

THE INDUSTRIAL
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FOR ECONOMIC
AND SOCIAL RESEARCH
STOCKHOLM

IUI YEARBOOK 1982—1983

MICROECONOMETRICS

IUI RESEARCH PROGRAM



Industriens Utredningsinstitut

THE INDUSTRIAL INSTITUTE FOR ECONOMIC AND SOCIAL RESEARCH

Stockholm, June 17, 1983

Dear Sirs,

As you may have noticed, we have gradually changed our English project program into a yearbook, including several articles from our current research. This is the third edition of the IUI yearbook and we would like to maintain the yearbook format. This is, however, quite an expensive activity. Hence, we would like to inquire into the interest in receiving the yearbook in the future. A symbolic sum will be charged for future yearbooks covering the printing costs for the extra article section.

If you mark X in the appropriate box on the detachable slip and return it with a cheque of 50 SEK enclosed, you will (1) indicate interest in receiving future editions and (2) automatically receive the next yearbook on exactly the same conditions as this one.

Book orders on the detachable slip on more than 150 SEK that reach us before September 1 will also entitle you to automatically receiving the next IUI Yearbook.

Sincerely,

Gunnar Eliasson
Dr., President



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 structural changes in the Swedish economy with emphasis on manufacturing industry.

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The Industrial Institute for Economic and Social Research
Stockholm

Microeconometrics

IUI Yearbook 1982–1983

Editors

Gunnar Eliasson and Harald Fries

IUI Research Program



Photo: Hans Hammarskiöld

Dr. Marcus Wallenberg, the Grand Entrepreneur of Swedish industry and long time supporter of this Institute, died on September 13, 1982. Dr. Wallenberg was chairman of the Institute for 25 years (1950-1975), and continued to show genuine interest and support as honorary chairman until his death. Without his protection IUI would hardly be the well recognized research institution it now is. With his death a unique personality has passed away.

We think it is appropriate that the conference commemorating the 100th anniversary of Joseph Schumpeter, planned by the Institute (see p. 125 ff.), also honors the late Marcus Wallenberg. He was not only an industrial entrepreneur but also a protector of science. Schumpeter's emphasis of the fundamental role of the individual agent was entirely in accordance with Marcus Wallenberg's views on the economic and industrial process. The conference will be sponsored by the Marcus Wallenberg Foundation for International Cooperation in Science.

Erland Waldenström
Chairman of the Board

In February, 1983, the Institute published Policy Making in a Disorderly World Economy. The book contains a collection of papers dealing with the enhanced uncertainty and unpredictability in the world economy during the 70s. It also discusses the theory needed to understand what is going on. The main configuration of authors is exhibited on the picture in a pose that illustrates the theme of the book; left to right Mark Sharefkin (Resources for the Future, Washington D.C.), Gunnar Eliasson (President, IUI), Bengt-Christer Ysander (IUI) and Karl-Olof Faxén (Chief Economist, the Swedish Employers' Confederation).

Photomontage
Micke Falck





The early autumn meeting of the IUI board is devoted to a discussion of the research program. It is always combined with a visit to some industries. In 1981 the northern iron ore mine in Kiruna and the government operated steel work in Luleå were visited.

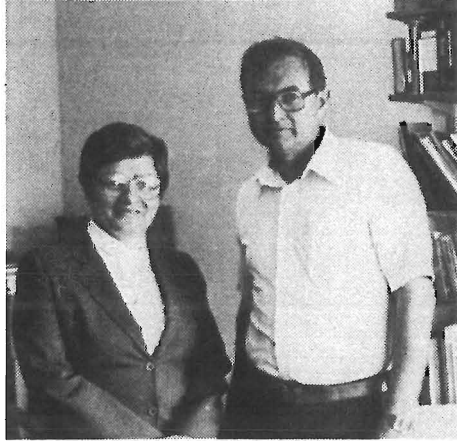


In 1982 the Swedish University of Agricultural Sciences, Ultuna and Pharmacia AB were studied. In the picture Professor Bengt Björkstén from Pharmacia Diagnostics explains experimental allergy research to Curt Nicolin (Chairman of the boards of ASEA and the Swedish Employers' Confederation, Vice Chairman of the board of SAS etc.), Johan Örtengren, Gunnar Eliasson, Anders Klevmarken and Alde Nilsson (ASEA board).



It has become a tradition that Nobel Prize Winners in Economics visit the Institute for "glögg" and "Lucia songs" in the morning before giving a lecture, jointly sponsored by the Institute and the Federation of Swedish Industries. Mr. and Mrs. Lawrence Klein in 1980, (upper picture) with Erland Waldenström (Chairman of the Institute board, to the left) and Gunnar Eliasson. Below George Stigler in 1982.

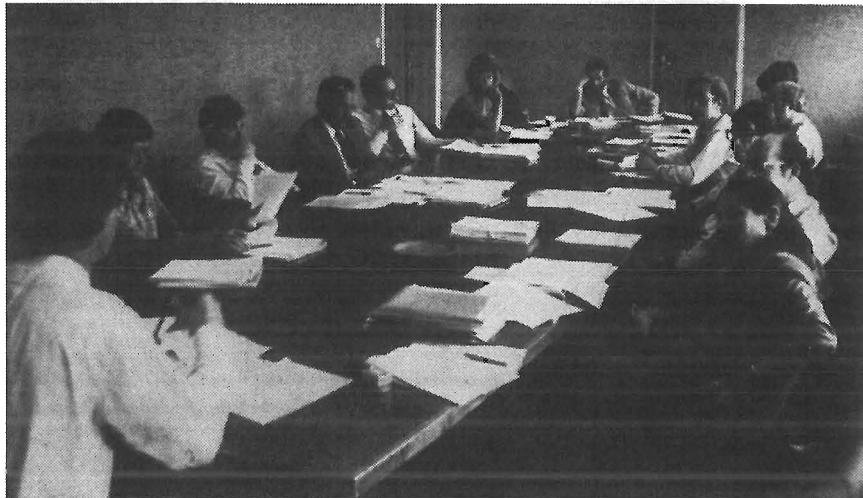
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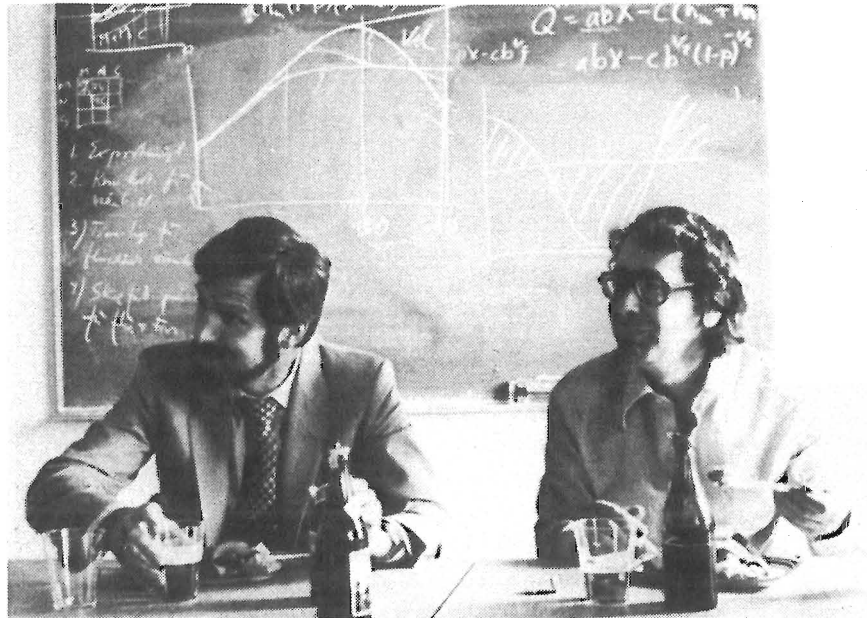
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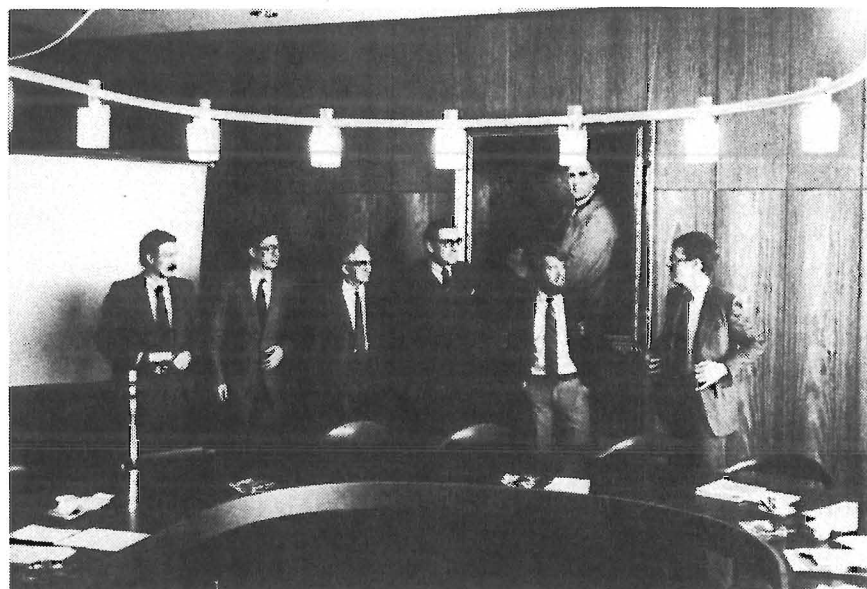
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The foreign guest research program has been very active. Anne Kreuger (Chief Economist, the World Bank) and James Henderson (University of Minnesota) (A) spent part of spring 1982 at IUI. Edwin Mansfield (University of Philadelphia) (B) and a picture from the 1981 IUI conference "Is Local Public Economic Growth Getting out of Control?" (C). Among the participants can be seen Ned Gramlich (University of Michigan), Ingemar Ståhl (University of Lund), George Peterson (Urban Institute), Peter Jackson (Leicester University) and Wallace Oates (University of Maryland).



The International Tax Comparison project together with NBER (Cambridge, U.S.), IFO (Munich, West Germany) and the University of Birmingham (U.K.) is currently in the publication process (see p. 73 ff. and p. 120). From one of the meetings at IUI, Willy Leibfritz (IFO) and Mervyn King (University of Birmingham).



During 1982 IUI, ETLA (Helsinki), IØI (Bergen, Norway) and IFFF (Copenhagen) agreed to carry out a joint, medium-term survey for the Nordic countries. From the left Pentti Vartia (ETLA), Juul Jørgensen and Torkel Kristensen (IFFF), Tauno Ranta (ETLA), Arne Selvik (IØI) and Gunnar Eliasson.



One of the largest economic research projects in Sweden, called HUS (for Household Market and Nonmarket Activities, see p. 104 ff.) has been designed and tested in a pilot study as a joint project between the Institute and the Department of Statistics at the University of Gothenburg.

The picture shows one of the planning meetings for pilot study field work. At the end of the table, from the left Gunnar Eliasson, and Anders Klevmarken (Gothenburg) who coordinate the project, and Bertil Holmlund and Anders Björklund both also at IUI. When this is being printed funding of a full scale study has not been secured.

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PART I *ARTICLES*

MICROECONOMETRICS AND THE DYNAMICS OF RESOURCE ALLOCATION

by Gunnar Eliasson

1. Business Cycles and Economic Growth

For some time, policy makers and the population at large have believed that their economic environment was controlled by an informed body of policy makers.

This comfortable situation abruptly ended in the early 70s. Macro demand management based on such presumptions was no longer a reputable way of policy making. Neither the informed, central overview nor the means to achieve ambitious targets appeared to be present. Less ambitious macro monetary management to fight inflation became popular. It is still there, but in doubt. Supply policies became a catch word.

The long-term supply problem of the 70s is still very much unresolved. Policy makers and their advisers are both confused. The old Schumpeterian ambition to understand the Business Cycle and Economic Growth simultaneously is returning after years of oblivion. It is not clear that the economics profession is capable of satisfying that ambition.

To capture the complex, economic process that has generated the unstable stagflation state of the 70s one has to look very deeply into the underlying microeconomic market processes. One has to understand, in particular, the firm, or the entrepreneur, as a market agent. Innovative change and uncertainty associated with the ambitions and competence of competitors in the market are forms of uncertainty that should in general be conducive to economic growth. Unpredictability created by misconceived macro policies or confused market agents on the other hand may disturb the market process and be detrimental to growth. The possibility that micro agents (firms, households and even local public bodies) may be in conflict with the ambitions of policies designed at the central level has to be considered afresh in modern economics.

There is a great need for a better understanding of the more comprehensive relationships that rule the macroeconomy. Since such relationships begin where decisions are taken, macroeconomic understanding has to be based on a good theory of the microdynamics of business, household and public body behavior.

A quantitative grasp of the microeconomic processes, hence, is essential to understanding what is currently going on. This demands a new level of econometric competence based on well integrated theory and measurement, extensive data-base work and the development of new statistical methods - in short, a new microeconomic competence. The ambition to develop such theory and competence is characteristic of the bulk of ongoing IUI research.

2. The Market Game

Disorderly Economies

An economy consists of a number of *agents* that operate in a more or less constrained *market environment*. This environment is characterized by different sets of rules. A few of them, like property rights, have to be safeguarded by the state. The stability and extent of these rules, the complexity of the market game played by actors and the consequent environmental predictability constitute the uncertainty or stability of the system. This overall problem of uncertainty and macroeconomic stability has been extensively covered within the large energy project (see p. 91), where the market instability created in the wake of the so-called "oil crisis" has been a prime focus of concern.¹

The main conclusion is that the *Disorderly Economies* of the 70s have lowered predictability and increased uncertainty to the extent that caution has begun to prevail. Agents are gradually learning to cope with new complexities associated with inflation and stagnation by developing new sets of decision rules. These rules of thumb may not be optimal if growth is again somehow restored. Recovery from the 70s appears to be a long process. Long-term financial commitments - notably industrial investments - have been the first to suffer.

Reasonable predictability of rules and prices is one feature of efficient market processes. The other, equally important, feature is the notion, formulated by Adam Smith, that price signaling should be organized to promote welfare and economic growth. This is the definition of well functioning markets.

Non-market Economies

We are beginning to realize that the modern welfare state incorporates practices which insulate major segments of the economy from the discipline

¹ A conference report within that project, *Policy Making in a Disorderly World Economy*, (eds., Eliasson-Sharefkin-Ysander), IUI Conference Reports 1983:1, has just been published.

of the price system. No current research allows us an overview of the elements that tend to erode the economic base, and the redistributive capacity of the welfare economy.

Widespread regulation affects market processes in several ways. Generalizing somewhat, we can talk about *the four important prices*; (1) food, (2) shelter, (3) labor and (4) capital. None of these prices are free to move in an unconstrained market process. Farm and food prices are controlled to a varying degree throughout western Europe. Rents are normally regulated, although the degree and extent of regulation vary according to political power and fashion. Wages are subjected to more or less centralized negotiation. In many countries incomes policy programs and some form of enforcement of contracts are carried out simultaneously. Throughout the 50s and the 60s – in conjunction with the fixed parity system (also a form of price control) – interest rates in most west European countries were regulated or “constrained”. Under the pressure of a growing and functioning international credit market the Bretton Woods system, and then gradually domestic credit rationing, were abandoned.

For those who accept the Smithian idea of the role of the price system the extent of regulation in the advanced economies should be a source of worry, if only for one reason: economists do not even have a good idea of the nature of the overall efficiency and dynamic allocation effects of regulated and destabilized price systems.

To clear away much of the political controversy associated with these matters, a careful historical comparison of market imperfection today and in the past would be enlightening.

The most important market that is out of equilibrium appears to be the labor market. The grave unemployment situation among industrial countries bears witness to that. Some economists argue that the situation is a good example of overpricing and rigidity exercised by unions. Under that verdict we are now in the middle of the price adjustment period, and politicians can do nothing useful except helping the adjustment along. The European unemployment situation placed in the middle of old and inert industrial structures, however, poses a real danger of growing political instabilities, if it continues or worsens.

There is no doubt that prospective wage benefits play a role in the labor market. Holmlund (see his paper below) shows that movers do gain by moving in the market, and stayers forego gains if they stay in a situation, where they would have increased their wage, had they moved. The reason they do not move is perceived of real costs associated with moving. The higher these costs in relation to the gains from moving, the lower is the propensity to move. This relation is affected by taxes, social insurance benefits and industrial subsidies (as we will show below). In essence, the observed decreased mobility in the labor market does not have to be caused by institutional rigor or complacent workers. Pricing (wage setting) in the

labor market may well be the prime reason. Sweden is noted for the smallest wage dispersion among the Nordic countries.¹ This is even more apparent from Klevmarken's comparison of wage and salary setting practices in the United States and Sweden (see pp. 150 ff.). Klevmarken also demonstrates that substitution between occupations is slow. Hence, union-pushed wage equalization ambitions in Sweden can have quite long lasting effects. Real adjustments occur instead: industries get problems and unemployment is created. Especially the youth seems to have been priced out of the market into unemployment in this way. These results also illustrate that price adjustment is slow in general - something that we have illustrated in simulations on our micro-to-macro model. Too fast adjustments generate instability in the economic system; too slow adjustments create stagnation. There are intermediate market regimes associated with an optimal rate of adjustment, maximum price stability, predictability, and output growth.²

The *capital market* is more difficult to deal with. Not long ago such markets did not really exist. With the exception of the U.S. economy and the international finance system, efficient capital markets are still rare. They are also carefully protected - to the extent possible - from outside influences.

The reason for the outdated or inefficient industrial structures facing competition from aggressive competitors in the newly industrialized countries may, in fact, be the particular kind of disequilibrium that has prevailed in the capital markets of most European economies for close to three decades. Interest rates, well below what marginal investors have been willing to pay, have made firms and policy makers alike happy to accept new investments in traditional sectors that became obsolete overnight, when prices changed in the wake of the 1973 oil situation, and when real interest rates began to climb in the early 80s. The argument of the new book (on policy making in a disorderly world economy) is that this is the real cause for concern, not oil prices or the OPEC cartel. The disorderly state of western economies today was all created by policy makers in the western economies.

Let me give a few Swedish examples of how we have distorted the all important capital market to the long-term distress of ourselves and our children.

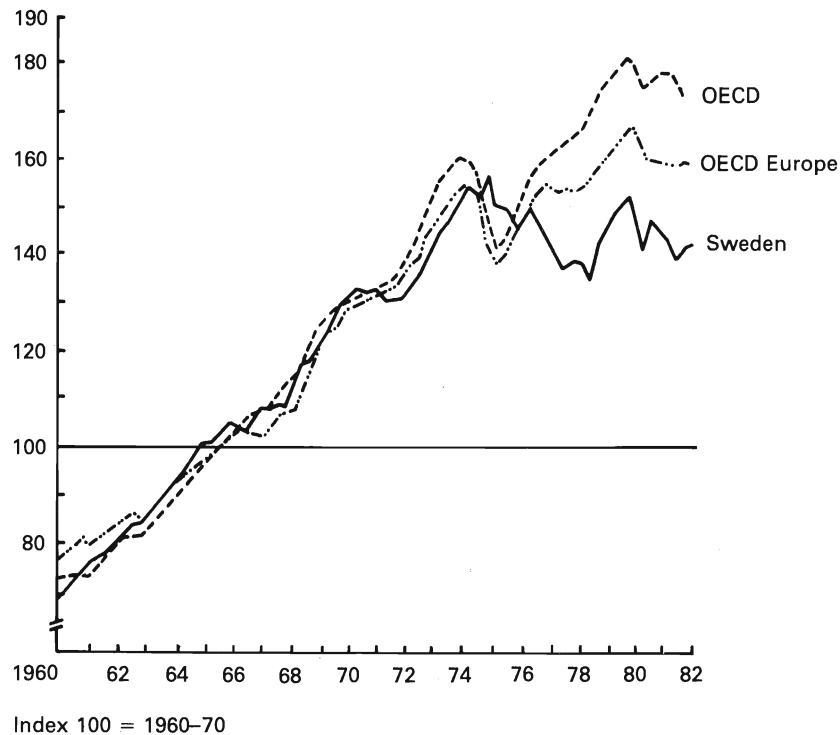
Are We Witnessing a Slow Motion Collapse of some Welfare Economies?

The most important factor behind Swedish stagflation - if I may mention a personal view - is the industrial subsidy program of the 70s. It is a completely

¹ See Holmlund, B., *Arbetsmarknad och strukturomvandling i de nordiska länderna*, (Labor Markets and Structural Change in the Nordic Countries), IUI Booklet No. 133, 1982.

² See Eliasson, G., "On the Optimal Rate of Structural Adjustment" in *Policy Making in a Disorderly World Economy*, IUI Conference Reports 1983:1.

Figure 1. *Industrial output in Sweden and in the industrialized world 1960-80.*



Source: *Policy Making in a Disorderly World Economy*, IUI Conference Reports 1983:1 (p. 17).

alien element in the old Swedish industrial policy model that was based on the idea that market-induced structural change in the production system should be allowed to take place, and even be promoted. The growth reducing effects of subsidies are so large (see Bo Carlsson's article) that they may even be the main reason for the apparent break in economic performance in Swedish industry since 1973 (figure 1).

Industrial subsidies are one part of the general business taxation system, that is subject to several ongoing investigations at the institute (see p. 120, p. 133 and pp. 135-138). Two overall conclusions come to the fore in these studies. First of all we have the distorted price signaling caused by various forms of tax wedges. This is a phenomenon recognized in all western economies, to the extent that the institute has been engaged for a few years in an international tax comparison project together with the NBER (U.S.), Institut für Wirtschaftsforschung (Munich) and the University of Birmingham. The ambition is to study the relative degree of price discrimination associated with the choice of investment object (machinery, construction or inventories), financing and type of ownership (see the article in this volume

by Lindberg and Södersten). Differences in pretax and after tax rates of return are large.

