERA (weighted by factor incomes)				-30.5
Sheltered industries				
Finance and Insurance	2	0.5	-4.5	-
Electricity and Gas Supply	0	-0.7	-3.9	-
Dwelling Services	-0.4	-0.9	-2.2	-
Domestic Transport	-0.2	-2.4	-4.8	-
Construction (excl. Oil Well Drilling)	-0.2	-2.6	-3.6	-
Other Private Services	0	-2.7	-7.2	-
Wholesale and Retail Trade	-2.2	-3.6	-2.6	-

[14] In the tables and diagrams in this section, the (potentially) exposed industries are are ranked according to the size of ERA in 1991.

Constancy of the ERAs between 1989 and 1991

As shown in diagram 1, the distribution of ERAs was mainly unchanged from 1989 to 1991. The average ERA increased from 25.1 to 30.5 percent, but the relative distribution between industries was almost the same. The most significant changes were the increased effective assistance to *Agriculture* and *Food Processing,* through higher equivalent tariff rates on their main products. Moreover, hydro power intensive industries, such as *Manufacture of Metals*, *Manufacture of Industrial Chemicals* and *Manufacture of Pulp and Paper Articles* benefited from higher implicit subsidies on hydro power electricity in 1991 than in 1989. The reason was that the general market price of electricity increased from 1989 to 1991, thereby increasing the gap down to the price fixed in the long-term contracts regulating most of the sales to the power intensive industries.

Diagram 1: ERA in 1989 and 1991 compared



The ERA-effects of different policy measures

In order to identify the policy measures which contribute most significantly to ERA for different industries, we have decomposed the ERA figures into contributions from the following policy categories: net non-commodity subsidies; commodity taxes; nominal tariffs and NTBs; and price discrimination on electricity. This is done by carrying out separate ERA calculations of each policy category, holding the other categories constant. In these calculations, we have applied closure rule A, cf. section 1, interpreting constant non-tariff protection as constant price differences between domestic and world prices.

Table 5 shows that the assistance effects of the specified policy categories differ between industries. In *Agriculture*, more than two thirds of the ERA can be attributed to non-commodity subsidies. Such subsidies also stand out as particularly important in *Fishing and Breeding of Fish* and *Building of Ships*.

Commodity taxes affect the ERAs directly through the purchaser prices of intermediary inputs and indirectly through changes in producer prices of non-traded input commodities. These taxes hit *Petroleum Refining* and *Manufacture of Metals* hardest, implying a reduction of effective output price close to 15 percent. The figures in the column showing the ERA-effects of protective trade policies are identical to the results of a calculation of ERPs, i.e. the effects on effective output prices from a removal of nominal and equivalent tariffs. The large assistance to *Food Processing* and *Manufacture of Beverages and Tobacco* is almost entirely due to protective trade policies, especially NTBs on the product markets. The potential importance of taking the tariff effects on input prices into account, is clearly illustrated by the results for *Fishing and Breeding of Fish*. Here, the branch *Breeding of Fish* paid much higher prices of important inputs, especially those supplied by the *Food Processing* industry, than in a free trade regime. In result, the factor income in *Fishing and Breeding of Fish* was reduced by nearly 30 percent due to the trade policy implemented in 1991. Not surprisingly, price discrimination in the electricity market benefited the hydro power intensive industries *Manufacture of Metals*, *Manufacture of Industrial Chemicals* and *Manufacture of Pulp and Paper Articles*.

The results in table 5 are also informative when examining to what extent the different policy measures reinforce or counteract each other. Counteracting policies may be a signal of «lack of consequence» in the industrial policy, but it may of course also reflect that policy measures may have other purposes than affecting the profitability of certain industries. Opposing effects may also reflect that the industries at the selected aggregation level are heterogeneous so that they include subsectors that are affected by different categories of government policy. There are large counteracting effects in the hydro power intensive industries where benefits from subsidised electricity is partly offset by commodity taxes on other inputs. Another example is *Fishing and Breeding of Fish* which was heavily assisted through non commodity subsidies (45 percent of factor income), but almost all of this support is offset by commodity taxation and trade policies. In this case, however, heterogeneity is the basic explanation to counteracting ERA-effects. The major part of the subsidies to this industry is received by *Fishing*, while trade policies mainly affect input prices in *Breeding of Fish*.

