A Quarterly M
of the Finnish

by
The Model Project Team
of the Research Department

Bank of Finland Institute for Economic Research

1972 D: 29

A Quarterly Model of the Finnish Economy

by
The Model Project Team
of the Research Department

Second edition

Bank of Finland Institute for Economic Research

Helsinki 1972

ISBN 951-686-007-9

PREFACE

This is a report on the research project begun in 1970 to construct and simulate an econometric model for Finland. The goals of the project and the structure of the model as well as the reasoning behind the specification of the equations are discussed in this report. More detailed reports on the various blocks of the model in addition to the results of the first simulations and forecast experiments are to be published later in 1972 and in 1973.

The construction and use of an econometric model requires a continuing effort. The team has experienced several changes during this process. Pertti Kukkonen initiated the project and has directed the work. He was assisted in 1970 mainly by Hannu Halttunen and Simo Lahtinen. Halttunen built the production and price-income block together with Ahti Molander and subsequently has been working with simulations. Lahtinen constructed the employment block and public sector block together with Antero Arimo. In 1970 Halttunen and Lahtinen used a large share of their time in the preparation and adjustment of data. In 1970 several research fellows of the Institute for Economic Research contributed to the project. Antero Arimo studied public finances, Esko

Aurikko foreign trade, Heikki Koskenkylä investment, Immo Pohjola and Seppo Kostiainen money markets. Pohjola also worked on the consumption equations. Ahti Molander devoted much of his time to the development of price and income equations until May, 1971 when he left the Institute. From the beginning of 1971 Juhani Hirvonen has contributed to the estimation of the complete model. From July 1971 Kari Alho has acted as consultant to the team on methodological problems. In the latter part of 1971 Timo Taivalaho built models for short-term foreign capital movements, and in 1972 Alpo Willman started building models for local government sector. Pekka Lastikka has been doing experiments with fixed point estimation. Riitta Jokinen has been responsible for the very important computer program development and testing. The team has received very generous assistance from many other persons in the Bank of Finland Institute for Economic Research.

This report has been written mainly by Pertti Kukkonen. Hannu Halttunen has written the text for Section 8 and Simo Lahtinen, that for Section 9. Gavin Bingham has checked the English version of the text.

CONTENTS

Page

CHARTS

I. INTRODUCTION

1. Goals of the Research Project

The goal of the project is to build a model suitable for the simulation of the effects of monetary, fiscal and incomes policies. Apart from the simulation of policy alternatives, the model will be used to supplement the more traditional forecasting methods used in the Bank of Finland Institute for Economic Research.

The need for systematic quantitative analysis to provide a basis for counter-cyclical policies is obvious. In Finland the amplitude of business cycles is great, and without doubt counter-cyclical policies can be improved. In particular better knowledge about dynamic relationships and about the time-lags of policy measures are needed. A dynamic quarterly model will add to this knowledge more than an annual model would, and the increase in the availability of quarterly and monthly data in the 1960's has made it possible to construct such a model.

An attempt has been made to construct a money market block and to analyse the effect of the money market on investment. There are still great difficulties in the specification of money market relationships especially as the institutions and relationships in the Finnish money market differ from those in other Western European countries and as the experiences of other countries cannot be applied directly to Finland.

Since the model will be used for the simulation of fiscal as well as monetary and incomes policies, the goal is to construct a rather detailed block for state finances. In the first version state income variables have been explained by means of tax parameters and tax-base variables. State expenditure has been treated as an exogenous policy instrument.

In recent years Finland has experimented quite extensively with incomes policies. An extensive income-price block has been developed and will later be incorporated into the model specifically to analyse the effects of incomes policy measures. In the present version, however, we have aggregated the eight sectors of the block into four sectors to make the model more manageable for practical application.

The smaller version of the model will be joined to the world trade model of the international LINK project. With the aid of this linkage it will become possible to obtain, e.g., consistent quantitative forecasts for Finnish exports. At the same time it will also increase understanding of how business cycles are transmitted from one country to another.

2. Data and Seasonal Adjustment

The model has been estimated for the years 1958-1968. Earlier years were not considered for two reasons. First, both the structure of foreign trade and price-income relationships changed in 1957-1958 when many of the restrictions on foreign trade were lifted following the devaluation of the Finnish mark in 1957. At the same time, the price and income controls of the early 1950's were relaxed. Second, prior to 1958 quarterly data were inadequate.

There are still many deficiencies in the quarterly data. In some cases we have used related annual or other data to construct quarterly series. Lack of data on inventory investments has permitted us to construct only a rudimentary equation for aggregate inventory investment. Time series for inventory investment have been very poor but are now being improved gradually. There is also a serious lack of information on local government finance. Therefore, no equations for local government finance are included in the present version. Work is under way to form a preliminary specification for this sector in the next version of the model. One special data problem has been encountered when joining the model to the LINK world trade model. The ICR (investment-consumption-raw materials) classification system has been used in building Finnish import equations. The LINK models are based on SITC classification. Transformation matrices from ICR to SITC classification are needed to allow the linkage of the Finnish model to the LINK world trade model.

Seasonally adjusted series have been used throughout the model. A method using iterated weighted moving averages has been developed and extensively tested in the institute. At a later stage we plan to analyse more thoroughly seasonal and calendar variations utilising a variant of the regression method[1].

3. Main Features of the Model

The present version of the model is a medium-sized model consisting of about 50 stochastic equations and 50 technical relationships and identities. The model is constructed within the framework of national accounting identities. The GNP-expenditure identity and the accounting framework of the banking system form the main identities.

A general feature of short-term models is that they are often specified in a way which allows explanation of variations in demand components. Total supply is determined from the GNP-expenditure-identity. This kind of specification is based on the fairly realistic assumption that in the short-run supply adjusts to changes in demand. If a rise in the domestic suply is restricted by capacity constraints, the share of imports in total supply will increase and at the same time prices will rise. In the longer run the relations are almost fully reversed. Owing to investment, the supply side becomes more independent.

---

1. See Pertti Kukkonen: Analysis of Seasonal and Other Short-term Variations with Applications to Finnish Economic Time Series, Bank of Finland Institute for Economic Research, Series B:28, 1968.

The structure of the Bank of Finland model follows these general lines. In the short-run, demand plays a dominant role and supply adjusts to it. Potential supply through the growth of capital stock reacts to changes in demand with a distributed lag. The desired capital stock is dependent mainly on changes in output. Actual capital stock then adjusts to the desired stock.

The model is basically a Keynesian income-multiplier model. Like other short-term macro-models it has other theoretical elements as well. Consumption equations are based on the permanent income hypothesis. In commodity and labour markets we assume that firms compete imperfectly and maximize profits. The models of demand for capital and labour services are consistent with a Cobb-Douglas production function although derivation of the labour demand equations was based on a CES-production function.

Special features of the Finnish money market have affected the specification of the demand for capital and investment equations and the money market block. In Finland interest rates have not reflected demand and supply conditions but have been kept quite rigid. They have not cleared the market and some credit rationing has come about. Jorgenson's neo-classical investment function with a cost of capital services variable is not applicable in this kind of institutional framework. We have had to resort to a less sophisticated model based on a flexible accelerator. We have incorporated both a variable measuring the availability of credit and an interest rate variable into this model. The availability of credit variable affects residential construction and investment in industrial buildings and machinery and indirectly, through the latter, the import of investment goods. In all cases it has a lag of considerable length.

The functioning of the Finnish money market is in a way more simple than in other Western European countries. Equity and bond markets are negligible compared to bank lending. The self-financing ratio of firms has been low, and bank loans play a central role in the financing of private enterprise. In such circumstances it has been natural to start construction of the monetary block of the model from the bank sector and from factors affecting bank lending. As a result the ratio of central bank credit to bank lending measures the availability of credit and is used in the investment equations.

In the first phase of the study, work on the foreign trade and balance of payments block was concentrated on import volume equations. For the most part, theory of demand gave rise to the hypotheses behind the equations. Income or activity variable together with relative prices, import prices divided by domestic prices, are the main variables of these functions. Import and export prices are taken as exogenous. Work is in progress on the construction of functions for export prices as well as for imports and exports of services and for short-term capital movements.

There are two versions for the production, employment, prices and incomes block which differ in the extent of their sectoral disaggregation. The smaller version has four and the larger eight sectors. The block is based on an extended input-output model, into which various pricing behaviour hypotheses and adjustments have been incorporated. We assume that pricing behaviour in sectors that are exposed to foreign competition is different from pricing behaviour in sheltered sectors. As the share of foreign trade in the Finnish economy is fairly large, import and export prices have a considerable impact on domestic prices.

The determination of wages is influenced by changes in prices and productivity and to a smaller extent by excess demand measured through unemployment as a percentage of the labour force. This Phillips-curve effect has probably more weight in wage drift than in negotiated wage increases.

Entrepreneurial and capital incomes are specified for the open sectors as residuals after deduction of wages and material inputs, and for the sheltered sectors such income is viewed as a constant share (with a trend) of total income. The disposable incomes of households are derived after adjustments owing to income transfers and taxes which are determined in the public finances block. The disposable income variable transmits the influence of tax and transfer payments as well as income changes on consumption and residential construction.

4. Non-linearities in the Model

The model is linear in the parameters but non-linear in the variables. First, many of the equations have been logarithmically transformed. This transformation has the advantage that it gives values corresponding to elasticities for the parameters and makes the variances of the error terms, which so often tend to increase with time, more constant. The other type of non-linearity is the use of price and interest rate ratios in consumption, import demand and some monetary relationships. In addition, non-linearities appear in some identities where the value of a variable is defined in terms of prices and quantities.

The non-linear nature and the dynamic properties of the model affect the techniques used in simulation and forecasting. Numerical algorithms have been used to find solutions for the fairly large simultaneous block of the model. So far we have been using mainly Gauss-Seidel algorithms in the SIMULATE II program of the University of Wisconsin in these experiments.

In the present version, the model has been estimated equation by equation with the ordinary least squares method. Consistent estimation of the system is under way. In the estimation process we have benefited substantially from the MASSAGER and DATABANK programs which the Bank of Canada has provided.

II. SPECIFICATION OF THE MODEL AND SOME ESTIMATION RESULTS

5. Investment[x]

The quarterly data for fixed investment is partly based on recent preliminary estimates of the Central Statistical Office, some of which were made specifically for the Bank of Finland model project. The intention is to improve the data at later stages of the project. The most serious difficulties are in the division of total investment into private and public quarterly investment and in the evaluation of quarterly investment in machinery and equipment.

Separate models have been constructed for fixed business investment, investment in machinery and equipment, residential construction and inventory investment. In the model public sector investment is exogenous.

One important aim in the construction of the investment block has been to discover the effects of the money markets

---

x Most of the research for this block has been carried out by Heikki Koskenkylä; the inventory investment equation was formulated by Hannu Halttunen.

on investment. Earlier in section 3 the special features of Finnish money markets were touched upon briefly. As interest rates were quite rigid in the 1960's, credit rationing effects were created. Mainly for this reason it has not been possible to apply directly Jorgensonian neoclassical theory to the explanation of the demand for capital.[1] In this theory the monetary effect is carried by the user cost of capital variable, and rationing effects have not been allowed for.

We have started from a version of the Chenery-Koyck flexible accelerator model[2] where we assume that the desired capital stock (K^+) is dependent on output (Q) and the expected availability of credit ($RKIR^e$)

$$(5.1.)\quad K_t^+ = \alpha Q_t + \beta RKIR_t^e ,$$

and where adaptation of the actual capital stock (K) to the desired level is shown by the model

$$(5.2.)\quad K_t - K_{t-1} = g(K_t^+ - K_{t-1}).$$

Further, we assume that expectations on the level of the availability of credit are formed in the following way

---

1. See e.g. Dale W. Jorgenson: "Capital Theory and Investment Behavior", American Economic Review, May 1963.

2. See Hollis B. Chenery: "Overcapacity and the Acceleration Principle", Econometrica, January 1952.
L.M. Koyck: Distributed Lags and Investment Analysis, Amsterdam 1954.

$$(5.3.)\quad RKIR_t^e - RKIR_{t-1}^e = v(RKIR_t - RKIR_{t-1}^e),$$

where RKIR is the actual level of availability of credit. It can be seen that the lag distribution in this specification is a convolution of two geometric distributions which (as a special case) leads to the Pascal distribution. Finally if we assume that replacement investment is proportional to capital stock, it can be shown that these assumptions lead to the following equation for gross investment (I)[1]:

$$(5.4.)\quad I_t = a_0 + a_1 (Q_t - Q_{t-1}) + a_2Q_{t-1} + a_3RKIR_{t-4}$$
$$+ a_4(K_{t-1} - K_{t-2}) - a_5K_{t-1}.$$

In addition, an interest rate of bank loans (RR) variable is included in the equation. This variable reflects here "the user cost of capital" concept. In principle, we should have here a variable describing the effect of business taxation as well. In Finland it is extremely difficult to specify this effect because of liberal rules in the valuation of inventories.

This kind of model is used for total fixed business investment and for investment in machinery and equipment. The lat-

---

1. The availability of credit variable is here lagged with four quarters, which was found both to improve the fit and also to be reasonable *a priori*.

ter variable is needed for the model explaining the import of investment goods. For fixed business investment (IYKT) we find[1]

$$(5.5.)\quad IYKT_t = \underset{(3.9)}{1168} + \underset{(4.3)}{1.318}\, Q4_{t-1} + \underset{(0.4)}{0.1579}\,(Q4_t - Q4_{t-1})$$

$$- \underset{(1.9)}{9.821}\, RKIR_{t-4} - \underset{(1.3)}{20.13}\, RR_t$$

$$+ \underset{(3.2)}{0.3462}\,(KKT_{t-1} - KKT_{t-2}) - \underset{(2.9)}{0.0357}\, KKT_{t-1},$$

$$\bar{R}^2 = 0.876 \qquad D\text{-}W = 1.25$$

where

Q4 = volume of production in sector 4 (mainly manufacturing industries) and

KKT = business capital stock.

For capital stock in the end of period t, our estimation gave the result

$$(5.6.)\quad KKT_t = IYKT_t + (1-\underset{(4349)}{0.0037})KKT_{t-1},$$

$$\bar{R}^2 = 0.999 \qquad D\text{-}W = 1.70$$

where we have a replacement coefficient of 0.0037 per quarter or 1.5 per cent per annum.

---

1. $\bar{R}^2$ is the coefficient of determination adjusted for degrees of freedom, D-W is Durbin-Watson statistic and the absolute values of the t-statistics are in brackets beneath the parameters.

For investment in machinery and equipment (IYK) and the corresponding stock of capital (KK), we obtain the estimates

$$(5.7.)\quad IYK_t = \underset{(8.7)}{1482} + \underset{(7.1)}{1.630}\, Q4_{t-1} + \underset{(2.8)}{0.8308}\,(Q4_t - Q4_{t-1})$$

$$- \underset{(2.1)}{24.30}\, RR_t - \underset{(5.5)}{0.0732}\, KK_{t-1}$$

$$\bar{R}^2 = 0.826 \qquad D\text{-}W = 1.59$$

$$(5.8.)\quad KK_t = IYK + (1 - \underset{(3321)}{0.0049})KK_{t-1}$$

$$\bar{R}^2 = 0.999 \qquad D\text{-}W = 1.94$$

For <u>residential construction</u>, a very simple specification has been used in the present version of the model. The volume of residential construction (IA) is seen as dependent on real disposable income (UIA), the availability of credit and two dummy variables (DI 62 and DI 66) describing the effect of the gradual abolition of the system of tax-free rent income, which was used as an incentive for investment in housing.

$$(5.9.)\quad IA_t = - \underset{(8.1)}{101.2} + \underset{(26.3)}{0.1499}\left(\frac{1}{4}\sum_{v=o}^{3} UIA_{t-v}\right)$$

$$+ \underset{(1.3)}{0.0695}\ \Delta\left(\frac{1}{4}\sum_{v=o}^{3} UIA_{t-v}\right) - \underset{(2.2)}{2.036}\, RKIR_{t-4}$$

$$+ \underset{(7.8)}{133.3}\, DI62_t + \underset{(3.6)}{75.10}\, DI66_t$$

$$\bar{R}^2 = 0.960 \qquad D\text{-}W = 1.18$$

A more elaborate model for housing investment has been constructed recently, but it has not been included in the present version of the total model. In this model a distinction has been made between construction financed privately and construction which has been financed in part through state subsidized loans.

The lack of data on inventory investment has meant that only a rudimentary equation on this item could be constructed for the economy as a whole. Because the data on inventory investment have been calculated as a residual from the national accounting identity, a "statistical discrepancy" is included as well.

The theoretical background for the equation rests on the stock adjustment hypothesis: the desired level of inventories is dependent on sales expectations (approximated by production (Q^e)) which, in turn, are assumed to be formed by the weighted sum of production in the current and the previous quarter [$Q_t^e = \lambda Q_t + (1 - \lambda)Q_{t-1}$]. The equation also includes time, to take account of the systematic changes in the statistical discrepancy and a dummy variable (DC) to allow for a sudden change in inventories before the new sales tax was introduced in 1964. The estimation results based on these hypotheses are given below.

