The Industrial Institute for Economic and Social Research

Stockholm

IUI

Current Research Projects

Summer 1977

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The Industrial Institute for Economic and Social Research

is an independent non-profit research institution, founded in 1939 by the Swedish Employers' Confederation and the Federation of Swedish Industries.

Objectives

To carry out research into economic and social conditions of importance for industrial development in Sweden.

Activities

The greater part of the institute's work is devoted to long-term problems especially to long-term changes in the structure of the Swedish economy particularly within manufacturing industry. This also includes continuous studies of the development of private consumption in Sweden and projections of demand for various products. Research results are published in the series issued by the Institute.

Along with the long-term research work the Institute carries out investigations concerning special problems and performs certain services to industrial enterprises, organizations governmental agencies, etc.

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Address:

Industriens Utredningsinstitut
Grevgatan 34, Box 5037, S-102 41 Stockholm, Sweden
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Introduction

The research program at the Industrial Institute for Economic and Social Research (IUI) covers a quite extensive area. Orientation is predominantly towards applied economics or theoretical investigations to support the analysis of empirical problems. There is no doubt that applied economics is rapidly becoming a highly sophisticated science that requires a solid base of technical skills. To phrase the same thing somewhat differently one may say that the tradition of the Institute has been to look for and define the problems to be investigated in the real world around us rather than in the body of economic theory. This tradition is well illustrated by the research orientation during 1976 and by the ongoing projects.

Long term economic projections

A substantial part of the research effort during 1975 and 1976 was devoted to a medium term (5 year) *comprehensive forecast* of the Swedish economy (see p 13). This was the first time such a comprehensive study had been attempted at the Institute. It can be seen as an extension of earlier long term surveys specialized on the industry sector. However, this project has required a much more concerted mobilization of research personnel with different specialities. Growth in output through 1980 was forecast for the major economic sectors (industry, service and trade, home construction, the public sector, etc) and for the most important subsectors of manufacturing. The forecasting is based upon a new input-output macro model built at the Institute. This model is described in more detail below and as a separate project on p 15).

The format of the long term assessment was shaped in the tradition of earlier Government sponsored long term surveys. It was defined to serve as a basis for economic policy making. Hence the analysis centered around the long term tendencies of employment, productivity and exports and the conditions required for external balance by 1980, rather than studying the cyclical time path that would take us there. The relationships between profitability, financing conditions and investment spending were also extensively discussed, although we have not yet managed to integrate this important

aspect of growth systematically and numerically with the forecasting work. A similar task remains for modelling price and wage formation.

Growth forecasts were based on two feasible and politically distinct alternatives for the 5 year period, that have been considered in recent political debate about economic policy. One extreme alternative presumed a continued high growth rate of the public sector. The other alternative was designed to have roughly the same aggregate employment consequences, but involved a relatively much faster growth in goods production and investment in the private sector (see table 1 on p 14). Both alternatives presumed that the current deficit caused by the oil price hike in 1973/74 would be eliminated by 1980 and that full employment would be maintained through the projection period.

The turmoil of recent years in the international economy has played havoc not only with exogenous input assumptions but also with economic relationships that were previously believed to be well established. This is also the case for the IUI medium term projection. In the more detailed account of the model given on p 15 we therefore include a comparison of how well current cyclical swings in some variables have traced the average growth trend so far and what that may mean for the next few years.

The purpose of this long term projection, and others of course, is to increase our knowledge of the feasible range within which future growth is to be expected, to identify and foresee those problems that will arise if economic development takes other and unexpected paths, and to analyse the consequences of different policy actions like changes in the taxation system. As always, some basic underlying assumptions play a dominant rôle for the outcome of the analysis. The extreme inflationary wave of the last few years has left much of what was previously considered established knowledge in a quite uncertain state. Assumptions about the development of relative prices now mean much more than before for profit performance in industry and hence feed into the basic growth and financing assumptions for the next few years. Profit rates in industry were back to the very low levels of 1971 and 1972 by early 1977 and hence substantially below the rates assumed in the forecast. The analysis of price and wage formation, profitability, investment and growth, however, has not been fully integrated in this study. Hence we are not in a position to tell whether or not this implies that we will return to the forecast growth paths over the next few years.

The long term economic projection can be seen from two different angles. First, it means a mobilization and coordination of the specialized competence that resides in the Institute. As long as these assessments are not too frequent and are not allowed to interfere too much with the research activities to which the Institute primarily devotes its attention, we can look upon them as a useful allocation of research resources. Second, if well designed, the comprehensive surveys can help to guide and coordinate research by indicating where the relevant problem areas are.

The macro model

The new competence of the Institute to make economy wide appraisals of the future development of the Swedish economy rests very much on the new model of input-output type that has been developed within the Institute and which is described in more detail on page 15. The model is integrated with a linear household expenditure system (p 19), and an income tax and transfer system (p 35). Both these submodels have also been developed within the Institute. The total model includes a detailed submodel for the public (local and national Government) sectors as well. The long term appraisal clearly demonstrates the obvious fact that the composition of total demand directed at the Swedish economy, e.g. the split between public and private consumption, is important for the attainment of a desired combination of economic growth, employment and the external balance. As shown in a special study, the composition of public demand (the choice between health care, defense, education, social welfare, road building, etc) has a strongly differential impact on production and employment (p 20). A collection of papers describing various parts of the total model has been published in August 1977 (p. 16, note 1).

Industrial structure, technology and energy

Economy wide models always have to be simplified to the extent that detailed aspects of the economy are not well handled. To increase realism and usefulness, constant improvements and updating have to be part of the regular maintenance of the model. Among ongoing projects with this aim, one on production structure and technological change in particular should be mentioned (p 31). To understand the mechanisms of a national economy, primary attention quite naturally has to be paid to the industry sector. Hence several

projects under way are aimed at measuring various aspects of productivity development within subsectors. For practical reasons work has begun in sectors with quite homogeneous products like particle board production, dairies (p 31) and energy production (p 29). Preliminary results indicate that the spread between productivity of new investments and average productivity within these sectors has been increasing over the last 10 years (p 31). About one third of measured total productivity growth in the postwar period in the manufacturing sector can be attributed to a reallocation of resources towards high productivity subindustries. We also know, however, that differences between subindustry productivity rates were smaller by the early seventies than they were in the early fifties. These results suggest that in the future, productivity growth will depend more on new technologies brought in through new investment. A general objective for future research is to pay increased attention to the leverage on growth exercised by technological change.

In the energy field the Institute has published projections of energy consumption in industry and of the consumption of electricity in the whole economy in connection with the 5-year economic forecast. Particular emphasis has been put on the relationships between technological change and energy consumption. In a current Institute project for the Swedish Energy Commission the focus is on the long term development of relative energy prices between countries and its relation to energy consumption at the macro level and the choice of production technology at the micro level (p 28).

Taxation

A number of studies on the Swedish tax system will be published during 1977. They deal with corporate income taxation, the effects of indirect factor taxes, like payroll and energy taxes, as well as sales taxes and the differential impact of individual income taxation. Two of these studies have been commissioned by a Government committee. Also a study on capital gains taxation (p 40) has been started. One clear conclusion from these studies is that the incidence from various kinds of tax changes, even though seemingly simple and evident in a narrowly defined context, is not so in a general equilibrium context. The incidence of changes in payroll taxes eventually falls on the wage earner either through lower real wages or by way of higher prices (p 36). It is not even self-evident, as often argued, that an increase in corporate

net income taxation will be carried by the owners. If the after-tax rates-of-return are determined outside the Swedish economy in international markets, as is probably the case, before-tax requirements may quite well be increased to the extent that investment and long run growth is lowered (p 38). We are simply faced with the classical dilemma that the way the cake is shared affects its size.

Finance

A second main research field of the Institute relates to credit market problems and profit performance in industry. A special study on industrial growth and long term finance is expected to be published during 1977 as a supplement to the report of the Government Capital Market Committee. The relationships between profitability, the leverage ratio and investment growth have been studied several ways, among others, by following over time the 40 largest industrial companies in detail with special Institute survey material for the period 1965–1975. In the gradually increasing external share of total financing of Swedish industry, an even faster growing share of "special" and partly subsidized credits from Government or semi-government capital market institutions can be noticed. Also, despite wishes to the contrary on the part of policy authorities, households seem to have increased their holdings of liquid assets by more than 60 per cent between 1970 and 1975. This is probably a consequence of inflation in combination with mortgaging of property. The increase in external financing and the deteriorating leverage position of industrial firms and perhaps also the increased "special financing" do not depend on a faster growth but rather a gradual decrease in profit rates. This decrease as well as the temporary, but sudden, increase in 1973/74 can be clearly seen in the statistical material collected. Even so, Swedish industry improved its profit performance over the same period compared to other industrial nations well into the 1970's. This beneficial relative change, however, seems to be all but gone by the end of 1976 and one of the important issues today is what this means for future economic growth.

Micro based studies

It may seem paradoxical, but an inflationary profit boom of the kind experienced in 1973/74 seems to be a mixed blessing for business firms if seen over a period longer than a couple of years. These and similar problems are studied systematically in a so-called micro simulation model of the Swedish economy being developed at the Institute (p 44). In fact, in this model (as it now stands) strong inflationary impulses, that at first may seem like positive stimulants for firms, generate a clearly negative long term growth effect. The long term effect on business profit margins of the same strong initial inflationary profit boom is also clearly negative.

In this micro based model individual firms are represented as simplified production and investment planning systems that are competing with one another in the markets for products and labour. The model is specially designed to simulate the transmission of inflationary impulses at the micro level and to catch (endogenously) the interaction between volume price adjustments in the entire economy. The goal is that the model shall be capable of simulating a production-investment and inflation cycle in an interactive fashion. The project as such means trying out a relatively new approach in applied economic research and hence is of an experimental nature. If successful, however, it should also be quite useful as a tool for coordinating individual firm information for a better understanding of macro economic behaviour.

There are several other micro oriented studies at the Institute, some involving the collection of very large statistical data bases. One such study is concerned with the entry and exit of business units (p 65). The statistical data base is currently being analysed with a view to quantifying the relationships between rates of entry on the one hand and market growth, economies of scale and concentration, etc on the other. The data base is probably unique. During a short time span the contribution to total growth from newly established firms obviously must be quite small. New entrants, however, play an important competitive rôle in different markets. Successful new entrants in the longer run also grow and represent sizeable contributions to total growth. A particularly interesting result is that the rate of entry tends to increase faster than the rate of market growth. In addition, both the size of initial capital requirements, technical skill requirements and market concentration seem to exercise a retarding influence on the rate of entry. The rate is also lower in subindustries where cartel arrangements have been

registered than in other subindustries. A related study on Swedish industrial development during the postwar period has been started recently. One prime question is *whether* a change of permanent nature has taken place around the middle of the 1960's and, if so, the goal is to identify the nature of this change. Such an investigation necessarily has to probe deeply into the micro structure of firms.

Problems at the industrial firm level are also investigated in other studies. The efficiency of price controls (p 73) has been part of international and Swedish economic debate for years and the answers are far from conclusive. One recently started project addresses this problem. Are price controls a useful tool to contain inflation at all? If so, should prices, wages or profits or all variables be subject to controls? How do firms adapt to controls? Does the degree of competition decrease? Productivity? Could it be that controls in fact speed up inflation by serving as collusion guide lines for firms? In this context a special study on the demand for telephone services that has just been concluded (p 70), should also be mentioned. A second part of that study is concerned with the efficient pricing of telephone services.

In two other projects the mobility of labour (p 59) and the relationship between labour market participation and professional success (p 59) are investigated. Which are the important determinants for recruitment, lay-offs and exits in the industrial labour force? What are the differences between blue and white collar workers? The Swedish labour market has become renowned for its low mobility and low unemployment rates relative to e.g. the U.S. market. At the same time it has been argued that a fairly large turnover in the labour market is both a sign of efficient market performance and a necessary consequence of fast economic growth. During the 1970's a number of laws have been enacted that may contribute to an even slower adjustment in the labour market.

International competitiveness and foreign trade

Micro orientation also dominates IUI research on foreign trade. Two large projects on Swedish external investments (outbound) (p 55) and foreign investments in Sweden (inbound) (p 57) are about to be completed. In both cases very large data bases on individual firms have been collected within the Institute. These studies will make it possible to map the complex network of international economic ties that constitute Swedish international economic

dependence in much more detail than before. It may even be possible to arrive at a more quantitative assessment of what these investments mean to Swedish industrial growth. A combination of these projects with a view towards studying the financial side of foreign investment has just begun (p 58).

Two large projects on foreign trade were also concluded during 1976, one on trade barriers and trade policy (p 53) and one on the international specialization of Swedish engineering industries (p 50). The first study clearly demonstrates that the formation of EFTA and EEC changed trade flows to and from Sweden in the direction of relatively more trade with EFTA. Furthermore, existing trade barriers strongly depend on where the comparative advantages of the country are located. Labour intensive and simple products, for instance, were much more protected in Sweden before the integration of the 1960's than were other products. The second study strongly suggests a continued specialization of our large engineering sector. This tendency seems to be prevalent in all industrial countries. This is again an instance of the increasing economic dependence on the rest of the world that other countries share with us. Swedish industry also seems to have strengthened its comparative advantages between 1960 and 1970 in production activities with large inputs of skilled technical personnel, that is to say with large inputs of engineers in the production of complex products. Until 1970 at least this effect has strengthened our earlier comparative advantage in production with a high input of skilled workers. In contrast to this, our comparative advantage in capital intensive production of standard products has declined significantly (p 50). This conclusion is also suggested by results from the previously mentioned study of foreign investment in Sweden.

There is an obvious benefit in coordinating some ongoing projects with the two model development projects. The synergy potential in data collection should be large. Furthermore, the possibility of relating the results of one particular study to the national macro level handled by the models should give quite useful insights. This is particularly the case for studies where micro and macro problems interact.

The number of full time researchers has been reduced by two to 20 during 1976. In addition, 5 researchers from universities and other organizations have been affiliated by way of projects. About 30 projects were under way by the end of 1976.

Gunnar Eliasson.

Long term projections

The IUI long term projection

Since the 1950's the Institute has been commissioned to cover the industry sector in the Government long term (5 year) surveys that have taken place every fifth year. In 1976 the Institute for the first time ventured upon a full long term inquiry of its own of the next five year period. The main report was published in May 1976. A series of special studies for this forecast were published in August this year. This special studies volume includes a documentation of the medium term forecasting model (see below) developed specifically for the purpose of helping to coordinate long term projection work.

A. The 1976 projection[1]

The first, full long term inquiry into the Swedish economy undertaken by the Institute took two distinct economic policy alternatives and a set of conventionally established assumptions as its starting point.

The projection is of the steady-state type assuming maintained full employment throughout the period and allowing for no cyclical oscillations. Furthermore the requirement was imposed on the analysis that the so-called structural deficits on current account, partly occasioned by the oil price hike, be closed by the 1980 horizon.

Two policy solutions to get there at an acceptable rate of growth were explored, the one (the *public-expansive* alternative) concentrated on generating full employment and less imports by having the public sector grow relatively faster than the rest of the economy. The second *(industry-expansive)* alternative sought to achieve the first part of this goal by raising the overall growth rate and shifting demand growth away from public consumption towards private consumption, investment and exports.

One may perhaps say that the first, "public-expansive" alternative meant solving our balance of trade dilemma by slowing down growth of domestic

[1] *IUI:s långtidsbedömning 1976* (The IUI Medium Term Projection 1976). The former director of the Institute, Dr Lars Wohlin, was the project leader and a large share of the Institute's staff was partially engaged. The development of the econometric model was headed by Dr Ulf Jakobsson.

demand and imports somewhat, while the second, "industry-expansive" alternative, implied a solution with higher growth in GNP, investment and industrial production – all compared with the last 10 year period. The first slow growth alternative by definition meant more taxes to contain import-intensive consumption. The second, bolder export solution focussed on the critical question of how to get investment going. We now, of course, have a problem in reconciling what is currently happening (1975, 1976) with the projected 1975–1980 trend (see table 1).

