AN APPLICATION OF COMPLETE DEMAND SYSTEM ANALYSIS IN AN INPUT-OUTPUT FRAMEWORK

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This paper represents the results of a three month study, in which several Junior Scientists from many countries took part during the summer of 1979 at IIASA. While many of these results are not fully completed, and some represent only preliminary directions of research, we feel that the documentation of the efforts of the Junior Scientists is justified.

PREFACE

Complete demand systems have not been widely used as parts of larger macro-economic models. This is, however, an important research area because of some of the properties that demand systems have. In this paper, we shall make an attempt to use a demand system as a part of an input-output model.

The paper has been written mostly during the IIASA International Summer Program for Junior Scientists held in 1979. I am grateful to many people at IIASA for their help. Especially I would like to thank Douglas Nyhus who, as my adviser during the program, has given valuable comments and did not spare his time helping me to overcome all the problems and difficulties I had. I am also thankful to Markku Kallio for valuable comments and suggestions with respect to both this and future work.

The discussions with other Junior Scientists have been inspiring and valuable. I would like to thank especially John Mayo and Stephen Sheppard.

All the remaining mistakes are, however, mine. Anyone mentioned above can not be held responsible for these.

CONTENTS

I. INTRODUCTION

Medium and long-range simulation and forecasting of economic development have become more and more important research areas. Modelling the development of economic phenomena in a perspective longer than the foreseeable future means that we have to be able to take the structural changes taking place in the economy into consideration. This, on the other hand, is only possible by using input-output type models.

In this paper we shall summarize some features of the Finnish input-output model system being developed in the Department of Economics in the University of Oulu. This modelis going to be used in simulating and analyzing long-range development possibilities of the Finnish economy. The main topic of the paper is demand analysis by means of a complete demand system and its application in the input-output framework.

An important feature in the development of input-output models since the first versions has been the combining of other econometric techniques to the basic model. The notion that input-output modelling is only concerned with the fixed Leontief inverse multiplier effects remains very rooted in much of the literature. That this is not entirely the case has been clearly shown by such models as the Cambridge Growth model and the INFORUM model.

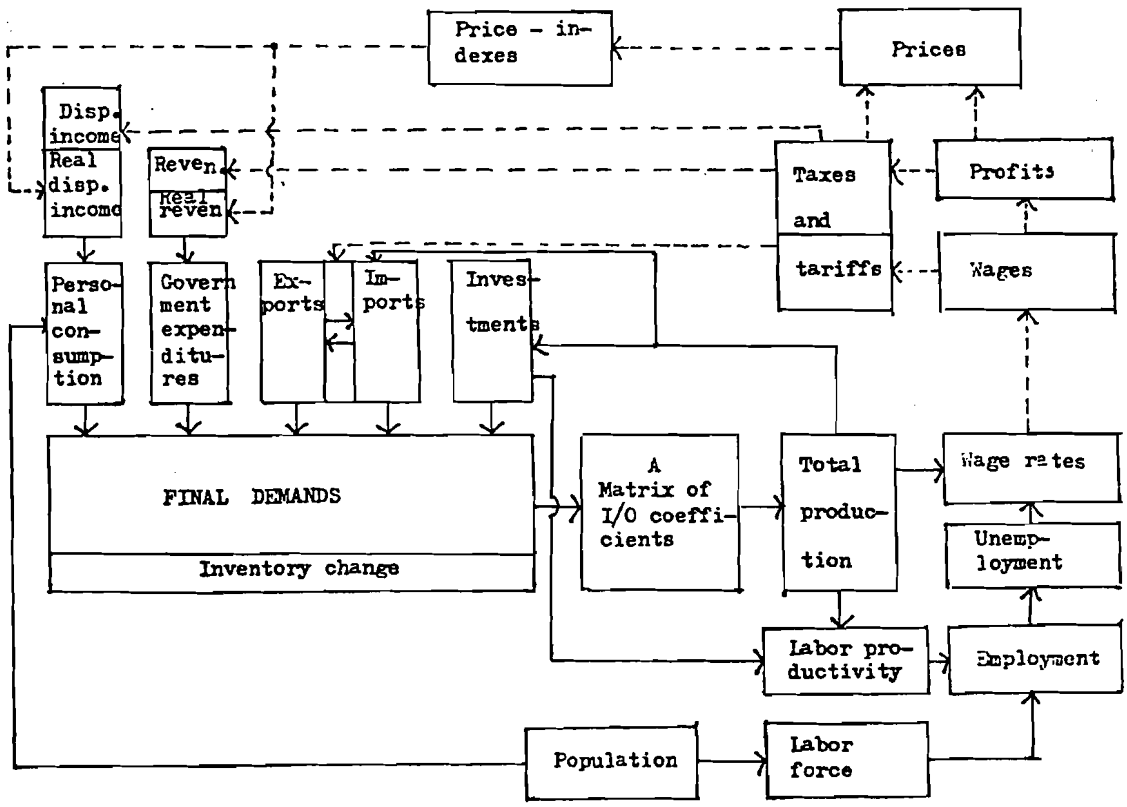
All national economic models, however good, are incomplete as long as the foreign trade sector in them is either exogenous or at least independent of the development in main trading countries. To overcome this difficulty the INFORUM research group at the University of Maryland has started to develop a system of national models that could be linked together through a trade model. This line of research is presently being carried out jointly with IIASA. As we see the proper forecasting of foreign trade as one of the key areas in our research, we shall also outline some possible lines of research in this area.

The basis of the Finnish long-range input-output model has been presented in Mäenpää (1978). Here we shall especially develop further the private expenditures submodel. The structure of the paper is as follows. In chapter two the main features of the Finnish model, as well as different solution algorithms are discussed. In chapter three the private consumption expenditures block of the model is derived and some results of estimations presented. In chapter four some simple simulations with the estimates from the demand equations are done and the results discussed. Some lines of future research are discussed in chapter five.

II. STRUCTURE OF THE MODEL AND SOLUTION ALGORITHMS

The structure of the model can be seen from the following diagram. Connections shown by solid lines refer to the real side of the model; dotted lines refer to financial links belonging to the price side of the model. Only the real side is under construction at the moment. The basic logic of the model is usual input-output model logic. No macroeconomic driver is used. The development of the components of final demand is projected in their own submodels.

Flow diagram of the Finnish long-range model system



The connections between final demand components and total production are manifested in the A matrix of input-output coefficients which transform final demands into a set of mutually consistent total productions of industries. From total products we estimate investments and labor productivity as well as wage rates, which are also dependent on unemployment rates. The price-model operates on cost push or cost passthrough basis prices being determined through production costs. Profits are determined from wages by means of a mark-up hypothesis. Through taxation models the financial flows turn into personal disposable incomes and government revenues. By means of price indexes disposable personal incomes and government revenues are transferred to real disposable incomes and real government revenues.

This basic logic is the same for both the INFORUM model and the Finnish model, abbreviated FMS (Finnish Long-Range Model System). The differences appear in the submodels and in the solution routines.

Analytically the basis of the production model is the well known accounting identity:

$$x + x^M = Ax + x^C + x^G + x^I + x^E \quad ,$$

where x = (38*1) column vector of gross outputs of industries

x^M = (38*1) vector of competitive imports

Ax = (38*1) vector of intermediate sales

x^C = (38*1) vector of private consumption expenditures

x^G = (38*1) vector of government expenditures

x^I = (38*1) vector of gross fixed capital formation

x^E = (38*1) vector of exports.

The list of industries is given in Appendix I. The technical input-output coefficient matrix A has been derived by summing the flows of domestic intermediate and competitive imports intermediate sales. This fact has to be noticed carefully, since it implies the assumption of fixed proportions in total intermediate usage, and thus complete substitutability of domestic and imported competitive goods as inputs in production.

The solution algorithms of the models differ somewhat. Basically both models are simulation models, i.e. not general equilibrium models, in the sense that the solution would be a price vector equating the supply and demand sides of the economy. In the solution process of the INFORUM model[1] a target level of employment is first fixed. A trial projection of disposable real income is made, personal consumption expenditures, government expenditures, exports and investments are then derived to form the final demands. Imports and inventory changes are then calculated sector-by-sector along with outputs in a Seidel iterative process. From outputs we have employment and we can compare the employment level generated by the initial income level and the target level. If the derived unemployment level is below the target level, the disposable income projection is revised upwards and the calculations performed again until the target level is reached. The problem now is that the output level we have reached also creates a pre-tax income level and we do not know whether this coincides with the given disposable income. The INFORUM model assumes that the Congress will adjust the tax rates accordingly.

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1. See Almon - Buckler - Horwitz - Reimbold (1974, p.9) and Almon (1979, p. 5-6).

The difficulty with this algorithm is that the tax rates may have to be set so low, that the employment target might remain a target. Also,although the tax rates are the most powerful policy instrument, they do not seem to be very responsive or elastic with respect to economic development. Moreover, the knowledge of the empirical effects of the tax basis changes is not very well established.

The original algorithm for the Finnish model has been proposed by Mäenpää (1978, p. 103-109). The solution is found as follows.The growth rate of GNP, and accordingly the aggregate private consumption and investments (with fixed savings rate), are fixed. The initial private and public expenditures are estimated in their submodels and with exogeneous imports run in the production model. Taxes are held constant. Employment and investments are derived from outputs by production functions of the vintage type. The model is iterated until an equilibrium with respect to GNP target is reached. If investments at the solution are higher than income less consumption the initial growth rate of GNP has been too high.

The problem with this algorithm is that it does not necessarily converge. Besides, the differential adjustment processes in the economy can affect the solution remarkably.

The international linking mechanism under construction by Douglas Nyhus offers another method for solving a national model. We start with an initial target for imports in the national model, feed this level to the international trade model and receive exports. With these exports we can adjust the growth rate of the open sector of the economy. We have two possible ways to proceed. Either we can fix the total growth rate and iterate the national model as long as the growth of the closed sector is high enough to produce the required total growth. The other possibility is to use the growth rate of the closed sector as a policy instrument.