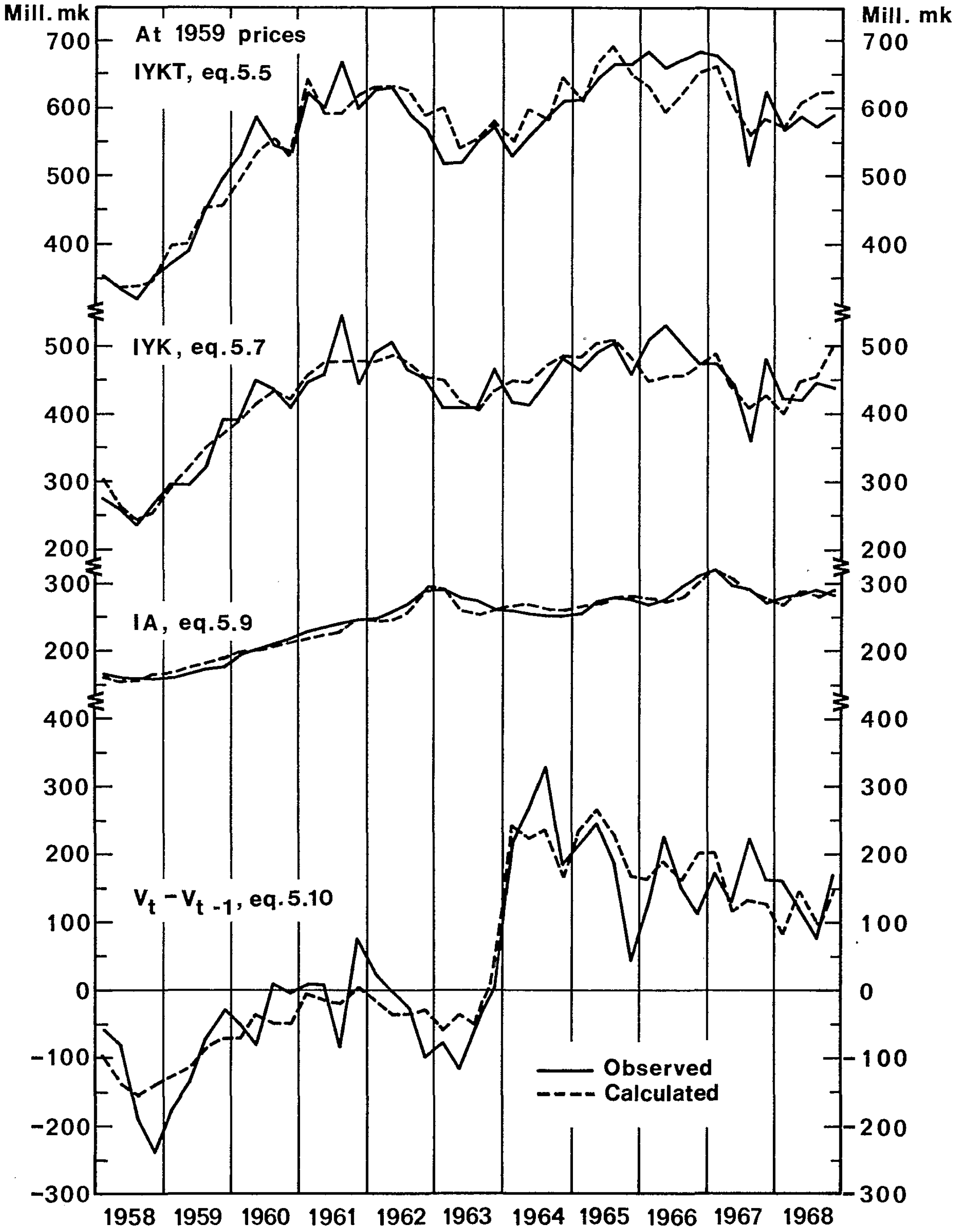
$$(5.10.)\quad V_t - V_{t-1} = \underset{(2.4)}{-\ 1286} + \underset{(2.6)}{0.445}\, Q_{t-1} + \underset{(3.1)}{0.5321}\, \Delta Q_t - \underset{(1.3)}{0.0227}\, V_{t-1}$$

$$+ \underset{(7.4)}{245.5}\, DC_t - \underset{(2.3)}{18.81}\, TIME$$

$\bar{R}^2 = 0.851 \qquad$ D-W = 1.35

Chart 1.

INVESTMENT



6. Monetary relationships[x]

6.1. General

As was indicated in the introduction, special features in the Finnish money market have strongly effected the specification of this block.

The Finnish money markets are relatively simple since equity and bond markets are negligible compared to bank lending. Bank loans play a central role in the financing of business, the more so as the self-financing ratio of firms has been low. Another special feature of the Finnish money market in the 1960's was almost totally rigid interest rates; both the lending interest rates and the deposit rates were almost unchanged in the 1960's.[1] The real interest rate has been relatively low. As a result, the demand for bank loans has generally exceeded the supply of funds, and credit rationing effects have been created.

---

x The research on this block has been carried out by Immo Pohjola.

1. A small part of total deposits, i.e. deposits in index-linked accounts experienced interest rate changes. In some cases minor changes in lending rates have resulted from index-linkages in deposit rates. In connection with the 1968 stabilization programme, the index-linkage system was abolished. In June 1971, the lending and deposit rates were raised by one percentage unit and in December 1971, lowered by 3/4 percentage units. The variations in the lending rate variable (RR) are thus comparatively small.

Banks´ funds have consisted mainly of time deposits from the public. Moreover, the banks have resorted to borrowing from the central bank and from abroad. The amount of central bank credit granted to the banks has been at a high level since 1959. By regulating the terms and availability of central bank credit, the Bank of Finland has affected the banks´ liquidity and thus their willingness to grant loans and other types of credit to the business sector and private persons. The liquidity of the banks and their credit expansion has also been manipulated through the control of the availability to the banks of foreign credits, which the Bank of Finland has the authority to regulate. Variations in interest rates have some additional effect in clearing the market.

6.2. The Accounting Identity and Central Bank Credit

In these circumstances it has been natural to start construction of the monetary block of the model from the banking sector and from factors affecting bank lending and the availability of credit for financing investments. We begin with the following accounting identity for the banking sector.

Central bank credit, net (RKPV)	=	total bank credits to the non-bank private sector (RL)
	+	banks´ credits to the central government,net (RGB)
	-	time and demand deposits (RT+RD)
	-	credits from abroad, net (RBF)
	-	own capital minus other assets of the banks, net (RO-RM)

We have specified equations for the items on the right-hand side of this identity except the banks´ net credits to the state, which in this phase of the study is taken to be exogenous, and changes in the banks´ other assets which are small compared to changes in other items and can be treated as exogenous.

Ex post, we can obtain central bank credit from this identity. Ex ante, central bank credit possibly adjusts only partially in accordance with this identity. At times the Bank of Finland actively affects this credit. To allow for this in the simulations, we can add a policy variable to the equation. Analogically we can allow for the effect of the Bank of Finland´s regulation of capital imports via the banks.

6.3. The Demand for Bank Credits

Total demand for financing is dependent on the value of private fixed investment and changes in inventories. In addition the degree of self-financing by firms influences the demand for bank credit. So far we have not obtained a reasonable estimate for the coefficient of the bank lending rate (RR). Probably credit rationing is so strong that the effect of the interest rate is slight. In the equations we are now working on, variables for the gross profits of firms (YH-YS-YKV-YDIV) and for the trade balance (BTF) are used as measures of self-financing opportunities. Other sources of finance, e.g. foreign loans, loans from insurance companies and the state budget should in principle be taken into account in this equation. So far we have been able to identify the effect of foreign long-term loans (PPN).

The equation is important for simulations and forecasts designed to discover the upper limit for fixed and inventory investment for any given amount of financing resources. The equation for the demand for bank loans is as follows:

$$(6.1.)\quad RL_t - RL_{t-1} = \underset{(2.2)}{83.57} + \underset{(2.2)}{0.1841}\,\left[(IYKT + IA)\,\frac{PI}{100} + DVF\right]_t$$

$$- \underset{(0.5)}{0.0533}\,(YH\text{-}YS\text{-}YKV\text{-}YDIV)_t - \underset{(3.2)}{0.5629}\,PPN_t$$

$$- \underset{(5.1)}{0.5510}\,BTF_t$$

$\bar{R}^2 = 0.616 \qquad D\text{-}W = 1.16$

6.4. Supply from Domestic Sources: Time and Demand Deposits

Time deposits (RT) is the most important item in the supply of funds for the banks. In Finland the stock of time deposits is almost ten times as great as the stock of demand deposits.[1] Therefore, special weight must be given to the explanation of time deposit behaviour. The most important variables influencing time deposits are disposable income of households (YD) and the share of forestry income in the total of agricultural and forestry incomes ($\frac{YS3}{YS1+YS3}$). The expected yields from other assets, e.g. houses, apartments and state bonds should also exert an influence. Our long-term target is to derive time series for the yields of different assets. In this first phase of the study we have had to resort to a simpler approach.

As was said earlier, interest rates for deposits have been almost constant for long periods; for time deposits they have been between 4 and 6 per cent depending on the type of account. To take account of the differences in profitability between time deposits and real assets, we have used the consumer price index-variable (PCY). Finally, there was a large sudden change in after tax rent income, when changes were made at the beginning of 1963 in the tax treatment of rent-income from houses and apartments. We have a dummy variable (DMY5) to allow for this effect.

---

1. The reason for this is that up to certain monthly limits Finnish bank practice has made time deposits almost as liquid as demand deposits. For this reason households and small firms hold their cash in time deposit accounts.

The linear model for first differences in time deposits (RT) is as follows:

$$(6.2.)\quad RT_t - RT_{t-1} = \underset{(1.0)}{-\,36.26} + \underset{(10.9)}{0.0535}\, YD_t + \underset{(2.1)}{2436}\, \frac{YS3_t}{YS1_t + YS3_t} - \underset{(3.6)}{2060}\, \frac{PCY_t - PCY_{t-1}}{PCY_{t-1}} - \underset{(7.6)}{64.73}\, DMY5_t$$

$\bar{R}^2 = 0.814 \qquad D\text{-}W = 1.39$

In Finland demand deposits (RD) are opened mainly by firms and entrepreneurs. Demand deposits are influenced by changes in business incomes (YH).

$$(6.3.)\quad RD_t = \underset{(4.1)}{151.3} + \underset{(22.6)}{0.3609}\, YH_t$$

$\bar{R}^2 = 0.922 \qquad D\text{-}W = 0.41$

6.5. Credits from Abroad

Banks use foreign credits (RBF) as an additional source of funds to an extent that depends partly on the demand for credits. This is measured by the availability of credit variable. The willingness to take foreign credits is also dependent on the ratio of foreign to domestic interest rates (RF/RR). The model is able to explain the level of foreign credits but not short-term fluctuations in them. For a small country such as Finland individual loans are relatively large compared to the total, and it is not possible to predict each individual transaction with the model. Therefore we have quite a significant error-term for this model. Another factor which increases the error-term is the control of foreign credits by the Bank of Finland. The effects of this control cannot be explained by the variables of the. model.

$$(6.4.)\quad RBF_t \quad \underset{(29.4)}{0.9752}\ RBF_{t-1} + \underset{(2.3)}{2.696} \sum_{v=1}^{3} RKIR_{t-v} - \underset{(1.3)}{28.31} \frac{RF_t}{RR_t}$$

$$\bar{R}^2 = 0.973 \qquad D\text{-}W = 1.93$$

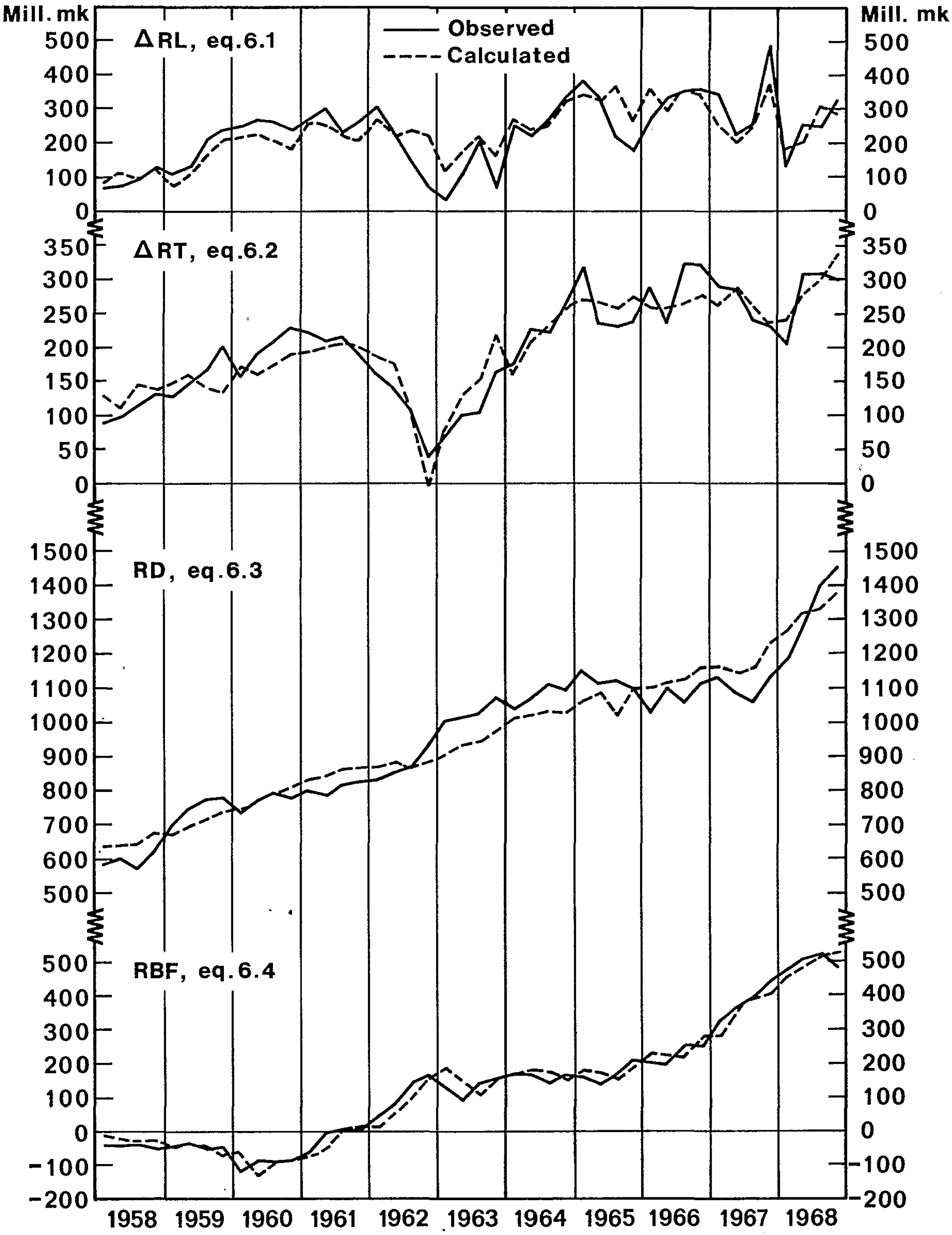
6.6. Availability of Credit

As was seen in section 5, the availability of credit variable (RKIR) was used in the investment equations to take into account the lagged effect of market conditions or the availability of credit for investment. We have experimented with a variable obtained by dividing total central bank credits by total bank credits to the private sector, which thus represents the share of central bank credit in total private sector credit: $RKIR = 100 \frac{RKPV}{RL}$.

It is possible that the effect of this variable is in fact curvilinear because as the share of central bank credit grows, central bank resistance to increasing its advances should rise more than proportionally. If there is an absolute ceiling to central bank credit which comes into effect, the variable will no longer reflect any increase in the tightness of conditions in the money market. This is one of the drawbacks of the model, and more research is needed to overcome it.

Chart 2.

MONETARY RELATIONSHIPS



7. Private Consumption[x]

There have been several important developments in consumption theory since the simple Keynesian consumption function. According to the permanent income hypothesis[1], the effect of income has a special lagged effect on consumption. In the present model, this has been approximated by a four quarter moving average of households´ real disposable income. Classical theory of consumer demand for different commodities provides the hypothesis that prices allocate total consumption among various goods.

Much less is known about the effect of wealth on consumption behavior. Lack of data on the stock of wealth of households is one obstacle to analysis in many countries. In Finland the lack of data is serious, and we have used just one variable, liquid assets (in Finland time deposits), to describe the effect of wealth variables.

Differences in the propensity to consume out of different types of income have been taken into account by variables

---

x The research on this block has been carried out by Immo Pohjola.

1. See, e.g., Franco Modigliani - Albert Ando: The "Permanent Income and Life Cycle Hypothesis..." in Study at Consumer Expenditures Incomes and Savings, Proceedings of the Conference on Consumption and Saving, Vol. II, Washington 1960.
Milton Friedman: A Theory of Consumption Function, 1957.

describing the shares of wage and other forms of income in total income. The changes in the distribution of income are so slow that their effect is very difficult to separate from the trend in consumption, and no attempt has been made to account for them.

It has been found in many countries that changes in incomes are not sufficient to explain the large variations in the purchases of durables, especially motor cars. It seems that employment also has an effect on the purchases of cars and other durable goods.[1] In the present equations unemployment rate is used to include this effect.

Quarterly data for durable goods other than cars is not available. For this reason, we have estimated different consumption equations for all goods (excluding cars), for cars and for services.

For the volume of the consumption of goods (CT), we get the following equation:

$$(7.1.)\quad \text{Log } CT_t = \underset{(18.0)}{0.9353} + \underset{(36.6)}{0.6530} \text{ Log } \frac{1}{4}\sum_{v=0}^{3}\left(\frac{YD}{PCY}\right)_{t-v}$$

$$+ \underset{(3.5)}{0.0202} \text{ Log } \frac{1}{4}\sum_{v=0}^{3}(RT_{t-v} - RT_{t-v-1})$$

$$- \underset{(4.9)}{0.0240} \text{ Log } LUR_t + \underset{(6.8)}{0.0225} \text{ DMY4}$$

$$\bar{R}^2 = 0.984 \qquad D\text{-}W = 1.57$$

---

1. See e.g. Michael K. Evans and Lawrence R. Klein: The Wharton Econometric Forecasting Model, Philadelphia 1968, p. 23.

where

$\frac{YD}{PCY}$ = real disposable income of households (PCY = price index for private consumption)

RT = time deposits of the public in banks

LUR = unemployment as a percentage of labour force

DMY4 = dummy variable for the effect of the change in sales tax in the beginning of 1964

For the volume of sales of cars (CA), we obtain the equation

$$(7.2.)\quad \text{Log } CA_t = \underset{(0.8)}{-1.543} + \underset{(7.1)}{2.201} \text{ Log } \frac{1}{4}\sum_{v=0}^{3}\left(\frac{YD}{PCY}\right)_{t-v}$$

$$- \underset{(4.2)}{2.006} \text{ Log}\left(\frac{PAU}{PCY}\right)_t - \underset{(3.1)}{0.2316} \text{ Log } LUR_{t-1}$$

$$- \underset{(2.2)}{0.3196} \text{ DMY3}$$

$\bar{R}^2 = 0.897$ D-W = 0.99

where

$\frac{PAU}{PCY}$ = prices of cars/prices of total private consumption

DMY3 = dummy variable for the effect of the devaluation of Fmk in 1967

For cars, the income elasticity of demand is fairly high, (2.20) and at the same time the relative price elasticity is high (2.01) as might well be expected. When unemployment rises from 1.5 to 3 per cent (which is the average rise during a moderate recession), ceteris paribus this will cause a 23 per cent fall in the sale of cars.