One heated issue over the last few years has been whether long run full employment is at all possible without the public sector growing faster than GNP. As already indicated, the answer is yes. The final assessment was that reality would choose a path somewhere between the two alternatives. GNP was assumed to grow at a rate between 3 and 3.5 per cent per annum between 1975 and 1980 to be compared with 4 per cent 1965–1970 and 2.8 per cent 1970–1974. We should note in passing that the current recession with a GNP growth rate of 0.5 per cent 1975 and 1.5 per cent 1976 (latest

estimates) means that a very strong recovery has to start up in 1977 if we are going to achieve the long term forecast by 1980. In fact the four years 1977 through 1980 would have to witness an average annual GNP growth of between 4 and 5 per cent, depending upon which alternative we choose. Few forecasters believe this to be realistic today *even though* such a figure was not at all unusual in the early 1960's for the four fastest growth years of a full cycle. The problem in fulfilling either of the two alternatives rather lies hidden in the decomposed GNP table. Requirements on industrial production and export growth would be astounding in both cases. In addition all expansion of public consumption "allowed" in the industry-expansive alternative seems to have been used up already during the two recession years 1975 and 1976.

The long term forecast also concluded that continued growth roughly along the trend of 1965–1974 requires that profit rates in the manufacturing sector stay substantially above the rates of the early 1970's. In fact, if this assumption is not realized the consequences will be a decrease in key financial ratios of a kind that makes it reasonable to expect that the underlying investment and growth assumption are no longer realistic.

B. Future projections

Preparatory work this year for the *next long term projection* will be mainly concentrated on the forecasting model (see below). Work on the long term inquiry itself will begin late this year and continue through 1978 and at least part of 1979. This appraisal will involve a temporary mobilization of some of the institute's specialized resources during part of 1979.

Gunnar Eliasson will be directing this project.

The IUI medium term forecasting model for the Swedish economy

A macro model developed at the Institute was the basic tool to make possible a consistent assessment and a systematic evaluation of alternative developments of the economy for the medium term projection of 1976. Further improvements of the model and a continuous updating of the data base are in progress and a medium term forecast for the whole economy is planned

Table 1. *The Swedish economy* (real, percentage change per annum)

	1965–1970	1970–1974	1974–1980		1975–1976 (average)	1977–1980 required to achieve	
			Public-expansive alternative	Industry-expansive alternative		Public-expansive alternative	Industry-expansive alternative
Private consumption	3.2	1.9	2.0	3.5	3.5	1.3	3.5
Public consumption	5.7	3.1	3.0	1.5	4.2	2.5	0
Gross investment (incl inventories)	3.7	1.9	3.0	3.5	-1.5	5.3	6.0
Exports	9.0	8.9	6.0	7.5	-2.5	10.5	13.0
Imports	8.3	6.8	5.0	6.5	1.5	7.0	9.0
GNP	4.0	2.8	3.0	3.5	1.0	4.0	4.8
Industrial production	5.3	3.6	4.0	5.5	-1.0	6.5	9.0
Labour productivity in industry	7.2	5.8	5.0	5.5	1.1	7.7	8.5

to be completed every third or fourth year.

The data base and the time-series used to estimate various parts of the model have been developed by the Central Bureau of Statistics (SCB) and cover a relatively long period of time. The time-series are consistent with the last revised version of the National Accounting statistics.

The model has been extensively presented in an anthology of papers.[1] The core of the model is 23 balance equations equalizing supply and demand of volumes of goods. Each equation represents a producing sector of the Swedish economy, e.g. agriculture and fishing, forestry etc.

Figure 1 gives a compact description of the model. The balance equation represents a 23 sector model where X, PI etc are column vectors. Circles represent endogenous variables, squares exogenous ones, and double framing stands for different model blocks. The model can be characterized as a Keynes-Leontief model, i.e. an input-output model with built-in multiplier mechanisms. The arrows emerging from the sector products indicate the order in which the multiplier effects work themselves through the model. As can be seen, no arrows lead into the central and local governmental block, thus indicating that they are exogenous. The same goes for PI, ΔS and EX. Since the system described by figure 1 involves a number of nonlinear relationships, the gross production levels have to be calculated with a nonlinear minimization program, and since last year's production influences both imports and private consumption, a solution has to be found for every year in the forecasting period. This makes the model dynamic but only in a technical sense, since the influence of the lagged values does not produce a trade cycle.

A brief description of each block in figure 1 will be given below.

Import functions

Import functions have been estimated for each production sector. The main principle has been to make imports dependent on gross production. When appropriate, however, other variables enter, e.g. private consumption.

[1] See Jakobsson, U, *En beskrivning av IUI-modellen* (A Description of the IUI-model); Normann, G, *Modeller för hushållssektorns inkomster, skatter och sparande* (Models of Household Income, Taxes and Saving); Dahlberg, L, *Offentlig sektor* (The Public Expenditure Model); appearing as chapters 1, 2 and 3 in *IUI:s långtidsbedömning 1976. Bilagor*. (Supplements to the IUI Medium Term Projection 1976).

Figure 1. *Main structure of the IUI macro model*
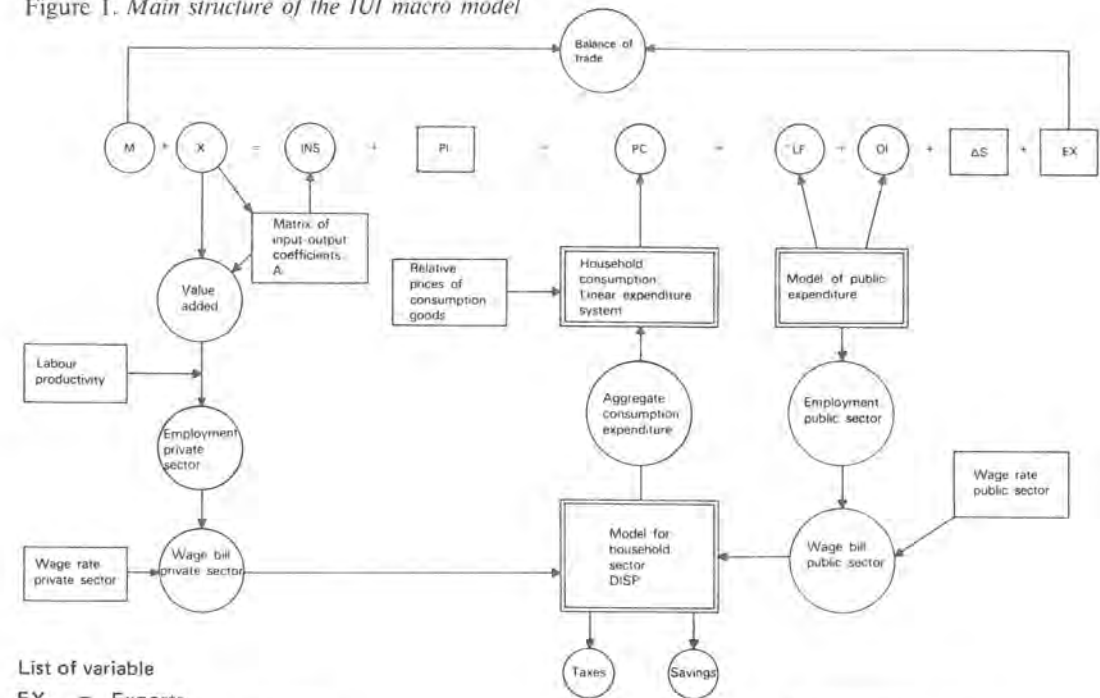
List of variable

EX	=	Exports
INS	=	Intermediate deliveries
LF	=	Public expenditures
M	=	Imports
OI	=	Public investments
PC	=	Private consumption by sector
PI	=	Private investments by delivering sectors
ΔS	=	Change in stocks
X	=	Gross output of production sectors

○ Endogenous variables

□ Exogenous variables

▢ Submodels to be described separately

Intermediate deliveries

Flows of intermediate goods between the 23 producing sectors are represented by a 23 x 23 input-output matrix A with the typical element a_{ij} which represents the amount of goods needed from sector i by sector j to produce one output unit. It has been regarded as unrealistic to let A be constant during the planning period. Therefore a projection for each coefficient and each year has been made with respect to observed historical trends and expert evaluations.

Public expenditure model

The public sector is divided into two parts, one for central government and the other for local government (see also p 20). The two parts are in turn

subdivided into seven and six sectors respectively. Public demand for goods from the producing sectors, both for current use and for investments, and public employment are functions of public consumption. Public consumption, on the other hand, is exogenously determined in the following way. First a minimum target has been determined based on the assumption that today's level of public services in all sectors be maintained. An increase in public consumption above this target and its distribution on sectors was exogenously "decided". The public sector thus enters the model as an exogenous block. It is used as a target variable (the minimum demand for public consumption) as well as a policy instrument (the distribution of the extra increases in public consumption).

Studies of the differential effects of public and private consumption are easily made, since the two types enter by way of separated blocks. Moreover, the disaggregated structure of the public sector allows us to analyse the impacts of different public spending patterns.[1]

Price and wage formation

Price and wage formation is handled by the so-called Scandinavian model of inflation. Domestic prices in the so-called "competitive sectors" are primarily determined by international prices. Pricing in sectors sheltered from foreign competition is basically of the mark-up type. Wage change in the competitive part of the economy is determined as the international price change plus the exogenous productivity change. This wage change spreads rapidly through the labour market, and differences in productivity trends between sectors of the economy will affect the general price level in a significant way.

In the current simplified version of the model, three sectors of the economy are distinguished: manufacturing industry, other production sectors, and the public sector. Firms in the manufacturing industry are assumed to compete in the international markets. Since Sweden is a relatively small country, the goods trading sector appears as a price taker. The other two sectors are assumed to be non-trading or sheltered sectors.

[1] See Dahlberg, L & Jakobsson, U. *On the Effects of Different Patterns of Public Consumption Expenditures*. Working paper no 2. (IUI) 1976.

The household sector

The submodel for the household sector, called DISP, establishes the link between factor income and disposable income (se figure 2). This link is strongly affected by fiscal policies (taxes and transfers).

One characteristic feature of this submodel is that the system of rules and parameters is explicit. Also, the distribution of income before taxes and transfers between different categories of income earners is handled explicitly. The model thus generates the development of disposable income under different hypotheses concerning the future development of income before tax for different types of households. We currently distinguish between three categories: employees, entrepreneurs and retired people.

The DISP-model draws heavily on the highly disaggregated TAX-model earlier developed at the Institute (see p 36). This model, covering personal income and payroll taxes, is used to estimate aggregate tax functions, one for each of the three categories in DISP. This means that the automatic properties of the progressive tax system are incorporated in the Keynesian multiplier. Changes in the parameters of the tax system are simulated by shift parameters in the aggregate tax function.

Figure 2. *The DISP-model*
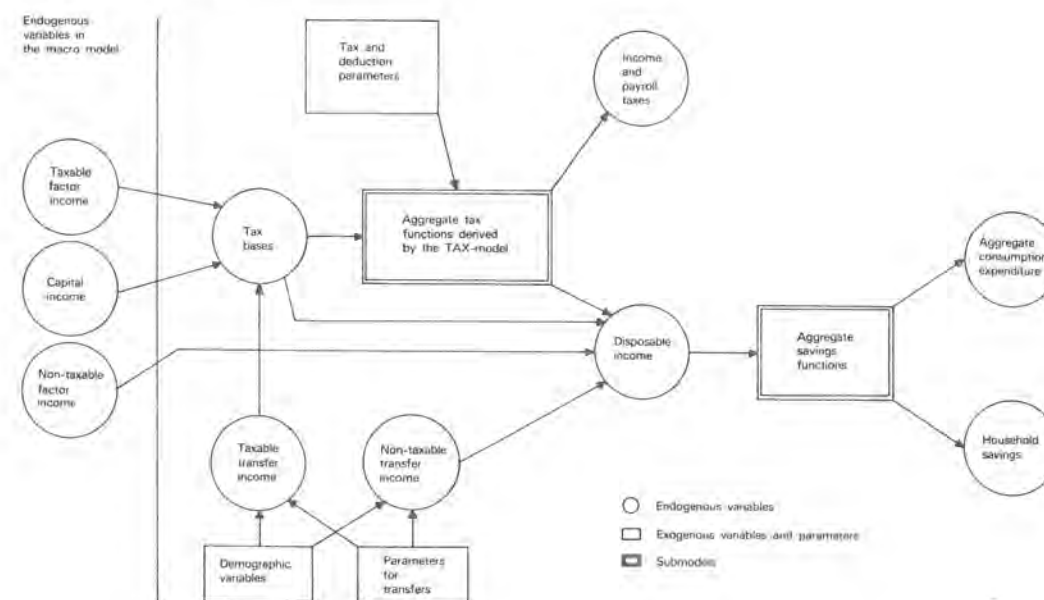
Private consumption

Consumer behaviour and the distribution of private consumption among various groups of goods have been the object of research at the Institute for a long time. Experience from these studies has been incorporated into the macro model. A linear expenditure system with habit formation,[1] estimated for 10 homogeneous groups of goods, has been used. The consumption of domestic goods is then distributed among the 23 production sectors by means of a transformation matrix.

Exports, stocks of produced goods and private investments enter as exogenous variables. Private investments are based on information from an industry enquiry about expected demand for investment goods.

Planned development of model

The model is planned to be used again in work on the next medium term forecast to be published in 1979. Besides an updating of the data base some extensions of the model are considered necessary.

Weak links in the model are between the real side and price formation on the one hand and between the real and financial side on the other. In earlier work financial considerations were handled outside the explicit model work. Experiences from that work together with an improved price model will be used to develop an integrated accounting routine. Furthermore, we plan to disaggregate the price model so that it operates on the same level of aggregation as the rest of the model.

Another goal is to introduce capital stock formation and an endogenous determination of investment, at least for the manufacturing industry. The export side will also have to be developed further.

Project leader: Göran Normann, assisted by Leif Jansson and Tomas Nordström.

The public sector

The treatment of the public sector in the 1976 long term projection[2] consists of three major parts.

[1] Developed at the Institute by Dahlman, C.J. & Klevmarken, A. in *Den privata konsumtionen 1931–1975* (Private Consumption in Sweden 1931–1975). (IUI). Stockholm 1971.

[2] See Dahlberg, L., Chapter 7 of *IUI:s långtidsbedömning 1976* (The IUI Medium Term Projection 1976); and Chapter 3 of *Supplements* to The IUI Medium Term Projection 1976.

Table 2. *Multiplier effects of a one million Skr increase in annual consumption volume in different public subsectors. 1968 prices.*

Public subsector where the consumption volume is increased

	State sector							Municipal sector					
	Defence (1)	Justice (2)	Schools (3)	Health (4)	Social care (5)	Roads (6)	Other services (7)	Fire-services (8)	Schools (9)	Health (10)	Social care (11)	Roads (12)	Other services (13)
Resulting employment effect in public sector (1 000's of hours worked)	27.8	38.1	23.3	102.1	27.3	24.1	32.8	24.7	28.8	50.2	65.3	16.8	22.7
Resulting employment effect in private sector (1 000's of hours worked)	12.9	6.7	7.8	16.9	10.9	28.0	9.4	6.9	6.0	10.4	10.9	35.6	17.8
Total resulting employment effect in private + public sector (1 000's of hours worked)	40.7	44.8	31.1	119.0	38.2	52.1	42.2	31.6	34.8	60.6	76.2	52.4	40.5
Resulting effect on annual import volume (million Skr, 1968 prices)	0.26	0.09	0.08	0.22	0.13	0.33	0.12	0.07	0.07	0.16	0.15	0.32	0.20
Resulting effect on (annual) private consumption (million Skr, 1968 prices)	0.21	0.11	0.13	0.34	0.19	0.44	0.17	0.09	0.08	0.19	0.32	0.54	0.26
Resulting effect on private sector gross production (million Skr, 1968 prices)	1.19	0.50	0.55	1.38	0.81	2.25	0.72	0.45	0.44	0.87	0.83	2.47	1.33

The first one deals with consumption plans of local governments for the period 1974–1980. Within boroughs as well as counties, long range plans for future activities are worked out every year. By special enquiries, information about these plans is collected and analysed centrally. The enquiries are discussed and analysed in part one. Necessary adjustments and supplementary calculations are made. Finally, the results of the interpretation are presented.