Table 5: ERA effects from different policy measures

	Net sector subsidies	Commodity taxes	Trade policies	Regulated electricity prices	TOTAL*
Agriculture	-72.2	2	-33	0.9	-102.3
Food processing	-3.2	7.6	-87.9	0.8	-84.3
Manufacture of Beverages and Tobacco	2.7	2.9	-52.1	0.5	-46
Building of Ships	-27.5	1.7	1.6	0.3	-24
Manufacture of Chemical and Mineral Products	-2.8	2.7	-15	-0.5	-15.6
Manufacture of Pulp and Paper Articles	-0.6	7.2	1.7	-18.9	-10.5
Manufacture of Oil production Platforms etc.	-5.3	2.5	-6.3	0.3	-8.8
Mining and Quarrying	-12.9	3.9	1.5	-0.7	-8.3
Forestry	-9.1	0.8	1.9	0	-6.4
Manufacture of Metals	-1.3	14.6	2.9	-22.6	-6.3
Fishing and breeding of Fish etc.	-45.4	9.2	28.8	1.5	-5.9
Manufacture of Industrial Chemicals	-0.2	7	-3.9	-8.6	-5.8
Manufacture of Metal Products, Machinery and Equipment	-2.4	1.9	-4.3	0	-4.8
Manufacture of Textiles and Wearing Apparel	-3.6	1.4	-0.5	0.4	-2.3
Manufacture of Wood and Wood Products	-2.8	2.1	1.9	-0.4	0.8
Printing and Publishing	-3.1	2.4	1.7	-0.2	0.9
Petroleum Refining	0.4	14.9	-3.6	-1.8	9.9

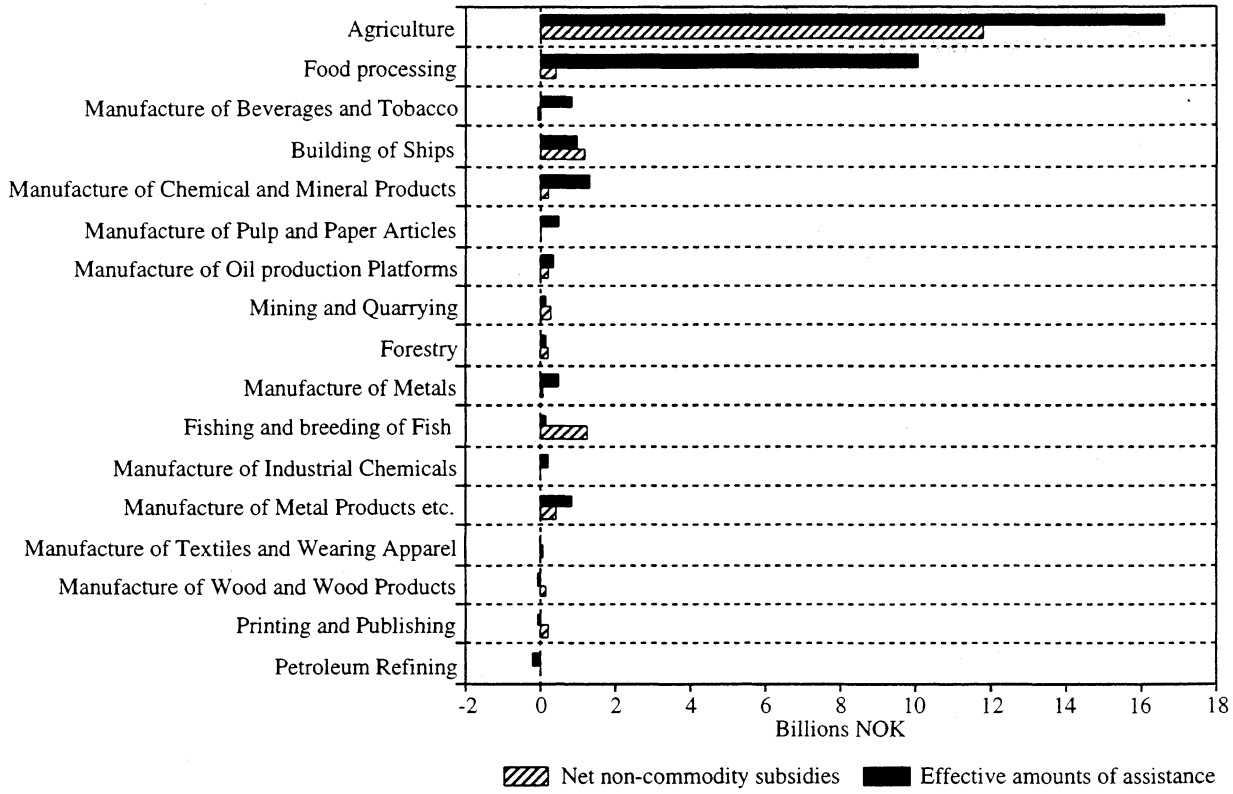
Do the ERA-calculations provide new information about assistance to Norwegian industries?

We are not aware of any studies of assistance to Norwegian industries that include all the measures considered in this study for a comprehensive set of industries. Qualitatively, our study is therefore undoubtedly original in a Norwegian context. In order to evaluate to what extent our ERA calculations provide information that substantially changes the *empirical* picture of industry assistance, it is necessary to evaluate the alternative available sources of relevant information.

Contrary to our ERA-figures, existing indicators of assistance are either «measure-specific» or «industry-specific». An example of a measure specific indicator is the simple and widely used listing of budgetary industry assistance reported annually by the Ministry of Finance in the National Budgets. The figures in the National Budgets roughly correspond to the net non-commodity subsidies included in our calculations. It is reasonable to suspect that this information together with additional information about *Agriculture*, to a large extent has formed the general public impression of the patterns of assistance. This information is presented in terms of absolute amounts rather than rates indicating shifts in the effective output price. Although such a form of presenting the assistance data may be more transparent to the general public and politicians, the theoretical model of resource allocation in an open economy clearly implies that assistance should be transformed into changes in effective prices[15]. However, neglecting this aspect for the sake of comparison, we have transformed our ERA-figures into corresponding *effective amounts of assistance,* which is ERA times initial factor income. Diagram 2 illustrates that the picture of assistance implied by the effective amounts of assistance differ significantly from the picture implied by the net budgetary industry assistance reported in the National Budgets.