If, in addition, after tax rates of return are more or less internationally determined - an assumption that we tend to adopt for the time being in our research - the potential effect of tax distortion on industrial investment may be substantial.

Most important of all appears to be the inelasticities associated with old supply structures that in turn refer back to the allocation effects of a tax distorted price system. Simulation results on the micro-to-macro model of the institute¹ suggest that it may not mean much at all if investments now and then are misallocated. This is a normal feature of a dynamic business life. The really large, socioeconomic cost is incurred if production is carried on in loss operations locking up labor for long periods. It may be all right for the individual company if production is carried on for years as long as variable costs and a little bit more are covered. But the macroeconomic costs of depriving the rest of the economy of the product of skilled labor, and of attracting a steady stream of newcomers to the labor market into unprofitable operations, are huge. In addition to this, the scarcity (of skilled labor in particular) created artificially, props up the wages share in the economy at a level that is not compatible with continued growth in other, non-subsidized industries. Negative effects are especially large in the Swedish case when subsidized crisis industries, that would be closed down within a few weeks of a withdrawal of subsidies, still - after almost ten years - pay the highest wages in industry. Abandoning mistakes and the art of scrapping, hence, is perhaps one of the most important elements in management competence.

It is also obvious that inquiries of this kind into market allocation processes require a microbased, dynamic theory and the corresponding empirical tools.

The public sector makes up a substantial part of the regulated non-market economy that is insulated from direct contact with competitive markets. However, when the important capital markets are realigning with world financial markets, this insulation (or protection) begins to erode. At the same time, the political process demands continued honoring, during an extended stagflationist unemployment period, of welfare commitments that no forecasts foresaw when the commitments were made. The economic base for this is diminishing also because economic activities are shifting out of public control. (The unobserved economy, see p. 159).

Inflation may be slowly eroding the welfare commitments themselves but inflation is also affecting the efficiency of the production system, and is

¹ See Eliasson-Lindberg; Allocation and Growth Effects of Corporate Income Taxes, in Eliasson-Södersten (eds.); *Business Taxation, Finance and Firm Behavior*, IUI Conference Reports 1981:1.

destroying wealth accumulated by savers. At last even patient savers are recoiling and demanding a real after tax return in order not to shift their resources into better investments than nominal assets. Extensive foreign borrowing to cover domestic resource deficiencies is helping them in bringing the foreign market interest rate into the domestic economy. This will soon effectively block both inflationary and credit financing of public expansion in open economies like the Swedish one. By allowing huge deficits on public and foreign account, the public sector managers are exposing themselves to the market tests that industrial firms have always had to pass. The market rate of interest will eventually force a real downward adjustment of public spending and a new set of welfare rules. In this sense, the market exercises a disciplinary force on politicians even in a highly regulated economy. It is, however, still very important to ask whether the actual, political economic scenario, currently played in many western economies, really is an efficient way of managing an economy, and how much long-run harm to output and economic welfare that has been done in the process.

This discourse defines an urgent task for economic research - to understand the dynamics of a mixed market and non-market economy as a whole. It is, however, so difficult that some consider it to be too pretentious even to mention on the research agenda. Nevertheless, it has to be there. And it is not a job for traditional paper writing in journals. It requires well organized teams of highly qualified experts in several fields working together. That is the kind of research we attempt to develop at the institute.

3. The Market Agents

The actors in the market game are many. We have to take at least four into account.

The *business organization* (the firms, the entrepreneurs), and especially their innovative activities are central for the long-term supply growth processes. The way innovative activity and technical change affect the growth process within the firm is the prime concern of a recently started project for the Swedish Computers and Electronics Commission (see p. 156 and Fries' article). The way firms internationalize has been, and still is, under careful study (pp. 144–149). The way they are affected or afflicted by the policies of the central government is another area of inquiry (see the articles by Lindberg-Södersten and by Carlsson on corporate taxes and industrial subsidies, respectively).

The *household* is the second, important actor in the market game. It is our ambition to engage in a large study on the household as a user of *time*, *money* and *public services* or, in short, a production unit, a *consumption* body and an

investment, saving and borrowing institution (see the HUS¹ project, p. 104 and also Klevmarken's article). Parts of households' economic activity have been studied in isolation. Practically all theory of the household and all empirical research deal with individuals. Within the HUS-project, we have decided that many partial results on individual behavior based on theory may be overthrown if the most important household activities are studied in an integrated way. As is the case with the business organization, the formation, size and character of a household to some extent depend on economic factors. Human capital as a substitute for tangible wealth in intergenerational transfers is a neglected area in economics, as is a general understanding of what human capital really is. We think improved information in this area is vital for understanding what is going on in an economy subject to economic decline and for knowing what policies to enact. We have designed a very comprehensive (and expensive) field survey that has been thoroughly tested.² However, the main study is still awaiting sufficient funding.³

The public sector. The tradition in economics has been to treat the public sector as a single, homogeneous and controlled policy body carrying out central decisions. This is completely misleading for most analytical purposes and our research policy has been to depart from this tradition. (See Ysander's article in this volume.) The largest public body is the set of local communities. In most western countries they have the right to tax their constituencies and to engage in economic matters without consulting any superior political body. The ambitions and goals of these public bodies, much like these of individuals, often depart from the objectives of the central political authority. The micro agents may act to block the consequences of central Government decisions on themselves. And in Sweden the local public sector employs more people than the whole manufacturing sector. But most public bodies are effectively protected from a market screening of the value of their activities.

Rapidly growing public bodies, including the transfer in recent years of crisis industries into the public sector, diminish the relative size of the economy that is guided by markets. Furthermore, the public sector through its taxation power, exercises an enormous influence on the effective price structures of the market section of the economy and on the monetary mechanisms. This poses particular stability problems in the market economy,

¹ Swedish for HOUSE.

² Thanks to a generous grant from The Bank of Sweden Tercentenary Foundation and the Swedish Council for Planning and Coordination of Research (FRN).

³ A brief description of the project is found on p. 141. Also see Eliasson-Klevmarken *Household Market and Non-Market Activities*, IUI Research Report No. 12, 1981. A full presentation in English of what has been accomplished so far is available in the form of the renewed application to The Bank of Sweden Tercentenary Foundation filed on October 1, 1982. An edited version will be published later.

since the whole burden of structural adjustment has to be borne by a smaller and smaller share of the economy.

Traditionally, the IUI has devoted considerable resources to research in public economics, and ongoing research includes a large project of local public economics which is currently shifting towards more microeconomic analysis (see p. 134 and Ysander's article). A particular concern is the exploding deficit on public account that the public sector as a whole seems unable to handle. New financing arrangements, including privatization and decentralization of public activities, have been discussed in several IUI publications and the institute is currently beginning a study of the macroeconomic consequences of shifting to a progressive expenditure tax (see p. 138).

Other organizations – a full treatment of the market and non-market behavioral characteristics of a modern industrial economy would have to deal also with the mass of all other non-market organizations, making up the socioeconomic or institutional structures which define the rules of the economic game. This side - which is important - is currently beyond our capacity to deal with. Current procedure in economics is to tacitly assume that institutions do not change. If the market is populated by constantly changing and interacting institutional forms affecting all agents, such assumptions will often result in misleading predictions. Accepting reality as it is, on the other hand, makes the measurement problem in economics an extremely tricky one. This is the reason why data base taxonomies and survey techniques will have to be important parts of microeconometrics (see papers by Klevmarken and by Brownstone).

4. Integrating Micro and Macro - the Aggregation Problem

A unified theory dealing with all these institutions, and how they interact, is completely absent from the current social science theory theater. This is quite easy to understand. We do not even have the pieces - agent and market behavior - well treated in theory (next section) and 30 years of macroeconomics have kept the mathematically versed economists looking elsewhere.

Integrating the political decision process would mean entering the theory of public choice into the economic model. This, in turn, means digging up game theory, the development of which almost came to a halt in the 50s, due I believe, to analytical difficulties.

Neither the theories of the firm, of the individual, nor of the household have been developed with a view being integrated within the same dynamic economic theory needed to deal with time properly and to understand the dynamics of resource allocation.

A macroeconomic system with all these actors would have to be explicit in its treatment of the dynamic market processes. Theoretical development in

this area has moved in a different direction, viz. towards static competitive analysis, which is of little use when it comes to understanding the dynamics of economic behavior. A dynamic market process would have to take us beyond the fixed point and steady state concepts (equilibrium analysis) and into a situation of perhaps impossible mathematical language requirements. Process modeling that is not based on static optimizing rules is a mathematical technique that is now entering economics. The solution may have to be simulation analysis - a methodological point that is argued strongly in the new book on Disorderly Economies.

The gist of this new dynamics is to remove all traditional aggregation assumptions in economics and to bring micro-to-macro aggregation through explicit market processes into the open (cf. Brownstone's article).

To address these micro-to-macro economic problems (which are truly Schumpeterian in reach) the institute is organizing an international seminar during the fall of 1983 commemorating the 100th anniversary of Joseph Schumpeter (see p. 126).

Since several years, the institute has been carrying out an experimental micro-to-macro modeling program that has slowly become an empirically based model, suitable for the analysis of endogenized growth processes (see p. 102). So far, however, this model deals with only one type of micro agent: the firm. After a massive data-base effort, this model now operates on real firm data covering 150 real firms and close to 75 percent of total manufacturing output and employment in 1976 - the base year for simulations currently used.

A vast potential of refreshed understanding of the macroeconomic cyclical and growth processes will probably be opened up on the basis of microeconomic modeling and extensive micro data-base work. We are talking about improved methods of economic measurement. To achieve results it appears that we have to modify the theoretical concepts of economics considerably. Theory has to recognize (and quantify) the character and extent of insufficient information and the ways actors respond to it through structural adjustment. This requires a micro approach. This also means that we have to (or should) give up much of the strict optimizing assumptions now routinely applied. Agents should, of course, act rationally in theory - they do in reality - but only on the basis of information known to exist. With this reformulation, economic theory will be much less constrained as to possible conjectures than we are used to. This is most likely a property of a real economy, that we should desire to have in theory. (Equilibrium analysis imposes heavy constraints on possible conclusions. Disequilibrium or rather process analysis is not necessarily more complex, but until we have changed, improved and sharpened our mathematical tools it will be immensely more difficult. Improvements in computer languages and - as I personally believe - graphical analysis may offer attractive solutions in the future.)

5. The Permanence of Institutions

Microeconometrics is really an improved method of measurement. Macroeconomic theory and application can survive on the law of large numbers, which under certain, restrictive, market stability assumptions reduces the aggregation problem (see Klevmarken's article). Modeling micro agent behavior is far more demanding as to complexity and relevance. A micro theory that is bad leads a vastly more precarious life in a scientific test environment than does a macro theory.

On the other hand, the aggregation problem becomes smaller in the sense that the unit of measurement becomes synonymous with a decision unit and hence more permanent as to its composition. Even at this level, however, permanence appears to be a more or less doubtful attribute. Institutions tend to blend continuously with the market characteristics by breaking up and forming new combinations. This we know from our study of the interior of business organizations. We hope to know more in the future in this respect about the households from the HUS project.

The fact that micro-to-macro theory models behavior and chooses the adequate decision units lends some stability to, for instance, the business organization. The relevant notion was phrased already by Coase (1937). He argued that relative market and nonmarket performance determines the size and transformation characteristics of a business organization. Internal and external performance can be modeled and measured. Market performance (rate of return) requirements force compliance on the interior life of a firm which - if modeled properly - leads to predictable production, employment, investment and growth behavior.

The largest project team at the institute just now is engaged in research on the *microeconomics of firm behavior*: The productivity effects of information technologies in firms, with emphasis on computer based internal guidance and control systems, computer communication and the nature of the modern firm are being investigated (see p. 117). The empirical studies concentrate on very large engineering firms. There is also a special investigation of the organizational problems associated with a large construction project (nuclear power plants) and their impact on measured productivity (see p. 119). A related group of researchers is engaged in the internal investment allocation mechanisms in a modern firm, with special emphasis on the nature of foreign investment decisions (see p. 148).

These projects will draw on and improve upon the data bases built around the micro-to-macro modeling project for econometric analysis.

6. Further Advantages of Microeconometrics

One aspect of the current practice of estimating macro theories on time series data, that have been aggregated in public bureaus of statistics, is that much of

the information collected is effectively killed. Much more knowledge could have been obtained if theory and estimated models had been allowed to reach all the way down into the underlying data sets. This underlines one important point. Micro-to-macro theory is superior to aggregate theory in utilizing information for a better understanding of what goes on at the macro level. Understanding the dynamics of the allocation process is the standard example that we have given.

Another aspect of the same thing is that macro theory as a rule is consistent with several conflicting micro based theories (hypotheses) that you cannot discriminate between, on the basis of a test based on the macro version of the same theories. Normally, the underlying micro structure is needed to derive useful policy rules.

Therefore, macro theory has little discriminatory power as to policy conclusions. On the same ground, micro based theory and the efficient use of micro data sets to estimate these models will leave much less room for bad theory. Tests will be more powerful in throwing out bad theory.

In addition, the quality (reliability) of micro data bases tend to be superior to that of aggregates. Statistical sources used by observation units themselves are normally sampled in the study of firms. We have several good examples of this from the micro-to-macro modeling project.

In a micro based model, like all process models, much of the information content is carried by the *initial data base*, compared to a macro model where most information is compressed through aggregation assumptions into the estimated coefficients. The influence of the initial data base repeats itself throughout the dynamic model processes, as agents respond to initial conditions and update their state for the next period decision and so on. Hence, the quality of direct measurement, that enters into the initial data base, dominates the econometric problem of dynamic micro-to-macro modeling. This may at first sight appear as a drawback, and lack of robustness. In one sense this is true, since errors of measurement, in terms of data base inconsistencies - among firms and sectors affect macro predictions. This robustness - or lack of robustness - can be investigated by studying the propagation of initial (stochastic) noise through dynamic sequences.

If, however, the economy responds very differently to the same parameter changes depending upon in what state they are enacted (policies carried out under different cyclical conditions, for instance), then we do not want to remove that quality of a model by assumption. It should be there and the investigator had better roll up his sleeves and work on improving his data base rather than changing his model. Microeconometrics requires a work effort as in all good laboratories.

Microeconometrics, hence, is something much more broadly defined than the application of least squares methods on economic data which has traditionally come to be associated with econometrics. Theory and good data base taxonomies must be an important part of this kind of research. Sample

design, data base organization and quality enter as perhaps the most important contribution to success (see Klevmarken's article). The pure statistical estimation side becomes only one side of a vastly more complex research design. The advancement of new measurement methods will set the pace of advancement of both theory and understanding. This is not surprising at all. It has always been true in science.

THERE IS A NEED FOR APPLIED MICROECONOMETRICS

– Survey Research about the Household

by Anders Klevmarken

”Year after year economic theorists continue to produce scores of mathematical models and to explore in great detail their formal properties; and the econometricians fit algebraic functions of all possible shapes to essentially the same sets of data without being able to advance, in any perceptible way, a systematic understanding of the structure and the operations of a real economic system.”

W. Leontief

(In Science 1982)

1. Introduction

Economics has become a science highly influenced by mathematical and statistical methods. Being an empirical science, good knowledge of mathematical and statistical methods should yield great benefits to the advancement of economics. Mathematics and statistics, however, require an investment in human capital, that is time-consuming to the extent that many economists never get beyond the investment stage. The danger lies in losing contact with economic realities.

It is argued in this paper that understanding *aggregate* ”facts” like unemployment, inflation, deficits in the balance of trade and the government budget is not likely to improve very much from the application of new desk theories to the old aggregate data. Too many theoretical constructions will always be consistent with a given set of aggregate ”facts”. Analyses of *micro* relations, both theoretical and empirical, will pay off much better in terms of accumulated knowledge of economic behavior including better insights about macro-economics.

An increased interest in applied micro-economics already appears to be growing within the economics profession. This is discussed in section 2. In section 3, the particular need for household micro-data is argued and in section 4 problems of collecting and using micro-data are discussed. Section 5 offers a few concluding remarks.

2. A New Interest in Micro-economics

During the 50s and 60s, business cycles and economic growth dominated the interest of the economics profession. Econometric models were first built to explain and forecast the business cycle. The early macro-models designed by

Tinbergen, Klein and others with only a few equations were followed by much larger and more sophisticated models. During the 60s a shift of interest towards problems of economic growth could be observed. Large economic models originating in input-output analysis were built to analyze medium and long-term balance problems. Today these models are used more or less routinely in economic planning and forecasting in many countries.

This development in economic theory and application was parallel to – and was made possible by – a similar development of national accounts, statistical methodology and in computer technology. In many countries, national accounts have been extended and refined to the extent that it is now possible to follow commodity and money flows in much greater detail than immediately after World War II. The compilation of input-output tables has apparently added much useful information to the accounts and at the same time increased consistency and reliability. In spite of this improvement, however, serious measurement errors in the national accounts remain.

The development of econometric methods during the 50s and 60s was completely dominated by the interest in macro-economic applications. The early textbooks in econometrics all concentrate on single equation and system methods for estimating macromodels from time series data of the national accounts type. Since Haavelmo's early contribution to the theory of estimation and testing in stochastically dependent equations, numerous estimation methods have been suggested, most of them based on either least-squares or on maximum likelihood criteria.

The rapid expansion of the capacity of computers made possible the practical application of these statistical methods to larger and larger models. However, even with modern computers we find it difficult to use full information methods for very large models with many parameters. The result is that for these models econometricians have resorted to relatively simple single-equation methods.¹

In the 70s a new interest for applied micro-economics developed. There were several reasons for this.

First, there has been an increasing interest in the distribution of income and wealth. Since industrial economies have experienced slow economic growth or no growth at all during the 70s, the questions of who should benefit from the small increase in our total resources, and who should give up benefits when our resources decrease, have become much more important than before. Parallel with this interest in distributional problems goes an increased concern with labor market issues, in particular job security, equal rights and female labor supply.

¹ Another reason against using full information methods is that they are not robust against specification errors. The effects on the estimates of a specification error in one part of the model are transmitted to other parts.

Second, econometric macro-models have failed to give reliable forecasts, in particular during the 70s. The economists' view of the possibilities and limitations of macro analyses, based on national accounts type data, has become more realistic. There are several reasons for this. One is a greater awareness of the measurement errors in national accounts. Much work has therefore been devoted to refining the national accounts. Sweden is one example. But the revisions made also reveal the magnitude of the errors built into the accounts. Sometimes these revisions have well exceeded normal annual changes in the series.

Equally important, however, is the low informational content of aggregate macro data. We frequently find it difficult to discriminate between models with very different implications for economic policy. Examples are models for wage and price determination, demand for consumer goods and for investment behavior. Since aggregate data tolerate a wide class of models the choice between them has to be based on other criteria than those implicit in statistical tests. These difficulties arise partly because the aggregation process gives smooth series with common trends and partly because most national accounts series are relatively short. This situation may improve partially as time passes and the data series lengthens. But in practice, new definitions adopted occasionally limit or prohibit the use of long time series. Breaks in the data series do not only reflect improved measurement methods and availability of new information. They also reflect real changes in the economy. Even if one can chain old series numerically to new ones, there are reasons to doubt if this is meaningful. Take, for instance, a series of household expenditures on consumer durables. Would it make sense to look at expenditures during the 30s and the 80s as observations on the same variable? Much of what now goes into the category "consumer durables" did not exist during the 30s and many of these commodities satisfy new needs of the consumers.

With such data problems it is not difficult to understand why econometric macro-models have not proved to be as useful as economists and econometricians originally expected. But there are more fundamental problems with econometric macro-models. The national accounts give, by the definitions of the accounting system, a set of constraints on the macro variables, which in a model framework, usually takes the form of a number of definitional equalities. The important relations in a macro-model are, however, the behavioral and so-called "technical" relations. These are frequently based on an economic theory developed for a single consumer or firm or with assumptions of markets in equilibrium – a theory which is then applied to macro data often without even discussing the aggregation problem. (See also Brownstone's paper in this volume.)

This procedure is analogous to regressing the number of annual lung cancer cases on the total expenditures on tobacco (in fixed prices) to analyze the effect of smoking on cancer. If the epidemiologists and cancer specialists

had been satisfied with this kind of analysis we would have known very little today about smoking and cancer.

Although we observe a certain stability in estimated macro relations it is not at all impressive. On the contrary, we frequently find that parameter estimates change in value when new data are added and that forecasts based on macro models only are marginally better than naive forecasts. The difficulty of the models from the 60s to explain the economies of the 70s and 80s is one example. The concept "structural change" is well-known in econometrics.¹ This relational instability indicates a lack of autonomy of the macro relations in the Haavelmo sense (Haavelmo, 1944). Macro aggregates probably hide fundamental changes in the economy, which can only be revealed and analyzed with micro-data.

Data shortage has constrained empirical applications of micro-economics. Although cross-sectional surveys of consumer expenditures and savings, labor force surveys and various surveys of industry and trade have been performed in most countries, they have not been designed for research, and their accessibility for research has been rather limited. However, a slowly increasing supply of micro-data, designed for research purposes, now adds to the growing interest for applied micro-economics. In particular, there are a few American longitudinal data sets which have been repeatedly used in the last decade (The Michigan Panel Study of Income Dynamics, The National Longitudinal Samples, the NBER-Thorndike Sample and Social Security Administration Data). In Sweden the level of living surveys have recently attracted the interest of economists.

Additional reasons for economists' reborn interest in micro studies is the capability of modern computers to handle large data sets and new statistical methods developed for analyses of these data. This will be discussed further below.