Before turning to the personal consumption expenditures model, a few words on the programming of the model are necessary. The core of the programming is the FORP input-output forecasting program developed by the INFORUM research group under Clopper Almon. This program is now operating on the IIASA PDP 10/70 under the Unix operating system.

This program can be used with an input-output table for one year as basic data. The program generates five percent exponential growths to all final demand components and, since the technical coefficients are fixed in this basic form, five percent yearly growths on outputs. This form of FORP, called SLIMFORP, is thus extraordinarily uninteresting as an economic model. But it becomes interesting as soon as we note that this basic program can easily be converted into more complicated forms - fattened, is the proper term. All five percent exponential growths can, with some programming, be changed to any kind of function one is willing to use for forecasting the development of final demand components. Also several kinds of changes can easily be introduced to technical coefficients. The simulations presented in chapter IV are done with FORP.

III. PRIVATE CONSUMPTION EXPENDITURES IN THE MODEL

3.1. Derivation of the expenditure model

Personal consumption expenditures are by far the largest individual item of GNP in most countries. Therefore the proper forecasting of this item is very important. The development of estimation techniques and computation possibilities has led to increased usage of complete systems of consumer demand equations. Complete systems of consumer behaviour have, however, not been widely used as parts of larger macro-economic models. The exceptions are the INFORUM model and the Cambridge Growth model. In the INFORUM model a system of consumer demand equations called the Symmetric Demand System and developed by Almon (1978) is used. In the Cambridge model the Linear Expenditure System is used (Stone 1954).

In the FMS model, we have been working with linear expenditure type demand equations. The results for long-range projections with disaggregated data have not been very encouraging. It is obvious that the linearity of the Engel curves is a severe restriction with respect to longer time period usage. Also, as we know from the work of Angus Deaton (1974), the additivity of preferences is a very restrictive assumption, because it implies a dependency between own price and total expenditure elasticities, which is hard to justify.

As stated above, the underlining idea behind the linear expenditure system is the rational utility maximising average consumer. The preferencies are supposed to be able to be expressed by the Stone-Geary utility function:

$$u = \sum_{i=1}^{n} b_i \ln(q_i - c_i) \ ,$$

where $b_i > 0$ and $q_i - c_i > 0$ for all $i=1,\dots,n$ and b_i and c_i are constants.

Maximising this utility function under the budget constraint leads to the demand equations of the form:

$$p_i q_i = p_i c_i + b_i (y - \sum_{i=1}^{n} p_i c_i)$$

or written as a whole system:

$$\hat{p}q = \hat{p}c + b(y - p'c),$$

where $\hat{p}$ = (n*n) diagonal matrix of prices of the n commodities in the model

q = (n*1) vector of quantities consumed of the n commodities

c = (n*1) vector of parameters

b = (n*1) vector of parameters

y = total expenditures.

Note, that by defining y as total expenditures we exclude savings from the model - or rather transfer it to the consumption function research.

The linear expenditure system can be also derived dually. From Gorman (1953), we know that the general class of indirect utility functions corresponding to linear Engel curves is of the form:

$$v(p,y) = \frac{[y-a(p)]}{b(p)}$$

where a(p) and b(p) are homogeneous of degree one. Solving for y yields:

$$y = a(p) + b(p)\ v(p,y)$$

This can be written as:

$$m(u,p) = a(p) + b(p)u ,$$

where m(u,p) is the expenditure function and u is derived by monotone transformation.

If we set $a(p) = \sum_{i=1}^{n} p_i c_i$ and $b(p) = \prod_{i=1}^{n} p_i^{b_i}$ and use the well known property of the expenditure function, that its partial derivatives with respect to prices yield the Hicksian demand functions, we have:

$$p_i q_i = p_i c_i + b_i (y - \sum_{i=1}^{n} p_i c_i).$$

The interpretation of the model is as follows. In the utility function, assume that $c_i \to q_i$ for all i=1,...,n. Then clearly $u \to -\infty$ so that the closer the amount of c_i is to q_i the smaller is the level of utility derived. This has led to the interpretation of the c parameters as 'committed quantites'. The parameters b give the allocation of 'supernumerary quantities'.

3.2. Properties of the linear expenditure system

When looking at the properties of the system, it is easy to notice that the demand functions are homogeneous of degree zero. To have adding-up, we must have

$$i'\hat{p}q = i'\hat{p}c + i'b(y - p'c) = y$$

or $$i'\hat{p}c + i'by - i'\hat{p}c = y ,$$

which yields $i'b = 1$, where i = identity column vector.

This summation property has great advantages over individual nonadding-up demand functions in forecasting, since adding-up prohibits consuming more than total expenditures. The Slutsky symmetry is not so obvious, but can be shown to exist if adding-up holds. For negativity we must have $y - p'c > 0$, which implies $q > c$.

It is obvious, that this system has, besides an intuitively appealing interpretation, many desirable properties. This model, however, has also some strong restrictive features, which can be seen by looking at the formulas for elasticities, which are not parameters of the system.

Income elasticities, or total expenditure elasticities, can easily be seen to be of the form:

$$e = y\hat{q}^{-1}\frac{\partial q}{\partial y} = \hat{p}^{-1}\hat{q}^{-1}by.$$

Noting $\hat{p}qy^{-1} = w$, where w = vector of budget shares, we can write:

$$e = \hat{w}^{-1}b$$

or $$e_i = b_i/w_i \quad \text{for } i=1,\dots,n.$$

This result has interesting implications. To see these, we have to look at the convexity conditions. Consider a two good indifference curve:

$$u(q_i,q_j) = b_i \ln(q_i-c_i) + b_j \ln(q_j-c_j) = k,$$

where k is constant. Totally differentiating, we have:

$$du = \frac{b_i}{q_i}\, dq_i + \frac{b_j}{q_j}\, dq_j = 0.$$

Solving yields:

$$\frac{dq_i}{dq_j} = -\frac{q_i}{q_j}\frac{b_j}{b_i}.$$

So that $$\frac{d^2q_i}{dq_j^2} = \frac{q_i}{q_j^2}\frac{b_j}{b_i}.$$

For the indifference curve to be strictly convex, we must have

$$\frac{d^2q_i}{dq_j^2} > 0$$

This implies that b_j / b_i must be positive. Since we have adding-up, we can write,

$$\frac{b_j}{b_i} = \frac{b_j}{1-b_j} = \frac{1}{1/b_j - 1} > 0$$

$$\frac{b_j}{b_i} = \frac{1-b_i}{b_i} = \frac{1}{b_i} - 1 > 0 ,$$

so that b:s must be positive. Looking back at the formula of the income elasticities, we see that the positiveness of the b parameters implies that all income elasticities are positive, so that the inferior goods are excluded from the model. For small models this might not be a severe restriction, but for large models it is. The question we have to ask in this context is whether it is more serious to abandon the assumption of convexity than to exclude inferior goods. Since we want to estimate a model with up to 34 commodities, some of which can be expected to be inferior, the b parameters are not constrained to be positive in the estimation. Unfortunately this leads to troubles elsewhere in the model. These problems can be seen from the expressions of the price elasticities.

The matrix of uncompensated price elasticities can be shown to be of the form

$$E = \phi\hat{e} - ew' - \phi eb' ,$$

$$\text{where } \phi = - \frac{(y-p'c)}{y}$$

is the inverse of Frisch's income flexibility of money. For any single commodity the own price elasticity can be written:

$$e_{ii} = \phi e_i - e_i(w_i + \phi b_i).$$

From this we see that since ϕ is negative, if convexity holds, all own price elasticities are negative. But if convexity is violated, own price elasticities become positive. To have an inferior good with positive own price elasticity is obviously nonsense. The own price elasticity formula above reveals still another problem that the model inherently has. Since w_i and b_i are small compared with e_i, the first term is nearly always dominant over the others. Thus we have an approximation:

$$e_{ii} \approx \phi \, e_i \ .$$

This approximation can be shown to be an implication of the additiveness of the utility function (Deaton 1974). This relationship is very severe. Empirically it has been shown to be very strong (see Deaton 1975, Svento 1979). On the other hand from the studies done with individual demand functions, we know that this kind of relationship has not emerged.

With respect to forecasting, we still have to mention two severe problems. One of these has already been mentioned - namely the linearity of the Engel curves. The structural changes taking place in the forecast period make the linear Engel curves forecasts quite unreliable. In this respect the model should be developed so that this linearity could be abandoned. Later on, we shall propose some ways on doing this non-linearization.

The other of the above mentioned problems with the model is the constancy of the allocation parameters. Changes in tastes and income pattern, for instance, can be expected to effect the allocation parameters. This indicates making these parameters functions of time or some other variable.

3.3. Estimation of the linear expenditure system

When estimating a linear expenditure type demand system we are faced with some difficulties. The most important ones of these can be stated followingly:

1. Even though the model is linear in variables, it is non-linear in parameters.
2. Existing time-series of data do not allow for proper estimation of large models.
3. Adding-up property causes the variance-covariance matrix to be singular.

I shall not go through the solutions to the problems in detail here. A good survey of the possibilities has recently been given by Deaton (1975).

Non-linearity is usually handled with iterative estimation. In ordinary least squares estimation for instance, the first order conditions for the minimum of the residual sum of squares can be shown to be such, that the b parameters are linear functions of the c parameters. The linearity does not however, hold with respect to c parameters. We make an initial quess (usually the vector of zeros) for the c vector, solve for b:s and using these solve for new c:s and so on, until the estimation converges.