The second part contains a description of the econometric model of the public sector and of its use in the long range forecast of the IUI. The model is recursive and contains more than 600 equations and approximately one thousand parameters. Consumption volumes of the base year are exogenous variables. The other variables are endogenous. The growth rates of local and state government consumption are the two central policy parameters. In the transition from one growth alternative to another, only these two parameters are changed.

In the third part the effects of various expansion patterns within the public sector are studied. The section contains both a theoretical and an empirical analysis. The latter includes, among other things, the computation of the multipliers which are presented in table 2. The table shows the effects on employment, private consumption and imports from a given increase in public consumption.

It is shown on the basis of these results that the choice of public growth pattern is of great importance to the development of other economic magnitudes. The exchange relation between public and private consumption growth is the subject of a special analysis, which sheds new light on the old discussion theme of "private versus public consumption". In an economy with richly differentiated activities in the public sector, this conflicting relation is neither unique nor exact. The amount of private consumption sacrificed for each unit of public consumption varies considerably, depending on in which subsector the public consumption expenditure is made.

Financing of manufacturing industry

The performance of firms is to a great extent influenced by their internal and external financing possibilities. Therefore an important objective for IUI's long-term projection was to map the financial implications for industry of changes in certain "exogenous" variables. This was done with a simple financial model which is partially linked to IUI's main forecasting model. The financial model transforms the growth rates in value added, labour costs, gross investments and depreciation costs into a projection of net investments, savings, real and financial assets, and debt.[1]

The financial model also makes it possible to forecast the rate of return before profit tax, and the leverage ratio for the industrial sector. The results are presented in table 3 below. For comparison the historical values of these variables are also given for 1970–1974. During this period the rate of return both on total assets and on equity has increased. The rise in the rate of return on equity is higher, due to a positive leverage effect, which depends on the rate of return on total assets being higher than the interest rate on borrowed capital. Furthermore this leverage effect has been strengthened by the fact that the leverage ratio has increased.

According to our calculations the nominal rate of return on total assets and equity will be 7.5 per cent and 9.7 per cent, respectively, in the industry-expansive alternative. This means a decrease of about 2 percentage points.

[1] The approach draws directly on models developed at the Institute. See Eriksson, G., *Företagens tillväxt och finansiering*. (IUI), Stockholm 1975; soon forthcoming in English under the title: *Growth and Financing of the Firm*.

Table 3. *Rates of return on total and on equity capital for the industry 1970–1980.*
Percentage points

	Average per year		Public-expansive alterna-tive	Industry-expansive alterna-tive
	1970–1973	1974	1980	
1. Nominal rate of return on total capital before profit tax	6.0	8.9	7.3	7.5
2. Interest rate[a]	4.9	5.5	5.5	5.5
3. Leverage ratio[a]	90.0	101.0	98	111
4. Nominal rate of return on equity capital before profit tax	6.9	12.3	9.1	9.7

[a] Calculated debt is equal to the borrowing from other sectors of the Swedish economy. As in the calculations for these sectors, we do not include accumulated tax obligations in the debt figure. Historically, the interest rate has been rising. We assume that the interest rate on long term debt will remain at the present high level. Together with an assumption that the firms will increase their debenture emissions, this makes us assume that the borrowing rate is going to be 5.5 per cent during the period 1974–1980.

from 1974 which was a year characterized by high business activity. The decrease in these rates will be little greater in the public-expansive alternative.

In summary, both alternatives imply lower rates of return in 1980 than in 1974, and the reductions in these variables are greater in the industry-expansive than in the public-expansive alternative. Our judgement is that the rate of return on total assets probably must be one percentage point above the calculated figure for investments required by the industry-expansive alternative to be realized. Such a rate of return would also imply an unchanged degree of self-financing and a lower leverage ratio than in 1974. On the other hand it is quite possible that firms will accept a higher leverage ratio provided the rate of return is improved.

Göran Eriksson.

The chemical industry

The purpose of this study is to evaluate future development possibilities for the Swedish chemical industry. An important part of such a study is to find out which factors have determined the growth rate of the industry in our country during the last one or two decades. A major component of the evaluation, however, will be an analysis of how the future growth pattern will be affected by the major changes which have taken place in the last few years.

One such important change is the large increase in energy prices. These hit the chemical industry in two ways: on the one hand because organic chemical production is based on petroleum, and on the other because the industry is one of those having the most energy intensive production processes. Consequently, the prices of organic chemicals and plastics rise relative to other prices, and this reduces their consumption growth rate. In the short run, however, this effect has not been so strong as was feared within the industry after the first drastic oil price increases.

For Swedish chemical industry, the situation has been changed also by the exploitation of North Sea oil and by an increased engagement in heavy chemical industry by the Swedish State. These changes may lead to political decisions on a coordination of Norwegian and Swedish investments in oil refineries and petrochemical industry.

The demand for printed products

On request from the Royal committee on the printing industry the Institute started a study on the demand for printed products. The primary task for the committee was to analyse the labour consequences of the expected rapid technical transformation of the industry. The committee was also asked to predict the demand for manpower.

The employment of the industry is indirectly determined by the demand for its products and by labour productivity. The institute has analysed the demand for printed products. Some results were published in 1974 in the committee report, others in 1976 in the medium term forecast of the Institute. According to this forecast, value added in the printing industry will increase by 2.7–2.9 per cent per annum between 1974 and 1980. Due to expected structural changes in the output delivery structure of the industry to other sectors, this corresponds to a somewhat lower increment of gross production, 2.5–2.7 per cent per annum. This forecast is substantially above the forecast made in the medium term projection of the Treasury. Most of the difference can be explained by the Institute's prediction that the input-output coefficients in deliveries from the printing industry to other sectors will be virtually the same in 1980 as in 1974, while the Treasury predicts that the coefficients for the printing industry's deliveries per unit of output of other sectors will be substantially reduced.

The full report of the results of the theoretical and empirical analysis will be published by the Institute.

Bertil Lindström.

Energy, Technology and Industrial Structure

For several years the Institute has been involved in research concerning technological change, industrial structure and energy questions. For various reasons, these problem areas have come to be closely related and they differ more in emphasis than in basic approach. During the last few years, the emphasis has been on energy questions, particularly analyses of energy consumption in industry and of the development in the energy conversion sector, i.e. the sector converting primary energy (crude oil, hydro power) into secondary energy (fuel oil, electricity, etc.).

Under the heading of technology and industrial structure we have gathered a number of studies of both empirical and theoretical nature, covering both whole industries and more narrowly defined processes. One project is concerned with structural change and technical progress in a few relatively homogeneous Swedish manufacturing industries. Another project is more theoretically oriented and deals with the problems of specifying and estimating technological change in various functional forms of the production function. A third project will try to analyse the technological position of some large Swedish firms, primarily in the engineering industry.

Bo Carlsson will be coordinating research in this area.

Energy studies

A. Analyses of energy consumption in Swedish industry

The greater part of the Institute's activities in this area in the last couple of years has been connected to the long term comprehensive projection. In a supplement to the report we have published detailed analyses of energy consumption in the iron and steel industry, the iron ore mines, and the cement industry.

The energy consumption in these industries is to a large extent determined by the choices of production processes which will be made in response to, among other things, the development of relative factor prices and the rate at which new technologies are introduced and old plants phased out. The following example from the steel industry can serve as an illustration.

In 1974, 6.0 million tons of raw steel were produced in Sweden, out of which 2.3 million tons in basic oxygen converters (especially LD-converters), 1.2 million tons in open hearth furnaces, and 2.5 million tons in electric steel furnaces. In order to make a projection of future energy consumption in this part of the steel industry, it is necessary to predict not only how much total production will grow but also how it will be distributed on types of steel furnaces. This, in turn, depends on the differences in cost structure, future relative factor price changes, and the elasticity of substitution.

The cost structure varies considerably among these types of furnaces because both fixed (capital) and variable costs differ; the ratio between scrap and raw iron inputs differs, and so does energy consumption and its distribution between energy sources.

As regards capital costs we have not obtained a complete picture, but the available data indicate that the capital cost per ton does not differ substantially between electric furnaces and oxygen converters, while that of open hearth furnaces is considerably higher.

Due to an agreement among the steel firms, the price of scrap in the Swedish market is tied to that of raw iron. But in the future it is not unlikely that the expansion of scrap-based so-called mini steelworks around the world will cause an increase in the price of scrap in relation to that of raw iron which will necessitate a similar change in the Swedish domestic market as well. This would disfavour the electric furnaces which use nearly 100 per cent scrap as raw material input and favour oxygen converters using mainly raw iron as input. Open hearth furnaces would be neither favoured nor disfavoured since, in principle, they can use scrap and raw iron in practically any ratio.

Another cost item which varies considerably among steel furnace types is costs of maintenance and repair. These are substantially higher for open hearth and electric furnaces than for LD furnaces. The same is true for costs of environmental pollution abatement.

Finally, there are important differences among steel furnaces also in regard to energy costs. Cf. table 4, where the energy costs per ton of raw steel are shown for various furnace types under the indicated assumptions about average input coefficients and prices. Thus in 1974 prices the energy cost per ton of raw steel was about Skr 12 (about U.S. $2.70) in LD converters, Skr 47 ($10.45) in open hearth furnaces, and Skr 38 ($8.45) in electric steel furnaces. The differences are due to both different levels of energy consumption and a different energy mix. With the same input coefficients but

with higher energy prices the differences in energy costs would be even greater, as is apparent from the figures for 1980 in the table.

In view of these considerations, assuming that the costs of scrap, electricity and labour will rise substantially in the next few years, it appears that open hearth furnaces will be phased out very rapidly, that electric steel furnace production will probably grow very slowly, if at all, and that replacement of these furnaces, as well as any expansion of production, is likely to take place through LD converters. The capital cost differences among the furnace types as well as the increasing requirements on measures to abate environmental pollution and to improve working conditions lead to the same conclusion, namely a relative expansion of LD steel production and therefore a substantial reduction in the energy consumption per ton of raw steel.

Bo Carlsson.

B. Energy prices and substitution

Analyses of this type can, of course, be extended in both depth and scope in many ways. For example, one way would be to investigate the sensitivity of the choice of production technology to variations in energy and other factor prices (i. e. the elasticity of substitution in the *ex ante* production function) and therefore what the long-run price elasticity of demand for energy is in various processes and industries.

This is in fact the thrust of a study currently going on at the Institute, commissioned by the Swedish Energy Commission. One part of the study analyses the long-term development of the prices of various kinds of energy relative to each other and to other goods and services in Sweden, the United Kingdom, the United States, and West Germany. Another part of the study investigates to what extent the structure and development of energy consumption in industry in these four countries can be attributed to relative price differences.

The third part of the study deals with the substitution between factors of production over time through the choice of technology. This analysis is based on detailed micro data for the production of milk, flour, particle boards, fibre boards, and cement in Sweden. The fourth part of the study attempts to analyse the choice of technology under different relative price conditions by studying investment decisions made in the cement industry in Sweden and the United States in the last ten years. The main purpose is to gain

Table 4. *Energy cost per ton of raw steel in different types of steel furnaces 1974 and 1980*

	1974			1980		
	LD furnaces	Open hearth furnaces	Electric steel furnaces	LD furnaces	Open hearth furnaces	Electric steel furnaces
Coke input, kg/ton of raw steel	20	–	20	20	–	20
Price of coke, Skr/ton	309	–	309	440	–	440
Cost of coke per ton of raw steel, Skr/ton	6.20	–	6.20	8.80	– *	8.80
Oil input, kg/ton of raw steel	5	130	10	5	130	10
Price of oil, Skr/ton	350	350	350	500	500	500
Cost of oil per ton of raw steel, Skr/ton	1.75	45.50	3.50	2.50	65.00	5.00
Input of electricity, kWh/ton of raw steel	75	30	570	75	30	570
Price of electricity, öre/kWh	5	5	5	9	9	9
Cost of electricity per ton of raw steel, Skr/ton	3.75	1.50	28.50	6.75	2.70	51.30
Total energy cost, Skr/ton of raw steel	11.70	47.00	38.20	18.05	67.70	65.10
Cost difference in comparison with LD furnaces	–	35.30	26.50	–	49.65	47.05

Sources: Specific energy consumption: Jernkontoret (Swedish Ironmasters' Association).
The price assumptions are based on available statistics for 1974 and on the assumption that oil and coke prices will increase at the rate of 6 per cent per year to 1980, while electricity prices will nearly double.

further insight into the *ex ante* substitution possibilities and therefore the long-run price elasticity of demand for energy in the industry.

Bo Carlsson and Lennart Hjalmarsson.

C. Technological change in the energy conversion sector

During the last few years the Institute has participated in an international study of innovation processes, mainly in the energy conversion sector, i.e. the sector converting primary energy such as hydro power and crude oil to secondary forms of energy (electricity, fuel oil, etc.). The work has been carried out jointly with the IFO Institut für Wirtschaftsforschung, Munich,

Table 5. *Rates of growth of production and productivity in the electric power producing sector 1960–1973*
Per cent per annum[a]

Period	Production	Capital productivity[b]	Labour productivity	Energy productivity[c]
1960–1965	8.7	3.1	1.9	3.1
1965–1970	7.8	4.0	9.2	−5.2
1970–1973	6.7	1.8	7.9	1.5
1960–1973	7.7	3.2	6.9	−0.7

[a] Based on trend fitted on annual observations.
[b] Including district heating.
[c] Including potential energy in hydro reservoirs calculated at 860 kcal/kWh.

which has been in charge of the project, the National Institute of Economic and Social Research, London, and the Soziologisches Seminar of Hamburg University. The project has been financed by the Volkswagen Foundation.

The international part of this project is now completed. The results will be published by the IFO Institut during 1977. Our Institute's work in this project is directed towards analysing technological change and its importance for the growth of productivity in the energy conversion sector in Sweden during the last few decades. In this connection we also intend to study the impact of certain individual innovations in this regard.

It is evident from table 5 that the rates of growth of capital and labour productivity in the electric power producing sector have declined somewhat in the first part of the 1970's in comparison with the latter half of the 1960's. For the period 1960–1973 the rate of growth of labour productivity has been more than twice that of capital productivity. During the same period there was actually a decline in energy productivity, due primarily to the fact that the share of thermal power increased at the expense of hydro power. The increase in the share of thermal power, in turn, depends mainly on two things. One is that new sites for hydro power production have become more and more inaccessible. The other is that declining oil prices combined with relatively low investment costs in oil fired power stations during the period provided incentives for constructing thermal rather than hydro power plants.

Technological change has made it possible to use bigger and bigger units in electric power production. Potential scale economies have been utilized, particularly with respect to capital productivity but also with respect to energy productivity in hydro power plants. This may be one of the reasons why

Swedish hydro power production nearly doubled between 1960 and 1973.

An important part of the study of technological change in the energy conversion sector is to study the factors which have influenced the increase in optimal plant size.

Anders Grufman.

Technology and industrial structure

## A. Industrial structure, technical progress and efficiency

In this project structural change and technical progress of a few Swedish industries are studied.

The first study investigates technical progress in dairy milk processing during a period of 10 years. Estimation of technical progress is based on both best-practice (frontier) production functions and average production functions. The results give little support for a hypothesis of neutral technical progress but rather a pattern of change exhibiting labour saving technical change increasing marginal productivity of capital relative to labour. The comparison between best-practice and average-practice estimates reveals an increased difference between best-practice and average-practice techniques. Numerical measures of the distance between best practice and average practice are computed.

The characteristics of technical advance can be illustrated by the development of the efficiency frontier. The efficiency frontier is the locus of all points where the elasticity of scale equals one, i.e. it is a technical relationship between inputs per unit of output for production units of optimal scale. Thus the efficiency frontier represents the optimal scale of the production function. In the input coefficient space the frontier production function defines the feasible set of production possibilities while the efficiency frontier is the limit towards the origin of this set. The development of the efficiency frontier through time is shown in figure 3.