3. A Need for Household Data

The increased interest in micro-economics has given an impressive array of results in labor economics. The human capital theory developed by *inter alia* Becker, Mincer and Schultz has produced a wealth of empirical results on earnings, wage distributions and labor supply. Most of these results have been obtained using American data but there is now an increasing number of studies from other countries as well. The development within this field has also gained a higher degree of realism through the so-called search and contract theories. Modeling micro behavior gives an incentive to take

¹ If a parameter estimate changes more than can be attributed to chance when new data are added to the sample, there is an indication of structural change. Since econometric work usually involves a search for a good model specification the standard errors, t-values, etc., usually reported are conditional on the final specification. This implies that these measures might greatly understate the true uncertainty of our estimates.

institutional constraints into account and thus give a greater realism to the analysis.

Much methodological work has also been done in connection with these applications. See, for instance, research on truncated or censored data or on selectivity problems surveyed in Amemiya (1981), Heckman (1976), Manski and McFadden (1982).

Studies of household savings and consumption decisions have a long tradition in economics. Empirical studies of household budget data date at least back to the work of Pierre Le Play (1806-82). In the last few decades research within this area has, however, not been as interesting as in labor economics.

Much effort has been devoted to analyzing aggregate time-series with all the difficulties already mentioned. Micro-data on consumer expenditures have not been used for anything much more sophisticated than classical Engel curve analyses. Recent advances in the theory of family economics might, however, offer new promising research opportunities. This is an approach which incorporates several aspects of household behavior in addition to savings and consumption behavior, namely marriage, household formation, children, schooling, occupational choice, labor supply, household maintenance and leisure activities. Also here, much inspiration comes from the work of Gary Becker, see for instance Becker (1981).

The micro simulation approach belongs to another school of thought which has also argued the need for micro studies. See for instance Orcutt et al. (1976) and Bergmann et al. (1980).

Government statistical agencies produce detailed statistics on industry production, trade and the public sector but much less statistics on the household sector. Compared, for instance, to its share of GNP much more information should be produced about the economic situation of households. One reason for the shortage of such data is the difficulty of obtaining reliable information from households. Contrary to business firms and public authorities households usually do not keep records or make up explicit plans which can be used as an input to data gathering. Depending on what data are asked for they are also more or less reluctant to cooperate. The fear for invasion of privacy causes both difficulties in survey work and constraints to be put on our possibilities to merge and use household data already available in various data files. The number of households and their small size also make data collection expensive, even if it is done on a sampling basis.

Although there are great difficulties involved in collecting household data, new efforts in overcoming them would most certainly pay off. In the end, economic policy aims at increasing the well-being of households. Statistical information about household behavior and well-being is needed to know what policy to follow and how successful it is.

In most countries we find occasional surveys of consumer expenditures, household savings and labor force surveys. With almost no exception these

areas are studied in separate surveys, i.e., a new sample is drawn for each survey. To analyze how the activities and decisions of a household are interrelated we would rather need data on labor supply, earnings and other incomes, savings, consumption and leisure activities for each household. To estimate simple descriptive characteristics of the finite population of households separate surveys are sufficient, but when we want to explain household behavior, and thus need to study relations, more data are needed for each household.

At each point in time we can think of the household as having resources in the form of time, human capital and (financial) wealth. These are used in the labor market, the goods market, the money market and during leisure time, partly to build up new resources and partly for consumption. This is schematically illustrated in Figure 1. Resources in the form of human capital and wealth are initially determined by family background and schooling. These resources are jointly used with time in the labor market to earn income and for investment in market oriented human capital. Labor income, capital income and transfer payments are used for saving activities in the money market and purchase activities in the goods market. Finally, resources are also used during leisure time for maintenance activities, non-market oriented investment activities and pure pleasure and recreational activities.

Figure 1 is not a model of household behavior but just a simple illustration of some of the relations between the activities in which a household participates. Depending on the focus of analysis one can rely more or less on the *ceteris paribus* assumption, but, in general, all household decisions are interrelated, particularly in a life cycle perspective. Data which would make possible an analysis of the strength of these interrelations are not yet available anywhere.¹

The observational unit should be both the household and each household member. The Panel Study of Income Dynamics has shown that the single most important factor in explaining changes in economic well-being is family composition changes like marriage, divorce, death and childbirth, and not as commonly believed, unemployment or changes in pay.

Whether we are interested in the distribution of economic well-being or in explaining household behavior, it is obviously impossible to disregard the household as a "production unit" or the other implications on behavior of the existence of a family. For instance, it could be argued that for the explanation of wealth accumulation and transmission of wealth between generations, an extended family concept is relevant. With individual data only, it will not be possible to see the family influence on economic decisions.

¹ The project Household Market and Nonmarket Activities (HUS), see p. 104 in this volume, was designed to analyze the interrelation of these different aspects of household behavior. According to plans a new household survey would become the first wave of a longitudinal study. The research program can be found in Eliasson and Klevmarken (1981) and an account for the design and the results of a pilot study in Klevmarken (1982).

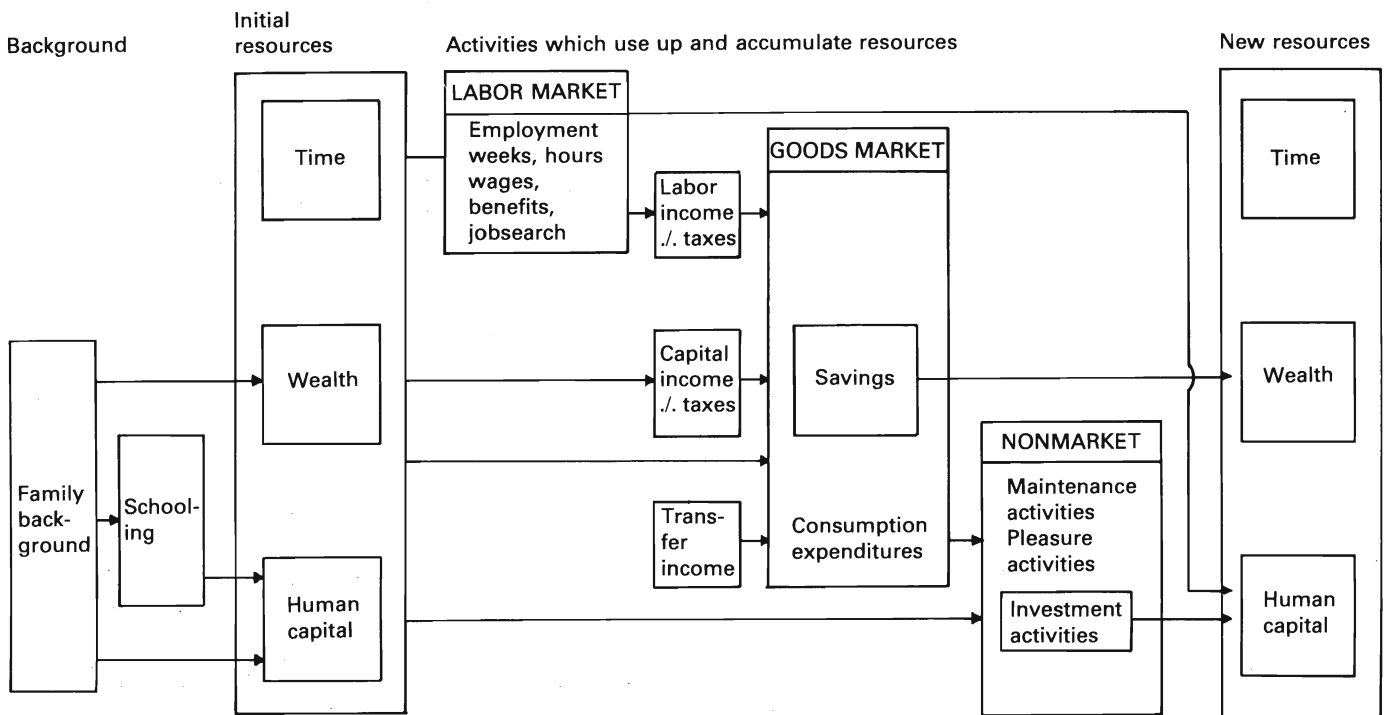


Figure 1. Use and accumulation of household resources in market and nonmarket activities

For studies of the distribution of well-being we can use single cross-sections, but for analyses of the dynamics of household behavior we need repeated observations. With repeated cross-sections we can gain a better understanding of the differences between cross-sectional and longitudinal relationships. It is, for instance, possible to estimate the effects of age, period and cohort, i.e., distinguish between the effects of aging, more or less lasting differences between generations, and temporary effects which influence more or less all birth cohorts (Klevmarken, 1981). Longitudinal data are, however, needed for a truly dynamic analysis. New economic decisions depend on past decisions and experiences, which are best observed directly in a longitudinal design rather than indirectly through retrospective questions. Experiences from the Panel Study of Income Dynamics show that also relatively simple descriptive studies of panel data force us to change our mind about economic behavior (Duncan et al., 1982). The mobility by income and job, and in and out from social benefit programs revealed by panel data is noteworthy.

A few decisions are made only once or a few times during the course of life but have lasting economic consequences for the household. They include education, marriage, childbirth, divorce and even purchase of a house. To explain these decisions and their effects on other decisions and on economic well-being, we would ideally need to observe the household both before and after the decision was made. With longitudinal data it is possible to analyze, for instance, joint decisions about market work and fertility. With longitudinal data on two generations we can analyze the controversial effects of economic, social and cultural background on the economic well-being of the new generation.

Panel data also make it easier to control for unobserved individual differences and thus reduce the effects of certain specification errors. Personal characteristics like "intelligence", "ambition" and "drive" are likely to influence earnings. If these characteristics are unobserved but correlated with other variables which also explain earnings, like schooling and experience, cross-sectional estimates of the effects of the latter variables will be biased. If these personal characteristics are stable over time and there are no interactions between observed and non-observed variables, unbiased estimates of the effects of the observed variables, can be obtained, if the model is estimated in first difference form. This requires, however, at least two observations on each individual.

The great advantage of microdata is *not* the gain in degrees of freedom. The most urgent task is not to reestimate the old macromodels with new microdata to enjoy a higher precision in the estimates. That precision is likely to be misleading. It is much more desirable to take advantage of the rich *variability* in microdata. Individuals are different, households are different, and firms are different. No longer do we have to concentrate exclusively on the average economic man. The dynamics of economic progress might well

be found in the tails of the distributions or in the existence of a dispersion. Used in this way, microdata will move the analyst in a direction towards greater detail and realism. The number of "unknown parameters", however, will increase accordingly.

4. Collecting and Using Microdata

4.1 Response and Privacy Issues

Microdata become available in two ways, either from already existing registers, usually collected for administrative purposes, or through a new survey. Modern computer techniques offer access to register data, but they do not solve all of the problems. Since these data sets were not collected for research they usually do not include all relevant variables and their definitions might not be ideal. The combined use of several registers usually makes analyses easier. If the same individuals can be found in more than one data set, exact matching can be used.¹

If registers do not include the same individuals but each register is a separate sample, the combined use of these samples becomes more difficult. There are techniques like statistical matching, imputations and predictive methods, but they all have the unavoidable disadvantage that the unobserved correlations are replaced by various assumptions. For this reason, these methods are likely to be most useful in a model based approach, i.e., when inference is not only based on the sampling design but on a subject matter model, for instance an economic model, which provides the theory for these assumptions (see also below).

Protection against invasion of privacy is a problem with both types of data. Legislation puts constraints on how data sets can be merged. There are also constraints on what data can be collected and stored in a computer. The public debate about the privacy issues has developed a consciousness of the general public and even created an unjustified hostility towards surveys and computers.

The nonresponse problems have become severe. To meet these problems, the research community has to demonstrate concern for integrity in its actual use of sensitive data. We also have to spend more time on the dissemination of results to a wider audience, to show that research based on microdata is useful and that there is no threat to personal privacy. In addition, the nonresponse problems can be met along more traditional lines by way of motivation and persuasion. Since research usually has no immediate and direct return to the individual respondent, it might become necessary to use gifts and payments to gain their cooperation. The more frequent survey

¹ The matching procedure is exact in the sense that there is a unique identification concept. Errors also occur in exact matching.

activities become, the likelier it will be that some kind of remuneration to respondents becomes necessary. This will increase the already high costs of survey research, which is something research funds will have to get used to. Also, it will bring about a more careful planning of this kind of research and an even harder priority ranking between research projects.

After a survey is completed, nonresponse problems can also be dealt with by analytical methods. In principle, these methods include an effort to model response behavior and then to use this model to correct for selectivity bias. Before going into this in more detail, it might be useful to take a broader view on the inference problem in survey work.

4.2 Principles of Inference

Traditionally there is a difference in view and emphasis between survey statisticians and econometricians. Survey statisticians are usually interested in an inference to a finite population. They want to find out *what* was. In classical sampling theory there is only one random experiment, namely the sampling procedure. Economists and econometricians are, however, usually not very interested in the finite population of households, firms, etc. but rather in more fundamental economic "laws". They want to know *why* things were the way they were. Population values are treated as realizations of an underlying stochastic model. As a result, the sampling procedure no longer plays a dominant role in the econometricians inference theory. In principle, there are two random experiments which need to be modeled - (1) drawings from the underlying random process (i.e. from the super-population), and (2) sampling from the finite population. It is sometimes justified to neglect the second experiment. This is the type of inference theory we find in most textbooks of regression analysis. In these, there is usually no mention of either sampling design or of a need to weigh the observations inversely proportional to the selection probabilities. Without going into detail, this approach turns out to be correct if the selection probabilities do not depend on any of the endogenous variables of the super-population model, i.e., if the two random experiments are independent. This is not the case for instance when there is self-selectivity. Then the sampling design will also influence inference to the super-population.

There are thus two main differences between the two approaches. One is the difference in interest, the finite vs. the infinite population, and the other the willingness to make assumptions about the universe. The inference theory becomes very different if one is willing to assume that the observations were generated by a linear model as compared to the problem of estimating the least-squares regression line which could be fitted into the entire finite population, whether the observations were generated according to a linear model or not.

In sampling practice one is usually reluctant to bring in untested assumptions about the universe, while in econometrics this has become habitual. In recent years, more emphasis has been placed on a *model-based sampling theory* which brings the two approaches closer together. *A priori* information is brought into design and estimation through a super-population model (Royall, 1970, Smith, 1976, and Cassel, Särndal, Vretman, 1977). The use of models in sampling theory is the subject of debate. It has, for instance, been suggested that one should distinguish between a *model-based* approach and a *model-dependent* approach. In the first case, a combination of design and estimator is chosen which gives consistent estimates *even if the model is unsatisfactory*. *A priori* information is only used to increase efficiency. In a model-dependent approach one might gain even more in efficiency but at the expense of inconsistent estimates if the model would be misspecified. The focus is, however, still on estimating characteristics of the finite population.

Which approach one should prefer is a matter of research strategy and philosophy of science. Is economics such an advanced science that it is justified to assume relatively stable relations or "laws" or do we always have to look upon our results as more or less unique to time and place?

Suppose that we ultimately want to generalize from the finite population to human behavior in a more general (but somewhat unclear) sense. One issue is whether we should do this within the framework of statistical inference or in a different way. Statistical inference then requires an assumption of a super-population model for which one might have more or less justification. If the statistical analysis is limited to the finite population no formal assumptions about a super-population are needed, but any generalization beyond the finite population must rely on some kind of implicit assumptions. An advantage of the super-population approach is that they are made explicit. A possible disadvantage is that the analyst is easily led to make assumptions for mathematical or computational convenience.

A comparison between two statistical methods is frequently based on criteria like consistency bias, variance and mean-square error. In this case the application of these criteria is not straightforward, because the method used to generalize from the finite population has not been specified. There is no common basis for a comparison. One way out might be to compare predictions from the estimated super-population model with the estimated finite relationship.

If it can be assumed that the functional form of the finite relationship is the same as the expected relationship in the super-population model, then the difference between the two approaches stems from the assumptions about the stochastic properties of the super-population model. Given that these assumptions, as well as the assumptions of functional form, are realistic, the super-population approach is likely to make more efficient use of data. But, if they do not hold, systematic errors are, in general, introduced in parameter

estimates and predictions, and the outcome of a comparison based on the mean-square errors is not obvious.

It is sometimes argued that the finite population approach would be more robust against specification errors in the functional form. This is dubious. Suppose that data were generated by a regression model with two explanatory variables but that the relationship fitted only included one of these. Also, assume that the estimates of the included slope parameter are compared. It cannot be difficult to find a true model and a sampling design for which the bias would be larger with the finite population approach than with the model-dependent approach.

In practice, an economic model is usually not estimated in one step only, but the final estimates are arrived at through a search procedure. In econometrics it is common to seek protection against specification errors by pre-testing key assumptions about variables to be included, normality, independence of error terms, etc. In the finite population approach one might also test, if a population regression slope is close to zero, i.e., if the corresponding variable should be excluded. Since the stochastic assumptions behind the two approaches are different, a common test statistic will not necessarily have the same properties and the two approaches can, in principle, result in different specifications of the functional form.

Another consequence of pre-testing is that part of the informational value of the data set is used up for the pre-test, and the efficiency of the estimates of the final model is lower, compared to a situation when no pre-test is needed. In most published work this reduction in efficiency does not show, because it is customary to publish estimates conditional on the assumptions of the final model. Since a super-population model usually involves more assumptions, pre-testing is perhaps more frequent in this approach. The gain in efficiency from a model-dependent approach vs. a finite population approach might thus be smaller than we are led to believe. Also, published results from both approaches tend to overstate the confidence we should have in them. What we perceive as structural changes might well lie within the limits of random variation.

A discussion of the principles of inference from economic survey data invoke basic issues in economic research which economists discuss too seldom. What role is given to economic models and how stable are they in time and space? These principles also have very practical implications for the choice of estimation and test procedures which in turn determine what results we will get. Additional analyses and discussions are needed.

In addition to these general problems of statistical inference, and compared to the traditional analysis of aggregate time-series, microdata offer new statistical problems to the econometrician. For instance, survey variables are frequently discrete, truncated or censored. There are response errors and other non-sampling errors. Indicator- and proxy-variables need particular models and methods. Selectivity is usually a severe problem. The

sampling design might imply a more or less complicated weighting system, etc. Much work has already been done to solve these problems. In particular, there are now a number of models and methods for limited dependent variables and various selectivity phenomena. From a sampling statistician's point of view the treatment of nonresponse is of particular interest. The approach adopted is to model response behavior as well as economic behavior and estimate these partial models simultaneously as one integrated model (Little, 1982, and JASA, Vol. 77, 1982). Nonresponse is just one particular form of self-selection, which is part of human behavior and could be subject to explanations as well as other forms of human behavior. The result is consistent, or sometimes even unbiased, estimates of the economic model.

There are, however, disadvantages. The sampling frame must include the supplementary data needed to model response behavior. The approach is model specific, which means that the sampling weights cannot be adjusted for nonresponse once and for all but each analyst must go through relatively complicated and expensive computations. Finally, the resulting estimates might not be robust against specification errors in the response model.

However, faced with the prospects of low response rates in household surveys, this is an approach we will have to adopt and build into our designs in spite of its drawbacks. Good sampling frames could be obtained from the rapidly increasing number of (administrative) databases. The computer bills are becoming less of a problem with new programs and computers. If methods are developed which build on less rigid assumptions about distributional properties, the sensitivity of these methods to specification errors might also be reduced.

Most of these methods belong to the maximum likelihood family and, more specifically, they usually assume normal distributions. The normality assumption is often difficult to justify except for its convenience. On the contrary, there are sometimes reasons to assume a non-normal distribution. With large data sets it should be possible to leave more to the data and use methods which assume less about functional form. More research is needed to develop such methods.

5. Concluding Remarks

Additional emphasis on microeconomics and applied microeconometrics will not necessarily give an immediate pay-off in improved economic policy. We will face new theoretical and methodological problems which will take time to solve. Human behavior is so variable that it will become difficult to isolate stable micro relations. Micro behavior is probably best interpreted as probability or frequency relations. The need for microeconometrics does *not* imply any need for macro analysis or other approaches. However, the micro

approach makes a close analysis of real decision makers possible. The ways their decisions are constrained by institutional realities can be uncovered rather than be buried by the smoothing filter put on by aggregation. *Rich micro data will leave less room for bad theory.* We could hope to get in a better position for judgements on the stability of macro relations and on the likely direction and speed of structural changes.

Methodological issues have to be addressed, both concerning the principles of inference and more technical problems. More than previously, econometricians will benefit from methods developed within other disciplines like, for instance, survey sampling and multivariate methods for behavioral research. An increased interest in micro behavior will more generally lead to inter-disciplinary work. There are many aspects of human behavior which usually are not treated by economists but contribute to the explanation of economic behavior.

New micro data are essential. This means that the funds needed for economic research will approach those needed in science. There will also be a need for a certain coordination of research efforts since everyone cannot make their own surveys. The increased competition for funds and the necessary coordination of research will repel many researchers within and outside the economics profession. But are there any alternatives?

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THE MICRO STRUCTURE OF THE PUBLIC SECTOR

– On the Role of Local Authorities for Macroeconomic Stability

by Bengt-Christer Ysander

1. "Who Governs Local Governments?"

Two notions about local governments - contrary but both simplistic - are common in traditional economic literature.

According to the *first* notion, local governments can be viewed as simply an extension of central government. Public consumption and investment can be treated in total as policy instruments for the central executive power. This is in fact the treatment still accorded local authorities - in e.g. the government's medium term economic plan in Sweden. The same is true in most other industrialized countries. This official fiction of a centralized control of public money is often also accepted and integrated in textbooks in economic theory, even in some of the books and papers explicitly dealing with fiscal policy and public finance. The contrast between this theoretical idea of centralized control and the real picture of decision-making in local authorities is perhaps nowhere more apparent than in Sweden, where 308 independent local governments are responsible for the major part, both of household taxes and of public real resource use and has tended to expand much faster than any other sector in the economy.