The problem with time-series is not only a technical difficulty. The data does not exist for large estimations in the sense, that the series are too short for the degrees of freedom in the model. In order to estimate large disaggregated demand systems we have to use some a priori information to increase the number of observations. We have adopted an assumption proposed by Deaton (1975), that the variance-covariance matrix is that of an multinomial distribution. The matrix is of the form:

$$\Omega = \delta^2(\hat{x} - xx') ,$$

where Ω = the variance-covariance matrix

δ^2 = parameter to be estimated (scaling factor)

x = vector of average budget shares, where

$$x_i = \frac{1}{T}\sum_{t=1}^{T} w_{it} , \quad i=1,...,n.$$

This form is especially useful , since the elements of the covariance matrix are dependent on the share of the commodity in the budget. Thus commodities with large budget shares have a bigger weight in the error structure.

The third major problem in estimation, the singularity of the covariance matrix is usually solved by the Barten elimination method (Barten 1969).

The parameters to be presented have been estimated under the above assumption of the form of the variance-covariance matrix. Otherwise the estimation is a maximum-likelihood estimation. Before estimation the model was rewritten into the form:

$$\hat{p}_t q_t = \hat{p}_t c + (b^0 + b^1 t)(y_t - p_t'c) + e_t ,$$

$\hat{p}_t$ = diagonal matrix of prices in year t (34*34)

q_t = vector of quantities consumed in year t (34*1)

b^1 = vector of trend factors in year t (34*1)

b^0 = vector of allocation parameters in year t (34*1)

c = vector of committed quantities (34*1)

y_t = total expenditures in year t

e_t = vector of residuals in year t (34*1).

3.4. Estimated parameters and elasticities of the model

The Central Statistical Office of Finland has kindly given their unpublished consumption series to be used in this study. The series constitute of 51 categories of consumption expenditures in years 1948 - 1975. Years 1948 and -49 were left out from the estimation, since they cannot be regarded as normal years in the respect that many restrictions were still valid after the war. The series have been deflated by average population to per capita figures. The prices used are Paasche implicit price deflators, with the base year in 1970. This is also the base year of the trend variable.

The model has been estimated for several levels of aggregation. Here the results for the broadest classification used, namely that of 34 commodities are presented. Other results have been presented in Svento (1979).

Durable goods (automobiles, household equipment and furniture) have been omitted from the estimations, since a static model cannot be presumed to explain well enough variables with strong dynamic elements.

In table 1 the parameters b^0, b^1 and c, as well as their standard deviations, R^2- and Durbin-Wattson statistics are presented. The correlation coefficients and the Durbin-Wattson statistics are presented for both expenditures (ex, meaning current prices) and quantities (q, for constant price series).

In table two the total expenditure elasticities for years 1950, -55, -60, -65, -70, -75 are presented. In table three we have the own price elasticities for the respective years.

The results need some comments. Starting from the parameters themselves, we see that adding-up holds for b^0 parameters and that the trend parameters sum to zero. All but one allocation parameter, namely that for arts and sports (27) are positive. The greatest allocation parameters are those of housing and private transportation (which here means only the costs of private transportation). The allocation parameters for food items are , except for meat, lower than other items. On the other hand the committed quantities are high for food items, which can also be expected. Other big necessary quantities are those of beverages, clothing, heat and public transportation. Except for the beverages, these are also understandable. The biggest individual committed quantity is however that of housing.

The standard deviations are generally low. The multiple correlation coefficients are very high. All correlation coefficients for quantities are lower than the respective coefficients for expenditures. This can be explained by the common trend factor in prices, which makes the expenditure series highly multicorrelated. The expenditure error terms are also autocorrelated.

The elasticities turn out to be generally acceptable. Some total expenditure elasticities turned out to be unsensible in 1950, these have been omitted.

From table two we see that for 1970, when the trend variable is zero, the model generates one inferior good (27), 15 normal goods and 18 luxury goods. All food items, except coffee, tea and cocoa and other food are normal goods. The luxuries are drinks, housing, transportation and service items, The negative elasticities for other years than 1970 can be explained by the trend factor. High (with respect to the respective allocation parameter) negative trend parameters can change the sum b^0+b^1t negative in years 1970-75, when the t variable is positive and high relative positive trend parameters can change the sum negative in the pre 1970 years.

All total expenditure elasticities approach the limit of one with some fluctuations. This happens because the b parameters are marginal budget shares approaching real budget shares as income increases. That the b parameters are marginal budget shares can be easily seen by derivating the model with respect to total expenditures.

As can be expected, we see from table three that for 1970 the own price elasticity of commodity 27, arts and sports is nonsensically positive. All demands are inelastic. Closest to unitary elasticity comes costs of private transportation, which is somewhat surpraising, but also encouraging. This phenomen may be explained by the popular holiday driving in Finland. This easily means long distances in a country shaped like Finland. The food items are generally closest to perfect inelasticity.

Table 1. Maximum likelihood estimates of the LES.

	b^0	$b^1 \times 10^2$	c	R^2_{ex}	R^2_g	DW_{ex}	DW_g
1. Bread and cereals	.0031 (.0031)	-.0419 (.0289)	217.71 (5.79)	.9994	.7164	1.3432	.0514
2. Meat	.0732 (.0034)	.0755 (.0290)	206.25 (9.59)	.9995	.7979	.9773	.0959
3. Fish	.0060 (.0011)	.0362 (.0126)	33.26 (1.94)	.9961	.8767	1.4483	.1521
4. Dairy products	.0268 (.0031)	-.0758 (.0307)	212.45 (6.73)	.9987	.8002	1.7992	.0708
5. Fats and oils	.0025 (.0020)	-.1148 (.0211)	127.76 (3.95)	.9984	.8245	1.1396	.0725
6. Fruits and vegetables	.0286 (.0017)	.0261 (.0176)	90.25 (3.50	.9970	.8739	.9504	.1880
7. Sugar and sweets	.0254 (.0015)	-.0840 (.0151)	77.52 (3.37)	.9992	.8584	1.1604	.2181
8. Coffee, tea and cocoa	.0320 (.0011)	-.0255 (.0157)	49.35 (3.46)	.9980	.9722	.8663	.3685
9. Other food	.0049 (.0008)	.0444 (.0080)	13.3 (1.42)	.9846	.8502	1.1113	.2950
10. Non-beverages	.0133 (.0008)	-.0070 (.0083)	6.70 (1.61)	.9936	.8971	.5485	.1671
11. Beverages	.0781 (.0032)	.2959 (.0289)	131.59 (6.16)	.9982	.8994	.7392	.1252
12. Tobacco	.0283 (.0028)	-.1858 (.0280)	97.52 (7.33)	.9990	.8350	1.1906	.0650
13. Footwear	.0104 (.0012)	-.0115 (.0147)	49.25 (2.29)	.9962	.9361	2.4284	.2777
14. Other clothing	.0408 (.0028)	.1150 (.0288)	266.98 (5.09)	.9950	.8965	1.6975	.1371
15. Personal items	.0099 (.0011)	.0087 (.0091)	23.87 (1.70)	.9964	.8329	1.2968	.1530
16. Housing	.1159 (.0070)	-.4568 (.0834)	294.86 (22.91)	.9993	.8903	.7291	.0648
17. Heat	.0126 (.0021)	-.0363 (.0123)	140.40 (4.22)	.9991	.7013	1.7225	.1260
18. Light	.0145 (.0007)	-.0208 (.0091)	16.35 (1.41)	.9917	.9103	.8020	.5119
19. Domestic services	.0023 (.0011)	.0196 (.0081)	24.62 (2.06)	.9993	.7288	1.4327	.0782
20. Household consumption	.0100 (.0013)	.1227 (.0118)	38.75 (2.00)	.9969	.8714	1.4667	.1963
21. Household services	.0043 (.0008)	.0004 (.0073)	13.19 (1.59)	.9992	.8076	.5445	.1041
22. Personal care	.0228 (.0011)	-.0046 (.0114)	24.39 (2.64)	.9990	.8887	1.6949	.1669
23. Health care	.0422 (.0015)	.0047 (.0162)	49.79 (4.09)	.9985	.8945	1.2345	.2076
24. Private transportation	.1106 (.0020)	-.0390 (.0222)	38.52 (8.73)	.9978	.8897	.7044	.2250
25. Public transporation	.0485 (.0028)	.1561 (.0253)	133.99 (5.56)	.9997	.8320	1.4620	.1104
26. Communication	.0189 (.0019)	.0319 (.0125)	22.72 (2.54)	.9993	.8991	1.0846	.2140
27. Arts, sports and entertainment	-.0015 (.0013)	.0418 (.0115)	30.09 (2.36)	.9945	.6996	.7955	.0455
28. Hotels and restaurants	.0303 (.0022)	.1387 (.0165)	60.94 (4.06)	.9995	.8039	1.1026	.1089
29. Books and magazines	.0160 (.0033)	.2971 (.0238)	88.23 (6.03)	.9967	.7754	.7584	.0988
30. Other recreation	.0396 (.0015)	-.0827 (.0158)	34.11 (4.90)	.9989	.9017	1.3636	.1476
31. Financial services	.0486 (.0023)	.1542 (.0206)	74.69 (4.77)	.9975	.8606	.7927	.1706
32. Education and research	.0299 (.0031)	-.2723 (.0142)	24.13 (9.22)	.9924	.7856	.5375	.1101
33. Other services	.0271 (.0016)	-.0194 (.0136)	42.09 (4.17)	.9991	.8347	.9171	.1337
34. Expenditures abroad	.0263 (.0018)	.0741 (.0157)	39.16 (3.98)	.9532	.8461	1.3434	.1530

Table 2. Total expenditure elasticities of LES: $e_i = b_i/w_i$.