The labour-saving bias of technical advance is reflected in the range northwest of P. In this range the frontier successively moves inwards towards the vertical axis and the origin, reflecting the way in which new technical knowledge opens up successive ranges of alternative techniques which make possible new levels of labour productivity. 18 of 28 units have also passed

Figure 3. *Unit input requirements of capital and labour in the dairy industry 1964–1973.*

Skr per ton milk
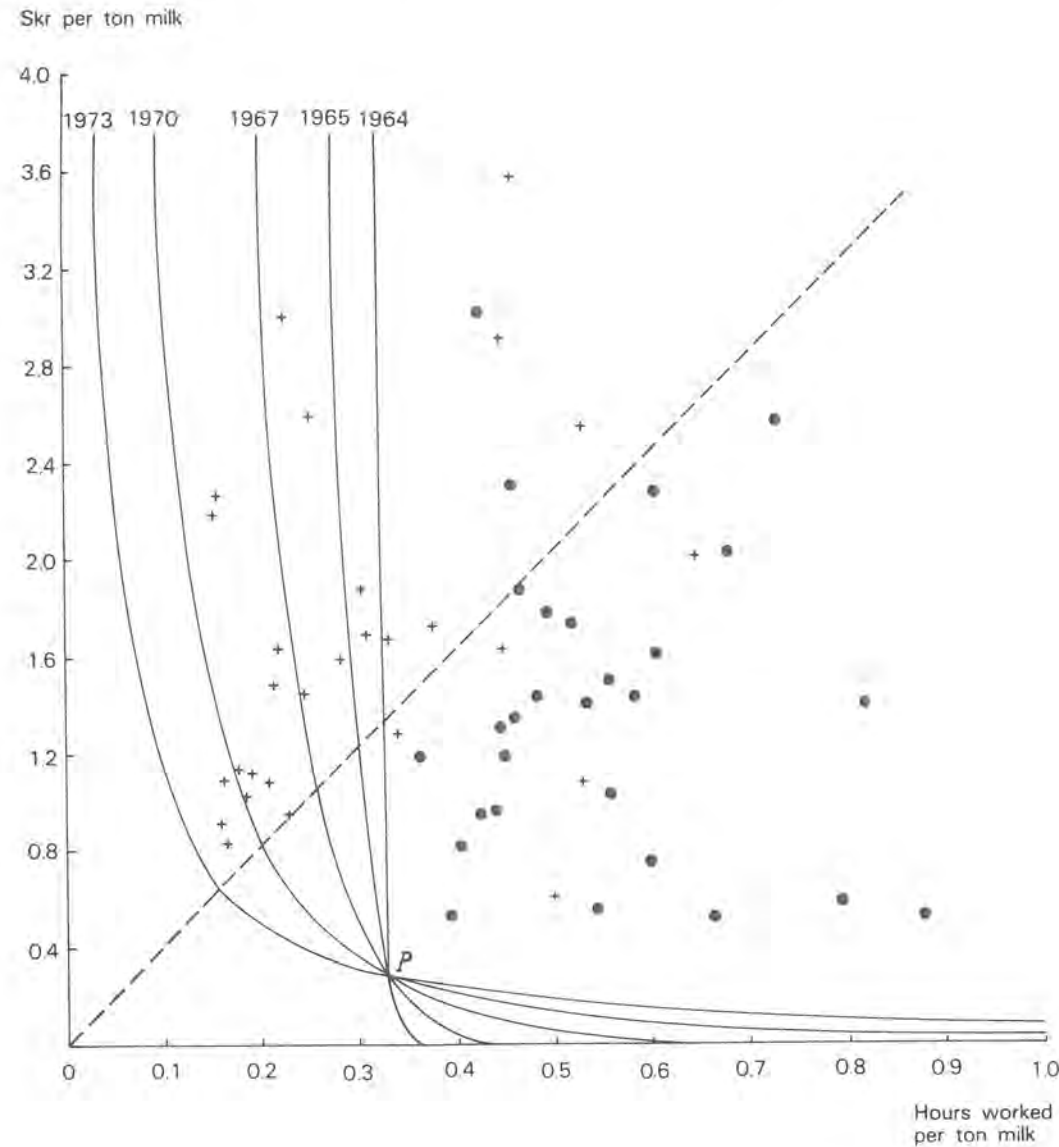
Note: The curves delimitate the feasable techniques for each year. Dots mark the input requirements for 1964 plants and crosses for 1973 plants.

the 1964 efficiency frontier. Changes of milk collection from cans to tanks and self-cleaning separators together with one-storey buildings are elements of this process of technical advance, and examples of labour-saving innovations.

In another study different estimates of technical efficiency, scale efficiency and structural efficiency are performed for a set of Swedish dairy plants during a period of 10 years.

A third study contains a production function analysis of the Swedish particle board industry in 1973. Particular attention is paid to the short run macro production function, which is calculated for different pairs of inputs.

Lennart Hjalmarsson and Finn Førsund.

B. The functional representation of production structures

Studies in basic theory of cost and production explore problems like: Under what conditions does duality between the cost and production side exist? What is the impact of different monotonicity and separability properties on the input-output structure? Explicit functional forms are merely used to elucidate the results and not as basic analytical tools. In empirical studies, though, it is often necessary to be more explicit and to introduce parametric functional forms. The problem then arises of choosing a functional representation which is sufficiently general so that no unwanted properties are imposed on the system to be studied, yet the system is still possible to estimate. Those two demands are often in conflict because the simpler the form, the more restrictions are generally imposed. Therefore, it is important to collect all available information about the technology beforehand. This can be done in basically two ways, namely by taking account of all *a priori* information that is available from other studies and general belief among experts, etc., and by a thorough assessment of the data before a parametric representation of the technology is introduced.

Both sources of information should of course be used, but often only the first one is brought into the picture, probably because very little work has been done to formalize a data analysis meaningful in the framework of production function theory. Methods for testing specific properties of the underlying technology such as monotonicity, convexity and homotheticity have been put forward, though. The aim of this study is to assess these methods

in an empirical work on production function theory. Also the object is to find similar methods of analysis to test different separability properties of the system, an important concept when it comes to decomposing multivariable problems.

Studies of this kind hopefully make possible the development of more precise analytical tools to work with when modelling technologies.

Leif Jansson.

C. The technological position of leading Swedish exporting firms

It is obvious that many industrial countries are currently experiencing difficulties in many of their traditional export trades, such as steel, shipbuilding, and textiles. Many of these problems are connected in one way or another to the events in the energy markets in the last few years, while others have more long-run causes. A common response to the difficulties is to try to find "niches" in the market where one can be protected, at least for a time, from competition. This is characteristic particularly of the engineering industry.

Since the engineering industry is the largest in Sweden in terms of exports as well as output and employment, it is important, from the point of view of economic policy as well as that of the information requirements for the Institute's continued work on medium term economic forecasting, to assess its technological base in international comparison. We intend to do this. But rather than approaching the problem from the macro side as is usually done, we will focus on a few of the largest firms to find out what their main problems and strategies are, who their main competitors are and how their basic technologies differ from those of their competitors. The emphasis will be on the technological challenge faced by each firm and its present and probable future response. It is our hope that a study of this sort will deepen our knowledge obtained from previous studies about the international competitiveness of the Swedish engineering industry.

Bo Carlsson.

The Incidence and Economic Effects of Taxes and Transfers

Over the last three decades some very important changes have occurred in the structure of the Swedish tax system. At the same time the general tax level has risen significantly. Among these structural changes we may note

i) an increase in the importance of indirect taxes such as payroll and sales taxes, relative to the personal income tax

ii) a considerable increase in income tax progression, especially during the last ten years

iii) some innovations in the system of corporate income taxation, such as the investment funds, along with a relative decrease in revenues from this source.

During the last ten-year period there has been an acceleration in the frequency of discretionary tax changes. The measures have included most components of the tax arsenal. As a consequence interest in the economic consequences of taxation has increased substantially during this period. At the IUI this is reflected in four research projects in this field with five economists involved at present. The main emphasis of research has been on an empirical analysis of the economic effects of recent tax developments in Sweden. Extensive studies on the development of personal and corporate income taxes have been produced by members of the staff.[1]

Although the research at the Institute has a clear bias towards applied research fundamental theoretical problems are necessary parts of an empirical inquiry. Such investigations, of course, very frequently force the economist to take a provisional stand on unsettled theoretical questions such as for example the incidence of different taxes. Hence several papers on theoretical

[1] *Inkomstbeskattningen i den ekonomiska politiken* (Personal Income Taxation and Economic Policy), by Ulf Jakobsson and Göran Normann, published by the IUI in 1974, and *Företagsbeskattning och resursfördelning* (Profit Taxes and Resource Allocation), by Jan Södersten (Uppsala 1975, mimeo), are mainly devoted to empirical investigations but also contain some material of a theoretical nature. Both volumes are written in Swedish with summaries in English.

In addition to these studies several empirically oriented articles primarily on the personal income tax have been published in Swedish in various domestic journals.

problems have been produced recently by the staff of the institute.[1]

Much of the IUI research in the tax area has been supported with grants from The Swedish Council for Social Science Research and the Public Committee for Business Taxation.

Personal income taxes and transfers

As mentioned above the system for personal income taxation for a historical period has been extensively studied at the Institute. The income tax simulation model developed and implemented at the IUI[2] originally covered the period 1951 to 1971. However, the model has currently been updated and used to analyse the effects of government policy measures during the 1970's.

An intrinsic property of the simulation model TAX is that public parameters as well as the distribution of income before tax appear explicitly. More specifically, the model consists of two parts, namely a micro part and an aggregative part. The micro part is constructed to compute the tax (national and local) for a random individual. This is the place where the formalized tax laws are introduced. An individual in the model is characterized by his income before tax and by the taxation category he belongs to (married men between 17 and 66 years old, unmarried old age pensioners, etc).

To get a macro-relation between income and taxes an aggregation procedure is introduced, which relies on knowledge of the income distribution in the different categories.

In this simulation model it is possible to distinguish and compare the effects on e.g. revenues and income distribution after tax of various specified changes in the parameter set. As the level and distribution of income before taxes appear explicitly, the built-in flexibility of the tax system can also be investigated.

Besides the current updating of the model, various extensions of it are under way. *First* the model will be expanded to include payroll taxes and central components of the transfer system such as old-age pensions, child- and housing allowances. This expansion is of obvious interest, since each of the revisions of the personal income tax in recent years has been combined

[1] Jakobsson, U., On the Measurement of the Degree of Progression. *Journal of Public Economics* 1976:1; Södersten, J., 1977, Approaches to the Theory of Capital Cost: An Extension. *Scandinavian Journal of Economics*, forthcoming; and Faxén, K.-O. and Normann, G., The Effects of Payroll Taxes – A Theoretical Analysis. In *Fiscal Policy and Labour Supply*. IFS Conference Series no. 4 1977. London.

[2] By U. Jakobsson and G. Normann, See p. 35 footnote no 1.

with substantial changes in the transfer system.

Second, the extended version of the model has been modified at the aggregate level to fit the medium term macro model of the Swedish economy, which has been developed at the IUI (p. 15).

From a teoretical point of view the exogenous income before tax assumption is a limitation. A *third* line of extension is to introduce a utility maximizing choice between labour and leisure by individuals. This version of the TAX model has been used to investigate the progressivity of the Swedish income tax within the framework of the theory of optimal income taxation.[1]

Göran Normann and Thomas Nordström.

Taxes on factors of production

Discriminatory taxes on specific factors of production such as labour, capital and energy have been at the centre of interest in Sweden in recent years, both as a source of income and a means of allocating resources. The payroll tax has a broad base and therefore is a means of collecting substantial public revenues without necessitating "too high" tax rates. The supply of labour is usually believed to be highly inelastic. Hence the assumption is that rates can be raised without undue consequences on the allocative process in the labour market or in the production sector. The inelastic labour supply also is an important reason why payroll taxes traditionally are assumed to be borne by labour in the long run. This working hypothesis on payroll tax incidence has also been supported by recent studies.

The current interest in energy taxes, on the other hand, is primarily due to the commonly felt need to restrict the use of energy. As the supply of energy in Sweden could be expected to be highly elastic, an increase in energy taxes would lead to substantial decreases in energy use provided that demand is not inelastic. Thus, the allocative effects of the measure would be important.

Institutional factors in the labour market seem to play a crucial rôle for the short run incidence of payroll taxes. If (as has been the case in Sweden in recent years) the increases in payroll taxes are directly linked to the centralized wage negotiations, it seems as if an immediate backward shift onto employees is the likely outcome. The addition to revenue from a rate increase, computed at a given base (the "direct" revenue effect) is then partially

[1] Jakobsson, U. & Normann, G., *Welfare Effects of Changes in Income Tax Progression in Sweden.* Working paper no. 3. (IUI) 1976.

counteracted by a fall in revenue because of the induced decline in the base. The latter "indirect" revenue effect comprises a decrease in income tax revenue as well as in payroll tax revenue.

An empirical investigation of the Swedish system of energy taxes clearly demonstrates that effective tax rates on energy for industrial use are very low compared to the nominal rates. Authorities seem to have been hesitant to introduce taxes that would affect the international competitiveness of Swedish industry adversely. Therefore the nominal tax structure has been supplemented by various kinds of deductions, exemptions and limitations. Regarding energy for use in final consumption (gasoline, household electricity, etc.) the effective rates are much closer to the rather high nominal rates. Since the possibilities for substitution probably are more limited in this sector, it seems reasonable to conclude that the existing structure of energy taxes is primarily aimed at serving a purely fiscal objective.

The theoretical analysis of the incidence of energy taxes ends up with the somewhat tentative conclusion that the burden is on labour in the long run. This result rests heavily on the argument that the price of energy and the required rate of return on capital are determined in international markets. The significance of being a small country for the incidence question in general is further stressed by the present work at the IUI on corporate income taxation (see below).

Göran Normann.

The corporation income tax

At the request of the Public Committee for Business Taxation, research is being done at the Institute on the effects of the corporation income tax on resource allocation and on income distribution.

A crucial question for long run income distribution effects has to do with stockholders' required rate of return before and after tax. In an open economy, much may be said for the assumption that the required rate of return depends strongly on alternative investment opportunities in world capital markets. It is, therefore, largely unrelated to changes in the taxation of corporate profits in Sweden. With this assumption, an increase in the tax rate would provide an incentive for firms to move part of their productive capacity abroad, in order to maintain stockholders' wealth. In equilibrium the after tax rate of return on the marginal domestic investment would equal the after tax rate of return abroad.

The paradoxical implication of this argument is that increases in the taxation of corporate profits in a *small and open* economy with perfect mobility of capital would affect the long run distribution of incomes in a regressive way. Owners of capital would be able to preserve their incomes by moving part of their assets abroad. *If* investments in productive capital within the firm are important for labour productivity growth, labour will suffer, since in the long run capital intensity will fall.

The empirical implications of these theoretical results, however, are somewhat complicated. The adjustment of the economy toward a long run equilibrium may require a considerable length of time. Capital mobility across borders may be regulated, as it is in the Swedish economy. For several decades, therefore, increases in the rate of tax on corporate profits quite well may exhibit a progressive impact on income distribution.

In Sweden and abroad, various methods are used to ease the double taxation of dividends. A special study has been made of the effects of these methods on the costs before taxes for capital obtained by stock issues. The comparison in table 6 exhibits the French and English systems, where tax deduction is assigned directly on the shareholder when the personal income tax is determined, the German so-called split-rate system with a differentiated company tax rate benefiting dividends, and the Swedish so-called Anell-system. The latter means that dividends (up to a maximum limit) on new equity

Table 6. *Return requirements before tax in different countries for capital obtained by stock issues.*

Per cent

Country	Corporate tax rate for dividends	Tax deduction	Return requirement
Sweden (1)	55	–	22.2
Sweden (2)	55	–	15.3
Sweden (3)	55	–	12.6
France	50	50	13.4
England	52	53.5	13.5
West Germany	25	–	13.3

Note: (1) Excl. Anell deduction
(2) Incl. present 5 per cent Anell deduction during 10 years
(3) Incl. 7 per cent Anell deduction.

are deductable for corporate taxation (during a limited period). The table is based on the assumption that shareholders demand a 3 per cent net return on their capital after taxes and that the marginal personal income tax rate is 70 per cent.

As can be seen from the table, the systems used in France, England and West-Germany give approximately the same company costs for new equity. The Swedish rules, combined with present tax rates, give slightly higher return requirements. The table also shows that an increase in the Anell deduction from 5 to 7 per cent would reduce Swedish capital costs for new equity to a level comparable to that in the other countries.

