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A COMPLETE DESCRIPTION OF THE SYSTEM OF EQUATIONS

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PREFACE

Over the last two decades, the multi-sectoral growth model MSG has been used by Norwegian authorities in long term planning and analysis. The present report gives a detailed presentation of the system of equations of the current (1985) version of this model. The report deals especially with the relations between the model's variables and the Norwegian national accounts and with the specifications of energy flows in physical units.

Erik Offerdal began working on this report; Knut Thonstad continued, and Haakon Vennemo completed the work.

Central Bureau of Statistics, Oslo, 3 July 1987

Gisle Skancke

C O N T E N T S

1.1. INTRODUCTION.

MSG, the Multi Sectoral Growth model of the Norwegian economy was first developed in 1960 by Leif Johansen (Johansen (1960)). It has later undergone three major revisions. Thus, the name of the present model is MSG-4. Minor revisions typically take place each time the base year of the model is being changed. The present model has 1985 as its base year. Whenever we want to stress this point, we can write MSG85 for short. The purpose of this paper is to give a detailed documentation of the system of equations in MSG85. For a more comprehensive documentation of MSG-4, see Longva, Lorentsen and Olsen (1985).

The MSG model may conveniently be characterized as a CGE (Computable General Equilibrium) model describing an economy of cost-minimizing producers and utility maximizing consumers. Equilibrium prices clear all markets and all factors of production are mobile between sectors. Given the development of the exogenous variables, the model can project long run equilibrium growth paths for the Norwegian economy. The MSG model has thus over the last 15 years been extensively used by the Ministry of Finance for long-term (20-30 years) macroeconomic planning purposes.

The structure of the paper is as follows: Section 1 gives a brief overview of the structure of MSG-4 and introduces some central concepts and definitions of the model. Sections 2 and 3 then give a detailed presentation of the different model blocks of MSG85, while section 4 presents alterations needed to implement balance of trade restrictions in the model.

1.2. THE MAIN STRUCTURE OF MSG-4.

The equations of the model may conveniently be separated into three blocks: a price submodel, a quantity submodel and a submodel for national accounting and physical energy flows. This is illustrated in figure 1.1.

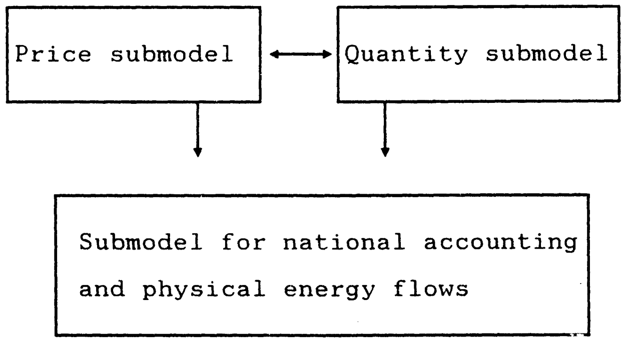

Figure 1.1. Block structure of MSG-4. Arrows fit MSG-4S

The MSG-4 model is at present formulated in three different versions, henceforth to be called MSG-4E, MSG-4S and MSG-4ET. In the two first versions the systems of equations are identical, but the two key variables R (economy wide rate of return to capital) and K (gross real capital) are exogenous and endogenous, respectively, in MSG-4E, and the opposite in MSG-4S. This makes MSG-4E block- recursive in the price- and quantity submodels, i.e. there are no repercussions from the quantity submodel to the price submodel. To explain this, note that if a sector exhibits constant returns to scale, then unit costs, prices and unit factor demands (the price block) are independent of the scale of operation (the quantity block), see eq. (1.4) below. In MSG all private cost minimizing sectors except sector 73 (Electricity Distribution) are assumed to exhibit constant returns to scale. The basic price of commodity 73 is exogenous.

In MSG-4S the two submodels are solved simultaneously. MSG-4E is the most widely used of the two.

In MSG-4ET extra equations are introduced to enable the model user to set exogenously the balance of trade in current prices. In all three versions the submodel for national accounting and physical energy flows is recursive to the former two.

Taking the MSG-4E version as an example, the structure of the <u>price</u> submodel may be illustrated as in figure 1.2.

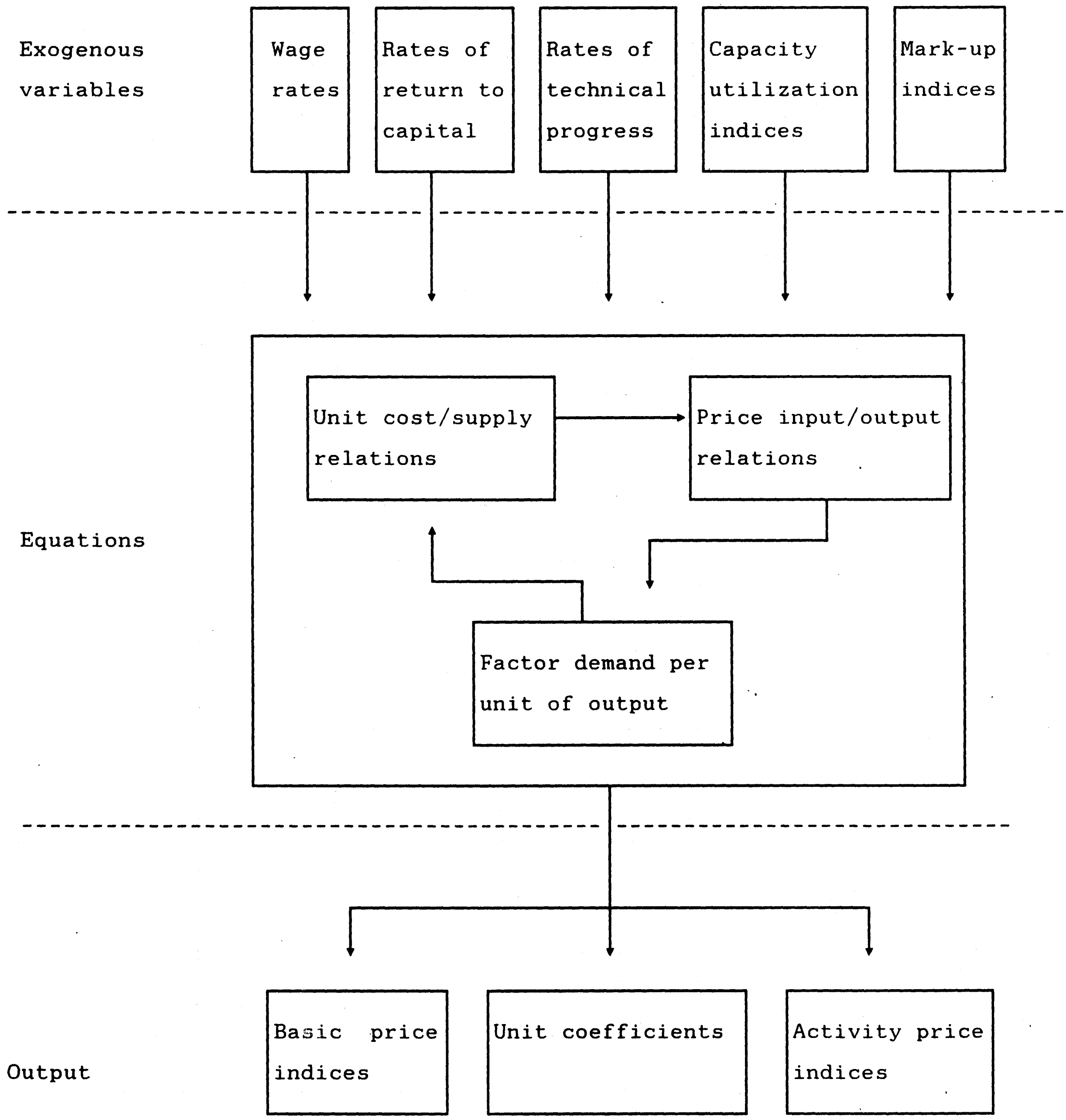

Figure 1.2. The price submodel of MSG-4E

The important exogenous inputs to the price submodel are the remunerations to the primary factors of production, namely wage rates and the rates of return to capital, and the rate of technical progress in each sector. The equations of the price submodel may be separated into three groups, namely

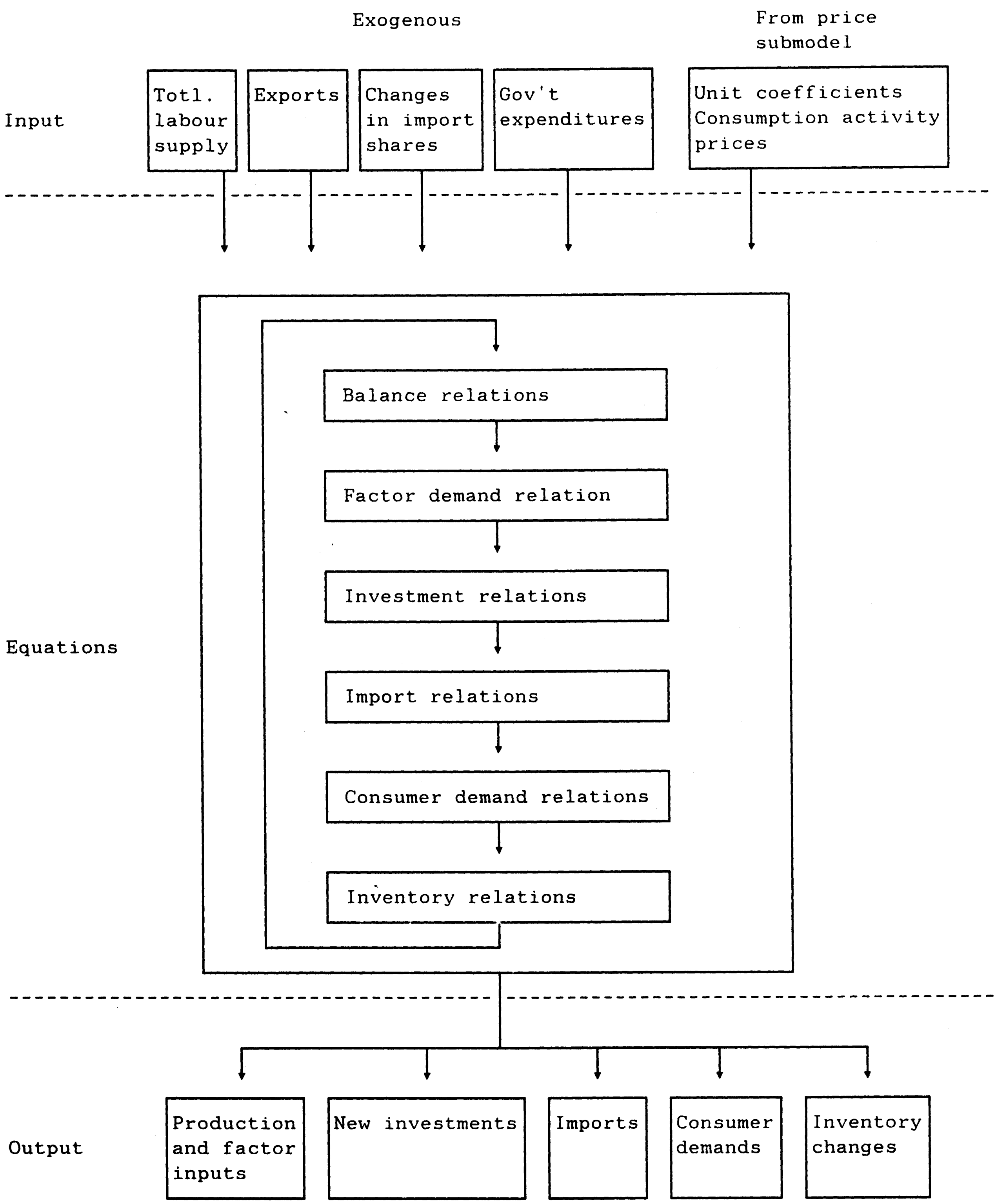

Figure 1.3. The quantity submodel of MSG-4E

market equilibrium conditions, a set of price indices, and factor demands per unit of output. The concepts of "activity price" and "basic price" are explained below in 1.3. The quantity submodel is illustrated in figure 1.3. The unit coefficients and prices of consumption activities serve as input to the quantity submodel from the price submodel. Total labour supply, exports, changes in import shares and government expenditure are exogenous inputs.

The core of the quantity submodel is a set of balance relations. These are interrelated with relations for factor demands and investments, import relations, consumption demand relations and inventory relations. The consumption demand relations determine to consumption by activity. MSG lacks an imdependent relation to explain total consumption, as such a relation would over-determine the system if nothing else in the model was changed.

Output from the quantity submodel include factor inputs and gross production, new investments, imports, total consumption and consumption by activity and inventory changes.

The structure of the submodel for national accounting and physical energy flows is sketched in figure 1.4. Along with exogenous input, this submodel uses output both from the price and quantity submodels as input.

There are two separate blocks of equations in this submodel. One is for national accounts identities, and the other for physical energy flows. Output is the familiar national accounts items, including taxes and employment in man-years. Where appropriate, the figures are given both in fixed and current prices. Electricity and fuel oil in physical units per sector complete the output from the submodel.

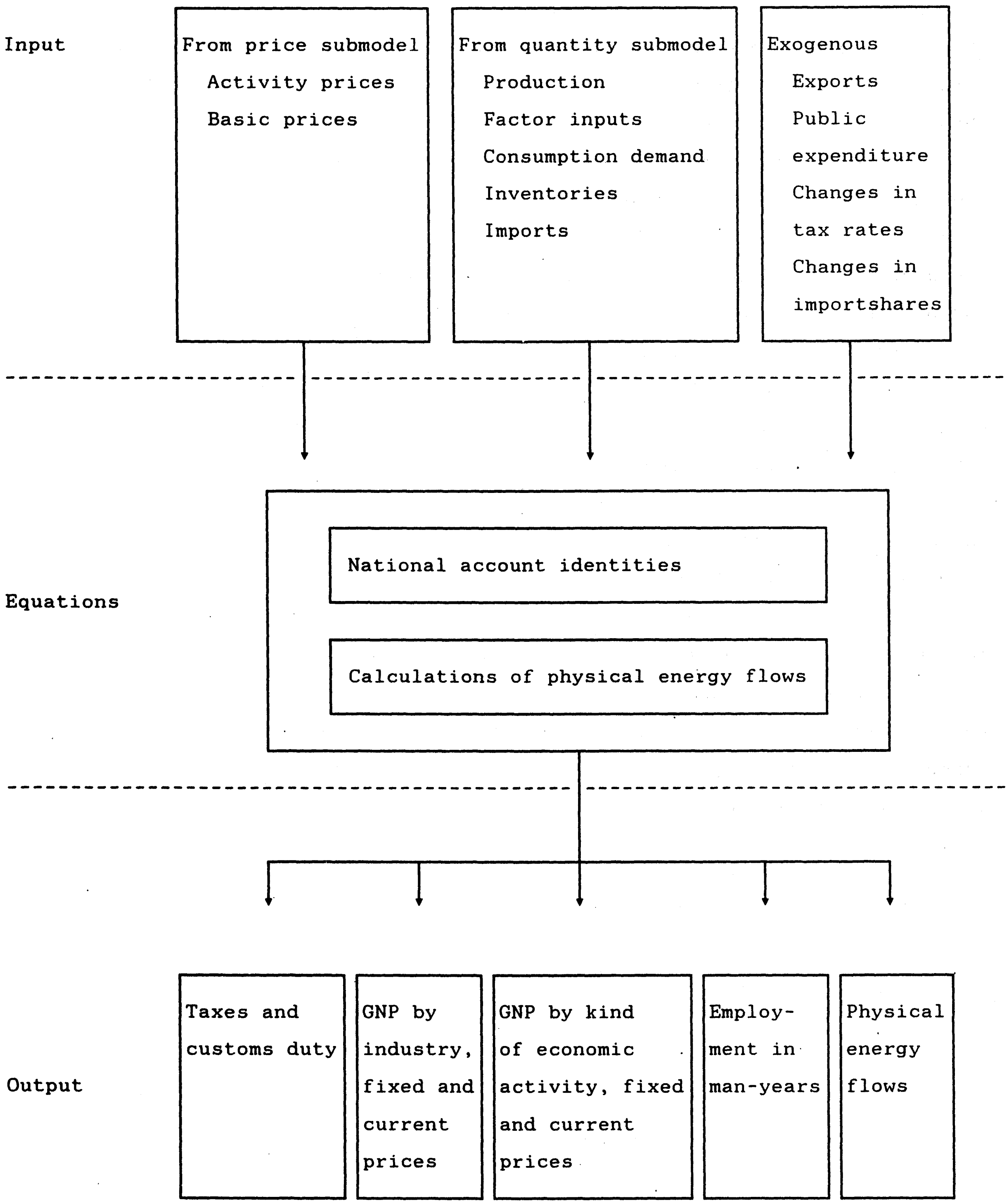

Figure 1.4. The submodel for national accounting and physical energy flows

1.3. SOME IMPORTANT CONCEPTS AND DEFINITIONS.

Two features are of central importance to the MSG-4 model; a rather detailed description of commodity flows of the economy, and the modelling of producer behaviour and substitution possibilities between factor inputs. This chapter will review some important concepts and relationships that will facilitate the understanding of the full system of equations in sections 2 and 3.

A brief note on duality

The modelling of producer behaviour in MSG-4 relies on duality theory. Below is given a brief review of the basic concepts behind this; for a full exposition the reader is referred to Varian (1978) or Diewert (1974).

Assume that a sector may be represented by a homothetic production function:

$$(1.1) \qquad X = f(v_1, v_2, \ldots\ldots\ldots, v_N) = \left[\Phi(v_1, v_2, \ldots\ldots\ldots, v_N)\right]^{\mu(x)}$$

where: X = gross production in the sector

v_i = input of factor i

$\mu(x)$ = scale elasticity of production

and the nested function Φ is assumed to exhibit constant returns to scale, while the f-function has a scale elasticity of $\mu(x)$. If (1.1) obeys certain regularity conditions; i.e. being continuous, weakly increasing and quasi-concave, it can be shown that this production structure and the concomittant competitive equilibrium of the sector may alternatively be represented in a compact form by the cost function:

$$(1.2) \qquad C = X^{\frac{1}{\mu(x)}} g(P_1, P_2, \ldots\ldots\ldots, P_N)$$

where: C = total production costs,

P_i = price per unit of input i,

The separability in a price and a quantity term follows from the homotheticity assumption.

It now follows from Shephards lemma that the sectoral demand for input i may be derived simply as the derivative of the cost function with respect to its price:

$$(1.3) \quad v_i = \frac{\partial C}{\partial P_i} = X^{\frac{1}{\mu(x)}} g'_{P_i}(P_1, P_2, \ldots\ldots\ldots, P_N)$$

or, written as demand for input i per unit of output X:

$$(1.4) \quad \frac{v_i}{X} = Z_i = X^{\frac{1-\mu(x)}{\mu(x)}} g'_{P_i}(P_1, P_2, \ldots\ldots\ldots, P_N)$$

Note that the unit cost of production can be written as:

$$(1.5) \quad \frac{C}{X} = \bar{C} = \Sigma \frac{v_i}{X} P_i = \Sigma Z_i P_i$$

Given the definition of the elasticity $\mu(x)$ of the cost function in (1.2), one may then write:

$$(1.6) \quad \frac{\delta C}{\delta X} = \frac{1}{\mu} \Sigma Z_i P_i$$

One well known property of the cost function which is used extensively in the MSG-4 model is now apparent. From (1.4) we see that if the underlying production function exhibits constant returns to scale (i.e. $\mu \equiv 1$), the quantity term on the right-hand side of (1.4) vanishes, implying that demand for input per unit of output, or the Z-coefficients, are independent of the level of production. Similarly it follows from (1.5) and (1.6) that if $\mu \equiv 1$, unit cost equals marginal cost, implying an infinitely elastic supply and zero profits if price equals unit costs. Total supply in each sector is then determined from the demand side.

Commodities, sectors and activities

Both as regards definition of variables and data requirements all models operated by the Central Bureau of Statistics are closely connected to each other and to the Norwegian national accounts. For practical purposes, the concepts commodity, sector and activity are identical in MSG-4 and the medium term model MODAG. Below is only given a brief review of these concepts; for a more detailed account the reader is referred to Cappelen, Garaas and Longva (1981) or to the documentation of the national budgeting model MODIS in Bjerkholt and Longva (1980).

Both commodities and sectors in MSG are aggregates of the corresponding concepts in the national accounts. The sectoral concept is used to classify firms and similar units into productions sectors, of which 26 are private production sectors and 7 are sectors producing public services. The sectoral concept is also used to classify final demands and imports into broad categories of goods and services classified by origin or use. Thus the MSG model has 19 consumption sectors, one export sector, one import sector and one sector for inventory changes.

Commodity flows may be defined as flows between functional sectors. The model applies a matrix of fixed commodity-by-sector coefficient, Λ's, to represent these flows. The commodity classification is arrived at by adopting the "main producer" principle, i.e. letting all goods and services with the same industry as the main producer form one commodity. The classifications of industries and commodities are thus closely related. If strictly followed, this procedure will give the same number of domestically produced commodities as the number of industries. [However, the principle is not strictly followed. See eqs. (2.35)-(2.39) and the text relating to these exceptions.] Commodities representing imports for which there is no domestic productions (non-competitive imports) are included as separate commodities. Altogether there are 42 commodities in the model - of which 31 are privately produced, 4 are marketed by public sectors, and 7 are non-competitive imports.

The rather disaggregate representation of the commodity-by-sector flows makes it possible to focus both on the industrial and final demand structure and on the industrial interdependences in a growth process. However, with respect to the specification of behavioural relations in the model it is hardly possible, nor essential for the quality of the model results, to introduce substitution possibilities between all inputs and outputs of each sector. To simplify, the detailed set of commodity and primary input flows of each sector is therefore partitioned into mutually exclusive and exaustive subsets. Each subset defines an aggregate of input or output commodities or of primary inputs. Substitution possibilities in the production or utility functions are introduced only between these aggregates. Within each aggregate fixed proportions are assumed, using commodity-by-activity coefficients (which also are denoted by the symbol Λ in the exposition below). In the model these fixed-coefficient commodity- and primary input aggregates within each sector are called activities.

Naturally, the classification of activities follows that of sectors. Most production sectors are assigned five input activities and one output activity each. None are assigned more than five input activities, but some sectors, i.e. nos. 14, 31, 40 and 64, carry two (and even three) output activities each (see eqs. (2.35)-(2.38)). (This makes necessary an "output activity list", while no spesific input activity list is needed.)

There are 18 consumption activities in all, which enter the utility functions of households. The concept of activity also applies to exports and imports. There is one of each per model-commodity.

In the model different value concepts are employed to evaluate commodity flows and activities. The principal concept for evaluating commodity flows in the model is (approximate) basic values (see eq. 2.1). This concept is preferred to producers' or purchasers' value because the trade margins (including transport charges) and tax rates may vary between receiving sectors for the same commodity and thus may cause a discrepancy between calculated total supply and total demand in producer and purchaser prices.

The activities are evaluated in market values, computed as producers' value of commodity outputs and purchasers' value of inputs. Because substitution is defined between activities, their market price is the relevant price concept in modelling the producers' and consumers' behaviour. Sectoral output is also measured in market values.

A complete listing of sectors, commodities and activities is given in appendix 3.

2. THE MAIN MODEL

2.1. THE PRICE SUBMODEL

This submodel consists of approximately 430 equations, which, as already mentioned, may be separated into three groups:

* market equilibrium conditions

* unit factor demand relations

* price input/output relations

In the exposition below equations (2.1) - (2.3) cover the first group, (2.8) - (2.15) the second and (2.16) - (2.31) the last group. The remaining equations in the price submodel may be regarded as auxiliary equations.

Market equilibrium, general specification

Eqs. (2.1) to (2.3) below are the product market equilibrium conditions in the MSG-model, equating price with marginal cost. On the right-hand side the major difference from eq. (1.6) is the last term, Z_{TSj} which gives sectoral taxes per unit of production. All sectors described by eq. (2.1) exhibit constant returns to scale, i.e. μ equals unity, and μ is in fact inserted in the equations for sectors 11, 13 and 31 only. See 1.3 above for a further explanation. The unit cost of production in a sector is equated to a weighted average of basic price indices Bi. The weights are fixed commodity-by-production sector coefficients Λ_{Xij}.