For the volume of services (CP), the estimated equation is

$$\text{(7.3.)}\quad \text{Log } CP_t = \underset{(0.1)}{-0.0145} + \underset{(26.0)}{0.9305} \text{ Log } \frac{1}{4}\sum_{v=0}^{3}\left(\frac{YD}{PCY}\right)_{t-v}$$

$$- \underset{(5.7)}{0.1724} \text{ Log } \left(100\frac{YS1 + YS3}{YW}\right)_t$$

$$\bar{R}^2 = 0.988 \qquad D\text{-}W = 1.02$$

where

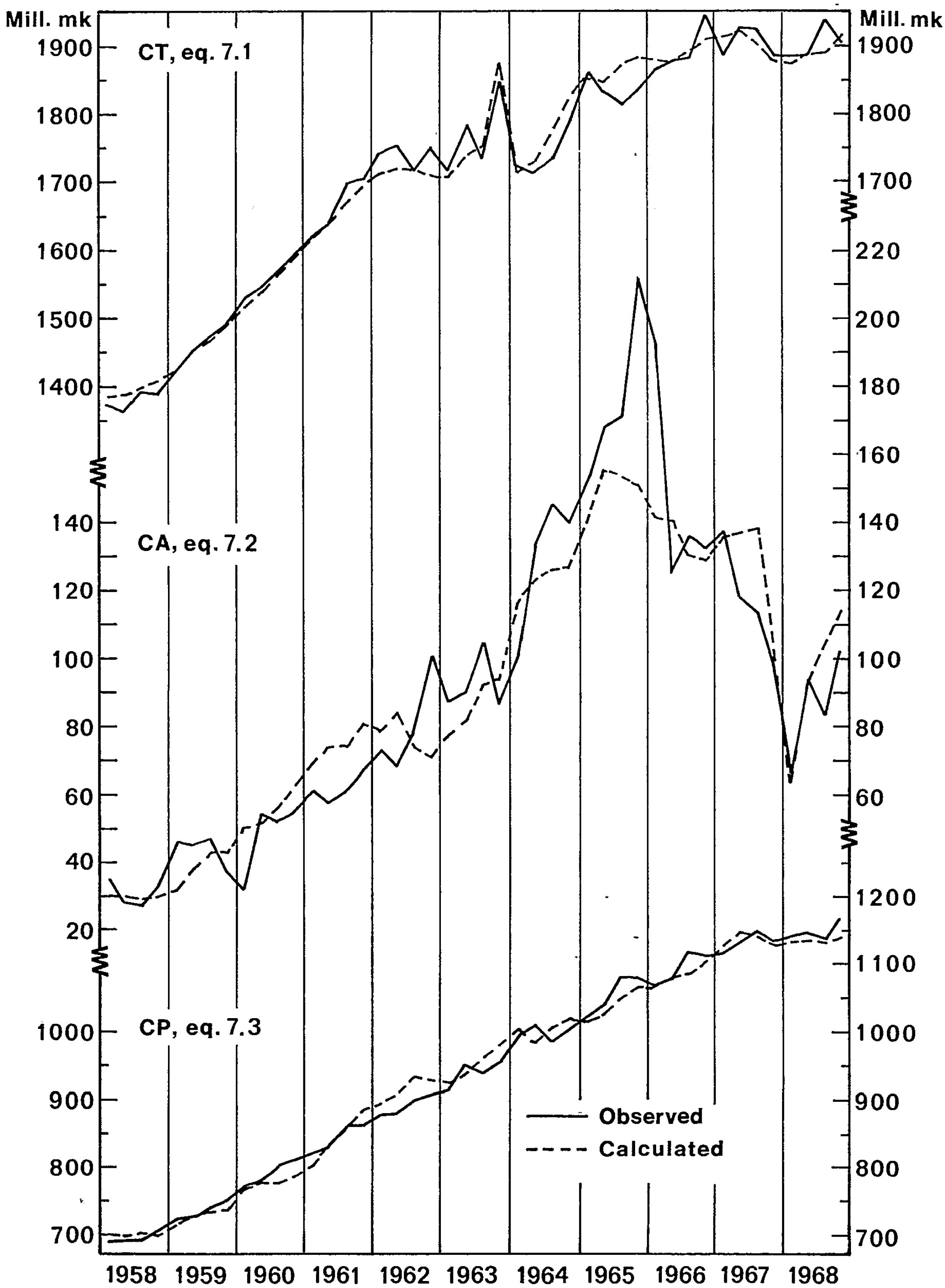
$\frac{YS1 + YS3}{YW}$ = ratio of entrepreneurial income in sectors 1 and 3 to wage income

The income elasticity for services is almost one (0.93). The average income elasticity for the three consumption categories is 0.82.

For the central government tax income equations, we need an explanation of the value of tobacco consumption (mainly cigarettes) and of the volume of gasoline (petrol) consumption. These additional consumption equations are presented later in the list of equations.

Chart 3.

CONSUMPTION



8. Production, Prices and Incomes[x]

8.1. General

In demand-oriented macroeconomic models where production is disaggregated, an input-output scheme can be used to generate a large number of sectoral production, price and non-wage income estimates.[1] An approach of this type has served as the primary basis for the work presented in the following sections.[2]

In the model the economy has been divided into four sectors, two of which are exposed to foreign influences and two of which are sheltered sectors.

The products of the sheltered sectors are marketed at home without any marked foreign competition either because of their physical nature or because of government protection. The exposed sectors either market their products abroad or on the domestic market under strong foreign competition.

---

x The research on this block has been carried out by Hannu Halttunen.

1. Cf., Odd Aukrust: "Prim I, A Model of the Price and Income Distribution of an Open Economy", The Review of Income and Wealth, No. 1 March 1970.
F.M. Fisher - L.R. Klein - Y. Shinkai: Price and Output Aggregation in the Brookings Econometric Model, Amsterdam 1965.
D. Kresge:, Price and Output conversion: a Modified Approach in the Brookings Model: Some Further Results, Amsterdam 1969.
A. Molander - H. Aintila - J. Salomaa: Vakautuksen vaikutus hinta- ja palkkatasoon, Publications of SITRA, Series B No. 5, Helsinki 1970 (in Finnish).

2. In sections 8.2. - 8.5. the subscript t denoting time has been left out because of the static nature of the equations.

We assume a different pricing behaviour in sheltered and exposed sectors. In the exposed sectors, production prices are assumed to be determined partly by world market prices and partly by domestic labour costs. Non-wage incomes in these sectors are then more or less a residual determined from the input-output framework.

In sheltered sectors, production prices have been derived from the input-output framework. In these sectors, non-wage income is assumed to be determined by simple mark-up pricing, modified by the rate of capacity utilisation.

The following sectoral division is used in the model.

Sheltered sectors

1) Agriculture

2) Non-competitive production (food processing, beverage and tobacco industries, printing, publishing and allied industries, electricity, gas, water and sanitary services, construction, transport and communications, commerce, banking and insurance, ownership of dwellings, public administration and defence, education, medical and health services and other services). 'Non-competitive' here indicates lack of competition with foreign products, no implication on the degree of competition at home is intended. Similarly in item 4, 'competitive' refers only to competition with foreign products.

Exposed sectors

3) Forestry

4) Competitive production (wood and paper industries, basic metal industries, manufacture of textiles, footwear,

other wearing apparel and made-up textile goods, manufacture of furniture and fixtures, manufacture of leather and leather products, manufacture of rubber products, manufacture of products of petrolium and asphalt, manufacture of non-metallic mineral products, manufacture of electrical machinery, apparatus, appliances and supplies, manufacture of transport equipment and miscellaneous manufacturing industries, mining and quarrying)

8.2. Output Conversion

Consider the national accounting identity

$$(8.1.)\quad Q_1 + Q_2 + \dots + Q_n = E_1 + E_2 + \dots + E_m$$

where Q_i is the volume of value-added in the ith sector and E_i is the volume of the ith component of final demand. Assume next that the output of each sector is simply a weighted sum of the various GNP components:

$$(8.2.)\quad \begin{bmatrix} Q_1 \\ Q_2 \\ \vdots \\ Q_n \end{bmatrix} = \begin{bmatrix} b_{11} & b_{12} & \dots & b_{1m} \\ b_{21} & & & \\ \vdots & & & \\ b_{n1} & & \dots & b_{nm} \end{bmatrix} \times \begin{bmatrix} E_1 \\ E_2 \\ \vdots \\ E_m \end{bmatrix}$$

Since one mark of expenditure must be matched by exactly one mark of output, the weights b_{ij} must sum to unity for each demand component:

$$(8.3.) \quad \sum_{i=1}^{n} b_{ij} = 1 \quad \text{for all } j.$$

Naturally all the weights must be non-negative as well.

So far it has been assumed that relation (8.2.) holds for all time periods. If this is the case, the B-matrix could be determined from input-output tables if they were available. If, however, B is not constant but changes over time such a procedure becomes dubious.

In this study instead of using input-output tables in calculating the B-matrix, regression analysis has been used in the following way. Each production variable has been regressed on each demand variable, and the regression coefficients are used as estimates of the rows of the B-matrix. Time has been included in every equation in order to provide a linear approximation of the net effect of changes in the coefficients. The coefficients of this trend variable ought to sum to zero. The empirical estimates of the B-matrix are given below.

	C	I	(X-M)	ΔV	TIME	$\bar{R}^2$	D-W
Q1	0.114 (6.5)	0.128 (2.5)	0.192 (4.3)	0.175 (4.4)	-5.594 (12.6)	0.477	1.813
Q2	0.627 (22.4)	0.137 (1.7)	0.314 (4.4)	0.158 (2.5)	3.518 (5.0)	0.994	1.512
Q3	0.046 (3.5)	0.175 (4.6)	0.161 (4.7)	0.196 (6.5)	-4.159 (12.4)	0.656	1.389
Q4	0.141 (14.3)	0.294 (10.4)	0.265 (10.5)	0.197 (8.9)	5.993 (24.0)	0.997	1.593
TS	0.072 (3.4)	0.266 (4.4)	0.068 (1.3)	0.274 (5.7)	0.242 (0.4)	0.961	0.883
Column-sum	1.000	1.000	1.000	1.000	0.000		

where

Q_i = volume of production in sector i at factor cost ($i = 1,\dots,4$)

TS = volume of indirect taxes minus subsidies

C = volume of total consumption

I = volume of total fixed investment

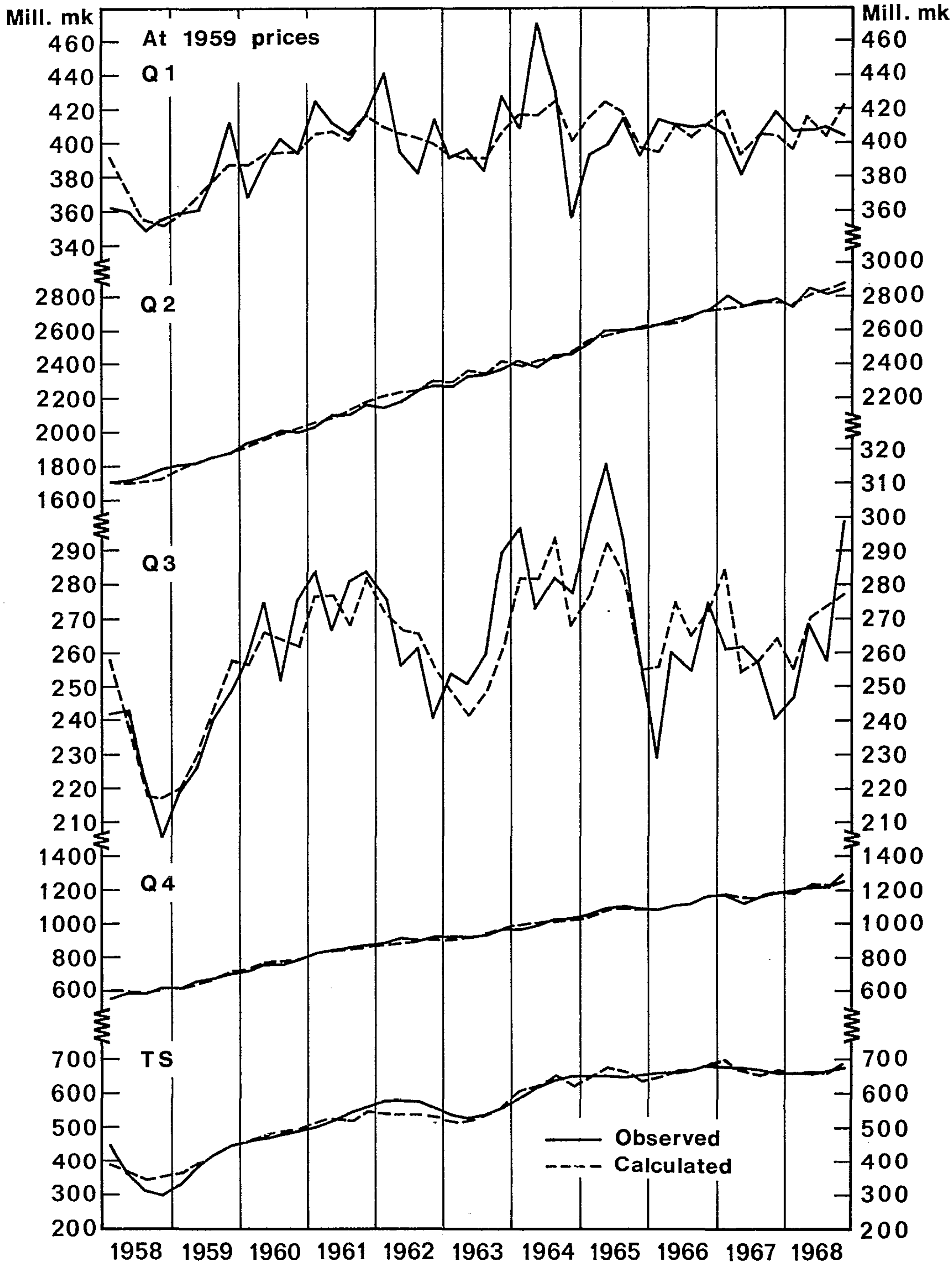
X = volume of export, goods and services

M = volume of imports, goods and services

ΔV = change in business inventories, volume

Chart 4.

OUTPUT CONVERSION



Because of inadequacies in the data, production is measured at factor cost; this means that we obtain an equation for indirect taxes minus subsidies as well.

As can be seen, the estimated B-matrix meets the unity and zero restrictions. This matrix has been used in the model to derive the estimates of sectoral output volumes.

8.3. Production Prices and Non-wage Incomes

The conventional input-output price model can be written

$$(8.4.) \quad P = (I - A')^{-1}F^{d}D$$

where P is the vector of production prices, A is the matrix of inter-industry input coefficients, F^{d} is the diagonal matrix of basic inputs[1] and D is the cost (deflator of production) vector of sectoral basic inputs.

Consider now an input coefficient matrix for an open economy which is partitioned according to the sectoral division.

1. Superscript d is used to denote a diagonal matrix formed by a F vector.

$\bar{A}_{SS}$	A_{SE}
$\bar{A}_{ES}$	$\bar{A}_{EE}$
A_{MS}	A_{ME}
F_S	F_E
π_S	π_E

$\bar{A}$ is the matrix of domestic inter-industry input coefficients; S refers to sheltered sectors and E to exposed sectors; A_M is the vector of input coefficients for imports; F is the vector of basic input coefficients and π is the vector of indirect tax coefficients.

According to equation (8.4.), the price model of the sheltered sectors can now be written as follows:

$$(8.5.)\quad P_S = [I - \bar{A}'_{SS} - \pi^d_S]^{-1} \times [\bar{A}'_{ES}P_E + A^d_{MS}P_{MS} + F^{d^{-1}}_S (YW_S/Q_S + YH_S/Q_S)]$$

where P_S is the price vector of gross production in the sheltered sectors, P_E is the price vector of gross production in the exposed sectors, P_M is the price vector of imported inputs, YW_S is the wage sum vector of sheltered sectors, YH_S is the vector of non-wage income in the sheltered sectors and Q_S is the vector of value-added in the sheltered sectors.

A corresponding model for prices in exposed sectors could be written by interchanging S by E. Non-wage income for exposed sectors is determined from this equation, when prices are first determined from the equation (8.20.) as for sector 4 or assumed to be exogenous, as for sectors 1 and 3.