Other special studies have been made regarding the effects of the Swedish corporation income tax on firm profitability and on capital cost. The tax appears to have had a selective influence on growth opportunities of different firms. Rapidly growing firms, making large enough profits to use the extensive possibilities of tax deferral – through accelerated depreciation, allocations to investment funds and inventory reserves – enjoy a particularly low effective corporate tax burden on their "true" profits. Stagnating, low profit firms, however, perhaps reporting book profits only to maintain stable dividends, often have to stand an extremely high effective tax burden as a result of Swedish tax laws.

At the theoretical level, the effects of accelerated depreciation and the investment funds system on the cost of capital to a firm maximizing stockholder's wealth have been studied in some detail. The analysis of capital cost is also extended to cover taxes paid directly by the shareholders – the personal income tax on dividends and the capital gains tax. This approach makes it possible, as well, to study the effects of different measures to reduce the so-called double taxation of dividends, currently in use in many countries.

Jan Södersten.

The capital gains tax

This study is concerned with the behavioral effects on various firms of the capital gains tax on the sales of stock certificates. For one thing these effects cannot be studied independently of other taxes on business profits. There is every reason to expect that corporate income taxes and, later, income taxes on dividends together with wealth taxes on the income earner also affect the reaction on the part of the firm to the capital gains tax.

A simplified model has been developed in which the investment and financing requirements of growing firms can be studied. Obviously the rate of return and the discount factor of owners together with the general inflation rate play a crucial rôle for the results. Secondly the rate of return, the growth rate chosen and the risk level also differentiate the analytical results.

One should note that the capital gain on shares is left untaxed until the actual sale. A person investing in shares that increase in value thus – in a sense – reaps the benefit of an interest free tax credit. Hence the effective tax rate is always lower than the nominal one as long as capital gains are positive. The longer the time between purchase and sale, the larger this difference. This means that an increase in the capital gains tax rate should create a "locking in" effect in the stock market.

Göran Eriksson.

Profitablity, Financing and Capital Market Analyses

Industrial development and the long-term supply of capital

The Government Capital Market Committee has commissioned a study at the IUI on the relationships between financing and growth of manufacturing industries.

One part of the investigation is devoted to a translation of growth forecasts for the manufacturing industry, traditionally made in physical terms (production volume, etc.), into financial forecasts. The results combined with assumptions about the behaviour of firms can be used to evaluate the realism of the underlying real forecasts.

The second part of the study analyses the financial development of the 40 biggest Swedish industrial firms or groups. One task is to see how total working capital has been allocated in firms with different profitability and solvency.

Structural changes in the capital markets since the middle of the 1960's are exhibited and analysed in a third part of the study. Table 7 shows the development of industrial borrowing in the organized Swedish capital market. Total liabilities to this market increased by 200 per cent between 1966 and 1975. Commercial bank loans, including reborrowing from the general pension funds, increased from a little more than 5 billion Skr 1966 to about 13 billion Skr 1975. It is obvious that the commercial banks are the most important lenders to the industry in this market, but also that their relative importance has decreased significantly. If we exclude reborrowing, the decrease is even more obvious. In 1966 the share (including the reborrowing) of the Swedish organized capital market was 47 per cent, and in 1974 and 1975 it had decreased to about 36 per cent. We also note that reborrowing has increased rapidly even though its relative importance has decreased. These liabilities have doubled between 1966 and 1975, but their share of the market has decreased from 17 to 10 per cent.

An interesting feature is the expansion of various types of loans from governmental or semi–governmental credit institutes. Among those are the governmental localization loans and credits from the Investment Bank, In-

Table 7. *Industrial debts from the Swedish capital market 1966, 1974 and 1975*
Stock of current debts at the end of each year

	1966 md Skr	%	1974 md Skr	%	1975 md Skr	%
Commercial banks excl. reborrowing	5.0	42	8.5	27	9.8	27
Reborrowing from pension funds	0.6	5	2.9	9	3.3[a]	9
Insurance companies	2.0	17	3.3	10	3.9	10
Special institutes	1.0	8	7.3	23	9.1	25
of which						
Localization loans	0.1		1.5		1.9	
Investment bank	0.0		1.7		2.2	
Industrikredit and Företagskredit	0.4		2.2		2.6	
Exportkredit	0.3		1.6		2.0	
Statens Industri-lånefond, etc.	0.2		0.3		0.4	
Other institutes	0.1	1	1.2	4	0.9	2
Bonds and debentures	3.3	27	8.5	27	9.9	27
Total debts	12.0	100	31.7	100	36.9	100

[a] Computed under the assumption that the industry share of total reborrowing is the same as in 1974, e.g. 68 per cent.

dustrikredit, Företagskredit, Exportkredit and from the Norrlandsfonden (a special fund for the northern part of Sweden). The share of such special loans has increased from 8 per cent of total industrial debts in the organized Swedish capital market in 1966 to no less than 25 per cent in 1975.

Bo Lindörn, Lars Wohlin, Thomas Lindberg.

Inflation and capital growth

The purpose of this research project, financed by a research grant to the Institute from the Swedish Central Bank Tercentenary Fund, is to study the theoretical and empirical consequences of inflation on the value and growth prospects of the firm.

The study will be concentrated to three aspects of particular importance.

The common view that the rate of inflation is not correctly foreseen and therefore not anticipated in loan agreements will be investigated. A second and closely related problem has to do with the effects of inflation on external financing patterns. As a third aspect, the workings of the corporate tax system in an inflationary process will be studied.

The three questions stated here will be dealt with in theoretical models of the value of the firm. Another important part of this project is to analyse the effects of inflation on the cost of capital. The aim is to find more realistic formulations of the concept of capital cost in order to improve our empirical knowledge of firm investment behaviour.

Jan Södersten.

Inflation, profitability and growth

The empirical part of this project is built around a micro-based simulation model. The industry sector constitutes its micro core and individual firms are represented by a number of numerically specified planning models.

These planning models (firms) interact in markets for labour and products and with other sectors, including exports and imports. Model work is arranged as a joint project between the IUI, the University of Uppsala and IBM Sweden.

The total model system is constructed so as to make comparisons possible at the macro, national accounts level. A first aim of the work is to develop a method to make better use of, organize and evaluate individual firm data in macro-economic analysis. A second purpose is to study the transmission of inflationary impulses through the economy at the micro level. A third goal is to quantify more adequately the relationships between profitability, investments and growth under different inflationary conditions. In fact the model has been designed particularly with the last two questions in mind, and they both obviously require a firm-based micro model to give meaningful answers at the macro-economic policy level. There is also a fourth objective, namely to evaluate the current technical possibilities of micro-macro modelling.

Figure 4 shows the interior of one firm and its contact points with the outside world, the markets for labour and products in particular.[1] Figure 4

[1] The specification of the firm micro model is based directly on experience from business planning methods in 60 U.S. and European firms during a 6 year period, as reported in Eliasson, G. *Business Economic Planning – Theory, Practice and Comparison*, Wiley 1976.

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Figure 4. *Business decision system (one firm)*
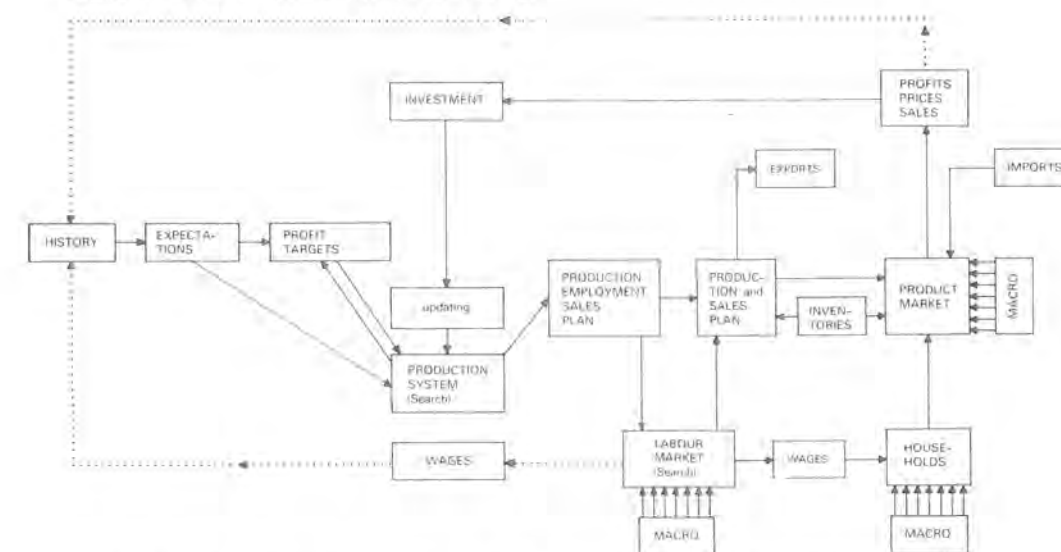
also shows how historic experience (left corner) generates expectations and profit targets that in turn guide both production and investment planning. In the right part of the figure it is finally shown how wages, determined endogenously in the labour market, generate demand via the household sector. In the adjustments between firm supplies and household demand, prices and profits are finally determined, and the information flows back into a new quarterly planning round.[1]
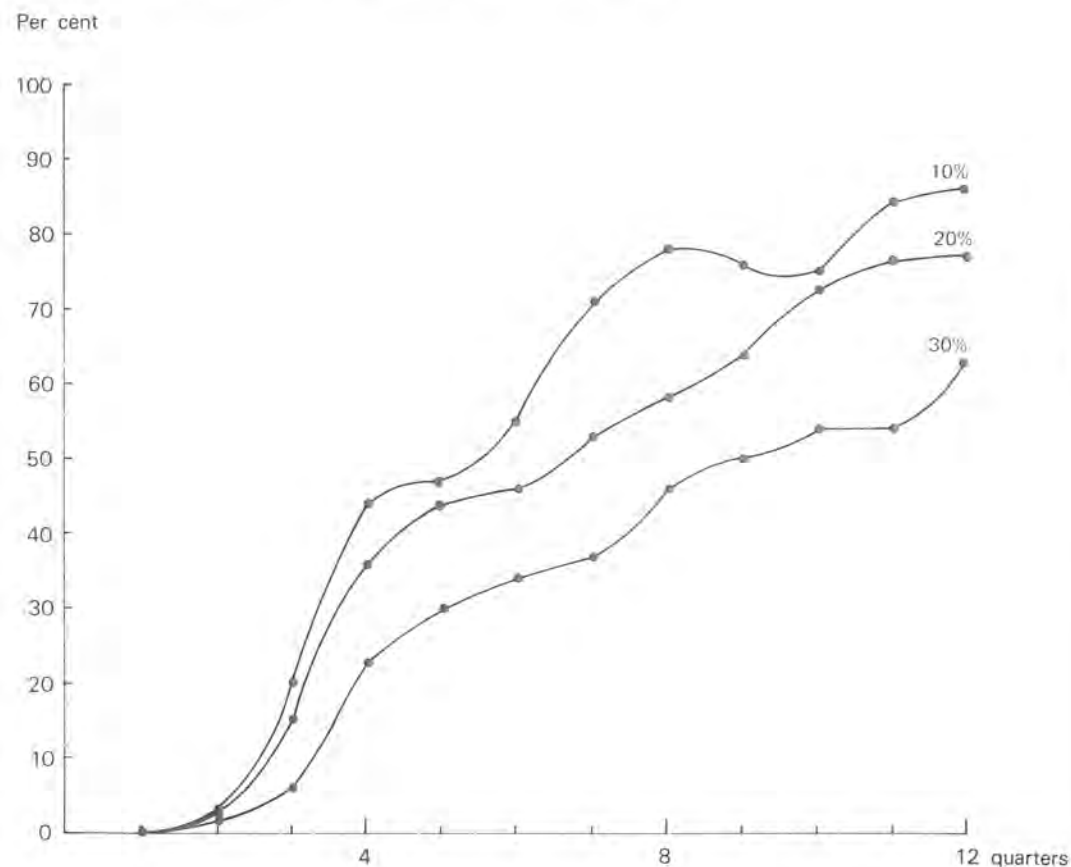
The model is already capable of generating cyclical time paths over several years, although the extensive empirical calibration work needed before empirical conclusions can be drawn is not yet completed. During the simulation, quarterly growth as well as relative prices and wages are endogenously determined. The behaviour of a group of firms can be numerically analysed under different assumptions as to the economic environment like foreign inflation, uncertainty, growth in other firms and sectors of the economy, etc. Much attention will be paid to modelling how erroneous expectations affect profits and growth of individual firms.[2]

[1] A full presentation of the model as implemented by late 1976 is available in Eliasson, G, *A Micro Macro Interactive Simulation Model of the Swedish Economy*. Working paper no 6. (IUI) 1976.

[2] A labour market simulation with the model was reported on in Eliasson, G., Competition and Market Processes in a Simulation Model of the Swedish Economy, *American Economic Review*, Vol. 67, No. 1, 1977.

The effects of exchange rate changes in different phases of the business cycle are studied in Eliasson, G., Exchange Rate Experiments on a Micro Based Simulation Model, *Industrikonjunkturen*, Spring 1977.

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Per cent

Note: Three alternatives have been simulated; 10, 20 and 30 per cent step increases in the foreign price, respectively. The curve plots the ratio between the resulting cumulated CPI change and the initial foreign price change, expressed in per cent. Also note that even though it takes longer for a large price hike than for a small one to work itself through the economy, the CPI change is already 10 per cent in the 6th quarter as a response to a 30 per cent foreign price change. In the 20 per cent case it takes 8 quarters and in the 10 per cent case more than 12 quarters.

A simplified version is already completed and is currently being calibrated against available statistical information. Figure 5 illustrates one simulation experiment, namely the transmission of a sudden change in Swedish export prices through production and export decisions via wage formation and purchasing decisions in the household sector to appear eventually in the consumer price index (CPI) (if not countered by economic policies). The model is still at an experimental stage and the figure should be viewed primarily as an illustration of what the model can do. It turns out that inflationary expectations in the business and household sectors can amplify the domestic inflationary effect. To begin with, prices are transmitted at about the same rate as has been measured in other studies. If we allow the simulation to continue CPI will normally increase beyond the initial world market price hike that started the development, before a contractive process begins. The realism of this transitional over-shooting effect cannot be assessed today. There is no empirical evidence to consult and the answer lies in continued estimation work on the model. One can also see in figure 5 that the higher the initial foreign price hike the longer it takes for the full effect to be transmitted through the economy.

It should be mentioned, finally, that a growth development can easily be aborted if firms have based their plans on unrealistically high, expected future inflation rates. Strong inflationary impulses like those in 1973/74, that have a brief positive impact on business profits and willingness to invest, in fact seem to have a clearly detrimental effect on growth as well as on profits in the long run, *ceteris paribus*. This phenomenon belongs to the class of problems that are central to the whole modelling venture.

Gunnar Eliasson.

Private Consumption Studies

The demand for consumption goods

There is a long tradition of demand analysis at the Institute, including studies of particular commodities and markets as well as contributions to the analysis of total private consumption. Data from the first major study by Bentzel in 1957 have since been updated and extended several times. The last revision was completed in 1976.[1] The results from these studies figured importantly in the recent medium-term projection of the Institute (p. 20).

Although Bentzel's study covered all commodities, his method was to study one commodity at a time. Dahlman & Klevmarken later extended the method to a complete systems approach, a linear expenditure system with habit formation. The complete systems approach has lately received a great interest and much work has been done internationally to find useful models. There are; however; as yet many unsolved problems, e.g. an adequate treatment of durables, identification and estimation of true demand relations in particular when there are supply rigidities, the distinction between private and public consumption, effects owing to the level of aggregation and the (small) sample properties of the estimates of income- and price-elasticity, etc. To approach some of these problems a research project was initiated, partly with grants from the Swedish Council for Social Science Research. This project has, so far, resulted in a survey of development tendencies and problems in the complete systems approach, a study of the small sample properties of estimators and test statistics applied to a Rotterdam system of demand functions and an unpublished comparative study of the fit and predictive ability of 10 complete systems.[2] This last study shows that estimated income and price elasticities will vary considerably between models and estimation methods. Certain differences in forecasting ability can also be ob-

served between different approaches. Finally, an attempt is also made to include the rigidities in the supply of housing sources due to rent control into the complete systems approach.

Anders Klevmarken.