The exogenous variable γ_{Kj} is a capacity utilization index correcting for short-term divergence between actual capital-input per unit of production as measured by the national accounts, and the long-term equilibrium level expressed by the estimated model. The exogenous variable γ_{Pj} corrects for short-term deviations in the base year between product price and estimated unit cost. These occur because the unit cost of capital P_K is computed using estimated (equilibrium) rates of return to capital, which may differ from the actual rate in the base year. The variable P_{Lj} is exogenous to the model, as are some B-variables (see appendix 1 for details). The list of private sectors is named

LISMPP, while LISMVA is the name of the commodity list. Sectors 60, 64, 68, 72 and 73 have no cost-functions (see eqs. (2.8)-(2.10)).

$$(2.1) \quad \gamma_{Pj}(\Sigma_i \Lambda_{Xij} B_i) = \frac{1}{\mu_j} \left[Z_{Mj}P_{Mj}+Z_{Uj}P_{Uj}+Z_{Lj}P_{Lj}+\gamma_{Kj}Z_{Kj}P_{Kj}+Z_{TSj} \right]$$

j = LISMPP - 60,64,68,72,73
i = LISMVA

Cost functions for the sectors Electricity Production (72) and Electricity Distribution (73)

The two sectors Electricity Production (72) and Electricity Distribution (73) are treated in a slightly different manner. In both sectors input of electricity and fuel oils are separate inputs, though in these sectors, "electricity inputs" actually means power losses in distribution only. Other inputs of electricity are parts of material inputs. In sector 72 the production function is assumed linearly homogenous, but the form of the function itself is open to interpretation: All input coefficients except Z_{K72} are exogenously given. Z_{K72} is determined independently of prices (in eq. (2.41)), and it relates to changes in K_{72} (see eq. (2.44)). In sector 73 production is assumed to exhibit constant returns to scale in labour, fuel oils and other materials, but to be homogenous of degree ν_{73} in electricity and capital. The product prices B_{72} and B_{73} are exogenous. The variables γ_{P72} and γ_{P73} are therefore endogenous here, indicating how much prices deviate from long-term marginal costs.

$$(2.2) \quad \gamma_{P72}(\Sigma_i \Lambda_{Xi72} B_i) = Z_{E72}P_{E72}+Z_{F72}P_{F72}+Z_{M72}P_{M72}+Z_{L72}P_{L72}+\gamma_{K72}Z_{K72}P_{K72} +Z_{TS72}$$

i = LISMVA

(2.3) $\gamma_{P73}(\Sigma_i \Lambda_{Xi73} B_i) = Z_{F73}P_{F73}+Z_{M73}P_{M73}+Z_{L73}P_{L73}+ \frac{1}{v_{73}} \cdot (Z_{E73}P_{E73}$

$+ \gamma_{K73}Z_{K73}P_{K73})+Z_{TS73}$

i = LISMVA

Price identities

The three sectors Manufacture of Food, Beverages and Tobacco (14), Mining and Qarrying (31) and Petroleum Refineries (40), are main producers of two commodities each, respectively Food (16) and Beverages/Tobacco (17), Coal (32) and Other Mining Products (33), and Gasoline (41) and Fuel Oil (42). In these sectors it is assumed that product prices of each "main" commodity develop identically, as expressed by eqs. (2.4) to (2.6). See 1.3 above and eqs. (2.35)-(2.39) below for further details on the sector-commodity distinction.

(2.4) $B_{16} = B_{17}$

(2.5) $B_{32} = B_{33}$

(2.6) $B_{41} = B_{42}$

Sectoral taxes per unit output

(2.7) $Z_{TSj} = t_{SVj}H_{SVj}\ B_i$

j = LISMPP - 60,64,68
i = LISMVA

Sectoral taxes are calculated on an ad valorem basis, i.e. taxes are proportional to the value of sectoral output. In eq. (2.7) the output term is divided through. H_{SV}, which may be negative, is the base year rate of sectoral taxes calculated from the national accounts, and t_{SV} is an exogenous variable which enables the model user to control the development of the sectoral tax rate over time. To determine the development of the value of sectoral output by the basic price of the main commodity is a simplification. Rather, the full weighted sum $\sum_i \Lambda_{ij} B_i$ should have been used. As it stands, i=j for all j except j=14, 31 and 40. For these sectors, which produce more than one main commodity, the price of the one that carries most weight in total sectoral output is used (this principle having little practical impact in view of eq. (2.4) to (2.6)). This means that in the sectors 14, 31 and 40 the corresponding calculation of sectoral taxes is based on the prices of the commodities 16, 32 and 41 respectively.

Unit coefficients for aggregated inputs, general specification

$$(2.8) \quad Z_{ij} = X_j^{\frac{1-\mu_j}{\mu_j}} e^{\frac{-\varepsilon_j \tau}{\mu_j}} \sum_r c_{irj} \left(\frac{P_{rj}}{P_{ij}}\right)^{\frac{1}{2}}$$

j = LISMPP - 60,64,68,72,73
i = L,M
r = K,L,U,M

$$(2.9) \quad \gamma_{Kj} Z_{Kj} = X_j^{\frac{1-\mu_j}{\mu_j}} e^{\frac{-\varepsilon_j \tau}{\mu_j}} \sum_r c_{Krj} \left(\frac{P_{rj}}{P_{Kj}}\right)^{\frac{1}{2}}$$

j = LISMPP - 60,64,68,72,73
r = K,L,U,M

$$(2.10) \quad Z_{Uj} = \gamma_{Uj} X_j^{\frac{1-\mu_j}{\mu_j}} e^{\frac{-\varepsilon_j \tau}{\mu_j}} \sum_r c_{Urj} \left(\frac{P_{rj}}{P_{Uj}}\right)^{\frac{1}{2}}$$

j = LISMPP - 60,64,68,72,73
r = K,L,U,M

These formulas correspond directly to eq. (1.4) above. The production structure of the indicated sectors is specified by Generalized Leontief (GL) cost functions, i.e. the parametric specification of eq. (1.2) above is given as:

$$(*) \qquad C = X^{\frac{1}{\mu}} \sum_i \sum_j c_{ij}(P_i P_j)^{\frac{1}{2}}$$

where the indices i and j extends over the input activities capital (K), labour (L), energy (U) and other materials (M). Note that the matrix of parametres in the GL cost function is symmetric, i.e. $c_{ij}=c_{ji}$. With the exception of the exponential term and the γ_{ij}'s, the formulas (2.8) to (2.10) now follow from the derivatives of (*) divided through with X. The denomiator ε_j is an exogenous variable for Hicks-neutral technical change; an increase in this variable will reduce demand for all inputs proportionately. The computerized version of the model approximates $e^{\varepsilon_j \tau}$ by $(1+\varepsilon_j)^{\tau}$ (see app. 1). γ_{Kj} was introduced in eq. (2.1). γ_{Uj} is an aggregate temperature correction coefficient, being a weighted sum of γ_{Ej} and γ_{Fj}, see eq. (2.11) below. μ_j is included in sectors 11, 13 and 31 only.

The current computerized version of the model also contains multiplicative coefficients η_{ij}. These used to play a role in the calibration of the model, but are now superflous and are to be removed.

Unit coefficients for inputs of energy, general specification

$$(2.11) \qquad Z_{Uij} = \gamma_{ij} \sum_r b_{irj} \left(\frac{P_{rj}}{P_{ij}}\right)^{1/2}$$

j = LISMPP - 12,40,60,64,68,72,73,81,83
i, r = E,F

In a formal sense the cost functions have five input activities which are substitutable against each other: capital, labour, electricity, fuel oil and other materials. In each sector however, electricity and fuel oil are assumed to form a separable group of inputs, named aggregate energy U. This group is substitutable against other input activities, and the marginal rate of substitution between energy and any of the other inputs are independent of the mixture of electricity and fuel oil within the aggregate energy input.

Aggregate energy U is in eq. (2.11) assumed to be "produced" within each sector by a linearly homogeneous technology where the substitution possibilities are described by Generalized Leontief production functions. The left-hand side of these equations are the demand for electricity and fuels respectively per unit of aggregate energy.

The sectoral demand for energy may therefore be described as a two-stage procedure: first finding the optimal mix of electricity and fuels depending on the relative prices of these two activities as described by eq. (2.11), and thereafter finding the optimal level of aggregate energy input per unit of production as described by eq. (2.8) to (2.10).

In eq. (2.11) the γ_{ij}'s are temperature correction coefficients.

(2.12) $Z_{UEj} = 0 , \quad Z_{UFj} = 1$

$j = 12,60,64,68,72,81,83$ in LISMPP

(2.13) $Z_{UE40} = 1 , \quad Z_{UF40} = 0$

The above sectors either use no electricity or (sector 40) use no fuels as input.

Marginal unit coefficients for production of electricity

(2.14) $Z_{K72} = \sum_i Z_{Ki72}$

$i = B1,M2,M3$ in LISMJA

In the sector Production of Electricity (72) the coefficient for marginal input of capital per produced unit is determined by (2.14), i.e. as the sum of the exogenously given marginal input coefficients of three kinds of capital (buildings, transport equipment and machinery respectively). The form "marginal" is due to the fact that Z_{K72} relates exclusively to changes in X_{72}, see eq. (2.44). The unit coefficients for all other inputs than capital in the sector are exogenously given.

Unit coefficients for Electricity distribution

(2.15) $Z_{E73} = \gamma_{E73} X_{73}^{\frac{1-\upsilon_{73}}{\upsilon_{73}}} \sum_r c_{Er73} \left(\frac{P_{r73}}{P_{E73}}\right)^{1/2}$

(2.16) $$Z_{K73} = X_{73}^{\frac{1-\upsilon_{73}}{\upsilon_{73}}} \sum_{r} c_{Kr73} \left(\frac{P_{r73}}{P_{K73}}\right)^{1/2}$$

r = E,K

In the sector Distribution of Electricity (73) the coefficients for input of electricity and capital per unit of output are determined by the GL cost functions in eqs. (2.15) and (2.16). Demand for labour, fuels and other materials per unit of output is exogenously given.

<u>Price indices, Electricity</u>

(2.17) $$P_{Ej} = \Sigma_i \Lambda_{Eij} \left[(1+t_{Vi} H_{Vij}) B_i\right] (1+t_{Mi} H_{Rij})$$

j = LISMPS - 12,34,37,43,60,64,68,72,81,83
i = 72,73 in LISMVA

Eq. (2.17) gives the price indices for inputs of electricity.

The Λ_{Eij}'s are commodity-by-activity coefficients for electricity. (The list of input activities is equal to the production sector list.) The H_{Rij}'s and H_{Vij}'s are rates of non-refunded value added tax (VAT) and accrued commodity tax on inputs of commodity i to production sector j. Note that $\Lambda_{Eij} = 0$ when $i \neq 72,73$. t_{Vi} and t_{Mi} are exogenous variables designed to enable the model user to control the development of H_{Vij} and H_{Rij} over time. The list of private plus public sectors is named LISMPS.

(2.18) $$P_{Ej} = (1+H_{V71j}) \sum_i \Lambda_{Eij} [(1+t_{Vi} H_{Vij}) B_i] (1+t_{Mi} H_{Rij})$$

j = 34,37,43 in LISMPS
i = 72,73 in LISMVA

H_{V71j} is an exogenous variable enabeling the model user to "tax" the sectors 34, 37 and 43 separately in the simulation period if desired.

(2.19) $$P_{Ej} = 0$$

j = 12,60,64,68,72,81,83 in LISMPS

Eq. (2.19) corresponds to eq. (2.12).

Price indices, Oil products

$$(2.20)\quad P_{Fj} = \Sigma_i \Lambda_{Fij} \left[(1+t_{Vi} H_{Vij}) B_i \right] (1+t_{Mi} H_{Rij})$$

j = LISMPS - 40
i = 41,42,81 in LISMVA

The right-hand side of (2.20) have the same explanation as in eq. (2.17). Note that $\Lambda_{Fij} = 0$ when $i \neq 41,42,81$.

$$(2.21)\quad P_{F40} = 0$$

Eq. (2.21) corresponds to eq. (2.13).

Price indices, Energy

$$(2.22)\quad P_{Uj} = \sum_i \gamma_{ij} \sum_r b_{irj} (P_{ij} P_{rj})^{1/2}$$

j = LISMPP - 12,40,60,64,68,72,81,83
i,r = E,F

Eq. (2.22) gives the price-index of the aggregated energy-input composed of electricity and fuels (see the explanation of eq. (2.11)). The Generalized Leontief functional form is used to form the index.

$$(2.23)\quad P_{Uj} = P_{Fj}$$

j = 12,60,64,68,72,81,83 in LISMPP

$$(2.24)\quad P_{U40} = P_{E40}$$

Eq. (2.23) and eq. (2.24) correspond to eq. (2.12) and eq. (2.13), respectively.

Price indices, other inputs of materials

$$(2.25) \quad P_{Mj} = \Sigma_i \Lambda_{Mij} \left[(1+t_{Vi} H_{Vij}) B_i \right] (1+t_{Mi} H_{Rij})$$

j = LISMPS
i = LISMVA

The right-hand side variables in eq. (2.25) have the same explanation as in eq. (2.17).

Price indices, private consumption

$$(2.26) \quad P_{Cj} = \Sigma_i \Lambda_{Cij} \left[(1+t_{Vi} H_{Vij}) B_i \right] (1+t_{Mi} H_{Mij})$$

j = LISMCP
i = LISMVA

Eq. (2.26) and eq. (2.27) define the net purchaser price indices for consumption sectors and types of investment goods. The list of consumption sectors is named LISMCP. P_{C70} is not defined, as consumption by foreigners is a fixed share of consumption in each consumption activity and sector (see for instance eqs. (2.60) and (3.32)). The Λ_{Cij}'s are commodity-by-consumption sector coefficients. H_{Mij} is the rate of VAT (accrued) on deliveries of commodity i to activity j. t_{Mi} enables the model user to control this rate over time. The other right-hand side variables have the same explanation as in eq. (2.17).

Price indices, investment goods by type

$$(2.27) \quad P_{Jj} = \Sigma_i \Lambda_{Jij} \left[(1+t_{Vi} H_{Vij}) B_i \right] (1+t_{Mi} H_{Mij})$$

j = LISMJA
i = LISMVA

The list of investment goods by type is named LISMJA.

Price indices, export

(2.28) $P_{Aj} = \Sigma_i \Lambda_{Aij} \left[(1+t_{Vi}H_{Vij})B_i\right]$

j = LISMVA - 05,19,36,55,83,94
i = LISMVA

Eq. (2.28) gives price indices (f.o.b) for export activities. Six sectors do not export anything. The list of export activities is identical to LISMVA, the commodity list. Note that $\Lambda_{Aij} = 0$ when $i \neq j$ and $i \neq 81$. All export-H_{Mij}'s are zero.

(2.29) $P_{Aj} = 0$

j = 05,19,36,55,83,94 in LISMVA

User-price of capital, general specification

(2.30) $P_{Kj} = \sum_i \varkappa_{ij}(\delta_{ij}+R_j)P_{Ji}$

j = LISMPS - 60,64,68,72,92S
i = LISMJA

(2.31) $P_{K92S} = 0$

Eq. (2.30) gives the user price of capital as a weighted sum of depreciation rates and a sector spesific rate of return to capital, R_j. The weights are endogenously given as the products of the prices of the types of investment goods, P_J, and capital structure coefficients, $\varkappa_{ij}$. Note that R_j is defined for the private sectors only. The model presupposes geometrical depreciation. The price of capital in the defence sector is set to zero, as this sector is conventionally assumed not to have capital.

User-price of capital in Electricity production

$$(2.32)\quad P_{K72} = \sum_i \frac{Z_{Ki72}}{Z_{K72}} \frac{R_{72}}{1-(1+R_{72})^{-T_i}} P_{Ji}$$

i = B1,M2,M3 in LISMJA

Eq. (2.32) gives the user price of capital in Electricity Production as a weighted sum of prices of the different types of investment goods multiplied with an annuity factor which transforms investment prices to user cost. Note that $\frac{R_{72}}{1-(1+R_{72})^{-T_i}}$ is equal to $\left[\sum_{s=1}^{T_i}(1+R_{72})^{-s}\right]^{-1}$. The weights can be interpreted as capital-structure-coefficients. In eq. (2.32) it is assumed that the production capacity of capital type i is constant over its life-time T_i.

The relationship between the rates of return

$$(2.33)\quad R_j = \varrho_j R$$

j = LISMPP - 60,64,68,72,73

Eq. (2.33) says that the rate of return to real capital in each sector is proportional to the rate of return in the economy as a whole. ϱ_j is an exogenous variable.

2.2. THE QUANTITY SUBMODEL

The commodity balances constitute the core of the quantity submodel. The commodity balances (including the assumption of fixed activity coefficients) are given by

$$(2.34)\quad \sum_{j} \Lambda_{Iij} I_j + \sum_{j} \Lambda_{Xij} X_j - \sum_{j} (\Lambda_{Mij} M_j + \Lambda_{Eij} E_j + \Lambda_{Fij} F_j$$

j=LISMVA- 55,60,67, 69,73,83, 92,93,94, 95   j=LISMPSA   j=LISMPS

$$- \sum_{j} \Lambda_{Cij} (C_j - C_{Kj}) - \sum_{j} \Lambda_{Jij} J_j - \sum_{j} \Lambda_{Aij} A_j = D_{Si}$$

j=LISMCP   j=LISMJA   j=LISMVA-05,19,36,55,83,94

i = LISMVA

As noted in 1.3, the Λ's are commodity-by-activity or -sector coefficients giving commodity flows relative to corresponding activity levels. The production activity list is named LISMPSA. Note that the commodity-by-activity coefficient Λ_{Xij} is not identical to Λ_{Xij} introduced in eq. (2.1). The latter runs over j=LISMPS and gives commodity-by-sector flows. The Λ's are calculated from the base year national accounts. Λ_{Iij}, Λ_{Eij}, Λ_{Fij} and Λ_{Aij} all have fairly simple structures, see eqs. (2.17), (2.20) and (2.28). Λ_{Iij} is in fact equal to zero when $i \neq j$. The commodity flows are measured in basic values, and the activity levels are measured in producer's values for output activities and purchasers' values for inputs. So are sector levels.

On the left hand side of eq. (2.34) the Λ's are combined with activity (sector) levels for imports (I_j), domestic production (X_j), intermediate input of meterials (M_j), input of fuels (F_j) and electricity (E_j), consumption less consumer's purchases of used real capital (C_j-C_{Kj}), gross investment (J_j) and exports (A_j). The import activity list is identical to LISMVA.

Some import-activities are excluded from eq. (2.34). These correspond to completely sheltered sectors. The excepted export-activites are noted in eq. (2.29).

The right hand side (D_{Si}) gives changes in stocks of commodity i measured in fixed base year prices.

The levels of all production activities are determined endogenously except for Agriculture (X_{11}), Fishery (X_{13}), Production of Coal (X_{32}) and Other Mining Products (X_{33}), Production of Crude Oil (X_{66}) and Production of Natural Gas (X_{67}).

Note that output from public sectors (92S to 92K) should be interpreted as privately paid (through fees etc.) output of public services. Gross product of public services is defined and measured in eq. (3.29), and public consumption in eq. (3.30).

18 of the changes in stocks (D_{Si}) are set to zero (see eq. (2.66)). The rest are determined by the model (see eq. (2.66)).

The main principle in the model is that one production activity is assigned to each production sector. The exceptions are Manufacture of Food, Beverage and Tobacco (X_{14}), Mining and Quarrying (X_{31}), Petroleum Refining (X_{40}) and Production and Pipeline Transportation of Crude Oil and Natural Gas (X_{64}). These produce more than one commodity, and are assigned one activity for each. The public sectors share commodities, and must also be treated separately.

Manufacture of Food, Beverages and Tobacco contains the two activities Manufacture of Food (X_{16}) and Manufacture of Beverages and Tobacco (X_{17}).

(2.35) $X_{14} = X_{16} + X_{17}$

The Mining sector (X_{31}) contains the two activities Production of Coal (X_{32}) and Production of Other Mining Products (X_{33}).

(2.36) $X_{31} = X_{32} + X_{33}$

The Petroleum Refining sector (X_{40}) contains Production of Gasoline (X_{41}) and Fuel Oil (X_{42}).

(2.37) $X_{40} = X_{41} + X_{42}$

The sector Production and Pipeline Transportation of Crude Oil and Natural Gas (X_{64}) contains the three production activities Production of Crude Oil (X_{66}), Production of Natural Gas (X_{67}) and Transportation of Crude Oil and Natural Gas by Pipeline (X_{69}).

(2.38) $X_{64} = X_{66} + X_{67} + X_{69}$

Total sectoral output from the public sectors 93, 94, 95 must be split into two activities S and K each (S and K stand for Central- and Local Government, respectively). This is done through F_{Xj}, which is the base year division of the two in the sector.

(2.39) $X_j = F_{Xj}(X_{iS} + X_{iK})$

j = 93S,94S,95S in LISMPSA
i = 93,94,95 in LISMVA

Balance equations for primary factors

Total employment in the production sectors measured in man-hours is set equal to the exogenously given supply of labour.

The employment by sector is determined by the model except for the sectors Ocean Transport (60), the petroleum sectors (64) and (68) and the public sectors (92S to 95K), where employment is given exogenously.

(2.40) $L = \sum_j L_j$

j = LISMPS

The total stock of capital in the production sectors is normally set equal to total supply of capital. In the two model versions MSG-4E and MSG-4ET total supply of capital is determined by the model, while it is exogenously given in the MSG-4S-version.

(2.41) $K = \sum_j K_j$

j = LISMPS

Equations for inputs in private production sectors

The common assumption is that an input to a private production is found by multiplying the relevant unit coefficient with the output level. This gives:

Labour supply

(2.42) $L_j = Z_{Lj} X_j$ j = LISMPP - 60,64,68

Labour supply is exogenously given in Ocean Transport (60) and the two petroleum sectors (64) and (68). The unit coefficients are exogenously given in the sectors Production of Electricity (72) and Electricity Distribution (73). Z_{L72} is zero.

Real capital

(2.43) $K_j = Z_{Kj}X_j$ $\qquad$ j = LISMPP - 60,64,68,72

Real capital in sectors 60, 64 and 68 is determined in eq. (2.55). In sector 72 the unit coefficient for import of capital relates to changes in production levels, as eq. (2.44) denotes:

(2.44) $$K_{72} = K_{72}(-1) + Z_{K72}\left[\frac{X_{72}}{Y_{K72}} - \frac{X_{72}(-1)}{Y_{K72}(-1)}\right]$$

Z_{K72} is the sum of the exogenously given marginal input coefficients for the different types of capital in the sector (see eq. (2.14)). Y_{K72} is an exogenously given capacity utilization rate.

Input coefficients for aggregate energy exist for all private sectors except 60, 64, 68, 72 and 73 (see eq. (2.10)). Z_{UEj} and Z_{UFj} are unit coefficients of electricity and fuels as shares of the energy-input (see eq. (2.11)).

For the five exceptions, unit coefficients of electricity and fuels as shares of production are defined. These are all exogenously given except for the unit coefficient of electricity in Electricity Distribution (73).

Electricity:

(2.45) $E_j = Z_{UEj} \cdot Z_{Uj} X_j$ $\qquad$ j = LISMPP - 60,64,68,72,73

(2.46) $E_j = Z_{Ej} \cdot X_j$ $\qquad$ j = 60,64,68,72,73 in LISMPP

Fuels:

(2.47) $F_j = Z_{UFj} \cdot Z_{Uj} \cdot X_j$ $\qquad$ j = LISMPP - 60,64,68,72,73

(2.48) $F_j = Z_{Fj} \cdot X_j$ $\qquad$ j = 60,64,68,72,73 in LISMPP

Materials:

In sectors 60, 64, 68, 72 and 73, the input coefficients for materials are exogenously given.

$$(2.49)\quad M_j = Z_{Mj}X_j \qquad j = LISMPP$$

Equations for inputs of Materials and Energy in public production sectors

In the public sectors the unit coefficients Z_{HEj}, Z_{HFj} and Z_{HMj} and total gross purchase of commodities and services (H_j) are exogenously given. LISMPO is the name of the list of public sectors.

$$(2.50)\quad E_j = \gamma_{Ej}Z_{HEj}H_j$$

$$(2.51)\quad F_j = \gamma_{Fj}Z_{HFj}H_j \qquad j = LISMPO$$

$$(2.52)\quad M_j = Z_{HMj}H_j$$

Capital structure coefficients in Production of Electricity

The capital structure coefficients $\varkappa_{i72}$ for the different types of capital used by sector 72 are endogenous variables determined by eq. (2.54). The respective marginal input coefficients (Z_{Ki72}) are exogenously given. $\varkappa_{i72}$ is zero for the remaining types of capital.

$$(2.53)\quad \varkappa_{i72} = 0$$

i = LISMJA - B1,M2,M3

$$(2.54)\quad \varkappa_{i72} = \frac{\varkappa_{i72}(-1)K_{72}(-1) + Z_{Ki72}\left[\frac{X_{72}}{\gamma_{K72}} - \frac{X_{72}(-1)}{\gamma_{K72}(-1)}\right]}{K_{72}}$$

i = B1,M2,M3 in LISMJA

Stocks of capital in the public sectors, the petroleum sectors and Ocean Transport

The stocks of capital in the sectors not mentioned in eqs. (2.43) or (2.44) are determined by exogenously given investments.

$$(2.55)\quad K_j = \xi_j(K_j(-1)+J_{KSj}) + K_{Xj}$$

where ξ_j is composed of coefficient terms:

$$\xi_j = \frac{1}{1+\sum_i \delta_{ij}\varkappa_{ij}}$$

j = LISMPO - 92S + 60,64,68 in LISMPP
i = LISMJA

The coefficients are depreciation rates (δ_{ij}) and capital structure coefficients $(\varkappa_{ij})$ by type of capital and sector.

The K_{Xj}'s are correction terms which are set to zero for all other periods than the base year.

$$(2.56)\quad K_{92S} = 0$$

Capital in the Defence Sector (92S) is conventionally set to zero. See eq. (2.31).

Employment in the sectors of eqs. (2.55) and (2.56) is exogenously given.