Solving the price model for the unit non-wage incomes (the ratio of non-wage income to value-added) in the exposed sectors, we get

$$(8.6.)\quad YH_E/Q_E = F_E^e\left[(I - \bar{A}'_{EE} - \pi_E^d)P_E - A'_{SE}P_S - A_{ME}^d P_{ME}\right] - YW_E/Q_E$$

Using the 1965 input-output tables to calculate the input coefficients we get the following estimates:

Delivering Sector \ Receiving Sector	1.	2.	3.	4.
1.	0.254	0.082	0.032	0.002
2.	0.138	0.177	0.012	0.101
3.	0.007	0.009	0.001	0.101
4.	0.055	0.103	0.011	0.285
A_{Mj}	0.023	0.039	0.003	0.143
F_j	0.516	0.565	0.934	0.358
π_j	0.007	0.025	0.007	0.010
Column-sum	1.000	1.000	1.000	1.000

When we substitute these estimates of the input coefficients into models (8.5.) and (8.6.), we obtain equations for prices in non-competitive production (8.7.) and non-wage incomes in the exposed sectors (8.8.), (8.9.), (8.10.). Agricultural prices are formulated in the income negotiations mainly between central organizations of farmers and the government, i.e. exogenously. Thus this sector has been treated as exposed. In this way we get a price equation for non-competitive production and equations for non-wage income in agriculture, forestry, and competitive production.

$$(8.7.)\quad \hat{P2} = 0.102\ P1 + 0.011\ P3 + 0.13\ P4 + 0.049\ PM3 + 0.708\ YH2/Q2 + 0.708\ YW2/Q2 + 0.708\ S2/Q2$$

$$(8.8.)\quad \hat{YH1} = 1.432\ P1 \times Q1 - 0.267\ P2 \times Q1 - 0.014\ P3 \times Q1 - 0.107\ P4 \times Q1 - 0.044\ PM1 \times Q1 - YW1 - S1$$

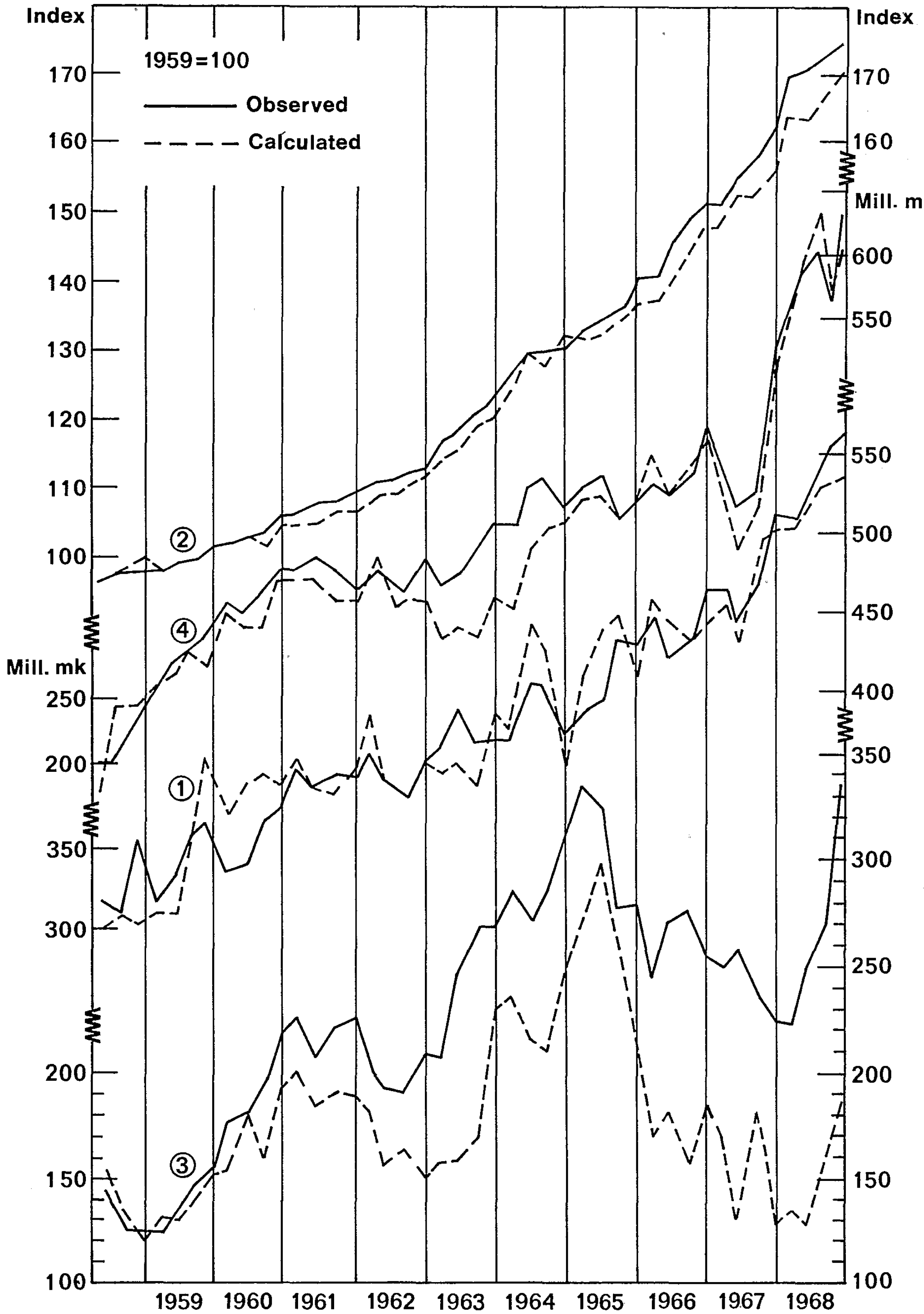
$$(8.9.)\quad \hat{YH3} = 1.062\ P3 \times Q3 - 0.034\ P1 \times Q3 - 0.013\ P2 \times Q3 - 0.012\ P4 \times Q3 - 0.003\ PM3 \times Q3 - YW3 - S3$$

$$(8.10.)\quad \hat{YH4} = 1.969\ P4 \times Q4 - 0.006\ P1 \times Q4 - 0.282\ P2 \times Q4 - 0.282\ P3 \times Q4 - 0.399\ PM4 \times Q4 - YW4 - S4$$

In order to see whether the above equations are reasonable, we have computed values for P2, YH1, YH3, and YH4 in the estimation period. See graphs on the next page.

Chart 5.

PRICES AND NON-WAGE INCOMES: INPUT-OUTPUT ESTIMATES



① Agriculture: non-wage income (YH1)

② Non-competitive production: prices (P2)

③ Forestry: non-wage income (YH3)

④ Competitive production: non-wage income (YH3)

As can be seen, computed prices and non-wage income estimates deviate more or less systematically from the observed figures, which suggests changes in input coefficients. To close the gap between computed and actual figures, we regressed the observed variables on the computed ones. Time was also tried in the equations to take into account systematic changes in the input coefficients. The results are listed below:[1]

(8.11.) $$P2 = \underset{(1.4)}{5.175} + \underset{(21.6)}{0.932}\ \hat{P2} + \underset{(3.4)}{0.233}\ TIME$$

$$\bar{R}^2 = 0.997 \qquad D\text{-}W = 0.51$$

(8.12.) $$YH1 = \underset{(3.9)}{136.1} + \underset{(4.4)}{0.508}\ \hat{YH1} + \underset{(4.4)}{3.603}\ TIME$$

$$\bar{R}^2 = 0.947 \qquad D\text{-}W = 0.82$$

(8.13.) $$YH3 = -\underset{(2.5)}{88.97} + \underset{(4.9)}{0.494}\ \hat{YH3} + \underset{(3.3)}{0.647}\ Q3 + \underset{(11.8)}{2.335}\ TIME$$

$$\bar{R}^2 = 0.919 \qquad D\text{-}W = 1.85$$

(8.14.) $$YH4 = \underset{(2.2)}{27.11} + \underset{(29.0)}{0.961}\ \hat{YH4}$$

$$\bar{R}^2 = 0.951 \qquad D\text{-}W = 0.51$$

These equations were used to obtain the final estimates of P2, YH1, YH3 and YH4, after having determined the first

---

1. In the equation for non-wage income in forestry, the production variable Q3 was included, perhaps in a somewhat arbitrary way, to take account of systematic fluctuations in the input coefficients not captured by TIME.

stage estimates with the aid of input-output equations (8.7. - 8.10.).

8.4. Consumption and Investment Prices

In the model the prices of the demand components are treated as weighted averages of production prices. Since we suppose these weights to be constant over time, the 1965 input-output tables allow us to calculate the weights (shares of production sectors and imports in each demand component) for the price indices of private and public consumption and investment. These are as follows:

$$(8.15.) \quad \hat{PCY} = 0.0549\ P1 + 0.7300\ P2 + 0.0011\ P3 + 0.1188\ P4 + 0.0954\ PMC$$

$$(8.16.) \quad \hat{PCG} = 0.0072\ P1 + 0.8860\ P2 + 0.0205\ P3 + 0.0493\ P4 + 0.0370\ PMC$$

$$(8.17.) \quad \hat{PI} = 0.6667\ P2 + 0.0126\ P3 + 0.1472\ P4 + 0.1735\ PMI$$

where PCY is the price index for private consumption, PCG the price index for public consumption, PI the price index for investment; P_i $(i = 1,...,4)$ are sectoral production price indices, and PMC and PMI are import price indices for consumption and investment respectively. When computing the estimates of PCY, PCG and PI, it was discovered that the equations for private consumption and investment prices behave satisfactorily. However equation (8.16.) systematically underestimates prices of public consumption, where the share of material input is small and prices of public services are more dependent on wage costs. The needed correction was carried out by using the following regression equation:

$$(8.18.)\quad PCG = -\underset{(15.1)}{30.29} + \underset{(81.4)}{1.29}\ \widehat{PCG}$$

$$\bar{R}^2 = 0.994 \qquad D\text{-}W = 0.85$$

8.5. Non-wage Incomes of Non-competitive Production

It is assumed that in the non-competitive industries the share of non-wage income of all factor incomes is left unchanged apart from the long-run decreasing trend and fluctuations caused by changes in capacity utilization; i.e., we implicitly presuppose that a mark-up pricing procedure is employed but modified by these additional factors. With these assumptions the following equation was estimated:

$$(8.19.)\quad YH2/(YH2 + YW2 + S2) = \underset{(141.0)}{45.69} - \underset{(16.7)}{0.160}\ T - \underset{(3.7)}{0.507}\ LUR$$

$$\bar{R}^2 = 0.891 \qquad D\text{-}W = 0.42$$

The unemployment rate (LUR) has been used as a rough indicator of capacity utilization.

8.6. Prices of Competitive Production

As was mentioned earlier, we suppose that prices in competitive industries are mainly determined by world market prices, i.e., export and import prices. To see whether the domestic cost factors have any influence, we added a variable for unit labour costs (YW_4/Q_4). Moreover we suppose that the change in production prices in any given period is proportional to the difference between desired prices (determined by world market prices and unit labour costs) and prices during the last period.

The equation based on these assumptions yields the following results:

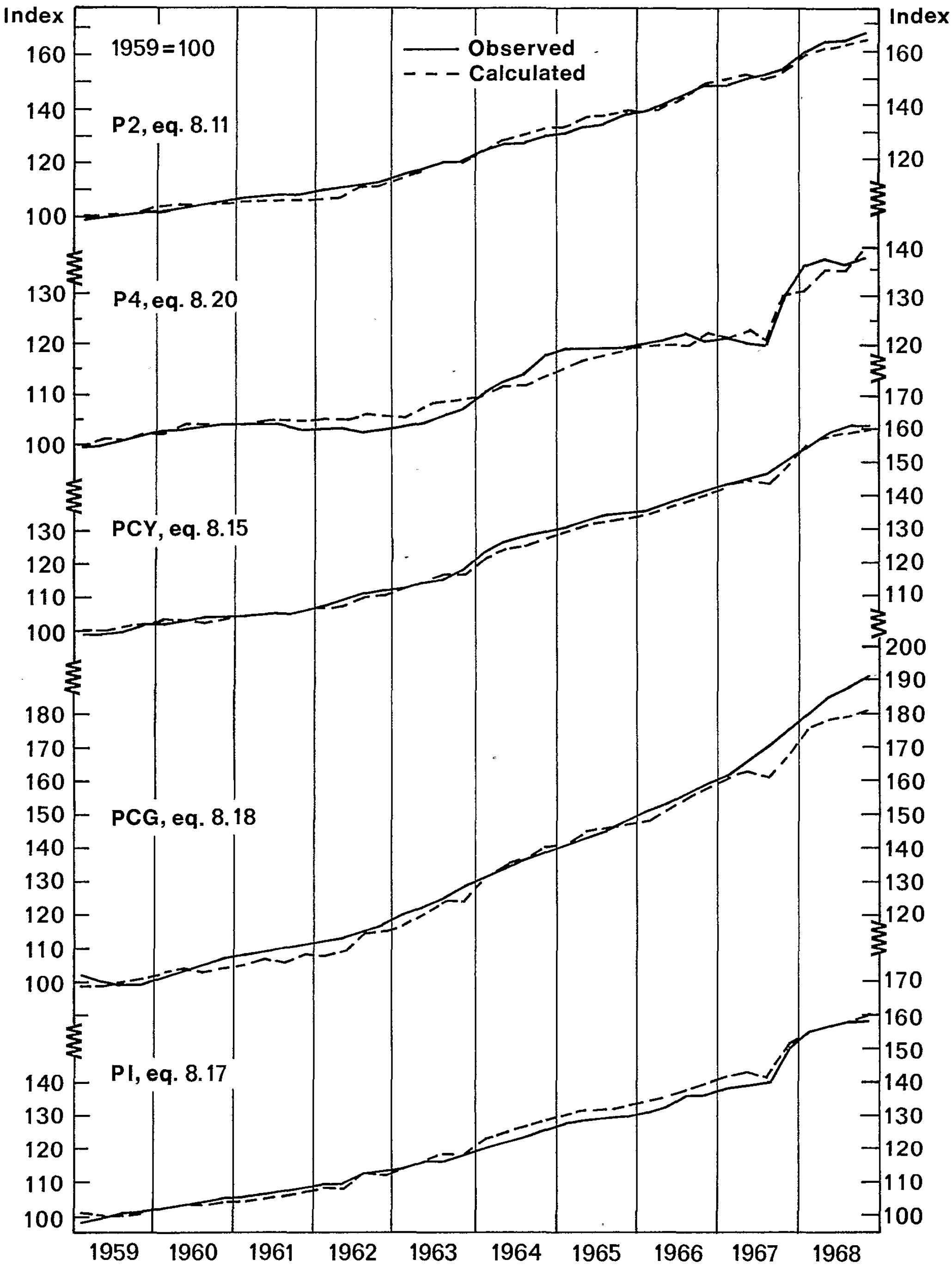
$$(8.20.)\quad P4_t = \underset{(7.5)}{0.300}\, PWX_t + \underset{(3.5)}{0.501}\, (YW4/Q4)_t + \underset{(5.9)}{9.439} \times \frac{1}{4} \sum_{v=0}^{3} P4_{t-v-1}$$

$$\bar{R}^2 = 0.980 \qquad D\text{-}W = 0.87$$

where the new variable (PWX) is the export price index of manufactured goods. Equation (8.20.) lacks the import price variable which did not work in the estimation. According to this equation some 90 per cent of the adjustment of prices in competitive industries takes place in the first year.

Chart 6.

PRICES[1]



1. The estimates of P2, P4, PCY, PCG and PI have been generated by the sub-system which includes the equations for output conversion, non-wage incomes and prices of production and of demand components.

8.7. Wages[1]

The rudimentary wage rate equations are basically disequilibrium functions that relate changes in wage rates (Δw) to excess demand for labour measured by the unemployment rate (LUR). Since changes in prices (Δp) are another important determinant of changes in wages, the wage function can be written as

$$(8.21.)\quad \Delta w = f(LUR, \Delta p).$$

Because wage changes should cover a yearly span - wage agreements in Finland are usually made for a one year period - changes have been measured from the corresponding quarter in the previous year. To see whether wage-earners in some sectors have gained because of faster increases in their productivity relative to productivity as a whole, we have added to the sectoral wage rate equations a variable which measures the deviation in labour productivity between that sector and the whole economy. Equations of this type were estimated for non-competitive industries, forestry and competitive industries. The results are as follows:

$$(8.22.)\quad WR2_t - WR2_{t-4} = \underset{(4.7)}{5.688} + \underset{(4.9)}{0.8751}\,(PCY_t - PCY_{t-4})$$

$$- \underset{(1.2)}{0.7394}\,LUR_t - \underset{(4.8)}{1.258} \times 43.03\,\left(\frac{Q2}{LW2}\right)_t$$

$$+ \underset{(4.8)}{1.258} \times 39.25\,\left(\frac{Q}{LW}\right)_t$$

$$\bar{R}^2 = 0.717 \qquad D\text{-}W = 1.13$$

---

1. Much of the work in this section rests on results found by Ahti Molander in A Study of Prices, Wages and Employment in Finland, 1957 - 1966, Bank of Finland Institute for Economic Research, Series B:31, 1969.

$$(8.23.)\quad WR3_t - WR3_{t-4} = \underset{(3.6)}{21.04} + \underset{(4.6)}{2.730}\,(PCY_t - PCY_{t-4})$$

$$- \underset{(3.2)}{8.298}\, LUR_t + \underset{(4.7)}{1.056} \times 31.56\,\left(\frac{Q3}{LW3}\right)_t$$

$$- \underset{(4.7)}{1.056} \times 39.25\,\left(\frac{Q}{LW}\right)_t$$

$\bar{R}^2 = 0.456 \qquad D\text{-}W = 2.21$

$$(8.24.)\quad WR4_t - WR4_{t-4} = \underset{(5.2)}{5.615} + \underset{(3.7)}{0.6181}\,(PCY_t - PCY_{t-4})$$

$$- \underset{(1.8)}{0.9626}\, LUR_t + \underset{(5.7)}{0.2893} \times 46.53\,\left(\frac{Q4}{LW4}\right)$$

$$- \underset{(5.7)}{0.2893} \times 39.25\,\left(\frac{Q}{LW}\right)_t$$

$\bar{R}^2 = 0.724 \qquad D\text{-}W = 1.09$

In the estimated equations all the coefficients have a priori plausible signs except the coefficient of the productivity deviation variable (43.03 Q2/LW2 - 39.25 Q/LW) in equation (8.22.) which turned out to be negative. The productivity deviation variable in this equation should evidently be replaced by the variable measuring changes in the productivity of the whole economy. Because productivity increases in the non-competitive sector have been slower than in the whole economy, there has been a general tendency for wages in this sector to rise, mainly with productivity as a whole rather than with sectoral productivity. This possible asymmetry is a weakness of the productivity deviation variable in all the wage equations.