[15] A comparison of the results for different industries, shows that equal changes in income and cost components yields rather unequal ERA figures. The reason for such a possibility lies in the definition of ERA - the percentage change in the factor income due to removal of policy measures. The ERA-effect of a given change in industrial incomes or expenditures caused by a change in a policy measure, depends on the share of factor income in the gross production value.

Diagram 2: Net budget payments compared to effective amounts of assistance. 1991



Food Processing is perhaps the most striking example of the discrepancy between the two sets of assistance amounts. Net budgetary support was less than 1 billion NOK in 1991, but extensive non-tariff protection had a large impact on the effective assistance, which amounts to a total of 10 billions NOK. Also for *Manufacture of Beverages and Tobacco* and *Manufacture of Chemical and Mineral Products* the effective amount of assistance is much larger than direct budget payments. The corresponding large difference for *Agriculture* should represent much less of a surprise, because the authorities are very well informed about the profitability in this industry because of political targets regarding the household income of farmers. On the other hand, *Fishing and Breeding of Fish* stands out as the most striking example of an industry where the direct budget payments are substantial whereas the effective amount of assistance is almost insignificant. As pointed out above, the reason is that NTBs on the products from *Processed Food* induce higher input prices for fish breeding.

The most prominent example of an industry indicator is perhaps the PSE measure of agricultural support regularly calculated by the OECD, see OECD (1994). One might argue that ERA is nothing more than PSE calculated for a set of industries. However, this is not the case. First, PSE does not capture the important inter-industry links; measures aimed at one industry may affect the remuneration of labour and capital in other industries. Second, PSE has not a very clear theoretical foundation, and can not be used to make any predictions of allocation effects. But perhaps the most important weakness of single industry measures such as PSE, is that they lack a point of reference. At least when allocative distortions are considered, one can infer nothing from a single industry figure of assistance no matter how thoroughly it has been estimated. Our ERA figures clearly show that the assistance to the majority of other industries makes the relative assistance to *Agriculture* substantially less than indicated by the single industry figure.

Are changes in the costs of intermediaries important to the ERAs?

Table 4 shows that the prices of intermediary inputs are significantly affected by the policy measures considered in this study. The figures illustrate that the arguments of evaluating the tariff structure in terms of ERPs rather than nominal tariff rates are more than theoretical - they have significant empirical consequences also when one includes other policy measures than tariffs into the framework. The calculations also reveal that the shifts in gross income and cost components which add up to the ERA figure, do not always work in the same direction. In *Agriculture*, a removal of the different policy measures leads to a large increase in net sector taxes and reductions in producer prices but these effects are partly offset by reductions in input prices. In *Fishing and Breeding of Fish* there are also counteracting effects. The total ERA figure is not among the largest, but substantial changes in net sector taxes and input prices pull in opposite directions.

Are endogenous price effects important?

Although ERA for sheltered industries per definition is zero, ERA calculations produce some relevant information for assessing effective government assistance to these industries. The changes in producer prices in sheltered industries, following a change in policy measures, reflect the net effects on costs associated with these measures. As shown in table 4, the removal of tariffs, NTBs and commodity taxes reduce prices of intermediate inputs. Combined with reductions in net non-commodity tax rates (not in *Finance and Insurance*), unit costs and producer prices fall in all industries except *Finance and Insurance*. Through the input-output structure these changes affect input prices in exposed industries, and finally influence their ERA-figures. To illustrate the empirical importance of using a model that captures such effects of endogenous prices of non-traded commodities, we have calculated ERAs on a completely recursive model, where prices on S-commodities are kept constant.

Table 6: Effects on ERA from including sheltered industries in the calculations

	Total ERA prices are	ERA when S-effects kept constant	«Feedback»
Agriculture	-102.3	-102.8	0.5
Food Processing	-84.3	-85.4	1.1
Manufacture of Beverages and Tobacco	-46	-47.2	1.2
Building of Ships	-24	-25	1
Manufacture of Chemical and Mineral Products	-15.6	-16.7	1.1
Manufacture of Pulp and Paper Articles	-10.5	-11.6	1.1
Manufacture of Oil Production Platforms etc.	-8.8	-11.7	2.9
Mining and Quarrying	-8.3	-9.2	0.9
Forestry	-6.4	-6.4	0
Manufacture of Metals	-6.3	-7.3	1
Fishing and Breeding of Fish	-5.9	-6.7	0.8
Manufacture of Industrial Chemicals	-5.8	-6.7	0.9
Manufacture of Metal Products etc.	-4.8	-5.6	0.8
Manufacture of Textiles and Wearing Apparel	-2.3	-2.9	0.6
Manufacture of Wood and Wood Products	0.8	-0.4	1.2
Printing and Publishing	0.9	-0.5	1.4
Petroleum Refining	9.9	8.8	1.1