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[1] Analyses and forecasts based on successive revisions have been published in Albinsson, G. and Endredi, G., *Den privata konsumtionen 1950–70* (Private Consumption 1950–70 in Sweden). (IUI) Stockholm 1966; Dahlman, C.J. and Klevmarken, A., *Den privata konsumtionen 1931–1975* (Private Consumption in Sweden 1931–1975). (IUI) Stockholm 1971; and Klevmarken, A., *System av efterfrågefunktioner; några utvecklingstendenser* (Systems of Demand Functions; Some Development Tendencies). (IUI) Stockholm 1976.

[2] Klevmarken, A. *A Comparative Study of Complete Systems of Demand Functions.* Working paper no 11 (IUI) 1977. Klevmarken, A., On the Small Sample Properties of Aitken-Type Estimators and Test Statistics Applied to Seemingly Unrelated Regressions. *The 1975 Business and Economic Statistics. Proceedings of the American Statistical Association.* 1975.

International Trade and Investment

Sweden is a very open economy, highly dependent on foreign trade and with considerable foreign investment activities. Consequently, the determinants of the international division of labour and of changes in international specialization patterns are questions which attract particular interest in Sweden. They all define the degree of international economic integration and dependence of the national economy. Several studies at the Institute have been directly addressed to various aspects of these questions. Sweden's comparative advantage and the effects of trade liberalization on Swedish trade are the respective subjects of two recently concluded studies. The relationship between commodity trade and factor movements, a dimension which used to be disregarded in trade studies, is a subject dealt with in ongoing studies on inward and outward foreign direct investment.

Patterns of engineering trade specialization in Sweden

The international specialization of the Swedish engineering industry has increased substantially in the 1960's. The industry's export ratio increased while its share of domestic consumption decreased. Engineering trade became more important in both Swedish exports and imports and amounted to 45 and 35 per cent of total exports and imports, respectively, in 1970. The export surplus which developed in the 1960's was the result of an almost century long tendency for engineering exports to grow more rapidly than imports. The study of Sweden's engineering trade specialization in the 1960's,[1] by Lennart Ohlsson, traces out the patterns of specialization within the engineering industry. It uses the modern factor proportions theory of international trade to explain the net export ratio and home market shares respectively at both the subindustry and commodity group levels.

The results of the empirical analysis are that the factor proportions theory could not explain the industry's specialization pattern very well neither in 1960 nor 1970, but that it was rather successful in explaining changes in

[1] Ohlsson, L., *Svensk verkstadsindustris internationella specialisering*. (Patterns of Engineering Trade Specialization in Sweden 1960–1970–with an International Comparison). (IUI) Stockholm 1976.

specialization patterns between these years. These results are probably due to the fact that we have not been able to identify and measure Sweden's relative factor abundance compared to the rest of the world in these two years as well as we have been able to measure changes over time in Sweden's relative factor endowment.

A common assumption underlying the factor proportions theory is that factor intensities are irreversible. That is, factor intensity differences are assumed to be stable between products internationally as well as intertemporally. A partial test of the validity of that assumption was carried out by measuring the factor intensity stability over time for 33 Swedish engineering subindustries. The availability of statistical data allowed a study of technical personnel intensity and capital intensity for two time-periods, namely 1954–1968 and 1959–1968.
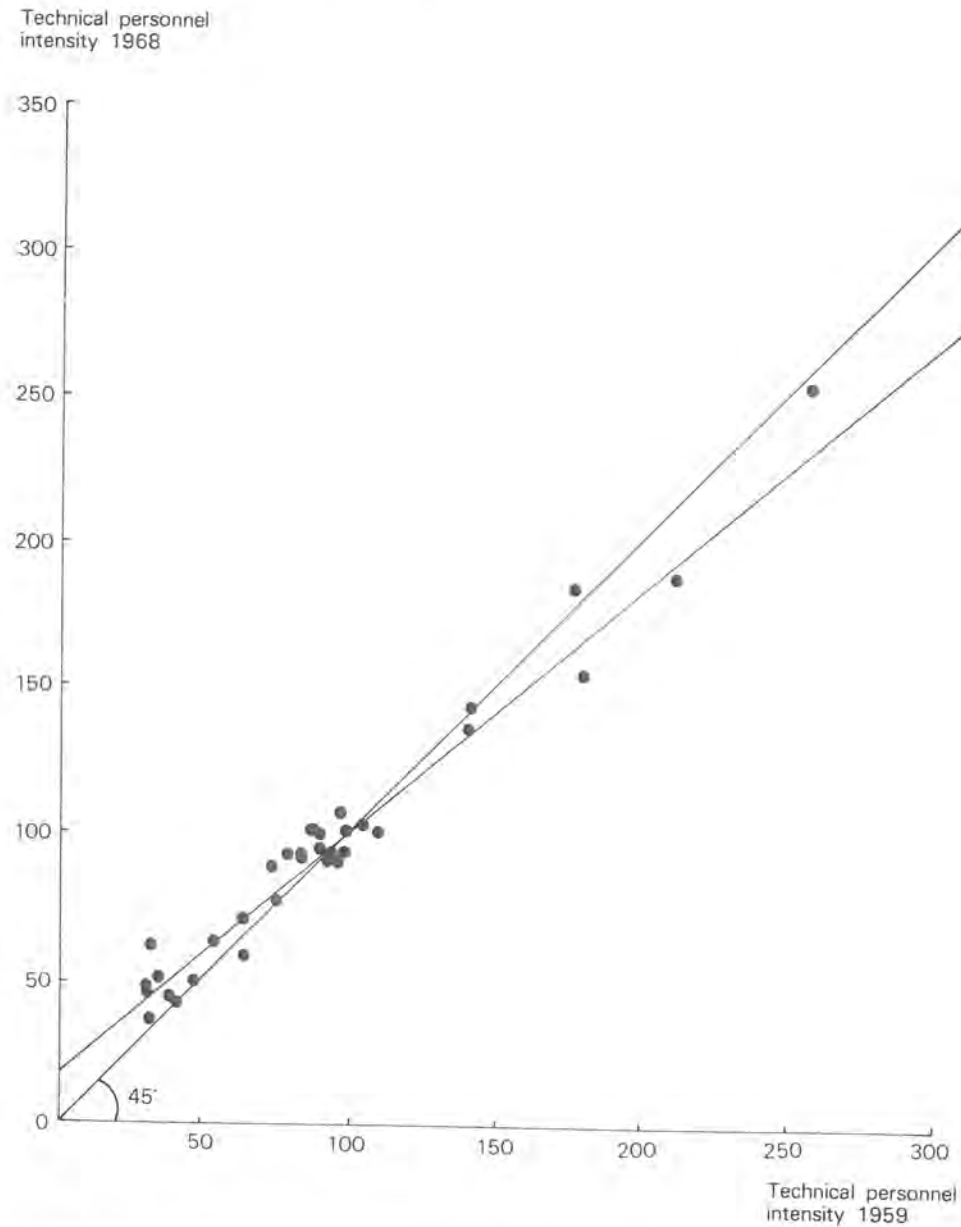
Both intensities increased substantially in both periods and for all subindustries. In order to eliminate a common trend, a relative factor intensity was calculated for each year by dividing the intensity of each industry with the corresponding intensity for the engineering industry as a whole.

Two important results of the comparison between the indices of initial and end factor intensities were obtained. First, the factor intensity rankings were in all six comparisons found to be very stable. Changes occurred only between industries which had similar initial values of their factor intensity indices. The regressions between the six pairs of end and initial intensities showed explanatory values ranging from 79 per cent to 98 per cent. Figure 6 presents one of the six relationships.

Secondly, statistical tests were performed to determine whether or not the *relative* differences in factor intensities were enhanced or diminished in the period. As is illustrated in figure 6 such tests can be formulated as tests on whether the estimated regression line is statistically distinguishable from a 45°-line through the origin. In five out of six cases it was impossible to distinguish the two from each other.

The sixth case is the one presented in figure 6. The relative differences in technical personnel intensities diminished somewhat in that industry between 1959 and 1968. In other words, technical change in that industry appears to have been intensive factor saving. There are several possible explanations for such a biased technological change. The interpretation proposed in the study is that the bias is endogenously determined by the observed change in Sweden's comparative advantage towards technical personnel intensive production.

Figure 6. *The relationship between indices of technical personnel intensities of engineering industries 1959 and 1968.* Index = 100

Technical personnel
intensity 1968

Technical personnel
intensity 1959

Regression function (standard error in parenthesis):

$y = 16.7 + 0.824 x$ $R^2 = 0.975$
    (0.024) $F(1;31) = 1\ 206\ 740$

Barriers to trade and trade policy

Changes in trade policy in the post-war period have led to a considerable reduction in tariffs and import quotas affecting Swedish exports and imports. These changes have been particularly important at the regional level, first through the formation of the EEC and EFTA and subsequently through the extension of the Common Market and the creation of a European free trade area for manufactured products. These changes and their implications for the Swedish economy are the subject of "*Handelshinder och handelspolitik*" (Barriers to Trade and Trade Policy – Studies of the Effects on the Swedish Economy) by Lars Lundberg (published in 1976).

The study deals not only with traditional instruments of trade policy, such as tariffs, but also with non-tariff barriers to trade. The latter group includes a broad spectrum of policies, ranging from subsidies of various kinds to discriminatory government purchases and different national standards regulating product characteristics. In the first part of the book the concept of trade barriers is discussed. There is also an analysis of the effects of trade barriers which are used for purposes of, e.g., stabilization or income redistribution, such as the use of import tariffs to increase the demand for domestic output or to protect factors of production in import competing industries.

The second part of the study describes the structure of tariffs and of non-tariff barriers to trade affecting Swedish exports and imports. These barriers and changes in them across industries and commodity groups are compared over time.

The question of whether industries with a relatively protected home market display similar production characteristics is examined. We find that the structure of barriers to Swedish imports can be explained by factors determining comparative costs in Sweden. Import barriers are concentrated on two types of products. Labour intensive and technologically simple standardized products receive a relatively high protection from tariffs and other "traditional" trade barriers, while technologically advanced products are protected through discriminatory government purchases and other non-tariff barriers. Changes in the structure of trade barriers seem to conform to long-term changes in Sweden's comparative advantage.

With respect to changes in the kind of trade barriers used one may note that the importance of tariffs is declining (see figure 7), while non-tariff barriers, foremost agreements putting limitations on exports and discriminatory government purchases, have assumed increased importance.

Per cent
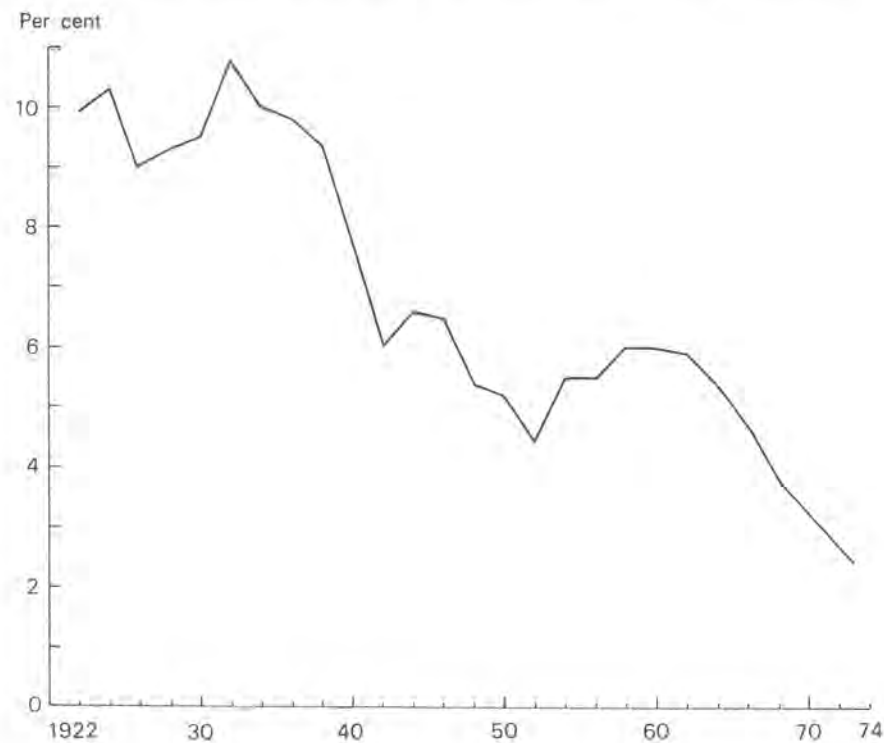
The third part of the book contains a study of the effects of changes in trade policy during the 1960's on the Swedish economy. Here, we analyse the effects both on the volume and direction of trade, and on the structure of output, and the effects on productivity. Our results indicate that the effects on trade and production structure due to the formation of the EEC and EFTA were considerable in Sweden. The effects in the home market appear to have been mainly of a trade creating kind, i.e., imports granted trade preferences have replaced domestic production. Furthermore, the increase in Swedish exports within EFTA appears to have more than compensated for their relative decrease within the EEC. These results are based on extensive comparisons of different methods of analysis. The study also finds some support for the hypothesis that trade liberalization has had positive effects on the growth of productivity in Swedish industry.

Swedish manufacturing investment abroad

The Institute has collected an extensive set of data regarding Swedish foreign investors and their foreign affiliates through questionnaire surveys. The data cover the three years 1965, 1970 and 1974 and encompass all Swedish manufacturing firms and their foreign sales and manufacturing affiliates. Part of this material has been presented in preliminary reports from the Institute,[1] in which the volume, distribution and growth of foreign investment by the Swedish manufacturing industry have been described.

The growth of foreign manufacturing by Swedish firms has been very rapid since the early 1960's. Employment in foreign manufacturing affiliates has doubled in the period 1960–1974, and in 1974 it amounted to 200 000 employees. This corresponded to 24 per cent of the total employment in the manufacturing sector in Sweden. Since manufacturing employment in Sweden has remained virtually unchanged in the same period, the relative importance of foreign manufacturing employment has also doubled.

Table 8 gives a breakdown of employment and total assets in manufacturing subsidiaries by industry. There we see that foreign manufacturing is highly concentrated to four industries, namely the non-electrical and electrical machinery industries, the chemicals and metal manufacturing industries, which together accounted for 80 per cent of total employment and 75 per cent of total assets in 1974. The relative dominance of the chemicals and non-electrical machinery industries has declined sharply since 1960, however, while the relative importance of all other industries has increased.

The collection by the Institute of data regarding the foreign activities of Swedish manufacturing firms was only partly motivated by the demand for general information in this area, where formerly relatively little was known. A further purpose was to empirically analyse the factors determining foreign production and the implications of production abroad for the Swedish economy. Such an analysis is currently under way.

An explanation of why firms produce abroad must contain the answer to two separate questions. One is what it is that enables Swedish firms to compete with other (local or foreign) firms in the country of production, that is, what competitive advantage Swedish firms have vis-à-vis these firms

[1] Swedenborg, B., *Den svenska industrins investeringar i utlandet 1965–1970* (Swedish Direct Investment Abroad 1965–1970). (IUI). Stockholm 1973; and Swedenborg, B. and Lindörn, B., *Den svenska industrins investeringar i utlandet 1970–1974* (Swedish Direct Investment Abroad 1970–1974. (IUI) Stockholm 1976.

Table 8. *Employment and total assets in foreign manufacturing subsidiaries by industry in 1960, 1970 and 1974.* Per cent

Industry	Employment			Total assets		
	1960	1970	1974	1960	1970	1974
Food, beverage and tobacco manufactures		1	1		1	1
Textiles, apparel, leather and leather products		2	3		1	1
Pulp and paper mill products	0.5	2	2	0,7	7	6
Paper products and printing, publishing and allied industries		2	3		3	4
Chemicals and allied products, rubber and miscellaneous plastic products	21	14	11	14	8	8
Primary and fabricated metals	7	10	12	11	14	13
Machinery, except electrical machinery	47	43	33	50	43	32
Electrical machinery, equipment and supplies	19	18	24	18	15	22
Transportation equipment	1	2	5	1	3	7
Other manufacturing	5	6	6	5	5	6
All industries	100	100	100	100	100	100

when they produce abroad. According to traditional trade theory the comparative advantage of countries (and the competitive advantage of firms in these countries) derives from differences in comparative production costs between countries. This, however, will not explain the international competitiveness of firms producing in and exporting from several countries. Instead, the competitive advantage of international firms must be based on a firm specific rather than a country specific advantage, i.e., a competitive advantage which is relatively difficult to transfer profitably between firms but is relatively mobile between countries. Sources of firm specific advantage may be different forms of knowledge such as a unique product, a superior technology or know-how.