	1950	1955	1960	1965	1970	1975
1. Bread and cereals	.1607	.1607	.1149	.0896	.0701	.0206
2. Meat	1.0739	1.0360	1.0552	1.0438	.9969	.9844
3. Fish	-.0862	.0389	.2087	.3712	.6463	.8030
4. Dairy products	.5296	.6551	.5030	.4826	.4950	.4808
5. Fats and oils	.4004	.4416	.3310	.2315	.0937	-.1790
6. Fruits and vegetables	.4913	.5176	.8175	.8596	.9348	.9534
7. Sugars and sweets	1.1438	1.0545	.9237	.9791	.9524	.7447
8. Coffee, tea and coca	1.9313	2.0683	1.6509	1.5584	1.3347	1.1917
9. Other food	-.5871	-.3573	.0969	.6564	1.0130	1.1762
10. Non-beverages		3.8077	3.0263	2.2488	1.8410	1.5861
11. Beverages	.4473	.7785	1.0949	1.2804	1.2856	1.3397
12. Tobacco	2.2550	1.7309	1.3652	1.0618	.8862	.8038
13. Footwear	.4181	.5548	.5776	.6682	.7213	.8139
14. Other clothing	.1056	.2126	.3269	.4278	.5727	.6969
15. Personal items	.7181	.9331	.9931	1.0185	1.0865	.9914
16. Housing		2.0055	1.3570	1.1482	1.0538	1.0748
17. Heat	.4236	.3550	.4202	.4356	.3754	.2872
18. Light	1.8236	1.4786	1.5897	1.5981	1.4984	1.3511
19. Domestic services	-.1959	-.0926	.0468	.2224	.3843	.4889
20. Household consumption	-.6763	-.5033	-.1562	.3328	.8258	1.0284
21. Household services	.9170	.9154	.9229	.9577	.9465	.8854
22. Personal care	2.5624	1.9605	2.0191	1.7657	1.5259	1.3867
23. Health care	1.9341	1.7046	1.8166	1.6715	1.4764	1.3717
24. Private transportation		4.5603	3.6481	2.5935	1.9528	1.6750
25. Public transportation	.4263	.5989	.7452	.9303	1.0074	1.0518
26. Communication	1.6813	1.6700	1.6593	1.5631	1.4659	1.4065
27. Arts, sports and entertainment	-.8730	-.9622	-.7670	-.5313	-.2789	.1067
28. Hotels and restaurants	.1311	.5631	.9429	1.1250	1.1861	1.1744
29. Books and magazines	-1.5752	-1.5322	-.7419	.0597	.6503	1.0196
30. Other recreation		2.9726	2.6309	1.9477	1.6278	1.4376
31. Financial services	.6682	1.0775	1.3140	1.3944	1.3364	1.3287
32. Education and research		5.9840	4.0368	2.3954	1.6576	1.2357
33. Other services	2.8363	1.9301	1.8142	1.5553	1.3307	1.1984
34. Expenditures abroad	1.8822	1.1861	1.5210	1.5764	1.3535	1.3420

Table 3. Own price elasticities in LES: $e_{ii} = \beta e_i - e_i(w_i + \beta b_i)$.

	1950	1955	1960	1965	1970	1975
1.Bread and cereals	.0077	-.0224	-.0248	-.0322	-.0341	-.0149
2.Meat	.0642	-.1410	-.2166	-.3638	-.4834	-.5636
3.Fish	-.0092	-.0037	-.0343	-.1162	-.2912	-.4345
4.Dairy products	.0194	-.0894	-.1038	-.1724	-.2407	-.2746
5.Fats and oils	.0217	-.0594	-.0639	-.0778	-.0440	.0994
6.Fruits and vegetables	.0346	-.0658	-.1480	-.2807	-.4317	-.5253
7.Sugar and sweets	.0903	-.1205	-.1705	-.3175	-.4375	-.4116
8.Coffee, tea and cocoa	.1310	-.2268	-.2958	-.4959	-.6056	-.6452
9.Other food	-.0673	.0309	-.0153	-.2011	-.4524	-.6326
10.Non-beverages	1.1086	-.3197	-.4709	-.6859	-.8197	-.8514
11.Beverages	.0341	-.0950	-.2081	-.4268	-.6042	-.7438
12.Tobacco	.1894	-.1891	-.2466	-.3473	-.4106	-.4413
13.Footwear	.0372	-.0567	-.0990	-.2112	-.3272	-.4414
14.Other clothing	-.0052	-.0404	-.0779	-.1601	-.2846	-.4024
15.Personal items	.0779	-.0839	-.1598	-.3152	-.4875	-.5358
16.Housing	.8762	-.3175	-.3358	-.4384	-.5295	-.6151
17.Heat	.0304	-.0464	-.0795	-.1445	-.1771	-.1629
18.Light	.1977	-.1358	-.2560	-.4923	-.6701	-.7274
19.Domestic services	-.0221	.0082	-.0075	-.0686	-.1725	-.2642
20.Household consumption	-.0685	.0497	.0262	-.1044	-.3729	-.5581
21.Household services	.1062	-.0784	-.1450	-.2933	-.4226	-.4765
22.Personal care	.2788	-.1793	-.3252	-.5458	-.6848	-.7485
23.Health care	.1829	-.1745	-.3083	-.5273	-.6700	-.7459
24.Private transportation	2.7549	-.4443	-.6092	-.8101	-.8816	-.9083
25.Public transportation	.0334	-.0726	-.1432	-.3111	-.4780	-.5879
26.Communication	.1883	-.1481	-.2658	-.4828	-.6574	-.7584
27.Arts, sports and entertainment	-.0968	.0867	.1238	.1652	.1255	-.0577
28.Hotels and restaurants	.0133	-.0549	-.1584	-.3563	-.5409	-.6428
29.Books and magazines	-.1554	.1568	.1288	-.0192	-.3001	-.5601
30.Other recreation	.6836	-.2813	-.4314	-.6082	-.7336	-.7781
31.Financial services	.0616	-.1109	-.2277	-.4462	-.6130	-.7279
32.Education and research	-2.5512	-.5232	-.6399	-.7379	-.7438	-.6673
33.Other services	.3013	-.1824	-.2988	-.4862	-.6018	-.6512
34.Expenditures abroad	.2135	-.1103	-.2474	-.4895	-.6114	-.7272

Similar estimations were also performed with the years 1950-69 as a sample period. Simulations for the years 1970-75 were then calculated. The results have been somewhat disappointing. Because of the linearity of the Engel curves the model is uncapable of detecting structural changes in the forecast period. The model should in this respect be revised so, that this linearity could be abandoned. One line of research in this direction is the one proposed by Carlevaro (1976). His idea is to set the allocation parameters related to income. He shows that an integrable class of demand functions with this property can be written:

$$q = c + \hat{p}^{-1} b g(y)(y - p'c).$$

If $g(y)$ is monotone increasing, we have strictly concave Engel curves for inferior goods and strictly convex Engel curves for luxury goods.

Another possibility is to set the committed quantities dependent on real income:

$$q = c(\tfrac{y}{P}) + \hat{p}^{-1} b(y - p'c(\tfrac{y}{P})).$$

Under what conditions this class of demand functions is integrable remains to be seen.

IV. THE EFFECTS OF PRIVATE CONSUMPTION EXPENDITURES IN 1970 - 1975

4.1. Rewriting the production model

Since the price model is not yet operative we cannot proceed with proper forecasts. Instead we shall do some simple simulations for the years 1970 - 75, for which period we can use the prices and total expenditures as exogeneous variables. The purpose of these simulations is twofold: to study the effects private consumption expenditures had on the economy as a whole during these years and to do some policy analysis. Total expenditures being exogeneous, we don't specify any total consumption function. In order to do the simulations we write the production model in the form:

$$x + x^{M} = Ax + Bx^{Cc} + x^{G} + x^{I} + x^{E} ,$$

where B = industry*category of consumption expenditures (38*37) bridge table

x^{Cc} = (37*1) vector of predicted consumption expenditures in categories of private consumption.

The bridge table is used to invert the consumption expenditures of commodities into demands of industries. The dimension of the vector of consumption expenditures is 37 because we have included the three durable goods categories, which are also exogeneous. Other components of final demand grow in these simulations with five percentage in a year. For the period in question this is a good average.

From table four we see the predicted absolute growths and growth rates for the period for the output and final demand components. The estimates of USE and total output are biased downwards.[1)] This can be explained by classification differences in the personal consumption expenditures data and input-output accounts. The differences are most striking with respect to hotels and restaurants and housing. In the consumption series only the services sold are included as in input-output accounts also the the value of commodities sold is included. For housing in input-output accounts, the costs of housing are calculated independent of the ownership relation.

The transportation equipment output is highly underestimated because of the low relationship between domestic production and sales taxes and import duties in the bridge table. The petroleum output is higly overestimated because of the fact, that at the moment heating costs of housing cannot be properly separated in the bridge table. In the future these mistakes will be corrected.

The respective real growth rates for GNP were: 2.14, 6.75, 4.26 and .90 so that the model underestimates on 1971, slightly overestimates on 1971-73, hits the target in 1974 and again overestimates on 1975. The overestimation in 1975 is mainly due to high overestimation of exports in that year. What has been said here is true only under the assumption that GNP and USE change in a similar way.

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1) We call gross output of table four USE for short, since it is defined by: final demand + inventory change - imports. We dont't have a proper estimate for GNP, since we have not included the value added components of final demand categories in the analysis.

Table 4. Simulated growth for 1970 - 1975

SECTOR	FORECAST FOR: FORP CONSUMPTION SIMULATION 1970	1971	1973	1974	1975
GROSS OUTPUT	415388.	431107.	489871.	511232.	534012.
OUTPUT	1115046.	1158626.	1306000.	1363978.	1422667.
PRIVATE NON-PROF SER	3195.	3359.	3712.	3902.	4102.
GOV SERV, CENTRAL	9309.	9786.	10816.	11370.	11953.
COMM PROD, CENTRAL G	-722.	-759.	-839.	-882.	-927.
GOV SERV, LOCAL	13424.	14112.	15596.	16396.	17237.
COMM PROD, LOCAL GOV	-1358.	-1428.	-1578.	-1659.	-1744.
EXPORT	110530.	116197.	128418.	135002.	141923.
CONSUMPTION	249141.	256948.	298648.	310815.	323930.
IMPORTS	94439.	99281.	109722.	115348.	121262.
INVENTORY CHANGE	11913.	11913.	11913.	11913.	11913.
INVESTMENT	114395.	120260.	132908.	139722.	146886.

