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EXPORTS AND IMPORTS IN THE BOF4 QUARTERLY MODEL OF THE FINNISH ECONOMY

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ABSTRACT

Specification of the volume and price equation of Finland's multilateral exports of goods is based on the assumption that Finnish products enjoy only temporary monopoly power. In the context of the whole model this implies that the price of exports of goods as well as short-run marginal costs converge towards a level determined solely by competing foreign prices.

The modelling of Finland's bilateral trade is based on the assumption that the value of bilateral exports adjusts to the value of bilateral imports, which, in turn, is determined by Finnish demand for imports from eastern markets.

Modelling of the trade in services and imports, excluding imports of oil, fuels and lubricants, is quite conventional: the volume of exports of services and the volumes of imports depend on relevant relative price and activity variables. The modelling of imports of crude oil, fuel and lubricants is based on the assumption that imports of energy are a residual determined by the demand for and the domestic supply of energy.

CONTENTS

1 INTRODUCTION

BOF4 is an econometric model of the Finnish economy built at the Bank of Finland for forecasting and policy analysis. The model consists of about 300 equations, and may be described as reflecting the "neoclassical synthesis" tradition of macroeconomic theory. It represents the fourth generation of "BOF" models since macroeconometric modelling began at the bank in 1970 (see A Quarterly Model (1972) and Willman & Tarkka (1985) for earlier versions). The present paper appears in a series intended to cover all sectors of the present version of BOF4.

For the purposes of the present report on exports and imports, it is useful to note two key characteristics of BOF4. As regards technology, a CES value-added production function is assumed throughout, embedded in a simple input-output framework describing the use of inputs other than labour and capital. The market structure assumption is basically one of monopolistic competition in all sectors in the short run, but in manufacturing and forestry perfect competition on worldwide markets is considered to be a relevant long-run assumption. This is clearly reflected in the export equations.

2 EXPORTS

Exports are divided into three categories in BOF4. Exports of services are distinguished from exports of goods, and exports of goods are divided into multilateral and bilateral exports; the latter group consists mainly of Finland's exports to the U.S.S.R., whereas other exports belong mostly to the former category. The special attention paid to bilateral trade in the model stems from the fact that the importance of this trade in the Finnish business cycle far exceeds its relative size as an item of aggregate demand.

2.1 Multilateral Exports of Goods

Multilateral, or "western", exports make up about 80 per cent of Finland's exports of goods. The export equation is shown as equation X.1 in the equation list (see appendix). The specification is almost identical to the one included in the previous BOF3 version of the model (see Tarkka & Willman, 1985). This equation is based on the idea that domestic and foreign productive capacity are fully substitutable for each other, at least in the long run. According to this view, Finland enjoys only temporary monopoly power in any field of production, and in the long run the equilibrium price of exports will, because of foreign competition, be determined quite independently of domestic factors. Another way of putting this is to say that foreign demand for Finnish products is dynamic: the demand curve is downward sloping in the short run but horizontal in the long run. This implies a Phelps & Winter (1971) type of demand equation for multilateral exports: a change in the market share of Finnish exports depends on the relative price level.

We measure the size of the market by the volume index of imports of Finland's 14 most important trading partners. As the relative price variable we have used the unit value index of Finland's exports of goods to western markets relative to the competing foreign prices. The index for the foreign competing prices was constructed as a weighted unit value index of imports of the same 14 countries used in measuring the growth of export markets and adjusted for the import price of fuels and lubricants. The energy adjustment is intended to take into account the fact that Finland is not an oil exporter.

The indices of import volumes and import prices of the 14 trading partners are Divisia-Törnqvist indices with moving annual weights. In table 1 the weights of different countries are given for a sample of years.

Our approach implies much stronger effects of domestic costs on export volumes than the conventional "large-country" model used by Aurikko (1985a) and many other authors. However, the differences

from the conventional approach are not very important in the short run.

Table 1. The shares of the 14 most important countries in Finland's multilateral exports of goods, per cent.

	1960	1965	1970	1975	1980	1985
Sweden	6.5	10.5	21.0	28.1	25.2	21.0
United Kingdom	35.7	29.9	24.2	22.5	17.3	17.0
Germany, F.R.	17.4	16.7	14.6	12.4	16.2	15.0
France	7.0	6.7	5.2	5.5	6.9	6.0
Netherlands	8.9	8.8	6.4	4.1	6.6	5.0
Norway	1.9	1.7	5.1	7.3	6.4	7.0
Denmark	5.2	5.6	5.7	5.6	5.3	6.0
United States	7.4	8.9	6.5	5.0	4.9	10.0
Italy	3.2	4.6	3.4	2.1	3.7	3.0
Switzerland	0.8	0.9	2.4	2.2	2.4	2.0
Belgium	5.5	4.9	2.6	2.2	2.1	2.0
Austria	0.2	0.4	1.1	1.3	1.1	1.0
Japan	0.1	0.2	0.4	0.8	1.1	2.0
Canada	0.1	0.3	0.1	0.8	0.8	2.0

The percentages may not sum exactly to 100 due to rounding.