The differences are shown in table 6. They reveal that price effects from sheltered industries have significant influence on many of the industrial ERAs, which illustrates the importance of using an input-output framework including sheltered industries when assessing industry assistance. In *Production of Oil Platforms*, ERA is 2.9 percentage points lower when taking the price effect into account. For *Printing and*

Publishing and *Manufacture of Wood and Wood Products* the price effects from sheltered industries even change the sign of ERA: From the «naive» calculations on the recursive model, these industries appear to be effectively taxed by the policy measures considered in this study. However, the original calculations, which account for the effects of endogenous prices of non-traded inputs, show that they are effectively assisted.

5 Conclusions

The present study indicates that most of the potentially exposed industries in Norway were effectively assisted through various forms of policy measures in 1989 and 1991. *Agriculture, Food Processing, Manufacture of Beverages and Tobacco* and *Building of Ships* stand out as the most heavily assisted industries in both years. Among the policy categories included in this study, budgetary subsidies and NTBs were found to be the most important channels of effective assistance. However, lack of relevant data made it impossible to take into account the effects of taxation of labour and capital. The fact that most industries were assisted also suggests that the allocative impact, if intended, could have been brought about at a lower level of government interference. It is also tempting to conclude that the complexity of the effects underlying the ERA figures and the substantial discrepancy between previous information about industry assistance and our ERA results, indicate that the allocative impact is not likely to be intended.

Compared to existing indicators, ERA has clear advantages as an «organising principle» when assessing the level of government assistance. But as emphasised, ERA has its limitations as a predictor for resource allocation effects of government assistance. In particular, it is a serious problem that the existence of sheltered industries, which employs the dominant share of labour and capital, weakens the correlation between effective prices and sectoral allocation of resources. This makes a case for complete AGE analyses. An AGE analysis will require all the information utilised in ERA calculations. Therefore, ERA calculations may be regarded as a necessary step towards a more complete model analysis.

References

Anderson, J.E., G.J. Bannister and J.P. Neary (1995): Domestic Distortions and International Trade. *International Economic Review* 36, 139-157.

Argy, S., H. Plunkett and R. Wilson (1992): The measurement of effective rates of assistance in Australia. Unpublished paper, OECD.

Bruno, M. (1973): Protection and Tariff Change Under General Equilibrium, *Journal of International Economics* 3, 3, 205 - 225.

Bye, T. and T.A. Johnsen (1991): *Effektivisering av kraftmarkedet*, Reports 91/13, Statistics Norway.

Corden, W.M. (1966): The structure of a tariff system and the effective protective rate. *Journal of Political Economy* 74, 3, 221 - 237.

Corden, W.M. (1971): *The theory of protection*, Oxford: Oxford University Press.

Diewert, E.W. (1985): A dynamic approach to the measurement of waste in an open economy. *Journal of International Economics* 19, 213-244.

Ethier, W. J. (1972): Input Substitution and the Concept of the Effective Rate of protection, *Journal of Political Economy* 80, 1, 34 -47.

Fæhn, T., A. Grünfeld, E. Holmøy, T. Hægeland and B. Strøm (1995): *Sammensetningen av den effektive støtten til norske næringer i 1989 og 1991*, Reports 95/9, Statistics Norway.

Gabrielsen, T.S. (1989): Økonomisk tilpasning i det norske markedet for kunstgjødsel (NPK), Reports 24/89, Center for Research in Economics and Business Administration, Bergen.

Holmøy, E., T. Hægeland, Ø. Olsen and B. Strøm (1993): *Effektive satser for næringsstøtte*, Reports 93/31, Statistics Norway.

Johnsen, T.A. (1991): *Modell for kraftsektoren*, Reports 93/12, Statistics Norway.

Jones, R.W. (1971): Effective Protection and Substitution, *Journal of International Economics* 1, 59-81.

Laird, S and A.Yeats (1990): *Quantitative Methods for Trade-Barrier Analysis*, London: The Macmillan Press.

Melchior, A. (1993): Helping Your Industry at the Greatest Cost. The Story of Norwegian Textile Quotas, Report no. 171, Norwegian Institute of Foreign Affairs.

Norman, V. (1990): "How Successful has EFTA Been ? "Revealed Protection" in three Scandinavian Industries, 1965-85". In *EFTA Countries in a Changing Europe*, EFTA, 9 - 23.

OECD (1994): *Agricultural Policies, Markets and Trade. Monitoring and Outlook 1994*. OECD, Paris.

Statistics Norway (1990): Analyse av strukturelle prisnivåforskjeller mellom Norge og EF-landene. Delrapport 4: Prisnivåindekser med og uten indirekte avgifter for Norge og 9 EF-land, Unpublished note, Statistics Norway.

Sørgård, L. (1992): Entry Games in the Norwegian Cement Market, Ph.D. thesis, Norwegian School of Business Administration.

Woodland, A. D. (1982): *International Trade and Resource Allocation*, Amsterdam: North-Holland Publishing company.

