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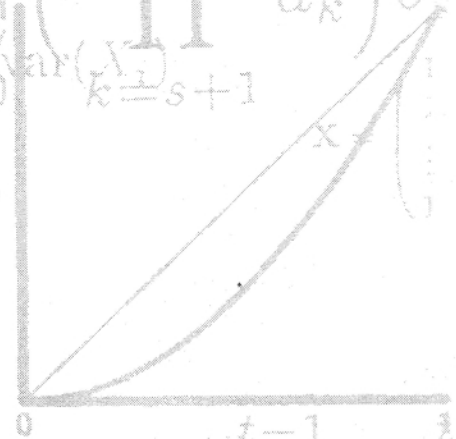
Discussion Papers

Recent Leaps Towards Free Trade

The Impact on Norwegian Industry and Trade Patterns



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Abstract:
In this study we model effects on Norwegian industry and trade patterns of the recently implemented trade reforms - the WTO-agreement, the EEA-treaty, the OECD ship building reform and the EFTA fishing agreement - through changes in tariffs, NTBs, government procurement and subsidy policy as well as shifts in foreign prices and demand. We employ a highly disaggregated CGE model to simulate the difference between an economy adapted to the mentioned reforms and an economy based on a multilateral maintenance of the pre-reform trade system. Exports and import shares are modelled differently depending on commodity characteristics. Labour supply and national wealth are exogenously determined in order to focus on the gains from reallocations of given resources. The results indicate strong effects on the patterns of industry and trade. Specifically, we observe an increase in the production of services and highly processed goods, and a decrease in the production of raw materials and less processed commodities.

Keywords: Trade reform, European economic integration, CGE analysis, Norway

JEL classification: F14, F15, F17

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1. Introduction

During the last five years, most European countries have endorsed a large number of multinational agreements on trade related issues. Although there exist numerous studies on the economic effects of these undertaken trade reforms, as far as we know, none have focused on the simultaneous industry and trade effects of *all* recently adopted trade agreements. This study is an attempt to measure these effects for a small European economy - Norway - by considering the following ratified agreements: (1) The EEA-treaty, (2) the GATT/WTO (Uruguay) agreement, (3) the OECD-treaty on ship building and (4) the EFTA-agreement on fishing.

To identify trade and industry allocation effects, we employ a large scale general equilibrium model, MSG-5[1], based on the Norwegian National Accounts. It specifies a highly disaggregate system of goods and industries and is benchmarked to 1991. CRS technology and perfect competition is assumed. This is well in accordance with econometric panel studies of the Norwegian manufacturing industries performed by Klette (1994), who finds quite small markups in all industries and no evidence of increasing returns to scale. In the service sectors, we make allowances for differences in competitiveness. To enhance the model realism, restrictions are imposed on production and input in some industries due to political regulations or resource constraints. Trade in goods is specified in two ways. Exports and import shares of most tradable goods are determined by Armington equations, reflecting a certain degree of product heterogeneity. For more homogenous goods or goods subject to highly regulated trade conditions, equilibrium net exports are determined residually on the product markets.

A wide range of reforms are rigorously quantified, including changes in tariffs, NTBs, subsidies, government regulations and procurement policy[2]. As the model is of a single country type, changes in foreign prices and demand rest on externally provided sources, as well. Here, our figures rely on results from two multiregional model studies of the recent trade agreements, performed by Haaland and Tollefsen (1994a) and Francois, McDonald and Nordström (1994).

The model is designed to solve for an equilibrium set of prices and quantities along a simulation path. We compare the long run solution of a path contingent upon trade reforms, with one reference solution representing the counterfactual policy scenario assuming that none of the above mentioned agreements were ratified, so that all countries would follow Norway in prolonging the pre-reform trade regime[3]. The scenarios are simulated with a common exogenous development of the total

[1] A full documentation of the model can be found in Holmøy, Norden and Strøm (1994). A more analytical discussion on the stylised properties of the model is presented in Holmøy (1992).
[2] For pre-reform domestic tariffs and non-tariff barriers, we employ a detailed data set documented in Fæhn (1996).
[3] This refers to the trade regime based on a large number of previously established bilateral trade agreements in addition to the 1972 treaty with the EEC, the Tokyo Round of the GATT and the EFTA free-trade agreement.

capital stock, labour supply and current account balance. This enables us to focus on the allocative effects on industry production and trade without considering additional growth effects. The implemented trade reforms seem to impose highly significant changes in the patterns of industry production. Our study gives reason to believe that the undertaken treaties will increase the activity in industries producing highly processed tradables as well as services. Producers of tradable manufactures first of all gain from improved export conditions and lower imported input prices. The sheltered service sector benefit partly from increased aggregate consumption as well as from enhanced domestic competitiveness due to market deregulation. This is an effect from trade liberalisation frequently ignored in other applied model studies on trade. A sensitivity test with a 50 percent increase in all trade elasticities reveals a pattern of highly robust conclusions.

The Norwegian industrial policies have developed much in the same way as those of other small European economies like Austria, Finland, Sweden and Switzerland. Before the recent international liberalising efforts, these countries also practised a highly restrictive pre-reform policy regime with respect to trade in agricultural products, trade distorting measures in the manufacturing industries were almost exclusively based on NTBs and the service sector was to a large extent sheltered from foreign competition and was strongly regulated. Within the next few years they will all experience the effects of the recent international agreements on trade. In light of these similarities, our identification of important mechanisms may also have relevance for other countries.

The model is presented in section 2. Calculations of pre- and post-reform protection rates and subsidies, as well as estimates on changes in government competition policies and export conditions are provided in section 3. The results are analysed in section 4 and section 5 concludes.

2. The Model

The following description is based on a simplified version of the model. For a full documentation of the system of equations, consult Holmøy, Nordén and Strøm (1994). The model specifies 20 private industries (presented in Table 4.1) and 7 government production sectors. We focus only on the private part of the economy, where the main impact of the trade reforms appears. The industries produce 21 tradable[4] and 6 non-tradable goods listed in Table 2.1. In addition, 8 non-competing import goods are identified. The motivation behind the classification of commodities in Table 2.1 is the character and the degree of international competition. The set V^I encompasses commodities that embody highly processed and differentiated products. The heterogeneity between varieties of different origin is partly maintained by the use of Armington equations allowing foreign and domestic

[4] Production and processing of oil and gas is not directly affected by the analysed policy changes. Hence we have chosen to merge five petroleum related products into one named *Petroleum Products*.

demanders to have destination specific preferences[5]. The classification of goods in V^2 is based on two observations. Firstly, they are to a large extent raw materials and less processed goods with prices believed to be determined on the world market. Thus, net trade flows are determined residually as the gap between domestic supply and demand, as in a Hecksher-Ohlin model of a small open economy. In the model, net trade is determined as the difference between exogenous gross exports and residually determined gross imports. Secondly, with respect to *Agricultural Products* and *Electricity*, exogenous exports are motivated by tight governmental regulation. Commodities In V^3 are non-tradable, while V^4 encompasses importables not produced domestically.

Table 2.1. List of Goods Produced in the Private Industries

Tradables where imports and exports are determined by Armington equations (V^1)	**Tradables where net exports are residually determined (V^2)**
Processed Food	*Agricultural Products*
Beverages and Tobacco	*Forestry Products*
Textiles and Clothes	*Fish*
Manufacturing Products	*Ships*
Pulp and Paper	*Ocean Transport and Petroleum Exploration*
Industrial Chemicals	*Oil Platforms*
Hardware and Machinery	*Electricity*
Metals	*Petroleum Products*
Repairs	
Non-Tradable Goods (V^3)	**Non-Competing Import Goods (V^4)**
Domestic Transport	*Food and Raw Materials*
Onshore Construction	*Cars, Tractors etc.*
Wholesale and Retail Trade	*Aircraft*
Finance and Insurance Services	*Defence Equipment*
Other Private Services	*Operating Expenditure Abroad*
Dwelling Services	*Selected Petroleum Products and Services*
	Others
	Direct Purchases Abroad

Let V be the set of goods produced domestically, $V = V^1 \cup V^2 \cup V^3$, and W be all goods, $W = V \cup V^4$. In this stylised representation of the model, we assume that industry i produces good i, only[6]. Industry specific unit factor demands Z_{hi} are determined by Generalised Leontief (GL) cost functions:

$$(1) \qquad Z_{hi} = \frac{\partial C_i}{\partial P_{hi}} = \sum_g \psi_{hgi} \sqrt{\frac{P_{gi}}{P_{hi}}} \qquad i \in V, \quad h,g = \{L,K,I,E\}$$

[5] This procedure is discussed in Robinson and de Melo (1989) and viewed in a critical light by Norman (1990).
[6] The fact that most industries produce many goods generates a difference between the value of industry production and the value of goods produced.