According to the *second* popular notion, local government choices are merely an indirect expression of consumers' preferences for social services, within an extended budget restriction, including all disposable income left after central government taxes. The local councillors are merely executing the wishes and the willingness to pay of a club of voters. This is not merely the idealized standard for local democracy but also the starting-point for many econometric attempts to determine local government expenditure.

By now, we all know that neither control from above - central government steering - nor control from below - voter determination - is complete or indeed easily identified. We know many areas, where responsibilities overlap, and where sluggishness or rigidity in local government planning and execution often makes it hard to distinguish the decisive influences *ex post*. With the slow-down in economic growth during the second part of the 70s and the consequent pressure exerted on public finance the question of controlling local expenditure became a focal political problem in many countries.

In June 9-10, 1981, IUI hosted a meeting of experts from the U.S., the U.K. and Sweden. The aim was to discuss and evaluate experiences from the respective countries on the control of local expenditures. The three countries

exemplify rather different aspects of the contrived problem. In the U.S. of tax revolts and tax limit proposals, the emphasis in public debate has been on voter control. The question has been raised whether there is a danger of local government expenditure outrunning voters' intentions – or running in the wrong directions. In Sweden with a much larger local government sector there seems to be less suspicion from below – but more anxiety from the central government level concerning the possibly destabilizing effects of a too fast expansion of local governments. In the U.K. finally, the pessimists would say they have the worst of both worries - inefficient central control over local expenditures and a very weak voter control over local taxing. These differences were spelled out clearly by the participants in the IUI Conference.

2. Controlling Local Government Expansion

USA

In the United States – where local government expenditures account for less than 10 percent of GNP and where the share decreased slightly during the 70s – politicians want to make sure that local expenditures do not grow more than voters are willing to pay for. Professor Edward Gramlich, University of Michigan, has studied how, and why, local government expenditures have sometimes become "too large" from a voter's point of view. He concludes that, with the exception of the rapidly growing welfare payments, the expenditure growth per se is, as yet, not in conflict with the desire of voters. Hence, there must be other reasons behind the decisions to put a ceiling on tax rates and expenditure growth in a number of American states. (Gramlich, 1983.)

Professor Wallace Oates, University of Maryland, who has studied the American tax revolts, interprets the tax limitations as consequences of income distribution problems, associated with local real estate taxes. In addition, he contends, there is a general suspicion of a widespread wastefulness within the public sector. (Oates, 1983.)

One possible way of checking local government expansion could be to privatize some of the services offered. Dr. George Peterson, Urban Institute in Washington D.C., has examined the attempts made in this direction in the U.S. In some East Coast states, worn-down public dwellings have been transferred to private ownership. This led, in many instances, to improved neighborhood services and a face-lift of the local area. Experiences from garbage collection service show, however, that the most efficient way is to place contracts with private companies. (Peterson, 1983.)

England

In Great Britain, where the share of local government expenditures in GNP has been slightly larger than 10 percent since the early 70s, a main concern

has been that the growing public sector would crowd-out the private industry from the labor and capital markets. There has also been much talk of "financial irresponsibility", associated with the fact – according to professor Peter Jackson from Leicester – that those local residents, who vote for more expenditures, only contribute one-sixth of the real estate taxes - the main source of tax income – while the rest are paid by business companies. (Jackson, 1983.)

According to Mr. Noel Hepworth, the attempts of the British central government to control local government expansion by way of tightened state subsidy regulations and cash limits have not had the intended effects. They have in many instances led to a political confrontation between local authorities and the central government. Mr. Hepworth contends that the main fault with the control attempts up till now has been that the subsidy system (1) is too detailed and too complex, (2) has been changed too often, and (3) leaves too much room for political arbitrariness. A continued escalation of the conflict between local and central authorities could lead to a strong centralization of expenditure control and put an end to local economic autonomy in Great Britain. (Hepworth, 1983.)

Sweden

In Sweden, both the proportions and the character of the problems are different. The share of local government expenditures in GNP has doubled in the last 20 years. It now amounts to approximately one-third. Local governments, including their business enterprises, now employ more people than the entire Swedish industry. Domestic consumption growth has to be checked in order to handle the imbalances in state budget and current accounts, and part of this restraint must be born by the local governments. We need to know more about what determines local government growth and what means the central authorities really have to control development.

Bengt-Christer Ysander and Tomas Nordström, IUI, have simulated local government growth in the 80s. (Nordström, Ysander, 1981.) They assert that several of the determinants of the rapid local public sector expansion during the 70s will change over the next decade. Population changes will to a lesser degree give rise to "automatic" increases in expenditures. Also, relatively moderate wage increases could lead to a more favorable cost development for local governments. They also stress the fact that the local government sector may, to a greater extent than before, give rise to, or reinforce, "domestic business cycles". Finally, as regards the instruments of the central policy authorities, cut-backs in state subsidies may have the same restraining effects on total domestic consumption as raised payroll taxes, but do not significantly change the public versus private share. The desired reallocation between private and public consumption is best achieved through limitations of local taxes.

The effectiveness of the present system of central control of local governments has been studied by Richard Murray. (Murray, 1981.) The immediate cost increasing effects of new regulations are often counteracted by a lower rate of growth of the expenditure area in question. There are, however, significant differences between regions as regards the effects of changes in state subsidies. Concerning state control of total, local government outlays, there is some doubt whether the voluntary agreements on limitations in local tax increases, which were tried in the 70s, had any effects whatsoever on the actual expenditure growth.

3. The IUI Research Program on Local Governments

The international conference was part of a broad research program at IUI which is now concluded, and the results being successively finalized and published.

The first phase of this program consisted in the collection and analysis of statistics for local government development in Sweden during the 70s (cf. Ysander, 1979, and for a summary account, Ysander, 1980).

In second phase local government behavior was studied econometrically. The determination of local government expenditure was analyzed from cross-section data by Murray (1981a) while a model of aggregate spending and taxing was estimated from timeseries data by Mellander and Ysander (cf. Ysander, 1979, and Nordström-Ysander, 1981). Supporting studies were also made of public budgeting matters with particular attention to ways of meeting the increased need for flexibility (cf. Ysander, 1982, and Robinson-Ysander, 1982).

In the third and final phase an attempt was made to relate local government behavior to the rest of the economy focusing in particular on its role for macroeconomic stability. We have already mentioned the international conference whose discussions centered around these issues. In the work of Nordström and Ysander (1981) the local government model was incorporated into the institute's macro model to enable simulation studies of the interaction between local authorities and the private sector. A survey and analysis of Swedish post-war experiences of central control of local authorities has also been carried out as part of a cooperative Nordic research effort initiated by the Nordic Economic Research Council (Murray-Ysander, 1983). One result of that study is to stress the change of business cycle impact in the stagflation of the 70s. From having on the whole contributed to a stabilization of total demand in the first post-war decades, the local governments in the 70s seem to have had rather a destabilizing impact on total demand fluctuations.

Although earlier research plans have now been carried out, there is at IUI a continuing interest and research activity directed towards the microeco-

nomics of local governments. Within the Nordic research program, already mentioned above, an attempt at a more ambitious econometric modeling of local government behavior will be started this summer at the institute. We hope that the insight provided by this work will enable us later to get a better understanding of the intricate network of interactions between different local authorities, between different levels of government and between private and public resource use.

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JOB MOBILITY AND WAGE GROWTH

– An Application of Microeconometrics

by Bertil Holmlund

1. Introduction

The growing availability of panel data and recent econometric advances in microeconomic methodology have made it possible to shed new light on a number of classical topics in labor economics, for example the causes and consequences of job mobility and the relationships between unionism and wages. This paper reports on a study of labor market mobility, with focus on male Swedish workers.¹

The study has two interrelated objectives. The first is to explore the role of expected wage gains for mobility decisions. The second aim is to investigate the effects of mobility on subsequent earnings. Do workers actually gain by moving or had they done better by not moving? This information, in turn, will illuminate the relationships between life cycle earnings profiles and life cycle patterns of job mobility.

The study extends beyond the standard, "naive" approach in mobility studies, where earnings differentials between stayers and movers are captured by a dummy variable in an earnings function. A tacit assumption in this traditional approach is that the computed wage differential (if positive) measures the stayers' gain from moving, had they moved. However, the movers and stayers are not randomly selected groups but rather *self-selected*, presumably on the basis of perceived benefits associated with the alternatives. The earnings of movers are, therefore, not necessarily attributable to stayers, had *they* moved; nor are the stayers' earnings necessarily attributable to those who actually moved, had they not moved.

Our analysis takes the interdependence between wage growth and mobility into account; wage growth rates are affected by mobility and the mobility decision responds to alternative prospective wage growth rates. The framework we use results in a model with binary and limited dependent variables.²

¹ It draws on Holmlund (1983).

² Methodologically, our study is similar to the paper by Rosen and Willis (1979) on education and self-selection and to Lee's analysis (1978) of unionism and wage rates. A recent application of the methodology to analyze migration is provided by Robinson and Tomes (1982). See also Heckman (1979) for a general discussion of self-selection problems in econometric models.

2. The Framework

We assume that the worker's mobility decision is based on a comparison between two prospective earnings streams, associated with job mobility and job staying, respectively. The worker has anticipations about wage growth and moves if discounted life time earnings, net of job transfer costs, are improved.

The model involves specification of two wage growth equations, one for movers and one for stayers. (In other words, we allow mobility status to interact with all explanatory variables of the wage growth equation.) This, however, leads to econometric problems, since wage growth for movers (stayers) is observed only for those who choose to move (stay). Estimates will have to be based on *censored* samples, a design that is likely to produce inconsistent estimates.

Procedures to deal with self-selection and censored data are available. We have applied these methods and been able to consistently estimate the wage growth equations. Given those estimated equations, we can impute hypothetical wage growth rates to each individual in the sample. The alternative wage paths represent the worker's prospective income streams, related to moving and staying, respectively. They will be used as major right-hand side variables in the equation that explains mobility decisions.

3. Variables and Data

The data analyzed are from the Swedish Level of Living Surveys of 1968 and 1974. In particular, we will explore the determinants of mobility and wage growth for male workers between 1968 and 1974. Mobility is defined as change of employer.

A summary description of the data is given in Table 1. It can be observed that movers generally tend to be younger, less frequently married and with shorter length of tenure. The initial wage level is lower for movers, whereas their rate of wage growth is higher than the average. Movers receive 5.3 percent real wage increase (before taxes) whereas stayers get 2.8 percent per year.

4. Empirical Results

As noted above movers and stayers are likely to be self-selected on the basis of perceived benefits associated with the different options. Our analysis can illuminate the nature of this self-selection. We find that those who preferred to stay did better as stayers than what measurably similar movers would have done, had *they* decided not to move. This is consistent with a comparative advantage story; those actually observed as stayers would be exactly those

Table 1. *Sample characteristics*

	All workers	Job movers	Job stayers
Age	37	32	40
Recently moved to current locality (= 1 if the person moved in 1967 or 1968, zero otherwise)	0.09	0.14	0.06
Δ Schooling	0.8	1.1	0.7
Δ Experience	5.2	4.9	5.3
Marital status (= 1 if married, zero otherwise)	0.73	0.55	0.81
Δ Marital status	0.10	0.22	0.05
Tenure	9.8	5.2	12.0
Local unemployment rate	2.1	2.1	2.1
$\ln$ initial wage	7.066	6.959	7.116
Real wage increase per year, percent	3.6	5.3	2.8
Sample size	1 047	330	717

Note: The figures refer to 1968 and to changes between 1968 and 1974. The wage rate is earnings per hour in Swedish öre. The local unemployment rate is the average for 1970-73 of unemployment rates in regions of co-operating municipalities (A-regions). Age, Schooling, Experience and Tenure are measured in years.

Table 2. *Actual and hypothetical real wage growth rates 1968-74.*
Percent per year

	Actual wage growth	Wage growth, moving	Wage growth, staying
All workers	3.6	5.5	2.3
Age 16-29	6.2	8.2	3.8
Age 30-49	2.5	4.5	1.7
Age 50-	1.9	3.4	1.4
Movers	5.3		3.0
Stayers	2.8	4.9	

who are likely to benefit from being stayers. The evidence on "selection-bias" is, however, inconclusive in the case of movers.

We may also ask: Do movers gain by moving? Or had they done better by not moving? Analogous questions are of course relevant for stayers. The measurement of gains from mobility requires that movers are compared to movers (and stayers to stayers). The computations are straightforward. The mean characteristics of movers are applied to the stayers wage function, hence giving a hypothetical wage change for movers, had they stayed. Analogously, the typical characteristics of the stayers are confronted with the movers wage equation, resulting in a calculated wage increase for stayers, had they moved. The results are shown in Table 2.

It is obvious that *movers do gain by moving*; the yearly wage growth rate is increased by somewhat above 2 percentage points for job movers, compared to a situation where they had stayed. Movers appear to gain by moving, but do stayers also gain by staying? The answer is no; stayers forego wage gains around 2 percentage points by refusing to move, presumably because of mobility costs.

The worker's mobility decision is by assumption based on a comparison of two alternative earnings streams, associated with job mobility and job staying, respectively. The estimated wage growth equations allow us to impute those alternative wage paths to each individual. Hence, we obtain the estimable "structural" decision equation.

Of special interest here is to see whether workers respond to their potential wage gains. The answer, according to our estimates, is affirmative; job mobility decisions are clearly affected by prospective wage gains.

5. Conclusions

We have reported on an analysis of determinants and consequences of individual mobility behavior in the Swedish labor market. Since workers are likely to move in response to their potential wage gains, there is a two-way causality between mobility and wage growth. The econometric procedures utilized take this interdependence into account.

The results of the empirical analyses indicate that actual job movers obtain around 2 percentage points higher real wage growth compared to a situation where they had decided not to move. It is also interesting to see that potential mobility gains are decreasing over the life cycle, thus providing one piece of an economic interpretation of observed life cycle patterns of mobility and earnings. The traditional human capital explanation of life cycle earnings profiles appear to need an extension to account for mobility behavior over the life cycle (and wage gains associated with this mobility).

Population heterogeneity is likely to interfere with unbiased estimates of the returns to individual job changes. We find evidence of positive self

selection for stayers; a random group of workers will experience lower wage growth rates as stayers than what actual stayers obtained. The evidence on self-selection is less conclusive for movers.

An interesting consequence of the adopted procedure is the possibility of estimating structural decision equations, where hypothetical wage growth rates enter as arguments. We find that workers respond to their "opportunity wages" in the expected direction.

A number of issues have been left out of focus in the present study. For example, the treatment of taxes has been illustrative rather than thorough. The interrelationships between mobility and labor supply decisions have also been ignored; throughout we have implicitly assumed hours worked to be fixed. In future research, it would be of interest to deal with those decisions in a unified theoretical and econometric framework. Finally, it would be desirable to view mobility decisions in a *household* perspective; the presence of various family ties are clearly of importance for inter-local job changes. This, however, requires panel data with information on both spouses (and possibly other family members as well). Such data sources are, unfortunately, still not available in Sweden. (See Klevmarken's article above.)

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THE FIRM, PRODUCTIVITY AND THE EMERGING TECHNOLOGY

by Harald Fries

1. Introduction

"The firm is a technical unit in which commodities are produced." Its entrepreneur "transforms inputs into outputs, subject to the technical rules specified by his production function". (Henderson & Quandt, 1971, p. 52.)

The opening quotation is a typical example of how the firm is introduced in the established, neoclassical theory of the firm. The business unit is treated as a profit maximizer which obtains the maximum output from every input combination according to its production function. Firm behavior is characterized by complete rationality in a world of certainty.

A theory should always be a simplification of reality - but not to the extent that it neglects or distorts important factors that guide the behavior of what is being modeled. Attempts to add empirical content to the theory of the firm have essentially followed two different routes. Along the first, firm *environment* has been made more realistic. The second route has led to more realistic assumptions regarding firm *decision processes*. This, more revisionist, approach takes into account that rationality of the economic actors is "bounded", due to "failures of knowing all the alternatives, uncertainty about relevant exogenous events, and inability to calculate consequences" (Simon, 1979, p. 502). Concepts such as search and "satisficing" are now common ingredients in economic analyses of firm behavior.

However, the diversity of the modern corporation, and its internal, organizational problems still escape the received theory of the firm. The notion of the firm brought forward, is that of a single factory, in which all activity is associated with mechanical hardware production. The firm is insufficiently treated as an *organization*. The article focuses on how this theoretical influence manifests itself in analyses of firm productivity and the (potential) effects of electronics and computer technology on corporate performance.

2. The Modern Firm

The modern industrial firm is a multiproduct/multiplant (and frequently multinational) corporation. It is often part of an industrial group controlled by a corporate headquarters. A mapping of the corporation would typically show a network of a head office, branch offices, factories, sales offices, service stations, warehouses and research laboratories. Such an organization

requires a great deal of administration, planning, coordination and control. Those are tasks normally associated with the head office. They include personnel administration, payroll accounting, training, computer support and service, external information service, pricing, budgeting, accounting, cash management, investment planning and decision making, financing, etc.

The degree of centralization of those functions varies from firm to firm, depending on such factors as size of operations, type of products and management style. With increasing size and complexity of the corporation, the *central* administrative involvement tends to become less detailed. Profit targeting and control, risk management and strategic planning are then taking a larger share of head office operations. Thus, much *administrative work* of the type listed above is often performed also at lower levels in the organization. And it is not a negligible part of total work input.

In order to maintain a competitive position, the firm has to invest a significant amount of resources into *sales, marketing and service* efforts. A product is rarely sold by just offering it to the market at the going price. An active role is required on the part of the seller. Potential buyers have to be made aware of the product. A fast and dependable delivery and a good after-sales service are often more effective sales arguments than the features of the product itself.

Most firms are also forced to engage in *research and development*. Relative changes in production costs and product prices will sooner or later make a product outdated. To ensure long run viability, the firm must therefore anticipate and adjust to new market conditions. It must introduce new products and improve the design and physical properties of its products already in the market. New products and designs not only create demand; they often enable a more efficient production.

IUI estimates show that R&D investments in Swedish manufacturing in 1973-76 amounted to approximately one-fifth of the investments in machinery and buildings (Örtengren, 1981). In 1978-80, this ratio increased to about one-third. In many firms, immaterial investments (which include R&D, and investments in training, marketing, and the sales and service organizations) are already of greater, or much greater, magnitude than material investments.

Even the production process itself requires a substantial amount of non-physical (software) activities. Besides direct physical production, it involves such key functions as customer order handling, design and technical preparations, production planning, inventory management, materials control (to ensure that necessary components and raw materials are available), purchasing, quality control, supervision, maintenance, delivery service, cost planning and control. A case study of a Swedish engineering factory showed that the amount of labor, that went into direct hardware production activities, only accounted for about one third of total labor use in the plant.

Software activities, such as those listed above, thus made up for the remaining two thirds of labor input (Eliasson, 1982).

The purpose of the IUI project "The Modern Corporation" (see p. 118) is to measure the proportions of the various activities going on in Swedish manufacturing firms. Tentative results indicate that the administrative, customer-oriented and innovative functions generally account for a large, and growing, share of total resource use. Table 1 shows that the production process in a large engineering firm accounted for less than half of total costs (excluding depreciation and interest expenses). A good theory of the firm should recognize the internal diversity of firm operations.

Table 1. *Total costs^a of engineering firm distributed on functions, 1981*
(percent of total)

	Percent
R&D, engineering design and documentation	17
Work scheduling	15
Production	44
Marketing and distribution	9
Financing and administration	5
Other	10
TOTAL	100

^a Excluding depreciation and interest expenses.

An interesting question is whether the crude, price-taking firm gives us any help in understanding *macro behavior*. The argument behind several current micro based IUI projects is that it rather distorts understanding or gives erroneous predictions.¹ The need for a realistic and dynamic micro foundation of existing macro theory is the main idea of the IUI micro-to-macro modeling project MOSES (see p. 102).

In narrowing the gap between theory and reality, a problem arises, however, in that the required micro data are generally not available. At IUI, a substantial amount of work has therefore been devoted to collecting and organizing real firm data bases, designed to fit the micro oriented research going on at the institute.

¹ See also the articles by Brownstone and Klevmarken in this volume. For more in-depth discussions on the problems of basing economic policy on current macro theory, see Eliasson, Sharefkin & Ysander (1983).

3. Firm Productivity Potential

Standard macro production function analysis of productivity does not adequately identify what lies behind changes in productivity. Above all, it fails to capture organizational and allocational effects on productivity change. If, as is our hypothesis, organizational techniques within firms are the main vehicles for productivity change we have to develop the appropriate analytical tool. By substituting the microscope for the macroscope in the study of productivity change, it is possible to more closely examine the origin of productivity growth. A number of IUI studies in recent years have set out to analyze productivity change at different levels of aggregation; from the macro level down to the workshop floor (Grufman 1978, Carlsson et al. 1979, Carlsson 1980, Eliasson 1976, 1979 and 1980, Nilsson 1981).

The results of these efforts strongly suggest that pure technical change does not play the dominant role in explaining total productivity growth. More important are the effects of the *organization* of resources already in use (labor being very important), and of the *allocation* of new investments. And this conclusion seems to be valid at both the macro and the micro level.

For the economy as a whole, the most significant productivity gains arise from structural change. When more productive firms expand in relation to less efficient units, productivity of the total economy is improved, and vice versa (see Carlsson's article on subsidies in this volume).

Also within the firm itself, the organization of resources appears to be the main source for efficiency improvements. This phenomenon is well-known as the "Horndal effect" (Lundberg, 1961) or as learning-by-doing (Arrow, 1962). It is often a question of removing bottle necks and increasing the throughput speed of intermediate parts, goods in process, final goods and – not the least – information. This requires that the "critical links" in the chain of activities can be identified. There is no point in installing machinery with greater capacity if, for instance, the additional materials needed cannot be provided or the paint shop is already working at full capacity. Hence, the ability to monitor and coordinate the operations is crucial for total firm productivity.