Issued in the series Discussion Papers

No. 1 *I. Aslaksen and O. Bjerkholt (1985):* Certainty Equivalence Procedures in the Macroeconomic Planning of an Oil Economy

No. 3 *E. Biørn (1985):* On the Prediction of Population Totals from Sample surveys Based on Rotating Panels

No. 4 *P. Frenger (1985):* A Short Run Dynamic Equilibrium Model of the Norwegian Production Sectors

No. 5 *I. Aslaksen and O. Bjerkholt (1985):* Certainty Equivalence Procedures in Decision-Making under Uncertainty: An Empirical Application

No. 6 *E. Biørn (1985):* Depreciation Profiles and the User Cost of Capital

No. 7 *P. Frenger (1985):* A Directional Shadow Elasticity of Substitution

No. 8 *S. Longva, L. Lorentsen and Ø. Olsen (1985):* The Multi-Sectoral Model MSG-4, Formal Structure and Empirical Characteristics

No. 9 *J. Fagerberg and G. Sollie (1985):* The Method of Constant Market Shares Revisited

No. 10 *E. Biørn (1985):* Specification of Consumer Demand Models with Stochastic Elements in the Utility Function and the first Order Conditions

No. 11 *E. Biørn, E. Holmøy and Ø. Olsen (1985):* Gross and Net Capital, Productivity and the form of the Survival Function. Some Norwegian Evidence

No. 12 *J.K. Dagsvik (1985):* Markov Chains Generated by Maximizing Components of Multidimensional Extremal Processes

No. 13 *E. Biørn, M. Jensen and M. Reymert (1985):* KVARTS - A Quarterly Model of the Norwegian Economy

No. 14 *R. Aaberge (1986):* On the Problem of Measuring Inequality

No. 15 *A.-M. Jensen and T. Schweder (1986):* The Engine of Fertility - Influenced by Interbirth Employment

No. 16 *E. Biørn (1986):* Energy Price Changes, and Induced Scrapping and Revaluation of Capital - A Putty-Clay Model

No. 17 *E. Biørn and P. Frenger (1986):* Expectations, Substitution, and Scrapping in a Putty-Clay Model

No. 18 *R. Bergan, Å. Cappelen, S. Longva and N.M. Stølen (1986):* MODAG A - A Medium Term Annual Macroeconomic Model of the Norwegian Economy

No. 19 *E. Biørn and H. Olsen (1986):* A Generalized Single Equation Error Correction Model and its Application to Quarterly Data

No. 20 *K.H. Alfsen, D.A. Hanson and S. Glomsrød (1986):* Direct and Indirect Effects of reducing SO_2 Emissions: Experimental Calculations of the MSG-4E Model

No. 21 *J.K. Dagsvik (1987):* Econometric Analysis of Labor Supply in a Life Cycle Context with Uncertainty

No. 22 *K.A. Brekke, E. Gjelsvik and B.H. Vatne (1987):* A Dynamic Supply Side Game Applied to the European Gas Market

No. 23 *S. Bartlett, J.K. Dagsvik, Ø. Olsen and S. Strøm (1987):* Fuel Choice and the Demand for Natural Gas in Western European Households

No. 24 *J.K. Dagsvik and R. Aaberge (1987):* Stochastic Properties and Functional Forms of Life Cycle Models for Transitions into and out of Employment

No. 25 *T.J. Klette (1987):* Taxing or Subsidising an Exporting Industry

No. 26 *K.J. Berger, O. Bjerkholt and Ø. Olsen (1987):* What are the Options for non-OPEC Countries

No. 27 *A. Aaheim (1987):* Depletion of Large Gas Fields with Thin Oil Layers and Uncertain Stocks

No. 28 *J.K. Dagsvik (1987):* A Modification of Heckman's Two Stage Estimation Procedure that is Applicable when the Budget Set is Convex

No. 29 *K. Berger, Å. Cappelen and I. Svendsen (1988):* Investment Booms in an Oil Economy - The Norwegian Case

No. 30 *A. Rygh Swensen (1988):* Estimating Change in a Proportion by Combining Measurements from a True and a Fallible Classifier

No. 31 *J.K. Dagsvik (1988):* The Continuous Generalized Extreme Value Model with Special Reference to Static Models of Labor Supply

No. 32 *K. Berger, M. Hoel, S. Holden and Ø. Olsen (1988):* The Oil Market as an Oligopoly

No. 33 *I.A.K. Anderson, J.K. Dagsvik, S. Strøm and T. Wennemo (1988):* Non-Convex Budget Set, Hours Restrictions and Labor Supply in Sweden

No. 34 *E. Holmøy and Ø. Olsen (1988):* A Note on Myopic Decision Rules in the Neoclassical Theory of Producer Behaviour, 1988

No. 35 *E. Biørn and H. Olsen (1988):* Production - Demand Adjustment in Norwegian Manufacturing: A Quarterly Error Correction Model, 1988

No. 36 *J.K. Dagsvik and S. Strøm (1988):* A Labor Supply Model for Married Couples with Non-Convex Budget Sets and Latent Rationing, 1988