New investments by investment activity

$$(2.57)\quad J_i = \sum_j(\varkappa_{ij}F_{Kj} + \delta_{ij}\varkappa_{ij}K_j)$$

$$+ \varkappa_{i72}K_{72} - \varkappa_{i72}(-1)K_{72}(-1) + DEP_{i72} \cdot \delta_{i72} \cdot K_{72} \cdot \varkappa_{i72}$$

$$+ J_{Ei} + J_{Xi}$$

i = LISMJA
j = LISMPS - 72

F_{Kj} are auxiliary variables defined by the equations

$$F_{Kj} = K_j - K_j(-1)$$

for j = LISMPP - 60,64,68

$$F_{Kj} = J_{KSj} - \sum_i \delta_{ij} \varkappa_{ij} K_j$$

for j = LISMPO + 60,64,68 in LISMPP

Eq. (2.57) gives total new investment by type of capital as determined by the structure and development of the total capital stocks in the different production sectors, exogenously given sales of used real capital (J_{Ei}) and exogenous investment (J_{Xi}). Exogenous investment is set to zero in all other periods than the base year of the model, where it is used as a correction factor.

Capital depreciation in the sector Production of Electricity (72) is treated in a special way. By introducing the exogenously given DEP_{i72}-variables different assumptions about the structure of the capital depreciation in the sector can be made, for example "sudden death" of capital equipment. Their base year value is one. Currently they are not exensively used.

Note that eq. (3.62) calculates gross investment as new investments less sales of used real capital.

Import equations

$$(2.58) \quad \sum_{\substack{i \\ j=LISMVA}} \Lambda_{Iij} I_j / H_{Bi} = \sum_{\substack{i \\ j=LISMPS}} (M_{Mi} \Lambda_{Mij} M_j + M_{Fi} \Lambda_{Fij} F_j) + \sum_{\substack{i \\ j=LISMCP}} M_{Ci} \Lambda_{Cij} (C_j - C_{Kj}) + \sum_{\substack{i \\ j=LISMJA}} M_{Ji} \Lambda_{Jij} J_j$$

$$+ M_{Si} \Lambda_{Si} D_{Si} + IA_i / H_{Bi}$$

i = 12,16,17,18,26,27,28,34,37,41,42,43,45,50,68,74,81,82,85 in LISMVA

The Λ's are commodity-by-activity/sector coefficients. Λ_{Si} is a vector giving base-year stocks of activity i as share of total stocks. See eq. (2.34) for more information about the Λ's. The M_{ri}'s are market shares for imports and the H_{Bi}'s are exogenously given changes in import shares. (The latter is easier to interpret if one multiplies both sides of the equation with H_{Bi}.) IA_i is re-exported imports.

Imports of the commodities Construction (55), Ocean Transport (60), Production of Natural Gas (67), Transportation of Oil and Gas by Pipeline (69), Electricity Distribution (73), Dwellings (83) and commodities from the public sectors (92-95) are set to zero and left out of the main model. Imports in the sector Production of Electricity (72) are exogenously given.

Imports of the commodities Agriculture (11), Fishery (13), Mining for Coal (32), Other Mining (33) and Production of Oil (66) are determined by the commodity balance equations (2.34). Production of these commodities is exogenously given.

Budget constraint, private consumption

(2.59) $$N_C V C_B = \sum_j P_{Cj}(C_j - F_{Cj} C_{70})$$

j = LISTECA

Eq. (2.59) gives total endogenous consumption expenditure as the sum of expenditures on each type of consumption activity, minus foreigners' consumption in Norway. The list of consumption activities is named LISTECA. The definition of total consumption expenditure employed in the model differs from the concept used in the national accounts in that estimated costs of keeping cars and not expenditure on car purchases is employed in the model. The definition of endogenous consumption differs from that of total consumption in that consumption of healthcare services is included in the latter.

N_C is the exogenously given population, whereas V_{CB} is total endogenous consumption expenditure per capita corrected for purchase of cars and services rendered from keeping a car, measured in current prices. The computerized version of the model normalizes N_C to one in the base-year, implicitly defining V_{CB} as "endogenous consumption per base-year population", rather than "per capita". P_{Cj} is purchasers' price index, private consumption activity j (see eq. (2.26)). C_j is private consumption of activity j, measured in fixed prices. C_{70} is exogenously given consumption by foreigners in Norway, while F_{Cj}'s are coefficients distributing this consumption to the different activities.

Equations of distribution, private consumption

(2.60) $$C_i = N_C \alpha_{Ci} (\Theta_C V_{CB})^{\xi_{Ci}} \prod_j P_{Cj}^{\varkappa_{Cij}} + F_{Cj} C_{70}$$

j = LISTECA
i = LISTECA - 12,13

The system of household demand functions determines the allocation of demand for consumption activities, (while commodity demand follows from the assumption of fixed coefficients within each of these aggregates, see 1.3 and eq. (2.34)). The system of demand functions have been directly specified and can be interpreted as a first-order logarithmic approximation of any complete system of demand functions. It should be noted however, that the estimation of eq. (2.60) presupposes an additive structure of the utility function, (see Bjerkholt et.al. (1983)).

The θ_C is an endogenous auxiliary variable, determined so that the adding up condition always will be fullfilled, i.e. the sum of consumption activities valued at purchaser prices equals total consumption expenditure (see eq. (2.59)).

θ_C is normalized to one in the base year as the constant term α_{Ci} is adjusted accordingly. The expenditure and price elasticities are then this year identical with the ξ's and $\varkappa$'s. In the following years, the effect through θ_C must be taken account of when calculating expenditure and price elasticities. The system of demand functions satisfies the homogenity-property, that demand functions must be homogenous of degree zero (as $\sum_j \varkappa_{Cij} = \xi_{Ci}$). The symmetry-property - that the matrix of underlying Slutsky-derivatives be symmetric is however fullfilled for the base year only.

The energy orientation of the model has led to the introduction of two additional parameters in activity 12 (Electricity) and activity 13 (Fuels). γ_{ECi} has the same interpretation as γ_E and γ_F that were introduced in eq. (2.22), while β_{Ci} enables the model user to study the effects of non-price induced changes in the consumption of the two activities, for instance the effects of increased energy awareness.

$$(2.61) \quad C_i = \beta_{Ci}\gamma_{ECi}N_C\alpha_{Ci}(\theta V_{CB})^{\xi_{Ci}}\prod_j P_{Cj}^{\varkappa_{Cij}} + F_{Cj}C_{70}$$

j = LISTECA
i = 12,13 in LISTECA

User price on cars

$$(2.62) \quad P_{C31} = (r_B + \delta_B)\left[\frac{C_{30}-C_{K30}}{C_{30}} \cdot P_{C30} + \frac{C_{K30}}{C_{30}} P_{JM2}\right]$$

Eq. (2.62) defines the user price of keeping cars (P_{C31}). Assuming geometrical depreciation this can be written as a sum of a rate of interest r_B and a depreciation factor δ_B, multiplied with a purchaser's price index of cars, which is a weighted sum of the purchasers prices of new (P_{C30}) and old (P_{JM2}) cars. C_{K30} was introduced in eq. (2.34). C_{30} is defined in eq. (2.63) below. The exogenous variable r_B is set to zero in the base year of the model, and is not exensively used in most model runs.

Total purchase of cars

$$(2.63) \quad C_{30} = (1+\delta_B)C_{31}-C_{31}(-1)$$

Eq. (2.63) estimates the volume of total purchase of cars (gross investment), as the net change in the stock of cars, δ_B is the depreciation rate of cars.

Equations for changes in stocks

$$(2.64) \quad D_{Si} = \sigma_S \sum_j \Lambda_{Xij}(X_j-X_j(-1))+D_{SEi}$$

i = 11,12,13,16,17,18,26,27,28,32,33,34,37,41,42,43,45,50,66,85 in LISMVA

j = LISMPSA

(2.65) $D_{Si} = \sigma_S \sum_j \Lambda_{Iij}(I_j - I_j(-1)) + D_{SEi}$

i = 00,01,02 in LISMVA
j = LISMVA

Eq. (2.65) says that the changes in stocks of non-competing import-commodities is assumed to be proportional to change in imports. In eq. (2.64) the changes in stocks of the other commodities in the model is assumed to be proportional to the change in gross production. D_{SEi} is exogenously given change in stocks, commodity i.

However, (changes in) stocks are set to zero for about half the commodities.

(2.66) $D_{Si} = 0$

i = 05,06,19,36,55,60,67,68,69,72,73,74,81,82,83,92,93,94,95 in LISMVA

3. THE SUBMODEL FOR NATIONAL ACCOUNTING AND PHYSICAL ENERGY FLOWS

3.1. CALCULATION OF TAXES, VAT AND CUSTOMS DUTY

In the submodel for national accounting and physical energy flows, which is recursive to the main model, the results from the main model are utilized to calculate important national account and energy figures using definition equations.

Among the figures calculated are commodity and sectoral taxes, private and public consumption, exports and imports, and sectoral figures for gross product, operating surplus, wages, employment in man hours, capital depreciation and gross investment.

The submodel also contains calculations of flows of electricity and oil-products.

Sectoral taxes by sector

(3.1) $$Y_{TSj} = Z_{TSj}X_j$$

j = LISMPP

For every private sector except Ocean Transport (60) and the two petroleum sectors the unit tax (Z_{TSj}) is determined by the main model. Z_{TSj} is exogenous for the three exceptions. See eq. (2.7).

Net commodity taxes by commodity

(3.2) $$T_{VTi} = \left[\sum_{j=LISMPS} H_{Vij}(\Lambda_{Mij}M_j+\Lambda_{Eij}E_j+\Lambda_{Fij}F_j) + \sum_{j=LISMCP} H_{Vij}\Lambda_{Cij}(C_j-C_{Kj}) + \sum_{j=LISMJA} H_{Vij}\Lambda_{Jij}J_j + \sum_{j=LISMVA} H_{Vij}\Lambda_{Aij}A_j\right] t_{Vi}B_i$$

i=00,02,11,16,17,27,34,37,41,42,45,50,74,81,85 in LISMVA

H_{Vij} is the accrued rate of commodity tax on inputs of commodity i to activity j. B_i is the base-price index for commodity i and t_{Vi} is the change in the tax rate, commodity i. For the commodities 72 and 73 one must also take account of the special tax H_{V71j} introduced in eq. (2.18). This tax uses purchasers value as its base, i.e. price including VAT and ordinary tax, t_{Vi}. (VAT is termed T_{MT} and defined below in eq. (3.7)). Note that sectors 72 and 73 deliver electricity only to the other production sectors.

(3.3) $$T_{VTi} = \{[\sum_{j=LISMPS} H_{Vij}\Lambda_{Eij}E_j + \sum_{j=LISMCP} H_{Vij}\Lambda_{Cij}(C_j - C_{Kj}) + \sum_{j=LISMVA} H_{Vij}\Lambda_{Aij}A_j]t_{Vi} + \sum_{j=34,37,43 \text{ in LISMVA}} H_{V71j}(1 + t_{Vi}H_{Vij})(1 + t_{Mi}H_{Rij})\Lambda_{Eij}E_j\}B_i$$

i = 72,73 in LISMVA

In the current version of the model, the commodity tax of most commodities is zero.

$$(3.4) \quad T_{VTi} = 0$$

i = LISMVA - 00,02,11,16,17,27,34,37,41,42,45,50,72,73,74,81,85

Net commodity taxes accrued on imports by commodity

$$(3.5) \quad T_{VBi} = t_{Vi}H_{VBi}B_{i}\sum_{j}\Lambda_{Iij}I_{j}$$

i = 00,02,16,17,27,34,37,45,50,72 in LISMVA
j = LISMVA

H_{VBi} is the rate of commodity tax accrued on imports of commodity i.

$$(3.6) \quad T_{VBi} = 0$$

i = LISMVA - 00,02,16,17,27,34,37,45,50,72

VAT accrued by commodity

$$(3.7) \quad T_{MTi} = \Big[\sum_{j}(1+t_{Vi}H_{Vij})H_{Mij}(\Lambda_{Mij}M_{j}+\Lambda_{Eij}E_{j}+\Lambda_{Fij}F_{j}) + (\sum_{j}(1+t_{Vi}H_{Vij})$$

j = LISMPS

$$H_{Mij}\Lambda_{Cij}(C_{j}-C_{Kj})) + \sum_{j}(1+t_{Vi}H_{Vij})H_{Mij}\Lambda_{Jij}J_{j}\Big] t_{Mi}B_{i}$$

j = LISMCP $\qquad\qquad$ j = LISMJA

i = LISMVA - 05,06,36,60,67,68,69,82,83,92,93,94,95

H_{Mij} is the rate of (accrued) VAT on commodity i delivered to sector j. H_{Vij} is the rate of commodity tax accrued on inputs of commodity i to j. The t_{Mi} is the change of VAT-rate, commodity i.

(3.8) $TMT_i = 0$

i = 05,06,36,60,67,68,69,82,83,92,93,94,95 in LISMVA

VAT accrued on imports by commodity

(3.9) $T_{MBi} = (1+t_{Vi}H_{VBi})t_{Mi}H_{MBi}B_i\sum_j \Lambda_{Iij}I_j$

i = LISMVA - 05,06,36,55,60,67,68,69,73,81,82,83,92,93,94,95
j = LISMVA

H_{MBi} is the rate of VAT on imports, commodity i. H_{VB} was introduced in eq. (3.5). Note that Λ_{Iij} is zero when $i \neq j$. In the current version of the model, VAT on imports is set to zero for some commodities. Eq. (3.10) lists these.

(3.10) $T_{MBi} = 0$

i = 05,06,36,55,60,67,68,69,73,81,82,83,92,93,94,95 in LISMVA

Refunded VAT on inputs, by sector

(3.11) $Y_{FMj} = \sum_i (1+t_{Vi}H_{Vij})H_{FMij} (\Lambda_{Mij}M_j+\Lambda_{Eij}E_j+\Lambda_{Fij}F_j)t_{Mi}B_i$

j = LISMPP - 60,64,68,82,83
i = LISMVA

The H_{FMij}'s are coefficients for rates of refunded VAT on deliveries of commodity i to production sector j. For the sectors 60, 64, 68, 82 and 83 Y_{FMj} is set to zero in the model.

(3.12) $Y_{FMj} = 0$

j = 60,64,68,82,83 in LISMPP

Refunded VAT on inputs, fixed prices, by sector

(3.13) $$Q_{FMj} = \sum_i (1+H_{Vij})H_{FMij}(\Lambda_{Mij}M_j+\Lambda_{Eij}E_j+\Lambda_{Fij}F_j)$$

j = LISMPP - 60,64,68,82,83
i = LISMVA

Note that the right hand side of eq. (3.13) is of the form $a_jM + b_jE_j + c_jF_j$, as the sum over LISMVA is constant for each j. Q_{FMj} is of course zero in the same sectors as Y_{FMj}.

(3.14) $$Q_{FMj} = 0$$

j = 60,64,68,82,83 in LISMPP

Total accrued customs duty

(3.15) $$T_{TB} = \sum_i H_{TBi}(\sum_j \Lambda_{Iij}I_j)$$

j = LISMVA
i = LISMVA

T_{TB} is total accrued customs duty and the parameter H_{TBi} is the rate of customs duty on imports of commodity i. Note that Λ_{Iij} equals zero when $i \neq j$.

Auxiliary variable for Wholesale and retail trade (VAT, commodity taxes and customs duties on imports)

(3.16) $$\Delta Y_{T81} = \sum_i (T_{VBi}+T_{MBi}) + T_{TB}$$

i = LISMVA

Net indirect taxes (accrued), by sector

(3.17) $$Y_{Tj} = \sum_i H_{TFij} (T_{MTi} - T_{MBi} + T_{VTi} - T_{VBi}) - Y_{FMj} + Y_{TSj}$$

j = LISMPP - 81
i = LISMVA

H_{TFij} is a distribution coefficient for tax and VAT accrued on deliveries of commodity i, T_{MTi} is VAT accrued on commodity i, T_{VTi} is net commodity tax on commodity i, T_{MBi} is VAT accrued on imports of commodity i and T_{VBi} is net commodity tax accrued on imports of commodity i. Y_{MFj} is refunded VAT and Y_{TSj} is sectoral tax. Wholesale and Retail Trade (81) is treated separately as customs duties, VAT and commodity taxes on imports are assumed to be collected in this sector. Y_{Tj} gives indirect taxes in current prices.

Net indirect taxes (accrued), Wholesale and Retail Trade

(3.18) $$Y_{T81} = \sum_i H_{TFi81} (T_{MTi} - T_{MBi} + T_{VTi} - T_{VBi}) - Y_{FM81} + Y_{TS81} + \Delta Y_{T81}$$

i = LISMVA

Eq. (3.18) is equivalent to eq. (3.17) except for ΔY_{T81} - the auxiliary variable defined in eq. (3.16). The introduction of ΔY_{T81} expresses the assumption that customs duties, VAT and commodity taxes on imports are collected in this sector.

3.2. CALCULATIONS OF INCOME

Total wages by sector

(3.19) $$Y_{Wj} = P_{Lj} L_j (1 - F_{WSj})$$

j = LISMPS

Total wages in a sector is the wage-index for the sector, P_{Lj}, multiplied with labour power, adjusted for the share of self-employed (F_{WSj}). Note that F_{WSj} = 0 in some sectors, see eq. (3.20) below.

Calculated remuneration to self-employed by sector

(3.20) $$Y_{WSj} = P_{Lj} L_j F_{WSj}$$

j = LISMPS - 34,37,40,43,64,68,72,73,92S,93S,93K,94S,94K,95S,95K

(3.21) $$Y_{WSj} = 0$$

j = 34,37,40,43,64,68,72,73,92S,93S,93K,94S,94K,95S,95K in LISMPS

The sum of eqs. (3.19) and (3.20)/(3.21) is of course $P_{Lj}L_j$.

Depreciation of capital by sector, current prices

(3.22) $$Y_{Dj} = \sum_i \delta_{ij} \varkappa_{ij} P_{Ji} K_j$$

j = LISMPS - 72,92S
i = LISMJA

(3.23) $$Y_{D72} = (\sum_i DEP_{i72} \delta_{i72} \cdot \varkappa_{i72} \cdot P_{Ji}) K_{72}$$

i = LISMJA

The capital depreciation in a sector is equal to the sum of products of depreciation rates, capital structure coefficients and prices for the specific types of capital, multiplied with total capital in the sector.

In the sector Production of Electricity DEP_{i72} is included. See the comments to eq. (2.57). Eqs. (2.53) and (2.54) define $\varkappa_{i72}$ as an endogenous variable.

(3.24) $Y_{D92S} = 0$

Y_{D92S} is zero as K_{92S} is zero. See eq. (2.31) and (2.56).

Gross product in private sectors, current prices

(3.25) $Y_j = \sum_i \Lambda_{Xik} B_i X_k + Y_{Tj} - Y_{TSj} - P_{Mj} M_j - P_{Ej} E_j - P_{Fj} F_j$

j = LISMPP - 81 + 81F   j = LISMPP
i = LISMVA
k = LISMPSA

The gross product in sellers' value in a production sector is equal to gross production in base values, plus (net) commodity taxes and VAT (Y_T), less sectoral tax (Y_{TS}) and inputs (in purchasers' values).

Note that eq. (3.25) gives the unadjusted GP in sector 81, that is Y_{81F}. (See eq. (3.72).)

Gross product in public sectors, current prices

(3.26) $Y_j = Y_{Wj} + Y_{Dj}$

j = LISMPO

Gross product in the public sectors is equal to total wages (Y_{Wj}) plus capital depreciation (Y_{Dj}). By definition, a public sector does not have operating surplus.

Operating surplus in private sectors

(3.27) $Y_{Ej} = Y_j - Y_{Wj} - Y_{Dj} - Y_{Tj}$

j = LISMPP - 81 + 81F   j = LISMPP

Operating surplus in a sector is gross product less wages, depreciation and net taxes.

Analogous to eq. (3.25), eq. (3.27) applies to Y_{E81F}, not Y_{E81}.

Gross product in private sectors, fixed prices

(3.28) $$Q_i = X_j - M_j - E_j - F_j - Q_{FMj}$$

i = LISMPP - 81 + 81F j = LISMPP

M_j, E_j and F_j are measured in values which are net of VAT. Refunded VAT in fixed prices Q_{FMj} must also be subtracted to get the value of gross product in fixed prices.

The equation for sector 81 is like eq. (3.28) except that the unadjusted gross product in the sector Q_{81F} is on the left hand side. (See the explanation of equation 3.65.)

Gross product in public sectors, fixed prices

(3.29) $$Q_j = e^{\omega_j \tau} P_{Lj}(0) L_j + \sum_i \delta_{ij} \varkappa_{ij} K_j$$

j = LISMPO
i = LISMJA

To measure the public gross product in fixed prices one must take explicit account of changes in productivity. This is done by introducing the trend-factor $e^{\omega_j \tau}$ for labour-augmenting technical change. (Note that this is a different assumption about technical change than is applied in the private sectors, see eq. (2.8) to (2.10).) $P_{Lj}(0)$ is the nominal wage in the base year of the model. The current base year is 1985.

Public consumption by production sector, fixed prices

(3.30) $G_j = Q_j + H_j - X_j$

$j = LISMPO$

Public consumption by production sector is the sum of gross product and purchase of goods and services less gross production.

3.3. PRIVATE CONSUMPTION

Total private consumption, fixed prices (national-account-definition)

(3.31) $C = \sum_j C_j - C_{70}$

$j = LISMCP$

Total private consumption is the sum of consumption by sector less consumption by foreigners.

Private consumption by consumption sector, current prices (national-account-definition)

(3.32) $V_{Cj} = C_j \cdot P_{Cj}$

$j = LISMCP$

(3.33) $V_{C70} = \sum_j F_{Cj} P_{Cj} \cdot C_{70}$

$j = LISMCP - 62$

Private consumption in each sector in current prices is consumption in fixed prices multiplied with the relevant price. To find the price index of consumption by foreigners, one must make use of the distribution coefficients F_{Cj} introduced in eq. (2.59). F_{C30} equals F_{C31}.

Total private domestic consumption, current prices (national-account-definition)

$$(3.34) \quad VC = \sum_j VC_j - VC_{70}$$

j = LISMCP

Eq. (3.34) uses eq. (3.32) and eq. (3.33) to find total private domestic consumption in current prices. As opposed to eq. (2.59), eq. (3.34) runs over consumption sectors.

3.4. INVESTMENT AND REAL CAPITAL

Gross investment by sector, fixed prices

$$(3.35) \quad J_{KSj} = (1 + \sum_i \delta_{ij}\varkappa_{ij})K_j - K_j(-1) + J_{Xj}$$

j = LISMPP - 60,64,68,72
i = LISMJA

The J_{Xj}'s are calculated from J_{Xi} (in eq. (2.57)) when the model is calibrated.

Gross investment, Production of Electricity, fixed prices

$$(3.36) \quad J_{KS72} = (1 + \sum_i DEP_{i72} \cdot \delta_{i72} \cdot \varkappa_{i72}) \cdot K_{72} - K_{72}(-1) + J_{X72}$$

i = LISMJA

Capital by sector, current prices

(3.37) $VK_j = \sum_i \varkappa_{ij} P_{Ji} K_j$

j = LISMPS - 92S
i = LISMJA

(3.38) $VK_{92S} = 0$

$\sum_i \varkappa_{ij} P_{Ji}$ gives the correct price index of sector j. As noted above, K_{92S} is zero.

Total real capital, current prices

(3.39) $VK = \sum_j VK_j$

j = LISMPS

Eq. (3.39) adds up capital in current prices for each sector to give total real capital in current prices.

Gross investment, current prices

(3.40) $VJ_{KSj} = \sum_i \varkappa_{ij} P_{Ji} \cdot J_{KSj}$

i = LISMJA
j = LISMPS - 72,92S

(3.41) $VJ_{KS72} = \sum_i (\varkappa_{i72} K_{72} - \varkappa_{i72}(-1) K_{72}(-1)) P_{Ji} + Y_{D72} + J_{X72}$

i = LISMJA

(3.42) $VJ_{KS92S} = 0$

See the text directly above for an explanation of eq. (3.40) and eq.

(3.42). $\varkappa_{i72}$ is an endogenous variable, see eq. (2.54). This explains eq. (3.41).

Rate of return to capital in private sectors

(3.43) $$R_{PPj} = \frac{Y_{Ej}-Y_{WSj}}{VK_j}$$

j = LISMPP

The rate of return to capital in each sector is calculated as operating surplus Y_{Ej} introduced in eq. (3.27) less renumeration to self-employed Y_{WSj}, see eq. (3.20), divided by the capital value.

Average rate of return to capital in private sectors

(3.44) $$R_{pp} = \frac{\sum_j (Y_{Ej}-Y_{WSj})}{\sum_j VK_j}$$

j = LISMPP

The average rate of return to capital is the sum of gross operating surpluses minus renumerations to self-employed for work-effort, divided by the total current value of capital.

3.5. EXPORTS AND IMPORTS

Exports of used real capital, fixed prices

(3.45) $$AJ = \sum_i J_{Ei}-C_{K30}$$

i = LISMJA

Total exports of real capital in fixed prices is equal to the sum of sales of used real capital less consumer purchases of used transportation equipment. Eq. (3.46) gives the same variable in current prices.

Exports of used real capital, current prices

(3.46) $$VAJ = \sum_{i} P_{Ji} J_{Ei} - P_{C30} C_{K30}$$

i = LISMJA

Total exports, fixed prices

(3.47) $$A = \sum_{j} A_{j} + AJ + C_{70}$$

j = LISMVA

Total exports in fixed prices is the sum of exports by export-activity, exports of used real capital plus foreigners' consumption in Norway. Eq. (3.49) gives the same variable in current prices. Eq. (3.48) calculates exports by activity in current prices.