Traditional trade theory comes into play in answering the second question, namely, what factors determine the locational choice of firms. Given the international competitiveness of firms, they may be expected to choose that source or combination of sources of supply that minimizes total costs. The international distribution of production then depends on differences in relative

production costs between countries, the importance of scale economies, whether production is resource or market oriented, transportation costs, tariffs and other barriers to trade.

The next step is to analyse the implications of foreign production for Swedish exports and imports. For example, is an increase in foreign production – everything else held constant – by Swedish firms associated with an increase or decrease in Swedish exports? Here we will seek to determine how foreign production affects exports from Sweden when account is taken of the competitive advantage of firms, the existence of trade barriers, etc.

These questions are analysed in cross-sections over Swedish firms and their foreign manufacturing subsidiaries for the years 1965, 1970 and 1974.

Birgitta Swedenborg.

Foreign direct investment in Sweden

The purpose of this study is to analyse the factors affecting direct investment in Sweden by foreign based companies. The study is based on data collected from foreign subsidiaries in Sweden through a questionnaire survey. It contains a detailed description of foreign ownership in Swedish industry, its overall size and its distribution by industry, the propensity of foreign-owned firms to export and to import respectively, R & D intensity, etc. In addition, there is a comparison between the relative importance of foreign ownership in Sweden and in other industrialized countries. The transfer of different forms of knowledge between countries which is associated with international direct investment is also examined.

Two sets of hypotheses are tested empirically in the study. The first is that firms undertaking foreign investment possess a firm-specific competitive advantage enabling them to produce in foreign countries in competition with domestic producers. The second hypothesis is that, given such an advantage, locational factors must favour foreign production for foreign investment to take place. Our results confirm both sets of hypotheses. In cross-sectional analyses over some 120 industries in Sweden we find that industries characterized by hypothesized sources of firm specific advantage, such as different forms of knowledge, display relatively large foreign ownership. In other words, foreign-owned firms account for a relatively larger proportion of output in these industries. Attributes hypothesized to yield firm-specific advantages

include measures of skilled labour intensity, advertising intensity, physical capital intensity and market concentration. In further cross-sectional analyses the choice between serving the Swedish market through exporting or through local production is examined. The choice is found to depend positively on whether production is characterized by a relatively high skilled labour intensity and capital intensity and on barriers to trade such as tariffs and transportation costs.

Hans-Fredrik Samuelsson.

Foreign investments and international capital flows

The growing internationalization of Swedish industry makes it increasingly misleading to restrict an analysis of the behaviour and growth of firms to a region or a country. Instead of only studying that part of a firm which is located in Sweden, one ought to consider the whole firm, regardless of the location of its parts, as the relevant economic and financial unit.

This study concentrates on the financial aspects of foreign investments. It is mainly based on the large empirical material regarding foreign direct investment by Swedish manufacturing firms, which the Institute has collected as reported above. The purpose is to map the interdependence between the Swedish and foreign activities of firms. An important task is to determine how profitability requirements vary between host countries. A further task is to find out to what extent the financial structure differs between investments in Sweden and in other countries, and to show how such differences influence the total financial situation of firms with respect to risk evaluation, solvency, etc.

In a more macro-oriented part of the study we will look at the international capital flows, which are associated with the international activities of Swedish firms, and try to determine their impact on the Swedish balance of payments.

Bo Lindörn.

Labour Market and Wage Formation

The mobility of labour

The decreasing growth rate of production in Sweden during the recession of 1975/77 has caused very small employment effects. Employment has been steadily maintained at a "normal" level, whereas labour productivity has displayed a marked decrease. To some extent this development reflects institutional labour market conditions of the early seventies. Layoffs have been made more difficult by new legislation as well as political ambitions to reduce cyclical fluctuations in employment. As a consequence part of the otherwise "open" unemployment now takes the form of redundant labour within the companies.

Available empirical data also suggest a growing immobilization of the labour force at least since the middle of the sixties. This is illustrated by figure 8, which shows quit rates and layoff rates during the period 1964–75. Obviously both voluntary and involuntary mobility have decreased.

The purpose of this research project is to describe and explain turnover in the Swedish labour market. Quit rates and layoff rates will be analysed as well as interdependencies between entries and exits in the labour market. Econometric models will be worked out which can be tested on available data.

Bertil Holmlund.

Applications of human capital models to Swedish earnings data

According to human capital theory earnings of individuals may be regarded as rentals paid on the stock of human capital possessed by the individual. The stock of human capital increases by investments and decreases by obsolescence and wearing off. Individuals add to their stock of human capital by schooling and on-the-job training. In equilibrium and in the absence of discrimination, units of human capital are paid the same rentals. Thus individuals are paid according to the amount of human capital they possess.

Figure 8. *Quit and layoff rates of industrial workers 1964–75*
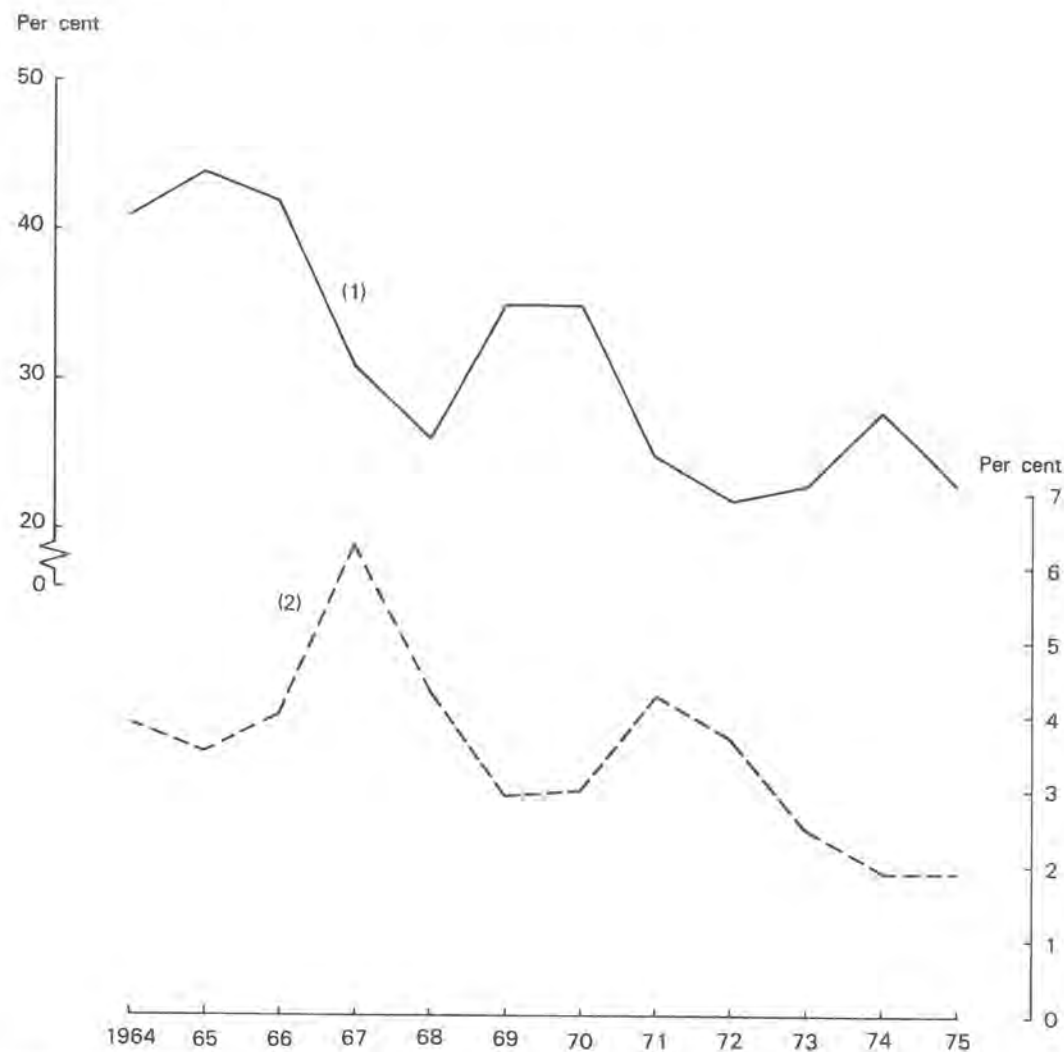
Per cent

Note: (1) Quit (left scale)
(2) Layoff (right scale)
both in per cent of total number of industrial workers

The IUI has made a number of studies on micro determinants of earnings.[1] The purpose of the study *"Determination and Structure of Salaries in the Government Sector of Sweden"* by Siv Gustafsson, was to discuss the earnings structure of salaried employees in the government sector. This was accomplished by using a human capital theoretic approach.

Salary data cross-classified by education, age, sex, region and government body were used. The hypothesis of equal earnings for individuals with equal amounts of human capital was tested in a number of ways.

One of the models tried was a "Mincer simple schooling model". A regression on log (salary) on years of schooling showed that salaries of male government employees increase by about 8 per cent for every year of schooling after compulsory schooling.

Education was defined as type of education completed. 17 different education types, some of them with equal duration of schooling, were identified and formed the observations. The amount of investment in on-the-job training was held constant by taking observations of salaries at the "overtaking point", in this case defined as salaries after 8 years of labour force experience.

The hypothesis of equal rentals per unit of human capital may also be applied to comparisons of the government and private sectors. Salaries were shown to be much higher in the private sector than in the government sector for most educational groups. There is a premium of private employment over government employment for all male educational groups and for all female groups with more than compulsory schooling. For men this advantage seems to be larger than can be motivated to compensate for better non-pecuniary advantages in government employment. For women with only compulsory schooling, government employment is much more advantageous than private employment, since better non-pecuniary rewards prevail in addition to higher salaries.

A third question raised is whether salary differentials between men and women are explained by the fact that men and women have accumulated different amounts of human capital. In 1971 women earned on the average 17.8 per cent less than men among government salaried employees. Stan-

[1] Klevmarken, A., *Statistical Methods for the Analysis of Earnings Data.* (IUI) Stockholm 1972; Klevmarken, A. et al, *Industritjänstemännens lönestruktur* (The Structure of Earnings in Swedish Industry). (IUI) Stockholm 1974; Klevmarken A. and Quigley, J.M., Age, Experience, Earnings, and Investments in Human Capital. *Journal of Political Economy* no 1 1976; Gustafsson, S., *Lönebildning och lönestruktur inom den statliga sektorn* (Determination and Structure of Salaries in the Government Sector of Sweden). (IUI) Stockholm 1976.

dardization for differences in education and age leaves an unexplained differential of 11.0 per cent. The corresponding figures for the private sector were 41.7 per cent and 26.4 per cent, respectively.

A new set of data has now been collected in which many of the weaknesses of the data used for the previously mentioned study have been overcome. The new set of data consists of individual data for 32 000 salaried employees in the private sector. For each individual the data give age, sex, education, labour force status and income for each of 15 years, approximate salary in 1974, occupation, branch of industry, size and location of company. This set of data will be analysed in a number of ways.

Since the number of years of experience is given in the new data set, one of the potentially most important variables for explaining salary differentials between men and women in the previous study can now be analysed. It is possible to investigate the influence of the amount of experience on earnings at a given age. This information has been used to estimate "rates of depreciation on human capital due to non-use". Both men and women are seen to incur salary decreases if they are absent for any considerable time from the labour market.

Siv Gustafsson.

Other Research Projects

Emission control costs in Swedish industry

In the late 1960's a more active environmental protection policy was initiated in Sweden. The Environment Protection Board was set up in 1968, and more stringent emission standards were enforced. Since 1969, the Government has subsidized emission control investments in order to reduce the economic consequences to the firms of the raised requirements.

An attempt to identify the amount of residuals generated in each of the basic unit operations that constitute the production process and to estimate the costs of reducing or modifying the discharges of these residuals has been made at the IUI in the report *"Emission Control Costs in Swedish Industry"* by Johan Facht, which was published in 1976.

Data for the study were obtained from the Environment Protection Board – the agency to which firms had to apply for subsidies – and cover investments carried out between July 1, 1969, and July 1, 1973, at plants which existed before July 1, 1969. The study is limited to two major industrial sectors – the iron & steel industry and the pulp & paper industry. These sectors account for a large portion of both industrial residuals discharges in Sweden and total government subsidies during the period studied.

The emission control investments covered by the study amounted to 372 million Skr in the pulp and paper industry and to 306 million Skr in the

Table 9. *Average cost per ton of pulp of emission control measures undertaken at Swedish pulp and paper plants between July 1, 1969 and July 1, 1973 for major plant categories*

Type of plant	Average emission control cost Skr/ton	Range of variation Skr/ton
Mechanical	9.44	0.58– 33.91
Sulphite, bl. and unbl.	33.64	14.59– 71.81
Sulphite (change of base)	81.73	20.51–117.85
Sulphate, bl.	19.40	6.04– 46.17
Sulphate, unbl.	15.25	3.07– 56.00
Total	14.65	0.58–117.85

iron and steel industry, government subsidies covering almost half of these sums. By the investments in the pulp and paper industry, plants with a total annual capacity of more than 7 million tons of pulp or paper have reached acceptable environmental standards. Annual costs for the environment improving measures at each plant have been computed. As can be seen from table 9, considerable variations in annual costs between plants and processes are found. The implications of this for environmental policy, for decisions on acceptable emission standards and for the construction of efficient subsidization schemes are also discussed.

Transport policy and the lorries

Up to 1963, transport legislation in Sweden as in most other industrialized countries had the purpose of protecting the railways and eliminating wasteful competition within the road haulage industry. The 1963 Transport Act, however, provided for a gradual relaxation of the restrictions on the road haulage industry and at the same time freed the railways from various obligations. This change of policy, which is fairly unique internationally, offers an interesting case for studying the effects of deregulation. Its effects on road freight transport are the subject of the report *"Transportpolitiken och last-bilarna"* (Transport Policy and the Lorries) by Lars Kritz, published in 1976.

An interesting result is that the long term capacity growth of the road haulage industry was not affected by the liberalization. Changes in carrying capacity have primarily reflected the general economic development of the country. Since the early 1950's, large carriers have increased their share of the market, and liberalization did not change this trend. However, the number of firms with only one vehicle increased rapidly during the first years of the new policy – partly because "illegal" operators took the opportunity to legalize their business.

The rapid growth of the road haulage industry has often been interpreted mainly as a transfer from rail to road. To a significant degree, however, this growth is explained by a decline in own account transports. Shippers have chosen to hire professional operators instead of carrying the goods in their own vehicles. Many drivers for existing own account operators have acquired their former employer's vehicles and become professional haulers carrying the original traffic.

Entry in Swedish manufacturing industry 1954–1970

The purpose of this project is to study the extent, character and determinants of entry, exit and growth of firms in Swedish manufacturing industry during the post-war period. The project covers three industries: plastics, primary metals and engineering, which account for almost 50 % of industrial employment in Sweden. For purposes of cross-section analyses, the industries are split up into 40 subindustries.

The study is based on information of about 6 000 establishments obtained from the register of establishments at the Swedish Central Bureau of Statistics and a large amount of supplementary data collected through direct contacts with a great number of industrial enterprises, from directories and from other data sources.