The model specifies 4 primary inputs over the index h; labour (L), capital (K), intermediates (I) and energy (E). $C_i(\cdot)$ is the industry unit cost function based on CRS technology and ψ_{hgi} is the GL substitution coefficient[7]. Factor prices P_{hi} are defined in the following equations:

$$
\begin{aligned}
&\text{(i)} && P_{Li} = \beta_i w && i \in V \\
(2)\quad &\text{(ii)} && P_{Ki} = \gamma f_i\left(r, \delta_i, PF_{Ji}\right) P_{Ji} && i \in V \\
&\text{(iii)} && P_{hi} = \sum_{j \in W} \left(\lambda_{ij}^h (1 - m_j) P_j^H + \lambda_{ij}^h m_j P_j^I\right) && i \in V, \quad h = \{J, I, E\}
\end{aligned}
$$

In *(i)* the wage costs in sector i are determined by a common wage level w adjusted by an exogenous parameter β_i that accounts for the base year wage rate differentials between industries. The price of capital in *(ii)* is a function of the price of investment goods, P_{Ji}, and the shadow price of capital γ which accounts for over all changes in capital costs. In addition, P_{Ki} is a function of the nominal interest rate r, the depreciation rate δ_i and the expected change in the price of investment goods PF_{Ji}., all assumed to be exogenous. As all inputs except from labour are composites of less aggregated goods, price indices from *(iii)* are specific for each industry depending on the structure of input demand. This structure is captured in the λ^h_{ij} representing fixed Leontief coefficients calibrated in the base year. The variable m_j is the import share of good j and is extensively discussed below[8], P^H_j is the domestic producer price of good j and P^I_j is the import price of the same good. Perfect competition in all industries demands that producer prices equal unit costs in equilibrium:

$$
(3)\qquad P_i^H = C_i\left(P_{Li}, P_{Ki}, P_{Ii}, P_{Ei}, s_i\right) \qquad i \in V
$$

where s_i is direct net unit subsidies to industry i. Furthermore, import prices are treated as given on the world market P^W_i, but affected by Norwegian tariffs t_i and NTBs measured in tariff equivalents t^e_i[9]:

$$
(4)\qquad P_i^I = P_i^W (1 + t_i)(1 + t_i^e) \qquad i \in V^1 \cup V^2
$$

Household demand D_i for good i is modelled as a function of consumer prices PC_i and aggregate consumption expenditure E,

$$
(5)\qquad D_i = D_i\left(PC_1, \ldots, PC_n; E\right) \text{ where } PC_i = PC_i\left(P_i^H, P_i^I, t_i^C\right) \qquad i \in W
$$

[7] The GL substitution coefficients are estimated and presented in Alfsen, Bye and Holmøy (1996).
[8] The fact that import shares are actually specific with respect to users, are suppressed here.
[9] For *Agricultural Products* P_i^I is however regarded as endogenously determined, due to a predominance of quantitative trade barriers, see section 3.1.

where t_i^C is an ad valorem commodity tax. Demand in equation (5) is specified by a linear expenditure system where parameters are estimated using the latent variable method on household budget panels as outlined in Aasness and Holtsmark (1993). Notice that the consumer is optimising her utility as a function of an intratemporal commodity composition restricted by the budget constraint $\sum_{i \in W} PC_i D_i \equiv E$. As earlier mentioned, export demand for good *i*, A_i, is modelled by an Armington equation:

$$\textbf{(6)} \qquad A_i = \alpha_i \left(\frac{P_i^A}{P_i^W} \right)^{\sigma_i^A} FD_i \qquad \text{where} \qquad P_i^A = P_i^H - s_i^A \qquad i \in V^1$$

s_i^A is unit export subsidies to good *i*. A positive shift in the import demand (FD_i) among Norway's trading partners is also believed to increase exports. The Armington elasticities, σ_i^A, reported in Appendix 1, are founded on econometric studies by Lindquist (1993). All export of commodities in V^2 is exogenous. Commodities defined in V^3 and V^4 are naturally not exported at all. On the import side, the import shares of total domestic demand m_i are also described by Armington equations:

$$\textbf{(7)} \qquad m_i = \beta_i \left[\frac{P_i^I}{P_i^H} \right]^{\sigma_i^B} \qquad i \in V^1$$

Here, the Armington elasticities, σ_i^B, are based on estimates by Naug (1994) (see Appendix 1). Import shares for commodities in category V^2 are exogenous. Equilibrium on the product market requires that[10]:

$$\textbf{(8)} \qquad X_i = (1 - m_i) \left[\sum_{j \in W} a_{ij} X_j + D_i \right] + A_i \qquad i \in V$$

where $(1\text{-}m_i)$ is home market share and a_{ij} is the input coefficient of good *i* in industry *j*, defined as

$$\textbf{(9)} \qquad a_{ij} = \sum_h \lambda_{ij}^h \frac{\partial C_j}{\partial P_{hj}} \qquad j \in W, \quad i \in V, \quad h = \{J, I, E\}$$

Assuming that there is no imports for direct re-exports, imports of good i, B_i is then defined as:

$$\textbf{(10)} \qquad B_i = m_i (\textstyle\sum_{j \in V} a_{ij} X_j + D_i)$$

[10] On the assumption of no re-exports.

Finally, to solve the model, equilibrium in the labour and capital markets is required, so that

$$\sum_{i\in V} L_i = \sum_{i\in V} \frac{\partial C_i}{\partial P_{Li}} X_i = \overline{L} \tag{11}$$

$$\sum_{i\in V} K_i = \sum_{i\in V} \frac{\partial C_i}{P_{Ki}} X_i = K \tag{12}$$

K and $\overline{L}$ are total factor supplies, of which $\overline{L}$ is a function of the population determined outside the model and is assumed to be inelastic with respect to the aggregate wage level w. The current account balance Δ is determined in the following equation:

$$\Delta = \sum_{i\in V^1, V^2} P_i^A A_i + \sum_{i\in V, V^2, V^4} P_i^I B_i \tag{13}$$

By combining **(2)**, **(3)** and **(4)** we find unit costs C_i as a function of w, γ and the exogenous variables. Since domestic commodity prices P_i^H equal marginal costs, equations in **(6)**, **(8)** and **(10)** for A_i, a_{ij} and m_i, respectively, may all be expressed as functions of w and γ. Furthermore, D_i is a function of w, γ and E. From **(7)** and **(9)** we see that also X_i and B_i are functions of w, γ and E. Hence, we may reduce the system further by inserting for C_i and X_i in **(11)** and **(12)** and for P_i^A, A_i and B_i in **(13)**. This yields:

$$\overline{L} = L(w,\gamma,E) = \sum_{i\in V}\left[\frac{\partial C_i(w,\gamma)}{\partial P_{Li}}(1-m_i(w,\gamma))\left(D_i(w,\gamma,E) + \sum_{j\in V}\sum_{h=J,I,E}\lambda_{ij}^h \frac{\partial C_j(w,\gamma)}{\partial P_{hj}} X_j(w,\gamma,E)\right) + A_i(w,\gamma)\right] \tag{14}$$

$$K = K(w,\gamma,E) = \sum_{i\in V}\left[\frac{\partial C_i(w,\gamma)}{\partial P_{Ki}}(1-m_i(w,\gamma))\left(D_i(w,\gamma,E) + \sum_{j\in V}\sum_{h=J,I,E}\lambda_{ij}^h \frac{\partial C_j(w,\gamma)}{\partial P_{hj}} X_j(w,\gamma,E)\right) + A_i(w,\gamma)\right] \tag{15}$$

$$\begin{aligned}\Delta = \Delta(w,\gamma,E) = &\sum_{i\in V^1\cup V^2} P_i^A(w,\gamma)A_i(w,\gamma) \\ &- \sum_{i\in V^1\cup V^2\cup V^4} P_i^I m_i(w,\gamma)\left(D_i(w,\gamma,E) + \sum_{j\in V}\sum_{h=J,I,E}\lambda_{ij}^h \frac{\partial C_j(w,\gamma)}{\partial P_{hj}} X_j(w,\gamma,E)\right)\end{aligned} \tag{16}$$

where m_i and A_i is independant of w and γ for $i \in W \setminus V^1$. Since the three equations **(14)**, **(15)** and **(16)** contain five unknowns, K, Δ, w, γ and E, we can close the model with exogenous values of K and

Δ. The exogenous current account balance excludes the possibility of economic changes due to different "macro budgets". Furthermore, a constant capital stock provides us with a given amount of resources, L and K, allowing us to only focus on the efficiency gains from liberalisation due to reallocations of given resources.