The dynamic form of the equation is obtained as a result of a search procedure. The dependent variable is the change in the market share of Finland's multilateral exports. The estimation was started with a general loglinear specification in which a large number of lags on all relevant variables were included. Statistically insignificant terms were then eliminated one by one until a parsimonious specification with only significant explanatory variables was obtained. The problem of endogeneity of export prices was treated by using the two-stage least squares method of estimation.

The dynamic elasticities of the demand for multilateral exports of goods are reported in the following table.

Table 2. Dynamic Demand Elasticities of the Demand for Finnish Multilateral Exports of Goods

variable	immediate elasticity	one-year elasticity	five-year elasticity	long-run elasticity
foreign imports	1.00	1.00	1.00	1.00
relative prices	-1.34	-1.85	-3.80	$-\infty$

As a result of the a priori constraint, the elasticity of export demand with respect to market growth is unity regardless of the time span of analysis. On the other hand, the price elasticity is clearly dynamic, increasing almost three-fold in five years from its first-quarter value. It is observed, however, that the increase in price elasticity towards infinity is rather slow.

2.2 Prices of Multilateral Exports of Goods

The theoretical foundations of the estimated equation for the price of multilateral exports of goods are defined by the following profit maximization problem of a representative firm:

$$(1) \qquad \max_{Y} \sum_{t=0}^{\infty} \emptyset^t \cdot PROFIT_t$$

$$PROFIT = P \cdot Y - W \cdot L - P^m \cdot M - P^k \cdot K$$

s.t.

$$Y/Y_{-1} = (P^f/P)^{\alpha}(D/D_{-1}) \qquad \text{(firm level demand for output)}$$

$$L = CES^{-1}[(1-a) \cdot Y, K, TIME] \qquad \text{(inverted CES-production function)}$$

$$M = a \cdot Y \qquad \text{(demand for material inputs)}$$

where Y is output, P is the price of output, W is the nominal wage rate, L is the required labour input, P^m is the price and M the

volume of material inputs, P^k is the implicit rent of capital, K the stock of capital, P^f is the competing price, and D is the demand shift variable. Variables W, P^m, P^f, P^k and K are here treated as exogenous, although they are of course endogenous in the full model.

We see that the specification of the demand function corresponds to that of the estimated equation for Finland's multilateral exports of goods: the price elasticity is finite in the short-run but becomes infinite in the long run.

Profit maximization implies the following first order condition:

$$(2) \qquad (1-1/\alpha)P_t - SMC_t = -(\emptyset/\alpha)(P_{t+1}Y_{t+1}/Y_t)$$

where

$$SMC = a \cdot P^m + (1-a) \cdot W \cdot (\delta L/\delta Y) \qquad \text{(short-run marginal costs of production)}$$

Dividing both sides of equation (2) by the term $[(\alpha - 1 + \emptyset)/\alpha] \cdot P_t$, we can write the following Euler equation

$$(3) \qquad \log(P_t/SMC_t) = -\beta \log(P_{t+1}Y_{t+1}/P_tY_t) + m$$

where $\beta = \emptyset/(\alpha - 1 + \emptyset) > 0$ and $m = \log[\alpha/(\alpha - 1 + \emptyset)] > 0$

Assuming adaptive expectations in P and Y and denoting the logs of the corresponding capital letters with small letters equation (3) reduces to

$$(4) \qquad \Delta p = b_0\Delta smc + b_1\Delta p^f + b_2(smc_{-1} - p_{-1}) + b_3\Delta(y_{-1} - d_{-1}) + b_4$$

where Δ denotes a difference operator and

$b_0 = 1/[1 + \beta(1-\mu)(\alpha-1)]$; $b_1 = \beta\alpha(1-\mu)b_0$;

$b_2 = \mu b_0$; $b_3 = \beta(1-\mu)b_0$; $b_4 = m\mu b_0$

and μ is the adaptation coefficient of the expectations mechanism.

Equation (4) shows that in the long-run equilibrium output price equals marginal costs. However, the form of the demand equation guarantees that in full equilibrium the price of output must also equal the competing world market price: as long as these two prices deviate from each other there are continuous changes in the market share of Finland's exports. As marginal costs are endogenous in the whole model this mechanism also forces them to adjust towards the competing world market price. Hence, in the long run equilibrium the equality $P = SMC = P^f$ prevails. The quantity produced by the manufacturing sector will then be determined solely by supply factors, and it will settle on the level where marginal costs have adapted to world market prices.

As operational counterparts for the size of the market for Finland's multilateral exports and for the competing world market price, we use the same variables as in the estimated equation for the volume of multilateral exports. The marginal cost variable is constructed with the aid of the nested Leontief-CES-production function estimated for manufacturing (see eq. X6).

The estimated price equation for Finland's multilateral exports of goods is given as X.5 in the list. Besides the variables included on the right hand side of equation (4), the estimated equation includes the lagged change in the relative price as an additional explanatory variable. This term captures the empirical fact that the short-run dynamics of the estimated export equation is more complicated than in equation (4).