No. 37 *T. Skoglund and A. Stokka (1988):* Problems of Linking Single-Region and Multiregional Economic Models, 1988

No. 38 *T.J. Klette (1988):* The Norwegian Aluminium Industry, Electricity prices and Welfare, 1988

No. 39 *I. Aslaksen, O. Bjerkholt and K.A. Brekke (1988):* Optimal Sequencing of Hydroelectric and Thermal Power Generation under Energy Price Uncertainty and Demand Fluctuations, 1988

No. 40 *O. Bjerkholt and K.A. Brekke (1988):* Optimal Starting and Stopping Rules for Resource Depletion when Price is Exogenous and Stochastic, 1988

No. 41 *J. Aasness, E. Biørn and T. Skjerpen (1988):* Engel Functions, Panel Data and Latent Variables, 1988

No. 42 *R. Aaberge, Ø. Kravdal and T. Wennemo (1989):* Unobserved Heterogeneity in Models of Marriage Dissolution, 1989

No. 43 *K.A. Mork, H.T. Mysen and Ø. Olsen (1989):* Business Cycles and Oil Price Fluctuations: Some evidence for six OECD countries. 1989

No. 44 *B. Bye, T. Bye and L. Lorentsen (1989):* SIMEN. Studies of Industry, Environment and Energy towards 2000, 1989

No. 45 *O. Bjerkholt, E. Gjelsvik and Ø. Olsen (1989):* Gas Trade and Demand in Northwest Europe: Regulation, Bargaining and Competition

No. 46 *L.S. Stambøl and K.Ø. Sørensen (1989):* Migration Analysis and Regional Population Projections, 1989

No. 47 *V. Christiansen (1990):* A Note on the Short Run Versus Long Run Welfare Gain from a Tax Reform, 1990

No. 48 *S. Glomsrød, H. Vennemo and T. Johnsen (1990):* Stabilization of Emissions of CO_2: A Computable General Equilibrium Assessment, 1990

No. 49 *J. Aasness (1990):* Properties of Demand Functions for Linear Consumption Aggregates, 1990

No. 50 *J.G. de Leon (1990):* Empirical EDA Models to Fit and Project Time Series of Age-Specific Mortality Rates, 1990

No. 51 *J.G. de Leon (1990):* Recent Developments in Parity Progression Intensities in Norway. An Analysis Based on Population Register Data

No. 52 *R. Aaberge and T. Wennemo (1990):* Non-Stationary Inflow and Duration of Unemployment

No. 53 *R. Aaberge, J.K. Dagsvik and S. Strøm (1990):* Labor Supply, Income Distribution and Excess Burden of Personal Income Taxation in Sweden

No. 54 *R. Aaberge, J.K. Dagsvik and S. Strøm (1990):* Labor Supply, Income Distribution and Excess Burden of Personal Income Taxation in Norway

No. 55 *H. Vennemo (1990):* Optimal Taxation in Applied General Equilibrium Models Adopting the Armington Assumption

No. 56 *N.M. Stølen (1990):* Is there a NAIRU in Norway?

No. 57 *Å. Cappelen (1991):* Macroeconomic Modelling: The Norwegian Experience

No. 58 *J.K. Dagsvik and R. Aaberge (1991):* Household Production, Consumption and Time Allocation in Peru

No. 59 *R. Aaberge and J.K. Dagsvik (1991):* Inequality in Distribution of Hours of Work and Consumption in Peru

No. 60 *T.J. Klette (1991):* On the Importance of R&D and Ownership for Productivity Growth. Evidence from Norwegian Micro-Data 1976-85

No. 61 *K.H. Alfsen (1991):* Use of Macroeconomic Models in Analysis of Environmental Problems in Norway and Consequences for Environmental Statistics

No. 62 *H. Vennemo (1991):* An Applied General Equilibrium Assessment of the Marginal Cost of Public Funds in Norway

No. 63 *H. Vennemo (1991):* The Marginal Cost of Public Funds: A Comment on the Literature

No. 64 *A. Brendemoen and H. Vennemo (1991):* A climate convention and the Norwegian economy: A CGE assessment

No. 65 *K.A. Brekke (1991):* Net National Product as a Welfare Indicator

No. 66 *E. Bowitz and E. Storm (1991):* Will Restrictive Demand Policy Improve Public Sector Balance?

No. 67 *Å. Cappelen (1991):* MODAG. A Medium Term Macroeconomic Model of the Norwegian Economy

No. 68 *B. Bye (1992):* Modelling Consumers' Energy Demand

No. 69 *K.H. Alfsen, A. Brendemoen and S. Glomsrød (1992):* Benefits of Climate Policies: Some Tentative Calculations

No. 70 *R. Aaberge, Xiaojie Chen, Jing Li and Xuezeng Li (1992):* The Structure of Economic Inequality among Households Living in Urban Sichuan and Liaoning, 1990

No. 71 *K.H. Alfsen, K.A. Brekke, F. Brunvoll, H. Lurås, K. Nyborg and H.W. Sæbø (1992):* Environmental Indicators