3. Recent trade policy reforms

The reference path represents the Norwegian economy in absence of recent international agreements on trade liberalisation directly involving Norway. The development in exogenous variables is faded out to obtain a stationary solution in the last part of the simulation period which stretches from 1991 to 2030. Most of the exogenous variables not directly affecting the trade conditions are based on forecasts presented in Ministry of Finance (1992-1993), containing the government long term programme.

To enhance model realism, we have imposed additional constraints on either production or factor supply in some industries due to existing political regulations or limited resource availability. First, input of energy is fixed in the industries producing *Pulp and Paper, Industrial Chemicals* and *Metals*. The firms have contracts on fixed amounts of energy at strongly subsidised prices and are practically excluded from the ordinary energy markets. The contracted supplies of hydroelectric power imposes severe constraints on output in these industries since exposure to market prices expectedly drive costs up to unprofitable levels[11]. Second, production in *Agriculture* and *Fishery* is exogenously determined as a result of tight governmental regulations and marine resource constraints, respectively. These imperfections are assumed to be active in both simulation paths.

Four international agreements comprise the reforms implemented in our study. An EFTA resolution on the removal of subsidies that distort international competition in the fishing industry was effectuated from January 1994. An OECD agreement on support to the shipbuilding industry that virtually prohibits state aid, was to be enforced from January 1996, but problems with the ratification still remain. The EEA was implemented from January 1994 and the WTO/GATT agreement from January 1995. Both involve considerable changes in the Norwegian import regime, export conditions and government aid, regulation and procurement patterns.

3.1. The changing import regime

Barriers on imports of good i are quantified by the good's *protection rate* or *equivalent tariff (ET)*. The trade barriers generate a gap between the import price (excluding domestic taxes), and the

[11] For more on pricing in the Norwegian energy market, see Johnsen (1991).

reference price defined as the lowest possible import c.i.f. price. The *ET* is defined as the ad valorem tariff rate that would generate an equivalent gap:

$$(17) \qquad ET_i = \frac{P_i^I - P_i^W}{P_i^W} = (1+t_i)(1+t_i^E) - 1$$

For NTB-protected goods, the *ET* will be determined in one of two ways: If the NTBs increase the costs of penetrating the domestic border, as is the case of moderate technical barriers or price discriminating procurement policies, the t_i^E will come on top of the tariffs and P_i^I will be determined by the exogenous variables P_i^W, t_i^E and t_i. If, on the other hand, the tariffs or penetration costs are prohibitive or if the barriers are quantitative, P_i^I will be endogenously determined by the demand side[12].

Aggregation of protection rates has been extensively discussed in the literature. Basevi (1971) suggested that weights should generally be chosen according to the focus of the study. As our focus is mainly on the allocation of factors, it will be essential to analyse in what manner protection levels affect the movement of labour and capital within the model. The Armington hypothesis implies that a higher price on the imported variety will shift demand towards the home produced variety. Production-based weights would capture the output response of this demand impulse. However, protection of intermediates do also affect the level of production. These protection rates should be weighted by each product's share in the imported aggregate input[13]. The strict theoretical criteria for perfect aggregation of prices in input-output analysis and the problems of violating them, are well-known (see e.g. Morimoto (1970)), and these problems are exactly what we encounter when allowing for many sources of impacts from protection levels to each sector's production[14]. One and only one weight will have to be assigned to the protection rate of a commodity no matter where it appears in the model. Empirically, the effects from protection predominantly arise from stimulating *production levels* of home varieties rather than from influencing *input levels* [15]. Thus, we choose the following production-based weights in our analysis:

$$(18) \qquad \vartheta_i = X_i P_i^W \Big/ \sum_{j=1}^{n} X_j P_j^W \qquad i = 1....n$$

where X_i is production quantities of all the n products entering into the model aggregate j in the base year. Production is valued in reference prices and we obtain price components not affected by trade barriers.

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[12] See Fæhn (1996).

[13] Relevant elasticities, both on the production and input side, could also be included into the weights, in order to capture composistion changes from the base year.

[14] Complications also arise from the fact that several sectors produce the same goods but in different compositions.

[15] See Fæhn et al. (1995).

In the reference path, the 1991 import regime is prolonged throughout the simulation period. Quantification of *ET*s for the Norwegian industries in 1991 are thoroughly documented in Fæhn (1996). The figures are presented in Table 3.1 in the column labelled Reference path. Only minor parts of these *ET*s are due to tariffs. Agreements on free trade existed between Norway and the individual member states of the EU ensuring the elimination of Norwegian tariffs on practically all goods except from agricultural products. Free trade with Sweden, Finland, Austria and Switzerland was regulated by the EFTA Convention. A substantial part of imports from developing countries was included in the General System of Preferences (GSP) assigning low or zero tariffs. Free trade arrangements applied to 80 percent of imports. The remaining were subject to Most Favoured Nation (MFN)-rates from the Tokyo-round of GATT (3.6 percent as an unweighted average). According to the Uruguay Round, the trade-weighted reductions in Norwegian MFN tariff rates on industrial products amount to 39.7 percent. The full reduction will gradually be obtained within year 2005. The reductions will only have minor effects on the protection rates. The substantial effects are believed to be related to an effective prohibition of NTBs due to both the WTO agreement and the EEA-treaty.

None of the mentioned agreements that were in force before the recent international trade agrrements placed effective restrictions on the application of *Non Tariff Barriers* (NTBs), and such policy measures were frequently used in the Norwegian import system.

The three most protected commodity aggregates were *Agricultural Products*, *Processed Food* and *Beverages and Tobacco*. For *Agricultural Products* a restrictive import quota system combined with a strict quality control system was in force, prohibiting the imports of main agricultural commodities. Thus, *ET* on *Agricultural Products* is treated as endogenous. The WTO agreement turns all previous quantitative barriers on *Agricultural Products* into tariff rates. However, the post reform tariff rates on most of the products will still exceed prohibitive levels and only have a minor effect on the average protection rates. Most *ET*s are hence still endogenous. The WTO agreement does not allow the market access of any product to fall, and access must rise if imports corresponded to less than 5% of the average consumption over the period 1986 to 1988. Lower tariffs on imports from LDC countries will presumably enable Norway to satisfy these requirements. The reform will generate an estimated fall from 71 percent to 65 percent in *ET* for *Agricultural Products* in the beginning of the simulation period. Thereafter, the *ET* is assumed to be endogenously determined by the domestic price growth along the simulation path[16]. The protection of *Processed Food* was previously strongly influenced by quantitative restrictions and rigid quality standards excluding semiprocessed importables. Furthermore, several highly manufactured agricultural commodities were protected by

[16] During the simulation period the endogenously determined import prices for some of the products are however expected to become inprohibitive, implying that the world market price inclusive of the negotiated tariff rates exogenously determine certain import prices. This opens for net import growth e.g. from LDCs, which benefit from concessionary tariff rates.

the *Commodity Compensation Arrangement* between the EU and EFTA countries, ensuring compensation for extra costs due to high domestic prices on agricultural imports. The compensation was intended to exactly correspond to the gap between the price of domestic commodities and the alternative price on the world market, implying no effective protection. However, estimates for 1991 suggest that the effective protection of the food producing industry was strong (see Fæhn (1996)). We have calculated a fall in the average *ET* on *Processed Food* from 52 to 44 percent. Although this estimate is influenced by several prohibitive arrangements, the major part of the production value is subject to exogenous protection rates. Therefore, we treat the aggregate *ET* for *Processed Food* as exogenous, as we do for all the remaining commodity aggregates. In 1991, *Beverages and Tobacco* were primarily sheltered by technical import barriers and an advertising prohibition that favoured established market participants. Both the WTO and the EEA agreement turn several technical barriers on wine, beer and soft drinks illegal. They also prohibit the import monopoly on alcoholic beverages. *ET* is estimated to fall from 45 to 28 percent.