Exports by activity, current prices

(3.48) $$VA_{j} = P_{Aj} \cdot A_{j}$$

j = LISMVA

Total exports, current prices

(3.49) $$VA = \sum_{j=LISMVA} VA_{j} + VAJ + \sum_{j=LISMCP-62} P_{Cj} F_{Cj} C_{70}$$

The last sum is equal to eq. (3.33).

Imports by commodity, current prices

$$(3.50)\quad VI_i = (B_i - H_{TBi})\sum_j \Lambda_{Iij} I_j$$

j = LISMVA
i = LISMVA - 55,60,67,69,73,83,92,93,94,95

The coefficient H_{TBi} is the rate of customs duty on imports of commodity i. Note that Λ_{Iij} is zero when $i \neq j$.

$$(3.51)\quad VI_i = 0$$

i = 55,60,67,69,73,83,92,93,94,95 in LISMVA

The import activities in eq. (3.51) are not defined in the main model, and are set to zero in the sub model. See the text accompanying eq. (2.58) for further details.

Total imports, current prices

$$(3.52)\quad VI = = \sum_i VI_i$$

i = LISMVA

Import shares by commodity

$$(3.53)\quad M_{Bi} = (\sum_j \Lambda_{Iij} I_j)/(\sum_j \Lambda_{Iij} I_j + \sum_j \Lambda_{Xij} X_j - \sum_j \Lambda_{Aij} A_j)$$

j=LISMVA j=LISMVA j=LISMPSA j=LISMVA
i = LISMVA - 00,01,05,06,19,36,55,60,67,69,73,83,92,93,94,95

The import-share of a commodity is the total imports of the commodity divided by Norwegian production less net exports. See eq. (2.34) for a note about the Λ's.

(3.54) $MB_i = 0$

$i = 55,60,67,69,73,83,92,93,94,95$ in LISMVA

See the text to eq. (3.51). Some commodities are neither to be found in eq. (2.53) nor in eq. (2.54). These are non-competing imports, which by definition have an import-share of one.

3.6. DEMAND AND SUPPLY OF COMMODITIES AND SERVICES

Unadjusted Gross National Product, fixed prices

(3.55) $QF = \sum_j Q_j + Q_{81F}$

j = LISMPS - 81

The unadjusted GNP is equal to the unadjusted gross product in sector 81 plus the gross products in all other sectors. (See the explanation of equation (3.68).)

Total imports, fixed prices

(3.56) $I = \sum_j I_j$

j = LISMVA

With some exceptions, the I's are defined in eq. (2.58). The exceptions are defined in eq. (3.56). See the text to eqs. (2.58) and (3.51) for further details.

Total new investments, fixed prices

(3.57) $J = \sum_{j} J_j$

j = LISMJA

The J_j's are calculated in eq. (2.57).

Total public consumption, fixed prices

(3.58) $G = \sum_{j} G_j$

j = LISMPO

The G_j's are calculated in eq. (3.30).

Total changes in stocks, fixed prices

(3.59) $DS = \sum_{i} D_{Si}$

i = LISMVA

The D_{Si}'s are calculated in eqs. (2.64)-(2.66).

Unadjusted Gross National Product, current prices

(3.60) $YF = \sum_{j} Y_j + Y_{81F}$

j = LISMPS - 81

The unadjusted GNP is equal to the unadjusted gross product in sector 81 plus the gross product in all other sectors.

Total changes in stocks, current prices

(3.61) $VDS = \sum_i B_i \cdot D_{Si}$

i = LISMVA

Commodities are measured in basic prices, as explained in 1.3. Changes in stocks of commodities are measured accordingly.

Gross investment by type of capital, fixed prices

(3.62) $J_{Ki} = J_i - J_{Ei}$

i = LISMJA

J_i is new investments, defined in eq. (2.57). J_{Ei} is exports of real capital, investment type i.

Gross investment by type of capital, current prices

(3.63) $VJ_{Ki} = P_{Ji} \cdot J_{Ki}$

i = LISMJA

Total gross investments, fixed prices

(3.64) $JK = \sum_i J_{Ki}$

i = LISMJA

Total gross investments, current prices

(3.65) $$VJK = \sum_{i} VJ_{Ki}$$

i = LISMJA

Public consumption by production sector, current prices

(3.66) $$VG_j = Y_j + (P_{Mj}Z_{HMj} + P_{Ej}\gamma_{Ej}Z_{HEj} + P_{Fj}\gamma_{Fj}Z_{HFj})H_j - B_iX_j$$

j = LISMPO · i = j
i = 92,93,94,95 in LISMVA

The prices of purchases H_j are weighted with the exogenously given input coefficients. Note that sectors 93S and 93K produce the same commodity (93), and so forth, as explained in the text to eq. (2.34).

Total public consumption, current prices

(3.67) $$VG = \sum VG_j$$

j = LISMPO

The VG_j's are calculated in eq. (3.66).

Shift-effects

Total supply and total demand measured in fixed prices will always add up in the base year of the model, but for the following years the model computations will give discrepancies.

The balance equation in fixed prices is given by:

(3.68) DELTA = QF+I-C-JK-A-G-DS

I.e. DELTA is equal to unadjusted gross national product (QF) plus imports (I), less private consumption (C), less total gross investments (JK), less exports (A), less public consumption (G), less changes in stocks (DS), all measured in fixed prices.

The discrepancy DELTA follows logically from the choosen value-concepts. It occurs when the distribution of demand by commodities with differentiated tax-rates differs from the distribution in the base year, see Bjerkholt and Longva (1980). The discrepancy in fixed prices is adjusted for against the gross product in Wholesale and Retail Trade (sector 81). (See eq. (3.69) and (3.70).)

Adjustment of the gross product in Wholesale and retail trade, fixed prices

(3.69) $Q_{81} = Q_{81F}\text{-DELTA}$

GNP, fixed prices

(3.70) $Q = \text{QF-DELTA}$

Shift effects, current prices

(3.71) $\text{VDELTA} = \text{YF+VI-VC-VJK-VA-VG-VDS}$

While DELTA gives the discrepancy in the balance equation in fixed prices, VDELTA measures the same in current prices.

VDELTA should be as close to zero as possible. A non-zero value is due to possible inacuracies in the computational work only, and a large VDELTA warns that something might be wrong in the computation.

The discrepancy in current prices is adjusted for against the gross product and operating surplus in the Wholesale and retail sale sector (81). See eqs. (3.72), (3.73) and (3.74).

Adjustment of the gross product in Wholesale and retail trade, current prices

(3.72) $Y_{81} = Y_{81F}$-VDELTA

GNP, current prices

(3.73) Y = YF-VDELTA

Adjustment of the operating surplus in Wholesale and retail trade

(3.74) $Y_{E81} = Y_{E81F}$-VDELTA

Total demand, fixed prices

(3.75) SUMQI = Q + I

Eq. (3.74) gives total demand in fixed prices as the sum of GNP and imports.

Final domestic use of goods and services, fixed prices

(3.76) DIFQIA = SUMQI - A

Domestic use of goods and services in fixed prices is total demand less exports.

3.7. EMPLOYMENT

Scaling employment from hours to years

(3.77) $NL = F_{NL} \cdot N/L$

N is total employment measured in man-years. L measures total employment in hours. Both are exogenous variables. F_{NL} is the inverse of N/L in the base year. NL then measures the degree of economy-wide shorter or longer average working time in the simulation period, compared to the base year.

Employment by sector, man years

(3.78) $N_j = NL \cdot F_{NLj} L_j$

j = LISMPS - 72

L_j is sector-employment in hours. F_{NLj} is a coefficient which converts hours to years. The size of this coefficient differs between sectors, reflecting differences in degree of part-time work etc. One must multiply with the scale factor to get employment in years.

(3.79) $N_{72} = 0$

As L_{72} is zero (see eq. (2.42)), so is N_{72}.

3.8. COMPUTATION OF ELECTRICITY-FLOWS

Input of electricity in production sectors

(3.80) $GWh_j \quad = \quad (\Lambda_{E72j} E_j)/P_s$

j = LISMPS - 12,60,64,68,72,81,83

The exogenous variable P_s is the "standard price" of electricity. It is calculated by the formula $P_s = \frac{E^P}{X^P}$, where E^P is base year estimated production value and X^P is total production measured in GWh in the base year. X^P is taken from the resource-accounts. Λ_{E72j} is of course a scalar for given j. Seven sectors use no electricity, as eq. (3.80) denotes:

(3.81) $GWh_j \quad = \quad 0$

j = 12,60,64,68,72,81,83 in LISMPS

Total input of electricity in production sectors

(3.82) $GWh_E \quad = \quad \sum_j GWh_j$

j = LISMPS

Electricity consumption in households

(3.83) $GWh_C \quad = \quad \Lambda_{C7212} C_{12}/P_s$

As sector 12 at the moment is the only consumption sector to contain electricity, eq. (3.83) becomes very simple. The same is the case for the next two equations.

Exports of electricity

(3.84) $GWh_A = \Lambda_{A7272} A_{72} / P_s$

Λ_{A7272} equals one.

Imports of Electricity, unadjusted figure

(3.85) $GWh_{IF} = \Lambda_{I7272} I_{72} / P_s$

The unadjusted GWh-import figure is the value of imports of electricity, divided by the standard price. Λ_{I7272} equals one.

Imports of Electricity, adjusted figure

(3.86) $GWh_I = GWh.I \cdot GWh_{IF}$

Because the standard price and the unit price on imports might differ, one has to adjust GWh_{IF} through the coefficient GWh.I, to get a correct GWh-figure.

Net production of Electricity, unadjusted figure

(3.87) $GWh_{XF} = (\Lambda_{X7272} \cdot X_{72})/P_s - \Lambda_{M7272} M_{72} / P_s$

Eq. (3.87) gives total indigenous production of electricity less use of electricity in the production of electricity, but including the losses in distribution (see the text above eqs. (2.2) and (2.3)).

Inputs of electricity in sector 72 is regarded as a part of material inputs, Λ_{M7272} being the factor of proportionality.

Net production of Electricity, adjusted figure

(3.88) $GWh_X = GWh_{XF} + (1 - GWh.I) \cdot (I_{72}(0)/P_s)$

Eq. (3.87) does not adjust for the consequences of different prices on indigenous production and imports. In eq. (3.88) one gets the adjusted net production figure by adding the base year value of the discrepancy between the unadjusted and adjusted import figure. See eq. (3.29) for an explanation of notation.

Shift-effects in the electricity account

Because the "standard price" of electricity differs between final uses, one faces basically the same problem when trying to add up the electricity account as in the fixed-price national accounts. Following eq. (3.68), it is introduced a variable to take account of shift-effects.

(3.89) $DELTAGWh = GWh_X + GWh_I - (GWh_E + GWh_C + GWh_A)$

I.e. DELTAGWh is equal to net production of electricity (GWh_X) plus imports of electricity, less the use of electricity in production, consumption and for exports.

Input of firm (guaranteed) electricity, by production sector

(3.90) $FGWh_j = F_{Ej} \ GWh_j$

j = LISMPS

Norwegian energy authorities distinguish between firm, or guaranteed electricity power, and surplus power. Eq. (3.90) tells how much firm power each production sector uses. Input of firm electricity power is supposed to be proportional to total electricity input in a sector, F_{Ej} being the factor of proportionality. F_{Ej}, which is the base-year share of firm power, is currently equal to one in sectors 12, 13, 31, 40, 55, 60, 64, 68, 72, 73, 74, 81, 83 and 92S. (Half of these sectors use no electricity at all, see eq. (3.81).)

Use of firm (guaranteed) electricity in housholds

(3.91) $FGWh_C = F_{EC} \cdot GWh_C$

Eq. (3.91) is explained the same way as eq. (3.90).

3.9. CALCULATION OF FLOWS OF OIL PRODUCTS

Inputs of oil products in production sectors

(3.92) $OL_{ij} = \Lambda_{Fij} F_j / P_{ij}$

j = LISMPS
i = 41,42 in LISMVA

Commodity 41 is Gasoline, 42 is Fuel Oil.

The OL_{ij}'s are measured in thousand tonnes. The P_{ij}'s are coefficients in the model, found by dividing base-year national account figures by resource-account figures.

Sector 40 neither uses gasoline nor fuel oil, see eq. (2.13). Sectors 68 and 72 use no gasoline, and sectors 82 and 83 use no fuel oil. The respective OL_{ij}'s are zero.

Consumption of oil products by households

(3.93) $OL_{Ci} = (\sum_j \Lambda_{Cij} C_j / P_{rC}) \cdot VED_i$

i = 41,42 in LISMVA
j = LISMCP
r = B,F

The standard-price coefficient P_{rC} is determined as the base year gross production in tonnes as measured by the resource accounts divided by the value of the gasoline or fuel oil.

The exogenous variable VED_i is designed to study the effects of a possible substitution between fuel oil/gasoline and fire-wood in consumption. The variable is equal to one in the base year of the model.

Exports of gasoline

(3.94) $OL_{A41} = \Lambda_{A4141} A_{41} / P_{BA}$

Exports of fuel oil

(3.95) $OL_{A42} = \Lambda_{A4242} A_{42} / P_{FA}$

The motivation behind P_{BA} and P_{FA} is the same as is behind P_{rC}. Gasoline and fuel oil are at the moment contained in one export activity each.

Net production of oil products

(3.96) $OL_{Xi} = (\sum_j \Lambda_{Xij} \cdot X_j - \Lambda_{Mi40} M_{40}) / P_{rX}$

i = 41,42 in LISMVA
j = LISMPSA
r = B,F

Eq. (3.96) gives total indigenous production less material inputs. The refining sector (sector 40) is the only sector to produce gasoline or fuels. In view of eqs. (2.13) and (3.91), inputs of gasoline and fuel oil in this sector are parts of its material inputs. r = B when i = 41, and r = F when i = 42.

Imports of gasoline

(3.97) $OL_{I41} = \Lambda_{I4141} I_{41} / P_{BI}$

Imports of fuel oil

$$\text{(3.98)} \quad OL_{I42} = \Lambda_{I4242} I_{42}/P_{FI}$$

The explanation of eqs. (3.97) and (3.98) is analogous to that of eqs. (3.94) and (3.95).

4. THE BALANCE OF TRADE RESTRICTION

In MSG-4E one can optionally apply a balance of trade restriction, in which case volumes of exports and imports are scaled proportionally to provide a given balance of trade at every point in time. This version of the model is called MSG-4ET. The basis for a simulation on MSG-4ET is always a model run on MSG-4E or MSG-4S. The idea underlying MSG-4ET is that exchange rate policy is used to secure the required competiveness.

The balance of trade restriction is:

$$\text{(4.1)} \quad HBA = \sum_{j = LISMVA} P_{Aj}(Aj + \Theta_{Aj} AI) - \sum_{j = LISMVA} B_j(I_j - \Theta_{Bj} AI) + \sum_{i = LISMJA} P_{Ji} J_{Ei} + \sum_{i = LISMCP - 62} P_{Ci} F_{Ci} C_{70} - P_{C30} C_{K30}$$

The HBA-variable is the exogenously given balance of trade in current prices and AI is the endogenously determined scaling factor. J_{Ei} is sales of used real capital (see eq. (2.57)), and C_{K30} is consumers' purchases of used cars.

The Θ_{Aj}'s and Θ_{Bi}'s are coefficients.

$$\text{i)} \quad \Theta_{Aj} = \frac{A_j}{Z} \qquad j = LISMVA - 00,01,02,05,06,19,36,50,55,60,67,72,73,83,92,93,94,95$$

ii) $\Theta_{Aj} = 0$ for the rest of the list.

iii) $\Theta_{Bi} = \frac{I_i}{Z}$ $\quad i$ = LISMVA - 00,01,02,05,06,11,13,19,32,33,36,50,55,60, 66,67,72,73,83,92,93,94,95

iv) $\Theta_{Bi} = 0$ for the rest of the list.

A_j and I_j are values of the variables in the base-year of the model and $Z = \Sigma_j A_j + \Sigma_j I_j$, the j's covering the same numbers of the list as in i) and iii).

4.1. ADDITIONAL EQUATIONS IN THE SUBMODEL FOR THE NATIONAL ACCOUNTING

Since the model now endogenously determines exports by commodity, new equations are introduced in the submodel for national accounting.

Exports by activity, fixed prices

(4.2) $$A_{Kj} = A_j + \Theta_{Aj} AI$$

j = LISMVA

A_{Kj} is exports by activity.

A_j is the original export-volume by activity. This is exogenous except for activity 67. Some are zero, see eq. (2.29).

$\Theta_{Aj} AI$ is the correction.

Imports by activity is explained the same way.

Imports by activity, fixed prices

(4.3) $I_{Kj} = I_j - \Theta_{Bj}AI$

j = LISMVA - 55,60,67,69,73,83,92,93,94,95

(4.4) $I_{Kj} = 0$

j = 55,60,67,69,73,83,92,93,94,95

4.2. CHANGES IN THE EQUATIONS OF THE PRICE/QUANTITY MODEL

Some equations have to be altered in the presence of the balance of trade restrictions. The new versions are set out below. Eq. (2.34a) is the new version of eq. (2.34) etc. The reader is referred the original explanations of the equations.

The commodity balances

(2.34a) $\Sigma\Lambda_{Iij}(I_j - \Theta_{Bj} . AI) + \Sigma\Lambda_{Xij}X_j$

j = LISMVA $\qquad$ j = LISMPSA

$= \Sigma(\Lambda_{Mij}M_j + \Lambda_{Eij}E_j + \Lambda_{Fij}F_j)$

j = LISMPS

$+ \Sigma\Lambda_{Cij}(C_j - C_{Kj}) + \Sigma\Lambda_{Jij}J_j$

j = LISMCP $\qquad$ j = LISMJA

$+ \Sigma\Lambda_{Aij}(A_j + \Theta_{Aj}AI) + D_{Si}$

j = LISMVA $\qquad$ i = LISMVA

4.3. CHANGES IN THE EQUATIONS OF THE SUBMODEL FOR NATIONAL ACCOUNTING

Total exports, fixed prices

(3.47a) $A = \Sigma A_{Kj} + A_j + C_{70}$

j = LISMVA

Exports by activity, current prices

(3.48a) $VAK_j = P_{Aj}A_{Kj}$

j = LISMVA

Total exports, current prices

(3.49a) $VA = \Sigma VAK_j + VAJ + \Sigma P_{Cj}F_{Cj}C_{70}$

j = LISMVA   j = LISMCP - 62

Imports by commodity, current prices

(3.50a) $VIK_i = (B_i - H_{TBi})\Sigma_i \Lambda_{Iij} I_{Kj}$

j = LISMVA
i = LISMVA - 55,60,67,69,73,83,92,93,94,95

(3.51a) $VIK_j = 0$

j = 55,60,67,69,73,83,92,93,94,95 in LISMVA

Total imports, current prices

(3.52a) $VI = \Sigma VIK_i$

i = LISMVA

Import shares by commodity

(3.53a) $M_{Bi} = (\Sigma \Lambda_{Iij} I_{Kj})/(\Sigma \Lambda_{Iij} I_{Kj}$

j = LISMVA j = LISMVA

$+ \Sigma \Lambda_{Xij} X_j - \Sigma \Lambda_{Aij} A_{Kj})$

j = LISMPSA j = LISMVA
i = LISMVA - 00,01,05,06,19,36,55,60,67,69,73,83,92,93,94,95

(3.54a) $M_{Bi} = 0$

i = 55,60,67,69,73,83,92,93,94,95

Total imports, fixed prices

(3.56a) $I = \sum_j I_{Kj}$

j = LISMVA

References

Bjerkholt, O., S. Longva, Ø. Olsen, S. Strøm. (eds) (1983): Analysis of Supply and Demand of Electricity in the Norwegian Economy. Samfunnsøkonomiske Studier from the Central Bureau of Statistics, No. 53, Oslo.

Bjerkholt, O. and S. Longva (1980): MODIS IV. A Model for Economic Analysis and National Planning. Samfunnsøkonomiske Studier from the Central Bureau of Statistics, No. 43, Oslo.

Cappelen, Å., E. Garaas and S. Longva (1981): MODAG. En modell for makroøkonomiske analyser. Rapporter 81/30. Central Bureau of Statistics, Oslo.

Diewert,E. (1974): "Applications of Duality Theory." In Frontiers of Quantitative Economics, vol. 2, ed. M. Intriligator and D. Kendrick, North-Holland Publishing Company, Amsterdam.

Johansen, L. (1960): A Multi-Sectoral Study of Economic Growth. North-Holland Publishing Company, Amsterdam.

Johansen, L. (1974): A Multi-Sectoral Study of Economic Growth. Second Enlarged Edition. North-Holland Publishing Company, Amsterdam.

Longva, S., L. Lorentsen and Ø. Olsen (1985): The Multi-Sectoral Growth Model MSG-4. Formal Structure and Empirical Characteristics. Discussion paper no. 8, Central Bureau of Stastistics, Oslo. Also in F. Førsund, M. Hoel, S. Longva (eds) (1985): Production, Multi-Sectoral Growth and Planning - Essays in Memory of Leif Johansen. North Holland Publishing Company, Amsterdam.

Varian, H.R. (1978): Microeconomic Analysis. W.W. Norton & Company, N.Y.

APPENDIX 1

This appendix is organized along the following principles:

The variables of the model are listed in alphabetical order of their TROLL-names. Variables with identical names are for the most part listed in numerical order.

The column "name" refers to the variables' symbolic names in this report. The term "ε" means that the subscript of the symbol "belongs to" a list (or lists), but not necessarily runs over the full list.

The letter (N) means a variable is endogenous, and (X) indicates that it is exogenous.

The column "appearance in" lists a variable as it appears in the equations of this documentation. By and large, this coincides with its appearance in the computerized model version. However, in the computer version, no terms containing Λ_{ij} values of zero are admitted. Not all such terms are excluded from the corresponding equation in this report (although some are, see the text to eq. (2.34)).

The text to the equations may give more information on some of the variables than what is given here.