The dynamic partial elasticities of the price of multilateral exports of goods with respect to marginal costs and to the foreign competing price is presented in the following table.

Table 3. Partial elasticities of Finland's multilateral export price of goods when marginal costs are exogenous

variable	immediate elasticity	one-year elasticity	long-run elasticity
marginal cost	0.29	0.50	1.00
competing foreign price	0.60	0.39	0.00

Due to the endogeneity of marginal costs the long-run elasticities in table 3 are not particularly interesting. The elasticity of marginal costs of exports with respect to the volume of exports is determined by the technology assumptions of the model and by the share of exports in manufacturing output. Evaluated for 1985, and for given nominal wages and a given capital stock, the long-run elasticity of marginal costs in manufacturing with respect to western exports is about 0.20. This implies an elasticity of -5 of export volume with respect to wages/world market prices after all price and volume adjustments have been carried out.

2.3 Bilateral Exports

The modelling of Finland's bilateral exports starts from the assumption that the value of bilateral exports is determined by the value of Finland's bilateral imports. Finland's imports from the Soviet Union consist mainly of crude oil and other energy, and the experience from the "oil shock" periods and from the oil price collapse of 1986 seems to support the conclusion that it is the volume of Finnish exports which ultimately adjusts to balance the bilateral trade account. For a closer examination of the Finnish-Soviet trade, see Rautava & Tervonen (1987) and Holopainen (1981).

Although the modelling of bilateral trade in goods is based on the adjustment of exports over time to equate exports and imports, this

is only an approximation. In reality it is the clearing account which must be balanced, not trade in goods. Since the invisible items (services and capital movements) are also considerable, there may at times be a significant difference between the balance of trade and the balance on clearing account payments.

The equation for the volume of Finland's bilateral exports is shown as X.2 in the list of equations. It is essentially an estimated partial adjustment mechanism to the balance-of-trade condition. The speed of adjustment in response to changes in relative prices and in the volume of bilateral imports is restricted to be the same. This is also apparent from table 4, where the dynamic elasticities of the equation are reported.

Table 4. Dynamic Elasticities of Finland's Bilateral Exports of Goods.

variable	immediate elasticity	one-year elasticity	long-run elasticity
bilat. imports	0.07	0.23	1.0
export price	-0.07	-0.23	-1.0

The modelling of the main determinant of bilateral exports, i.e. the value of bilateral imports, is discussed in connection with the other import items.

The price of bilateral exports depends - as stipulated in trade agreements - on the prices of corresponding products in western markets. Let us assume that bilateral trade contracts are concluded at the same price at which industrial products are sold in the domestic market. If the time span between contracts and deliveries is geometrically distributed, the prices will follow domestic industrial product prices with a geometric lag. As most export contracts are made in clearing roubles, changes in the FIM rate of the rouble during the lag will have to be taken into account.

Despite the fact that bilateral trade prices are tied to prices elsewhere, prices have nevertheless increased clearly faster than domestic prices in Finland or foreign trade prices generally. This may be due to increased technological sophistication in bilateral exports, which will have to be taken into account by a time trend if we wish to restrict the elasticity of bilateral export prices with respect to domestic prices of industrial products to one. The estimated equation is shown an X.4 in the list of equations.

According to the equation, the convergence of prices of bilateral exports towards the domestic price level of industrial products is fairly fast: as much as 42 per cent of the price gap is eliminated in a quarter. Because of the trend variable, the rise in prices of bilateral exports is approximately 2.1 per cent faster than the rise in P4.

2.4 Exports of Services

Exports of services relate partly to the transportation of Finland's foreign trade. The share of transportation in total exports of services was 41.8 per cent in 1980, while the remaining 58.2 per cent consisted of tourism and exports of other services. The scale, or income, variable of the equation is a geometric weighted average of the volume of Finnish foreign trade and of the volume of imports of Finland's major trading partners. The latter is intended to measure the general level of economic activity abroad. The weights correspond to the above-mentioned shares in 1980 of transportation revenue and other revenue in exports of services. The long-run elasticity of the composite scale variable is restricted to unity.

The equation for exports of services is shown as X.3 in the equation list. Because of data problems involved in deflating the nominal export figures, relative prices (competitiveness) are measured by the ratio of prices of private services etc. to import prices of consumer goods. Here we assume that the import prices of consumer goods also reflect the general level of prices of services abroad.

The dynamic properties of the equation are as indicated in table 5.

Table 5. The Dynamic Elasticities of Exports of Services

variable	immediate elasticity	one-year elasticity	long-run elasticity
foreign trade	0.42	0.42	0.42
activity abroad	0.58	0.58	0.58
relative prices	0.00	-0.80	-1.07

For more econometrics on Finnish exports of services, see Moilanen (1981). The price of exports of services is determined as a weighted average of the prices of domestic private services and imports of services (see equation X.8).

3 IMPORTS

In BOF4, five categories of imports are distinguished: 1) raw materials excl. crude oil; 2) crude oil, fuels and lubricants; 3) consumer goods; 4) investment goods and 5) services. In addition there is an equation for the determination of the nominal value of bilateral (mainly Soviet) imports.