To sum up, a productivity analysis heavily influenced by the prevalent theory of the firm is apt to overemphasize the role of technical change, and to overlook the productivity potential inherent in the organization of existing resources and the allocation of new resources.

4. The Emerging Technology

The questions brought up thus far are highly relevant for the much debated issue of the productivity impact of the rapidly spreading use of electronics and computer technology in manufacturing activity. To a large extent, the debate centers around substitution possibilities between the new technology

and manpower. The labor saving effects of introducing industrial robotics and numerically controlled (NC) machines on the workshop floor, and wordprocessors in the office, are typically emphasized. A widely held view, is that the essential effect of the improved technical capabilities, is to increase productivity by way of reducing blue collar and routine clerical employment.

This and the following section give a summary account of case studies of the computerization process in several large manufacturing firms. They illustrate that the non-physical side of firm production involves a heavy load of information processing, often entailing communication between geographically different locations, and thus provides a wealth of potential applications of information technology. And in most of those applications the new technology enters as a *complement* to labor rather than as a substitute.

Of the typical head office functions, the heavy volume routines – such as accounts payable and receivable, payroll, invoicing and accounting – are usually the first that are computerized. Together with the ongoing office automation, this normally increases the demand for computer-experienced and technically skilled personnel, whereas the amount of low-skilled clerical work is reduced. A good illustration of this is provided by a major Swedish corporation. The share of routine personnel in total salaried employment was almost constant during the 1960s. But the share dropped from 52 percent in 1971 to 28 percent in 1981, due to a concentration of administrative development efforts on mechanizing manual work. No employees were laid off, however, as a direct result of the rationalizations.

Along with substantial reductions in the price/performance ratio of hardware¹, with the development of more sophisticated software, and with improvements in the techniques for data communications and data base handling, the electronics technology is finding applications also in higher managerial functions. Computerized systems for budgeting, reporting, group consolidation, cash management, financial planning and control, are becoming more and more common. Less structured functions, such as risk management and strategic planning, are frequently supported by computerized calculations and simulations. At this level of firm operations, the new technology yields faster and more reliable information flows, provides more sophisticated tools for analyses, and enables managers to concentrate on their qualified tasks (up to 95 percent of a manager's time is spent on written and verbal communication (Mintzberg, 1973)). Decisions can be based on

¹ It has been estimated that the price/performance ratio has improved by a factor of 10^6 over the last two decades (Stübner, 1981).

better data and more thorough analyses. Control of the organization is facilitated and problems can be detected and corrected more rapidly.

We underlined above that suppliers are judged not only on the basis of the price and quality of their product, but also on the efficiency of the service they offer. This has made computerized customer order receiving systems increasingly popular. These systems interlink the order entry function with, for instance, finished stock control, invoicing and the accounts receivable ledger. Aided by such a system, and equipped with a display unit, the order receiver can rapidly and accurately give information to the customer regarding prices, available quantities, options, terms of delivery, discounts, etc. More time can be spent on discussing the needs of the customer. Delivery time can be shortened and made more reliable. The result should be increased sales and customer satisfaction. Also, with direct access to the accounts receivable ledger, over-due claims on customers can be collected more effectively.

Modern information technology is increasingly being utilized also in the production process, which, as we noted above, includes many important functions other than direct physical production. Indeed, individual efficiency of most of those functions can be increased by mechanizing some of their subroutines. Engineering design is one area in which the new technology has proven to be very useful. It has been estimated that an engineering designer devotes, on average, only about one-fourth of his working hours to creative work. The rest of his time is spent on searching for information and turning out engineering documentation (such as drawings, workshop instructions, manuals and detailed product specifications). But with a computerized data base system, storage and retrieval of drawings and basic engineering data is greatly facilitated. The designer can re-utilize and reproduce information more easily, and will thus have more time and better support for his creative work. This should enable him to design products which are less costly to manufacture and more attractive to potential buyers.

5. Improving Coordination and Control

It is important to understand, however, that partial productivity gains rarely affect productivity of the whole organization to a corresponding degree. As we pointed out earlier, a capacity improvement in one activity is often "blocked" by bottle necks in other activities. In Swedish manufacturing, for example, waiting for the next operation often makes up for 90-95 percent of the throughput time from filing a production order to final shipment. Obviously, substantial productivity gains can be reaped by improving the coordination of the different functions. Table 2 indicates the effects a large Swedish corporation obtained by installing a worldwide, integrated system for automatic order processing and inventory control. It illustrates that by

Table 2. *Qualitative effects of an installation of a computerized system for order processing and inventory control*

Routine personnel	↓
Throughput time for customer orders	↓
Delivery security	↑
Relative stock levels	↓
Stock replenishment times	↓
EDP costs ^a	↓

^a Costs for electronic data processing were cut by using inhouse computers instead of hiring service bureaus.

making information flows more efficient, modern technology has important potential effects besides labor saving.

Modern computer-based data communications systems are of particular value for the coordination and control of large, multiplant corporations. Vast quantities of data need to be transmitted over long distances from peripheral to central coordinating units, and vice versa. And the information must be processed and digested before it is passed on to the end users. Improved capabilities in those areas enable top management to monitor the organization more effectively from a distance.

That, in turn, can pave the way for a *decentralization* of profit responsibility. With more effective tools for controlling target fulfillment, top management can delegate a larger share of decision making. Divisionalizing, establishing profit centers and giving subsidiaries greater freedom of action are steps frequently taken to push profit thinking down the hierarchy. A divisionalization normally requires more sophisticated group budgeting and reporting systems. Therefore, computer support is often necessary for making such a reorganization workable.

In a more decentralized organization, top management can devote more time to its principal task; allocating available financial resources in such a way that long run profits are maximized. The corporation's ability to react quickly and accurately to market signals is enhanced, since decision-making becomes less bureaucratic and takes place closer to the markets. Also, decentralization normally makes it possible to relocate qualified personnel from central staff positions to more operative functions in subsidiaries and lower level profit centers.

The conclusion suggested is that the greatest productivity potential of modern information technology probably lies in improving the *coordination* of firm activities. This side of the emerging technology is usually overlooked in discussions on the impact of computerization. One problem in studying the effects mentioned in this section, however, is that they are difficult to measure properly. The aim of several, recently started micro studies at IUI

(see p. 117) is to get a both theoretical and empirical grasp of the potential effects of computer-based information systems on total firm productivity.

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INDUSTRIAL SUBSIDIES IN SWEDEN: Simulations on a Micro-to-Macro Model*

by Bo Carlsson

Background

Like many other countries, Sweden was hit by severe economic problems in the mid 70s, especially the shipping, shipbuilding, steel and mining and certain parts of the forest-based industries. Together, these crisis-stricken industries accounted for some 35 percent of total Swedish exports. Many firms and even whole industries were facing bankruptcy or drastic cutbacks. This situation created strong political demands for action on the part of the government. Thus, "in order to prevent or delay unacceptable reductions of employment in an industry or an enterprise or to facilitate re-structuring which can yield long-term profitability"¹ the government took direct action to save the threatened firms.

Thus, between 1973 and 1979, total industrial subsidies in Sweden rose from 3.2 billion SEK to 15.4 billion SEK, corresponding to about 5 percent and 16 percent, respectively, of value added in mining and manufacturing. The 1979 ratio is far above that in most other industrial nations.² Most of this increase consisted of firm specific subsidies, i.e. subsidies to specific firms in acute need. These subsidies increased from 0.2 billion SEK in 1973 to 7.5 billion SEK in 1979. Other industrial subsidies (export, R&D, sectoral, small firm, regional, and employment subsidies) also grew fast, raising the ratio of total subsidies in percent of GDP from 1 1/2 percent before 1973 to about 3.5 percent in 1979. See Figure 1.

*This article is based on a recent IUI study: B. Carlsson, F. Bergholm and T. Lindberg, *Industristödspolitik och dess inverkan på samhällsekonomin* (The Industrial Subsidy Program and Its Macroeconomic Impact), IUI, Stockholm, 1981. The study was commissioned and financed by the Government Committee on Industrial Subsidies (*Industristödsutredningen*). Financial support in the form of computer time provided by *Industriøkonomisk Institutt*, Bergen, Norway, is also gratefully acknowledged.

¹ According to the Directives given to the Government Committee on Industrial Subsidies.

² Our estimates show that total industry subsidies in the U.K. (1979-80), Italy (1978), Norway (1979) and West Germany (1980) amounted to 3.6, 7.1, 7.6 and 4.0 percent of value added, respectively.

Table 1. *Firm specific subsidies by receiving sector in Sweden 1977-79*
(Sum of grants and loans. Paid-out amounts. Credit guarantees not included.)

	Million SEK	In relation to		
		Value added %	Total wage-bill %	No. of employees, thousands of SEK
Shipyards	9 094	72.3	120.2	282
Steel	4 880	35.6	33.4	92
Forest-based	2 012	11.2	12.4	32
Mines	1 666	32.9	41.2	100
Textile and apparel	1 125	9.5	11.6	21
All manufacturing	20 238	6.9	8.5	21

Table 1 shows that over 20 billion SEK (or 77 percent of all subsidies during the 70s) was paid out during the last three years alone (1977-79). Approximately one-half of this amount went to the shipyards, roughly one-quarter to the commercial steel industry, and the remainder to the forest-based industry, the mining industry, and the textile and apparel industry. Most of these subsidies were given in the form of wage subsidies to the ailing firms.

During the three-year period 1977-79 the shipbuilding subsidies corresponded to 120 percent of the total wage bill. In 1978 and 1979, subsidies actually exceeded the value added in the shipbuilding industry - i.e., inputs in the production process were worth more when they arrived at the shipyards than they were when they left in the form of newly built ships. In the steel and the mining industries, subsidies corresponded to 30-40 percent of the wage bill or about 100 000 SEK per employee for the three-year period as a whole. Since nearly all of the steel subsidies have gone to the commercial steel sector, which represents one-third of total employment in the industry (specialty steel making up the remaining two-thirds), it turns out that the subsidies to the commercial steel industry were nearly as large as those to the shipyards, measured per employee. The subsidies to the forest-based industry have gone mainly to three firms, where they represented about 40 percent of the total wage bill 1977-79. Given its prominent place in the political debate, it may seem surprising that the textile and apparel industry ranks lowest among the subsidized industries. Nevertheless, that is the case; the number of recipient firms in the industry is also fairly large.

The following comparisons may be helpful in getting an idea of the magnitude of the subsidies given to crisis-stricken firms:

- Government revenue in the form of corporate income tax 1970-79 amounted to 13.8 billion SEK - i.e., about one-half of firm-specific subsidies during the same period.
- During the period 1977-79, the total industrial subsidies (both general and specific) were somewhat larger than the total appropriations for national defense. At the same time, the firm specific subsidies corresponded to one-half of the payroll tax paid by all industrial firms.
- During the same period (1977-79), the firm specific subsidies corresponded to 2 500 SEK (about US\$ 500) per individual in Sweden or about 5 000 SEK (US\$ 1 000) per person employed in the whole economy. Nearly half of this went to the shipyards.

The Problem

What, then, has been the macro-economic impact of such firm-specific subsidies?¹ We are primarily interested in the long-term growth and allocation effects compared to the short-term stimulative effects. How do the effects of such a highly selective subsidy scheme compare to those of a more general subsidy program or a laissez-faire policy?

We have chosen to analyze these questions through simulations on a micro-(firm)-based simulation model of the Swedish economy, named MOSES. A short description of some of the most central features of the model will be given in the next section.

*The Model*²

The model is oriented mainly towards analyzing industrial growth. Therefore, the manufacturing sector is the most detailed in the model. Manufacturing is divided into four industries (raw material processing, semi-manufactures, durable goods manufacturing, and manufacture of consumer nondurables). Each industry consists of a number of firms, some of which are real (with data supplied mainly through an annual survey) and some of which are synthetic. Together, the synthetic firms in each industry make up the differences between the real firms and the industry totals in the national

¹ Eliasson, in *Micro (Firm) Foundations of Industrial Policy*, IUI Working Paper No. 86, 1983, even suggests that this subsidy scheme is by far the dominant explanation for the poor performance of Swedish industry during the 70s; the growth rate of manufacturing output trailed that of all other industrial nations, including the U.K. and was about 25 percent below the OECD industrial average for the decade.

² For a more complete description of the model, see Eliasson, 1978, (ed.), *A Micro to Macro Model of the Swedish Economy*, IUI Conference Report 1978:1, and "The Firm and Financial Markets in the Swedish Micro to Macro Model", 1983, IUI (forthcoming).

accounts. The 147 real firms (including the eight "crisis-stricken firms" - see next paragraph) in the model cover 70-75 percent of industrial employment and production in the base year, 1976. The model is based on a quarterly time specification.

In addition to the real firms which are normally included in the data base, certain "crisis-stricken firms" have been added in the present runs: two forest-based firms (Södra Skogsägarnas Cellulosa AB and NCB), the consolidated commercial steel company (Svenskt Stål AB), the consolidated Swedish shipyards (Svenska Varv, formed by merging the three large Swedish shipyards), and four textile and apparel "firms", each representing a subsector within that industry. Together, these firms received the great bulk of industrial subsidies during the 70s. Iron ore mining (also a major subsidy recipient) is outside the micro specified manufacturing sector in the MOSES model and therefore is not analyzed here.

Firms in the model constitute short- and long-run planning systems for production and investment. Each quarter they decide on their desired production, employment and investment. Armed with these plans they go into the labor market where their employment plans confront those of other firms as well as labor supply. The labor force is treated as homogeneous in the model, i.e. labor is recruited from a common "pool". However, labor can also be recruited from other firms. This process determines the wage level, which is thus endogenous in the model. Even though the labor market is homogeneous, wages vary among both firms and industries without any tendency to converge. Since the labor market is only subdivided into industries, not regions, mobility in the labor market is probably overestimated. This is important in interpreting the results.

The micro to macro model features an endogenous firm exit device. It is activated when net worth of a firm goes below a certain minimum level in percent of total assets (bankruptcy) and/or when the firm runs out of cash (liquidity crisis). The firm, of course, gradually fades away through lack of investment if its cash flow diminishes and if it cannot borrow in the capital market at the going interest rate.

Domestic product prices and the production volume in the four product markets are determined through a similar process. The export volume is determined endogenously in the following way.

Each quarter the firms determine their production volume in two steps. First, they determine their desired production volume, taking into account desired changes in their inventories of finished goods, based on their expected total sales (including exports) which are in turn based on the firms' historical experience. This first production plan is revised by the firms with regard to profit targets, capacity utilization, and the expected labor market situation. After this revision, the production plan is executed. The production volume is distributed to the export and domestic markets according to an export share, which is dependent on that for the previous

quarter, but which also depends on the difference during the previous quarter between the export price and the domestic price. If this export price (which is exogenous) was higher than the domestic price, the firms try to increase their export share during the present quarter. However, the adjustment takes place over several quarters, not instantly. If the export price is lower than the domestic price, the firms do not try to lower their export share but rather maintain it at a constant level. In spite of this asymmetry concerning the effect of positive or negative price differences between exports and the domestic market, it turns out that the export shares in the various markets can both increase and decrease. This depends on whether firms with high export shares fare better or worse than other firms in the market. The import share in the four markets is also determined by the difference between the export and domestic prices with a certain time delay. High domestic prices relative to foreign prices lead to increasing import shares.

There is also a capital market in the model where firms compete for investment resources and where the rate of interest is determined. However, in the present runs the rate of interest has been determined exogenously. At this given interest rate firms invest as much as they find it profitable to invest, given their profit targets. Competition among firms, the Government and households for capital hence does not raise the rate of interest in the subsidy case relative to the non-subsidy case. As a consequence, the effect of subsidies on investment is more favorable than would otherwise be the case.

Public sector employment is determined exogenously, and the rate of wage increase in the public sector has been set equal to the average wage change in manufacturing, preserving the relative, average salary and wage differential between the two sectors. Thus, public sector employment is the same regardless of the size and direction of subsidies.

The exogenous variables (besides government policies) which drive the model are the rate of technical change (which is specific to each sector and raises the labor productivity associated with new, best practice investment in each firm) the rate of change of prices in the export markets, and the labor supply. These variables are identical in all runs reported here.

In contrast to most econometric macro models, domestic prices and wages are determined endogenously in MOSES. These in turn influence the firms' profits and therefore their production plans, the allocation of sales to the domestic and export markets, their investments, and therefore their productivity. This is the main mechanism through which resource allocation is determined in the model. These features make the model especially suited for analyzing the effects of policy measures, which can be expected to influence the expectations and plans of firms and which influence the development of prices and wages. The advantage of a micro-based simulation model is, that one can introduce various policy measures affecting

individual firms, rather than industries and analyze the effects. In a more traditional macro model one is usually forced to make assumptions regarding the resource allocation effects, i.e. one has to *assume* a large portion of the results.

The Simulations

The point of departure for the simulations has been to compare the results of the type of policy actually conducted with those of other alternatives. All exogenous variables have been exactly the same in all the simulations except the specification of the subsidy program. In all cases, the simulations have covered 18 years beginning in the base year 1976, i.e. they have covered the period up through 1994.

Experiment 1: Selective Wage Subsidies

This experiment mimics the subsidy program actually carried out. It can be characterized in the following way. The eight subsidized firms in the model have been given temporary wage subsidies of a magnitude corresponding to the total level of actual support during the period 1977–79. The subsidies have been given in the form of that percentage of the total wage bill, which corresponds to the actual level for each recipient firm. This level of support has been assumed to continue for another three years and then be reduced to two-thirds in 1983 and one-third in 1984 and eliminated completely thereafter.

The subsidies paid out through this program during the entire subsidy period 1977–84 amount to 70 billion SEK. The program is financed in the model through a percentage increase in the level of the income tax applicable throughout the entire 18-year period 1977–94. Thus, the economy is stimulated at the beginning of the period through the subsidy program but at the same time held back through the income tax hike. However, most of the income tax revenue comes towards the end of the simulation, i.e. after the subsidies have been phased out.

Experiment 2: Export Subsidies

As an alternative to this extremely selective actual subsidy program (support given to specific firms in specific circumstances) we have specified a more general alternative, in which subsidies are given to all firms as a percentage reduction of their total wage bill in proportion to the rate at which they increased their exports in the preceding quarter. This is referred to as the *export subsidy case*. It should be noted that support is not necessarily given to the largest exporters or to the firms with the largest export share but rather to those which *increase* their exports at the highest rate.

Experiment 3: General Wage Subsidies (Reduced Payroll Tax)

An even more general alternative is to give wage subsidies to all manufacturing firms in proportion to their wage bill during the same period as the selective subsidy. This can be regarded as either a (temporary) *general wage subsidy* or a (temporary) *reduced payroll tax*. It turns out that in order to reach the same magnitude as the actual subsidies, the general wage subsidy has to be about 10 percent. In other words, the payroll tax, currently about 40 percent, has to be reduced to about 20 percent of the total wage bill.

In summary, the subsidy experiments can be described in the following way. We have studied the macro-economic impact of a temporary stimulus in the form of wage subsidies to either a) a group of non-competitive firms, b) a group of rapidly growing export oriented firms, or c) all manufacturing firms, all other things being equal. In all these cases, the magnitude and time profile of the subsidy program has been kept constant (about 70 billion SEK during the period 1977–84), changing only the type of policy measures used.

Experiment 4: Laissez-faire

As a contrast to subsidy policies with varying degrees of selectivity we have also constructed a *laissez-faire* case in which no measure is taken, i.e. no subsidies are given at all. In this case, there is of course no need to finance a subsidy program; therefore there is no extra income tax increase either.

Most of the ailing firms are highly export oriented; protecting their domestic market in a "protectionist" experiment – something we considered originally – would not have yielded very interesting results.

Simulation Results

Through the selective subsidies, the recipient firms survive in the simulation at least until the subsidies begin to be phased out in 1983. In this experiment, one of the forest-based firms as well as the commercial steel firm and the shipyards are closed down in 1983–84 when deprived of their subsidies. The other recipient firm in the forest-based industry is closed down in 1988 and one of the textile firms in 1990. The other textile and apparel "firms" survive throughout the whole simulation.

But what happens if these firms are *not* subsidized? In the *laissez-faire* case, the largest among them (the shipyards, the commercial steel and the two forest-based firms) are eliminated during the first few years of the simulation, while the textile and apparel firms are phased out more gradually. But even in the cases when the selective subsidies are replaced by more general subsidies, the shipyards, steel and forest firms are forced to close down rather quickly. In the export subsidy case, the textile firms also

gradually fail, but in the general subsidy (reduced payroll) case, three of the four textile "firms" survive throughout the simulation.

The conclusion to be drawn from this is that it would have been difficult to maintain employment in the crisis-stricken firms, or even to prevent these firms from failing, without direct subsidies. But what are the more general effects of these selective policies? What, e.g., would have happened to unemployment in the longer run?

As shown in Figure 2a, closing down several of the ailing firms at the beginning of the period would have led to considerable unemployment for a few years at the end of the 70s. However, the additional unemployment would have been smaller than the number of people employed initially in the closed-down firms, because approximately one-third as many jobs would have been created elsewhere in the manufacturing sector during the first couple of years.

One of the main reasons for this result is that when the wages in non-competitive firms are subsidized, these firms maintain their employment. Non-subsidized firms therefore have to raise their wage offers in order to be able to recruit people from either new entrants into the labor market, from the subsidized firms or other firms or from the unemployment pool (which is reduced because of the subsidies). It should be mentioned in passing that the wage level is generally higher, and in some cases substantially higher in the subsidized firms than average manufacturing wages. This empirical fact is explicitly represented in the wage setting process in the model. This causes generally higher wages, lower profits in non-subsidized firms, and therefore fewer incentives for and hence less expansion in the non-subsidized firms.¹ The result is that the adjustment to changing external circumstances which necessitated the subsidies in the first place is delayed.