SECTOR	FORECAST FOR: FORP CONSUMPTION SIMULATION 70-71	71-73	73-74	74-75
GROSS OUTPUT	3,71	6,39	4,27	4,36
OUTPUT	3,83	5,99	4,34	4,21
PRIVATE NON-PROF SER	5,00	5,00	5,00	5,00
GOV SERV, CENTRAL	5,00	5,00	5,00	5,00
COMM PROD, CENTRAL G	5,00	5,00	5,00	5,00
GOV SERV, LOCAL	5,00	5,00	5,00	5,00
COMM PROD, LOCAL GOV	5,00	5,00	5,00	5,00
EXPORT	5,00	5,00	5,00	5,00
CONSUMPTION	3,09	7,52	3,99	4,13
IMPORTS	5,00	5,00	5,00	5,00
INVENTORY CHANGE	0,00	0,00	0,00	0,00
INVESTMENT	5,00	5,00	5,00	5,00

From Appendixes I and II, we can see the predicted values and respective growth rates for consumption expenditure vectors and output vectors. The lowest predicted growth rate is that for grain industry, which is also clear when we remember that the total expenditure elasticity for bread and cereals was very low. The textile industry, which also has a low growth rate, has troubles with competitive imports. We can see the energy crisis in 1973-74. The wide fluctuation of transport equipment industry was overestimated in 1974.

4.2 Simulating the effects of the 1976-1977 deflation

In 1976-77, strong restrictive economic policies for anti-inflationary purposes were carried out in Finland. In practice, this meant moderate income policies and credit rationing. We try to simulate the effects of these policies in the following way. We proceed with two simulations, I and II. In I, which could be called income policy simulation, we fix the growth rate of the volume of total expenditures on non-durable commodities in 1974 and 1975 for those of 1976 (1.01) and 1977 (.98). In simulation II, which could be called credit rationing simulation, we also fix the durable goods consumption real growth rates (.93 and .92).

From Table 5. we can see the total effects. In both cases the growth rates of USE are, of course, lower than in the original simulation. Even though the growth rates are higher in 1974-75 (as compared with 1973-74) the absolute values are lower. The predicted final demand elements of the private consumption expenditures vector and the respective growth rates can be seen from Appendices IVa and IVb. The effects of I and II on growth rates of outputs can be seen from Appendix V. Again, to understand the growth rates we have to look at Appendix IVa. The higher growth rates in simulation II in 1975 do not mean higher respective base values.

Table 5. Deflation simulations for 1970 - 1975

(a). Restricted non-durables consumption

SECTOR	FORECAST FOR: FORP CONSUMPTION SIMULATION 70-71	71-73	73-74	74-75
GROSS OUTPUT	3,71	6,39	2,37	3,25
OUTPUT	3,83	5,99	2,65	3,21
PRIVATE NON-PROF SER	5,00	5,00	5,00	5,00
GOV SERV, CENTRAL	5,00	5,00	5,00	5,00
COMM PROD, CENTRAL G	5,00	5,00	5,00	5,00
GOV SERV, LOCAL	5,00	5,00	5,00	5,00
COMM PROD, LOCAL GOV	5,00	5,00	5,00	5,00
EXPORT	5,00	5,00	5,00	5,00
CONSUMPTION	3,09	7,52	0,86	2,26
IMPORTS	5,00	5,00	5,00	5,00
INVENTORY CHANGE	0,00	0,00	0,00	0,00
INVESTMENT	5,00	5,00	5,00	5,00

(b). Restricted total consumption

SECTOR	FORECAST FOR: FORP CONSUMPTION SIMULATION 70-71	71-73	73-74	74-75
GROSS OUTPUT	3,71	6,39	1,76	3,29
OUTPUT	3,83	5,99	2,12	3,26
PRIVATE NON-PROF SER	5,00	5,00	5,00	5,00
GOV SERV, CENTRAL	5,00	5,00	5,00	5,00
COMM PROD, CENTRAL G	5,00	5,00	5,00	5,00
GOV SERV, LOCAL	5,00	5,00	5,00	5,00
COMM PROD, LOCAL GOV	5,00	5,00	5,00	5,00
EXPORT	5,00	5,00	5,00	5,00
CONSUMPTION	3,09	7,52	-0,16	2,33
IMPORTS	5,00	5,00	5,00	5,00
INVENTORY CHANGE	0,00	0,00	0,00	0,00
INVESTMENT	5,00	5,00	5,00	5,00

V DIRECTIONS OF RESEARCH

In the future the work will proceed on completing all submodels of the system. With respect to the demand system, the main task will be to change the model so that it will become possible to forecast also the structural changes taking place in the demand pattern. This means non-linearization of the Engel curves as well as abolishing the assumption of fixed parameters. Also, the effects of income distribution and its changes should be included.

An important area for future work is the formulation and estimation of the price model of the system. The main factors to be considered in the price model are labor productivity, wage rates, capital costs, costs of intermediate inputs and taxes. In the most basic form the price model can be written in the form:

$$p = pD + fM + V,$$

where p = row vector of domestic prices

f = row vector of foreign prices

D = domestic input i-o matrix

M = i-o matrix of imported inputs

V = row vector of value added components.

The most difficult part of the price model is proper forecasting of the valve added components.

All national economic models, however good, are incomplete as long as the foreign trade block is exogeneous or independent of the development in the main trading countries. This fact led the INFORUM research group to develop the idea of a system of national input-output models linked together through a trade model. This model has been developed by Douglas Nyhus (1975).

The trade model focuses on forecasting exports of 119 commodities (mercandise) from nine developed countries and an 'others' region. Here some possibilities to separate from the 'others' region a region, which can be called 'small open economies' are studied. When speaking of small open economies, we mainly refer to Scandinavian countries. Research groups in Finland, Norway and Sweden are working on similar types of input-output models than INFORUM, and are interested to be linked into the trade model. As individual entities these countries might, however, be too small to be linked to the model themselves. Therefore we discuss some possibilities to link these countries to the model through an SOE (small open economies) block, which is only afterwards allocated among individual SOE countries.But first we shall have a closer look on the trade model.

The trade model in question is based on analysing and forecasting trade share matrixes of the commodities. A trade share matrix M is square and has as many rows and columns as there are countries in the model. The ith row of M expresses the exports of country i to each other country. The jth column of M expresses the imports of jth country from all other countries in the model. The diagonal element from-others-to-others is the only non-zero diagonal element. The matrix of market shares S is obtained by dividing each column of M by its column sum. The ijth element of S is thus the proportion of country j's imports coming from country i. The elements of S must satisfy the constraints of non-negativeness and adding-up.

The trade model focuses on predicting the S matrixes for all commodities. This is done by the following mechanism (Nyhus 1975). First an effective price for every commodity in every country is defined as a weighted average of present and past domestic prices:

$$p_{eit} = \sum_{\tau=0}^{5} w_\tau P_{it-\tau} ,$$

where P_{it} = domestic price of good in question in country i.

The weights will vary from commodity to commodity, but for a given commodity they will be same for each importer.

With the effective prices we simultaneously determine the world price of the commodity and substitution parameters from equations:

$$M_{ijt} = S_{ij0} M_{.jt} \left(\frac{p_{eit}}{p_{wjt}}\right)^{b_{ij}}$$

and

$$\sum_i S_{ij0} \left(\frac{p_{eit}}{p_{wjt}}\right)^{b_{ij}} = 1 ,$$

where p_{wjt} = world price of commodity as seen from country j

b_{ij} = substitution parameter of country i:s exports in country j:s imports.

$M_{.jt}$, the total imports in country j are determined in national models by the equation:

$$M_{.jt} = (a + bU_{jt})\left(\frac{P_{wjt}}{P_{jt}}\right)^{c} ,$$

where U_{jt} = domestic use of the good in country j in year t

P_{jt} = domestic price of good in country j in year t.

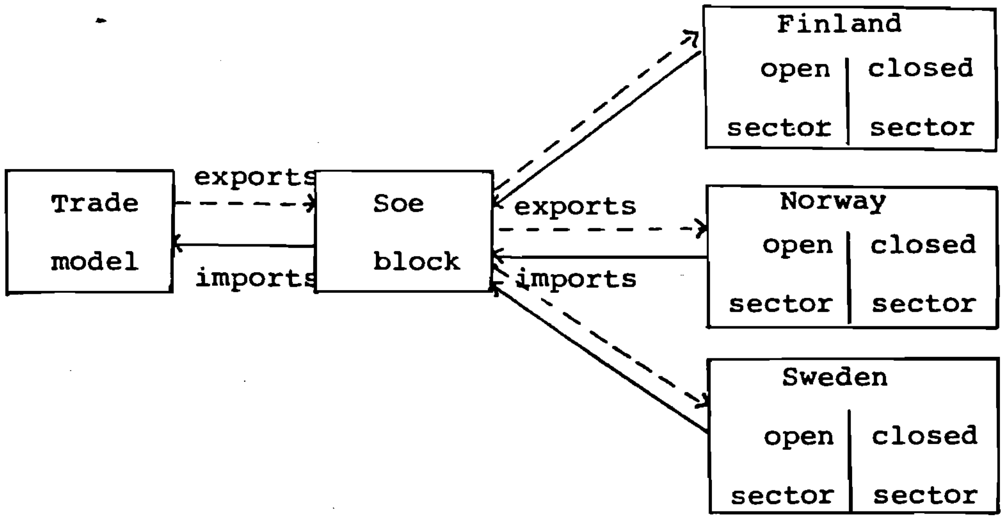
The determination of the world price has a crucial role in this mechanism. It ensures that global adding-up holds and appears as an explaining variable in the national import equations. Global adding-up can be seen by summing M_{ijt} over exporting countries:

$$\sum_i M_{ijt} = \sum_i S_{ij0} M_{.jt}\left(\frac{P_{eit}}{P_{wjt}}\right)^{b_{ij}} = M_{.jt}.$$

The world price is estimated with an non-linear estimation method using share terms. This means that the national import volumes are not needed in the determination of the world price. In the actual estimation also a trend factor is added to the equation of M_{ijt}.