VARIABLES

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
A	(N)	A	Exports	(3.47)(3.68)(3.76) (3.47a)	I.e. total exports. In eq. (3.47a) "A" measures total exports adjusted for the balance of trade restrictions in MSG-4ET.
AI	(N)	AI	Balance of Trade scaling Factor	(4.1)(4.2)(2.34a)	
AJ	(N)	AJ	Exports of Used Real Capital	(3.45)(3.48)	
A_{Kj} j ε LISMVA	(N)	AK00,AK01, AK02,AK05, AK06,AK11, AK12,AK13, AK16,AK17, AK18,AK19, AK26,AK27, AK28,AK32, AK33,AK34, AK36,AK37, AK41,AK42, AK43,AK45, AK50,AK55, AK60,AK66, AK67,AK68, AK69,AK72, AK73,AK74, AK81,AK82, AK83,AK85, AK92,AK93, AK94,AK95	Exports by Activity	(4.1)(3.47a)(3.48a) (3.53a)	Adjusted for balance of trade restriction in MSG-4ET.
A_j j ε LISMVA	(X)	A00,A01,A02, A06,A11,A12, A13,A16,A17, A18,A26,A27, A28,A32,A33, A34,A37,A43, A45,A50,A60, A66,A68,A69, A73,A74,A81, A82,A85,A92, A93,A95	Exports by Activity	(2.34)(3.2)(3.3)(3.47) (3.48)(3.53)(4.1)(4.2) (2.34a)(2.47a)	In MSG-4ET, A_j are unadjusted exports.
	(X)	A05,A19,A36, A55,A83,A94		(3.2)(3.3)(3.47)(3.48) (3.53)(4.1)(4.2)(2.34a) (3.47a)	

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
	(X)	A41		(2.34)(3.2)(3.3)(3.47) (3.48)(3.53)(3.94)(4.1) (4.2)(2.34a)3.47a)	
	(X)	A42		(2.34)(3.2)(3.3)(3.47) (3.48)(3.53)(3.95)(4.1) (4.2)(2.34a)(3.47a)	
	(N)	A67		(2.34)(3.2)(3.3)(3.47) (3.48)(3.53)(4.1)(4.2) (2.34a)(3.47a)	
	(X)	A72		(2.34)(3.2)(3.3)(3.47) (3.48)(3.53)(3.84)(4.1) (4.2)(2.34a)(3.47a)	
B_{Ci} i ε LISTECA	(X)	BETAC12	Consumption shift Variables	(2.61)	Indicate exogenous change in consumption activities 12 and 13.
	(X)	BETAC13		(2.61)	
B_i i ε LISMVA	(X)	B00	Basic Price Index	(2.1)(2.2)(2.3)(2.7) (2.25)(2.26)(2.27)(2.28) (3.2)(3.5)(3.7)(3.9) (3.11)(3.25)(3.50)(3.61) (4.1)(3.50a)	
	(X)	B01		(2.1)(2.2)(2.3)(2.7) (2.25)(2.26)(2.27)(2.28) (3.7)(3.9)(3.11)(3.25) (3.50)(3.61)(4.1)(3.50a)	
	(X)	B02		(2.1)(2.2)(2.3)(2.7) (2.25)(2.26)(2.27)(2.28) (3.2)(3.5)(3.7)(3.9) (3.11)(3.25)(3.50)(3.61) (4.1)(3.50a)	
	(X)	B05,B06		(2.1)(2.2)(2.3)(2.7) (2.25)(2.26)(2.27)(2.28) (3.7)(3.21)(3.25)(3.50) (3.61)(4.1)(3.50a)	
	(N)	B11		(2.1)(2.2)(2.3)(2.7) (2.25)(2.26)(2.27)(2.28) (3.2)(3.7)(3.9)(3.11) (3.25)(3.50)(3.61)(4.1) (3.50a)	
	(N)	B12,B13		(2.1)(2.2)(2.3)(2.7) (2.25)(2.26)(2.27)(2.28) (3.7)(3.9)(3.11)(3.25) (3.50)(3.61)(4.1)(3.50a)	

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
	(N)	B16,B17		(2.1)(2.2)(2.3)(2.4) (2.7)(2.25)(2.26)(2.27) (2.28)(3.2)(3.5)(3.7) (3.9)(3.11)(3.25)(3.50) (3.61)(4.1)(3.50a)	Are equal
	(N)	B18		(2.1)(2.2)(2.3)(2.7) (2.25)(2.26)(2.27)(2.28) (3.7)(3.9)(3.11)(3.25) (3.50)(3.61)(4.1)(3.50a)	
	(X)	B19		(2.1)(2.2)(2.3)(2.7) (2.25)(2.26)(2.27)(2.28) (3.7)(3.9)(3.11)(3.25) (3.50)(3.61)(4.1)(3.50a)	
	(N)	B26		(2.1)(2.2)(2.3)(2.7) (2.25)(2.26)(2.27)(2.28) (3.7)(3.9)(3.11)(3.25) (3.50)(3.61)(4.1)(3.50a)	
	(N)	B27		(2.1)(2.2)(2.3)(2.7) (2.25)(2.26)(2.27)(2.28) (3.2)(3.7)(3.9)(3.11) (3.25)(3.50)(3.61)(4.1) (3.50a)	
	(N)	B28		(2.1)(2.2)(2.3)(2.7) (2.25)(2.26)(2.27)(2.28) (3.7)(3.9)(3.11)(3.25) (3.50)(3.62)(4.1)(3.50a)	
	(N)	B32,B33		(2.1)(2.2)(2.3)(2.5) (2.7)(2.25)(2.26)(2.27) (2.28)(3.7)(3.9)(3.11) (3.25)(3.50)(3.61)(4.1) (3.50a)	Are equal
	(N)	B34		(2.1)(2.2)(2.3)(2.7) (2.25)(2.26)(2.27)(2.28) (3.2)(3.5)(3.7)(3.9) (3.11)(3.25)(3.50)(3.61) (4.1)(3.50a)	
	(X)	B36		(2.1)(2.2)(2.3)(2.7) (2.25)(2.26)(2.27)(2.28) (3.7)(3.11)(3.25)(3.50) (3.61)(4.1)(3.50a)	
	(N)	B37		(2.1)(2.2)(2.3)(2.7) (2.25)(2.26)(2.27)(2.28) (3.2)(3.5)(3.7)(3.9) (3.11)(3.25)(3.50)(3.61) (4.1)(3.50a)	

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
	(N)	B41,B42		(2.1)(2.2)(2.3)(2.6) (2.7)(2.20)(2.25)(2.26) (2.27)(2.28)(3.2)(3.7) (3.9)(3.11)(3.25)(3.50) (3.61)(4.1)(3.50a)	Are equal
	(N)	B43		(2.1)(2.2)(2.3)(2.7) (2.25)(2.26)(2.27)(2.28) (3.7)(3.9)(3.11)(3.25) (3.50)(3.61)(4.1)(3.50a)	
	(N)	B45,B50		(2.1)(2.2)(2.3)(2.7) (2.25)(2.26)(2.27)(2.28) (3.2)(3.5)(3.7)(3.9) (3.11)(3.25)(3.50)(3.61) (4.1)(3.50a)	
	(N)	B55		(2.1)(2.2)(2.3)(2.7) (2.25)(2.26)(2.27)(2.28) (3.7)(3.11)(3.25)(3.61) (4.1)	
	(X)	B60,B67,B69		(2.1)(2.2)(2.3)(2.7) (2.25)(2.26)(2.27)(2.28) (3.7)(3.11)(3.25)(3.61) (4.1)	
	(X)	B66		(2.1)(2.2)(2.3)(2.7) (2.25)(2.26)(2.27)(2.28) (3.7)(3.9)(3.11)(3.25) (3.50)(3.61)(4.1)(3.50a)	
	(X)	B68		(2.1)(2.2)(2.3)(2.7) (2.25)(2.26)(2.27)(2.28) (3.7)(3.11)(3.25)(3.50) (3.61)(4.1)(3.50a)	
	(X)	B72		(2.1)(2.2)(2.3)(2.7) (2.17)(2.18)(2.25)(2.26) (2.27)(2.28)(3.3)(3.5) (3.7)(3.9)(3.11)(3.25) (3.50)(3.61)(4.1)(3.50a)	
	(X)	B73		(2.1)(2.2)(2.3)(2.7) (2.17)(2.18)(2.25)(2.26) (2.27)(2.28)(3.3)(3.7) (3.11)(3.25)(3.61)(4.1)	
	(N)	B74		(2.1)(2.2)(2.3)(2.7) (2.25)(2.26)(2.27)(2.28) (3.2)(3.7)(3.9)(3.11) (3.25)(3.50)(3.61)(4.1) (3.50a)	

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
	(N)	B81		(2.1)(2.2)(2.3)(2.7) (2.20)(2.25)(2.26)(2.27) (2.28)(3.2)(3.7)(3.11) (3.25)(3.50)(3.61)(4.1) (3.50a)	
	(N)	B82		(2.1)(2.2)(2.3)(2.7) (2.25)(2.26)(2.27)(2.28) (3.7)(3.11)(3.25)(3.50) (3.61)(4.1)(3.50a)	
	(N)	B83		(2.1)(2.2)(2.3)(2.7) (2.25)(2.26)(2.27)(2.28) (3.7)(3.11)(3.25)(3.61) (4.1)	
	(N)	B85		(2.1)(2.2)(2.3)(2.7) (2.25)(2.26)(2.27)(2.28) (3.2)(3.7)(3.9)(3.11) (3.25)(3.61)(4.1)(3.50a)	
	(X)	B92,B93,B94, B95		(2.1)(2.2)(2.3)(2.7) (2.25)(2.26)(2.27)(2.28) (3.7)(3.11)(3.25)(3.61) (3.66)(4.1)	
C	(N)	C	Private consumption	(3.31)(3.68)	I.e. total of consumption sectors.
C_{Kj} j ε LISMCP	(X)	CK00,CK11, CK12,CK13, CK14,CK15, CK21,CK22, CK23,CK41, CK42,CK50, CK61,CK62, CK63,CK64, CK65,CK66,	Consumption of Used Real Capital	(2.34)(2.58)(3.2)(3.3) (3.7)(2.34a)	
	(X)	CK30		(2.34)(2.58)(2.62)(3.2) (3.3)(3.7)(3.45)(3.46) (4.1)(2.34a)	
C_j j ε LISMCP LISTECA + 70	(N)	C00,C11,C14, C15,C21,C22, C23	Private consumption	(2.34)(2.58)(2.59)(2.60) (3.2)(3.3)(3.7)(3.31) (3.32)(3.93)(2.34a)	
	(N)	C12,C13		(2.34)(2.58)(2.59)(3.2) (3.3)(3.7)(3.31)(3.32) (3.83)(3.93)(2.34a)	

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
	(N)	C30		(2.34)(2.58)(2.62)(2.63) (3.2)(3.3)(3.7)(3.31) (3.32)(3.93)(2.34a)	
	(N)	C31		(2.59)(2.60)(2.63)	
	(N)	C41,C42,C50, C61,C63,C64, C65,C66		(2.34)(2.58)(2.59)(2.60) (3.2)(3.3)(3.7)(3.31) (3.32)(3.93)(2.34a)	
	(X)	C62		(2.34)(2.58)(3.2)(3.3) (3.7)(3.31)(3.32)(3.93) (2.34a)	
	(X)	C70		(2.34)(2.58)(2.59)(2.60) (2.61)(3.2)(3.3)(3.7) (3.31)(3.33)(3.47)(3.49). (4.1)(2.34a)(3.47a)(3.49a)	
DELTA	(N)	DELTA	Shift-Effect in National Account	(3.68)(3.69)(3.70)	
DELTAGWh	(N)	DELTAGWh	Shift-Effect in Electricity Account	(3.89)	
ΔY_{T81}	(N)	DELYT81	Auxiliary variable	(3.16)(3.18)	
DEP_{i72} i ε LISMSA	(X)	DEPB172, DEPM272, DEPM372	Capital-Depreciation Variables, sector 72	(2.57)(3.23)(3.36)	Handles differing assumptions about the structure of capital depreciation in sector 72
DIFQIA	(N)	DIFQUIA	Domestic Use of Goods and Services	(3.76)	
DS	(N)	DS	Change in Stocks	(3.59)(3.68)	Total
D_{Si} i ε LISMVA	(N)	DS00,DS01, DS02	Change in Stocks	(2.34)(2.65)(3.59)(3.61) (2.34a)	
	(N)	DS05,DS06		(2.34)(2.66)(3.59)(3.61) (2.34a)	Zero
	(N)	DS11		(2.34)(2.64)(3.59)(3.61) (2.34a)	

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
	(N)	DS12		(2.34)(2.58)(2.64)(3.59) (3.61)(2.34a)	
	(N)	DS13		(2.34)(2.64)(3.59)(3.61) (2.34a)	
	(N)	DS16,DS17, DS18		(2.34)(2.58)(2.64)(3.59) (3.61)(2.34a)	
	(N)	DS19		(2.34)(2.66)(3.59)(3.61) (2.34a)	Zero
	(N)	DS26,DS27, DS28		(2.34)(2.58)(2.64)(3.59) (3.61)(2.34a)	
	(N)	DS32,DS33		(2.34)(2.64)(3.59)(3.61) (2.34a)	
	(N)	DS34		(2.34)(2.58)(2.64)(3.59) (3.61)(2.34a)	
	(N)	DS36		(2.34)(2.66)(3.59)(3.61) (2.34a)	Zero
	(N)	DS37,DS41, DS42,DS43, DS45,DS50		(2.34)(2.58)(2.64)(3.59) (3.61)(2.34a)	
	(N)	DS55,DS60, DS66,DS67		(2.34)(2.66)(3.59)(3.61) (2.34a)	Zero
	(N)	DS68		(2.34)(2.58)(2.66)(3.59) (3.61)(2.34a)	Zero
	(N)	DS69,DS72, DS73		(2.34)(2.66)(3.59)(3.61) (2.34a)	Zero
	(N)	DS74,DS81, DS82		(2.34)(2.58)(2.66)(3.59) (3.61)(2.34a)	Zero
	(N)	DS83		(2.34)(2.66)(3.59)(3.61) (2.34a)	Zero
	(N)	DS85		(2.34)(2.58)(2.64)(3.59) (3.61)(2.34a)	
	(N)	DS92,DS93, DS94,DS95		(2.34)(2.66)(3.59)(3.61) (2.34a)	Zero

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
D_{SEi} i ε LISMVA	(X)	DSE00,DSE01, DSE02	Exogenous Changes in Stocks	(2.65)	Used to calibrate the model
	(X)	DSE11,DSE12, DSE13,DSE16, DSE17,DSE18, DSE26,DSE27, DSE28,DSE32, DSE33,DSE34, DSE37,DSE41, DSE42,DSE43, DSE45,DSE50, DSE66,DSE85		(2.64)	
E_j j ε LISMPS	(N)	E11	Electricity Input	(2.34)(2.45)(3.2)(3.3) (3.7)(3.11)(3.13)(3.25) (3.28)(3.80)(2.34a)	
	(N)	E12		(2.34)(2.45)(3.2)(3.3) (3.7)(3.11)(3.13)(3.25) (3.28)(2.34a)	
	(N)	E13,E14,E18, E26,E27,E28, E31,E34,E37, E40,E43,E45, E50,E55		(2.34)(2.45)(3.2)(3.3) (3.7)(3.11)(3.13)(3.25) (3.28)(3.80)(2.34a)	
	(N)	E60,E64,E68		(2.34)(2.46)(3.2)(3.3) (3.7)(3.25)(3.28)(2.34a)	
	(N)	E72		(2.34)(2.46)(3.2)(3.3) (3.7)(3.11)(3.13)(3.25) (3.28)(2.34a)	
	(N)	E73		(2.34)(2.46)(3.2)(3.3) (3.7)(3.11)(3.13)(3.25) (3.28)(3.80)(2.34a)	
	(N)	E74		(2.34)(2.45)(3.2)(3.3) (3.7)(3.11)(3.13)(3.25) (3.28)(3.80)(2.34a)	
	(N)	E81		(2.34)(2.45)(3.2)(3.3) (3.7)(3.11)(3.13)(3.25) (3.28)(2.34a)	
	(N)	E82		(2.34)(2.45)(3.2)(3.3) (3.7)(3.25)(3.28)(3.80) (2.34a)	
	(N)	E83		(2.34)(2.45)(3.2)(3.3) (3.7)(3.25)(3.28)(2.34a)	

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
	(N)	E85		(2.34)(2.45)(3.2)(3.3) (3.7)(3.11)(3.13)(3.25) (3.28)(3.80)(2.34a)	
	(N)	E92S,E93K, E93S,E94K, E94S,E95K, E95S		(2.34)(2.50)(3.2)(3.3) (3.7)(3.80)(2.34a)	
$e^{\frac{-\varepsilon_j \tau}{\mu_j}}$ $j \in$ LISMPP	(X)	EPS11,EPS12, EPS13,EPS14, EPS18,EPS26, EPS27,EPS28, EPS31,EPS34, EPS37,EPS40, EPS43,EPS45, EPS50,EPS55, EPS74,EPS81, EPS82,EPS83, EPS85	Technical Change	(2.8)(2.9)(2.10)	Note that $e^{\frac{-\varepsilon_j \tau}{\mu_j}} = e^{-\varepsilon_j \tau} \approx \frac{1}{(1+\varepsilon_j)^\tau}$ where $(1+\varepsilon_j)^\tau = EPS_\tau$. It appears from this formula that EPS_τ indicates the technological level. Technical change is really the change in EPS. EPS is normalized to one in the base year of the model.
η_{k73}	(X)	ETAK73	Calibration Coefficient	(2.16)	Defined as a variable for technical reasons only
F_j $j \in$ LISMPS	(N)	F11	Fuel-oil Input	(2.34)(2.47)(2.58)(3.2) (3.7)(3.11)(3.13)(3.25) (3.28)(3.92)(2.34a)	
	(N)	F12		(2.34)(2.47)(2.58)(3.2) (3.7)(3.11)(3.13)(3.25) (3.28)(2.34a)	
	(N)	F13,F14,F18, F26,F27,F28, F31,F34,F37, F40,F43,F45, F50,F55		(2.34)(2.47)(2.58)(3.2) (3.7)(3.11)(3.13)(3.25) (3.28)(3.92)(2.34a)	
	(N)	F60,F64,F68		(2.34)(2.48)(2.58)(3.2) (3.7)(3.25)(3.28)(3.92) (2.34a)	
	(N)	F72,F73		(2.34)(2.48)(2.58)(3.2) (3.7)(3.11)(3.13)(3.25) (3.28)(3.92)(2.34a)	
	(N)	F74,F81		(2.34)(2.47)(2.58)(3.2) (3.7)(3.11)(3.13)(3.25) (3.28)(3.92)(2.34a)	

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
	(N)	F82,F83		(2.34)(2.47)(2.58)(3.2) (3.7)(3.25)(3.28)(3.92) (2.34a)	
	(N)	F85		(2.34)(2.47)(2.58)(3.2) (3.7)(3.11)(3.13)(3.25) (3.28)(3.92)(2.34a)	
	(N)	F92S,F93K, F93S,F94K, F94S,F95K, F95S		(2.34)(2.51)(2.58)(3.2) (3.7)(3.92)(2.34a)	
$FGWh_j$ $j \in$ LISMPS	(N)	FGWH11,FGWH12, FGWH13,FGWH14, FGWH18,FGWH26, FGWH27,FGWH27, FGWH28,FGWH31, FGWH34,FGWH37, FGWH40,FGWH43, FGWH45,FGWH50, FGWH55,FGWH60, FGWH64,FGWH68, FGWH72,FGWH73, FGWH74,FGWH81, FGWH82,FGWH83, FGWH85,FGWH92S, FGWH93K,FGWH93S, FGWH94K,FGWH94S, FGWH95K,FGWH95S	Firm (Guaranteed) GWh-input	(3.90)	
$FGWh_C$	(N)	FGWH C	Firm (Guaranteed) GWh Consumption	(3.91)	In households
G	(N)	G	Public Consumption	(3.57)(3.68)	Total
γ_{ECi} $i \in$ LISTECA	(X)	GAMEC12 GAMEC13	Temperature Correction Coefficient	(2.61)	For temperature corrections in the consumption system
γ_{Ej} $j \in$ LISMPS	(X)	GAME11,GAME13, GAME14,GAME18, GAME26,GAME27, GAME28,GAME31, GAME34,GAME37, GAME43,GAME45, GAME50,GAME55, GAME74,GAME82, GAME85	Temperature Correction Coefficient	(2.11)(2.22)	For temperature corrections of electricity in the factor input system

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
	(X)	GAME73		(2.15)	
	(X)	GAME92S, GAME93K, GAME93S, GAME94K, GAME94S, GAME95K, GAME95S		(2.50)(3.66)	
γ_{Fj} i ε LISMPS	(X)	GAMF11, GAMF13, GAMF14, GAMF18, GAMF26, GAMF27, GAMF28, GAMF31, GAMF34, GAMF37, GAMF43, GAMF45, GAMF50, GAMF55, GAMF74, GAMF82, GAMF85	Temperature Correction Coefficient	(2.11)(2.22)	For temperature corrections of fuel oils in the factor input system
	(X)	GAMF92S, GAMF93K, GAMF93S, GAMF94K, GAMF94S, GAMF95K, GAMF95S		(2.51)(3.66)	
γ_{Kj} j ε LISMPP	(X)	GAMK11, GAMK12, GAMK13, GAMK14, GAMK18, GAMK26, GAMK27, GAMK28, GAMK31, GAMK34, GAMK37, GAMK40, GAMK43, GAMK45, GAMK50, GAMK55	Capacity-utilization index	(2.1)(2.9)	
	(X)	GAMK72		(2.2)(2.44)(2.54)	
	(X)	GAMK73		(2.3)	
	(X)	GAMK74, GAMK81, GAMK82, GAMK83, GAMK85		(2.1)(2.9)	
γ_{Pj} i ε LISMPP	(X)	GAMP11, GAMP12, GAMP13, GAMP14, GAMP18, GAMP26, GAMP27, GAMP28, GAMP31, GAMP34, GAMP37, GAMP40, GAMP43, GAMP45, GAMP50, GAMP55	Price-Deviation Measure	(2.1)	Used to calibrate the model

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
	(N)	GAMP72		(2.2)	
	(N)	GAMP73		(2.3)	
	(X)	GAMP74, GAMP81, GAMP82, GAMP83, GAMP85		(2.1)	
γ_{Uj} $j \in$ LISMPP	(X)	GAMU11, GAMU12, GAMU13, GAMU14, GAMU18, GAMU26, GAMU27, GAMU28, GAMU31, GAMU34, GAMU37, GAMU40, GAMU53, GAMU45, GAMU50, GAMU55, GAMU74, GAMU81, GAMU82, GAMU83, GAMU85	Temperature Correction Coefficient	(2.10)	For temperature corrections of aggregated energy in the factor input system
GWh_A	(N)	GWHA	Exports of GWh	(3.84)(3.89)	
GWh_C	(N)	GWHC	Consumption of GWh	(3.83)(3.89)(3.91)	
GWh_E	(N)	GWHE	Factor Input of GWh	(3.82)(3.89)	
GWh_I	(N)	GWHI	Imports of GWh	(3.86)(3.89)	Adjusted
GWh_{IF}	(N)	GWHIF	Imports of GWh	(3.85)(3.86)	Unadjusted
GWh_X	(N)	GWHX	Net Production of GWh	(3.88)(3.89)	Adjusted
GWh_{XF}	(N)	GWHXF	Net Production of GWh	(3.87)(3.89)	Unadjusted

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
GWh_j j ε LISMPS	(N)	GWH11,GWH13, GWH14,GWH18, GWH26,GWH27, GWH28,GWH31, GWH34,GWH37, GWH40,GWH43, GWH45,GWH50, GWH55,GWH73, GWH74,GWH82, GWH85,GWH92S, GWH93K,GWH93S, GWH94K,GWH94S, GWH95K,GWH95S	Input of GWh	(3.80)(3.82)(3.90)	
	(N)	GWH12,GWH60, GWH64,GWH68, GWH72,GWH81, GWH83		(3.81)(3.82)(3.90)	Zero
G_j j ε LISMPO	(N)	G92S,G93K, G93S,G94K, G94S,G95K, G95S	Public Consumption	(3.30)(3.58)	
HBA	(X)	HBA	Balance of Trade	(4.1)	The central new variable in MSG-4ET
H_{Bi} i ε LISMVA	(X)	HB12,HB16, HB17,HB18, HB26,HB27, HB28,HB34, HB37,HB41, HB42,HB43, HB45,HB50, HB68,HB74, HB81,HB82, HB85	Changes in Import Shares	(2.58)	
H_{V71j} j ε LISMPS	(X)	HV7134, HV7137, HV7143	Change in Electricity Tax	(2.18)(3.3)	The electricity price of these three sectors is heavily subsidized.
H_j j ε LISMPO	(X)	H92S,H93K, H93S,H94K, H94S,H95K, H95S	Public Sector Gross Purchase of Goods and Services	(2.50)(2.51)(2.52) (3.30)(3.66)	
I	(N)	I	Imports	(3.56)(3.68)(3.75) (3.56a)	Total. In eq. (3.56a), "I" measures total imports adjusted for the balance of trade restriction in MSG-4ET.