The economic content of the import equations has not changed much since the BOF3 version of the model. The dynamic specifications are, however, now obtained as a result of a systematic search method. This has also been used by Aurikko (1985), whose results are mostly vindicated by our findings.

The equations are loglinear demand functions with an empirically determined lag structure. The determinants for each category of imports are 1) an activity variable, and 2) a relative price variable. These are defined as follows.

For imports of raw materials, real GDP is used as the activity variable and the import prices of raw materials relative to the price of domestically produced manufactures is used as the relative price.

For imports of consumer goods, private consumption less consumption of services by households and government is used as the activity variable. The relative price is the import price adjusted by the sales tax rate and divided by the private consumption deflator.

For imports of investment goods, the volume of total fixed investment is used as the activity variable and the import price relative to the price of domestically produced manufactured goods measures the relative price.

For imports of services, the activity variable is a geometric average of real GDP and the volume of private consumption of services. The weights correspond to the shares in imports of services other than travel, and travel, respectively. The relative price is the import price of services divided by the deflator of private consumption of services.

The modelling of imports of crude oil, fuels and lubricants is a little more complicated. The approach used here is to view imports of energy as a residual determined by the demand for energy, on the one hand, and by the domestic supply of energy, on the other. In the equation we have used real GDP as the activity variable with long-run elasticity constrained to unity and the tax-adjusted import price of fuels relative to the private consumption deflator as the price variable. The long-run propertes of the equation have been restricted so that any increase in domestically produced energy will eventually crowd out a corresponding amount of energy imports. In the equation a fixed coefficient of 0.9421 is used to make the energy figures (which are in 1000 toe) commensurable with the import figures (which are millions of FIM in 1985 prices).

The actual import volume equations are shown as M.1, M.2, M.3, and M.5 in the equation list. The properties of the import equations may

be characterized by dynamic price and activity elasticities. These are reported in the following tables. The activity elasticites are calculated in two different ways: first, holding the domestic energy supply constant, and second, changing the domestic energy supply proportionately with the other activity variables.

Table 6. Dynamic Activity Elasticities of Imports. (domestic energy supply constant)

import category	immediate elasticity	one-year elasticity	long-run elasticity
raw materials	1.86	2.24	0.78
oil, fuels etc.	0.69	0.81	1.36
consumer goods	1.22	1.48	1.60
investment goods	0.52	0.73	1.01
total goods	1.32	1.51	1.02
services	1.16	1.42	1.54
total imports	1.29	1.49	1.09

Table 7. Dynamic Activity Elasticities of Imports. (domestic energy supply proportional to activity)

import category	immediate elasticity	one-year elasticity	long-run elasticity
raw materials	1.86	2.24	0.78
oil, fuels etc.	0.69	0.61	1.00
consumer goods	1.22	1.48	1.60
investment goods	0.52	0.73	1.01
total goods	1.32	1.51	1.02
services	1.16	1.42	1.54
total imports	1.29	1.49	1.09

An interesting feature of imports of raw materials is the high short-run elasticity with respect to GDP. However, the elasticity declines in the long run. We believe that this behaviour is associated with an inventory cycle in raw materials. This finding has also been confirmed by other Finnish studies (see e.g. Vajanne (1983)).

Table 8. Dynamic Price Elasticities of Imports.

import category	immediate elasticity	one-year elasticity	long-run elasticity
raw materials	-0.68	-0.68	-0.79
oil, fuels etc.	0.00	-0.19	-0.71
consumer goods	-0.47	-0.57	-0.61
investment goods	-0.97	-0.99	-1.14
total goods	-0.53	-0.57	-0.77
services	-0.63	-0.76	-0.83
total imports	-0.55	-0.60	-0.78

Apart from the system of import demand functions now described, the BOF4 model includes a very simple equation for forecasting the value of Finland's bilateral imports (eq. M6 in the equation list). It is based on the assumption of constant marginal propensities to import from multilateral sources: according to the equation, 76.9 per cent of imports of oil, fuels and lubricants come (at the margin) from the Soviet Union and other bilateral sources; the corresponding propensity for other categories of imports is 4.3 per cent.

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APPENDIX I: LIST OF EQUATIONS

List of equations in the foreign trade block of the BOF4 quarterly model of the Finnish economy, May 1988 version.

Notation used:

Values of parameter estimates are ordinary least squares estimates.

Standard errors of parameter estimates are in parentheses below the coefficients.

When standard error is not shown, the parameter in question is fixed a priori e.g. on the basis of input-output studies.

Weights of Almon lags are denoted by a_i, b_i, etc.

Variables with a subscript are lagged. Subscripts refer to number of lags in quarters.

Δ	is the difference operator.
Δ^n	denotes difference over n quarters.
log	denotes natural logarithms.

Units:
Values are in millions of FIM.
Volumes are in millions of FIM at 1985 prices.
Price indices take the value 100 in 1985.
Interest rates are in per cent.
Energy is in 1000 toe.
Labour force figures are in 1000 persons.