When solving the trade model with SOE countries as an extra row and column in the market share matrixes, we have on the SOE column total imports of the commodity to the SOE countries and on the SOE row total exports of the commodity to all other countries from SOE countries. Also we have now two non-zero elements on the diagonal. The basic question is how to allocate these quantities between the SOE countries.

We can illustrate the situation with the aid of the following diagram.



The arrows in the diagram describe flows of information between the models of the system: the national models give imports which will be aggregated in the SOE block, and as fed in the trade model will give exports.

Instead of having one square trade share matrix for every commodity, in the SOE allocation model, we have two different non-square share matrixes for every commodity. These can be called the export matrix E and the import matrix M^0. Each element of $E - e_{ij} - i*1,2,3$, $j=1,...,11$ shows the volume of exports from economy i to country j. The row sums of E, $E_{\cdot j}$ give total imports of country j from small open economies as received from the trade model. The column sums are total exports of every SOE country.

Every matrix M^0 is a (11*3) matrix, and each element m_{ij} shows the volume of imports of small open economy j from country i.

The row sums $M^0_{.j}$ show total imports of country j as estimated in the national model. Column sums $M^0_{i.}$ show total exports of country i to small open economies. These matrixes can be illustrated followingly.

$$
\begin{array}{l|cccccc|l}
 & \text{Can} & \text{USA} & \text{Jap} & \ldots & \text{SOE} & \text{Others} & \\
\hline
\text{Fin} & e_{11} & e_{12} & & & & e_{1,11} & E_{1.} \\
\text{Nor} & e_{21} & e_{22} & & \ldots & & & \\
\text{Swe} & e_{31} & e_{32} & & & & e_{3,11} & E_{3.} \\
\hline
 & E_{.1} & E_{.2} & & & & E_{.11} & E_{..}
\end{array}
$$

$$
\begin{array}{l|ccc|l}
 & \text{Fin} & \text{Nor} & \text{Swe} & \\
\hline
\text{Can} & m_{11} & m_{12} & m_{13} & M^0_{1.} \\
\text{USA} & m_{21} & m_{22} & m_{23} & M^0_{2.} \\
\text{Jap} & & & & \\
\cdot & & & & \\
\cdot & & & & \\
\cdot & & & & \\
\text{SOE} & m_{10,1} & & m_{10,3} & M^0_{10.} \\
\text{Oth.} & & & & \\
\hline
 & M^0_{.1} & M^0_{.2} & M^0_{.3} & M^0_{..}
\end{array}
$$

The basic question for future work in this area is to construct the mechanism of forecasting the development of the elements of these matrixes.

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Appendix I. List of FMS-industries

01. Agriculture, hunting and fishing
02. Forestry and logging
03. Mining
04. Slaughtering, prepairing and preserving meat
05. Manufacture of dairy products
06. Grain mill products
07. Other manufacture of food products
08. Beverage and tobacco industries
09. Manufacture of textiles
10. Manufacture of clothings (also footwear), fur and leather products
11. Sawing, planing and preserving
12. Other manufacture of wood
13. Pulp mills
14. Manufacture of paper and paperboard
15. Manufacture of pulp, paper and paperboard articles
16. Printing and publishing
17. Manufacture of chemicals
18. Manufacture of chemical products
19. Petroleum re ineries, miscellaneous products of petroleum and coal
20. Manufacture of rubber and plastic products
21. Pottery, glass and earthenware products
22. Manufacture of metals
23. Manufacture of metalproducts
24. Manufacture of machinery
25. Manufacture of electrical products
26. Shipbuilding and repairing
27. Other manufacture of transport equipment
28. Other manufacture
29. Electricity, gas, steam, water works and supply
30. Building
31. Other construction
32. Trade
33. Restaurants and hotels
34. Transport
35. Communications
36. Letting and operating of dwellings
37. Other real estate, financing insurance and business services
38. Private social and personal services

Appendix II a. Predicted private consumption demand on industries in 1970-75

SECTOR	FORECAST FOR;	FORP CONSUMPTION SIMULATION 1970	1971	1973	1974	1975
1	AGRICULTURE, HUNTING	10206.	10523.	11476.	11777.	11844.
2	FORESTRY AND LOGGING	555.	586.	674.	688.	669.
3	MINING	3.	3.	3.	3.	4.
4	MEAT PRODUCTS	8712.	8956.	9726.	10197.	10336.
5	DAIRY PRODUCTS	13892.	14119.	14717.	14881.	15053.
6	GRAIN AND DAIRY PROD	10565.	10737.	11155.	11236.	11075.
7	OTHER FOOD PRODUCTS	6027.	6261.	6983.	7741.	8814.
8	BEVERAGE AND TOBACCO	4116.	4347.	5092.	5534.	5576.
9	TEXTILES	4028.	4151.	4737.	4925.	5009.
10	CLOTHING, FOOTWEAR,	8158.	8431.	9230.	9463.	9692.
11	WOOD SAWING, PLANING	1.	1.	1.	1.	1.
12	OTHER WOOD PRODUCTS	1987.	2024.	2926.	3281.	3202.
13	PULP MILLS	11.	12.	15.	15.	15.
14	PAPER AND PAPERBOARD	30.	32.	38.	37.	38.
15	PAPER ARTICLES	294.	307.	393.	410.	419.
16	PRINTING AND PUBLISH	4019.	4170.	4523.	4707.	4854.
17	CHEMICALS	34.	36.	41.	41.	41.
18	CHEMICAL PRODUCTS	2480.	2615.	3026.	3054.	3124.
19	PETROLEUM AND COAL	9037.	9103.	9882.	9531.	9879.
20	RUBBER AND PLASTIC	868.	906.	1118.	1191.	1231.
21	POTTERY AND GLASS	860.	900.	1119.	1216.	1248.
22	METALS	9.	9.	13.	15.	16.
23	METAL PRODUCTS	1152.	1187.	1754.	2060.	2139.
24	MACHINERY	3021.	3176.	4719.	5839.	6508.
25	ELECTRICAL PRODUCTS	1137.	1198.	1671.	1973.	2161.
26	SHIPBUILDING	8.	9.	11.	11.	12.
27	TRANSPORT EQUIPMENT	880.	769.	1156.	1000.	1168.
28	OTHER MANUFACTURE	892.	935.	1110.	1167.	1223.
29	ELCTRICITY, POWER	1943.	2124.	2672.	2670.	2578.
31	OTHER CONSTRUCTION	61.	65.	81.	81.	86.
32	TRADE	37423.	38273.	45814.	47600.	49564.
33	RESTAURANTS, HOTELS	5517.	5673.	6370.	6394.	6481.
34	TRANSPORTATION	10829.	11196.	12740.	12752.	13106.
35	COMMUNICATION	2852.	3108.	3662.	3880.	3962.
36	LETTING, OPERATING O	25002.	26340.	30882.	33065.	36530.
37	BUSINESS SERVICES	11759.	12318.	14189.	14701.	15296.
38	OTHER SERVICES, PRIV	24335.	25419.	29568.	30677.	31763.
39	IMPORT DUTIES	1397.	1387.	1756.	1749.	1841.
40	SALES TAXES	17676.	17922.	21261.	21896.	22886.
41	COMMODITY TAXES	20847.	21153.	26002.	27057.	28209.
42	COMMODITY SUBSIDIES	-3479.	-3534.	-3659.	-3704.	-3723.
	TOTAL	249141.	256948.	298648.	310815.	323930.

Appendix II b. Predicted growth rates of private consumption expenditures in 1970-75

SECTOR	FORECAST FOR:	FORP CONSUMPTION SIMULATION 70-71	71-73	73-74	74-75
1	AGRICULTURE, HUNTING	3,06	4,34	2,59	0,57
2	FORESTRY AND LOGGING	5,46	7,02	2,00	-2,75
3	MINING	6,81	9,05	3,06	2,27
4	MEAT PRODUCTS	2,77	4,13	4,73	1,35
5	DAIRY PRODUCTS	1,62	2,07	1,11	1,15
6	GRAIN AND DAIRY PROD	1,61	1,91	0,73	-1,45
7	OTHER FOOD PRODUCTS	3,82	5,45	10,32	12,98
8	BEVERAGE AND TOBACCO	5,46	7,91	8,32	0,75
9	TEXTILES	3,00	6,61	3,90	1,68
10	CLOTHING, FOOTWEAR,	3,30	4,52	2,49	2,39
11	WOOD SAWING, PLANING	8,93	11,48	-0,07	-3,51
12	OTHER WOOD PRODUCTS	1,84	18,43	11,46	-2,43
13	PULP MILLS	8,93	11,48	-0,07	-3,51
14	PAPER AND PAPERBOARD	5,30	8,35	-1,25	2,52
15	PAPER ARTICLES	4,21	12,38	4,25	2,28
16	PRINTING AND PUBLISH	3,70	4,06	3,97	3,08
17	CHEMICALS	5,31	7,32	-0,57	0,01
18	CHEMICAL PRODUCTS	5,31	7,29	0,91	2,27
19	PETROLEUM AND COAL	0,72	4,11	-3,62	3,58
20	RUBBER AND PLASTIC	4,27	10,53	6,30	3,30
21	POTTERY AND GLASS	4,51	10,88	8,31	2,64
22	METALS	6,55	16,90	14,52	6,71
23	METAL PRODUCTS	3,02	19,53	16,09	3,74
24	MACHINERY	5,00	19,79	21,31	10,84
25	ELECTRICAL PRODUCTS	5,21	16,66	16,58	9,12
26	SHIPBUILDING	5,73	10,52	4,00	2,57
27	TRANSPORT EQUIPMENT	-13,51	20,40	-14,50	15,55
28	OTHER MANUFACTURE	4,77	8,58	5,01	4,67
29	ELCTRICITY, POWER	8,93	11,48	-0,07	-3,51
31	OTHER CONSTRUCTION	5,57	11,05	-0,12	5,76
32	TRADE	2,25	8,99	3,83	4,04
33	RESTAURANTS, HOTELS	2,79	5,80	0,38	1,34
34	TRANSPORTATION	3,34	6,46	0,09	2,74
35	COMMUNICATION	8,60	8,20	5,78	2,08
36	LETTING, OPERATING O	5,21	7,95	6,83	9,97
37	BUSINESS SERVICES	4,65	7,07	3,54	3,97
38	OTHER SERVICES, PRIV	4,36	7,56	3,68	3,48
39	IMPORT DUTIES	-0,73	11,80	-0,40	5,16
40	SALES TAXES	1,38	8,54	2,94	4,42
41	COMMODITY TAXES	1,46	10,32	3,97	4,17
42	COMMODITY SUBSIDIES	1,56	1,74	1,21	0,51
	TOTAL	3,09	7,52	3,99	4,13