Because of the specific nature of income increases in agriculture, the price variable has been replaced by the negotiated wage rate variable with the following result:

$$(8.25.)\quad WR1_t - WR1_{t-4} = \underset{(5.2)}{1.301} (WRN_t - WRN_{t-4})$$

$$+ \underset{(2.3)}{0.1501} \times 13.00 \left(\frac{Q1}{LW1}\right)_t$$

$$- \underset{(2.3)}{0.1501} \times 39.25 \left(\frac{Q}{LW}\right)$$

$$\bar{R}^2 = 0.564 \qquad D\text{-}W = 0.69$$

For the level of negotiated wages a simple equation of the following form was estimated:

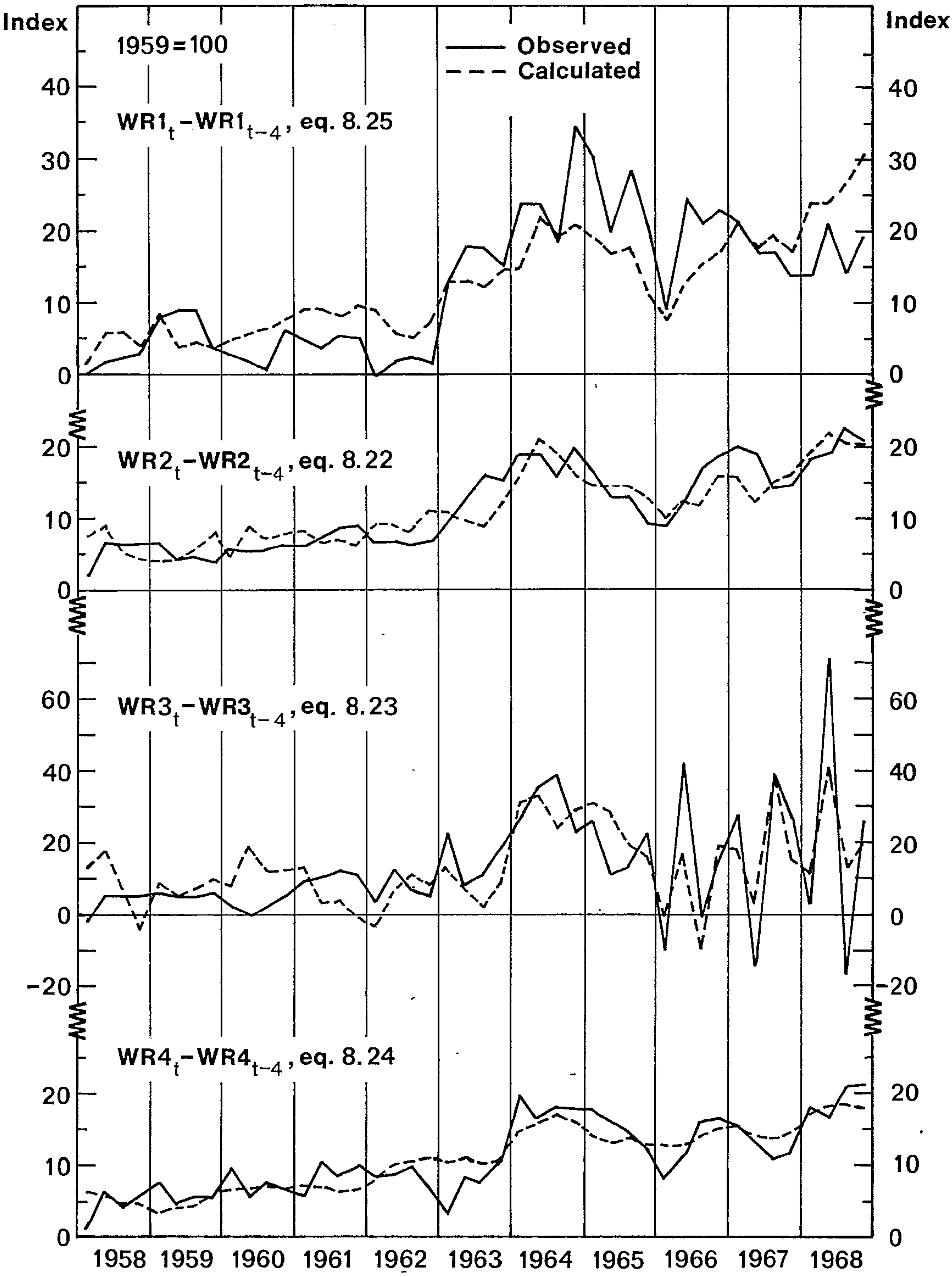
$$(8.26.)\quad WRN_t = - \underset{(5.0)}{29.43} + \underset{(20.3)}{1.020} PCY_t + \underset{(2.6)}{0.270} \times 39.25 \left(\frac{Q}{LW}\right)_t$$

$$\bar{R}^2 = 0.995 \qquad D\text{-}W = 1.91$$

According to the estimated equations changes in prices have the most powerful effect on changes in wages. The unemployment rate in linear form behaves as expected on a priori grounds as a measure of excess demand for labour, although it is not always statistically significant.

Chart 7.

WAGES



8.8. Other Incomes

Mainly for the calculation of disposable income, regression, equations have been calculated for the following items: farmers´ income from agriculture (YS1, sector 1), forestry income (YS3, sector 3), other income from unincorporated enterprises in non-competitive and competitive industries (YSO), rent and interest income (YKV), dividends (YDIV) and employers´ contributions to social security in each sector (S_i, i = 1,...,4). Farmers´ income from agriculture and forestry income are dependent on sectoral prices and the volume of production respectively. Other incomes from unincorporated enterprises and rent and interest incomes are related to current GNP. For dividends we have an equation where dividends are dependent on the non-wage income of competitive industries and past dividends. To get an estimate for employers´ contributions to social security in all sectors, we have calculated a regression for the ratio S/YW (S = total social security payments, YW = total wage bill) in order to find sectoral payments ($S_i = S/YW \times YW_i$, i = 1,...,4). The ratio S/YW is related to compulsory social security payment rates and time. The estimated equations of these other incomes can be found in the list of equations.

9. Employment[x]

When the labour market block of the model was first constructed, it consisted of the aggregate equations for the labour force and

x The research on this block has been carried out by Simo Lahtinen.

employment, the identity for the unemployment rate and eight sectoral equations describing the demand for paid labour. The number of sectors was reduced to four for the aggregate version of of the model. The first simulation experiments on the aggregate equations revealed that the unemployment rate did not behave satisfactorily when solved for from the identity. Although forecasting errors for the labour force and employment estimates may be small, the figure for unemployment, which is calculated as a difference, can be very inaccurate. For this reason the model now contains only equations for paid labour inputs and a simple equation for the unemployment rate.

As the demand for labour is mainly dependent on output, production and unemployment are inversely related. First degree polynomial weights were used to distribute the lags of the production variable (Q). The trend variable (TIME) represents the effects of increases in productivity and other similar long-term factors. A logarithmic transformation was used in the estimation of <u>unemployment rate</u> (LUR) and the following estimate was obtained.

$$\text{(9.1.)} \quad \text{Log LUR}_t = \underset{(8.9)}{37.28} - \underset{(9.0)}{3.574} \text{ Log } Q_t - \underset{(9.0)}{2.859} \text{ Log } Q_{t-1}$$

$$- \underset{(9.0)}{2.145} \text{ Log } Q_{t-2} - \underset{(9.0)}{1.430} \text{ Log } Q_{t-3}$$

$$- \underset{(9.0)}{0.7149} \text{ Log } Q_{t-4} + \underset{(10.0)}{0.0611} \text{ TIME}$$

$$\bar{R}^2 = 0.762 \qquad \text{D-W} = 0.89$$

It should be possible to improve the specification and the fit of the equation through further study of the effects of employment policy.

The theoretical basis for the sectoral labour input equations lies in neoclassical production theory.[1] By maximizing the ordinary profit equation

(9.2.) $\pi_t = P_t Q_t - W_t L_t - R_t K_t$,

where

π = profit
P = price
Q = production
W = wage level
L = labour input
K = capital input
R = price of K

under the constraint of the CES-production function

(9.3.) $Q_t = \gamma[\alpha L_t^{-b} + (1 - \alpha)K_t^{-b}]^{-h/b}$

the following marginal productivity condition for labour is obtained:

(9.4.) $\frac{\partial Q_t}{\partial L_t} = \frac{W_t(1 + 1/e_L)}{P_t(1 + 1/e_Q)}$.

With the assumption that imperfect competition prevails in labour and output markets and that price elasticities e_L and e_Q are increasing functions of the capacity utilization rate (C), the desired demand for labour (L^+) can be obtained from the marginal productivity condition:

1. See, e.g., P.J. Dhrymes: A Model of Short-run Labor Adjustment, in The Brookings Model: Some Further Results, eds. J. Duesenberry et al., Amsterdam 1969.

$$(9.5.) \quad \text{Log } L_t^+ = a_0 + a_1 \text{ Log } Q_t - a_2 \text{ Log } (W_t/P_t) + a_3 \text{ Log } C_t$$

Assuming that partial adjustment takes place between the desired demand for labour and actual demand for labour

$$(9.6.) \quad \text{Log } L_t - \text{Log } L_{t-1} = \lambda(\text{Log } L_t^+ - \text{Log } L_{t-1}),$$

the following equation is obtained for the sectoral paid labour inputs:

$$(9.7.) \quad \text{Log } L_t = a_0\lambda + a_1\lambda \text{ Log } Q_t - a_2\lambda \text{ Log } (W_t/P_t) + a_3\lambda \text{ Log } C_t + (1 - \lambda) \text{ Log } L_{t-1}$$

There are no data on the capacity utilization rate. Therefore this variable was replaced by the unemployment rate which is inversely related to it. The following sectoral equations were chosen for the model:

$$(9.8.) \quad \text{Log } LW1_t = \underset{(4.1)}{2.839} - \underset{(2.4)}{0.5744} \text{ Log } (LW2 + LW3 + LW4)_t - \underset{(3.4)}{0.3910} \text{ Log } \left(\frac{WR1}{P1}\right)_t + \underset{(2.4)}{0.3551} \text{ Log } LW1_{t-1}$$

$\bar{R}^2 = 0.916$ D-W = 1.73

$$(9.9.) \quad \text{Log } LW2_t = \underset{(8.0)}{0.4762} + \underset{(8.1)}{0.5945} \text{ Log } Q2_t - \underset{(3.5)}{0.2093} \text{ Log } \left(\frac{WR2}{P2}\right)_t + \underset{(1.6)}{0.1662} \text{ Log } LW2_{t-1}$$

$\bar{R}^2 = 0.994$ D-W = 2.02

$$(9.10.)\quad \text{Log LW3}_t = \underset{(5.1)}{0.5170} + \underset{(4.4)}{0.5884}\ \text{Log Q3}_t - \underset{(6.6)}{0.4145}\ \text{Log}\ \left(\frac{WR3}{P3}\right)_t$$

$$- \underset{(1.6)}{0.0588}\ \text{Log LUR}_t$$

$$\bar{R}^2 = 0.743 \qquad D\text{-}W = 1.79$$

$$(9.11.)\quad \text{Log LW4}_t = \underset{(4.1)}{0.4363} + \underset{(6.0)}{0.2997}\ \text{Log Q4}_t - \underset{(4.1)}{0.2237}\ \text{Log}\ \left(\frac{WR4}{P4}\right)_t$$

$$- \underset{(2.4)}{0.0145}\ \text{Log LUR}_t + \underset{(5.7)}{0.4892}\ \text{Log LW4}_{t-1}$$

$$\bar{R}^2 = 0.975 \qquad D\text{-}W = 2.20$$

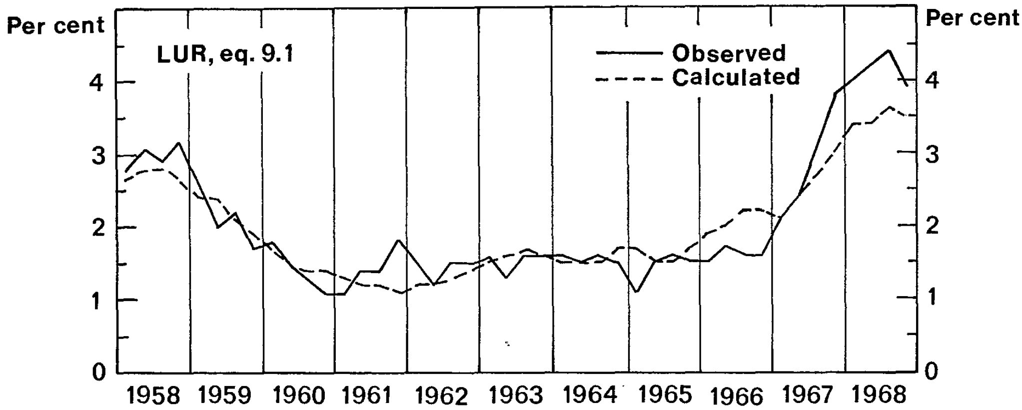
In the paid labour input equation for agriculture (9.8.), production (Q1) has been replaced by the demand for labour in other sectors (LW2 + LW3 + LW4). The explanation is that agriculture served as a labour reserve for other sectors in the 1960's.

There were difficulties in formulating a reliable equation for sector 2 because of its heterogeneity; the coefficient of variable $LW2_{t-1}$ in equation (9.9.) may be too small. The equations for sectors 3 and 4 correspond to the theoretical specifications. In sector 3 the adjustment of labour turned out to be just about perfect ($\lambda \simeq 1$). The paid labour input for the whole economy is obtained by summing those for the individual sectors.

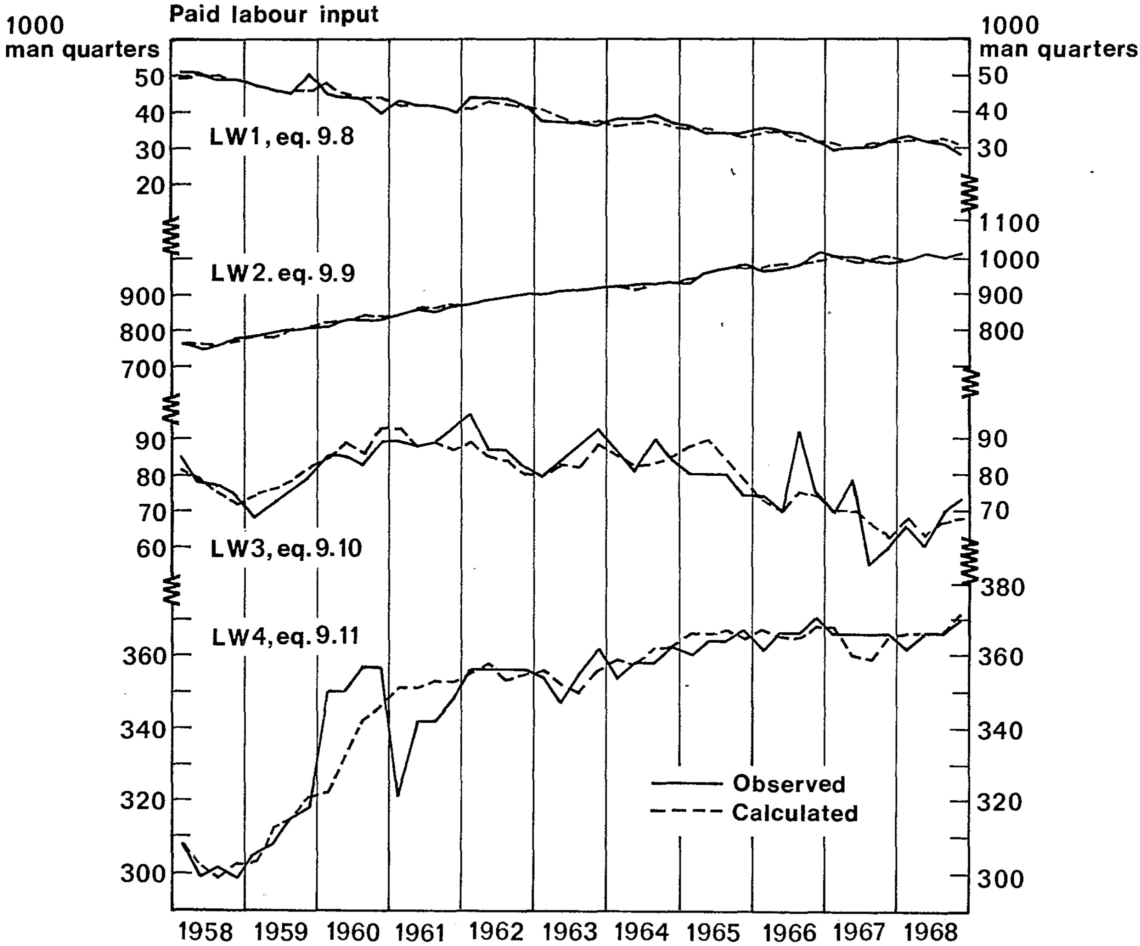
Chart 8.

EMPLOYMENT

Unemployment rate



Paid labour input



10. Exports and Imports[x]

10.1. Total Exports

Participation in the international LINK-project led us to place main emphasis on the explanation of imports in the first phase;[1] exports were initially taken as exogenous. However, we have begun the estimation of equations for export volumes and prices. In the present version of the model, we have included an equation for the total volume of exports (XT). Export volume is explained by an activity variable for the countries most important for Finnish exports (Q4(OECD), weighted average of industrial output in OECD-countries), by a relative prices variable $(\frac{PX}{PX(OECD)})$ and by a capacity utilization variable (LUR) for Finland which reflects some supply factors:

$$(10.1.) \quad XT_t = \underset{(4.1)}{261.8} + \underset{(27.8)}{8.53}\, Q4(OECD)_t + \underset{(1.71)}{2.20}\, LUR_t - \underset{(3.2)}{2.93} \left(\frac{PX}{PX(OECD)}\right)_t$$

$$\bar{R}^2 = 0.951 \qquad D\text{-}W = 1.89$$

---

x The research on this section has been carried out by Esko Aurikko.

1. In the world trade model, import functions for different countries were estimated. Exports were determined by total world demand via export share matrices.

10.2. Imports of Raw Materials and Producer Goods

This equation is mainly based on the technical fact that 95 per cent of the volume of raw material imports (MR) is used by manufacturing industry and is hence dependent on manufacturing output (Q4). The timing of fluctuations in manufacturing output and raw material imports is the same but the amplitude of the latter is much greater. The explanation may be found in a sharp increase in inventories during periods of rapid growth and a decrease in inventories during recessions. As we do not have accurate data on inventories, we have used the relative change in output $Q4_t/Q4_{t-4}$ to explain this phenomenon.

There is some substitution of domestic for imported materials. Thus relative prices $(\frac{PMR}{P4})$ have an effect on raw material imports. The equation can be given in logarithmic form:

$$(10.2.)\quad \text{Log } MR_t = -\underset{(0.2)}{0.0265} + \underset{(17.1)}{0.8963} \text{ Log } Q4_{t-1}$$

$$- \underset{(4.2)}{0.6282} \text{ Log } \left(\frac{PMR}{P4}\right)_{t-1} + \underset{(4.6)}{0.7932} \text{ Log } \left(\frac{Q4_t}{Q4_{t-4}}\right)$$

$$\bar{R}^2 = 0.972 \qquad D\text{-}W = 2.00$$

The large amplitude of import fluctuations could perhaps also be explained by variations in the utilization of capacity in domestic production. However, experiments with several kinds of capacity utilization measures did not lend support to this hypothesis.