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
IA_i i ε LISMVA	(X)	IA12,IA16, IA17,IA18, IA26,IA27, IA28,IA34, IA37,IA41, IA42,IA43, IA45,IA50, IA68,IA74, IA81,IA82, IA85	Re-exported imports	(2.58)	
I_{Kj} j ε LISMVA	(N)	IK00,IK01, IK02,IK05, IK06,IK11, IK12,IK13, IK16,IK17, IK18,IK19, IK26,IK27, IK28,IK32, IK33,IK34, IK36,IK37, IK41,IK42, IK43,IK45, IK50,IK66, IK68,IK72, IK74,IK81, IK82,IK85	Imports	(4.2)(3.50a)(3.53a) (3.56a)	Adjusted for balance of trade restriction in MSG-4ET
	(N)	IK55,IK60, IK67,IK69, IK73,IK83, IK92,IK93, IK94,IK95		(4.3)(3.53a)(3.56a)	
I_j j ε LISMVA	(N)	I00,I02	Imports	(2.34)(2.65)(3.5)(3.9) (3.15)(3.50)(3.56)(4.1) (4.2)(2.34a)	In MSG-4ET, I_j are unadjusted imports
	(N)	I01		(2.34)(2.65)(3.9)(3.50) (3.56)(4.1)(4.2)(2.34a)	
	(N)	I05,I06		(2.34)(3.50)(3.56)(4.1) (4.2)(2.34a)	
	(N)	I11		(2.34)(3.9)(3.15)(3.50) (3.53)(3.56)(4.1)(4.2) (2.34a)	
	(N)	I12		(2.34)(2.58)(3.9)(3.15) (3.50)(3.53)(3.56)(4.1) (4.2)(2.34a)	
	(N)	I13		(2.34)(3.9)(3.50)(3.53) (3.56)(4.1)(4.2)(2.34a)	

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
	(N)	I16,I17		(2.34)(2.58)(3.5)(3.9) (3.15)(3.50)(3.53)(3.56) (4.1)(4.2)2.34a)	
	(N)	I18		(2.34)(2.58)(3.9)(3.15) (3.50)(3.53)(3.56)(4.1) (4.2)(2.34a)	
	(N)	I19		(2.34)(3.9)(3.50)(3.56) (4.1)(4.2)(2.34a)	
	(N)	I26		(2.34)(2.58)(3.9)(3.15) (3.50)(3.53)(3.56)(4.1) (4.2)(2.34a)	
	(N)	I27		(2.34)(2.58)(3.5)(3.9) (3.15)(3.50)(3.53)(3.56) (4.1)(4.2)(2.34a)	
	(N)	I28		(2.34)(2.58)(3.9)(3.15) (3.50)(3.53)(3.56)(4.1) (4.2)(2.34a)	
	(N)	I32,I33		(2.34)(3.9)(3.50)(3.53) (3.56)(4.1)(4.2)(2.34a)	
	(N)	I34		(2.34)(2.58)(3.5)(3.9) (3.15)(3.50)(3.53)(3.56) (4.1)(4.2)(2.34a)	
	(N)	I36		(2.34)(3.50)(3.56)(4.1) (4.2)(2.34a)	
	(N)	I37		(2.34)(2.58)(3.5)(3.9) (3.15)(3.50)(3.53)(3.56) (4.1)(4.2)(2.34a)	
	(N)	I41		(2.34)(2.58)(3.9)(3.50) (3.53)(3.56)(3.97)(4.1) (4.2)(2.34a)	
	(N)	I42		(2.34)(2.58)(3.9)(3.15) (3.50)(3.53)(3.56)(3.98) (4.1)(4.2)(2.34a)	
	(N)	I43		(2.34)(2.58)(3.9)(3.15) (3.50)(3.53)(3.56)(4.1) (4.2)(2.34a)	
	(N)	I45,I50		(2.34)(2.58)(3.5)(3.9) (3.15)(3.50)(3.53)(3.56) (4.1)(4.2)(2.34a)	
	(X)	I55,I60		(3.56)(4.1)(2.34a)	Zero
	(N)	I66		(2.34)(3.9)(3.50)(3.53) (3.56)(4.1)(4.2)(2.34a)	

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
	(X)	I67		(3.56)(4.1)(2.34a)	Zero
	(N)	I68		(2.34)(2.58)(3.9)(3.50)(3.53)(3.56)(4.1)(4.2)(2.34a)	
	(X)	I69		(3.56)(4.1)(2.34a)	Zero
	(X)	I72		(2.34)(3.5)(3.9)(3.56)(3.85)(4.1)(4.2)(2.34a)	
	(X)	I73		(3.56)(4.1)(2.34a)	Zero
	(N)	I74		(2.34)(2.58)(3.9)(3.50)(3.53)(3.56)(4.1)(4.2)(2.34a)	
	(N)	I81,I82		(2.34)(2.58)(3.50)(3.53)(3.56)(4.1)(4.2)(2.34a)	
	(X)	I83		(3.56)(4.1)(2.34a)	Zero
	(N)	I85		(2.34)(2.58)(3.9)(3.50)(3.53)(3.56)(4.1)(4.2)(2.34a)	
	(X)	I92,I93, I94,I95		(3.56)(4.1)(2.34a)	Zero
J	(N)	J	New Investment	(3.57)	Total
J_j $j \in$ LISMJA	(N)	JB1,JB2,JM1, JM2,JM3,JM5, JM6,JM7	New Investment	(2.34)(2.57)(2.58)(3.2)(3.7)(3.57)(3.62)(2.34a)	
J_{Ei} $i \in$ LISMJA	(X)	JEB1,JEB2, JEM1,JEM2, JEM3,JEM5, JEM6,JEM7	Sales of Used Real Capital	(2.57)(3.45)(3.46)(3.62)(4.1)	
JK	(N)	JK	Gross Investments	(3.64)(3.68)	Total
J_{Kj} $j \in$ LISMJA	(N)	JKB1,JKB2, JKM1,JKM2, JKM3,JKM5, JKM6,JKM7	Gross Investments	(3.62)(3.63)(3.64)	By type

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
J_{KSj} j ε LISMPS	(N)	JKS11,JKS12, JKS13,JKS14, JKS18,JKS26, JKS27,JKS28, JKS31,JKS34, JKS37,JKS40, JKS43,JKS45, JKS50,JKS55	Gross Investments	(3.35)(3.40)	By sector
	(X)	JKS60,JKS64, JKS68		(2.55)(2.57)(3.40)	
	(N)	JKS72		(3.36)	
	(N)	JKS73,JKS74, JKS81,JKS82, JKS83,JKS85		(3.35)(3.40)	
	(X)	JKS92S		(2.57)	
	(X)	JKS93K,JKS93S, JKS94K,JKS94S, JKS95K,JKS95S		(2.55)(2.57)(3.40)	
J_{Xi} i ε LISMJA	(X)	JXB1,JXB2, JXM1,JXM2, JXM3,JXM5, JXM6,JXM7	Exogenous Investments by Type	(2.57)	Used to calibrate the model
J_{Xj} j = LISMPP	(X)	JX11,JX12, JX13,JX14, JX18,JX26, JX27,JX28, JX31,JX34, JX37,JX40, JX43,JX45, JX50,JX55, JX73,JX74, JX81,JX82, JX83,JX85	Exogenous Investments by Sector	(3.35)	These are calculated on the basis of exogenous investments by type
	(X)	JX72		(3.36)(3.41)	
K		K	Real Capital	(2.42)	Total. Endogenous in MSG-4E, exogenous in MSG-4S.

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
κ_{i72} i ε LISMJA	(N)	KAPB712, KAPM272, KAPM372	Capital Structure Coefficients Sector 72	(2.54)(2.57)(3.23)(3.36) (3.41)	
	(N)	KAPB272, KAPM172, KAPM572, KAPM672, KAPM772		(2.53)(2.57)(3.23)(3.36) (3.41)	Zero
K_j j ε LISMPS	(N)	K11,K12,K13, K14,K18,K26, K27,K28,K31, K34,K37,K40, K43,K45,K50, K55	Real Capital	(2.41)(2.43)(2.57)(3.22) (3.35)(3.37)	
	(N)	K60,K64,K68		(2.41)(2.55)(2.57)(3.22) (3.37)	
	(N)	K72		(2.41)(2.44)(2.54)(2.57) (3.23)(3.36)(3.37)(3.41)	
	(N)	K73,K74,K81, K82,K83,K85		(2.41)(2.43)(2.57)(3.22) (3.35)(3.37)	
	(N)	K92S		(2.41)(2.56)(2.57)(3.22) (3.29)	Zero
	(N)	K93K,K93S, K94K,K94S, K95K,K95S		(2.41)(2.55)(2.57)(3.22) (3.29)(3.37)	
K_{Xj} j ε LISMPS	(X)	KX60,KX64, KX68,KX93K, KX93S,KX94K, KX94S,KX95K, KX95S	Real Capital Correction Term	(2.55)	Used to calibrate the model
	(X)	KX92S		(2.56)	Zero
L	(X)	L	Total Labour Supply	(2.40)(3.78)	In hours
L_j j ε LISMPS	(N)	L11,L12,L13, L14,L18,L26, L27,L28,L31, L45,L50,L55	Employment	(2.40)(2.42)(3.19) (3.20)(3.78)	In hours
	(N)	L34,L37,L40, L43		(2.40)(2.42)(3.19)(3.78)	
	(X)	L60		(2.40)(3.19)(3.20)(3.78)	

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
	(X)	L64,L68		(2.40)(3.19)(3.78)	
	(N)	L72		(2.40)(2.42)(3.19)	Zero
	(N)	L73		(2.40)(2.42)(3.19)(3.78)	
	(N)	L74,L81,L82, L83,L85		(2.40)(2.42)(3.19)(3.20) (3.78)	
	(X)	L92S,L93K, L93S,L94K, L94S,L95K, L95S		(2.40)(3.19)(3.29)(3.78)	
M_j $j \in$ LISMPS	(N)	M11,M12,M13, M14,M18,M26, M27,M28,M31, M34,M37,M43, M45,M50,M55	Material Inputs	(2.34)(2.49)(2.58)(3.2) (3.7)(3.11)(3.13)(3.25) (3.28)(2.34a)	
	(N)	M40		(2.34)(2.49)(2.58)(3.2) (3.7)(3.11)(3.13)(3.25) (3.28)(3.96)(2.34a)	
	(N)	M60,M64,M68		(2.34)(2.49)(2.58)(3.2) (3.7)(3.25)(3.28)(2.34a)	
	(N)	M72		(2.34)(2.49)(2.58)(3.2) (3.7)(3.11)(3.13)(3.25) (3.28)(3.87)(2.34a)	
	(N)	M73,M74,M81, M85		(2.34)(2.49)(2.58)(3.2) (3.7)(3.11)(3.13)(3.25) (3.28)(2.34a)	
	(N)	M82,M83		(2.34)(2.49)(2.58)(3.2) (3.7)(3.25)(3.28)(2.34a)	
	(N)	M92S,M93K, M93S,M94K, M94S,M95K, M95S		(2.34)(2.52)(2.58)(3.2) (3.7)(2.34a)	

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
M_{Bi} i ε LISMVA	(N)	MB11,MB12, MB13,MB16, MB17,MB18, MB26,MB27, MB28,MB32, MB33,MB34, MB37,MB41, MB42,MB43, MB45,MB50, MB66,MB68, MB72,MB74, MB81,MB82, MB85	Import Shares	(3.53)(3.53a)	In eq. (3.53a) "MB" measures import shares adjusted for the balance of trade restriction in MSG-4ET.
	(N)	MB55,MB60, MB67,MB69, MB73,MB83, MB92,MB93, MB94,MB95		(3.54)(3.54a)	Zero
N	(X)	N	Total Labour Supply	(3.77)	In man-years
N_C	(X)	NC	Population	(2.59)(2.60)(2.61)	Normalized to one in the base-year
NL	(N)	NL	Scaling-factor from Hours to Years	(3.77)(3.78)	
N_j j ε LISMPS	(N)	N11,N12,N13, N14,N18,N26, N27,N28,N31, N34,N37,N40, N43,N45,N50, N55,N60,N64, N68,N73,N74, N81,N82,N83, N85,N92S, N93K,N93S, N94K,N94S, N95K,N95S	Employment	(3.78)	In years
	(N)	N72		(3.79)	Zero
OL_{A41}	(N)	OLA41	Exports of Gasoline	(3.94)	In tonnes
OL_{A42}	(N)	OLA42	Exports of Fuel Oil	(3.95)	In tonnes

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
OL_{C41}	(N)	OLC41	Consumption of Gasoline	(3.93)	In tonnes
OL_{C42}	(N)	OLC42	Consumption of Fuel Oil	(3.93)	In tonnes
OL_{I41}	(N)	OLI41	Imports of Gasoline	(3.97)	In tonnes
OL_{I42}	(N)	OLI42	Imports of Fuel oil	(3.98)	In tonnes
OL_{X41}	(N)	OLX41	Net production of Gasoline	(3.96)	In tonnes
OL_{X42}	(N)	OLX42	Net Production of Fuel Oil	(3.96)	In tonnes
OL_{ij} i=41 in LISMVA j ε LISMPS	(N)	OL4111,OL4112, OL4113,OL4114, OL4118,OL4126, OL4127,OL4128, OL4131,OL4134, OL4137,OL4143, OL4145,OL4150, OL4155,OL4160, OL4164,OL4173, OL4174,OL4181, OL4182,OL4183, OL4185,OL4192S, OL4193K, OL4193S, OL4194K, OL4194S, OL4195K, OL4195S	Imports of Gasoline	(3.92)	These are all measured in tonnes
	(N)	OL4140,OL4168, OL4172		(3.92)	Zero

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
OL_{ij} i=42 in LISMVA j ε LISMPS	(N)	OL4211,OL4212, OL4213,OL4214, OL4218,OL4226, OL4227,OL4228, OL4231,OL4234, OL4237,OL4243, OL4245,OL4250, OL4255,OL4260, OL4264,OL4268, OL4272,OL4273, OL4274,OL4281, OL4285,OL4292S, OL4293K, OL4293S, OL4294K, OL4294S, OL4295K, OL4295S	Imports of Fuel Oil	(3.92)	These are all measured in tonnes
	(N)	OL4240,OL4282, OL4283		(3.92)	Zero
$\omega\tau_{ej}$	(X)	OMEGA92S, OMEGA93K, OMEGA93S, OMEGA94K, OMEGA94S, OMEGA95K, OMEGA95S	Technical Change	(3.29)	Labour-augmenting change in public sectors
P_{Aj} j ε LISMVA	(N)	PA00,PA01, PA02	Price Index, Exports	(2.28)(3.48)(4.1)(3.48a)	
	(N)	PA06,PA11, PA12,PA13, PA16,PA17, PA18,PA26, PA27,PA28, PA32,PA33, PA34,PA37, PA41,PA42, PA43,PA45, PA50,PA60, PA66,PA67, PA68,PA69, PA72,PA73, PA74,PA81, PA82,PA85, PA92,PA93, PA95		(2.28)(3.48)(3.49)(4.1) (3.48a)	
	(N)	PA05,PA19, PA36,PA55, PA83,PA94		(2.29)(3.48)(3.49)(4.1) (3.48a)	Zero

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
P_{Cj} j ε LISMCP, LISTECA	(N)	PC00,PC11, PC12,PC13, PC14,PC15, PC21,PC22, PC23,PC41, PC42,PC50, PC61,PC63, PC64,PC65, PC66	Price Index, Consumption	(2.26)(2.59)(2.60)(2.61) (3.32)(3.33)(3.49)(4.1) (3.49a)	
	(N)	PC30		(2.26)(2.62)(3.32)(3.46) (3.49)(4.1)(3.49a)	
	(N)	PC31		(2.59)(2.60)(2.61)(2.62)	
	(N)	PC62		(2.26)(3.32)(3.33)	
P_{Ej} j ε LISMPS	(N)	PE11,PE13, PE14,PE18, PE26,PE27, PE28,PE31, PE43,PE45, PE50,PE55, PE74,PE82, PE85	Price Index, Electricity	(2.11)(2.17)(2.22)(3.25)	
	(N)	PE12,PE60, PE64,PE68, PE81,PE83		(2.19)(3.25)	Zero
	(N)	PE34,PE37		(2.11)(2.18)(2.22)(3.25)	
	(N)	PE40		(2.17)(2.24)(3.25)	Equal to PU40
	(N)	PE72		(2.2)(2.19)(3.25)	Zero
	(N)	PE73		(2.3)(2.15)(2.16)(2.17) (3.25)	
	(N)	PE92S,PE93K, PE93S,PE94K, PE94S,PE95K, PE95S		(2.17)(3.66)	
P_{Fj} j ε LISMPS	(N)	PF11,PF13, PF14,PF18, PF26,PF27 PF28,PF31, PF34,PF37, PF43,PF45, PF50,PF55, PF74,PF82, PF85	Price Index, Fuels	(2.11)(2.20)(2.22)(3.25)	

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
	(N)	PF12,PF60, PF64,PF68, PF72,PF73, PF81,PF83		(2.20)(3.25)	Equal to PU_j
	(N)	PF40		(2.21)(3.25)	Zero
	(N)	PF92S,PF93K, PF93S,PF94K, PF94S,PF95K, PF95S		(2.20)(3.66)	
P_{Jj} j ε LISMJA	(N)	PJB1	Price Index, Investment Goods	(2.27)(2.30)(2.32)(3.22) (3.23)(3.37)(3.40)(3.41) (3.46)(3.63)(4.1)	
	(N)	PJB2,PJM1		(2.27)(2.30)(3.22)(3.23) (3.37)(3.40)(3.41)(3.46) (3.63)(4.1)	
	(N)	PJM2		(2.27)(2.30)(2.32)(2.62) (3.22)(3.23)(3.37)(3.40) (3.41)(3.46)(3.63)(4.1)	
	(N)	PJM3		(2.27)(2.30)(2.32)(3.22) (3.23)(3.37)(3.40)(3.41) (3.46)(3.63)(4.1)	
	(N)	PJM5,PJM6, PJM7		(2.27)(2.30)(3.22)(3.23) (3.37)(3.40)(3.41)(3.46) (3.63)(4.1)	
P_{Kj} j ε LISMPS	(N)	PK11,PK12, PK13,PK14, PK18,PK26, PK27,PK28, PK31,PK34, PK37,PK40, PK43,PK45, PK50,PK55, PK74,PK81, PK82,PK83, PK85	User Price on Capital	(2.1)(2.8)(2.9)(2.10) (2.30)	
	(N)	PK72		(2.2)(2.32)	
	(N)	PK73		(2.3)(2.15)(2.16)(2.30)	
	(N)	PK92S		(2.31)	Zero
	(N)	PK93K,PK93S, PK94K,PK94S, PK95K,PK95S		(2.30)	

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
P_{Lj} j ε LISMPS	(X)	PL11,PL12, PL13,PL14, PL18,PL26, PL27,PL28, PL31,PL45, PL50,PL55, PL74,PL81, PL82,PL83, PL85	Wage Rate	(2.1)(2.8)(2.9)(2.10) (3.19)(3.20)	
	(X)	PL34,PL37, PL40,PL43		(2.1)(2.8)(2.9)(2.10) (3.19)	
	(X)	PL60		(3.19)(3.20)	
	(X)	PL64,PL68, PL92S,PL93K, PL93S,PL94K, PL94S,PL95K, PL95S		(3.19)	
	(X)	PL72		(2.2)(3.19)	
	(X)	PL73		(2.3)(3.19)	
P_{Mj} j = LISMPS	(N)	PM11,PM12, PM13,PM14, PM18,PM26, PM27,PM28, PM31,PM34, PM37,PM40, PM43,PM45, PM50,PM55, PM74,PM81, PM82,PM83, PM85	Price Index, Material Inputs	(2.1)(2.8)(2.9)(2.10) (2.25)(3.25)	
	(N)	PM60,PM64, PM68		(2.25)(3.25)	
	(N)	PM72		(2.2)(2.25)(3.25)	
	(N)	PM73		(2.3)(2.25)(3.25)	
	(N)	PM92S,PM93K, PM93S,PM94K, PM94S,PM95K, PM95S		(2.25)(3.66)	
P_S	(X)	PS	Standard Price of Electricity	(3.80)(3.83)(3.84)(3.85) (3.87)(3.88)	

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
P_{Uj} j ε LISMPP	(N)	PU11,PU13, PU14,PU18, PU26,PU27, PU28,PU31, PU34,PU37, PU43,PU45, PU50,PU55, PU74,PU82, PU85	Price Index, Energy	(2.1)(2.8)(2.9)(2.10) (2.22)	
	(N)	PU12		(2.1)(2.8)(2.9)(2.10) (2.23)	Equal to PF12
	(N)	PU40		(2.1)(2.8)(2.9)(2.10) (2.24)	Equal to PE40
	(N)	PU60		(2.23)	Equal to PF60
	(N)	PU64		(2.23)	Equal to PF64
	(N)	PU68		(2.23)	Equal to PF68
	(N)	PU72		(2.23)	Equal to PF72
	(N)	PU81		(2.1)(2.8)(2.9)(2.10) (2.23)	Equal to PF81
	(N)	PU83		(2.1)(2.8)(2.9)(2.10) (2.23)	Equal to PF83
Q	(N)	Q	GNP	(3.70)(3.75)	Adjusted figures
QF	(N)	QF	GNP	(3.55)(3.69)(3.70)	Unadjusted figure
Q_{FMj} j ε LISMPP	(N)	QFM11,QFM12, QFM13,QFM14, QFM18,QFM26, QFM27,QFM28, QFM31,QFM34, QFM37,QFM40, QFM43,QFM45, QFM50,QFM55, QFM72,QFM73, QFM74,QFM81, QFM85	Refunded VAT	(3.13)(3.28)	
	(N)	QFM60,QFM64, QFM68,QFM82, QFM83		(3.14)(3.28)	Zero

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
Q_j $j \in$ LISMPP	(N)	Q11,Q12,Q13, Q14,Q18,Q26, Q27,Q28,Q31 Q34,Q37,Q40, Q43,Q45,Q50, Q55,Q60,Q64, Q68,Q72,Q73, Q74,Q82,Q83 Q85	Gross Product	(3.28)(3.55)	
	(N)	Q81		(3.69)	
	(N)	Q81F		(3.28)(3.55)(3.69)	
	(N)	Q92S,Q93K, Q93S,Q94K, Q94S,Q95K Q95S		(3.29)(3.30)(3.55)	
R		R	Rate of Return	(2.33)	This is the rate for the economy as a whole. Endogenous in MSG-4S. Exogenous in MSG-4E.
r_B	(X)	RB	Rate of Return, Car Usage	(2.62)	Set to zero in most model runs
ϱ_j $j \in$ LISMPP	(X)	RHO11,RHO12, RHO13,RHO14, RHO18,RHO26, RHO27,RHO28, RHO31,RHO34, RHO37,RHO40, RHO43,RHO45, RHO50,RHO55, RHO74,RHO81, RHO82,RHO83, RHO85	Relative Rate of Return Factor	(2.33)	The relative rate of return itself is the rate of return multiplied with this factor
R_j $j \in$ LISMPS	(N)	R11,R12,R13, R14,R18,R26, R27,R28,R31, R34,R37,R40, R43,R45,R50, R55,R74,R81, R82,R83,R85	Rate of Return by Sector	(2.30)(2.33)	These are ex ante measures
	(X)	R72		(2.32)	
	(X)	R73		(2.30)	

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
R_{pp}	(N)	RPP	Average Rate of Return in Private Sectors	(3.44)	This is an ex post measure
R_{ppj}	(N)	RPP11,RPP12, RPP13,RPP14, RPP18,RPP26, RPP27,RPP28, RPP31,RPP34, RPP37,RPP40, RPP43,RPP45, RPP50,RPP55, RPP60,RPP64, RPP68,RPP72, RPP73,RPP74, RPP81,RPP82, RPP83,RPP85	Rate of Return in Private Sectors	(3.43)	These are ex post measures
SUMQI	(N)	SUMQI	Total Demand	(3.75)(3.76)	
Θ_C	(N)	THETAC	Auxiliary Variable	(2.60)(2.61)	Ensures that the adding-up property is satisfied in the consumption system
t_{Mi} $i \in$ LISMVA	(X)	TM00,TM01, TM02,TM11, TM12,TM13, TM16,TM17, TM18,TM19, TM26,TM27, TM28,TM32, TM33,TM34, TM37,TM43, TM45,TM50, TM66,TM74, TM85	Change in VAT	(2.25)(2.26)(2.27)(3.7) (3.9)(3.11)	
	(X)	TM05,TM06, TM36,TM55, TM60,TM67, TM68,TM69, TM92,TM93, TM94,TM95		(2.25)(2.26)(2.27)(3.7) (3.11)	
	(X)	TM41,TM42		(2.20)(2.25)(2.26)(2.27) (3.7)(3.9)(3.11)	
	(X)	TM72		(2.17)(2.18)(2.25)(2.26) (2.27)(3.3)(3.7)(3.9) (3.11)	

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
	(X)	TM73		(2.17)(2.18)(2.25)(2.26) (2.27)(3.3)(3.7)(3.11)	
	(X)	TM81		(2.20)(2.25)(2.26)(2.27) (3.7)(3.11)	
T_{MBi} i ε LISMVA	(N)	TMB00,TMB01, TMB02,TMB06, TMB11,TMB12, TMB13,TMB16, TMB17,TMB18, TMB26,TMB27, TMB28,TMB32, TMB33,TMB34, TMB37,TMB41, TMB42,TMB43, TMB45,TMB50, TMB66,TMB72, TMB74,TMB85	VAT on Imports	(3.9)(3.16)(3.17)(3.18)	
	(N)	TMB05,TMB19, TMB36,TMB55, TMB67,TMB73, TMB81,TMB92, TMB93,TMB94, TMB95		(3.10)(3.16)(3.17)(3.18)	Zero
	(N)	TMB60,TMB68, TMB69,TMB82, TMB83		(3.10)(3.15)(3.16)(3.17)	
T_{MTi} i ε LISMVA	(N)	TMT00,TMT01, TMT02,TMT06, TMT12,TMT13, TMT16,TMT17, TMT19,TMT26, TMT27,TMT28, TMT32,TMT33, TMT34,TMT37, TMT41,TMT42, TMT43,TMT45, TMT50,TMT55, TMT66,TMT72, TMT73,TMT74, TMT81,TMT85	VAT by Commodity	(3.7)(3.17)(3.18)	
	(N)	TMT05,TMT06, TMT36,TMT60, TMT67,TMT68, TMT69,TMT82, TMT83,TMT92, TMT93,TMT94, TMT95		(3.8)(3.17)(3.18)	Zero

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
t_{SVj} j ∈ LISMPP	(X)	TSV11,TSV12, TSV13,TSV14, TSV18,TSV26, TSV27,TSV28, TSV31,TSV34, TSV37,TSV40, TSV43,TSV45, TSV50,TSV55, TSV72,TSV73, TSV74,TSV81, TSV82,TSV83, TSV85	Change in Sectoral Tax	(2.7)	
T_{TB}	(N)	TTB	Total Customs Duty	(3.15)(3.16)	
t_{Vi} i ∈ LISMVA	(X)	TV00,TV02, TV16,TV17, TV34,TV37, TV45,TV50	Change in Commodity Tax	(2.25)(2.26)(2.27)(2.28) (3.2)(3.5)(3.7)(3.9) (3.11)	
	(X)	TV01,TV12, TV13,TV18, TV19,TV26, TV28,TV32, TV33,TV43, TV66		(2.25)(2.26)(2.27)(2.28) (3.7)(3.9)(3.11)	
	(X)	TV05,TV06, TV36,TV55, TV60,TV67, TV68,TV69, TV82,TV83, TV92,TV93, TV94,TV95		(2.25)(2.26)(2.27)(2.28) (3.7)(3.11)	
	(X)	TV11,TV27, TV74,TV85		(2.25)(2.26)(2.27)(2.28) (3.2)(3.7)(3.9)(3.11)	
	(X)	TV41,TV42		(2.20)(2.25)(2.26)(2.27) (2.28)(3.2)(3.7)(3.9) (3.11)	
	(X)	TV72		(2.17)(2.18)(2.25)(2.26) (2.27)(2.28)(3.3)(3.5) (3.7)(3.9)(3.11)	
	(X)	TV73		(2.17)(2.18)(2.25)(2.26) (2.27)(2.28)(3.3)(3.7) (3.11)	
	(X)	TV81		(2.20)(2.25)(2.26)(2.27) (2.28)(3.2)(3.7)(3.11)	

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
T_{VBi}	(N)	TVB00,TVB02, TVB16,TVB17, TVB27,TVB34, TVB37,TVB45, TVB50,TVB72	Net Commodity Tax on Imports	(3.5)(3.16)(3.17)(3.18)	
	(N)	TVB01,TVB05, TVB06,TVB11, TVB12,TVB13, TVB18,TVB19, TVB26,TVB28, TVB32,TVB33, TVB36,TVB41, TVB42,TVB43, TVB55,TVB60, TVB66,TVB67, TVB68,TVB69, TVB73,TVB74, TVB81,TVB82, TVB83,TVB85, TVB92,TVB93, TVB94,TVB95		(3.6)(3.16)(3.17)(3.18)	Zero
T_{VTi} i ε LISMVA	(N)	TVT00,TVT02, TVT11,TVT16, TVT27,TVT34, TVT37,TVT41, TVT42,TVT45, TVT50,TVT72, TVT73,TVT74, TVT81,TVT85	Net Commodity Tax	(3.2)(3.17)(3.18)	
	(N)	TVT01,TVT05, TVT06,TVT12, TVT13,TVT17, TVT18,TVT19, TVT26,TVT28, TVT32,TVT33, TVT36,TVT43, TVT55,TVT60, TVT66,TVT67, TVT68,TVT69, TVT82,TVT83, TVT92,TVT93, TVT94,TVT95		(3.4)(3.17)(3.18)	Zero
VA	(N)	VA	Total Exports	(3.49)(3.71)(3.49a)	Current prices. In eq. (3.49a), VA measures exports adjusted for the balance of trade restrictions in MSG-4ET.
VAJ	(N)	VAJ	Exports of Used Real Capital	(3.46)(3.49)(3.49a)	Current prices

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
VAK_j j ε LISMVA	(N)	VAK00,VAK01, VAK02,VAK05, VAK06,VAK11, VAK12,VAK13, VAK16,VAK17, VAK18,VAK19, VAK26,VAK27, VAK28,VAK32, VAK33,VAK34, VAK36,VAK37, VAK41,VAK42, VAK43,VAK45, VAK50,VAK55, VAK60,VAK66, VAK67,VAK68, VAK69,VAK72, VAK74,VAK81, VAK82,VAK83, VAK85,VAK92, VAK93,VAK94, VAK95	Exports	(3.48a)(3.49a)	Current prices. Adjusted for balance of trade restriction in MSG-4ET.
VA_j j ε LISMVA	(N)	VA00,VA01, VA02,VA05, VA06,VA11, VA12,VA13, VA16,VA17, VA18,VA19, VA26,VA27, VA28,VA32, VA33,VA34, VA36,VA37, VA41,VA42, VA43,VA45, VA50,VA55, VA60,VA66, VA67,VA68, VA69,VA72, VA74,VA81, VA82,VA83, VA85,VA92, VA93,VA94, VA95	Exports	(3.48)(3.49)	Current prices. Unadjusted
VC	(N)	VC	Total Private Consumption	(3.34)(3.71)	Current prices

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
VC_j j ε LISMCP	(N)	VC00,VC11, VC12,VC13, VC14,VC15, VC21,VC22, VC23,VC30, VC41,VC42, VC50,VC61, VC62,VC63, VC64,VC65, VC66	Private Consumption	(3.32)(3.34)	Current prices
	(N)	VC70		(3.33)(3.34)	
VC_B	(N)	VCB	Endogenous Consumption	(2.59)(2.60)(2.61)	Total, in current prices. Not equivalent with total consumption
VDELTA	(N)	VDELTA	Shift-effect	(3.71)(3.72)(3.73) (3.74)	Current prices
VDS	(N)	VDS	Change in Stocks	(3.61)(3.71)	Current prices
VED_i i = 41, 42 in LISMVA	(X)	VED41,VED42	Fire-wood-substitution Variable	(3.93)	
VG	(N)	VG	Total Public Consumption	(3.67)(3.71)	Current prices
VG_j j ε LISMPO	(N)	VG92S,VG93K, VG93S,VG94K, VG94S,VG95K, VG95S	Public Consumption	(3.66)(3.67)	Current prices
VI	(N)	VI	Total Imports	(3.52)(3.71)(3.52a)	Current prices. In eq. (3.52a), VI measures imports adjusted for the balance of trade restriction in MSG-4ET.