$\bar{R}^2$	= corrected coefficient of determination
DW	= Durbin - Watson statistic
SE	= standard error of estimate
rho	= coefficient of first-order autocorrelation correction

The estimation period is given after the summary statistics

MFOR	Imports of Finland's major export countries, 1985 = 100
PFXG	Index of competing foreign prices
PXGW	Export prices of goods, multilateral, 1985 = 100
XGW	Exports of goods, multilateral, millions of 1985 FIM

X. VIENTI JA VIENTIHINNAT
EXPORTS AND EXPORT PRICES

X.1 Tavaroiden lännenviennin määrä
Exports of Goods, Multilateral, Volume

$$\Delta \log(XGW/MFOR) = \underset{(0.0135)}{-\ 0.01009}$$
$$\underset{(0.1181)}{+\ 0.48086} \cdot \Delta\log(XGW_{-1}/MFOR_{-1})$$
$$\underset{(0.3979)}{+\ 1.35315} \cdot \log(PFXG/PXGW)$$
$$\underset{(0.3511)}{-\ 1.17166} \cdot \log(PFXG_{-2}/PXGW_{-2})$$

$\bar{R}^2 = 0.266$ DW = 2.108 SE = 0.07031 70.1 - 85.4

(estimoitu kaksivaiheisella PNS-menetelmällä)
(estimated with two-stage least squares)

MFOR	Imports of Finland's major export countries, 1985 = 100
MG	Imports of goods, total, millions of 1985 FIM
MGEV	Imports of goods, bilateral, FIM million
P2	Prices in services, 1985 = 100
PMC	Import prices of consumer goods, 1985 = 100
PXGE	Export prices of goods, bilateral, 1985 = 100
XG	Exports of goods, millions of 1985 FIM
XGE	Exports of goods, bilateral, millions of 1985 FIM
XS	Exports of services, millions of 1985 FIM

X.2 Tavaroiden idänviennin määrä
Exports of Goods, Bilateral, Volume

$$XGE = \underset{(0.0757)}{0.45142} \cdot \sum_{i=0}^{10} a_i \, (MGEV/(0.01 \cdot PXGE))_{-i} + \underset{(0.0826)}{0.51576} \cdot XGE_{-1}$$

viive i	0	1	2	3	4	5	6	7	8
paino a_i	0.17	0.15	0.14	0.12	0.11	0.09	0.08	0.06	0.05

viive i	9	10	$\sum$
paino a_i	0.03	0.02	1

$\bar{R}^2 = 0.937$ DW = 2.019 SE = 311.1023 64.1 - 85.4

X.3 Palvelusten viennin määrä
Exports of Services, Volume

$$\Delta(\log XS - varl) = \underset{(0.5272)}{-1.06860} \cdot \Delta\log(P2_{-1}/PMC_{-1})$$

jossa varl = 0.418 · log(XG + MG) + 0.582 · log MFOR

$\bar{R}^2 = 0.076$ DW = 1.905 SE = 0.10969 71.1 - 85.4

D75	Dummy: 60.1 - 74.4 = 1, 75.1 - = 0
FXSSUR	Exchange rate, USD/SUR
FXSUSD	Exchange rate, FIM/USD
MFOR	Imports of Finland's major export countries, 1985 = 100
P4	Prices in manufacturing, 1985 = 100
PFXG	Index of competing foreign prices
PXGE	Export prices of goods, bilateral, 1985 = 100
PXGW	Export prices of goods, multilateral, 1985 = 100
SMCXG	Marginal costs in exports
TREND	Linear trend: 60.1 = .25, 60.2 = .50 etc.
XGW	Exports of goods, multilateral, FIM million

X.4 Tavaroiden idänviennin yksikköarvoindeksi
Export Prices of Goods, Bilateral

$$\log(PXGE/P4) = -0.18544 \quad (0.02759)$$
$$+ 0.57920 \cdot \log varl \quad (0.05455)$$
$$+ 0.00882 \cdot TREND \quad (0.00128)$$

Jossa $varl = \log[(PXGE_{-1}/P4)\cdot(FXSUSD/FXSUSD_{-1})\cdot(FXSSUR/FXSSUR_{-1})]$

$\bar{R}^2 = 0.937$ DW = 2.056 SE = 0.0359 64.1 - 85.4

X.5 Tavaroiden lännenviennin yksikköarvoindeksi
Export Prices of Goods, Multilateral

$$\Delta\log PXGW = 0.00006 \quad (0.00481)$$
$$+ 0.29595 \cdot \Delta\log SMCXG \quad (0.1751)$$
$$+ 0.60307 \cdot \Delta\log PFXG \quad (0.1611)$$
$$+ 0.10396 \cdot \log(SMCXG_{-1}/PXGW_{-1}) \quad (0.0620)$$
$$- 0.20733 \cdot \Delta^2\log(PFXG_{-1}/PXGW_{-1}) \quad (0.1002)$$
$$+ 0.07804 \cdot \Delta\log(XGW_{-1}/MFOR_{-1}) \quad (0.0457)$$
$$+ 0.03902 \cdot \Delta\log(XGW_{-2}/MFOR_{-2}) \quad (0.0229)$$
$$- 0.05964 \cdot \Delta D75 \quad (0.0303)$$
$$+ 0.07364 \cdot \Delta D75_{-1} \quad (0.0325)$$