10.3. Imports of Consumer Goods

The share of imports in private consumption has been 10 per cent in recent years. The share of consumer durables in consumer goods imports is as high as 40 per cent. We can get quite a good fit for this equation simply by using the same disposable income variable as for private consumption categories and by using relative prices $(\frac{PMC}{P4})$. In addition, the capacity utilization variable (Q4KA) has some effect. The impact of import credit restrictions, which affected a varying number of consumer imports in 1958 - 1959, 1962 - 1966 and 1967, has been measured by a dummy variable (RP). This variable takes values between 0 and 1 depending on the share of goods covered by the restrictions when these are in force and zero in other years. The log-form equation for the volume of consumer goods imports (MC, excluding cars) is as follows:

$$(10.3.)\quad \text{Log } MC_t = \underset{(17.6)}{-5.671} + \underset{(24.3)}{2.268} \text{ Log } \left(\frac{YD}{PCY}\right)_t - \underset{(3.5)}{0.8480} \text{ Log } \left(\frac{PMC}{P4}\right)_t$$

$$+ \underset{(0.2)}{0.0469} \text{ Log } Q4KA_t - \underset{(0.6)}{0.0095} RP_t$$

$$\bar{R}^2 = 0.963 \qquad D\text{-}W = 1.50$$

It can be seen that both income and price elasticities for imports of consumer goods are high, reflecting the high elasticity of demand for durables in general.

For the volume of imported passenger cars (MA), we have a purely technical relationship, where imports are explained by sales (CA, measured by registrations). Sales are explained in the private consumption block. This type of specification is valid as long as domestic production of passenger cars is very small compared to imports and there are no great fluctuations in stocks. The equation is:

$$(10.4.)\quad \text{Log } MA_t = -\underset{(2.9)}{0.3016} + \underset{(17.6)}{0.9483}\ \text{Log } CA_t$$

$$\bar{R}^2 = 0.881 \qquad \text{D-W} = 1.40$$

10.4. Imports of Investment Goods

The import content of investment in machinery and equipment is very high in Finland, more than half. Fluctuations in the volume of imports of investment goods (MI) have a great amplitude. They can be explained largely by fluctuations in investment in machinery and equipment (IYK), exports of metal products (XME) and relative prices $(\frac{PMI}{P4})$. Here the relationship between investment and the imports of machinery and equipment is mainly a technical one. We obtained the following estimates:

$$(10.5.)\quad \text{Log } MI_t = -\underset{(6.6)}{0.8768} + \underset{(19.2)}{1.074}\ \text{Log } IYK_t + \underset{(5.3)}{0.1772}\ \text{Log } XME_t - \underset{(4.5)}{1.187}\ \text{Log } \left(\frac{PMI}{P4}\right)_t$$

$$\bar{R}^2 = 0.937 \qquad \text{D-W} = 1.27$$

10.5. Imports of Fuels and Lubricants

The volume of imports in this category (MP) is explained by industrial output (Q4), since industry is the main user, and by an exogenously determined change in the volume of stocks of fuels and lubricants (PV). The rapid conversion from firewood and coal to oil is captured by the variable Q4.

The result is:

$$(10.6.)\quad \text{Log } MP_t = \underset{(4.2)}{-3.130} + \underset{(6.8)}{2.183} \text{ Log } Q4_t + \underset{(1.9)}{0.415} \text{ Log } \left(\frac{PV_t}{PV_{t-1}}\right)$$

$$\bar{R}^2 = 0.870 \qquad D\text{-}W = 1.41$$

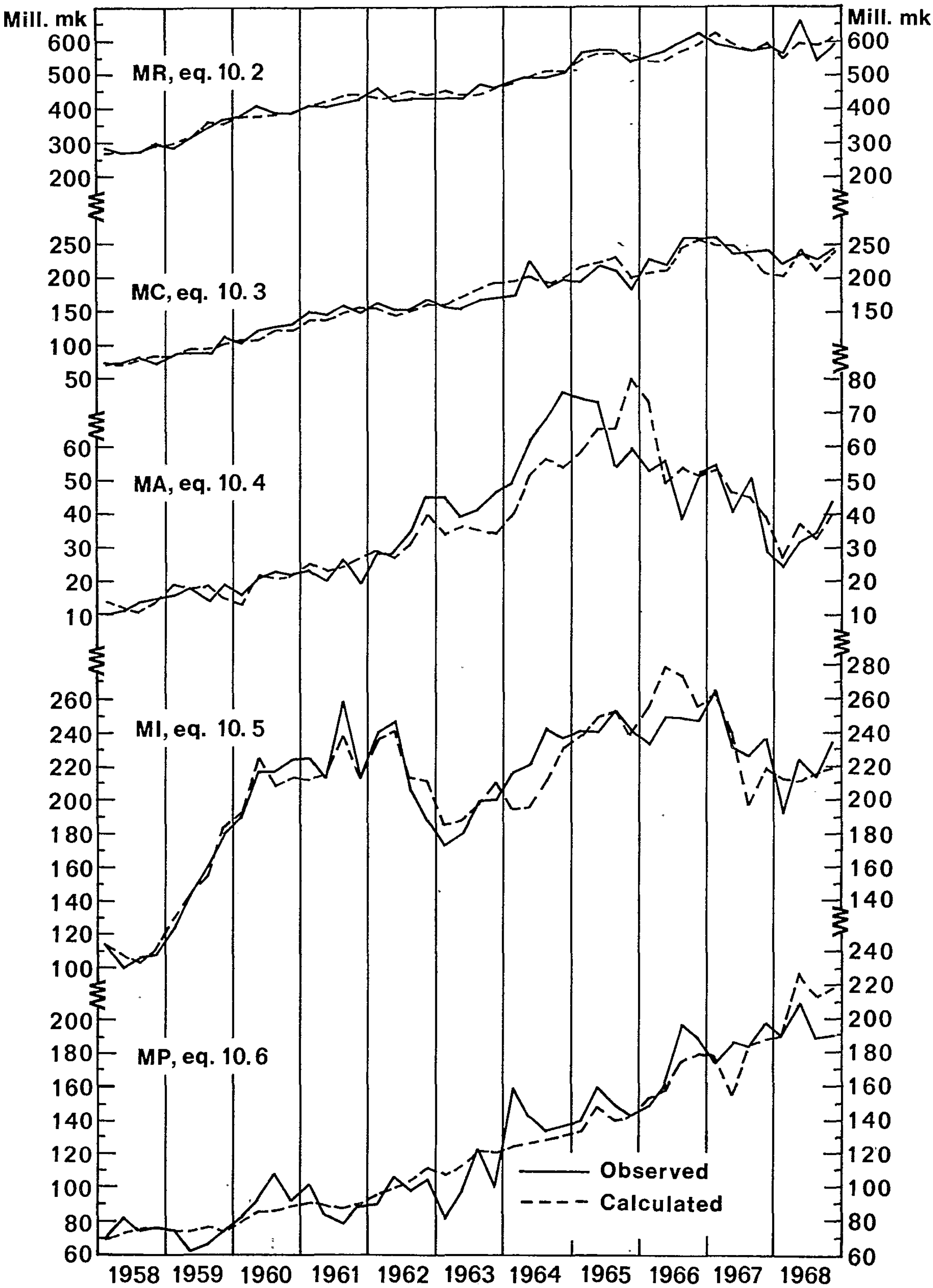
10.6. Imports of Services and Import Prices

Preliminary equations in the service sector have been estimated but they are not included in this version of the model. It seems that the import of transportation and insurance services is roughly proportional to commodity imports and exports.

Import prices are taken as exogenous. As Finnish trade makes up only a small share of and has only a slight influence on total world trade and prices, this is a natural solution.

Chart 9.

IMPORTS



11. State Finances[x]

The public sector has the greatest number of economic policy parameters. Through these, the public sector has a considerable effect on total demand. The main channels of influence from the public sector block of the model to other blocks are public expenditure, influencing production and employment, public sector taxes and other revenue and transfer payments, which act through disposable income of households, and changes in state debt influencing money markets.

So far main emphasis in the research has been on explaining state revenue by means of tax or payment rates (as policy parameters) and income base variables. These relationships are mainly of a technical nature. To illustrate these relationships, we take the equations of state revenue from sales tax, excise duties and revenue from social security contributions. Other equations of the block appear in the list of equations.

Sales tax revenue (GTS) is explained by the value of private consumption (CYF), the sales tax rate (TTSL) and two dummy variables. The first dummy (DIL) takes into account the average sales tax rate in the period before the reform of the sales tax in 1964, when there were several rates for different

x The research on this block has been carried out by Antero Arimo.

commodities. The other dummy (D2L) takes into account avoidance of sales tax in 1962 - 1963 before the reform.

$$\text{(11.1.)} \quad \text{Log GTS} = \underset{(17.6)}{-\ 3.792} + \underset{(3.2)}{0.7375} \text{ Log TTSL} + \underset{(26.7)}{1.555} \text{ Log CYF}$$

$$+ \underset{(3.8)}{0.8566} \text{ Log D1L} - \underset{(12.3)}{0.1415} \text{ Log D2L}$$

$\bar{R}^2 = 0.988 \qquad$ D-W = 1.76

Excise duty revenue is explained by the value of tobacco consumption (CTB) and volume of motor fuel consumption (CJP) and the corresponding duty rates (TTB and TJP). These two duties make up over 90 per cent of all excise duty revenue.

$$\text{(11.2.)} \quad \text{GTE} = \underset{(2.3)}{22.25} + \underset{(2.6)}{0.6141} \text{ TTB} \times \text{CTB} + \underset{(9.5)}{1.316} \text{ TJP} \times \text{CJP}$$

$\bar{R}^2 = 0.942 \qquad$ D-W = 1.81

State revenue from social security contributions is explained by wage income (YW) and the rate of contributions (TC23). This revenue is collected both from employers and employees.

$$\text{(11.3.)} \quad \text{SOC} = \underset{(48.1)}{1.039} \text{ TC23} \times \text{YW}$$

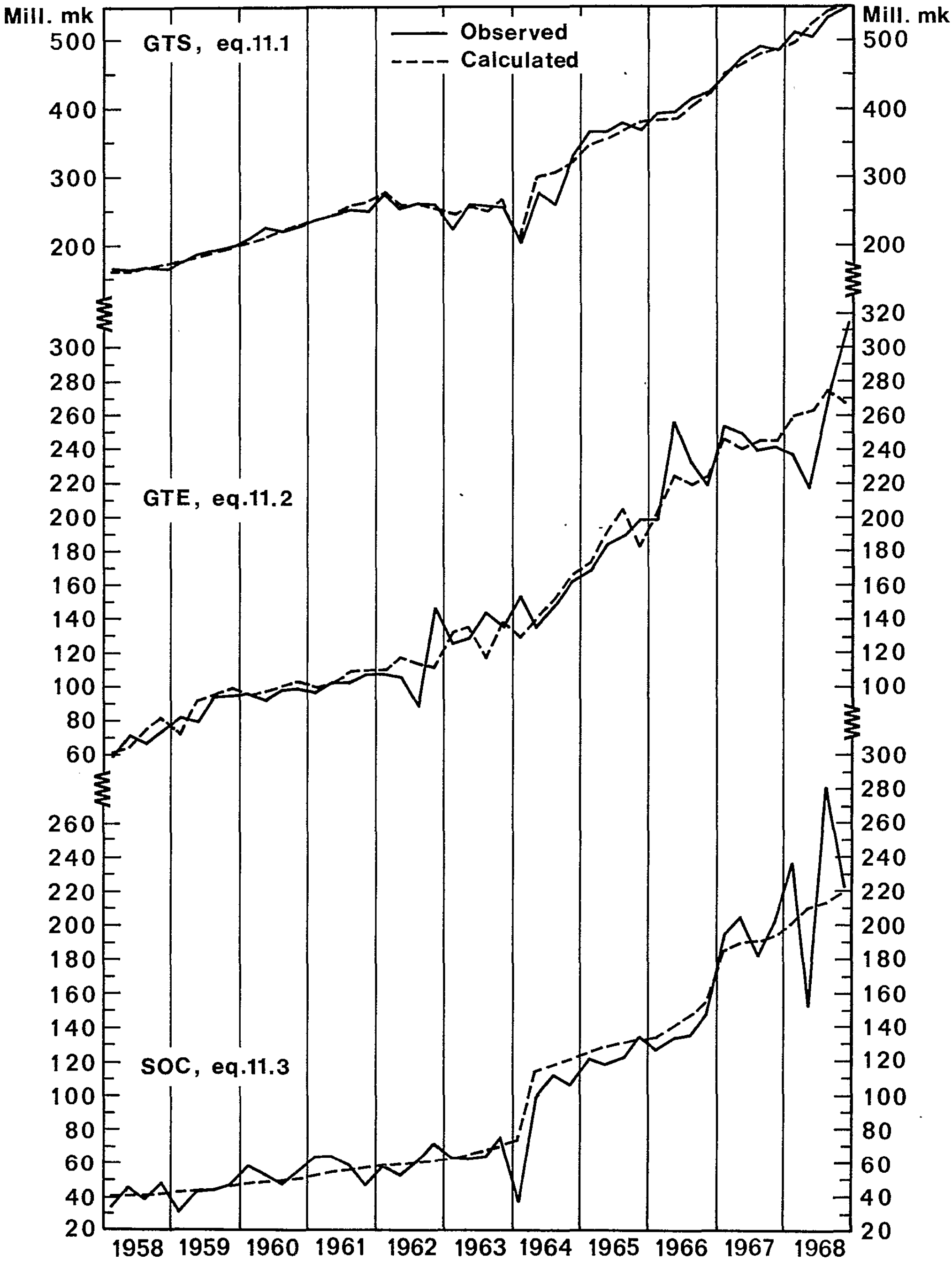
$\bar{R}^2 = 0.935 \qquad$ D-W = 2.68

The equation for state revenue from income and property tax is still unsatisfactory as the tax rate and the effect of progression has not yet been taken into account. One of the difficulties is in the data; we have only the sum of personal and corporate taxes at hand. Work is in progress to construct a sub-system for personal income taxation, in which progression will be taken into account by changes in income distribution and effective tax rates for different incomes.

As was stated in the introduction, work is also in progress to construct models for the local government sector where data problems have been even greater than for state finances. In the present model we have included definitional equations which combine state and local government expenditure and demand components.

Chart 10.

STATE FINANCES



III LIST OF EQUATIONS

$\bar{R}^2$ = Adjusted coefficient of determination

D-W = Durbin-Watson statistic

The absolute values of the t-statistics are in brackets beneath the equations

INVESTMENT

1. Private investment in machinery, equipment and non-residential construction, volume

$$IYKT_t = \underset{(3.9)}{1168} + \underset{(4.3)}{1.318}\ Q4_{t-1} + \underset{(0.4)}{0.1579}\ (Q4_t - Q4_{t-1})$$

$$- \underset{(1.9)}{9.821}\ RKIR_{t-4} - \underset{(1.3)}{20.13}\ RR_t + \underset{(3.2)}{0.3462}\ (KKT_{t-1} - KKT_{t-2})$$

$$- \underset{(2.9)}{0.0357}\ KKT_{t-1}$$

$\bar{R}^2 = 0.867$ D-W = 1.25

2. Stock of fixed business capital, total, volume (corresponding to investments in 1.)

$$KKT_t = IYKT_t + (1 - \underset{(4349)}{0.0037})\ KKT_{t-1}$$

$\bar{R}^2 = 0.999$ D-W = 1.70

3. Private investment in machinery and equipment, volume

$$IYK_t = \underset{(8.7)}{1482} + \underset{(7.1)}{1.630}\ Q4_{t-1} + \underset{(2.8)}{0.8308}\ (Q4_t - Q4_{t-1})$$

$$- \underset{(2.1)}{24.30}\ RR_t - \underset{(5.5)}{0.0732}\ KK_{t-1}$$

$\bar{R}^2 = 0.826$ D-W = 1.59

4. Stock of fixed business capital, machinery and equipment, volume (corresponding to investments in 3.)

$$KK_t = IYK + (1 - \underset{(3321)}{0.0049})\ KK_{t-1}$$

$\bar{R}^2 = 0.999$ D-W = 1.94

5. Residential construction, volume

$$IA_t = - \underset{(8.1)}{101.2} + \underset{(26.3)}{0.1499}\ (\tfrac{1}{4} \sum_{v=0}^{3} UIA_{t-v})$$

$$+ \underset{(1.3)}{0.0695}\ \Delta(\tfrac{1}{4} \sum_{v=0}^{3} UIA_{t-v}) - \underset{(2.2)}{2.036}\ RKIR_{t-4} + \underset{(7.8)}{133.3}\ DI62_t$$

$$+ \underset{(3.6)}{75.10}\ DI66_t$$

$\bar{R}^2 = 0.960$ D-W = 1.18

6. Fixed investment, total, volume

$$I = IYKT + IA + IMV + IGR$$

7. Change in business inventories, volume

$$DV_t = - \underset{(2.4)}{1286} + \underset{(2.6)}{0.4450}\ Q_{t-1} + \underset{(3.1)}{0.5321}\ (Q_t - Q_{t-1}) - \underset{(1.3)}{0.0227}\ V_{t-1}$$

$$+ \underset{(7.4)}{245.5}\ DC_t - \underset{(2.3)}{18.81}\ TIME$$

$\bar{R}^2 = 0.851$ D-W = 1.35

8. Stock of business inventories, volume

$$V_t = V_{t-1} + DV_t$$

MONETARY RELATIONSHIPS

9. Availability of credit ratio

$$RKIR = 100 \frac{RKPV}{RL}$$

10. Demand for bank credit

$$RL_t - RL_{t-1} = \underset{(2.1)}{83.57} + \underset{(2.2)}{0.1841} \left[(IYKT + IA) \frac{PI}{100} + DVF\right]_t$$

$$- \underset{(0.5)}{0.0533} (YH - YS - YKV - YDIV)_t$$

$$- \underset{(3.2)}{0.5629} PPN_t - \underset{(5.1)}{0.5510} BTF_t$$

$\bar{R}^2 = 0.616$ D-W = 1.16

11. Credit form the Central Bank to the banks, net

$$RKPV = RL - RBF - RT - RD - RO + RGB + RM$$

12. Foreign credits of the banks, net

$$RBF_t = \underset{(29.4)}{0.9752} RBF_{t-1} + \underset{(2.3)}{2.696} \sum_{v=1}^{3} RKIR_{t-v} - \underset{(1.3)}{28.3} \left(\frac{RF}{RR}\right)_t$$