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
VIK_i i ε LISMVA	(N)	VIK00,VIK01, VIK02,VIK05, VIK06,VIK11, VIK12,VIK16, VIK17,VIK18, VIK19,VIK26, VIK27,VIK28, VIK32,VIK33, VIK34,VIK36, VIK37,VIK41, VIK42,VIK43, VIK45,VIK50, VIK66,VIK68, VIK72,VIK74, VIK81,VIK82, VIK85	Imports	(3.50a)(3.52a)	Current prices. Adjusted for balance of trade restriction in MSG-4ET.
	(N)	VIK55,VIK60, VIK67,VIK69, VIK73,VIK83, VIK92,VIK93, VIK94,VIK95		(3.51a)(3.52a)	Zero
VI_i i ε LISMVA	(N)	VI00,VI01, VI02,VI05, VI06,VI11, VI12,VI16, VI17,VI18, VI19,VI26, VI27,VI28, VI32,VI33, VI34,VI36, VI37,VI41, VI42,VI43, VI45,VI50, VI66,VI68, VI72,VI74, VI81,VI82, VI85	Imports	(3.50)(3.52)	Current prices. In MSG-4ET VI are unadjusted imports.
	(N)	VI55,VI60, VI67,VI69, VI73,VI83, VI92,VI93, VI94,VI95		(3.51)(3.52)	Zero
VJK	(N)	VJK	Total Gross Investments	(3.65)(3.71)	Current prices
VJ_{Ki} i ε LISMJA	(N)	VJKB1,VJKB2, VJKM1,VJKM2, VJKM3,VJKM5, VJKM6,VJKM7	Gross Investments by Type	(3.63)(3.65)	Current prices

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
VJ_{KSj} j ε LISMPS	(N)	VKS11,VKS12, VKS13,VKS14, VKS18,VKS26, VKS27,VKS28, VKS31,VKS34, VKS37,VKS40, VKS43,VKS45, VKS50,VKS55, VKS60,VKS64, VKS68,VKS73, VKS74,VKS81, VKS82,VKS83, VKS85,VKS93K, VKS93S,VKS94K, VKS94S,VKS95K, VKS95S	Gross Investments by Sector	(3.40)	Current prices
	(N)	VKS72		(3.41)	
	(N)	VKS92S		(3.42)	Zero
VK	(N)	VK	Total Real Capital	(3.39)	Current prices
VK_j j ε LISMPS	(N)	VK11,VK12, VK13,VK14, VK18,VK26, VK27,VK28, VK31,VK34, VK37,VK40, VK43,VK45, VK50,VK55, VK60,VK64, VK68,VK72, VK73,VK74, VK81,VK82, VK83,VK85,	Real Capital	(3.37)(3.39)(3.43) (3.44)	Current prices
	(N)	VK92S		(3.38)(3.39)	Zero
	(N)	VK93K,VK93S, VK94K,VK94S, VK95K,VK95S		(3.37)(3.39)	
X_j j ε LISMPS LISMPSA	(X)	X11	Production	(2.8)(2.9)(2.10)(2.34) (2.42)(2.43)(2.45)(2.47) (2.49)(2.64)(3.1)(3.25) (3.28)(3.53)(3.96)(2.34a) (3.53a)	

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
	(N)	X12,X18,X26, X27,X28,X34, X37,X43,X45, X50,X55,X74, X81,X82,X83, X85		(2.8)(2.9)(2.10)(2.34) (2.42)(2.43)(2.45)(2.47) (2.49)(2.64)(3.1)(3.25) (3.28)(3.53)(3.60)(2.34a) (3.53a)	
	(X)	X13		(2.8)(2.9)(2.10)(2.34) (2.42)(2.43)(2.45)(2.47) (2.49)(2.64)(3.1)(3.25) (3.28)(3.53)(2.34a)(3.53a)	
	(N)	X14		(2.8)(2.9)(2.10)(2.34) (2.35)(2.42)(2.43)(2.45) (2.47)(2.49)(2.64)(3.1) (3.25)(3.28)(3.53)(3.96) (2.34a)(3.53a)	
	(N)	X16,X17		(2.34)(2.35)(2.64)(3.53) (3.96)(2.34a)(3.53a)	
	(N)	X31		(2.8)(2.9)(2.10)(2.34) (2.36)(2.42)(2.43)(2.45) (2.47)(2.49)(2.64)(3.1) (3.25)(3.28)(3.53)(3.96) (2.34a)(3.53a)	
	(X)	X32,X33		(2.34)(2.36)(2.64)(3.53) (3.96)(2.34a)(3.53a)	
	(N)	X40		(2.8)(2.9)(2.10)(2.34) (2.37)(2.42)(2.43)(2.45) (2.47)(2.49)(2.64)(3.1) (3.25)(3.28)(3.53)(3.96) (2.34a)(3.53a)	
	(N)	X41,X42		(2.34)(2.37)(2.64)(3.53) (3.96)(2.34a)(3.53a)	
	(N)	X60,X68		(2.34)(2.46)(2.48)(2.49) (2.64)(2.34a)(3.53a)	
	(N)	X64		(2.34)(2.38)(2.46)(2.48) (2.49)(2.64)(2.34a)(3.53a)	
	(X)	X66,X67		(2.34)(2.38)(2.64)(3.53) (3.96)(2.34a)(3.53a)	
	(N)	X69		(2.34)(2.38)(2.64)(3.53) (3.96)(2.34a)(3.53a)	
	(N)	X72		(2.34)(2.42)(2.44)(2.46) (2.48)(2.49)(2.54)(2.64) (3.1)(3.25)(3.53)(3.87) (3.96)(2.34a)(3.53a)	

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
	(N)	X73		(2.15)(2.16)(2.34)(2.42) (2.43)(2.46)(2.48)(2.49) (2.64)(3.1)(3.25)(3.28) (3.53)(3.96)(2.34a)(3.53a)	
	(N)	X92S,X93K, X93S,X94K, X94S,X95K, X95S		(2.34)(2.39)(2.64)(3.30) (3.53)(3.66)(3.96)(2.34a) (3.53a)	
Y	(N)	Y	GNP	(3.73)	Current prices. Adjusted
Y_{Dj} j ε LISMPS	(N)	YD11,YD12, YD13,YD14, YD18,YD26, YD27,YD28, YD31,YD34, YD37,YD40, YD43,YD45, YD50,YD55, YD60,YD64, YD68,YD73, YD74,YD81, YD82,YD83, YD85,YD93K, YD93S,YD94K, YD94S,YD95K, YD95S	Depreciation of Capital	(3.22)(3.27)	Current prices
	(N)	YD72		(3.23)(3.27)(3.41)	
	(N)	YD92S		(3.24)(3.26)	Zero
Y_{Ej} j ε LISMPP + 81F	(N)	YE11,YE12, YE13,YE14, YE18,YE26, YE27,YE27, YE31,YE34, YE37,YE40, YE43,YE45, YE50,YE55, YE60,YE64, YE68,YE72, YE73,YE74, YE82,YE83, YE85	Operating Surplus	(3.27)(3.43)(3.44)	
	(N)	YE81		(3.43)(3.44)(3.74)	
	(N)	YE81F		(3.27)(3.74)	

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
Y_F	(N)	YF	GNP	(3.60)(3.71)(3.72)	Unadjusted
Y_{FMj} j ε LISMPP	(N)	YFM11,YFM12, YFM13,YFM14, YFM18,YFM26, YFM27,YFM28, YFM31,YFM34, YFM37,YFM40, YFM43,YFM45, YFM50,YFM55, YFM72,YFM73, YFM74,YFM85	Refunded VAT on Inputs	(3.11)(3.17)	Current prices
	(N)	YFM60,YFM64, YFM68,YFM82, YFM83		(3.12)(3.17)	Zero
	(N)	YFM81		(3.11)(3.18)	
Y_{TSj} j ε LISMPP	(N)	YTS11,YTS12, YTS13,YTS14, YTS18,YTS26, YTS27,YTS28, YTS31,YTS34, YTS37,YTS40, YTS43,YTS45, YTS50,YTS55, YTS60,YTS64, YTS68,YTS72, YTS73,YTS74, YTS82,YTS83, YTS85	Sectoral Tax	(3.1)(3.17)(3.25)	Current prices
	(N)	YTS81		(3.1)(3.18)(3.25)	
Y_{Tj} j ε LISMPP	(N)	YT11,YT12, YT13,YT14, YT18,YT26, YT27,YT28, YT31,YT34, YT37,YT40, YT43,YT45, YT50,YT55, YT60,YT64, YT68,YT72, YT73,YT74, YT82,YT83, YT85	Net indirect Taxes	(3.17)(3.25)(3.27)	Current prices
	(N)	YT81		(3.18)(3.25)(3.27)	

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
Y_{WSj} j ε LISMPS	(N)	YWS11,YWS12, YWS13,YWS14, YWS18,YWS26, YWS27,YWS28, YWS31,YWS45, YWS50,YWS55, YWS60,YWS74, YWS81,YWS82, YWS83,YWS85	Renumeration of Self-Employed	(3.20)(3.43)(3.44)	Current prices
	(N)	YWS34,YWS37, YWS40,YWS43, YWS64,YWS68, YWS72;YWS73		(3.21)(3.43)(3.44)	Zero
	(N)	YWS92S,YWS93K, YWS93S,YWS94K, YWS94S,YWS95K, YWS95S		(3.21)	Zero
Y_{Wj} j ε LISMPS	(N)	YW11,YW12, YW13,YW14, YW18,YW26, YW27,YW28, YW31,YW34, YW37,YW40, YW43,YW45, YW50,YW55, YW60,YW64, YW68,YW72, YW73,YW74, YW81,YW82, YW83,YW85	Total Wages	(3.19)(3.27)	Current prices
	(N)	YW92S,YW93K, YW93S,YW94K, YW94S,YW95K, YW95S		(3.19)(3.26)	
Y_j j ε LISMPS + 81F	(N)	Y11,Y12,Y13, Y14,Y18,Y26, Y27,Y28,Y31, Y34,Y37,Y40, Y43,Y45,Y50, Y55,Y60,Y64, Y68,Y72,Y73, Y74,Y82,Y83, Y85	Gross Product	(3.27)(3.60)	Current prices
	(N)	Y81		(3.72)	
	(N)	Y81F		(3.27)(3.60)(3.72)	

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
	(N)	Y92S,Y93K, Y93S,Y94K, Y94S,Y95K, Y95S		(3.26)(3.60)(3.66)	
Z_{Ej} j ε LISMPS	(N)	ZE73	Unit Coefficient for Electricity	(2.3)(2.15)(2.46)	Per unit output
	(X)	ZE60,ZE64, ZE68		(2.46)	
	(X)	ZE72		(2.2)(2.46)	
Z_{Fj} j ε LISMPS	(X)	ZF60,ZF64, ZF68	Unit Coefficient for Fuel Oils	(2.48)	Per unit output
	(X)	ZF72		(2.2)(2.48)	
	(X)	ZF73		(2.3)(2.48)	
Z_{HEj} j ε LISMPO	(X)	ZHE92S,ZHE93K, ZHE93S,ZHE94K, ZHE94S,ZHE95K, ZHE95S	Unit Coefficient for Electricity	(2.50)(3.66)	Per unit "gross purchase of commodities and services" (H)
Z_{HFj} j ε LISMPO	(X)	ZHF92S,ZHF93K, ZHF93S,ZHF94K, ZHF94S,ZHF95K, ZHF95S	Unit Coefficient for Fuel Oils	(2.51)(3.66)	Per unit H
Z_{HMj} j ε LISMPO	(X)	ZHM92S,ZHM93K, ZHM93S,ZHM94K, ZHM94S,ZHM95K, ZHM95S	Unit Coefficient for Material Inputs	(2.52)(3.66)	Per unit H
Z_{Kj} j ε LISMPP	(N)	ZK11,ZK12, ZK13,ZK14, ZK18,ZK26, ZK27,ZK28, ZK31,ZK34, ZK37,ZK40, ZK43,ZK45, ZK50,ZK55, ZK74,ZK81, ZK82,ZK83, ZK85	Unit Coefficient for Real Capital	(2.1)(2.9)(2.43)	Per unit output
	(N)	ZK72		(2.2)(2.14)(2.32)(2.44)	Sum of three exogenous unit coefficients
	(N)	ZK73		(2.3)(2.15)(2.43)	

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
Z_{i72} i ε LISMJA	(X)	ZKB172,ZKM272, ZKM372	Unit Coefficient for Capital, Sector 72	(2.14)(2.32)(2.54)	One for each type of capital in the sector
Z_{Lj} j ε LISMPP	(N)	ZL11,ZL12, ZL13,ZL14, ZL18,ZL26, ZL27,ZL28, ZL31,ZL34, ZL37,ZL40, ZL43,ZL45, ZL50,ZL55, ZL74,ZL81, ZL82,ZL83, ZL85	Unit Coefficient for Labour	(2.1)(2.8)(2.42)	Per unit output
	(X)	ZL72		(2.2)(2.42)	
	(X)	ZL73		(2.3)(2.42)	
Z_{Mj} j ε LISMPP	(N)	ZM11,ZM12, ZM13,ZM14, ZM18,ZM26, ZM27,ZM28, ZM31,ZM34, ZM37,ZM40, ZM43,ZM45, ZM50,ZM55, ZM74,ZM81, ZM82,ZM83, ZM85	Unit Coefficient for Material Inputs	(2.1)(2.9)(2.49)	Per unit output
	(X)	ZM60,ZM64, ZM68		(2.49)	
	(X)	ZM72		(2.2)(2.49)	
	(X)	ZM73		(2.3)(2.49)	
Z_{TSj} j ε LISMPP	(N)	ZTS11,ZTS12, ZTS13,ZTS14, ZTS18,ZTS26, ZTS27,ZTS28, ZTS31,ZTS34, ZTS37,ZTS40, ZTS43,ZTS45, ZTS50,ZTS55, ZTS74,ZTS81, ZTS82,ZTS83, ZTS85	Sectoral Taxes per Unit Output	(2.1)(2.7)(3.1)	
	(X)	ZTS60,ZTS64, ZTS68		(3.1)	

Name	Endogenous (N) Exogenous (X)	TROLL-name	Full name	Appearance in	Comments
	(N)	ZTS72		(2.2)(2.7)(3.1)	
	(N)	ZTS73		(2.3)(2.7)(3.1)	
Z_{UEj} j ε LISMPP	(N)	ZUE11,ZUE13, ZUE14,ZUE18, ZUE26,ZUE27, ZUE28,ZUE31, ZUE34,ZUE37, ZUE43,ZUE45, ZUE50,ZUE55, ZUE74,ZUE82, ZUE85	Unit Coefficient for Electricity	(2.11)(2.45)	Per unit energy input
	(N)	ZUE12,ZUE81, ZUE83		(2.12)(2.45)	Zero
	(N)	ZUE40		(2.13)(2.45)	Equal to one
	(N)	ZUE60,ZUE64, ZUE68,ZUE72		(2.12)	Zero
Z_{UFj} j ε LISMPP	(N)	ZUF11,ZUF13, ZUF14,ZUF18, ZUF26,ZUF27, ZUF28,ZUF31, ZUF34,ZUF37, ZUF43,ZUF45, ZUF50,ZUF55, ZUF74,ZUF82, ZUF85	Unit Coefficient for Fuel Oils	(2.11)(2.47)	Per unit energy input
	(N)	ZUF12,ZUF81, ZUF83		(2.12)(2.47)	Equal to one
	(N)	ZUF40		(2.13)(2.47)	Zero
	(N)	ZUF60,ZUF64, ZUF68,ZUF72		(2.12)	Equal to one
Z_{Uj} j ε LISMPP	(N)	ZU11,ZU12, ZU13,ZU14, ZU18,ZU26 ZU27,ZU28, ZU31,ZU34, ZU37,ZU40, ZU43,ZU45, ZU50,ZU55, ZU74,ZU81, ZU82,ZU83, ZU85	Unit Coefficient for Energy	(2.1)(2.10)(2.45)(2.47)	Per unit output

APPENDIX 2

COEFFICIENTS OF MSG-4

The coefficients of the model are listed alphabetically according to the latin pronounciation of their (greek) names - which normally coincide with their TROLL-names. If a coefficient does not have a TROLL-name, the word "number" is used.

The coefficients are listed exclusive of reference to sector, activity or commodity. This implies that the equations listed in the "Appearence in" coloumn may or may not utilize all of the coefficients of a given type. For instance, eq. (2.60) makes use of all α_{Ci} except α_{C12} and α_{C13}, which instead are used in eq. (2.61). (This is why we use the symbol "ε" instead of "=" in the "name"-column.)

The text to the equations may give more information on some of the coefficients than what is given here.

Name	TROLL-name	Full-name	Appearence in	Comment
α_{Ci} i ε LISTECA	ALFAC	Constant terms in consumption	(2.60) (2.61)	Constant-terms in the system of demand equations. Used to calibrate the demand-system to base year values.
b_{irj} i,r = E,F j ε LISMPP	BEE BEF BFE BFF	GL-coefficients	(2.11) (2.22) (2.11) (2.22) (2.11) (2.22) (2.11) (2.22)	General Leontief (GL) coefficients in the unit-of-energy cost functions. Estimation period 1962-81. Updated and calibrated to base year values.
c_{Er73} r = E,K c_{Kr73} r = E,K	CEE 73 CEK 73 CKE 73 CKK 73	GL-coefficients	(2.15) (2.15) (2.16) (2.16)	GL-coefficients in the sector Distribution of Electricity. Defines explicit substitution possibilities between electricity and capital. This possibility is confined to this sector only.
c_{irj} i,r = K,L,U,M j ε LISMPP	CKK CKL CKM CKU CLK CLL CLM CLU CMK CML CMM CMU CUK CUL CUM CUU	GL-coefficients	(2.9) (2.9) (2.9) (2.9) (2.8) (2.8) (2.8) (2.8) (2.8) (2.8) (2.8) (2.8) (2.10) (2.10) (2.10) (2.10)	GL-coefficients in the unit cost functions. Estimation period 1962-81. Updated and calibrated to base year values.
δ_B	DELB	Depreciation rate of cars	(2.62) (2.63)	Measures depreciation in value terms, i.e. as share if value of car stocks. Set to 0.2. Last revised 1978.

Name	TROLL-name	Full-name	Appearence in	Comment
δ_{ij} $i \varepsilon$ LISMJA $j \varepsilon$ LISMPS	number	Depreciation rates by type of capital goods and sector	(2.30) (2.55) (2.57) (3.22) (3.23) (3.29) (3.35) (3.36)	Equal to base-year rates as measured by the national accounts.
F_{Cj} $j \varepsilon$ LISTECA LISMCP	number	Distribution coefficients for consumption by foreigners	(2.59) (2.60) (2.61) (3.33) (3.49) (4.1) (3.49a)	Aggregates of the same coefficients in the model MODIS.
F_{Ej} $j \varepsilon$ LISMPS	number	Share of firm electricity in el-input	(3.90)	Equal to base-year shares as measured by the resource accounts.
F_{EC}	number	Share of firm electricity in el-consumption	(3.91)	Equal to base-year share as measured by the resource accounts. Currently, the share is one.
F_{NL}	number	Work-hour to year scale-factor	(3.77)	Equal to base-year rate of economy-wide man-hour input to man-year input
F_{NLj} $j \varepsilon$ LISMPS	number	Work-hour to year scale factor, by sector	(3.78)	Based on special surveys.
F_{WSj} $j \varepsilon$ LISMPS	number	Share of self-employed, by sector	(3.19) (3.20)	Based on special surveys.
F_{Xj}	number	Central government output as share of central public output	(2.39)	Equal to the base year share as measured by the national accounts.
GWh.I	GWH.I	Electricty-imports correction coefficient	(3.86) (3.88)	Calculated from base-year resource accounts figures.

Name	TROLL-name	Full-name	Appearence in	Comment
H_{FMij} $i \varepsilon$ LISMVA $j \varepsilon$ LISMPP	number	Rate of refunded VAT	(3.11) (3.13)	Equal to base-year refunded VAT as share of delivery of commodity i to sector j. The delivery is measured in basic value plus commodity-taxes. Differenciated by commodity and sector.
H_{Mij} $i \varepsilon$ LISMVA $j \varepsilon$ LISMCP LISMJA LISMVA	number	Rate of accrued VAT	(2.26) (2.27) (3.7)	Calculated as base-year accrued VAT as share of basic value plus commodity taxes. Differenciated by commodity and sector.
H_{MBi} $i \varepsilon$ LISMVA	number	Rate of VAT on imports	(3.9)	Calculated as base-year VAT-share on import-goods measured in basic value plus commodity-taxes.
H_{Rij} $i \varepsilon$ LISMVA $i \varepsilon$ LISMPS	number	Rate of non-refunded tax on input-activities	(2.17) (2.18) (2.20) (2.25) (3.3)	Calculated as base-year share of inputs measured in basic value plus commodity-taxes. Differenciated by commodity and sector.
H_{SVj} $j \varepsilon$ LISMPP	number	Rate of sectoral tax	(2.7)	Equal to total sectoral tax by sector, devided by total output. All in base-year values as measured by the national accounts.
H_{TBi} $i \varepsilon$ LISMVA	number	Rate of customs duty on imports	(3.15) (3.50) (3.50a)	Equal to the rate of customs duty on commodity imports measured in basic values. The source is the base-year national accounts.