The basic reason why the unemployment rate becomes substantially higher during the first half of the 80s in the selective subsidy case than in the other cases is that when the subsidies are phased out, most of the recipient firms fail. In order to rescue them permanently, the subsidies would either have had to be larger or be continued for a longer period than we assumed. Thus, in our simulations the effect of the subsidies as far as unemployment is concerned is largely to delay unemployment and hold back expansion outside the subsidized firms.

Of course, in the absence of direct subsidies to crisis-stricken firms, industrial production would have been lower for a few years but would then have been higher for the rest of the simulated period after the subsidies are phased out, for reasons similar to those given above. See Figure 2b. This

¹ This growth reducing effect of a dynamically non-efficient incentive system has already been demonstrated in simulation experiments.

conclusion does not hold for the laissez-faire case, however. In that case, the production lost during the subsidy period is not made up later.

If direct subsidies had not been given to the ailing firms, the balance of trade would also have suffered a relative decline during the first few years. See Figure 2c. This is due to the fact that several of the firms receiving subsidies, e.g. the shipyards, are large exporters. Therefore, when the subsidies are phased out and several of the subsidized firms close down, the trade balance suffers. After the elimination of the subsidies, the more general subsidy policies turn out to yield a more positive trade balance than the selective policy. Again, the laissez-faire policy turns out to perform less well. Looking over the entire simulated period, both export subsidies and a general wage subsidy (reduced payroll tax) are clearly more favorable as regards the trade balance than the selective policy.

However, as far as private consumption is concerned (see Figure 2d), the selective wage subsidy policy may be said to yield the most favorable development over the simulated period as a whole and especially during the period of the subsidy program. This indicates that direct subsidies to crisis-stricken firms is a more effective means of maintaining capacity utilization and therefore also private consumption than the other policy alternatives. On the other hand, as just pointed out, these other alternatives are more successful in improving the trade balance.

Conclusions

Summing up, if we first confine the discussion to the stated objectives of the subsidy program, it is quite clear that in terms of the first objective, that of preventing or delaying unacceptable reductions of employment, the selective wage subsidies have favorable short-run effects relative to all other alternatives investigated here. But in the longer run, this policy performs worse than the other alternatives (except the laissez-faire case) even in pure employment terms. And in terms of the second objective, that of facilitating restructuring, this policy is worse than both export subsidies and general wage subsidies.

If we broaden the evaluation to include more than just employment effects, the conclusions are rather similar. The selective wage subsidy yields higher industrial production and exports during the first few years than the alternative policies investigated, because the subsidized firms, most of which are heavily export oriented, do not fail like in the other policy alternatives. However, both export subsidies and general wage subsidies lead to more favorable long-term effects on industrial production as well as trade performance (and unemployment). We also find that a general wage subsidy is superior to a "selective" export subsidy in terms of dynamic allocation effects (long-run growth). The firms exhibiting fast export growth in the initial state *need not be* the most efficient, profitable and expansive firms in

the longer run. The general wage subsidy also generates more real income to households and hence more consumption than the export subsidy alternative. In comparison with all alternatives, the selective subsidy program yields negative long-run output growth effects.

It is of course impossible, in a brief article like this to document all the technical details and evaluate all the assumptions that have gone into these experiments.¹ One of the most interesting features in the model is that it is possible to analyze the allocation effects of various policies both over time and between firms (or industries). There is perhaps one exception to what appears a priori plausible: the laissez-faire experiment seems to give a considerably less favorable outcome than one might have expected. Otherwise, the results seem on the whole to confirm to what one would expect.

Compared to the laissez-faire case, the effects of the selective policies are very favorable in the short run and yet not particularly costly in the long run. The virtual absence of long-term (allocative) effects in the selective relative to the laissez-faire case is explained by several circumstances: (1) that the subsidies are actually phased out after eight years and that the firms which fail then are allowed to close down; and (2) that the subsidies are limited and non-negotiable. The recipient firms receive "only" a certain percentage of their total wage bill - even though this percentage is very high in some cases. They are not allowed to negotiate for more subsidies. Therefore, their incentives are not destroyed. It is not likely that such constraints apply in the real world. In other words, it is likely that the negative long-run effects of the selective subsidy policy on incentives and labor morale in industry relative to the laissez-faire policy have been underestimated.²

¹ For this the reader is referred to Carlsson-Bergholm-Lindberg op. cit. and the documentation on the model referred to above.

² An alternative way to view the laissez-faire case is the following. The subsidy cases all involve both a subsidy scheme and an income tax hike to finance the subsidies. Suppose we disregard the latter (fiscal) aspect and simply take the income tax increase as given. Then the laissez-faire experiment would represent a case of a fiscal stimulus to the household sector (in the form of the absence of an income tax increase) rather than to firms. The magnitude of the stimulus is the same as that of the subsidies, although with a different time profile. That is why private consumption holds up relatively well in this case, and it also explains the relatively large negative impact on the trade balance, particularly towards the end of the simulation. But since the fiscal stimulus is channeled through the pockets of consumers rather than going directly to firms, the long-run impact on growth is reduced, compared to the general wage subsidy and export subsidy cases. Apparently, the stimulus to growth-oriented firms is sufficient, in these cases, to more than make up for the income tax hike. But in the selective wage subsidy case, the subsidized firms do not have the same growth potential. Therefore, the laissez-faire case tends to yield somewhat higher manufacturing output during the second half of the simulation than the selective subsidy case.

It should perhaps also be pointed out that the whole issue of how subsidies affect the incentives of firms has not been dealt with adequately in this study. While using a micro-based model for the analysis offers considerable advantages in examining allocation effects between firms compared to conventional macro and sector models, the question of incentives *within* firms has been handled here only by assumption. Here remains an important topic for further research.

Figure 1. *Swedish industrial subsidies 1970–79*
(Paid-out amounts in current prices)

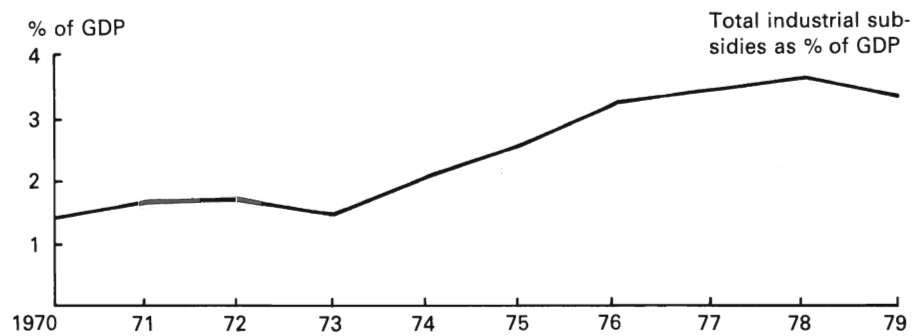


Figure 2a. *Unemployment difference between the simulations*
(Percentage points, selective policy = 0)

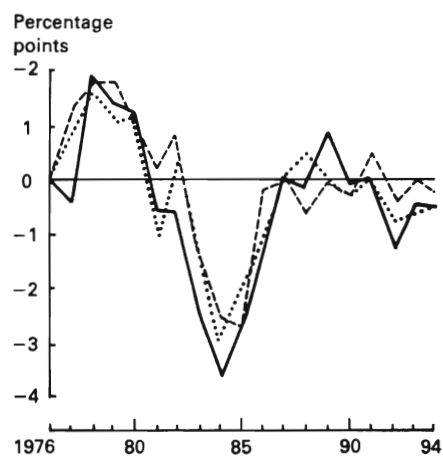


Figure 2b. *Manufacturing output*
(Index, selective policy = 100)

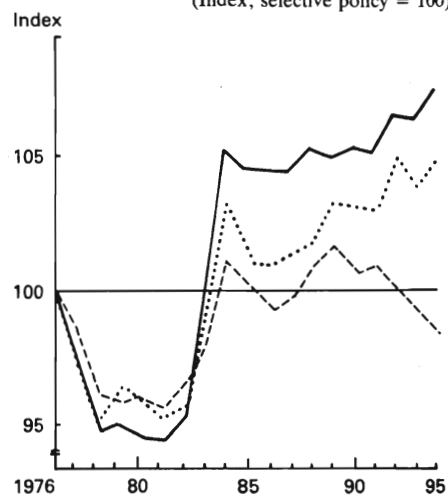


Figure 2c. *Net trade balance in percent of GNP*
(Index, selective policy = 100)

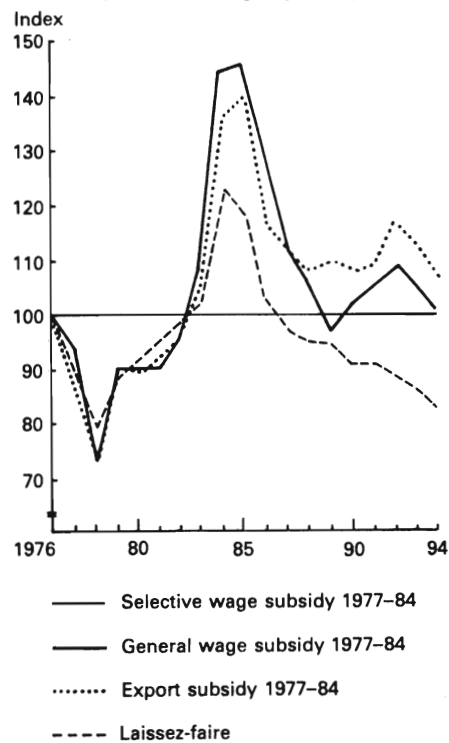
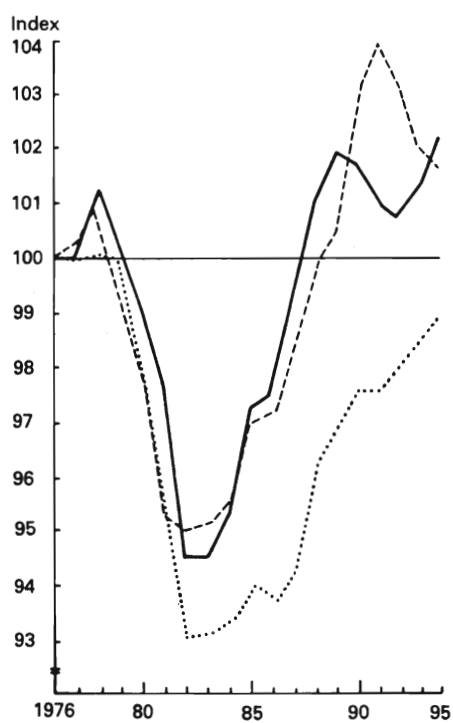


Figure 2d. *Private consumption*
(Index, selective policy = 100)



INTERNATIONAL TAX COMPARISONS

by Thomas Lindberg and Jan Södersten

The incentives to save and invest afforded by the tax system are subjects of continuing debate among politicians and economists. In the last decade a growing concern has been voiced in Sweden about the efficiency effects of the present system of taxing capital income. There is a widespread belief that the tax system diverts savings into "unproductive" investments such as art, antiques, gold and consumer durables at the expense of bank accounts and shares which are regular channels to finance business investment in fixed capital. It is also believed that residential investment in owner-occupied housing and summer cottages is greatly favored by the tax system, contributing to the divergent development of the returns to investments in housing and corporate equity during the 1970s.

There is another aspect of capital income taxation to which comparatively less attention has been paid during recent years, namely the interaction between the domestic tax system and the tax systems of other countries. The emerging importance of multinational corporations and an international credit market in linking the industrial economies together have made the *international* side of capital income taxation valid as a real economic factor.

As an important first step in the process of improving our knowledge of the workings of tax systems in an international setting, IUI accepted in 1979 an invitation from the National Bureau of Economic Research (NBER) in the United States to participate in a large scale comparative study of capital income taxation in Germany, Sweden, the United Kingdom and the United States. The study started in the spring of 1980 under the direction of public finance economists from IUI, Princeton University, the University of Birmingham and Institut für Wirtschaftsforschung (IFO), Munich. After three years of work, the project is now completed and the results will shortly be released by the University of Chicago Press as a joint publication of IFO institute, IUI and NBER.¹

¹ The project was first presented in Bradford, David and Södersten, Jan, "An International Comparison of Effective Corporate Tax Rates" in *The Firms in the Market Economy*, IUI Yearbook and Research Program 1979/80.

Methodology of the Project

The purpose of the project was to examine and compare the incentives to save and invest in the private, non-financial corporate sector afforded by the tax systems of the four countries. We measure the effective *marginal* tax rate on capital income for each of the four countries where the *margin* is a small increase in the level of real investment. Let (p) be the pre-tax, real rate of return on a marginal investment project and let (s) denote the post-tax, real rate of return to the saver (a household or an institution) who supplied the finance for the investment. The effective tax rate can then be defined as the tax "wedge" $(p-s)$, divided by the pre-tax rate of return (p) .

There are several kinds of taxes that should be taken into account when estimating the tax wedge $(p-s)$. These include the corporate income tax, the personal income tax and the wealth tax. The size of the tax wedge may vary depending on whether funds are invested in machinery, buildings or inventories, and on whether savings are channeled into real investment as debt, retained earnings or new share issues. It is important also to take into account whether the financial claims on the profits (corporate debt and equity) are held directly by household investors or by institutions such as insurance companies.

The estimates of the tax wedge $(p-s)$ and the effective tax rate to be reported in this article are carried out for a given value of the pre-tax rate of return (p) of 10 percent. For each project we assume the same value for (p) and then we compute the value of (s) , the real post-tax rate of return to savers which the project could sustain. It is assumed that all corporations take full advantage of the depreciation allowances, rules of inventory write-down, etc., granted by the tax laws. This implicitly assumes either that the "representative" firm has pre-tax profits which are sufficiently large, or that the tax laws provide full loss offset on "tax accounting" losses.

Our estimates take into account four important characteristics of a hypothetical investment project; (1) the type of real asset (machinery, building or inventory) in which funds are invested, (2) the industry (manufacturing, other industry or commerce) of the project, (3) the way in which the project is financed (debt, retained earnings or new share issues) and (4) the ultimate recipient of the returns (households, tax-exempt institutions or insurance companies). The number of possible combinations of a hypothetical investment project is therefore 81 ($=3 \times 3 \times 3 \times 3$).

Results for Sweden

The results of our calculations for three of the 81 possible combinations for Sweden appear in Table 1. The table shows the post-tax, real rate of return (s) received by *households* and the corresponding effective tax rate for investment in *machinery* within the *manufacturing* industry. Three alterna-

Table 1. *Real post-tax rates of return on Swedish household savings and corresponding effective tax rates^a*
(Percent)

A. <i>Post-tax rate of return on household savings</i>		
Source of finance		
1. Debt		5.3
2. New share issues		-3.3
3. Retained earnings		-1.6
B. <i>Effective tax rates</i>		
Source of finance		
1. Debt		47.2
2. New share issues		132.8
3. Retained earnings		115.5

^a The table assumes that household savings are used to finance corporate investment in machinery within the manufacturing industry. The pre-tax rate of return is set to 10 percent.

tive ways of channeling household savings into real investment are considered and the inflation rate is assumed to be 10 percent. For a given pre-tax rate of return of 10 percent on the machine, companies can afford to pay a market interest rate on *debt* such that the post-tax real rate of return to household savers will be 5.3 percent. This implies an effective tax rate of 47.2 percent. For *equity* finance, the effective tax burden is considerably higher as a result of the "double taxation" of corporate profits. A 10 percent pre-tax rate of return on real investment is not sufficient to enable households to earn a positive post-tax rate of return. The figures in Table 1 also confirm the common view of new share issues as the most expensive form of equity finance.

Detailed information on the structure of capital income taxation was obtained by computing the effective marginal tax rate for each of the 81 combinations of the hypothetical investment project. This information has been supplemented by estimates of "average" marginal tax rates. These estimates serve the purpose of facilitating comparisons between the four countries, and may be interpreted in terms of a "representative" firm. This "representative" firm undertakes investments in machinery, buildings and inventories in proportion to the *actual* distribution of the net capital stock among assets for the three industry groups, and is financed by debt, new share issues and retained earnings in proportion to *existing* financial patterns. Table 2 presents such average marginal tax rates for Sweden according to the tax rules in force in 1980, assuming a pre-tax real rate of return on corporate real investments of 10 percent. Estimates are provided for both 0 and 10 percent inflation.

The first three rows of Table 2 show the average marginal tax rates for the

Table 2. *Effective marginal tax rates in Sweden.*
Pre-tax rate of return (p) set to 10 percent.
1980 tax rules
(Percent)

	<i>Annual inflation rate</i>	
	Zero	Ten
<i>Owner</i>		
1. Households	57.1	108.0
2. Tax-exempt institutions	– 39.2	– 52.8
3. Insurance companies	– 16.0	22.0
<i>Source of finance</i>		
1. Debt	– 12.9	6.4
2. New share issues	44.2	93.2
3. Retained earnings	40.9	69.5
<i>Asset</i>		
1. Machinery	–18.1	1.5
2. Buildings	28.9	37.3
3. Inventories	26.5	71.0
<i>Industry</i>		
1. Manufacturing	8.1	28.3
2. Other industry	29.6	62.6
3. Commerce	12.1	40.7
Overall average	12.9	37.0

three categories of owners. When the average is taken over industry group, source of finance and type of asset the marginal tax rate for household investors is 108 percent at 10 percent inflation. This means that if all real assets would earn a pre-tax rate of return of 10 percent at the margin, the average of the post-tax marginal rate of return to households would be minus 0.8 percent. Investments financed by savings channeled through tax-exempt institutions, on the other hand, receive a substantial subsidy. The seemingly paradoxical effective tax rate of minus 51.8 percent is explained by the interaction between personal and corporate taxation. The corporate tax system in Sweden via the combined effect of accelerated depreciations and interest deductions reduces the "net cost of investment" relatively more than it reduces the present value of gross earnings from marginal investment projects.

The following three rows of Table 2. show the effective marginal tax rates for the different sources of finance. The 6.4 percent effective tax rate on debt finance at 10 percent inflation implies that the post-tax rate of return on debt

instruments is 9.4 percent when the average is taken over households, tax-exempt institutions and insurance companies. The effective tax burden on equity financed investments is much higher and, as mentioned above, this is explained by the double taxation of corporate profits and also by the fact that, on average, household marginal income tax rates are lower on interest receipts than on dividends.

The variation in the effective tax rate by asset is striking. As far as investment in machinery is concerned, the present tax system approximates an expenditure tax (equivalent to a zero tax rate on capital income). It is, in fact, more favorable than an expenditure tax at a zero inflation rate, providing a net subsidy to investment in machinery. For other assets, the tax rate is higher. With a fully indexed comprehensive income tax, the marginal tax rates corresponding to Table 2. would equal an average of marginal income tax rates. In 1980, the average marginal income tax rate of households taken over debt and equity was 57.3 percent, and apart from investment in inventories when inflation is high, the present tax system is more favorable than an income tax.

The differences in effective tax rates among the industry groups are explained mainly by differences in the composition of their capital stock. Inventories constitute twice as large a share of the total net capital stock in other industry and commerce as in manufacturing, and inventory investment is the most heavily taxed type of real investment. The average allowed rate of inventory write-down is only 19.3 percent for other industry compared to 60 percent for the other two industry groups, and this contributes to the dispersion of tax rates.

Finally, the last row of Table 2. shows the overall average marginal tax rates, where the average is taken over source of finance, category of owner, industry and type of asset. At 10 percent inflation, this overall tax rate is considerably below the average marginal income tax rate of household investors in equity and debt, which (as mentioned above) was 57.3 percent in 1980. On *average*, therefore, the present tax system is more favorable than a comprehensive income tax (which would tax capital income at an effective rate of 57.3 percent) and is closer to an expenditure tax (with a zero effective tax rate) than to a comprehensive income tax at zero inflation. An important difference between the present system and either an expenditure tax or a comprehensive income tax is of course the wide distribution of effective tax rates around the mean and the sensitivity of effective tax rates to inflation.

A comparison between the different columns of Table 2. reveals the effects of inflation on the effective tax rates. The Swedish tax system is not indexed and it is often assumed that this causes the effective tax burden to rise as the rate of inflation increases. This assumption is in general confirmed by this study. An increase in inflation from 0 to 10 percent almost triples the overall effective tax rate.

Table 3. *Ownership of corporate equity 1980*
(Market values, percent)

	Germany	Sweden	U.K.	U.S.
Households	44.3	56.0	40.8	71.3
Tax-exempt institutions	12.5	28.0	33.7	20.7
Insurance companies	3.8	8.7	19.2	3.9
Foreign owners	39.4	7.3	6.3	4.1
Total ultimate ownership	100.0	100.0	100.0	100.0

There are several factors that combine to explain the remarkable sensitivity of effective tax rates to inflation in Sweden. FIFO accounting rules make corporations pay taxes on purely nominal capital gains on inventories. The real value of historical cost depreciations is undermined by inflation. The tax reducing effect of allowing corporations to deduct nominal interest costs, furthermore, is outweighed by a full income taxation of nominal interest receipts to households. The taxation of capital income received by (property) insurance companies, finally, is strongly dependent on the rate of inflation, since the tax law exempts from tax a nominal rate of return on the so called "insurance funds" of 4 percent.