No. 72 *B. Bye and E. Holmøy (1992):* Dynamic Equilibrium Adjustments to a Terms of Trade Disturbance

No. 73 *O. Aukrust (1992):* The Scandinavian Contribution to National Accounting

No. 74 *J. Aasness, E. Eide and T. Skjerpen (1992):* A Criminometric Study Using Panel Data and Latent Variables

No. 75 *R. Aaberge and Xuezeng Li (1992):* The Trend in Income Inequality in Urban Sichuan and Liaoning, 1986-1990

No. 76 *J.K. Dagsvik and S. Strøm (1992):* Labor Supply with Non-convex Budget Sets, Hours Restriction and Non-pecuniary Job-attributes

No. 77 *J.K. Dagsvik (1992):* Intertemporal Discrete Choice, Random Tastes and Functional Form

No. 78 *H. Vennemo (1993):* Tax Reforms when Utility is Composed of Additive Functions

No. 79 *J.K. Dagsvik (1993):* Discrete and Continuous Choice, Max-stable Processes and Independence from Irrelevant Attributes

No. 80 *J.K. Dagsvik (1993):* How Large is the Class of Generalized Extreme Value Random Utility Models?

No. 81 *H. Birkelund, E. Gjelsvik, M. Aaserud (1993):* Carbon/energy Taxes and the Energy Market in Western Europe

No. 82 *E. Bowitz (1993):* Unemployment and the Growth in the Number of Recipients of Disability Benefits in Norway

No. 83 *L. Andreassen (1993):* Theoretical and Econometric Modeling of Disequilibrium

No. 84 *K.A. Brekke (1993):* Do Cost-Benefit Analyses favour Environmentalists?

No. 85 *L. Andreassen (1993):* Demographic Forecasting with a Dynamic Stochastic Microsimulation Model

No. 86 *G.B. Asheim and K.A. Brekke (1993):* Sustainability when Resource Management has Stochastic Consequences

No. 87 *O. Bjerkholt and Yu Zhu (1993):* Living Conditions of Urban Chinese Households around 1990

No. 88 *R. Aaberge (1993):* Theoretical Foundations of Lorenz Curve Orderings

No. 89 *J. Aasness, E. Biørn and T. Skjerpen (1993):* Engel Functions, Panel Data, and Latent Variables - with Detailed Results

No. 90 *I. Svendsen (1993):* Testing the Rational Expectations Hypothesis Using Norwegian Microeconomic DataTesting the REH. Using Norwegian Microeconomic Data

No. 91 *E. Bowitz, A. Rødseth and E. Storm (1993):* Fiscal Expansion, the Budget Deficit and the Economy: Norway 1988-91

No. 92 *R. Aaberge, U. Colombino and S. Strøm (1993):* Labor Supply in Italy

No. 93 *T.J. Klette (1993):* Is Price Equal to Marginal Costs? An Integrated Study of Price-Cost Margins and Scale Economies among Norwegian Manufacturing Establishments 1975-90

No. 94 *J.K. Dagsvik (1993):* Choice Probabilities and Equilibrium Conditions in a Matching Market with Flexible Contracts

No. 95 *T. Kornstad (1993):* Empirical Approaches for Analysing Consumption and Labour Supply in a Life Cycle Perspective

No. 96 *T. Kornstad (1993):* An Empirical Life Cycle Model of Savings, Labour Supply and Consumption without Intertemporal Separability

No. 97 *S. Kverndokk (1993):* Coalitions and Side Payments in International CO_2 Treaties

No. 98 *T. Eika (1993):* Wage Equations in Macro Models. Phillips Curve versus Error Correction Model Determination of Wages in Large-Scale UK Macro Models

No. 99 *A. Brendemoen and H. Vennemo (1993):* The Marginal Cost of Funds in the Presence of External Effects

No. 100 *K.-G. Lindquist (1993):* Empirical Modelling of Norwegian Exports: A Disaggregated Approach

No. 101 *A.S. Jore, T. Skjerpen and A. Rygh Swensen (1993):* Testing for Purchasing Power Parity and Interest Rate Parities on Norwegian Data

No. 102 *R. Nesbakken and S. Strøm (1993):* The Choice of Space Heating System and Energy Consumption in Norwegian Households (Will be issued later)

No. 103 *A. Aaheim and K. Nyborg (1993):* "Green National Product": Good Intentions, Poor Device?

No. 104 *K.H. Alfsen, H. Birkelund and M. Aaserud (1993):* Secondary benefits of the EC Carbon/ Energy Tax

No. 105 *J. Aasness and B. Holtsmark (1993):* Consumer Demand in a General Equilibrium Model for Environmental Analysis

No. 106 *K.-G. Lindquist (1993):* The Existence of Factor Substitution in the Primary Aluminium Industry: A Multivariate Error Correction Approach on Norwegian Panel Data

No. 107 *S. Kverndokk (1994):* Depletion of Fossil Fuels and the Impacts of Global Warming

No. 108 *K.A. Magnussen (1994):* Precautionary Saving and Old-Age Pensions

No. 109 *F. Johansen (1994):* Investment and Financial Constraints: An Empirical Analysis of Norwegian Firms