Imports of *Textiles and Clothes* from most low cost countries were in 1991 met by high tariffs (17 percent on average). Some items were also strongly restricted by VER quotas[17]. However, about 80% of the imports of these products originated from countries with trade preferences, leaving the average protection rate relatively low[18]. Here, the removal of VERs and reduction in tariffs in accordance with the WTO-treaty generates a 2 percentage point reduction in the protection rate. The *ET* on *Manufacturing Products* in 1991 was related to a protection rate of 20 percent for pharmaceutical products due to technical barriers and import restrictions. Also, we found evidence for collusive behaviour in the cement industry, estimated to represent an *ET* of 80 percent. The 1991 protection rate of 3 percent for *Industrial Chemicals* arises from an estimated *ET* for fertilisers of 16 percent. The fertiliser market was characterised by monopoly power in presence of restricted imports due to detailed technical standards. *Hardware and Machinery* were to some extent sheltered from foreign competition by tariffs and technical standards. Finally, *Oil Platforms* were found to be significantly protected through discriminating government procurement policies. For all of these industrial products, the EEA and WTO agreements are intended to eliminate the possibility for nations to protect themselves against foreign competition by means of technical standards, quantitative restrictions, discriminatory procurement policies and market regulations. Hence, we anticipate all these NTBs to abolish and only small tariff rates to remain, see the column Reform path in Table 3.1.

[17] Norway participated in the Multi-Fibre Arrangement of GATT, which opened for agreements on Voluntary Export Restraints (VERs) with exporters of low-cost textiles and clothing products.

[18] As tariff rates are calculated on the basis of import values and tariff revenues, countries of origin are implicitly weighted by their share of imports. This is not ideal, as reference prices are defined as the lowest possible import c.i.f. price. The discriminatory tariff policies of Norway tend to favour high-cost trade partners, thereby overstating the implicit reference prices. The calculation of the effects from MFA-quotas have the same implicit bias.

Table 3.1. Equivalent tariff (*ET*) rates before and after liberalisation

Goods	Reference path	Reform path
Tradables in V^1		
Processed Food	52.0	44.0
Beverages and Tobacco	45.0	28.0
Textiles and Clothes	3.0	1.0
Manufacturing Products	3.0	0.0
Industrial Chemicals	3.0	0.0
Hardware and Machinery	3.0	0.0
Tradables in V^2		
Agricultural Products	71.0[1)]	65.0[1)]
Oil Platforms	3.0	0.0

1) These figures refer to the estimates for the starting point of the paths. *ET*s for the agricultural sector are, as mentioned, endogenously determined.

3.2. Aggravated competition in service markets

Before the implementation of the EEA treaty, the cross border mobility of services and capital including enterprises as well as foreign acquisitions was partly restricted. Combined with comprehensive governmental regulation, this resulted in inhibited domestic competition in several service markets. The General Agreement on Trade in Services, GATS, ratified in the Uruguay round, as well as the principle of free movement of services in the EEA treaty are meant to increase the degree of competition in these sectors. There is reason to believe that market power will gradually decrease. We have exogenously manipulated a component in the market price to capture the price effects of lower mark-ups. Changes in rules of producer behaviour are however not reflected.

The Norwegian *Banking* sector was considerably less efficient than the Swedish in 1990. According to Berg, Førsund, Hjalmarson and Suominen (1993), commercial Swedish banks were found to be at least 30 percent more efficient. The efficiency differences among the state banks and the insurance companies were probably smaller. The study is based on data from 1990 when Norway faced a business cycle trough with reduced credit demand. As the Nordic banking sectors gradually merge into one large competitive market, we have assigned a long run mark-up reduction of 10 percent. The *Domestic Transport* sector is large and amalgamated containing some of the most regulated activities in Norway. In OECD (1995), the Norwegian telecommunication industry was shown to be highly centralised compared to other OECD countries. Second, In a study by Norman and Strandenes (1994) it was demonstrated that free competition on the market for air transport services could lead to a 20 percent price reduction on the most important routs. There is also reason to believe that the production of ferry services (see Førsund (1991)), postal services and road transport could be improved through increased competition. Based on these observation, we have implemented a 15 percent fall in the average mark-up in the *Domestic Transport* sector. Finally, we believe that the

Domestic Construction sector profited from discriminating government procurement policy. In light of scarce documentation[19], a mark-up reduction of 5 percent may be regarded as a cautious estimate.

3.3. Rules on governmental aid

Recent international negotiations on trade liberalisation have increasingly focused on the diverting role of subsidies. The clearest example is export subsidies. In international negotiations subsidies seem to be divided into two categories. Subsidies given on a lump sum basis to every producer in an industry are not believed to affect marginal costs and thereby levels of production in a partial context. Subsidies given as rates of production, inputs, etc. are believed to stimulate production at the expense of unsubsidised producers, in particular foreign competitors. Apparently, only such subsidies have been subject to concern[20]. The pattern of subsidies to Norwegian industries in 1991 (see Table 3.2) was greatly concentrated on a small number of sectors[21]. The utmost supported sector was *Agriculture*, followed by *Fishery* and *Building of Ships and Platforms*. The 1991 net subsidy rates are kept constant through the reference path.

Table 3.2. Subsidies to production sectors in 1991

Sectors	Net subsidies (mill. ECU)	Net subsidy rate[1)]
Agriculture	1473	42.8
Forestry	28	5.1
Fishery	159	11.0
Manufacturing Product Industry	121	1.4
Hardware and Machinery Industry	55	0.9
Building of Ships and Platforms	177	3.0
Construction	110	2.0
Finance and Insurance	-291	-2.2

1) Net subsidy rate is defined as net subsidies as percentage of gross production value in the sector

According to the WTO agreement on *Agriculture*, support defined to distort competition is to be reduced by 20% within 2001. The impact of the rules is uncertain, as the scope for interpretations is wide. What is clear, however, is that support will have to be redirected. Skjeflo et al. (1994) outline three scenarios, of which we include the one that prolongs the base year real subsidy level. The WTO agreement also restricts the use of export subsidies to agricultural products, including several products in *Processed Food*. As Norwegian agricultural exports and export subsidy rates are relatively small, these effects are minor. The EFTA resolution on *Fisheries* is designed to eliminate subsidies that affect competition between the contracting parties. According to the Ministry of

[19] Our reference is Golombek (1991) where only relevant qualitative information is presented.
[20] In a general equilibrium context *lump sum subsidies* do also affect the industry production level, through entrance stimulated by reduced average costs. In a general context one may also draw interesting conclusions about the trade diverting effects of subsidies to *non-tradables*. Further, if technology possesses constant returns to scale properties, the distinction between subsidy categories is even less relevant, as average and marginal costs will be identical.
[21] See Fæhn et al. (1995) for further details.

Foreign Affairs (1990), several of the supporting arrangements in 1991 were in conflict with the resolution. The agreement is believed to reduce the subsidy rate by approximately 40 percent. The ship building member countries of the OECD failed to ratify an agreement on complete removal of all government support to the *Ship Building Industry*. We do however anticipate the agreement to be ratified in some near future.

The WTO and the EEA treaty also regulate government aid to the industry sectors. WTO defines three categories of subsidies; *prohibited*, *actionable* and *non-actionable*. Subsidies contingent upon export performance or use of domestic inputs sort under the first category. Actionable subsidies are those exceeding 5 percent of a product's value, or which are designed to cover sustained operating losses in an industry or a particular firm. Remittance of debt is also an actionable support measure. The EEA agreement prohibits government aid which favours certain undertakings or certain goods at the expense of other contracting parties. None of these rules are found to impose any additional restrictions on the provision of state aid.