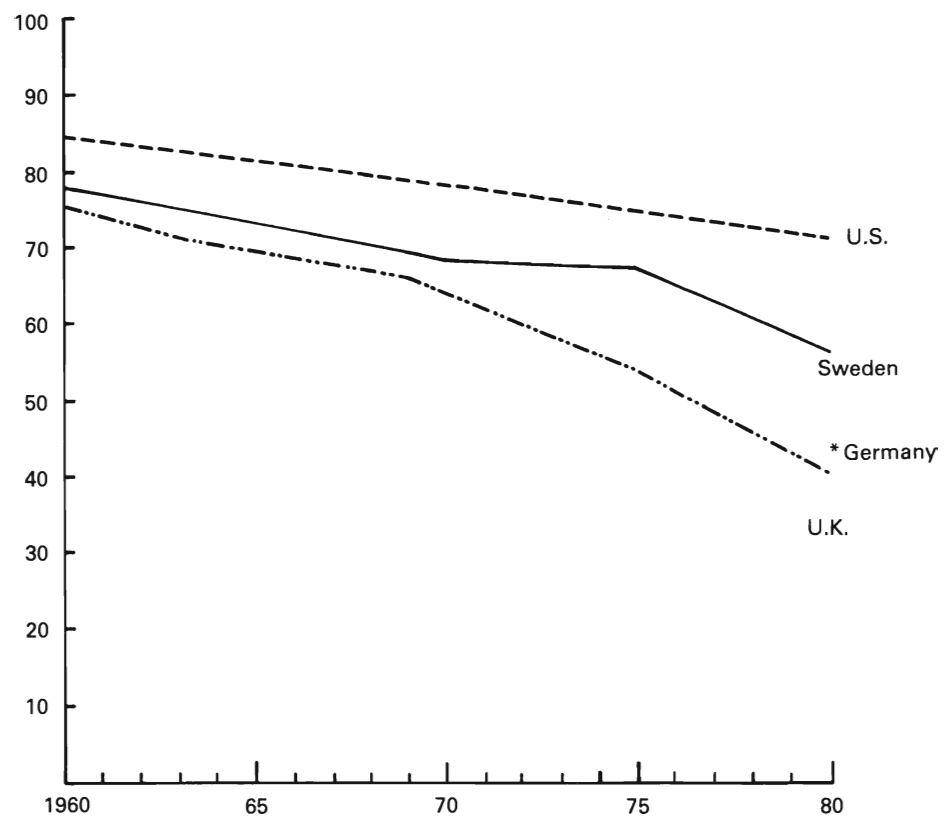
Comparisons of Equity Ownership

As mentioned earlier, the purpose of this international project was to make possible a comparison of the taxation of income from capital between the four countries. Hence, marginal effective tax rates consistent with the Swedish tax rates presented above, have been computed for Germany, the U.K. and the U.S. We obtained a high degree of comparability by adopting identical definitions in measuring and accounting for the intricacies of the statutory systems and in the actual, institutional settings. A full account of these estimates will appear in the forthcoming volume from the University of Chicago Press.

The empirical foundation of the weighting procedure, on which the average marginal tax measures shown in Table 2. are based, was not readily available in official statistics. Extensive work with many different data sources was required. These data provide interesting descriptions on their own. For instance Table 3. shows the distribution of corporate equities among four categories of owners in the four countries.

Note that the ownership refers to ultimate, beneficial holdings, i.e., after elimination of intermediaries like banks, nominee trusts and Swedish "closed end" investment companies. As apparent from the table the patterns

Figure 1. *Households' share in ultimate ownership of corporate equity*
1960–80
(Percent)



Note that only one observation (1980) exists for Germany.

MICROECONOMETRICS

by David Brownstone*

1. The Microeconomic Problem

Microeconometrics is the application of econometric techniques to microeconomic data at the household or firm level. Of course this is not really a new field since economists and econometricians have been using micro data for decades. However, in the last decade there has been a marked shift in the research of many econometricians towards techniques and applications requiring micro data. The main reason for this shift has been the inability of macroeconomic models developed in the 60s to satisfactorily predict economic events in the last decade. The use of micro data has also been facilitated by the increasing availability of micro data sources and the decreasing cost of computers, large enough to effectively handle the large data sets necessary for empirical microeconomic work.

The growth of microeconometrics has also been caused by the large increase in government policies designed to directly affect microeconomic decisions and the distribution of wealth and income. In Sweden good examples of these policies are found in labor market policies and regional investment policies. Any model for evaluating these policies must be disaggregated at least to the smallest level treated differently by the policy. Since many policies interact with the tax and transfer systems this smallest level is frequently the individual or firm. Although most microeconomic work has been directed at detailed analysis of specific policies it is theoretically possible to generate aggregate predictions from these models. Since the aggregate data used to calibrate macroeconomic models are just summaries of the underlying micro data sources, it should be possible to generate improved macro predictions using microeconomic models. This is the basic idea behind the microsimulation modeling pioneered by Orcutt and implemented in the MOSES model (see Eliasson, 1980) for Sweden. Realization of these improved aggregate predictions requires much more research on large model specification as well as lower computing costs.

One frequent criticism of macroeconomic models is that they are based on ad hoc specifications and are generally inconsistent with any coherent theory of economic behavior. The primary difficulty, for those attempting to remedy this problem, is that the strong assumptions needed, to generate

*IUI and Stockholm School of Economics. The author acknowledges useful comments and references provided by Eliasson, G., and Klevmarken, A., but retains sole responsibility for remaining errors. The references given in this paper are to the most recent general papers on a given topic. These papers all contain complete historical references.

aggregate relationships consistent with standard economic theory, are clearly incorrect and lead to very restrictive aggregate specifications. If macroeconometric models are just going to be used for generating aggregate predictions, then consistency with any theory is of course not required. However, the practical impossibility of relating these models to theoretical constructs has served to alienate theorists and therefore increase the gulf between economic theory and practice.

In microeconomic models, the basic model specification assumptions are made at the individual level. For example, the specification of some models of consumer behavior begins with an explicit representation of the individual's behavioral assumptions into testable assumptions about the empirical model parameters. Although this procedure has not always led to better predictive performance, it does allow for fruitful cooperation between theorists and applied workers. This cooperation is evident in the current work on labor supply where empirical models are being generated from theoretical models of workers' job search behavior. The empirical results have been useful for identifying implausible assumptions as well as generating quantitative predictions.

Microeconomic models, which have been used to simulate the macroeconomy (like IUI's MOSES model), have also been criticized for making large numbers of ad hoc assumptions. These assumptions are usually necessary to identify parts of the model where no calibration data exist. One way of quantifying the impact of a priori assumptions is to adopt a Bayesian framework where the assumptions are incorporated into the prior distribution. The importance of these assumptions for a particular set of calibration data can then be measured as the contribution of the prior distribution to the posterior distribution calculated from the data. When viewed in this framework macroeconomic models clearly impose a large number of assumptions in addition to those discussed in econometrics textbooks. In order to insure that these models are structurally stable it is necessary to assume that a large number of aggregation conditions are satisfied. For the consumer sector these conditions generally require all consumers to have identical utility functions. When compared to these assumptions the admittedly ad hoc assumptions used in microeconomic simulation models do not seem so bad.

In spite of the claims made in the previous paragraph it is still true that microeconomists have been guilty of making too many ad hoc assumptions. In a recent paper Heckman and Singer have shown that the results from microeconomic models of labor force dynamics are very sensitive to certain distributional assumptions used in these models. They also show that these assumptions are not necessary to identify these models and suggest new estimation techniques which do not require strong distributional assumptions.

2. Distinguishing Features

The development of microeconomic techniques during the last decade has been heavily influenced by two features of most micro data sources: large sample size and the presence of discrete and qualitative data. Most applied microeconomic studies use samples with 500 to 5 000 observations. While these sample sizes are much smaller than those used in demography and many physical sciences, they are much larger than those used in macroeconomic work. These large sample sizes allow the application of asymptotic statistical theory to justify the efficient estimation of non-linear models by likelihood maximization techniques. The large sample sizes also allow the use of robust statistical estimation procedures. These robust procedures do not require specific assumptions about the distribution of the error terms. It has been shown that (see Basset and Koenker, 1982) incorrect distributional assumptions can cause serious biases in the parameter estimates. Unfortunately, good robust estimation procedures are only available for the standard linear model. More work is needed to develop usable robust procedures for the more complicated models used in microeconomic studies.

The presence of discrete and qualitative data in micro data sources has motivated a large amount of research on appropriate models and estimation techniques. (For a good description of this work, see Manski and McFadden, 1981.) In many microeconomic studies the endogenous variables to be predicted are qualitative. Examples of these variables include the decision to enter (or exit) the labor force and the choice of transportation mode for commuting to work. During the early 70s McFadden and others developed a new class of econometric models, called qualitative choice models, to handle these discrete endogenous variables. These models are extensions of models originally developed in biometrics by Thurstone (1927) and others. Qualitative choice models specify the probability that the individual will choose a particular discrete alternative given observations on the relevant exogenous factors. This probability, called the choice probability, is a continuous function of the exogenous variables and unknown parameters, so the econometric techniques previously developed for continuous models can be directly applied.

Although these choice probabilities are continuous they must lie between 0 and 1, and the sum of the choice probabilities over all the discrete alternatives must equal one for each individual. These restrictions do not allow the use of simple estimators like linear regression techniques. Therefore qualitative choice models must be estimated using non-linear, iterative computer algorithms. Reliable and relatively fast algorithms have been developed for simple qualitative choice models, but more work is needed to develop usable algorithms for more complex and realistic models. Until the next generation of "supercomputers" become available, the computational costs of using

qualitative choice models will be much higher than those associated with other econometric models.

One common method for specifying a qualitative choice model is to assume that the utility derived from choosing discrete alternative i is given by:

$$V_i = U_i(Z_i, B) + e_i$$

where U is the representative or observable utility function of the exogenous attributes, Z , and parameters B . The "error term", e , represents the unmeasured utility. With these assumptions, the choice probability is given by:

$$P_i = \text{Probability that } V_i > V_j \text{ for all possible } j$$

Given a specific distributional assumption about how the e 's vary across the sample it is possible to estimate the parameters, B , and therefore estimate the representative utility function, U . A qualitative choice model for firm behavior (i.e. technology choice) can be developed in a similar fashion where U and V are production or cost functions. Any qualitative choice model derived in this fashion is consistent with standard microeconomic theory. This fact allows the use of general welfare measures derived from the estimated parameter values (see Rosen and Small, 1981). Also many common simplifying assumptions about the properties of utility (or cost) functions can be translated into hypotheses about the parameters B . Testing these hypotheses using empirical estimates of B provides a simple way of testing theorists' assumptions.

If it were possible to directly observe the utilities V in the previous paragraph then the unknown parameters B could be estimated using standard econometric techniques for continuous endogenous variables. The difficulties here are caused by the fact that the V 's are not directly observed; only indicators of their magnitudes are observed. Using this interpretation of qualitative choice models, Heckman (1978) has proposed a general class of econometric models which includes the standard simultaneous equation system as well as qualitative choice models. Heckman's system also includes other models, where the endogenous variables are only partially observed (truncated or Tobit models), as well as models where some variables are not observed at all (latent variable models).

These general models have been used where there are related discrete and continuous endogenous variables. These models arise when qualitative and continuous choices are derived from demand for an underlying good. Examples include the decision to purchase a car and the number of miles to drive it, and the firm's decision to choose a particular discrete technology for a plant and how much to produce in the plant. In the first example the

underlying good is transportation services, and in the second it is profit. Microeconomic theory places many restrictions on the parameters of the joint discrete-continuous choice model. These restrictions can either be tested empirically or used to greatly reduce the number of parameters which must be estimated (see Brownstone, 1980, and Duncan, 1980, for examples). These models are also potentially useful for policy analysis. For example, it would be possible to consistently estimate the effects of a gasoline price increase on the decision to purchase a car as well as miles driven. Furthermore, it would be possible to examine these effects for different groups (i.e. rich or poor) in the sample.

Once a microeconomic model has been specified and estimated, there is still the problem of how to use it for policy analysis. Most applied microeconomic work has used steady-state equilibrium models estimated with cross-section data. Policy analysis for these models is therefore limited to comparing equilibrium values across hypothetical changes in the exogenous variables. Since most of these models are non-linear due to the presence of qualitative choices it is not possible to analytically compute equilibrium values for these models. The most popular solution to this problem is to numerically simulate the effects of the exogenous changes for each individual in a random sample (which is usually identical to the estimation sample) and then sum up the individual effects to estimate the overall effect. It is easy to modify these techniques to account for the stratification used in most existing surveys.

The problems of policy analysis and prediction are much more difficult for *dynamic* microeconomic models. These models must be calibrated using panel (or longitudinal) data sets which generally contain information for a relatively large number of individuals over a small number of time periods. Most reasonable dynamic specifications depend on the initial values of the exogenous variables at the beginning of the process. Due to short time coverage, these initial conditions are rarely observed in current panel data, so they must be treated as unobserved latent variables. If assumptions are made about the distribution of these initial values over the population then it is generally possible to estimate the other parameters in the model, but frequently the resulting estimates (and therefore predictions) are very sensitive to the choice of distribution for the initial values. This problem has been noticed by researchers at IUI's MOSES project. They have discovered that the predictions from MOSES are very sensitive to the initial values chosen. The only solution to this problem is to estimate (or otherwise specify) a specific distribution for the initial values and then numerically calculate expected predictions with respect to this distribution. Heckman (1981) has clearly elucidated the identification problems caused by unobserved initial conditions. MacCurdy (1982) and Chamberlain (1982) have also proposed promising techniques for estimating the distribution of initial values without imposing highly restrictive assumptions. In addition to the problems with

initial conditions, Klevmarken (1980) has shown that there are also problems with the dynamic simulation algorithms used in existing microsimulation models.

3. Survey Data Problems

Since most microeconomic data sets are collected using survey interviews of households or firms, microeconometricians have been forced to develop techniques for dealing with the shortcomings of survey data. The largest and most common problem is missing data. In any survey there are always people who refuse to answer any questions or who give obviously incorrect answers. It is well known that if these non-respondents are different from the respondents, then predictions based on the survey may be incorrect (this effect is called sample selection bias). Therefore, before using any survey the analyst must first test to see if there is sample selection bias, and if so use techniques to remove the bias. These problems are not unique to microeconometrics (see the survey by Little, 1982), but due to the sensitive nature of the questions economists like to ask, non-response is frequently very high.

It is useful to note that the decision to answer an interviewer's questions can be modeled using qualitative choice models discussed earlier. This approach to sample selection problems, called the model-based approach, provides a general framework for testing and correcting for sample selection bias. It also provides a framework for using auxiliary information about non-respondents (like census records) to improve the accuracy of these model-based techniques.

Another problem with economic survey data is the possibility of lying by respondents. This is particularly likely if the respondents are cheating on their taxes and they think that the tax authorities will have access to the survey data. One approach to this problem is to develop qualitative choice models for the event that the respondent is lying, and then use this model to remove likely cheaters from the sample as well as correct for the resulting sample selection bias. The difficulty with this approach is that it is very difficult to obtain data for calibrating the cheating model. It may be possible to ask the same question in different forms in the course of a long interview. Hopefully the cheaters will forget the original incorrect figure they gave for the first question and give a different (probably also incorrect) figure for the second question. The other possibility is to link the survey data to tax records and look for inconsistencies.

Even if survey respondents do not intentionally give misleading or incorrect answers it is frequently not clear that they could give accurate answers even if they wanted to. One common example of this problem occurs when surveying firms to determine their cost or production functions.

Standard accounting practices do not produce figures which correspond to economists' notions of cost or production functions. Therefore it may be very difficult for the firm to give an accurate estimate of these quantities. Furthermore, if the firm undertakes the effort to calculate its marginal costs, then this new information might change the firm's actions. There is no general solution to these problems, but if the firm does not have estimates of its cost and demand functions then it is hard to understand how they are conforming to the neoclassical profit-maximizing assumptions.

The actual collection of sample survey data is by far the most expensive part of applied microeconomic work. Since economists are interested in policies which only affect a small number of people (like unemployment benefits) it is frequently necessary to use a stratified sampling procedure to insure that enough people are sampled in each category. Unfortunately this stratification is frequently based on variables which are endogenous to the models being considered. It is well known that this type of endogenous stratification makes it impossible to use estimation techniques developed for random sampling schemes. Recent work by Cosslett (1981) has shown that it is possible to derive consistent estimates from these endogenously stratified samples by making some very simple changes to the random sample estimation procedures. In some contexts, Cosslett's results can be used to design more cost effective sampling plans. For example, if one is interested in commuters' choice of transportation mode then it is much easier to take separate samples from each mode than to take a random sample of the population large enough to insure sufficient observations in each mode. These types of sampling schemes are also frequently used in epidemiology.

Microeconometricians are concerned with a number of other survey problems. Techniques for measuring time use and consumer expenditures are one area of active research (see Klevmarken's paper in this volume). One difficult problem is the measurement of small but infrequent purchases by consumers. Deaton and Irish (1982) have recently proposed a model which accounts for possible under-reporting of these expenditures. The main feature of their model is a qualitative choice model to predict whether the respondents report all of their purchases.

4. Microeconomic Research at IUI

IUI has been actively engaged in microeconomic data collection and analysis for some time. Current projects utilizing advanced microeconomic techniques include the labor supply work by A. Björklund and B. Holmlund and the HUS project (see page 104 in this volume). During the next year the author and A. Klevmarken will be doing methodological research in a number of different areas for the HUS project. Although this research is

aimed at developing techniques for analyzing the HUS project data, these techniques will be useful for other researchers at IUI and elsewhere. IUI's MOSES model is also an example of a dynamic microeconomic model. Because of the disparate data sources used to calibrate MOSES, the techniques discussed in this article cannot be directly applied. However, the general principles and techniques discussed here may be useful for improving the calibration and predictive accuracy of the MOSES model.

The HUS project pilot study shows that one of the largest problems with the HUS sample is going to be high non-response and the possibility of sample selection bias. Current techniques for dealing with these problems require strong assumptions about the household's decision to participate in the survey. In most applications these assumptions cannot be tested since there is generally no data available for non-respondents. The HUS project is fortunate to have HINK register data for all members of the sample, including non-respondents. These HINK data include tax and basic census information for all years beginning in 1978. Certainly these data can be used to test the modeling assumptions made by current sample selection models. In addition it should be possible to develop new methods which use the supplementary information to improve the accuracy of the bias corrections. If these new techniques are successful, then these results could be used by other researchers, to justify obtaining similar supplementary information for other surveys where sample selection bias is a problem.

The author is also working on developing robust estimation techniques for qualitative choice models. Current qualitative choice models require strong assumptions about the distribution of the "error terms" across the sample. These assumptions are very difficult to test and in some cases the resulting estimates appear to be quite sensitive to the specific assumptions made. A related problem is the high computation costs associated with estimating more realistic qualitative choice models. The author is one of the main developers of the QUAIL computer package, which is the most popular computer package for estimating qualitative choice models. He has recently completed a small study with K. Small (1982) showing that it is computationally feasible to efficiently estimate moderate sized Nested Logit models. These models are important members of a group of qualitative choice models proposed by McFadden (see Manski and McFadden, 1981) which require less restrictive distributional assumptions than current popular models. Other researchers are working on these problems in the U.S. and England, and it is likely that any new results could be directly applied to analysis of HUS project data and other microeconomic projects at IUI.

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PART II

CURRENT AND RECENTLY COMPLETED RESEARCH PROJECTS

1. Medium-Term Projections and Coordination Projects

This heading includes both larger studies in which a group of researchers work together within a project and coordination projects that hold together a number of small projects.

Energy and Economic Structure (KRAN)

This project has involved a large number of researchers over several years. It is now in its completion stage. The principal aim of the project has been to provide an empirical basis for discussions concerning energy policy strategies.

Different scenarios of the development of the international energy markets have been worked out to serve as background for the subsequent studies in the project.¹ The ability of Swedish industry of adjusting to drastic changes in energy prices and/or availability has been examined from many angles. One large sub-project analyzes the effects of major energy disturbances on economic stability and uncertainty under the heading: Policy Making in a Disorderly World Economy. It is presented separately below.

The development of two dynamic macro models has been an important part of the project. The two growth models ISAC (see p. 101) and ELIAS (developed at the Stockholm School of Economics) are now used for projections of the effects of possible future energy crises on structural change and growth in the Swedish economy.

¹ Published as:

Carling-Björk-Kjellman, *Internationella Energimarknader - Prognosmetoder och Framtidsbedömningar*. (International Energy Markets - Forecasting Methods and Future Assessments), IUI 1979, and

Eng, T., *Framtida energikriser - Hur påverkas världsekonomin? Hur sårbart är Sverige? - En studie av krisscenarier för tiden fram till år 2000*. (Future Energy Crises - Their Possible Causes and Their Impacts on World Economy and on the Swedish Economy. A Study of Scenarios up to the Year 2000). Research Report No. 14, IUI 1982.

In all, the project has produced 25 studies – published or forthcoming in books from IUI. Some studies were carried out at the Stockholm School of Economics and at the Energy System Research Group at the University of Stockholm as parts of the KRAN project. The major part of the studies were completed at IUI or by IUI collaborators in the U.S. or Switzerland.¹

What remains to conclude of this large project can be divided into three parts and three corresponding sets of papers that are currently being edited for publication.

The first part contains econometric studies that analyze *the use of energy in Swedish manufacturing* and its sensitivity to changes in energy prices and supply.²

The second part presents the two *macro models* of the Swedish economy, used in the project for simulating the effects of changing energy prices. The two models represent methodologically two quite different departures, ELIAS being an equilibrium model while ISAC incorporates various of inertia and disequilibria in the economy. Both models a relatively detailed accounting of energy use in manufacturing.³

The third part presents the results from the main *simulation studies* of energy crises and economic adjustment carried out on the two models ELIAS and ISAC.⁴

¹ For those who are interested, the original work program can be obtained from the institute.

Ysander, B.-C., *Kris och anpassning i svensk energihushållning – ett långsiktigt perspektiv* (Crises and Adjustment in Swedish Energy Management – A Long Term Perspective), IUI mimeo, 1978.