Name	TROLL-name	Full-name	Appearence in	Comment
H_{TFij} i ε LISMVA j ε LISMPP	number	VAT and commodity tax distribution coefficients	(3.17) (3.18)	Based on the base year national accounts figures of the share of total tax and VAT in sector j that originates from delivery of commodity i.
H_{Vij} i ε LISMVA j ε LISMPS LISMCP LISMJA LISMVA	number	Rate of commodity tax by commodity and receiving activity	(2.17) (2.18) (2.20) (2.25) (2.26) (2.27) (2.28) (3.2) (3.3) (3.7) (3.11) (3.13)	Equal to base year rate as measured by the national accounts. The receiving activity is measured in basic values.
H_{VBi} i ε LISMVA	number	Rate of commodity tax on imports	(3.5) (3.9)	Equal to base year rate (national accounts). Imports are measured in basic values.
$I_{72}(0)$	number	Imports in sector 72	(3.88)	Based on base-year national account figures. Used to adjust the "production of GWh" figure.
$\varkappa_{ij}$ i ε LISMJA j ε LISMPS	number	Capital structure coefficients	(2.30) (2.55) (2.57) (3.22) (3.29) (3.35) (3.37) (3.40)	Equal to base year share of capital of type i in sector j.
$\varkappa_{Cij}$ i ε LISTECA j ε LISTECA	KAPC	Base year price elasticities	(2.60) (2.61)	Calculated on the basis of base-year budget shares and expenditure elasticities, see formula (4), ch. IV in Bjerkholt et.al. (1983). The estimation period is 1962-1978.
ξ_{Ci} i ε LISTECA	KSIC	Base-year expenditure elasticities	(2.60) (2.61)	Calculated (i.e. updated) on the basis of budget shares and estimated elasticities using formula (4), ch. IV in Bjerkholt et.al. (1983). The estimation period is 1962-1978.

Name	TROLL-name	Full-name	Appearence in	Comment
Λ_{Aij} i = LISMVA j = LISMVA	number	Commodity-by-export activity coefficient	(2.28) (2.34) (3.2) (3.3) (3.53) (3.84) (3.94) (3.95) (2.34a)(3.53a)	Equal to base year national-account value of exports of commodity i (in basic values) relative to total exports of activity j, A_j (in market values). The other Λ coefficients are determined the same way.
Λ_{Cij} i ε LISMVA j ε LISMCP	number	Commodity-by consumption sector coefficient	(2.24) (2.34) (2.58) (3.2) (3.3) (3.7) (3.83) (3.93) (2.34a)	See the explanation of Λ_{Aij} above.
Λ_{Eij} i ε LISMVA j ε LISMPS	number	Commodity-by-activity coefficient for electricity	(2.17) (2.18) (2.34) (3.2) (3.3) (3.7) (3.11) (3.13) (3.80) (2.34a)	See the explanation of Λ_{Aij} above.
Λ_{Fij} i ε LISMVA j ε LISMPS	number	Commodity-by-activity coefficient for fuel-oils	(2.20) (2.34) (2.58) (3.2) (3.7) (3.11) (3.13) (3.92) (2.34a)	See the explanation of Λ_{Aij} above.
Λ_{Iij} i ε LISMVA j ε LISMVA	number	Commodity-by-import activity coefficient	(2.34) (2.58) (2.64) (3.5) (3.9) (3.15) (3.50) (3.53) (3.85) (3.97) (3.98) (2.34a) (3.50a)(3.53a)	See the explanation of Λ_{Aij} above.
Λ_{Jij} i = LISMVA j = LISMJA	number	Commodity-by-type of investment coefficient	(2.27) (2.34) (2.58) (3.2) (3.7) (2.34a)	See the explanation of Λ_{Aij} above.
Λ_{Mij} i = LISMVA j = LISMPS	number	Commodity-by-activity coefficient for material inputs	(2.25) (2.34) (2.58) (3.2) (3.7) (3.11) (3.13) (3.87) (3.96) (2.34a)	See the explanation of Λ_{Aij} above.

Name	TROLL-name	Full-name	Appearence in	Comment
Λ_{Si} $i \varepsilon$ LISMVA	number	Share of commodity stocks to total stocks	(2.58)	Equal to base-year national accounts figures.
Λ_{Xij} i = LISMVA j = LISMPS LISMPSA	number	Commodity-by-production sector or -by-production activity coefficient	(2.1) (2.34) (2.64) (3.25) (3.53) (3.87) (3.96) (2.34a) (3.53a)	See the explanation of Λ_{Aij} above.
M_{Ci} $i \varepsilon$ LISMVA	number	Share of imports in consumption, by commodity	(2.58)	Equal to base-year national account shares.
M_{Fi} $i \varepsilon$ LISMVA	number	Share of imports in input of fuel oils, by commodity	(2.58)	Equal to base year national account shares.
M_{Ji} $i \varepsilon$ LISMVA	number	Share of imports in investment, by commodity	(2.58)	Equal to base year national account shares.
M_{Mi} $i \varepsilon$ LISMVA	number	Share of imports in material input, by commodity	(2.58)	Equal to base year national account shares.
M_{Si} $i \varepsilon$ LISMVA	number	Imported stocks as share of total stocks of a commodity	(2.58)	Equal to base year national account shares.
μ_j $j \varepsilon$ LISMPP	MYH 11 MYH 13 MYH 31	Scale elastisities of production	(2.1) (2.8) (2.9) (2.10)	Equal to one, eg. "constant returns to scale".
υ_{73}	NU 73	Scale parameter in the GL-cost functions of sector 73	(2.15) (2.16)	Equal to 1.5.
ν_{73}	NY 73	Scale parameter in the market clearing equation of sector 73	(2.3)	Equal to 1.5.

Name	TROLL-name	Full-name	Appearence in	Comment
P_{ij} i = 41,42 in LISMVA $j \varepsilon$ LISMPS	number	Fixed-price-coefficients in input of oil products to sectors	(3.92)	Found by dividing resource account figures of inputs in physical units by national accounts figures of inputs in value terms. (P_{ij} may vary between sectors because of price discrimination.)
P_{rj} r = B,F j = A,C,I,X	PBA PBC PBI PBX PFA PFC PFI PFX	Standard-price-coefficient	(3.94) (3.93) (3.97) (3.96) (3.95) (3.93) (3.98) (3.96)	Found by dividing resource account figures of use of gasoline in exports by national accounts measures of the same figure.
$P_{Lj}(0)$	number	Wage-rate in public sectors	(3.29)	Based on base-year national account figures. Used to calculate gross product in public sectors.
δ_S	number	Coefficients for changes in stocks	(2.64) (2.65)	Set to 0.1.
T_i $i \varepsilon$ LISMJA	TB1 TM2 TM3	Life-time of capital in sector 72	(2.32)	Set to 75. Set to 25. Set to 4.
Θ_{Aj} $j \varepsilon$ LISMVA	THETAA	Export adjustment coefficient	(4.1) (4.2) (2.34a)	Helps to adjust the balance of trade in MSG-ET. Calculated as base year exports by activity to total exports plus imports.
Θ_{Bj} $j \varepsilon$ LISMVA	THETAB	Import adjustment coefficient	(4.1) (4.3) (2.34a)	Helps to adjust the balance of trade in MSG-ET. Calculated as base year imports by activity to total exports plus imports.

LISMVA: LIST OF COMMODITIES
LIST OF IMPORT-ACTIVITIES
LIST OF EXPORT-ACTIVITIES

	MSG/ MODAG- code	DATSY- code	FULL-NAME (Norwegian name in parenthesis)	KVARTS- code	DATA- BANK- code	MODIS-IV code	National Accounts Commodity code
			Commodities from private production sectors				
1	11	120	Agricultural Commodities (Jordbruksprodukter)	10	21,22	102,108,111, 121,122,129, 130	101-105,108,110, 113-118,121-127, 134,136,138-140
2	12	142	Commodities from Forestry (Skogbruksprodukter)	10	12	142	143,144,146,147
3	13	150	Commodities from Fishery (Fisk m.v.)	10	13	150	151-157
4	32	160	Coal (Kull)	30	32	160	160
5	33	174	Other Commodities from Mining and Quarrying (Andre bergverksprod.)	30	33	170,176	171,172,175,181
6	16	202	Processed Commodities from Agriculture and Fishery (Foredlede jordbruks- og fiskeprodukter)	15	16	201,211-213, 215,220,225, 230,235,240, 245,250,255, 260,266,270	200,205,211-213, 215,220,225,230, 235,240,245,250, 255,260,266,270
7	17	261	Beverages and Tobacco (Drikkevarer og tobakk)	15	17	275,280,285, 290	275,280,285,290
8	18	301	Textiles and Wearing Apparels (Tekstil- og bekled- ningsvarer)	15	18	295,300,305, 310,321,333, 346,350	295,300,305,310 315,320,325,331, 332,335,340,345, 350
9	26	356	Timber, Wood and Wooden Products (Trevarer)	25	26	355,360,365, 370,375	355,360,365,370, 375
10	34	381	Pulp and Paper Articles (Treforedlings- produkter)	30	34	380,385,390, 395,400	380,385,390,395, 400
11	37	422	Industrial Chemicals (Kjemiske råvarer)	30	37	420,425,430	420,425,430
12	41	461	Gasoline (Bensin)	40	41	461	461

	MSG/ MODAG- code	DATSY- code	FULL-NAME (Norwegian name in parenthesis)	KVARTS- code	DATA- BANK- code	MODIS-IV code	National Accounts Commodity code
13	42	464	Fuel oils etc. (Fyringsolje o.l.)	40	42	464	462,463
14	27	471	Non-industrial Chemical and Mineral Articles etc. (Kjemiske og mineralske produkter m.v.)	25	27	435,446,450, 455,468,470, 475,486,495, 501,505,681	435,440,445,450, 455,468,470,475, 480,485,490,495, 500,505,665,670, 675,680
15	43	511	Metals (Metaller)	30	43	510,515,520, 525,530,535	510,515,520,525, 530,535
16	45	548	Metal Products, Machinery and Equipment (Verkstedprodukter)	45	46,47	070,073,086, 546,555,566, 570,575,580, 591,595,600, 605,610,615, 620,625,645, 654	070-072,075,084, 085,090,091,540, 545,550,555,560, 565,570,576,577, 580,585,590,595, 600,605,610,615, 620,625,646,647, 652,653,663,664
17	50	586	Ships and Oil Platforms etc. (Skip og oljeplattformer m.v.)	50	48,49	582-584,592, 628,629,635, 640	582-584,596-599, 630-634,636-640
18	28	408	Publishing and Printed Matters (Grafiske produkter)	25	28	405,409,411 412,416,417	406,407,409,411 412,416,417
19	72	692	Production of Electricity (Elektrisitetsproduksjon)	part of 71	part of 71	part of 686	part of 686
20	73	693	Distribution of Electricity (Elektrisitetsdistribusjon)	part of 71	part of 71	part of 686	part of 686
21	55	700	Construction (Bygg og anlegg)	55	55	095-097,685, 700	082,083,131-133, 148,149,158,159, 683,684,688,689, 701-716,718,719, 803,804,862,863, 957,958
22	81	722	Wholesale and Retail Trade (Varehandel)	80	81	079,720,721	079,720,14xxx
23	66	164	Crude Oil (Råolje)	66	66	166,168	166,168

	MSG/ MODAG- code	DATSY- code	FULL-NAME (Norwegian name in parenthesis)	KVARTS- code	DATA- BANK- code	MODIS-IV code	National Accounts Commodity code
24	67	167	Natural Gas (Naturgass)	67	67	167	167
25	68	699	Oil and Gas Exploration and Drilling, Leasing of Oil Drilling Rigs (Boring etter olje og gass, utleie av borerigger)	68a	68	699	717,906
26	69	824	Oil and Gas Pipeline Transport (Olje- og gasstransport med rør)	68a	69	824	824
27	60	830	Ocean Transport of Goods and Passangers (Transporttjenester, utenriks sjøfart)	60	60	830	831,832
28	74	853	Domestic Transport Services (Transporttjenester, innenlands)	70	75,76, 61	801,802,806, 807,811,816, 821,836,839, 840,842,845, 851,852,855, 861	801,802,806,807, 811,816,820,826, 827,833,836,837, 842-844,846,847, 851,852,856,857, 858,861
29	82	870	Finance and Insurance Services (Bank- og forsikringstjenester m.v.)	80	63,89	866,868,873, 876	866,867,871,872, 874,875,881,882
30	83	885	Dwellings (Boligtjenester)	83	83	885	885
31	85	970	Other Private Services (Annen privat tjenesteyting)	80	77-79, 86-88	691,761,762, 891,901,907, 921,925,935, 936,941,950, 956,961,965, 900	690,696,761,762, 890,895,901,902, 905,921,926,927, 931,932,936,940, 946,951,952,956, 960,965,971,972, 900
			Commodities from Public Production Sectors (Fees etc.)				
32	92	919	Defence (Forsvar)	92	92	919	916,917
33	93	924	Education and Research (Undervisning og forskning)	90	93	924	928,929

	MSG/ MODAG- code	DATSY- code	FULL-NAME (Norwegian name in parenthesis)	KVARTS- code	DATA- BANK- code	MODIS-IV code	National Accounts Commodity code
34	94	943	Health and veterinary Services etc. (Helsetjenester m.v.)	90	94	930,939	933,934,937,938
35	95	949	Other Public Services (Annen offentlig tjenesteyting)	90	91,95	828,841,850, 910,920,993	137,145,687,828, 838,841,848,949, 870,903,904,911, 912,922,923,947, 948,953,954
			<u>Non-competing Imports</u>				
36	00	100	Foods (Matvarer)		00	106,112,267	106,107,109,267
37	01	177	Raw Materials, Metals (Råvarer)		01	173,182	173,182
38	02	648	Cars, Tractors etc. (Industrielle ferdigvarer)		02	061,578,651, 658,908,909	061,578,651,661, 662,908,909
39	05	052	Operating Expenditure Abroad, Fishing and Shipping (Skipsfartens driftsutgifter i utlandet)		05	052	051,053
40	06	042	Assorted Net Import Activities in Oil and Gas Exploration (Oljeutvinning, diverse import og eksport)		06	046,047,048 049,050,056, 057	046,047,048,056, 057,060,062,063, 064
41	19	043	Other Non-competing Imports (Annen ikke-konkurrerende import)		19	045,055,065, 914	045,055,058,059, 913,915,918
42	36	044	Direct Purchases Abroad by Resident Households (Konsum i utlandet)		36	066-069	066-069

LISMPS: LIST OF PRODUCTION SECTORS
LIST OF INPUT ACTIVITIES
INCLUDING LISMPP AND LISMPO

	MSG/ MODAG- code	DATSY- code	FULL-NAME (Norwegian name in parenthesis)	KVARTS- code	DATA- BANK- code	MODIS-IV code	National Accounts Sector code
			LISMPP: List of Private Production Sectors			Type of Account 23	
1	11	23105	Agriculture (Jordbruk)	10	21,22	100,121,131	100,120,140,130, 135
2	12	23145	Forestry (Skogbruk)	10	12	145	145
3	13	23151	Fishery (Fiske og fangst)	10	13	151	150,155
4	31	23158	Mining and Quarrying (Bergverksdrift)	30	31	159,176	160,170,175,180
5	14	23203	Manufacture of Food, Beverages and Tobacco (Produksjon av nær- ings- og nytelses- midler)	15	16,17	201,210,215, 220,225,230, 235,240,245, 250,255,260, 265,270,275, 280,285,290	200,205,210,215, 220,225,230,235, 240,245,250,255, 260,265,270,275, 280,285,290
6	18	23301	Manufacture of Textiles and Wearing Apparel (Produksjon av tek- stil- og beklednings- varer)	15	18	295,300,305 310,321,333, 346,350	295,300,305,310, 315,320,325,330, 335,340,345.350
7	26	23356	Manufacture of Timber, Wood and Wooden Products (Produksjon av trevarer)	25	26	355,360,365, 370,375	355,360,365,370, 375
8	34	23381	Manufacture of Pulp and Paper Articles (Produksjon av tre- foredlingsprodukter)	30	34	380,385,390, 395,400	380,385,390,395, 400
9	37	23422	Manufacture of Industrial Chemicals (Produksjon av kjemiske råvarer)	30	37	420,425,430	420,425,530
10	40	23460	Petroleum Refining (Raffinering av jordolje)	40	40	460	460

	MSG/ MODAG- code	DATSY- code	FULL-NAME (Norwegian name in parenthesis)	KVARTS- code	DATA- BANK- code	MODIS-IV code	National Accounts Sector code
11	27	23471	Manufacture of non-industrial Chemical and Mineral Articles etc. (Produksjon av kjemiske og mineralske produkter m.v.	25	27	435,446,450, 455,465,470, 475,486,495, 501,505,681	435,440,445,450, 455,465,470,475, 480,485,490,495, 500,505,665,670, 675,680
12	43	23511	Manufacture of Metals (Produksjon av metaller)	30	43	510,515,520, 525,530,535	510,515,520,525, 530,535
13	45	23601	Menufacture of Metal Products, Machinery and Equipment (Produksjon av verkstedsprodukter)	45	45	546,555,566, 570,575,580, 591,595,600, 605,610,615, 620,625,645, 651	540,545,550,555, 560,565,570,575, 580,585,590,595, 600,605,610,615, 620,625,645,650, 660
14	50	23631	Building of Ships and Oil-Platforms (Bygging av skip og oljeplattformer m.v.)	50	48,49	582,630,635, 640	582,630,635,640
15	28	23411	Printing and Publishing (Grafisk produksjon)	25	28	405,410,415	405,410,415
16	72	23692	Production of Electricity (Elektrisitetsproduksjon)	part of 71	part of 71	part of 685	part of 685
17	73	23693	Distribution of Electricity (Elektrisitetsdistribusjon)	part of 71	part of 71	part of 685	part of 685
18	55	23700	Construction, excl. Oil Well Drilling (Bygge- og anleggsvirksomhet)	55	55	700	700
19	81	23722	Wholesale and Retail Trade (Varehandel)	80	44,51 -54,56, 57	721	720,750,751,752, 753,754,756
20	64	23718	Production and Pipeline Transport of Oil and Gas (Råolje og naturgass, utvinning og transport)	65	66,69	165,824	165,824

	MSG/ MODAG- code	DATSY- code	FULL-NAME (Norwegian name in parenthesis)	KVARTS- code	DATA- BANK- code	MODIS-IV code	National Accounts Sector code
21	68	23717	Oil and Gas Exploration and Drilling (Boring etter olje og gass)	65	68	717	717
22	60	23830	Ocean Transport (Utenriks sjøfart)	60	60	830	830
23	74	23851	Domestic Transport (Innenriks samferdsel)	70	61,75, 76	800,809,815, 821,835,840, 845,850,855, 860	800,805,810,815 820,825,835,840, 845,850,855,860
24	82	23871	Finance and Insurance (Bank- og forsikringsvirksomhet)	80	63,89	865,868,872 876	865,869,870,873, 874,875,880
25	83	23885	Dwellings (Boligtjenester)	83	83	885	885
26	85	23971	Other Private Services (Annen privat tjenesteproduksjon)	80	77,78, 79,86, 87,88	691,760,891, 901,920,925, 930,935,941, 950,955,961, 965	690,695,760,890, 895,900,905,920, 925,930,935,940, 945,950,955,960, 970,965
			<u>LISMPO: List of Public Production Sectors</u>			<u>Type of Account 21</u>	
27	92S	21916	Defence (Forsvar)	92	92S	915	915
28	93S	21925	Central Education and Research (Statlig undervisning og forskningsvirksomhet)	90	93S	925	925
29	94S	21929	Central Healthcare and Veterinary Services etc. (Helsetjenester m.v., stat)	90	94S	930,935	930,935
30	95S	21951	Other Central Services (Annen statlig tjenesteproduksjon)	90	91S,95S, 96S,97S 98S	140,825,840, 845,910,920, 945,950,991	135,145,825,840, 845,870,900,945, 950

	MSG/ MODAG- code	DATSY- code	FULL-NAME (Norwegian name in parenthesis)	KVARTS- code	DATA- BANK- code	MODIS-IV code	National Accounts Sector code
						Type of Account 22	
31	93K	22925	Local Education and Research (Kommunal undervisning og forskningsvirksomhet)	90	93K	925	925
32	94K	22929	Local Healthcare and Veterinary Services (Helsetjenester m.v., kommuner)	90	94K	930,935	930,935
33	95K	22951	Other Local Services (Annen kommunal tjenesteproduksjon)	90	91K,95K, 97K	825,910,920, 945,950	825,910,920,945, 950

LISMPSA: List of Production Activities

This list is equal to LISMVA - 00,01,02,05,06,19,36,92,93,94,95 plus LISMPO

LISMCP: LIST OF CONSUMPTION SECTORS

	MSG/ MODAG- code	DATSY- code	FULL-NAME (Norwegian name in parenthesis)	KVARTS- code	DATA- BANK- code	MODIS-IV code	National Accounts Sector code
						Type of Account 33	
1	00	33900	Foods (Matvarer)	00	00	901-913	001-004,011,012, 021-026,031-034, 041,042,051-056, 061,062,071,081-083,091-093
2	11	33910	Beverages and tobacco (Drikkevarer og tobakk)	10	11	914-917	111-113,121-124
3	12	33932	Electricity (Elektrisitet)	10	12	922	321
4	13	33933	Fuels (Brensel)	10	13	923	322-324
5	14	33965	Petrol and Car Maintenance (Driftsutgifter til egne transportmidler)	10	14	930,931	621-624
6	15	33981	Other Goods (Andre varer)	10	15	939,940	811-814,821-825
7	21	33920	Clothing and Footwear (Klær og skotøy)	20	21	918-920	211-216,221-223 231-234
8	22	33945	Other Household Goods (Andre husholdnings-varer)	20	22	926	441-445,451-452
9	23	33973	Other Recreation Goods (Andre fritidsvarer)	20	23	935,937	715-718,731-733
10	30	33961	Purchase of Cars etc. (Kjøp av egne transportmidler)	30	30	929	611,612
11	41	33944	Furniture and Electrical Equipment (Møbler og elektriske husholdningsartikler)	40	41	924,925	411-413,421,422 431-436
12	42	33971	Durable Recreation Goods (Varige fritidsgoder)	40	42	934	711-714
13	50	33931	Gross Rents (Bolig)	50	50	921	311

	MSG/ MODAG- code	DATSY- code	FULL-NAME (Norwegian name in parenthesis)	KVARTS- code	DATA- BANK- code	MODIS-IV code	National Accounts Sector code
14	61	33964	Public Transport Services (Bruk av off. transportmidler, porto og teletjenester)	60	68,69	923,933,943	631-637,641,642
15	62	33950	Medical Care and Health Expenses (Helsepleie)	60	62	928	511-516
16	63	33974	Public Entertainment and Education (Offentlige forestillinger, andre tjenester, skolegang)	60	63	936,938	721-726,741
17	64	33946	Insurance and Domestic Services (Diverse husholdningstjenester)	60	64	927	453,454,461,471
18	65	33982	Other Services (Andre tjenester)	60	24,67	941,942	831,832,841,851-853
19	66	33991	Norwegians' Consumption Abroad (Nordmenns konsum i utlandet)	66	66	991	991

CORRECTION ITEM

1	70	33992	Direct Purchases in Norway by Non-Resident Households (Utlendingers konsum i Norge)	70	70	992	992

LISTECA: LIST OF CONSUMPTION ACTIVITIES

This list is equal to LISMCP - 30, 62, and plus

31	User Cost of Cars etc. (Bilhold)

LISMJA: LIST OF REAL CAPITAL AND INVESTMENT GOODS BY TYPE

	MSG/ MODAG- code	DATSY- code	FULL-NAME (Norwegian name in parenthesis)	KVARTS- code	DATA- BANK- code	MODIS-IV code	National Accounts Sector code
						Type of Account 20	
1	B1	20510	Dwellings, Cottages and Non-Residental Buildings etc. (Bolig-, fritids- og driftsbygg m.v.	B	B1	501,511-513, 521-524,531-536	101,111,113,119, 121-136,211-236, 311-336
2	B2	20537	Oil Constructions etc. (Oljeanlegg m.v.)	B	B2	537, 538	137,138,237,238, 337,338
3	M1	20540	Ships, Fishing Boats etc. (Skip, fiskebåter m.v.	S	M1	541,542	141,142,241,242, 341,342
4	M2	20560	Aircrafts, Cars etc. (Fly, biler m.v.)	M	M2	550,561,562, 563,570	150-170,250-270, 350-370
5	M3	20581	Machinery excl. Oil Drilling Rigs etc. (Maskiner m.v. ekskl. oljeboreplattformer o.l.)	M	M3	581-586	181-186,281-286, 381-386
6	M5	20587	Oil Rigs, Platforms etc.: Commodity 45 (Verkstedsprodukter m.v.: Vare 45)	01	part of M4	587,588	187,188
7	M6	20587	Oil Rigs, Platforms etc.: Commodity 50 (Skip og oljebore-plattformer: Vare 50)	02	part of M4	587,588	187,188
8	M7	20587	Oil Rigs, Platforms etc.: Commodity 06 (Oljeutv. direkte import: Vare 06)	03	part of M4	587,588	187,188

PUBLIKASJONER SENDT UT FRA STATISTISK SENTRALBYRÅ ETTER 1. JULI 1986. EMNEINNDELT OVERSIKT
PUBLICATIONS ISSUED BY THE CENTRAL BUREAU OF STATISTICS SINCE 1 JULY 1986. SUBJECT-MATTER ARRANGED SURVEY

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Befolkningsstatistikk 1986 Hefte II Folkemengd 1. januar Population Statistics Volume II Population 1 January. 1987-150s. (NOS B; 669) 50 kr ISBN 82-537-2429-2

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