3.4. Changes in export conditions

Approximately 80 percent of Norwegian exports are sold on EU markets. Norway benefited from free export of all goods to the EU and the EFTA countries except for *Agricultural Products*, *Processed Food*, *Fish* and *Beverages and Tobacco*. In 1991, EU tariffs on fish products ranged from 10 to 30 percent depending on the degree of processing. In addition, the EU had and still has an option to employ minimum prices and anti-dumping measures on Norwegian fish products. The 1991, EU and EFTA tariffs on *Agricultural Products* and most of the *Beverages and Tobacco* and *Processed Food* products were set at prohibitive levels. Some trade restricting measures directed towards other goods were also available, including anti-dumping rules against metal imports and rules of origin affecting the Norwegian textile industry.

In order to provide data on the effects of the agreements on foreign prices and demand, we have primarily consulted two external analysis. One is by Haaland and Tollefsen (1994a), who study the effects of the WTO treaty on global production and trade. They apply a 4-region (EU, EFTA, USA and Japan) CGE model that allows for imperfect competition. The results from this study are evaluated by comparing them to the results generated by Francois, McDonald and Nordström (1994). They simulate the same effects of the WTO treaty using a 15 sector, 9 region perfect competition CGE model where the EFTA countries are defined as one region. In addition, we apply some of the data on the effect of EEA provided by Haaland (1994). As Norway is implicitly included in these studies, as part of EFTA, we face a problem of double counting. However, for all of the goods in our study, except for some petroleum products, fish and metals, this problem is of minor importance

because Norwegian exports are negligible when compared to the exports of competing countries. According to Haaland and Tollefsen (1994a), the WTO treaty will increase interregional trade substantially, but will affect the regions quite differently. The calculated shifts in foreign demand for each export aggregate *i*, (FD_i), is determined by weighted averages of the simulated foreign import changes for each good as presented in Haaland and Tollefsen (1994a). They are listed in Table 3.3 along with estimated world market price changes. The most striking figures are those representing changes in foreign demand for *Processed Food* and *Beverages and Tobacco.* The figures reflect the increased imports of such goods into Japan, USA and EU due to removal of large trade barriers[22]. The increased foreign demand for *Textiles and Clothes, Manufacturing Products* and *Hardware and Machinery* is first of all a result of rising imports demand in Japan and USA, due to removal of protection.

Table 3.3. Changes in export conditions (percentage change from reference path)

Goods	World market price	Foreign demand	Export volume
Processed Food	-1.8	74.4	
Beverages and Tobacco	-1.8	74.4	
Textiles and Clothes	-1.6	24.3	
Manufacturing Products	0.0	21.3	
Pulp and Paper	-1.7	*	
Industrial Chemicals	-1.7	*	
Metals	-1.6	*	
Hardware and Machinery	-1.9	17.0	
Fish	-	-	3.0
Ships	-	-	-12.1

* As mentioned in section 2 and further discussed in section 4.2, foreign demand for these goods is determined residually by the commodity equilibrium equation (8) due to fixed amounts of low price energy.

The exogenous shift in export of *Fish* is based on the WTO simulations of FMN, supplemented by a calculated 2 percentage point reduction in EU-tariffs and NTBs in response to the EEA agreement (see Bowitz et al. (1995)). Exports are unaffected by the subsidy reductions, since the price effects will be of the same magnitude among Norway's foreign competitors. The 12 percent fall in exports of *Ships* is a result of the OECD agreement on subsidy elimination. Due to low levels of support in Japan and South Korea (see ECON (1993)), Norwegian export prices are expected to increase by approximately 6 percent relative to the average world market price[23].

3.5. The trade reform vector

In terms of the model presented in section 2, the following changes describe the implemented trade reforms: Import prices are reduced through reductions in the exogenous components, P_i^W, t_i and t_i^e

[22] The effect of the changes in FD_i on exports presented in section 4.2 also appears to be rather consistent with the estimated changes in exports presented by HT.
[23] The response in exports is based on an export elasticity similar to the one estimated for *Hardware and machinery.*

in equations (4). For goods sorting under $\mathbf{V}^1$, a reduction in these variables imposes increased import shares (m_i) through the equations in (7). For goods sorting under $\mathbf{V}^2$, the m_i's are manipulated exogenously, taking changes in terms of trade into account whenever reasonable. We will refer to these measures as the *import reforms* (***B***). Exports of goods in $\mathbf{V}^1$ are affected through exogenous changes in foreign demand (FD_i) and world market prices (P_i^W) in the equations ins (6). The changes in export subsidies, s_i^A, are negligible. For commodities sorting under $\mathbf{V}^2$, exports are exogenously altered if the market growth or terms of trade are expected to change due to the trade reforms. We hereby refer to these changes as the *export reforms* (***A***). Sector subsidies (***s***) that are reduced in the equations in (3) initiate a rise in domestic prices. For sectors believed to become more competitive through new rules of tender practices and government procurement policies, markups (***mu***) are reduced through a residual component affecting the equations in (3), though not included in the stylised exposition in section 2. The following policy vector sums up all the reform instruments:

(19) $$\varepsilon = \{\boldsymbol{B}, \boldsymbol{A}, \boldsymbol{s}, \boldsymbol{mu}\}$$

4. Simulation results

4.1. A decomposition of general equilibrium effects

Although the initial trade reform impulses explain much of the changed patterns of production and trade, endogenous general equilibrium effects on factor prices and consumption expenditure are important for the results, as they influence the industries quite differently. To understand the model mechanisms, we make a decomposition of these effects founded on the method of Holmøy (1992). In terms of the reduced form model in (14), (15) and (16), the impact of the trade reforms on industry cost- and demand components will be regulated by changes in E, w and γ to fulfil the resource- and trade balance constraints. Equation (14) implicitly defines E as a function of w, γ and the exogenous trade reform parameters in the ε-vector:

(20) $$E = E(w, \gamma; \varepsilon)$$

Similarly (15) and (16) define w as functions of γ, E and ε.

(21) $$w = k(\gamma, E; \varepsilon)$$

(22) $$w = d(\gamma, E; \varepsilon)$$

Differentiating and eliminating dE gives:

(23) $$dw = \frac{(k'_\gamma + k'_E E'_\gamma)}{(1 - k'_E E'_w)} d\gamma + \frac{(k'_\varepsilon + k'_E E'_\varepsilon)}{(1 - k'_E E'_w)} d\varepsilon$$

and

$$dw = \frac{(d'_\gamma + d'_E E'_\gamma)}{(1 - d'_E E'_w)} d\gamma + \frac{(d'_\varepsilon + d'_E E'_\varepsilon)}{(1 - d'_E E'_w)} d\varepsilon \quad (24)$$

(23) expresses the change in wages necessary to fulfil the capital market restraint, for given changes in the economy-wide shadow price of capital or in the trade regime. Generally, w is influenced both by the direct effect on capital demand and by the induced effect on E as changes in γ or ε affect labour demand and will have to be counteracted by changes in consumption expenditure. Analogously, (24) represents the necessary wage response to maintain the trade balance. Equation (23) and (24) imply

$$w = \kappa(\gamma; \varepsilon) \quad (25)$$

$$w = \delta(\gamma; \varepsilon) \quad (26)$$

which in terms of Holmøy (1992) represent the *capital locus* and the *trade balance locus*, respectively. The capital locus is defined by all combinations of γ and w which for a given trade regime fulfil the capital restraint. The trade balance locus is defined by all sets of γ and w that keep the trade balance unaltered. The location and slope of the two loci in the reference path are simulated and graphed by the κκ-curve (capital locus) and the δδ-curve (trade balance locus) in Figure 4.1. We proceed by studying the properties of the loci in 4.1.1 and 4.1.2 and how they are shifted by the recent changes in the trade regime in 4.1.3.

4.1.1. The capital locus

The slope of the capital locus is best understood by studying the first term on the right hand side of equation (23). First, we consider the *direct capital locus effect* represented by the partial derivative k'_γ. It can be decomposed into two effects:

(i) *Substitution effects* from changes in capital demand per produced unit, which, in terms of equation (15), refers to changes in $\partial C_i(w, \gamma)/\partial P_{Ki}$ for all i.