Appendix III a. Predicted outputs 1970-75

SECTOR	FORECAST FOR:	FORP CONSUMPTION SIMULATION 1970	1971	1973	1974	1975
1	AGRICULTURE, HUNTING	55401.	56906.	61125.	62931.	64045.
2	FORESTRY AND LOGGING	26376.	27588.	30614.	32114.	33605.
3	MINING	4935.	5057.	5541.	5768.	5954.
4	MEAT PRODUCTS	16736.	17240.	18788.	19654.	20025.
5	DAIRY PRODUCTS	27436.	28183.	30009.	30732.	31455.
6	GRAIN AND DAIRY PROD	14305.	14556.	15190.	15341.	15191.
7	OTHER FOOD PRODUCTS	13172.	13570.	14857.	15926.	17268.
8	BEVERAGE AND TOBACCO	5426.	5709.	6636.	7145.	7216.
9	TEXTILES	10375.	10564.	11771.	12053.	12117.
10	CLOTHING, FOOTWEAR,	12436.	12893.	14129.	14566.	15004.
11	WOOD SAWING, PLANING	14071.	14795.	16513.	17403.	18280.
12	OTHER WOOD PRODUCTS	12920.	13509.	15758.	16803.	17410.
13	PULP MILLS	26989.	28299.	31280.	32811.	34399.
14	PAPER AND PAPERBOARD	27137.	28550.	31802.	33466.	35194.
15	PAPER ARTICLES	5923.	6205.	6982.	7338.	7687.
16	PRINTING AND PUBLISH	14571.	15146.	16924.	17625.	18282.
17	CHEMICALS	9756.	9955.	10837.	11117.	11287.
18	CHEMICAL PRODUCTS	4469.	4659.	5336.	5436.	5572.
19	PETROLEUM AND COAL	15441.	15781.	17538.	17528.	18286.
20	RUBBER AND PLASTIC	5049.	5164.	5717.	5901.	6041.
21	POTTERY AND GLASS	9591.	10053.	11322.	11942.	12493.
22	METALS	23856.	24723.	28047.	29673.	31062.
23	METAL PRODUCTS	12164.	12623.	14541.	15497.	16182.
24	MACHINERY	25827.	27043.	31438.	33968.	36036.
25	ELECTRICAL PRODUCTS	9009.	9349.	10688.	11402.	11975.
26	SHIPBUILDING	8087.	8485.	9415.	9880.	10376.
27	TRANSPORT EQUIPMENT	2100.	1955.	2714.	2525.	2751.
28	OTHER MANUFACTURE	1803.	1877.	2162.	2258.	2352.
29	ELCTRICITY, POWER	19601.	20572.	23553.	24543.	25426.
30	BUILDING CONSTR.	59673.	62680.	69379.	72918.	76666.
31	OTHER CONSTRUCTION	24569.	25827.	28598.	30046.	31565.
32	TRADE	60566.	62444.	72758.	75778.	79039.
33	RESTAURANTS, HOTELS	6776.	6982.	7855.	7943.	8097.
34	TRANSPORTATION	42116.	43902.	49263.	51009.	53161.
35	COMMUNICATION	8420.	8903.	10222.	10726.	11098.
36	LETTING, OPERATING O	25002.	26340.	30882.	33065.	36530.
37	BUSINESS SERVICES	29839.	31117.	35572.	37004.	38549.
38	OTHER SERVICES, PRIV	32370.	33783.	38979.	40461.	41950.
39	IMPORT DUTIES	3971.	4062.	4736.	4897.	5159.
40	SALES TAXES	31259.	32211.	37347.	38794.	40681.
41	COMMODITY TAXES	25724.	26206.	31628.	32863.	34221.
42	COMMODITY SUBSIDIES	-11294.	-11695.	-12604.	-13055.	-13485.
43	WAGES AND SALARIES	146801.	152812.	172827.	180693.	188364.
44	COMPENSATION OF EMPL	22308.	23228.	26233.	27423.	28574.
45	CONSUMPTION OF FIXED	46587.	48422.	54433.	56771.	59137.
46	OTHER INDIRECT TAXES	2832.	2953.	3376.	3506.	3636.
47	OTHER SUBSIDIES	-3927.	-4075.	-4506.	-4667.	-4818.
48	OPERATING SURPLUS	126490.	131519.	147795.	154456.	161570.
	TOTAL	1115046.	1158626.	1306000.	1363978.	1422667.

Appendix III b. Growth rates of outputs 1970-75

SECTOR	FORECAST FOR:	FORP CONSUMPTION SIMULATION			
		70-71	71-73	73-74	74-75
1	AGRICULTURE, HUNTING	2,68	3,58	2,91	1,76
2	FORESTRY AND LOGGING	4,49	5,20	4,78	4,54
3	MINING	2,43	4,57	4,01	3,17
4	MEAT PRODUCTS	2,97	4,30	4,51	1,87
5	DAIRY PRODUCTS	2,69	3,14	2,38	2,33
6	GRAIN	1,74	2,13	0,99	-0,98
7	OTHER FOOD PRODUCTS	2,97	4,53	6,95	8,09
8	BEVERAGE AND TOBACCO	5,07	7,53	7,39	0,99
9	TEXTILES	1,81	5,41	2,37	0,53
10	CLOTHING, FOOTWEAR,	3,60	4,58	3,05	2,96
11	WOOD SAWING, PLANING	5,01	5,49	5,25	4,92
12	OTHER WOOD PRODUCTS	4,46	7,70	6,42	3,55
13	PULP MILLS	4,74	5,01	4,78	4,73
14	PAPER AND PAPERBOARD	5,08	5,39	5,10	5,03
15	PAPER ARTICLES	4,65	5,90	4,97	4,64
16	PRINTING AND PUBLISH	3,87	5,55	4,06	3,66
17	CHEMICALS	2,01	4,25	2,55	1,51
18	CHEMICAL PRODUCTS	4,15	6,78	1,86	2,47
19	PETROLEUM AND COAL	2,18	5,28	-0,06	4,24
20	RUBBER AND PLASTIC	2,26	5,08	3,18	2,33
21	POTTERY AND GLASS	4,71	5,94	5,33	4,51
22	METALS	3,57	6,31	5,64	4,58
23	METAL PRODUCTS	3,71	7,07	6,37	4,32
24	MACHINERY	4,60	7,53	7,74	5,91
25	ELECTRICAL PRODUCTS	3,70	6,70	6,47	4,91
26	SHIPBUILDING	4,81	5,20	4,83	4,89
27	TRANSPORT EQUIPMENT	-7,20	16,41	-7,22	8,59
28	OTHER MANUFACTURE	4,02	7,06	4,37	4,06
29	ELCTRICITY, POWER	4,84	6,77	4,12	3,53
30	BUILDING CONSTR,	4,92	5,08	4,97	5,01
31	OTHER CONSTRUCTION	4,99	5,10	4,94	4,93
32	TRADE	3,06	7,64	4,07	4,21
33	RESTAURANTS, HOTELS	2,99	5,89	1,11	1,92
34	TRANSPORTATION	4,15	5,76	3,48	4,13
35	COMMUNICATION	5,57	6,91	4,81	3,41
36	LETTING, OPERATING O	5,21	7,95	6,83	9,97
37	BUSINESS SERVICES	4,19	6,69	3,95	4,09
38	OTHER SERVICES, PRIV	4,27	7,15	3,73	3,61
39	IMPORT DUTIES	2,26	7,68	3,34	5,21
40	SALES TAXES	3,00	7,40	3,80	4,75
41	COMMODITY TAXES	1,85	9,40	3,83	4,05
42	COMMODITY SUBSIDIES	3,49	3,74	3,52	3,24
43	WAGES AND SALARIES	4,01	6,15	4,45	4,16
44	COMPENSATION OF EMPL	4,04	6,08	4,44	4,11
45	CONSUMPTION OF FIXED	3,86	5,85	4,21	4,08
46	OTHER INDIRECT TAXES	4,17	6,70	3,78	3,65
47	OTHER SUBSIDIES	3,69	5,03	3,50	3,18
48	OPERATING SURPLUS	3,90	5,83	4,41	4,50
	TOTAL	3,83	5,99	4,34	4,21

Appendix IV a. The effects of simulations I and II .