$\bar{R}^2 = 0.491$ DW = 1.981 SE = 0.02313 70.1 - 85.4

D5863	Dummy replacing sales tax rate in 1958 - 1963
GDP4	Production at factor cost, manufacturing, millions of 1985 FIM
GDPFV	GDP at factor cost, FIM million
GDPVG	Production at factor cost, FIM million
LH4	Performed working hours, manufacturing, millions of hours
LW4	Paid labour input, manufacturing, millions of 1985 FIM
MGV	Imports of goods, total, FIM million
P1	Prices in agriculture, 1985 = 100
P2	Prices in services etc., 1985 = 100
P3	Prices in forestry, 1985 = 100
PMFL	Import prices of fuels and lubricants, 1985 = 100
PMR	Import prices of raw materials, 1985 = 100
PMS	Import prices of services, 1985 = 100
PXGE	Export prices of goods, bilateral, 1985 = 100
PXGW	Export prices of goods, multilateral, 1985 = 100
PXS	Export prices of services, 1985 = 100
SMCXG	Marginal costs in exports
SOCCR4	Employers' social security contribution rate, manufacturing
SUB	Subsidies, millions of 1985 FIM
TIR4	Indirect tax rate on production, manufacturing
TIRXG	Indirect tax rate on exports, goods
TREND	Linear trend: 60.1 = .25, 60.2 = .50 etc.
TSR	Sales tax rate
WR4	Wage rate, manufacturing, 1985 = 100
XGE	Exports of goods, bilateral, millions of 1985 FIM
XGEV	Exports of goods, bilateral, FIM million
XGW	Exports of goods, multilateral, millions of 1985 FIM
XGWV	Exports of goods, multilateral, FIM million

X.6 Vientituotannon rajakustannus
Marginal Costs in Exports

$$SMCXG = 1.05892 \cdot [((1 + TIR4) \cdot (0.1179 \cdot WR4 \cdot LW4/LH4 \cdot (1 + SOCCR4)/(0.08 \cdot (GDP4/LH4)^{1.2271} \cdot e^{-0.0072 \cdot TREND}) + (0.0931 \cdot P1 + 0.1545 \cdot P2 + 0.0561 \cdot P3 + 0.1592 \cdot PMR + 0.0999 \cdot PMFL))] \cdot (1 + TIRXG)$$

X.7 Välillisten verojen osuus tavaraviennistä
Indirect Tax Rate on Exports, Goods

$$TIRXG = (1 - 0.9509 \cdot SUB/(GDPFV + MGV - GDPVG))/(1 - 0.0771 \cdot 0.01 \cdot TSR \cdot D5863) - 1$$

X.8 Palvelusten viennin hinta
Export Prices of Services

$$\Delta\log(PXS/PMS) = \underset{(0.09195)}{0.90721} \cdot \Delta\log(P2/PMS)$$

$\bar{R}^2 = 0.7392$ DW = 1.7781 SE = 0.1003 77.1 - 85.4

X.9 Tavaroiden lännenviennin arvo
Exports of Goods, Multilateral, Value

$$XGWV = PXGW \cdot XGW/100$$

X.10 Tavaroiden idänviennin arvo
Exports of Goods, Bilateral, Value

$$XGEV = PXGE \cdot XGE/100$$

PXG	Export prices of goods, 1985 = 100
PXS	Export prices of services, 1985 = 100
X	Exports of goods and services, millions of 1985 FIM
XG	Exports of goods, millions of 1985 FIM
XGE	Exports of goods, bilateral, millions of 1985 FIM
XGEV	Exports of goods, bilateral, FIM million
XGV	Exports of goods, FIM million
XGW	Exports of goods, multilateral, millions of 1985 FIM
XGWV	Exports of goods, multilateral, FIM million
XS	Exports of services, millions of 1985 FIM
XSV	Exports of services, FIM million
XV	Exports of goods and services, FIM million

X.11 Tavaroiden viennin määrä
Exports of Goods, Volume

XG = XGW + XGE

X.12 Tavaroiden viennin arvo
Exports of Goods, Value

XGV = XGWV + XGEV

X.13 Palvelusten viennin arvo
Exports of Services, Value

XSV = 0.01 • PXS • XS

X.14 Tavaroiden viennin hinta, yksikköarvoindeksi
Export Prices of Goods

PXG = 100 • XGV/XG

X.15 Tavaroiden ja palvelusten viennin määrä
Exports of Goods and Services, Volume

X = XG + XS

X.16 Tavaroiden ja palvelusten viennin arvo
Exports of Goods and Services, Value

XV = XGV + XSV

FXSCHF	
FXSDEM	Exchange rate, USD/DEM
FXSE	Efective exchange rate index, 1985 = 100
FXSGBP	Exchange rate, USD/GBP
FXSUSD	Exchange rate, FIM/USD