(ii) *Demand effects* determining production scales for given unit capital demand. The remaining elements on the right hand side of (15) represent demand components. The effects may for instructive purposes be further divided into

(iia) an *intermediate demand effect* caused by the substitution. Changes in primary factor intensities affect demand for produced intermediates per unit, i.e. the components $\sum_{j \in V} \sum_{h=J,I,E} \lambda^h_{ij} \partial C_i(w, \gamma)/\partial P_{hi}$ for all i in (15).

(iib) a *general activity effect* from the fact that partial changes in γ affect domestic prices. This alters the purchasing power for given consumption expenditure, and thus real consumption (D_i) as well as market shares of domestic varieties, both at home ($1-m_i$) and abroad (A_i).

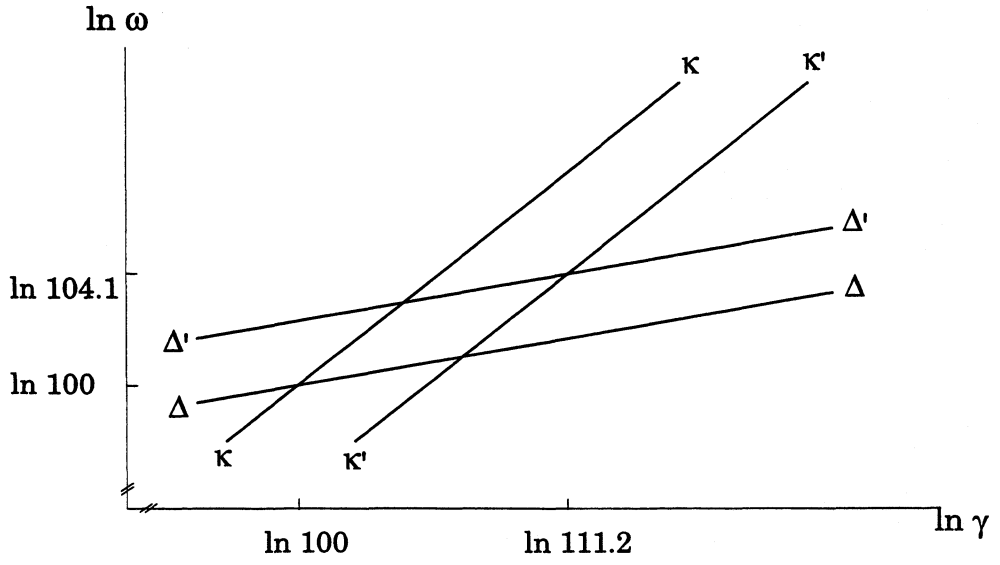
First, consider the substitution effect (i) in isolation: A rise in γ will reduce demand for capital and raise demand for labour. To obey the labour supply constraint, w must rise accordingly. Second, the increased aggregate labour intensity has the effect of reducing input of intermediates per unit (iia). This reinforces the capital demand fall and w must rise further. Finally, through (iib) increased γ causes domestic price growth; D_i falls, and so do market shares of domestic varieties. This requires a fall in w to restore prices and restimulate capital demand. In sum, the *direct* effect on the capital market from increased γ causes w to rise if the substitution and intermediate demand effects dominate, while a stronger general activity effect will make w decrease.

Next, the *indirect capital locus effects* arise through the influence of factor prices on the labour market, which will be counteracted by changes in consumption expenditure, E. Changes in E again affect the wage rate, depending on k'_E, which may be analysed analogously to k'_γ described above. The concluding signs will be just opposite: $k'_E<0$ in case of dominating substitution and intermediate demand effects; $k'_E>0$ in case of a stronger general activity effect. The mechanisms behind the changes in E may be decomposed and identified in the labour market relation **(14)**, analogously to the above effects in the capital market. E adjusts to altered factor prices in accordance to E'_γ and E'_w. Through the substitution effect (i) increased γ will cause labour demand to rise, requiring a fall in consumption expenditure. The intermediate demand effect (iia) accounts for discouraged intermediate production as labour demand rises. Less input demand affects labour demand negatively, and must be neutralised by a rise in E. Finally, increased γ induce domestic price growth. This will reduce general activity (iib) and labour demand and must be offset by increased E. Thus, $E'_\gamma>0$ if the two demand effects (ii) dominate, while $E'_\gamma<0$ if the substitution effect dominates. Analogous reasoning lead to the conclusion that $E'_w>0$ if the substitution effect in (i) and the general activity effect in (iib) dominate, as they do.

By summing up the sign of the coefficient determining the slope of the capital locus in **(25)**, we find that the locus is increasing in the (w,γ)–space if substitution effects dominate, while the sign of the slope is ambiguous if the demand effects dominate. Demand effects will only be significant if they disproportionally affect relatively capital intensive industries stronger than relatively labour

intensive[24]. Holmøy (1992) identifies the only significant disproportionate effects to appear through changes in the market shares *(1-m_i)* and A_i. Increased γ result in market share losses for tradables; the significance depends on trade elasticities as well as capital intensity in production. The higher are the trade elasticities and the average capital intensity of tradables, the stronger is the reduction in capital demand from this disproportional effect and the stronger is the partial negative impact on w to regain market shares. The combination of moderate Armington elasticities and relatively labour intensive manufacturing technology leaves us with only inferior downward pulling forces of this kind. Thus, the capital locus slopes upwards, as graphed in Figure 4.1 by the curve κκ. Both w and γ are normalised to 100 in the reference solution. Simulations reveal a fairly log-linear capital locus in the relevant interval, with an elasticity of approximately 0.7.

Figure 4.1.



4.1.2. The trade balance locus

The slope of the trade balance locus can be explained by examining the first term on the right hand side of equation **(24)**. It will be instructive to relate the effects to the right hand side of **(16)**. *The direct trade balance locus effect,* d'_γ, describing partial effects of changes in γ for given E, is best understood by identifying four different sub-effects. The first three work through increased domestic prices, and will all require a counteracting fall in wages:

(iii) The *Export price effect* accounts for increased price components of the export values (P_i^A)

(iv) The *Market share effect* captures market share reductions both at home (*1-*m_i) and abroad (A_i)

[24] Holmøy (1992) shows analytically that in MSG-5 *proportional* demand effects are insignificant, due to the fact that there is no systematic tendency for capital intensive products (in an input-output-corrected sense) to have the relatively highest income elasticities. Proportional demand stimulation will, for given values of Z_{Ki} and Z_{Li} increase demand for capital and labour in the same proportion in all sectors,. The labour market equilibrium will then recover by a simultaneous change in E. This will cause practically the same relative change in capital demand and neutralise the initial demand incentive.

(v) The *Consumption import leakage effect*[25] works through decreasing purchasing power and thus import leakage in consumption (D_i).

A last effect counteracts the first three:

(vi) An *Intermediate import leakage effect* originates from the substitution towards labour demand at the expense of intermediates, among them imported, as γ rise. Rising w counteracts this substitution.

In the model, the last effect is inferior to the first three, thus $d'_\gamma < 0$.

The *indirect trade balance locus effects* work through changes in the labour market. As outlined in 4.1.1, $E'_w > 0$, while the sign of E'_γ is positive or negative depending respectively on whether the demand effects (ii) or the substitution effect (i) dominate. A discussion on d'_E, i.e. how such changes in E affect w via the trade balance, remains. Increased consumption expenditure will deteriorate the trade balance through import leakage. To restore the balance, the necessary change in w will depend on the relative strength of four effects analogous to those above. To restore the trade balance, w would have to fall if the effects (iv) and (vi) were the strongest. Then improved market shares and less import leakage from intermediate demand would outperform (iii) and (v), which have the adverse effects of decreasing export prices and increasing import leakage in consumption, respectively. In simulations, we find that w-reductions increase export value, implying that the effect of reduced export prices (iii) is indeed inferior. The main reason is to be found in the rather large Armington elasticities in exports. Since also (v) is found to be inferior to the remaining effects, d'_E is negative.