$\bar{R}^2 = 0.974$ D-W = 1.93

13. Time deposits

$$RT_t - RT_{t-1} = \underset{(1.0)}{-36.26} + \underset{(10.9)}{0.0535}\ YD_t + \underset{(2.1)}{243.6}\ \frac{YS3_t}{YS1_t + YS3_t}$$

$$\underset{(3.6)}{-2060}\ \frac{PCY_t - PCY_{t-1}}{PCY_{t-1}} - \underset{(7.6)}{64.73}\ DMY5_t$$

$\bar{R}^2 = 0.814$ D-W = 1.39

14. Demand deposits

$$RD_t = \underset{(4.1)}{151.3} + \underset{(22.6)}{0.3609}\ YH_t$$

$\bar{R}^2 = 0.922$ D-W = 0.41

CONSUMPTION

15. Consumer expenditure, durables (except cars) and non-durables, volume

$$\text{Log } CT_t = \underset{(18.0)}{0.9353} + \underset{(36.6)}{0.6530}\ \text{Log } \frac{1}{4} \sum_{v=0}^{3} \left(\frac{YD}{PCY}\right)_{t-v}$$

$$\underset{(3.5)}{-0.0202}\ \text{Log } \frac{1}{4} \sum_{v=0}^{3} (RT_{t-v} - RT_{t-v-1})$$

$$\underset{(4.9)}{-0.0240}\ \text{Log } LUR_t + \underset{(6.8)}{0.0225}\ DMY4$$

$\bar{R}^2 = 0.984$ D-W = 1.57

16. Consumer expenditure, motor cars, volume

$$\text{Log } CA_t = -\underset{(0.8)}{1.543} + \underset{(7.10)}{2.201} \text{ Log } \frac{1}{4}\sum_{v=0}^{3} \left(\frac{YD}{PCY}\right)_{t-v}$$

$$- \underset{(4.22)}{2.006} \text{ Log } \left(\frac{PAU}{PCY}\right)_t - \underset{(3.11)}{0.2316} \text{ Log } LUR_{t-1}$$

$$- \underset{(2.2)}{0.3196} \text{ DMY3}$$

$\bar{R}^2 = 0.897$ D-W = 0.99

17. Consumer expenditure, services, volume

$$\text{Log } CP_t = -\underset{(0.1)}{0.0145} + \underset{(26.0)}{0.9305} \text{ Log } \frac{1}{4}\sum_{v=0}^{3} \left(\frac{YD}{PCY}\right)_{t-v}$$

$$- \underset{(5.7)}{0.1724} \text{ Log } \left(100 \frac{YS1 + YS3}{YW}\right)_t$$

$\bar{R}^2 = 0.988$ D-W = 1.02

18. Consumer expenditure, tobacco, value

$$\text{Log } CTB = -\underset{(2.5)}{3.563} + \underset{(8.8)}{1.247} \text{ Log } \frac{1}{4}\sum_{v=0}^{3} \left(\frac{YD}{PCY}\right)_{t-v}$$

$$+ \underset{(8.5)}{0.6025} \text{ Log } PTU_t$$

$\bar{R}^2 = 0.914$ D-W = 2.53

19. Consumer expenditure, fuel for motor cars, volume

$$\text{Log CJP} = -\underset{(4.0)}{4.845} + \underset{(21.0)}{2.130} \text{ Log } \frac{1}{4} \sum_{v=0}^{3} \left(\frac{YD}{PCY}\right)_{t-v}$$

$\bar{R}^2 = 0.912$ D-W = 1.49

20. Total private consumption, volume

$$CY = CT + CP + CA$$

21. Total private consumption, value

$$CYF = 0.01\ CY \times PCY$$

22. Total consumption, volume

$$C = CY + CG$$

FOREIGN TRADE

23. Imports of raw materials, volume

$$\text{Log } MR_t = -\underset{(0.2)}{0.0265} + \underset{(17.1)}{0.8963} \text{ Log } Q4_{t-1} - \underset{(4.2)}{0.6282} \text{ Log } \left(\frac{PMR}{P4}\right)_{t-1}$$

$$+ \underset{(4.6)}{0.7932} \text{ Log } \left(\frac{Q4_t}{Q4_{t-4}}\right)$$

$\bar{R}^2 = 0.972$ D-W = 2.00

24. Imports of fuels and lubricants, volume

$$\text{Log } MP_t = -\underset{(4.2)}{3.130} + \underset{(6.8)}{2.183} \text{ Log } Q4_t + \underset{(1.9)}{0.415} \text{ Log } \left(\frac{PV_t}{PV_{t-1}}\right)$$

$\bar{R}^2 = 0.870$ D-W = 1.41

25. Imports of consumer goods (other than motor cars), volume

$$\text{Log } MC_t = -\underset{(17.6)}{5.671} + \underset{(24.3)}{2.268} \text{ Log } \left(\frac{YD}{PCY}\right)_t - \underset{(3.5)}{0.8480} \text{ Log } \left(\frac{PMC}{P4}\right)_t$$

$$+ \underset{(0.2)}{0.0469} \text{ Log } Q4KA_t - \underset{(0.6)}{0.0095} RP_t$$

$\bar{R}^2 = 0.963$ D-W = 1.50

26. Imports of motor cars, volume

$$\text{Log } MA_t = -\underset{(2.9)}{0.3016} + \underset{(17.6)}{0.9483} \text{ Log } CA_t$$

$\bar{R}^2 = 0.881$ D-W = 1.40

27. Imports of investment goods, volume

$$\text{Log } MI_t = -\underset{(6.6)}{0.8768} + \underset{(19.2)}{1.074} \text{ Log } IYK_t + \underset{(5.3)}{0.1772} \text{ Log } XME_t$$

$$- \underset{(4.5)}{1.187} \text{ Log } \left(\frac{PMI}{P4}\right)_t$$

$\bar{R}^2 = 0.937$ D-W = 1.27

28. Imports of goods, total, volume

$$MT = MR + MP + MC + MI + MA$$

29. Imports of goods, total, value

$$MTF = 0.01 \times PM \times MT$$

30. Exports of goods, total, volume

$$XT_t = \underset{(4.1)}{261.8} + \underset{(27.8)}{8.53}\, Q4(OECD)_t + \underset{(1.71)}{2.20}\, LUR_t - \underset{(3.2)}{2.93} \left(\frac{PX}{PX(OECD)}\right)_t$$

$\bar{R}^2 = 0.951$ D-W = 1.89

31. Exports of goods, total, value

$$XTF = 0.01 \times PX \times XT$$

32. Trade balance

$$BTF = XTF - MTF$$

33. Imports of goods and services, volume

$$M = MT + MS$$

PRODUCTION AND EMPLOYMENT

Sectors (aggregate model):

1. Agriculture
2. Non-competitive production (mainly services)
3. Forestry
4. Competitive production (mainly manufacturing)

Production at factor cost in sectors 1 - 4, volume

34. $$Q1_t = \underset{(6.5)}{0.114}\, C_t + \underset{(2.5)}{0.127}\, I_t + \underset{(4.3)}{0.193}\, (X_t - M_t) + \underset{(4.4)}{0.175}\, DV_t - \underset{(12.6)}{5.594}\, TIME$$

$\bar{R}^2 = 0.477$ D-W = 1.81

35. $$Q2_t = \underset{(22.4)}{0.627}\, C_t + \underset{(1.7)}{0.137}\, I_t + \underset{(4.4)}{0.315}\, (X_t - M_t) + \underset{(2.5)}{0.158}\, DV_t + \underset{(5.0)}{3.518}\, TIME$$

$\bar{R}^2 = 0.994$ D-W = 1.51

36. $$Q3_t = \underset{(3.5)}{0.046}\, C_t + \underset{(4.6)}{0.174}\, I_t + \underset{(4.7)}{0.162}\, (X_t - M_t) + \underset{(6.5)}{0.196}\, DV_t - \underset{(12.4)}{4.159}\, TIME$$

$\bar{R}^2 = 0.656$ D-W = 1.39

37. $$Q4_t = \underset{(14.3)}{0.141} C_t + \underset{(10.4)}{0.294} I_t + \underset{(10.5)}{0.266} (X_t - M_t) + \underset{(8.9)}{0.197} DV_t + \underset{(24.0)}{5.993} TIME$$

$\bar{R}^2 = 0.997$ D-W = 1.59

38. Indirect taxes minus subsidies, volume

$$TS_t = \underset{(3.4)}{0.072} C_t + \underset{(4.4)}{0.266} I_t + \underset{(1.3)}{0.069} (X_t - M_t) + \underset{(5.7)}{0.275} DV_t + \underset{(0.4)}{0.242} TIME$$

$\bar{R}^2 = 0.961$ D-W = 0.88

39. Production at factor cost, total, volume

$$Q = Q1 + Q2 + Q3 + Q4$$

40. Production at market prices, total, volume

$$QM = Q + TS$$

41. Unemployment as a percentage of total labour force

$$\text{Log } LUR_t = \underset{(8.9)}{37.28} - \underset{(9.0)}{3.574} \text{ Log } Q_t - \underset{(9.0)}{2.859} \text{ Log } Q_{t-1} - \underset{(9.0)}{2.145} \text{ Log } Q_{t-2} - \underset{(9.0)}{1.430} \text{ Log } Q_{t-3} - \underset{(9.0)}{0.7149} \text{ Log } Q_{t-4} + \underset{(10.0)}{0.0611} TIME$$

$\bar{R}^2 = 0.762$ D-W = 0.89

Labour input in sectors 1 - 4

42. $$\text{Log } LW1_t = \underset{(4.1)}{2.839} - \underset{(2.4)}{0.5744} \text{ Log } (LW2 + LW3 + LW4)_t$$

$$- \underset{(3.4)}{0.3910} \text{ Log } \left(\frac{WR1}{P1}\right)_t + \underset{(2.4)}{0.3551} \text{ Log } LW1_{t-1}$$

$\bar{R}^2 = 0.916$ D-W = 1.73

43. $$\text{Log } LW2_t = \underset{(8.0)}{0.4762} + \underset{(8.1)}{0.5945} \text{ Log } Q2_t - \underset{(3.5)}{0.2093} \text{ Log } \left(\frac{WR2}{P2}\right)_t$$

$$+ \underset{(1.6)}{0.1662} \text{ Log } LW2_{t-1}$$

$\bar{R}^2 = 0.994$ D-W = 2.02

44. $$\text{Log } LW3_t = \underset{(5.1)}{0.5170} + \underset{(4.4)}{0.5884} \text{ Log } Q3_t - \underset{(6.6)}{0.4145} \text{ Log } \left(\frac{WR3}{P3}\right)_t$$

$$- \underset{(1.6)}{0.0588} \text{ Log } LUR_t$$

$\bar{R}^2 = 0.743$ D-W = 1.79

45. $$\text{Log } LW4_t = \underset{(4.1)}{0.4363} + \underset{(6.0)}{0.2997} \text{ Log } Q4_t - \underset{(4.1)}{0.2237} \text{ Log } \left(\frac{WR4}{P4}\right)_t$$

$$- \underset{(2.4)}{0.0145} \text{ Log } LUR_t + \underset{(5.7)}{0.4892} \text{ Log } LW4_{t-1}$$

$\bar{R}^2 = 0.975$ D-W = 2.20

PRICES AND INCOMES

Sectors: 1. Agriculture

2. Non-competitive production (mainly services)

3. Forestry

4. Competitive production (mainly manufacturing)

Prices in sectors 2 and 4

46. $P2H_t = 0.1027\ P1_t + 0.0113\ P3_t + 0.1291\ P4_t + 0.0489\ PM2_t$

$$+ 70.79 \left(\frac{YW2 + YH2 + S2}{Q_2}\right)_t$$

47. $P2_t = \underset{(1.4)}{5.175} + \underset{(21.6)}{0.932}\ P2H_t + \underset{(3.4)}{0.233}\ TIME$

$\bar{R}^2 = 0.994 \qquad D\text{-}W = 0.51$

48. $P4_t = \underset{(7.5)}{0.300}\ PWX_t + \underset{(3.5)}{0.501}\ (YW4/Q4)_t + \underset{(5.9)}{0.439}\ \frac{1}{4} \sum_{v=0}^{3} P4_{t-v-1}$

$\bar{R}^2 = 0.980 \qquad D\text{-}W = 0.87$

49. Fixed investment prices

$PI_t = 0.6667\ P2_t + 0.0126\ P3_t + 0.1472\ P4_t + 0.1735\ PMI_t$

50. Private consumption prices

$PCY_t = 0.0549\ P1_t + 0.7300\ P2_t + 0.0011\ P3_t + 0.1188\ P4_t$

$+ 0.0954\ PMC_t$

51. Public consumption prices

$$PCG_t = 0.0072\ P1_t + 0.8860\ P2_t + 0.0205\ P3_t + 0.0493\ P4_t + 0.0370\ PMC_t$$

52. Negotiated wage rate

$$WRN_t = \underset{(5.0)}{-29.43} + \underset{(20.3)}{1.020}\ PCY_t + \underset{(2.6)}{0.270} \times 39.25 \left(\frac{Q}{LW}\right)_t$$

$\bar{R}^2 = 0.995$ D-W = 1.91

53. Implicit level of earnings, total

$$WR = 86.30 \left(\frac{YW}{LW}\right)$$

Level of earnings in sectors 1 - 4

54. $$WR1_t - WR1_{t-4} = \underset{(5.2)}{1.301} (WRN_t - WRN_{t-4}) + \underset{(2.3)}{0.1501} \times 13.00 \left(\frac{Q1}{LW1}\right)_t - \underset{(2.3)}{0.1501} \times 39.25 \left(\frac{Q}{LW}\right)_t$$

$\bar{R}^2 = 0.564$ D-W = 0.69

55. $$WR2_t - WR2_{t-4} = \underset{(4.7)}{5.688} + \underset{(4.9)}{0.8751}\,(PCY_t - PCY_{t-4})$$

$$- \underset{(1.2)}{0.7394}\,LUR_t - \underset{(4.8)}{1.258} \times 43.03\,\left(\frac{Q2}{LW2}\right)$$

$$+ \underset{(4.8)}{1.258} \times 39.25\,\left(\frac{Q}{LW}\right)_t$$

$\bar{R}^2 = 0.717$ D-W = 1.13

56. $$WR3_t - WR3_{t-4} = \underset{(3.6)}{21.04} + \underset{(4.6)}{2.730}\,(PCY_t - PCY_{t-4}) - \underset{(3.2)}{8.298}\,LUR_t$$

$$+ \underset{(4.7)}{1.056} \times 31.56\,\left(\frac{Q3}{LW3}\right)_t - \underset{(4.7)}{1.056} \times 39.25\,\left(\frac{Q}{LW}\right)_t$$

$\bar{R}^2 = 0.456$ D-W = 2.21

57. $$WR4_t - WR4_{t-4} = \underset{(5.2)}{5.615} + \underset{(3.7)}{0.6181}\,(PCY_t - PCY_{t-4})$$

$$- \underset{(1.8)}{0.9626}\,LUR_t + \underset{(5.7)}{0.2893} \times 46.53\,\left(\frac{Q4}{LW4}\right)$$

$$- \underset{(5.7)}{0.2893} \times 39.25\,\left(\frac{Q}{LW}\right)_t$$

$\bar{R}^2 = 0.724$ D-W = 1.09

Wages and salaries in sectors 1 - 4

58. YW1 = 0.006709 WR1 x LW1

59. YW2 = 0.01184 WR2 x LW2

60. YW3 = 0.01183 WR3 x LW3

61. $YW4 = 0.01161\ WR4 \times LW4$

62. Wages and salaries, total

$$YW = YW1 + YW2 + YW3 + YW4$$

Employers' contributions to social security, sectors 1 - 4

63. Rate of contributions

$$A_t = \underset{(140.5)}{0.062_t} + TTC_t + \underset{(23.9)}{0.019\ DTE_t} + \underset{(6.8)}{0.0002\ TIME}$$

$\bar{R}^2 = 0.987$ D-W = 0.76

64. $S1 = A \times YW1$

65. $S2 = A \times YW2$

66. $S3 = A \times YW3$

67. $S4 = A \times YW4$

68. Employers' contributions to social security, total

$$S = S1 + S2 + S3 + S4$$

Total non-wage income in sectors 1 - 4

69. $YH1H_t = 0.01432\ P1_t \times Q1_t - 0.000136\ P3_t \times Q1_t$

$- 0.001066\ P4_t \times Q1_t - 0.002674\ P2_t \times Q1_t$

$- 0.000446\ PM1_t \times Q1_t - YW1_t - S1_t$

70. $YH1_t = \underset{(3.9)}{136.1} + \underset{(4.4)}{0.508}\ YH1H_t + \underset{(4.4)}{3.603}\ TIME$

$\bar{R}^2 = 0.947$ D-W = 0.82

71. $\left(\frac{YH2}{YH2 + YW2 + S2}\right)_t = \underset{(141.0)}{45.69} - \underset{(16.7)}{0.160}\ TIME - \underset{(3.7)}{0.507}\ LUR_t$

$\bar{R}^2 = 0.891$ D-W = 0.42

72. $YH3H_t = 0.01062\ P3_t \times Q3_t - 0.000118\ P4_t \times Q3_t$

$- 0.000343\ P1_t \times Q3_t - 0.000129\ P2_t \times Q3_t$

$- 0.000032\ PM3_t \times Q3_t - YW3_t - S3_t$

73. $YH3_t = - \underset{(2.5)}{88.97} + \underset{(4.9)}{0.494}\ YH3H_t + \underset{(3.3)}{0.647}\ Q3_t + \underset{(11.8)}{2.335}\ TIME$