Consumption

		I 1974	II 1974	I 1975	II 1975
1	AGRICULTURE, HUNTING	11466.	11466.	11357.	11357.
2	FORESTRY AND LOGGING	665.	665.	635.	635.
3	MINING	3.	3.	3.	3.
4	MEAT PRODUCTS	9856.	9856.	9794.	9794.
5	DAIRY PRODUCTS	14699.	14699.	14759.	14759.
6	GRAIN AND DAIRY PROD	11091.	11091.	10871.	10871.
7	OTHER FOOD PRODUCTS	7448.	7448.	8248.	8248.
8	BEVERAGE AND TOBACCO	5288.	5288.	5190.	5190.
9	TEXTILES	4838.	4756.	4863.	4795.
10	CLOTHING, FOOTWEAR,	9241.	9235.	9326.	9321.
11	WOOD SAWING, PLANING	1.	1.	1.	1.
12	OTHER WOOD PRODUCTS	3273.	3027.	3190.	2982.
13	PULP MILLS	15.	15.	14.	14.
14	PAPER AND PAPERBOARD	36.	36.	36.	36.
15	PAPER ARTICLES	399.	386.	401.	390.
16	PRINTING AND PUBLISH	4585.	4585.	4651.	4651.
17	CHEMICALS	40.	40.	39.	39.
18	CHEMICAL PRODUCTS	2929.	2929.	2923.	2923.
19	PETROLEUM AND COAL	9346.	9346.	9559.	9559.
20	RUBBER AND PLASTIC	1155.	1131.	1174.	1151.
21	POTTERY AND GLASS	1187.	1142.	1202.	1162.
22	METALS	15.	14.	16.	15.
23	METAL PRODUCTS	2058.	1897.	2136.	1963.
24	MACHINERY	5829.	5377.	6492.	6050.
25	ELECTRICAL PRODUCTS	1946.	1828.	2118.	2003.
26	SHIPBUILDING	11.	11.	11.	11.
27	TRANSPORT EQUIPMENT	994.	923.	1158.	1085.
28	OTHER MANUFACTURE	1133.	1110.	1167.	1145.
29	ELCTRICITY, POWER	2536.	2536.	2381.	2381.
31	OTHER CONSTRUCTION	76.	76.	78.	78.
32	TRADE	46411.	45414.	47641.	46688.
33	RESTAURANTS, HOTELS	6149.	6149.	6092.	6092.
34	TRANSPORTATION	12314.	12314.	12393.	12393.
35	COMMUNICATION	3689.	3689.	3658.	3658.
36	LETTING, OPERATING D	31769.	31769.	34162.	34162.
37	BUSINESS SERVICES	14040.	14039.	14211.	14210.
38	OTHER SERVICES, PRIV	29269.	29230.	29473.	29437.
39	IMPORT DUTIES	1713.	1660.	1787.	1734.
40	SALES TAXES	21350.	20957.	21998.	21614.
41	COMMODITY TAXES	26020.	25707.	26571.	26239.
42	COMMODITY SUBSIDIES	-3668.	-3668.	-3666.	-3666.
	TOTAL	301216.	298176.	308109.	305191.

Appendix IV b. Simulations I and II, growth rates of consumption

SECTOR	FORECAST FOR:	I 73-74	II 73-74	I 74-75	II 74-75
1	AGRICULTURE, HUNTING	-0,09	-0,09	-0,95	-0,95
2	FORESTRY AND LOGGING	-1,48	-1,48	-4,54	-4,54
3	MINING	-2,22	-2,22	-0,81	-0,81
4	MEAT PRODUCTS	1,33	1,33	-0,62	-0,62
5	DAIRY PRODUCTS	-0,12	-0,12	0,40	0,40
6	GRAIN	-0,57	-0,57	-2,01	-2,01
7	OTHER FOOD PRODUCTS	6,45	6,45	10,20	10,20
8	BEVERAGE AND TOBACCO	3,77	3,77	-1,86	-1,86
9	TEXTILES	2,11	0,39	0,50	0,77
10	CLOTHING, FOOTWEAR,	0,13	0,06	0,92	0,93
11	WOOD SAWING, PLANING	-5,21	-5,21	-6,34	-6,34
12	OTHER WOOD PRODUCTS	11,22	3,39	-2,57	-1,56
13	PULP MILLS	-5,21	-5,21	-6,34	-6,34
14	PAPER AND PAPERBOARD	-5,59	-5,59	-0,04	-0,04
15	PAPER ARTICLES	1,50	-1,81	0,60	1,03
16	PRINTING AND PUBLISH	1,36	1,36	1,43	1,43
17	CHEMICALS	-4,27	-4,27	-2,06	-2,06
18	CHEMICAL PRODUCTS	-3,27	-3,27	-0,19	-0,19
19	PETROLEUM AND COAL	-5,58	-5,58	2,24	2,24
20	RUBBER AND PLASTIC	3,29	1,14	1,58	1,77
21	POTTERY AND GLASS	5,90	2,08	1,27	1,69
22	METALS	12,93	7,19	6,10	6,57
23	METAL PRODUCTS	16,00	7,83	3,69	4,74
24	MACHINERY	21,14	13,07	10,76	11,79
25	ELECTRICAL PRODUCTS	15,23	8,98	8,44	9,12
26	SHIPBUILDING	-0,58	-1,90	-0,18	0,02
27	TRANSPORT EQUIPMENT	-15,09	-22,48	15,31	16,15
28	OTHER MANUFACTURE	1,97	-0,00	2,96	3,08
29	ELCTRICITY, POWER	-5,21	-5,21	-6,34	-6,34
31	OTHER CONSTRUCTION	-6,34	-6,34	2,10	2,10
32	TRADE	1,30	-0,88	2,62	2,77
33	RESTAURANTS, HOTELS	-3,54	-3,54	-0,93	-0,93
34	TRANSPORTATION	-3,40	-3,40	0,63	0,63
35	COMMUNICATION	0,74	0,74	-0,86	-0,86
36	LETTING, OPERATING O	2,83	2,83	7,26	7,26
37	BUSINESS SERVICES	-1,05	-1,06	1,21	1,21
38	OTHER SERVICES, PRIV	-1,02	-1,15	0,70	0,71
39	IMPORT DUTIES	-2,44	-5,59	4,22	4,34
40	SALES TAXES	0,42	-1,44	2,99	3,09
41	COMMODITY TAXES	0,07	-1,14	2,09	2,05
42	COMMODITY SUBSIDIES	0,24	0,24	-0,04	-0,04
	TOTAL	0,86	-0,16	2,26	2,33

Appendix V. Effects of simulations I and II on growth rates of outputs

FORECAST FOR:		I	II	I	II
SECTOR		73-74	73-74	74-75	74-75
1	AGRICULTURE, HUNTING	0,93	0,92	0,61	0,61
2	FORESTRY AND LOGGING	4,24	4,03	4,20	4,24
3	MINING	3,25	2,27	2,71	2,79
4	MEAT PRODUCTS	1,44	1,43	0,09	0,09
5	DAIRY PRODUCTS	1,35	1,34	1,73	1,73
6	GRAIN AND DAIRY PROD	-0,40	-0,41	-1,62	-1,62
7	OTHER FOOD PRODUCTS	3,46	3,44	5,67	5,67
8	BEVERAGE AND TOBACCO	3,06	3,04	-1,49	-1,49
9	TEXTILES	-0,23	-1,69	-1,20	-1,01
10	CLOTHING, FOOTWEAR,	1,27	1,20	1,88	1,89
11	WOOD SAWING, PLANING	5,10	4,87	4,83	4,87
12	OTHER WOOD PRODUCTS	6,13	4,45	3,37	3,66
13	PULP MILLS	4,53	4,47	4,59	4,59
14	PAPER AND PAPERBOARD	4,77	4,69	4,85	4,86
15	PAPER ARTICLES	4,02	3,62	4,08	4,13
16	PRINTING AND PUBLISH	1,70	1,37	2,26	2,28
17	CHEMICALS	0,22	-0,38	0,08	0,13
18	CHEMICAL PRODUCTS	-1,76	-2,17	0,32	0,35
19	PETROLEUM AND COAL	-2,33	-2,54	2,76	2,78
20	RUBBER AND PLASTIC	1,13	0,31	1,10	1,16
21	POTTERY AND GLASS	4,55	4,00	4,07	4,14
22	METALS	4,91	3,61	4,16	4,27
23	METAL PRODUCTS	5,73	4,01	3,95	4,14
24	MACHINERY	7,25	5,55	5,65	5,78
25	ELECTRICAL PRODUCTS	5,55	3,98	4,39	4,50
26	SHIPBUILDING	4,57	4,48	4,75	4,76
27	TRANSPORT EQUIPMENT	-12,57	-17,84	5,82	6,04
28	OTHER MANUFACTURE	1,84	0,53	2,59	2,68
29	ELCTRICITY, POWER	2,30	1,85	2,54	2,58
30	BUILDING CONSTR,	4,79	4,76	4,89	4,90
31	OTHER CONSTRUCTION	4,80	4,78	4,85	4,86
32	TRADE	2,06	0,64	3,08	3,18
33	RESTAURANTS, HOTELS	-2,38	-2,50	-0,08	-0,08
34	TRANSPORTATION	2,12	1,88	3,36	3,38
35	COMMUNICATION	1,86	1,50	1,73	1,76
36	LETTING, OPERATING O	2,83	2,83	7,26	7,26
37	BUSINESS SERVICES	0,99	0,60	2,36	2,39
38	OTHER SERVICES, PRIV	-0,29	-0,46	1,25	1,26
39	IMPORT DUTIES	1,34	0,04	4,06	4,11
40	SALES TAXES	2,08	0,97	3,78	3,85
41	COMMODITY TAXES	0,27	-0,76	2,14	2,11
42	COMMODITY SUBSIDIES	2,92	2,91	2,90	2,90
43	WAGES AND SALARIES	2,91	2,30	3,28	3,33
44	COMPENSATION OF EMPL	2,92	2,33	3,25	3,30
45	CONSUMPTION OF FIXED	2,54	2,03	3,10	3,14
46	OTHER INDIRECT TAXES	0,70	0,37	1,87	1,89
47	OTHER SUBSIDIES	1,76	1,56	2,19	2,20
48	OPERATING SURPLUS	2,42	2,05	3,27	3,31
	TOTAL	2,65	2,12	3,21	3,26