While the *direct trade balance locus effect* (d'_γ) is found to be negative, the *indirect* may be both, due to the indecisive sign of E'_γ. If the demand effects (ii) dominate in the labour market, $E'_\gamma > 0$, the indirect effect is negative, and the trade balance locus slopes unambiguously downwards. However, simulations show that the trade balance locus is increasing slightly in the (γ,w)-space, with an elasticity of approximately 0.2 (see the $\delta\delta$-curve in Figure 4.1). This implies that the substitution effect not only dominates the demand effects in the labour market, but also outperforms the *direct trade balance effect*. The dominating substitution effect increases labour intensity and implies a fall in consumption expenditure. Thereby, import leakage falls and allows for increased w, in spite of the fact that wage growth has isolated adverse effects on the trade balance. The most important explanation for this dominance is to be found in sufficiently low average Armington elasticities (the non-tradable commodities pull the average down), which means that the increase in w have small implications for the international competitiveness.

[25] Again, small substitution effects are left out, see Holmøy (1992).

4.1.3. Simulated factor price responses to the trade reforms

Our simulations show that the overall effect of the reforms (ε) shifts the capital locus downwards, as illustrated by the κ'κ'-curve. This means that their initial effect is to increase capital demand. For a given γ, *w* then has to decrease to leave capital demand unaltered. As for changes in γ, the significant mechanisms are found in the substitution between capital and labour, as well as in demand changes that affect capital and labour intensive industries disproportionally. Simulations show that the partial effect of the reforms is to strongly promote substitution towards capital, both through cheaper imports of capital and through reduced prices on domestic capital goods. The latter is due to cost reductions primarily arising from lower import prices and mark-up reductions in the construction industry. On the other hand, for given factor prices, the trade reforms systematically favour demand for relatively labour-intensive tradables, while the capital-intensive sectors, strongly dominated by *Dwelling Services*, are negatively affected by a crowding out of consumption. Although these disproportionate effects dampen the increase in capital demand from substitution, overall capital demand is still stimulated by the reforms.

The trade balance locus is shifted up to δ'δ'. The shift is due to an initial increase in the value of net export. Hence for a given γ, wages must rise to maintain the trade balance. The *direct* effects from ε on the trade balance work through the channels (iii) to (vi), as discussed above, as well as through an additional effect (vii) representing changes in the price components of the import values, P_i^I's in **(16)**. The export value is affected through (iii) and (iv). Although a fall in costs and domestic prices reduce the price component (iii), their positive effect on export volumes (iv) is larger. In addition, export volumes are strongly stimulated by the *export reforms* through (iv). The total effect on the import value is not that clear. Import shares (iv) rise slightly as prices of imported varieties generally fall relative to domestic prices. Furthermore, (v) and (vi) also contribute to deteriorate the trade balance, as import leakage increases. The reduced price components in the import value (vii) and the *indirect* effect from the labour market adjustments, which reduce consumption expenditure, do to some extent counteract the increases in import volumes. In sum, for given factor prices, the import value raises somewhat, but not sufficiently to counteract the growth in export value, giving rise to the upward shift. The intersection of the κ'κ'- and the δ'δ'-loci in Figure 4.1 represents the new equilibrium for γ and *w*, where *w* has increased by 4.1 percent and γ has increased by 11.2 percent.

4.2. Simulated industry and trade effects

The effects on industry production and producer prices are outlined in Table 4.1. The reforms seem to impose highly significant changes in the Norwegian patterns of production. Particularly, the simulation provides some striking regularities: Activity in industries producing highly processed goods and services is promoted at the expense of the activity in industries producing raw materials

and less processed goods. For highly manufactured tradables, the effects from the implemented export reforms explain much of these results, see Table 4.2. Increased private consumption is the dominant force behind improved growth in the service sectors. Consumption is not increased by the GDP growth, which is practically ruled out by the assumption of unaltered primary factor supplies. Only minor changes are obtained due to reallocation of resources to more effective industries are obtained. Rather, a general terms of trade gain allows total imports to increase stronger than total exports given the trade balance restriction (see Table 4.3). Thus private consumption increases by 2.2 percent. In other words, the increase in private consumption is made possible by exploiting the productivity gap between foreign and domestic producers. For some of the service sectors, more competitive domestic markets also play a crucial role. The losers in the battle for primary resources are producers of less processed goods, for whom the implemented reforms provide small demand effects, aggravated import competition and increased costs through raising primary factor prices.

Table 4.1. Changes in industry production and prices with a sensitivity test

Industry	**Production** value in percent of base year GDP (1991)	**Production** percentage change from reference path	**Prices** percentage change from ref. path	**Production sensitivity** 50 percent larger trade elasticities
Consumption Goods Industry	3.3	9.9	0.5	-6.3
Hardware and Machinery Industry	2.7	4.4	0.8	3.9
Manufacturing Product Industry	3.7	3.6	1.2	2.8
Pulp and Paper Industry	0.7	-0.1	2.1	-0.1
Industrial Chemicals Production	0.7	-13.7	1.1	-3.1
Metal Production	1.0	-3.0	1.3	-1.5
Building of Ships and Platforms	1.5	-2.9	4.9	-3.0
Agriculture	1.7	0.0	4.7	0.0
Fishery	0.7	0.0	4.3	0.0
Forestry	0.5	3.8	3.9	2.9
Petroleum Refining	0.2	1.0	1.1	0.5
Prod. and Transp. of Oil and Gas	14.5	0.0	0.0	0.0
Ocean Transp. and Petroleum Expl.	3.4	0.1	-0.1	0.1
Production of Electricity	3.8	-0.5	4.8	-0.6
Domestic Transport	5.9	7.5	-12.3	9.2
Finance and Insurance	4.0	1.0	-8.0	1.0
Other Private Services	11.0	3.1	2.4	2.7
Construction	3.6	0.4	-3.9	0.4
Wholesale and Retail Trade	9.7	3.4	2.3	2.7
Dwelling Services	4.9	-0.4	5.2	-0.7

Consumption Goods, *Manufacturing Products* and the *Hardware and Machinery* are all relatively highly processed goods that sort under V^1 [26]. Their activity growth mainly relies on the implemented export reforms, enhancing export demand. The adverse effects from higher domestic prices are relatively moderate. Prices are only modestly affected by the substantial price growth on capital

[26] The *Consumption Goods Industry* mainly produce the product aggregates *Processed Food, Beverages and Tobacco* and *Textiles and Cloths.*

goods, while imported and non-tradable intermediates have become cheaper. The simulated increases in imports competing with the these products are also due to the demand shifts and the terms of trade gains.

The three industries producing *Pulp and Paper*, *Industrial Chemicals* and *Metals*, are the most energy intensive ones. The producers have traditionally been highly export oriented and have been able to compete on prices due to government provided low-priced energy contracts. When the economy wide wage rate (w) and price of capital (γ) increase, factor substitution increase demand for energy per unit production. As pointed out in section 3, these industries are assumed to absorb a fixed amount of strongly subsidised hydroelectric power. Equation **(1)** therefore implies that production must fall. In the *Pulp and Paper Industry*, this effect is small, primarily due to low factor substitution parameters. Increases in domestic demand and in terms of trade, drive up imports. Exports, which are residually determined by the commodity equilibrium conditions **(8)**, are crowded out by domestic demand.

Activity in *Building of Ships and Platforms* falls, first of all as a consequence of the loss of competitiveness in production of *Ships* due to the OECD treaty. This is counteracted by a shift in domestic demand, primarily generated in the *Domestic Transport* sector. Market shares are however lost to competing imports[27].

The extreme increase in net imports of *Agricultural Products*, which are mainly importables, is a reflection of the exogenous constraints on domestic production, the strong rise in demand from the *Consumption Goods Industry* and the relatively low reference level of trade. For *Fish*, which is an important exportable, net exports fall marginally, due to enhanced domestic demand from the *Consumption goods Industry*.

The four sectors *Domestic Transport*, *Finance and Insurance*, *Other Private Services,* and *Wholesale and Retail Trade*, all producing non-tradables, are significantly stimulated by increased private consumption. This is especially so for *Other Private Services* and *Wholesale and Retail Trade* due to large Engel elasticities. The production of *Domestic Transport*, *Finance and Insurance* services and *Construction* also gain from significant reduction in prices due to the exogenous changes in price-cost margins. Furthermore, to some extent they benefit from reduced import prices on intermediates. *Construction* services do however suffer from the strong increase in capital prices. So do the heavy capital-intensive sector *Dwelling Services*, where production falls in spite of increased consumption.

[27] As for exports, the market share is exogenously decreased in accordance with changes in terms of trade.