Figure 9. *New and discontinued firms and branch establishments in the plastics, primary metals and engineering industries 1954–1970.*
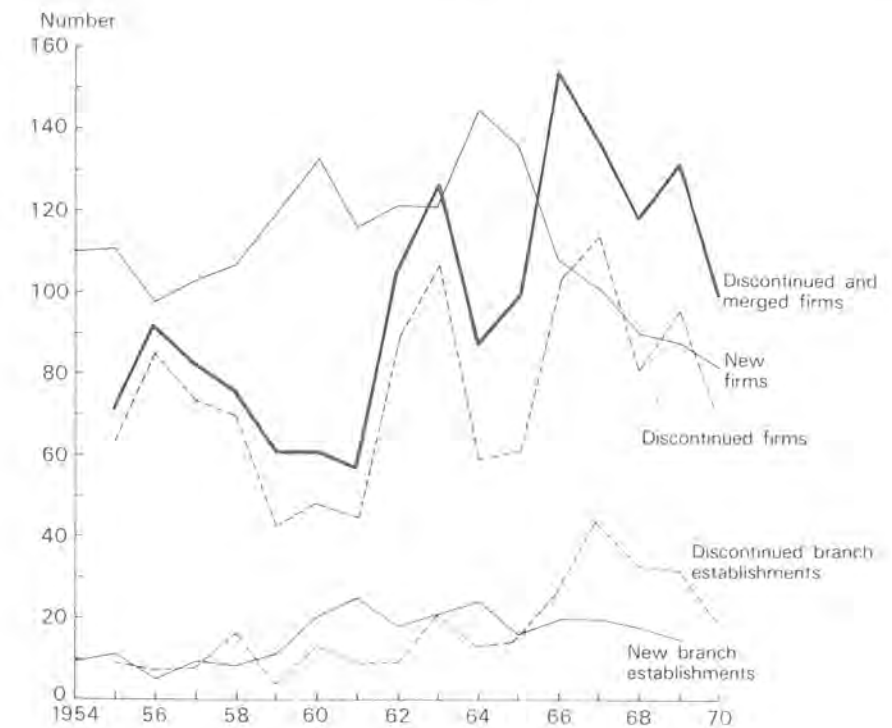
So far, the study has resulted in two publications.[1] The principal descriptive findings of the investigation are presented. From the monograph published 1975 is reproduced figure 9 showing the year to year figures for entries and exits of firms and bransch establishments during the period 1954–1970.

The number of new fims per year has increased slightly between 1954 and 1964 in the segment of the manufacturing industry which is covered by the study. However, this trend was broken in 1965, when the new firm entry rate started to decrease. It is difficult to ascertain the exact magnitude of this decrease because the estimates of the number of new firms for the last few years of the period have been made on a weaker statistical basis. However, it can be affirmed with a relatively high certainty that a decrease has occurred which cannot be explained solely by the recession in 1966–1967. There has been no corresponding decrease in the number of new branch establishments. This type of entry has been maintained at about twice as high a level during the 1960's as during the 1950's.

The number of discontinued firms as well as the number of discontinued branch establishments have increased over the period under consideration. The sharply increased exit rate of branch establishments in the late 1960's seems to depend in part on the increased merger rate in the 1960's. That is so because a considerable number of the purchased firms have been shut down a few years after the merger; and these closures have been registered as discontinuations of branch establishments.

The entry of new firms has covaried positively, and the exit of firms negatively, with the general business climate measured by the rate of growth of industrial production. During the boom years 1954–1955, 1959–1961 and 1964–1965 the number of new firms was unusually high and the number of discontinued firms unusually low. The fluctuations in the number of new firms over the business cycles studied have been rather small, but the fluctuations in the number of discontinued firms have been considerably greater. Further, the number of new branch establishments seems to have been larger in boom years than in recession years. The number of discontinued bransch establishments has not varied systematically over the business cycles. The total number of firms that ceased as independent units, that is the sum

of the discontinued and merged firms, has increased more rapidly than the number of discontinued firms and exceeded the number of new firms during the second half of the 1960's. As a consequence, the population of independent firms has decreased during this period.

The study on entry is completed by an analysis of the determinants of entry and diversification. The core of the theoretical analysis is a model that considers how changes in the industry growth rate affect the supply changes from three categories of firms: entering, leaving and permanent firms. The long-run cost curves of all firms are assumed to be perfectly elastic after a certain minimum volume. By introducing an assumption about increasing costs of expansion for a firm as its growth rate increases, it is possible to determine within the model both the entry rate and the growth rate of permanent firms. A central implication of the model is that the entry rate is an increasing convex function of the equilibrium market growth rate.

The model discusses how the entry rate in a specified industry is affected by different industry growth rates. It also considers how specific industry characteristics influence the entry rate for a specified industry growth rate: scale economies and other entry barriers, technological change, monopolistic behaviour, etc.

80 per cent of the total variation between 40 industries in new firm entry is explained by the model and more than 50 per cent of the total variation in diversification entry. The analysis gives confirmation to the hypothesis that the entry rate is an increasing, convex function of the industry growth rate. Further, the results indicate that the minimum optimum scale is an important barrier to new firm entry but not to diversification entry.

Finally, the technical personnel ratio is found to be strongly inversely related to both new firm and diversification entry.

Gunnar Du Rietz.

The development of Swedish industry during the postwar period

In a number of research projects, both current and completed, the Institute has studied growth patterns and structural changes of Swedish industry from different angles. Partly within the framework of this research program, partly as a follow-up and extension of the 1950 study *"Svensk industriell före-*

[1] Du Rietz, G., *Etablering och nedläggning av självständiga företag i metallmanufakturindustrin 1954–70*(Entry and Exit of Firms in the Metal Manufacturing Industry, 1954–1970).(IUI)Stockholm 1973; Du Rietz, G., *Etablering nedläggning och industriell tillväxt i Sverige 1954–1970* (Entry, Exit and Growth of Firms in Swedish Manufacturing Industry during the Post-War Period). (IUI) Stockholm 1975.

tagarverksamhet"[1], the Institute is now studying the development of Swedish industry during the postwar period. The study is primarily historical in character and the intention is to throw light upon the interaction between technological change, finance and economic development. Interest is focussed on entrepreneurial activity, its conditions and meaning.

A characteristic feature of postwar industrial development is that several changes of a structural kind seem to have taken place around the middle of the 1960's. Industrial employment in Sweden stagnated and subsequently tended to decrease. On the other hand employment in Swedish-owned firms abroad increased rapidly. Investment activity was to a higher degree directed towards machinery rather than construction. A labour shortage was experienced (or anticipated) in Swedish industry which turned out to push a more rapid substitution of capital for labour than before. There is much indication that this "labour shortage" also tended to decrease the differences in real wages between industries. The average profitability in Swedish industry had been decreasing since the middle of the 1950's only to turn up again temporarily 1973/74. The debt-equity ratio had been rising. Differences in development between industries and individual firms furthermore were considerably more accentuated. Structural change became more rapid during the 1960's. There was a marked upswing both in merger activity and in the number of closed-down firms, while on the other hand entry of new firms became less frequent (also see p 65).

An important task in this study is to analyse and explain this change. An important factor to investigate will be the sharp increase in international competition facing Swedish industrial firms. New competitors are now on par with Swedish firms in terms both of quality of products and efficiency in their production. At the same time a number of features in the technological development and in the field of transport have deprieved some Swedish industries of some advantages they once possessed. Apart from these changes in external conditions, several domestic factors have reduced the ability to reallocate resources and to adapt easily to a changing environment. The changes in the labour market have also contributed towards inflexibility. Finally, the level of interest rates has gradually risen due to external as well as internal forces. Thus, the opportunities to borrow money as cheaply as before and receive a high rate of return with the help of nominal profit

[1] By Erik Dahmén and translated into English by Axel Leijonhufvud for the American Economic Association and published under the title *"Development of Swedish Industry 1919–1939"*. Irwin, Homewood 1970.

increases have virtually disappeared. The working hypothesis is that increased international price competition in combination with a gradual loss of previous relative productivity advantages and a tougher cost development in the domestic labour market have produced a critical turning point in Swedish industrial development around the middle of the sixties.

New and better products are a momentous manifestation of entrepreneurial activity. The importance of new products in postwar industrial development belongs to the questions being subjected to special attention. Narrowly defined, new products generated during the postwar period constituted some 30 per cent of the production value of Swedish industry in 1974. This share would be appreciably higher if significant and decisive improvements in the quality and performance of already existing products could be included. The mechanisms behind the generation of new products are being examined as well as the diffusion of the effects of these new products through the economy in the form of characteristic chain reactions and blocks of development. The part played by new and better products in the development of productivity during the postwar period is also being explored. In earlier studies of industrial productivity focus has, as a rule, been placed on improvements in methods of production rather than on new products.

Erik Dahmén.

Industry finance during the postwar period

In connection with professor Erik Dahmén's research on Swedish industrial development during the postwar period, the Institute intends to treat the financial aspects of the industrial transformation process in a separate study, which takes its starting-point in the fact that the financial conditions in Swedish industry have undergone substantial changes since the beginning of the 1950's. Lower profitability and higher debt-equity ratios are among the most characteristic features. Especially the first half of the 1960's seems to have been a time of transition in these respects.

The intention is to map how industry finance has developed in terms of financial flows, financial stocks and profitability on the basis of individual firm data. Among the most interesting questions raised are for instance: To what extent has industry been able to finance investments out of internally generated funds? How have debt-equity ratios developed? What rates of return have been obtained on postwar investments? Has the spread in pro-

fitability and debt-equity ratios increased among industries and individual firms? The answers to these and other questions will form a basis for an analysis of the part played by financial factors in the industrial transformation process.

Johan Örtengren.

Demand and pricing of teleservices

This study has been commissioned by the Swedish Telecommunications Administration. It was considered desirable to draw on the experience from demand studies accumulated at the IUI to improve forecasts of the volume of telephone services, and income from those services. Our interest in this study is primarily explained by the fact that to the Institute the study is concerned with an entirely new type of technically advanced services which are marketed under special conditions.

The first results of the study on the demand for telephone services have already been published in 1976.[1] The study is a first step in a further socio-economic analysis of the demand and supply of teleservices. Its main purpose has been to forecast the demand for telephone services and telephones in Sweden for the period 1975–1980. The econometric method used is regression analysis, and the study is based on annual data covering the period 1949–1974. The demand for telephones is broken down into three sectors: residence, business and public. For each group of subscribers the demand is further broken down into connected and disconnected telephones. The demand for telephone services is disaggregated into domestic and international outgoing telephone services.

The explanatory variables in the model are of two kinds, on the one hand those supported by economic theory, e.g. income, price of telephones and telephone services and price of substitutes for teleservices, and on the other variables which are more special for the telecommunications market, e.g. the degree of automation and the number of potential subscribers.

The forecasts for the period 1975–1980 of course depend on the assumed values of the exogenous variables and hence should be regarded as examples

[1] Pousette, T., *Efterfrågan på telefontjänster och telefoner* (The Demand for Telephone Services and Telephones), (IUI) Stockholm 1976. A paper which summarizes the main part of the research report in English is available.

of possible development. The demand for domestic telephone services is assumed to increase by 3.6 per cent per year according to the higher forecast alternative and by 3.0 per cent according to the lower alternative. This can be compared with the annual growth rate of the demand for telephone services during the first half of the 1970's, which was 3.1 per cent. The forecasts for the demand for telephones show an annual increase 1975–1980 for the stock of telephones as a whole of 3.6 per cent according to the higher alternative and of 3.4 per cent according to the lower alternative. The increase in the stock of telephones 1970–1974 was 3.8 per cent per year.

Attention is currently concentrated upon an analysis of the optimal pricing system of the Telecommunications Administration. This part deals only with the telephone and the datacommunications branches of the Administration. Later, the telex and possibly the telegraph branch will also be studied. The study mainly deals with domestic communications, since the pricing of international traffic is primarily determined by international agreements.

Short-run pricing decisions within a given capacity are separated from the long-run questions that also involve new investments and capacity additions for different types of teleservices.

A quite detailed demand analysis is required to analyse different methods of pricing. Among other things regional, seasonal and daily demand variations have to be considered. Information on short-run and long-run marginal costs is also needed. Of special interest are system costs, i.e. costs of administrating the price system and of transmitting information about prices. The pricing problems created by external effects of calls and subscriptions will also be discussed.

A third step in the project concerns the pricing of new goods and services and capital costs and other costs in connection with the introduction of new techniques.

Tomas Pousette.

Economic growth in Sweden

Swedish economic growth in the last century has been the subject of a large research project at the IUI. So far five studies have been published. These have dealt with production and productivity, foreign trade, capital formation, labour supply and economic policy, respectively. Substantial differences between periods have been found in growth rates and in income distribution.

The project has now been extended with a comprehensive analysis of industrial development in which a central part is the construction and the empirical analysis of a long-term model based on the vintage theory of capital. This model is the end result of a number of experiments with different alternative model types. These experiments indicate among other things that it was not meaningful to include variables representing embodied technological progress. One single type of technological progress, a labour augmenting factor, came out to be sufficient to make the model workable. The experiments furthermore demonstrated that the model makes it possible to simulate very closely the development of production within the private sector of the Swedish economy during the period 1870–1975. The only numerical information used for this simulation was estimates of the Swedish economic structure in 1870 and time-series of the volume of investment and the rate of interest from 1870 to 1975.

According to the results of the simulation, the labour augmenting factor varied around a value of 2 per cent per year, a figure that seems to be the "normal" rate. No upward or downward trends can be discerned from the figures. The simulations also showed a decrease in the life length of capital from 63 years to 30 years and a decrease also in the output-capital ratio in new vintages from 0.43 to 0.26. This development implies a decrease in the social rate of return of capital and, consequently, a decrease in the growth potential of the economy. If the model estimates correspond to reality, the future growth rate of the Swedish economy will be considerably lower than before, unless the investment rate is raised substantially.

Ragnar Bentzel.

Competition on equal terms

Many regions and industries are at present exposed to economic strains. These have been aggravated by the extended depression of recent years, but to a large extent their origin is of a structural nature. Partly they are explained by the extremely rapid productivity increase which during the last decade has characterized the industrial sector all over the world, partly by the abolition of import tariffs which have previously constituted a support and protection against foreign competition.

As shown in a recent IUI report (p. 53) tariffs have in recent years to some extent been replaced by non-tariff trade barriers. On the one hand these can be seen as expressions of a wish on the part of authorities to support the industrial development of the country and to strengthen the international competitiveness of its economy on the premise that shelter from competition helps. On the other hand, a growing disbelief in the capability of general economic-political measures to support cherished political goals has developed during the past decade. Such conventional policy measures are considered too blunt to reach more ambitious and more detailed goals. Instead, governments are beginning to experiment with selective measures. Non-tariff trade barriers are one example. The arsenal of such measures is growing rapidly, apparently without a parallel inquiry into the short and long run consequences of their use. The current study at the IUI is concerned with the extended use, and the consequences, of such selective measures in Sweden. Particular attention is paid to their effects on the competition between countries, regions, industries and firms.

Jan Bröms.

Price controls in Sweden

During and immediately after the second World War price controls were used in Sweden in an attempt to help down the rate of inflation. In this period, however, one lost faith in the efficiency of price controls in controlling inflation.

Scepticism also characterized the government study on price controls which was presented in 1955. This study resulted in a new price control law, which made it possible to introduce different kinds of price controls in case of war or threat of war or if for some other reason there was a danger that the general price level in the country would rise seriously. The law had to be ratified by parliament.

Price controls were not under this law until August 27, 1970, when controls on certain food stuffs were announced. In the spring of 1973 Parliament approved a new law, which stated that price controls may be introduced when there is a danger of a serious price rise on important commodities or services – that is, not only a rise of the general price level. This law further stated that government agencies may negotiate with firms to set prices, which may not be altered subsequently without permission from

the agency. Under the provision of this law it is also possible to require that advance notice must be given of price increases. Price controls have been used fairly extensively under this law.

The main purpose of this study is to describe and analyse the effects of price controls in Sweden since 1970. The study can be divided into two parts: the effect of price controls on the rate of inflation and on resource allocation, respectively.

In the first part of the study we seek to determine whether the rate of inflation has in fact been lower in periods of price controls than otherwise would have been the case and, secondly, whether in the period following controls the rate of inflation has been higher than otherwise would have been the case. To do this we need a model of inflation which allows us to eliminate the influence of other explanatory variables. Dummy variables can be used to capture the influence of price controls in periods when these have been in use.

The second part, the study of allocation effects, proceeds from the fact that firms can adjust in various ways to a situation where prices are regulated. Our theoretical knowledge in this area is considerable, but empirically we know relatively little. We intend, therefore, to study more closely how firms behave when prices are regulated, how controls affect, e.g., the choice between home market sales and exports, investment, product changes, etc. An important question is also whether price controls affect competition between firms and thereby the size distribution of firms.

Bo Axell.

The Institute's Publications 1970–1977

A complete list of the Institute's publications can be obtained by request. Prices given are list prices in Swedish crowns before value-added-tax.

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