$\bar{R}^2 = 0.919$ D-W = 1.85

74. $YH4H_t = 0.01969\ P4_t \times Q4_t - 0.00282\ P3_t \times Q4_t$

$- 0.000056\ P1_t \times Q4_t - 0.00282\ P2_t \times Q4_t$

$- 0.00399\ PM4_t \times Q4_t - YW4_t - S4_t$

75. $YH4_t = \underset{(2.2)}{27.11} + \underset{(29.0)}{0.961}\ YH4H_t$

$\bar{R}^2 = 0.951 \qquad D\text{-}W = 0.51$

76. Farmers´ income from agriculture (sector 1)

$YS1_t = -\underset{(9.0)}{287.5} + \underset{(16.9)}{2.897}\ P1_t + \underset{(5.5)}{0.751}\ Q1_t$

$\bar{R}^2 = 0.910 \qquad D\text{-}W = 1.23$

77. Forestry income (sector 3)

$YS3_t = -\underset{(10.1)}{215.3} + \underset{(9.1)}{1.101}\ P3_t + \underset{(9.7)}{0.95}\ Q3_t$

$\bar{R}^2 = 0.902 \qquad D\text{-}W = 1.68$

78. Other incomes from unincorporated enterprises

$YSO_t = \underset{(3.5)}{28.57} + \underset{(29.4)}{0.042}\ QF_t$

$\bar{R}^2 = 0.953 \qquad D\text{-}W = 2.04$

79. Incomes from unincorporated enterprises, total

$YS = YS1 + YS3 + YSO$

80. Dividends

$YDIV_t = -\underset{(2.4)}{7.538} + \underset{(4.9)}{0.053}\ YH4_t + \underset{(25.5)}{0.964}\ YDIV_{t-1} - \underset{(4.1)}{0.380}\ TIME$

$\bar{R}^2 = 0.970 \qquad D\text{-}W = 0.55$

81. Rent and interest income

$$YKV_t = -\underset{(2.5)}{24.62} + \underset{(80.7)}{0.114}\ QF_t$$

$\bar{R}^2 = 0.994$ D-W = 0.84

82. Gross national product at factor cost, value

$$QF = YW + YH + S$$

83. Gross national product at market prices, value

$$QMF = QF + TSF$$

84. Income tax base

$$KVT = QF - S$$

85. Disposable income of households

$$YD = YW + S + YS + YDIV + YKV - NTRG$$

86. Real gross disposable income

$$UIA = 100\left(\frac{YW + YS + YKV - BTRG}{PCY}\right)$$

THE GOVERNMENT SECTOR

87. State revenue from income and property tax

$$GTY_t = -\underset{(4.0)}{97.19} + \underset{(15.9)}{0.0820}\ KVT_t$$

$\bar{R}^2 = 0.854$ D-W = 2.01

88. State revenue from child allowance contributions

$$GTC_t = \underset{(85.9)}{1.052}\ (TC \times YW)_t$$

$\bar{R}^2 = 0.956$ D-W = 2.44

89. State revenue from sales tax

$$\text{Log } GTS_t = -\underset{(17.6)}{3.792} + \underset{(3.2)}{0.7375}\ \text{Log } TTSL_t + \underset{(26.7)}{1.555}\ \text{Log } CYF_t$$

$$+ \underset{(3.8)}{0.8566}\ \text{Log } D1L_t - \underset{(12.3)}{0.1415}\ \text{Log } D2L_t$$

$\bar{R}^2 = 0.988$ D-W = 1.76

90. State revenue from customs duties

$$\text{Log } GTD_t = \underset{(2.1)}{0.7419} + \underset{(3.7)}{0.4490}\ \text{Log } MTF_t + \underset{(2.4)}{0.8826}\ \text{Log } K_t$$

$$+ \underset{(6.9)}{0.9421}\ \text{Log } (EF \times E - EF + 1)_t$$

$\bar{R}^2 = 0.754$ D-W = 2.05

91. State revenue from excise taxes

$$GTE_t = \underset{(2.3)}{22.25} + \underset{(2.6)}{0.6141} (TTB \times CTB)_t + \underset{(9.5)}{1.316} (TJP \times CJP)_t$$

$\bar{R}^2 = 0.942$ D-W = 1.81

92. State revenue from tax on motor cars and motor cycles

$$\text{Log } GTH_t = - \underset{(11.1)}{8.503} + \underset{(19.5)}{1.482} \text{ Log } MA_t + \underset{(9.4)}{3.645} \text{ Log } PAU_t$$

$\bar{R}^2 = 0.937$ D-W = 1.75

93. Revenue from social security contributions

$$SOC_t = \underset{(48.1)}{1.039} (TC23 \times YW)_t$$

$\bar{R}^2 = 0.935$ D-W = 2.68

94. Total state revenue

$$GT = GTY + GTC + GTS + GTD + GTE + GTH + GTA + GTO + GTR$$

95. Total state expenditure

$$GE = VEC + VEI + VEO$$

96. State borrowing, net

$$NB = GE - GT$$

97. Total public house construction investment

IGR = IGRV + IGRK

98. Total land and waterway construction

IMV = IMVV + IMVK + IMVP

99. State investment expenditure, value

VEI = PI x IGRV + PI x IMVV

100. State consumption expenditure, value

VEC = PCG x CGV

101. Total public consumption, volume

CG = CGV + CGK

IV. LIST OF VARIABLES

- in alphabetic order
- endogenous variables are denoted by (x)

LIST OF VARIABLES

(endogenous variables are denoted by ×)

× A = Rate of employers' contributions to social security

× BTF = Trade balance

BTRG = Gross income transfers from households to public sector

× C = Total consumption, volume

× CA = Consumer expenditure, motor cars, volume

CG = Total public consumption, volume

CGK = Public consumption, local government, volume

CGV = " " , state, volume

× CJP = Consumer expenditure, fuel for motor cars, volume

× CP = Consumer expenditure, services, volume

× CT = Consumer expenditure, durables (except cars) and non-durables, volume

× CTB = Consumer expenditure, tobacco, value

× CY = Total private consumption, volume

× CYF = Total private consumption, value

DC = Dummy variable for sales tax reform in 1964

DEV = " " for devaluation in October 1967

DI62 = Dummy variable for the change in taxation of rent income (1962 effect)

DI66 = Dummy variable for the change in taxation of rent income (1966 effect)

DMY2 = Dummy variable for termination of import rationing of motor cars in 1962

DMY3 = Dummy variable for impact of devaluation on sales of motor cars in 1967

DMY4 = Dummy variable for sales tax reform in 1964

DMY5 = Dummy variable for the change in taxation of rent income in 1962

DMY6 = Dummy variable for harbour strike in 1963

DTE = Dummy variable for other social security payment rate

x DV = Change in business inventories, volume

DIL = Dummy variable for sales tax rate in 1958 - 1963

D2L = Dummy variable for sales tax avoidance in 1962 - 1963

E = Dummy variable for EFTA tariff reductions

EF = Share of EFTA countries and USSR in Finnish imports

GE = Total state expenditure

x GT = Total state revenue

GTA = State revenue from alcohol monopoly

x GTC = State revenue from pension and child allowance contributions

x GTD = State revenue from custom duties

x GTE = State revenue from excise taxes

x GTH = State revenue from tax on motor cars and motor cycles

GTO = State revenue from other taxes

GTR = State revenue, other

x GTS = State revenue from sales tax

x GTY = State revenue from income and property tax

x I = Fixed investment, volume total

x IA = Residential construction, volume

IGR = Public investment, in construction, volume

IGRK = Public investment in construction, local government, volume

IGRV = Public investment in construction, state volume

IMV = Investment in land and waterway construction, volume

IMVK = Public land and waterway construction, local government, volume

IMVV = Public land and waterway construction, state, volume

IMVP = Private land and waterway construction, volume

x IYK = Private investment in machinery and equipment, volume

x IYKT = Private investment in machinery, equipment and non-residential construction, volume

K = Dummy variable for Kennedy-round tariff reductions

x KKT = Stock of fixed business capital, total, volume

x KVT = Income tax base

x KK = Stock of fixed business capital, machinery and equipment, volume

x LUR = Unemployment as percentage of total labour force

x LW = Paid labour input, total

x LW1 = Labour input in sector 1 (agriculture)

x LW2 = Labour input " 2 (non-competitive production)

x LW3 = Labour input " 3 (forestry)

x LW4 = Labour input " 4 (competitive production)

x M = Imports of goods and services, volume

x MA = Imports of motor cars, volume

x MC = Imports of consumer goods (other than cars), volume

x MI = Imports of investment goods, volume

x MP = Imports of fuels and lubricants, volume

x MR = Imports of goods, raw materials, volume

MS = Imports of services, volume

x MT = Imports of goods, total, volume

x MTF = Imports of goods, total, value

* NB = State borrowing, net

NTRG = Net income transfers from households to public sector

PAU = Price index for motor cars

* PCG = Public consumption prices

* PCGH = " , input-output estimate

* PCY = Private consumption prices (cost-of-living index)

PM = Import prices, goods

* PI = Fixed investment prices

PMC = Import prices, consumption goods

PMI = Import prices, investment goods

PMR = Import prices, raw materials

PM1 = Import prices, raw materials for sector 1

PM2 = " , " " 2

PM3 = " , " " 3

PM4 = " , " " 4

PPN = Imports of foreign long-term capital

PTU = Price index for tobacco

PV = Stock of fuels

P1 = Prices in sector 1 (agriculture)

* P2 = Prices in sector 2 (non-competitive production)

* P2H = Prices in sector 2, input-output estimate

P3 = Prices in sector 3 (forestry)

* P4 = Prices in sector 4 (competitive production)

PX = Export prices

PX(OECD) = Export prices in OECD countries (weighted average)

PWX = Export prices of manufactured goods

* Q = GNP at factor cost, volume

* QF = GNP at factor cost, value

x QM = GNP at market prices, volume

x QMF = GNP at market prices, value

x Q1 = Production at factor cost, volume in sector 1

x Q2 = " , " 2

x Q3 = " , " 3

x Q4 = " , " 4

x Q4KA = Capacity utilization variable in sector 4 (the ratio of output to its semi-logarithmic trend)

Q4(OECD) = Industrial production in OECD countries (weighted average)

x RBF = Foreign credits of the banks, net

x RD = Demand deposits

RF = Foreign interest rate (3-month Treasury bill, London)

RGB = Banks´ credit to state, net

x RKIR = Availability of credit ratio

x RKPV = Credit from the Central Bank to the banks, net

x RL = Bank credit to the non-bank private sector

RM = Banks´ "other assets"

RO = Banks´ own capital

RP = Cash payment dummy variable (imports)

RR = Commercial bank lending rate

x RT = Time deposits

x S = Employers´ contributions to social security, total

x SOC = Revenue from social security contributions

x S1 = Employers´ contributions to social security, sector 1

x S2 = " , " 2

x S3 = " , " 3

x S4 = " , " 4

TC = Rate of pension and child allowance contributions

TC23 = Rate of national pension and sickness insurance contributions

	TIME	= Time trend, 1,2,3,...
	TJP	= Excise tax rate on fuel for motor cars
	TO	= Bonds temporarily purchased by Central Bank from the banks under repurchase obligation
x	TS	= Indirect taxes minus subsidies, volume
	TSF	= " " , value
	TTB	= Excise tax rate on cigarettes
	TTC	= Rate of social security contributions
	TTSL	= Sales tax rate
x	UIA	= Real gross disposable income
x	V	= Stock of business inventories, volume
	VEC	= State consumption expenditure, value
	VEI	= State investment expenditure, value
	VEO	= Other state expenditure, value
x	WR	= Implicit level of earnings, total
x	WRN	= Negotiated wage rate
x	WR1	= Level of earnings, sector 1
x	WR2	= " , " 2
x	WR3	= " , " 3
x	WR4	= " , " 4
x	X	= Exports of goods and services, volume
	XME	= Exports of metal and engineering industry products, volume
	XPF	= Exports of woodworking and paper industry products, volume
x	XT	= Exports of goods, total, volume
x	XTF	= Exports of goods, total, value
x	YD	= Disposable income of households
x	YDIV	= Dividends
x	YH	= Total non-wage income

x YH1 = Non-wage income in sector 1

x YH2 = " " 2

x YH3 = " " 3

x YH4 = " " 4

x YH1H = Non-wage income in sector 1, input-output estimate

x YH3H = " " 3, "

x YH4H = " " 4, "

x YKV = Rent and interest income

x YS = Incomes from unincorporated enterprises, total

x YSO = Other incomes from unincorporated enterprises in sectors 2 and 4

x YS1 = Farmers' income from agriculture (sector 1)

x YS3 = Forestry income (sector 3)

x YW = Wages and salaries, total

x YW1 = Wages and salaries in sector 1

x YW2 = " " 2

x YW3 = " " 3

LIST OF REFERENCES

Aukrust, Odd: "Prim I, A Model of the Price and Income Distribution of an Open Economy", The Review of Income and Wealth, No. 1, March 1970.

Chenery, Hollis B.: "Overcapacity and the Acceleration Principle", Econometrica, January 1952.

Dhrymes, P.J.: A Model of Short-run Labor Adjustment in the Brookings Model: Some Further Results, eds. J. Duesenberry et al., Amsterdam 1969.

Evans, Michael K. and Klein, Lawrence R.: The Wharton Econometric Forecasting Model, Philadelphia 1968.

Fisher, F.M., Klein, L.R. and Shinkai, Y.: Price and Output Aggregation, in the Brookings Econometric Model, Amsterdam 1965.

Friedman, Milton: A Theory of Consumption Function, 1957.

Jorgenson, Dale W.: "Capital Theory and Investment Behavior", American Economic Review, May 1963.

Koyck, L.M.: Distributed Lags and Investment Analysis, Amsterdam 1954.

Kresge, D.: "Price and Output Conversion: a Modified Approach" in the Brookings Model: Some Further Results, eds. J. Duesenberry et al., Amsterdam 1969.

Kukkonen, Pertti: Analysis of Seasonal and Other Short-term Variations with Applications to Finnish Economic Time Series, Bank of Finland Institute for Economic Research, Series B:28, 1968.

Modigliani, Franco and Ando, Albert: "The Permanent Income and Life Cycle Hypothesis..." in Study at Consumer Expenditures Incomes and Savings, Proceedings of the Conference on Consumption and Savings, Vol. II, Washington 1960.

Molander, A.: A Study of Prices, Wages and Employment in Finland, 1957 - 1966, Bank of Finland Institute for Economic Research, Series B:31, 1969.

Molander, A., Aintila, H. and Salomaa J.: Vakautuksen vaikutus hinta- ja palkkatasoon, Publications of SITRA, Series B No. 5, Helsinki 1970 (in Finnish).

BANK OF FINLAND INSTITUTE FOR ECONOMIC RESEARCH PUBLICATIONS

Series D

1. Pertti Kukkonen: On the Measurement of Seasonal Variations. 1963. 11 p. In English.

2. The Index Clause System in the Finnish Money and Capital Markets. 1964, Revision 1969. 15 p. In English.

3. J.J. Paunio: Adjustment of Prices to Wages. 1964. 15 p. In English.

4. Heikki Valvanne and Jaakko Lassila: The Taxation of Business Enterprises and the Development of Financial Markets in Finland. 1965. 26 p. In English.

5. Markku Puntila: The Demand for Liquid Assets and the Development of the Liquidity of the Public in Finland during 1948-1962. 1965. 110 p. In Finnish.

6. J.J. Paunio: A Theoretical Analysis of Growth and Cycles. 1965. 117 p. In Finnish.

7. Ahti Molander: The Determination of Aggregate Price and Wage Levels in Finland 1949-1962. 1965. 159 p. In Finnish.

8. Erkki Pihkala: The Permanent Commissions of COMECON as Realizers of the Distribution of Labour. 1965. 35 p. In Finnish.

9. Kari Nars: Price Policy Parameters of the State. 1965. 118 p. In Swedish.

10. Heikki Valvanne: The Framework of the Bank of Finland's Monetary Policy. 1965. 34 p. In English.

11. Jouko Sivander: On the Theory and Measurement of Elasticities of Substitution in International Trade. 1965. 91 p. In Finnish.

12. Timo Helelä, Paavo Grönlund and Ahti Molander: Memorandum on Wage Negotiations. 1965. 56 p. In Finnish.

13. Erkki Laatto: Quarterly Volume Series of Finland's External Trade in Goods between 1949 and 1964, Adjusted for Certain Short-term Fluctuations. 1965. 24 p. In Finnish, summary in English.

14. Dolat Patel: The Shares of the Developing Countries in Finnish Foreign Trade. 1966. 31 p. In English.

15. Pekka Lahikainen: On Variations in the Relationship between Output and Labour Input. 1966. 25 p. In Finnish.

16. Heikki U. Elonen: On Demand for and Supply of Finance for an Enterprise. 1966. 88 p. In Finnish.

17. Timo Helelä and J.J. Paunio: Memorandum on Incomes Policy. 1967. 10 p. In English.

18. Kari Nars: A Study in the Pressure of Demand. 1967. 119 p. In Swedish.

19. Kari Puumanen: Debt Instruments Tied to Price Indices as Objects of Choice. 1968. 186 p. In Finnish.

20. Richard Aland: The Investment Banking Function in the United States. 1968. 31 p. In Finnish and English in one edition.

21. Timo Helelä: Strikes and Industrial Relations in Finland, 1919-1939. 1969. 341 p. (In two volumes.) In Finnish.

22. Sirkka Hämäläinen: On Subjective Factors Affecting Household Savings and the Possibility of Quantifying Them. 1969. 177 p. In Finnish.

23. Heikki Koskenkylä: An Evaluation of the Predictive Value of the Investment Survey of the Bank of Finland Institute for Economic Research. 1969. 12 p. In English.

24. Heikki Koskenkylä: On the Statistical Problems of the Investment Survey of the Bank of Finland. 1970. 71 p. In Finnish.

25. Pertti Kukkonen and Esko Tikkanen: Icebreakers and Winter Traffic. 1970. 136 p. In Finnish.

26. Heikki U. Elonen and Antero Arimo: A Study of the Finances of the Lutheran Church in Finland. 1970. 73 p. In Finnish.

27. Juhani Hirvonen: A Simultaneous Econometric Model for International Economy. 1971. 64 p. In Finnish.

28. Heikki Koskenkylä: On Problems of the Theoretical and Empirical Analysis of Investment. A Study of Manufacturing Investment in Finland in 1948-1970. 1972. 182 + 58 p. In Finnish.

29. A Quarterly Model of the Finnish Economy by The Model Project Team of the Research Department. 1972. 105 p. In English.

KYRIIRI OY 2571
Helsinki 1973

ISBN 951-686-007-9