Table 4.2. Imports and exports (percentage change from reference path)

Commodity	Exports	Imports	Net Exports	Sensitivity results 50 percent increase in trade elasticities	
				Exp.	Imp.
Processed Food	59.5	14.0	-16.3	61.3	23.4
Beverages and Tobacco	61.4	16.5	8.2	63.5	20.4
Textiles and Clothes	15.3	5.2	4.5	17.0	4.0
Hardware and Machinery	8.7	6.5	-4.3	9.1	6.9
Repairs	-2.0	2.7	-2.2	1.0	2.2
Manufacturing Products	17.5	6.5	2.0	21.0	6.1
Pulp and Paper	-5.9	13.2	-13.3	-1.5	11.8
Industrial Chemicals	-14.5	2.3	-18.1	-2.2	10.1
Metals	-2.4	6.9	-49.7	-0.3	6.6
Agricultural Products	0.0	62.0	79.2	0.0	-17.7
Fish	3.1	71.4	-0.7	3.1	38.5
Ships	-12.1	6.6	23.2	-12.1	6.6
Oil Platforms	0.0	-0.3	-0.3	0.0	-0.6
Forestry Products	0.0	4.5	12.4	0.0	3.2
Ocean Transp. and Petroleum Expl.	0.0	0.0	0.0	0.0	0.0
Electricity	0.0	0.0	0.0	0.0	0.0
Petroleum Products	0.0	3.9	-3.0	0.0	1.5
Non-Comp. Import Goods (V^4)					
Food and Raw Materials	-	1.7	1.7	-	-1.8
Cars, Tractors etc.	-	0.1	0.1	-	-1.1
Aircraft	-	5.4	5.4	-	6.5
Others	-	4.5	4.5	-	4.1
Direct Purchases Abroad	-	3.8	3.8	-	1.8

In the industries *Production of Electricity*, *Petroleum Refining* and *Ocean Transport and Petroleum Exploration*, the changes in production are very small. So are the changes in the residually determined net exports, indicating small changes in domestic demand. Net exports of *Petroleum Products* do, however, decrease somewhat, as a response to growth in private consumption and activity in the *Domestic Transport Sector*.

Enhanced non-competing imports are mainly due to higher private consumption, but is also explained by growth in the *Consumption Goods Industry* and in *Domestic Transport*.

Table 4.3. Changes in macro variables[1] (percentage change from reference path)

Private consumption	2.2	(1.5)	*Total export*	3.4	(4.2)
Private consumer price index	0.1	(-0.8)	*Import Prices*	-2.4	(-2.4)
Gross investment	0.5	(0.5)	*Export prices*	0.6	(-0.9)
GDP	0.1	(0.3)	*Wage rates (w)*	4.1	(2.6)
Total import	6.5	(5.9)	*Capital prices (γ)*	11.2	(10.9)

1) Figures in parenthesis express percentage change from reference path when all trade elasticities are multiplied by 1.5.

4.3. Effects of increased trade elasticities - a sensitivity test

Tables 4.1, 4.2 and 4.3 also report sensitivity results represented by a 50 percent increase in all Armington elasticities. We only analyse a positive parameter shift, because there are reasons to suspect a tendency of systematic underestimation, see Naug (1994, 1995) for more on this. One important reason is to be found in the highly aggregated data, which may reveal strong variations with respect to heterogeneity. As hardly none of the observed aggregate changes in the foreign/domestic price ratio stem from homogenous products, substitution elasticities of the relatively differentiated products within the aggregates tend to be overemphasised. Another systematic error is to be found in the import price data, where quota rents are omitted. This might suppress import price fluctuations as a reason for market share variations.

A 50 percent increase in trade elasticities appears to have a very small impact on patterns of production and trade, indicating a high degree of simulation robustness. Production effects of the trade reforms are slightly modified both in the case of declining and growing industries. Yet, except from the *Consumption Goods Industry*, all industry production effects stay qualitatively unchanged. In addition, the ranking of industry specific effects is hardly changed at all. It is necessary to point out that changes in the industry pattern are now partly influenced by the fact that the recalibrated reference scenario contains a different composition of trade due to the imposed increases in trade elasicities. In general, we now observe a considerably lower reference level of exports of highly processed tradables, whereas the reference level of exports is larger in the industries restricted by fixed energy supply, as the crowding out by domestic demand is reduced[28].

For the declining energy-intensive industries, lower export reductions explain much of the modification. As mentioned earlier, export in these industries is residually determined by the gap between domestic demand and industry supply. Stronger exposure to foreign competition results in smaller terms of trade gains and lower consumption growth, in spite of a fall in consumer prices. Lower domestic demand growth means less crowding out of energy-demanding exports. For the growing industries, the modified outcome can in general be explained by loss of market shares in the domestic markets. Increased trade elasticities appear to dominate the effect of lower domestic price growth, and the relative strength of these two effects ultimately rests on the input-output corrected primary factor (labour and capital) intensities of the industries. As mentioned, production in the *Consumption Goods Industry* is significantly altered with accompanying changes in the qualitative conclusion. This change is primarily due to a considerably lower reference level of export demand accompanied by only minor reductions in imports. Reduced activity in this industry contributes to the *few* significant deviations in the patterns of trade. Since agricultural production is exogenous, declining demand from the *Consumption Goods Industry* must be reflected in reduced imports (the large simulated fluctuations reflect the small levels of base year agricultural trade). Furthermore, this reduction in demand also strongly affects the imports of *Food and Raw Materials*.

[28] The pattern of imports is only marginally affected by the recalibration.

5. Conclusion

Our general equilibrium assessment of the recent international agreements on trade indicates that one can expect rather substantial changes in the future Norwegian patterns of industry and trade. The most significant changes arise from stimulated export demand and increased competition in the domestic markets. Industries are affected quite differently both by the direct effects of the trade reforms, and by the induced cost shifts due to resource constraints. The treaties clearly tend to enhance growth in production of highly processed and differentiated goods, as well as services, at the expense of less manufactured and more energy demanding products. Highly processed tradables benefit first of all from strong export impulses as a consequence of considerably more liberal trade policies among our most important trading partners. The service industries gain from improved efficiency as well as increased private consumption. This qualitative pattern is fairly robust to a 50 percent increase in the Armington substitution elasticities for the differentiated goods. The strength of the effects is however modified, as both consumer demand and market shares tend to fall along with reduced terms of trade gains.

Compared to previous studies on the same subject, the model is considerably more up to date with respect to national accounting figures and estimates on trade policy measures. Parameters are founded on econometric estimations. The level of aggregation is more detailed, enabling us to focus on the large variety of policy measures and mechanisms influencing the different industries. In particular, the deregulatory effect on several service industries is explicitly modelled. Though the sectors are mainly sheltered, internal contestability will be influenced by the new international rules. Since the service sectors account for a large proportion of the total activity (see Table 4.1), reforms directed towards these sectors also affect the commodity producing industries significantly. In many CGE studies of trade liberalisation, the impact of trade agreements on activity in the service sector works only through indirect general equilibrium effects.

For a large number of other European countries (e.g. Austria, Finland, Sweden and Switzerland), the structure of government intervention in primary sectors, manufacturing industries and service production in the early nineties were quite similar to those of Norway. So are the nature of their commitments undertaken in the recent international negotiations[29]. Thus, our estimated effects of the trade reforms and the identification of mechanisms through which they work, may provide important information to a broad group of European policy makers.

[29] Although EEA participation deviates from full EU membership in several ways, a Norwegian study revealed quite insignificant differences with respect to trade conditions (see Bowitz et al. (1995). When it comes to trade conditions and state aid in agriculture, the choice between staying inside or outside the EU may however constitute important differences.

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Appendix 1

The table presents Armington substitution elasticities in the import share functions, σ_i^B and in the export functions, σ_i^A.

Table A.1: Substitution elasticities in trade and elasticity of exports to foreign demand

Goods	σ^B	σ^A
Processed Food	-2.35	-3.68
Beverages and Tobacco	-1.00	-3.36
Textiles and Clothes	-2.03	-3.62
Manufacturing Products	-2.53	-2.77
Pulp and Paper	-2.35	-3.68
Industrial Chemicals	-2.35	-3.68
Metals	-2.35	-3.68
Hardware and Machinery	-1.00	-2.77
Repairs	-2.03	-2.77

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