X.17 Efektiivinen valuuttakurssi-indeksi 1985 = 100
Efective Exchange Rate Index, 1985 = 100

FXSE = Exp(1.18720 + log(FXSUSD) + 0.324 · log(FXSGBP)
+ 0.372 · log(FXSDEM) + 0.052 · log(FXSCHF))

DFT69	
DS63	
GDPF	GDP at factor cost, millions of 1985 FIM
MR	Imports of raw materials, millions of 1985 FIM
P4	Prices in manufacturing, 1985 = 100
PMR	Import prices of raw materials, 1985 = 100

M. TUONTI
IMPORTS

M.1 Tuonnin määrä, raaka-aineet
Imports of Raw Materials, Volume

$$\log MR = + 0.16243 \quad (0.50838)$$
$$+ 0.30548 \cdot \log MR_{-1} \quad (0.07422)$$
$$+ 0.18540 \cdot \log MR_{-2} \quad (0.05763)$$
$$+ 1.84867 \cdot \log GDPF \quad (0.32836)$$
$$- 1.45062 \cdot \log GDPF_{-3} \quad (0.32597)$$
$$- 0.68435 \cdot \log(PMR/P4) \quad (0.08576)$$
$$+ 0.28035 \cdot \log(PMR_{-1}/P4_{-1}) \quad (0.10072)$$
$$+ 0.29022 \cdot DS63 \quad (0.05431)$$
$$- 0.29960 \cdot DFT69 \quad (0.03947)$$

$\bar{R}^2 = 0.9854$ DW = 1.8937 SE = 0.0616 62.1 - 85.4

CEND	Domestic energy (incl. nuclear power) consumption, 1000 toe
D5863	
DTO	
GDPF	GDP at factor cost, millions of 1985 FIM
MFL	Imports of fuels and lubricants, millions of 1985 FIM
PCP	Private consumption prices, 1985 = 100
PMFL	Import prices of fuels and lubricants, 1985 = 100
TEBR	Excise tax rate on petrol
TEDR	Excise tax rate on diesel oil
TSR	Sales tax rate

M.2 Tuonnin määrä, raakaöljy sekä poltto- ja voiteluaineet
Imports of Fuels and Lubricants, Volume

$$\Delta \log MFL = + 0.57025 \quad (0.8145)$$
$$- 0.41318 \cdot \Delta \log MFL_{-1} \quad (0.1538)$$
$$- 0.56142 \cdot \Delta \log MFL_{-2} \quad (0.1301)$$
$$- 0.68779 \cdot [\log(MFL_{-1} + 0.9421 \cdot CEND_{-1}) - \log GDPF] \quad (0.2488)$$
$$- 0.36092 \cdot \log(POIL_{-2}/PCP_{-2}) \quad (0.1358)$$

jossa $POIL = (2.2052 \cdot PMFL + 100 \cdot (0.5494 \cdot TEBR + 0.4506 \cdot TEDR)) \cdot (100 + DTO \cdot TSR \cdot D5863)$

$\bar{R}^2 = 0.604$ DW = 1.859 SE = 0.12253 76.2 - 85.4

DS63	
ITOT	Total fixed investment, millions of 1985 FIM
MI	Imports of investment goods, millions of 1985 FIM
P4	Prices in manufacturing, 1985 = 100
PMI	Import prices of investment goods, 1985 = 100

M.3 Tuonnin määrä, investointitavarat
Imports of Investment Goods, Volume

$$\log MI = -1.04731 \quad (0.47875)$$
$$+ 0.31301 \cdot \log MI_{-1} \quad (0.09099)$$
$$+ 0.17298 \cdot \log MI_{-2} \quad (0.07221)$$
$$+ 0.51928 \cdot \log ITOT \quad (0.10144)$$
$$- 0.98158 \cdot \log(PMI/P4) \quad (0.12394)$$
$$+ 0.38932 \cdot \log(PMI_{-1}/P4_{-1}) \quad (0.15407)$$
$$+ 0.32788 \cdot DS63 \quad (0.07785)$$

$\bar{R}^2 = 0.859$ DW = 2.0181 SE = 0.0879 63.1 - 85.4

CG	Total public consumption, millions of 1985 FIM
CS	Private consumption, services, millions of 1985 FIM
CTOT	Total consumption, millions of 1985 FIM
D5863	
DFT69	
DMCP	
DS63	
MC	Imports of consumer goods, millions of 1985 FIM
PCP	Private consumption prices, 1985 = 100
PMC	Import prices of consumer goods, 1985 = 100
TSR	Sales tax rate

M.4 Tuonnin määrä, kulutustavarat
Imports of Consumer Goods, Volume

$$\log MC = -4.23859 \quad (1.79027)$$
$$+ 0.23228 \cdot \log MC_{-1} \quad (0.07988)$$
$$+ 1.22264 \cdot \log(CTOT - CS - 0.82 \cdot CG) \quad (0.16841)$$
$$- 0.47372 \cdot \log(100 + TSR \cdot D5863) \cdot PMC/PCP \quad (0.15444)$$
$$+ 0.36588 \cdot DS63 \quad (0.06084)$$
$$+ 0.15240 \cdot DFT69 \quad (0.04362)$$
$$- 0.04631 \cdot DMCP \quad (0.01574)$$