No. 110 *K.A. Brekke and P. Børing (1994):* The Volatility of Oil Wealth under Uncertainty about Parameter Values

No. 111 *M.J. Simpson (1994):* Foreign Control and Norwegian Manufacturing Performance

No .112 *Y. Willassen and T.J. Klette (1994):* Correlated Measurement Errors, Bound on Parameters, and a Model of Producer Behavior

No. 113 *D. Wetterwald (1994):* Car ownership and private car use. A microeconometric analysis based on Norwegian data

No. 114 *K.E. Rosendahl (1994):* Does Improved Environmental Policy Enhance Economic Growth? Endogenous Growth Theory Applied to Developing Countries

No. 115 *L. Andreassen, D. Fredriksen and O. Ljones (1994):* The Future Burden of Public Pension Benefits. A Microsimulation Study

No. 116 *A. Brendemoen (1994):* Car Ownership Decisions in Norwegian Households.

No. 117 *A. Langørgen (1994):* A Macromodel of Local Government Spending Behaviour in Norway

No. 118 *K.A. Brekke (1994):* Utilitarism, Equivalence Scales and Logarithmic Utility

No. 119 *K.A. Brekke, H. Lurås and K. Nyborg (1994):* Sufficient Welfare Indicators: Allowing Disagreement in Evaluations of Social Welfare

No. 120 *T.J. Klette (1994):* R&D, Scope Economies and Company Structure: A "Not-so-Fixed Effect" Model of Plant Performance

No. 121 *Y. Willassen (1994):* A Generalization of Hall's Specification of the Consumption function

No. 122 *E. Holmøy, T. Hægeland and Ø. Olsen (1994):* Effective Rates of Assistance for Norwegian Industries

No. 123 *K. Mohn (1994):* On Equity and Public Pricing in Developing Countries

No. 124 *J. Aasness, E. Eide and T. Skjerpen (1994):* Criminometrics, Latent Variables, Panel Data, and Different Types of Crime

No. 125 *E. Biørn and T.J. Klette (1994):* Errors in Variables and Panel Data: The Labour Demand Response to Permanent Changes in Output

No. 126 *I. Svendsen (1994):* Do Norwegian Firms Form Exptrapolative Expectations?

No. 127 *T.J. Klette and Z. Griliches (1994):* The Inconsistency of Common Scale Estimators when Output Prices are Unobserved and Endogenous

No. 128 *K.E. Rosendahl (1994):* Carbon Taxes and the Petroleum Wealth

No. 129 *S. Johansen and A. Rygh Swensen (1994):* Testing Rational Expectations in Vector Autoregressive Models

No. 130 *T.J. Klette (1994):* Estimating Price-Cost Margins and Scale Economies from a Panel of Microdata

No. 131 *L. A. Grünfeld (1994):* Monetary Aspects of Business Cycles in Norway: An Exploratory Study Based on Historical Data

No. 132 *K.-G. Lindquist (1994):* Testing for Market Power in the Norwegian Primary Aluminium Industry

No. 133 *T. J. Klette (1994):* R&D, Spillovers and Performance among Heterogenous Firms. An Empirical Study Using Microdata

No. 134 *K.A. Brekke and H.A. Gravningsmyhr (1994):* Adjusting NNP for instrumental or defensive expenditures. An analytical approach

No. 135 *T.O. Thoresen (1995):* Distributional and Behavioural Effects of Child Care Subsidies

No. 136 *T. J. Klette and A. Mathiassen (1995):* Job Creation, Job Destruction and Plant Turnover in Norwegian Manufacturing

No. 137 *K. Nyborg (1995):* Project Evaluations and Decision Processes

No. 138 *L. Andreassen (1995):* A Framework for Estimating Disequilibrium Models with Many Markets

No. 139 *L. Andreassen (1995):* Aggregation when Markets do not Clear

No. 140 *T. Skjerpen (1995):* Is there a Business Cycle Component in Norwegian Macroeconomic Quarterly Time Series?

No. 141 *J.K. Dagsvik (1995):* Probabilistic Choice Models for Uncertain Outcomes

No. 142 *M. Rønsen (1995):* Maternal employment in Norway, A parity-specific analysis of the return to full-time and part-time work after birth

No. 143 *A. Bruvoll, S. Glomsrød and H. Vennemo (1995):* The Environmental Drag on Long- term Economic Performance: Evidence from Norway

No. 144 *T. Bye and T. A. Johnsen (1995):* Prospects for a Common, Deregulated Nordic Electricity Market

No. 145 *B. Bye (1995):* A Dynamic Equilibrium Analysis of a Carbon Tax

No. 146 *T. O. Thoresen (1995):* The Distributional Impact of the Norwegian Tax Reform Measured by Disproportionality

No. 147 *E. Holmøy and T. Hægeland (1995).* Effective Rates of Assistance for Norwegian Industries

Statistics Norway
Research Department
P.O.B. 8131 Dep.
N-0033 Oslo

Tel.: + 47 - 22 86 45 00
Fax: + 47 - 22 11 12 38
ISSN 0803-074X

Statistics Norway
Research Department