$\bar{R}^2 = 0.965$ DW = 1.899 SE = 0.0647 62.I - 85.4

CS	Private consumption, services, millions of 1985 FIM
GDPF	GDP at factor cost, millions of 1985 FIM
MFLV	Imports of fuels and lubricants, FIM million
MG	Imports of goods, total, millions of 1985 FIM
MGEV	Imports of goods, bilateral, FIM million
MGV	Imports of goods, total, FIM million
MFL	Imports of fuels and lubricants, millions of 1985 FIM
MFLV	Imports of fuels and lubricants, FIM million
MS	Imports of services, millions of 1985 FIM
PCS	Private consumption prices, services, 1985 = 100
PMC	Import prices of consumer goods, 1985 = 100

M.5 Tuonnin määrä, palvelukset
Imports of Services, Volume

$$\log MS = \underset{(1.37160)}{-\ 6.36627} + \underset{(0.08460)}{0.24332} \cdot \log MS_{-1} + \underset{(0.16309)}{1.16111} \cdot (0.28 \cdot \log CS + 0.72 \cdot \log GDPF) - \underset{(0.07526)}{0.63080} \cdot \log(PMS/PCS)$$

$\bar{R}^2 = 0.8496$ DW = 2.513 SE = 0.0655 77.1 - 85.4

M.6 Tavaroiden idäntuonnin arvo
Imports of Goods, Bilateral, Value

$$MGEV/MGEV_{-1} = \underset{(0.02939)}{0.76917} \cdot MFLV/MGEV_{-1} + \underset{(0.01071)}{0.04333} \cdot (MGV - MFLV)/MGEV_{-1} + \underset{(59.93944)}{557.85216} \cdot (MGV - MFLV)/((MG - MFL) \cdot MGEV_{-1})$$

$\bar{R}^2 = 0.6829$ DW = 1.1595 SE = 0.0899 62.1 - 85.4

MC	Imports of consumer goods, millions of 1985 FIM
MCV	Imports of consumer goods, FIM million
MFL	Imports of fuels and lubricants, millions of 1985 FIM
MFLV	Imports of fuels and lubricants, FIM million
MG	Imports of goods, total, millions of 1985 FIM
MI	Imports of investment goods, millions of 1985 FIM
MIV	Imports of investment goods, FIM million
MR	Imports of raw materials, millions of 1985 FIM
MRV	Imports of raw materials, FIM million
MS	Imports of services, millions of 1985 FIM
MSV	Imports of services, FIM million
PMC	Import prices of consumer goods, 1985 = 100
PMFL	Import prices of fuels and lubricants, 1985 = 100
PMI	Import prices of investment goods, 1985 = 100
PMR	Import prices of raw materials, 1985 = 100
PMS	Import prices of services, 1985 = 100

M.7 Tuonnin arvo, raaka-aineet
Imports of Raw Materials, Value

$$MRV = 0.01 \cdot PMR \cdot MR$$

M.8 Tuonnin arvo, raakaöljy sekä poltto- ja voiteluaineet
Imports of Fuels and Lubricants, Value

$$MFLV = 0.01 \cdot PMFL \cdot MFL$$

M.9 Tuonnin arvo, investointitavarat
Imports of Investment Goods, Value

$$MIV = 0.01 \cdot PMI \cdot MI$$

M.10 Tuonnin arvo, kulutustavarat
Imports of Consumer Goods, Value

$$MCV = 0.01 \cdot PMC \cdot MC$$

M.11 Tuonnin arvo, palvelukset
Imports of Services, Value

$$MSV = 0.01 \cdot PMS \cdot MS$$

M.12 Tavaroiden tuonnin määrä
Imports of Goods, Total, Volume

$$MG = MR + MFL + MC + MI$$

M	Imports of goods and services, millions of 1985 FIM
MCV	Imports of consumer goods, FIM million
MFLV	Imports of fuels and lubricants, FIM million
MG	Imports of goods, total, millions of 1985 FIM
MGV	Imports of goods, total, FIM million
MIV	Imports of investment goods, FIM million
MRV	Imports of raw materials, FIM million
MS	Imports of services, millions of 1985 FIM
MSV	Imports of services, FIM million
MV	Imports of goods and services, FIM million
PMG	Import prices of goods, 1985 = 100

M.13 Tavaroiden tuonnin arvo
Imports of Goods, Total, Value

MGV = MRV + MFLV + MCV + MIV

M.14 Tavaroiden tuonnin hinta
Import Prices of Goods

PMG = 100 * MGV/MG

M.15 Tavaroiden ja palvelusten tuonnin määrä
Imports of Goods and Services, Volume

M = MG + MS

M.16 Tavaroiden ja palvelusten tuonnin arvo
Imports of Goods and Services, Value

MV = MGV + MSV

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