² The papers are ready in working paper form:

Dargay, J., *Energy Usage and Energy Prices in Swedish Manufacturing*. Working Paper No. 80, IUI.

Dargay, J., *The Demand for Energy in Swedish Manufacturing*, Working Paper No. 33, IUI.

Jansson, L., *A Vintage Model for the Swedish Iron and Steel Industry*, Working Paper No. 41, IUI.

Lundgren, S., *A Model of Energy Demand in the Iron and Steel Industry*, Research Paper No. 6254, EFI, Stockholm School of Economics.

Hultcrantz, L., *Energy Substitution in the Forest Industry*, Research Paper, EFI, Stockholm School of Economics.

Carlsson, B., *Energy Prices, Industrial Structure and Choice of Technology: An International Comparison with Special Emphasis on the Cement Industry*, Working Paper No. 79, IUI.

³ Ysander-Jansson-Nordström, *Kalkyler för 80-talet* (Modeling the 80s), Special Studies, Vol. 2, for IUI's Medium-Term Survey 1979.

Bergman, L., *ELIAS – A Model of Multisectoral Economic Growth in a Small Open Economy*, Working Paper No. 81, IUI.

⁴ Nordström, T., - Ysander, B.-C., *Oil Prices and Economic Stability – Simulation Experiments with a Macroeconomic Model*, Working Paper No. 82, IUI.

Bergman, L., - Mäler, K.G., *Oil Price Uncertainty and National Energy Policies*. Research Paper No. 6255, EFI, Stockholm School of Economics.

Project leader: Bengt-Christer Ysander.

Other researchers: Bo Carlsson, Joyce Dargay, Gunnar Eliasson, Harald Fries, Eva Christina Horwitz, Leif Jansson, Märtha Josefsson, Tomas Nordström, Tomas Pousette and Johan Örtengren.

Policy Making in a Disorderly World Economy

Stable economic growth at the national level requires a continuous structural adjustment at the level of firms, establishments and households. Normal characteristics of this process are business cycles, exits of inefficient production units and entry of superior competitors. Hence, "creative destruction", healthy competition and business cycles have to be key ingredients in economic growth. This Schumpeterian view of the dynamics of an industrial economy is the notion presented by Gunnar Eliasson, Mark Sharefkin and Bengt-Christer Ysander in a new publication from IUI that takes a comprehensive view on the problems studied within the KRAN project:

Policy Making in a Disorderly World Economy

(IUI Conference Reports 1983:1)

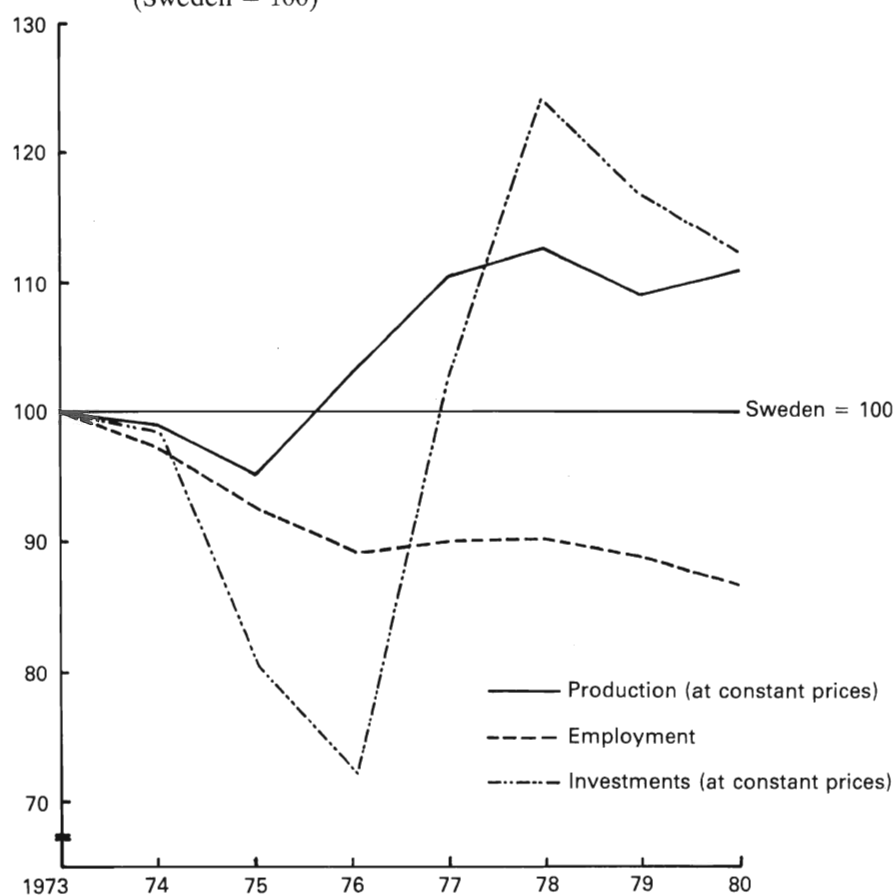
The ten studies in this volume deal with the transmission - after the oil-price hikes in the seventies - of price signals and quantity reactions through the international markets and into the Swedish economy. They also report on simulation experiments concerning future energy crises on three different kinds of models; the WEFA global model, the IUI macro model and the IUI micro-to-macro model. Some tentative policy conclusions are drawn. The studies are summarized in the introductory essay.

One reason behind the stagflation of the 70s is that this adjustment process has been contained by the policy makers. An inelastic supply seems to be a characteristic feature of the modern welfare states. A workable cure of the stagflation problem has to recognize this and old Schumpeterian wisdom seems to be more up to this task than modern neoclassical, Keynesian or monetary economics. It is even so that Keynesian inspired demand policies of the 50s and 60s did generate strong and steady growth for some 20 years only to build a statically efficient production system of the industrial nations that was very sensitive to the disturbances that occurred from the end of the 60s; inflation, the collapse of the Bretton Woods system, the oil-price hikes, etc. The stagflation of the 70s is of our own making and cannot be blamed on OPEC, such is the message of the book.

The book includes an empirical section describing the features of the world economy - mostly from data on the Swedish economy - that constitutes the structural instability problem. Märtha Josefsson and Johan Örtengren study relative price stability in Sweden - its extent and duration - during earlier periods of crisis on an historic database beginning 1913. Harald Fries compares the post 1973 adjustment and policy response in four countries: West Germany, the Netherlands, the U.K. and Sweden. Figure 1. illustrates the importance for the economy of the dynamic allocation process. Investments in Swedish industry and employment were relatively much larger than in Dutch industry. Nevertheless, output decreased relative to that in Dutch industry.

Eva Christina Horwitz studies price sensitivity of Swedish exports and Hans Genberg establishes the existence of price overshooting and asymmetries in the transmission of foreign prices into the Swedish economy.

Figure 1. *Production, employment and investments in manufacturing industry 1973-80: the Netherlands compared with Sweden (Sweden = 100)*



One Question - Three Answers

Simulation experiments on three different models are reported on. Shock experiments have been carried out on the 23 sector input output macro model ISAC (Ysander's paper), on a dynamic micro-to-macro model on the Swedish economy (Eliasson's paper) and on the WEFA model of the world economy (Sarma's paper). The demand driven WEFA model appears to be quite insensitive by assumption to the price shocks of the 70s. In the micro-to-macro system the entire growth process is endogenized. Firms operate in markets characterized by monopolistic competition. It appears that variously designed adjustment speeds on the part of firms and differing competitive intensities in the markets produce widely differing long-term growth trajectories of the Swedish economy, even when technical specifications of new investments are identical. The key mechanism is the investment decision at the firm level which is endogenous and dependent upon how firms interpret their price environment. There is an optimal rate of structural adjustment that maximizes growth, a rate that depends on the nature of the disturbance.

The Theoretical Heritage

This conclusion takes us right into the third part on policy problems. Mark Sharefkin investigates the general impossibility of understanding fully the dynamics of a national economy on the basis of existing economic theory. One can view the market process as an ongoing noncooperative game, where actors obey certain "learned" rules of thumb. These rules are reliable under conditions of "business as usual" but lead to various sorts of chaos when the system somehow gets upset. The 70s was characterized by such disorder in the sense that price signaling in all markets has been extremely unreliable predictors of future prices and existing rules of thumb have been misleading guides for decisions.

Karl-Olof Faxén takes this increased uncertainty as the characteristic of the 70s and concludes that we are dealing with genuine uncertainty that has to be reduced through markets. We do not face a situation with calculable risks. Under high uncertainty, decision makers make mistakes and eventually get cautious. They stop investing and employing people. The reduction of uncertainty in the world economy appears to be the key policy problem.

Policies

The editors of the book conclude in their introduction that one necessary condition for a return to a less uncertain world economic environment is to *restore predictability* in the world and national price systems. This is difficult

when the world price systems are significantly out of order (destabilized), when "stabilizing" appears to take up to ten years at least, and when policy makers do not have a reliable and useful theory to guide their policies.

Control of each individual economy requires policy control of the entire economy of the industrial world and a world consensus of policy making that we have never seen before; above all, a cautious, global demand expansion coupled with a lifting of all protective and price distorting restrictions to trade. Heavy subsidizing of crisis industries of the kind carried out in Sweden would have to go first.

Requirements for policy control of the world economy appear to be so formidable that they are not realistic. Far more likely is that each individual nation will continue to travel its own way and eventually policies in the industrial world will collapse into deliberate protectionism. Only a large and well established "free trade area" like the U.S. economy has the potential to weather such a development well and the reason is its size and internal diversity on the one hand and on the other the relative absence of central policy authorities assigned to watch and do something about the structural adjustment process.

Investigators: Gunnar Eliasson, Mark Sharefkin, Bengt-Christer Ysander, (editors), Karl-Olof Faxén, Harald Fries, Hans Genberg, Eva Christina Horwitz, Märtha Josefsson, K.S. Sarma and Johan Örtengren.

Swedish Industry Facing the 80s

IUI's latest medium-term survey was concentrated on industrial issues. It was completed in the fall of 1981 and reported in the book "Industrin inför 80-talet" (The Industry Facing the 80s) as a sequel to the 1979 all economy survey.¹ The most important findings are summarized below.

The industrial sector in Sweden, and thereby the principal exporting capacity of the country, has diminished. It may, in fact, have become too small for a decisive reduction of the heavy Swedish current account deficits. Industrial production at the business cycle peak in 1980 was below that of the previous peak in 1975. At the same time private consumption was up 5 percent and public consumption by no less than 18 percent. If external balance is to be restored, without considerable cuts in living standards of the Swedish people, industrial growth must be restored during the 80s. What are the prospects?

¹ *Att välja 80-tal* (Choosing the 80s), IUI Medium-Term Survey 1979, and supplementary volumes.

Factors Holding Back Industrial Growth in Sweden

The most important obstacles to industrial growth in Sweden seem to be (1) sluggish demand for Swedish products in the world markets, (2) the sharp increase in uncertainty regarding future market conditions that has taken place since the first oil-price shock and (3) structure preserving industrial policies.

One example of such policy measures in Sweden has been the extensive industry subsidy program. Without increasing the long-run viability of the companies that have received subsidies, the industry subsidies have increased uncertainty for other firms about competitive conditions, and paved the way for an economy of negotiations rather than of markets. The industry subsidies add to inflationary pressures and lead to crowding out problems. They also lock up resources, primarily skilled labor, in low-yielding activities. (See Carlsson's article above.)

One of the main conclusions in the book is that outside the limited number of crisis-stricken firms receiving huge subsidies, Swedish industry is on the whole highly efficient and competitive.

Swedish firms have generally adapted remarkably well to the difficult market conditions since the mid 70s. On the other hand, due to the cost conditions given, the high rates of inflation and the general uncertainty, adaptation has meant rationalization, specialization and shorter time horizons in planning. Only in very limited sectors of the industry it has meant growth.

Capital Formation - Primarily a Question of Resource Allocation

There is a widely held view in Sweden that the will to invest has decreased dramatically in Swedish manufacturing. Investments in machinery and structures are down to the levels of the early 60s. The economic policy proposed - as regards investments - is a policy of substantial investment incentives. This approach is challenged in the book.

Firstly, the upswing in investments in Sweden during the first half of the 70s primarily took place in the crisis-stricken industries and can be considered a very severe misallocation of resources in the Swedish economy. Therefore, the fall in material investments in the second half of the 70s took place from a much too high level.

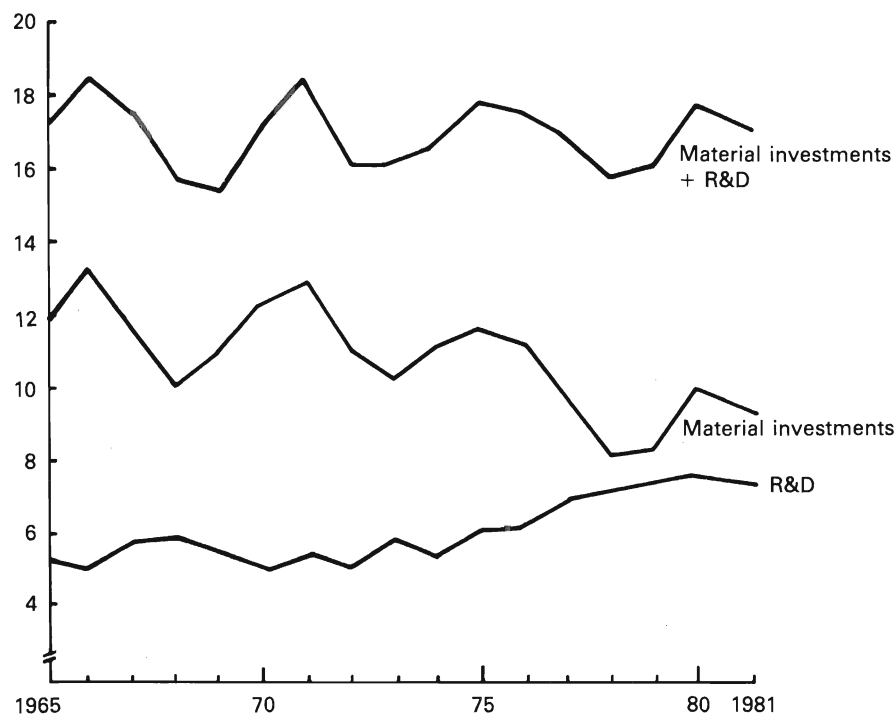
Secondly, and more important for the long-run perspective, investments are not only a matter of machinery and structures. It is to an increasing degree a matter of investments in knowledge - primarily R&D - and in markets. The activities of the firm stretch from research and development over production to selling the product and often also providing maintenance. In all these activities the firm invests, i.e., spends money with the purpose of getting them back over a longer time period. With this enlarged investment

concept we have to modify our picture of a serious slack in the will to invest. This is illustrated in Figure 2. where the more traditional measure of investment activity - investments in machinery and structures - is related to value added. Figure 2. also shows R&D intensity, i.e., expenditure on research and development related to value added. The sector shown is the engineering industry.

As can be seen, the traditional measure, the ratio of investments to value added, started to fall already in the beginning of the 70s. This is, however, offset by an increase in R&D-intensity. If the two concepts are aggregated no fall can be seen in the propensity to invest. At the end of the decade, investments in intangible capital equaled nine tenths of investments in tangible capital.

This enlarged investment concept also has important implications for the future allocation of resources in Swedish industry. The so-called growth-industries, above all the engineering industries and fine-chemicals, are

Figure 2. *Investment ratios in engineering industry (excl. shipyards) 1965-81.*
Percent



Investment ratio = Material investments and R&D-expenditures in relation to value added.

R&D-intensive and invest much more in markets than the crisis-stricken industries. This indicates that future industrial growth will require considerably less investments in machinery and structures but much more in knowledge and markets.

Increasing Imbalance in the Labor Market

Total employment in Swedish industry will not likely increase in the 80s. An increasing number of people is not finding jobs in the open labor market. The number is far greater than the official unemployment figure. Nevertheless, Swedish industry experiences a shortage of skilled labor. One of the factors behind this recruitment problem is a negative attitude to industrial work among the labor force. Another factor is a lack of appropriate training. There are no short-cuts to the solutions of these problems. Reduced employment in the public sector will, for instance, provide no immediate solution since the employees on the margin in the public sector are part-time female labor.

Instead, policy measures must aim at making industrial work more attractive in comparison with work in other sectors to attract new entrants in particular. Such measures should include more differentiated wages in the economy with manufacturing as the leading sector. The main target for containment is of course the public sector. Within the labor market training programs, wages should be differentiated with a bonus for training for industrial work. Lower starting wages for younger workers and the reopening of the former industrial schools could give positive effects on youth employment. Young people could get a more job-oriented education and better chances to find a job after school.

The Growth Industry Problem

In the medium-term survey published in 1979 by IUI¹ an evaluation was included of the Swedish crisis-industries, i.e., the iron ore mining, the steel industry, the shipyards and, to some extent, the forest industry. In "The Industry Faces the 80s" the emphasis is put on those more expansive and viable sectors that are regularly called growth-industries in the economic debate. Among these industries, the engineering and the chemical industries play a prominent part.

The Competitiveness of Swedish Engineering Firms

Among the expansive industries hopes have been pinned to the engineering industry. These hopes seem to be well-founded according to an investigation

¹ *Att välja 80-tal* (Choosing the 80s), IUI Medium-Term Survey 1979.

into the competitiveness of Swedish engineering firms. By international standards, even the largest Swedish engineering firms are relatively small. Nevertheless, they have been able to achieve leading positions within the rather narrow product areas that they have specialized in. Furthermore, they are strongly oriented towards the world market. One of the means has been to build international market organizations, which the firms view as one of the most important factors of competitiveness.

Much of the characteristics of Swedish engineering firms is valid also for the automobile industry which was given an in-depth study in the book. Swedish automobile industry had to face hardening market conditions during the 70s. Slower market growth, a fiercer competition and an increasing degree of regulation were characteristic features. The strategies chosen by Swedish automobile manufacturers to deal with these challenges are examined. Being a small producer, as to the number of cars produced, is not considered to be such a disadvantage because of the heterogeneity of the market. Both Volvo and Saab have specialized in a small segment of the market. Within that segment, they are rather big producers. Both firms try to maintain the brand identity where it is regarded as advantageous. Where it is not, they seek joint production with other producers.

The Chemical Industry

The chemical industry has been among the fastest growing sectors during the whole postwar period. Despite the oil-crises of the 70s, the chemical industry continued to grow faster than manufacturing as a whole. Also during the 70s many people have seen it as a growth industry. Growth prospects for the chemical industry, however, are not as good as they used to be. Only small segments, like pharmaceuticals and special chemicals, should be expected to grow rapidly during the 80s. Growth in the chemical industry was for a long time strongly linked to rapid growth in the production of plastics and plastic products. Between 1974 and 1978 this production did not grow at all in Sweden. In important sub-sectors like plastics, rubber wheels and certain petrochemical products the market situation in Western Europe today is characterized by excess capacity.

Growth Patterns in Swedish Multinational Companies

Swedish multinational companies have become increasingly internationalized during the 60s and the 70s.¹ *First*, the share of their total sales going to markets outside Sweden has increased. *Second*, production affiliates abroad

¹ Swedenborg, B., 1979, *The Multinational Operations of Swedish Firms. An Analysis of Determinants and Effects*, IUI, Stockholm.

account for an increasing share of *total* sales. One aspect of the internationalization process studied in the book is whether production affiliates abroad also account for a larger share of sales abroad. The answer is yes on average. An analysis on the firm level shows, however, that the pattern is far from uniform. We cannot speak of a typical growth pattern. Another result from the study is that foreign investments by Swedish firms abroad more often is a question of acquisitions of existing firms than establishing of a new firm.

Investigators: Bo Carlsson, Johan Örtengren, Petra Lantz, Tomas Pousette, Lars Jagrén and Fredrik Bergholm.

Large Scale Model Building at IUI

a) The Structure of Industry and Economic Growth (ISAC)

ISAC is a sector growth model of the Swedish economy which above all facilitates a study of how relative price changes in international markets and those in domestic factor markets influence structural changes in industry and the development of productivity. The model has been developed over the last several years and was used for IUI's latest medium-term survey.¹ In connection with the KRAN project (see p. 91) ISAC has been thoroughly revised in order to make it better suited for studies of the long-run growth mechanisms in the economy.

The new situation that Swedish industry has faced since the mid 70s requires new tools of analysis. The growth of the Swedish economy depends on the possibilities - and the costs - of adjusting the production structure to changing technology and relative prices. An analysis of growth from this perspective demands, among other things, a supply oriented model that takes account of the existence within different industries of fixed capital equipment that reflects earlier technological choices and varying possibilities for substitution.

In order to capture the significance of energy in the analysis of growth ISAC identifies different types and uses of energy. The model has so far primarily been used for the study of risk and uncertainty in energy policy and for dealing with long-run effects on productivity and structural changes of possible drastic increases in the price of energy.

By special agreement, the Ministry of Finance will use ISAC in its work on medium-term projections of the Swedish economy.

Investigators: Bengt-Christer Ysander, Leif Jansson, Tomas Nordström.

¹ *Att välja 80-tal* (Choosing the 80s), IUI Medium-Term Survey 1979.

b) The Swedish Micro-to-Macro Model - Idea, Design and Application (MOSES)

This modeling project began in 1975. It has three main ambitions:

- (1) To conceptualize a dynamic economic process in terms of economic agents operating in markets (*Theory*).
- (2) To serve as a means of quantification and, eventually, forecasting (*Model*).
- (3) To serve as a consistent (theoretical) design for building a systematic micro-to-macro statistical base (*Database*).

The theoretical base is a Schumpeterian type economic process with individual – real – firms forming their own decisions as to price, production, hiring of labor, wages, investment and how fast to grow in an endogenized market framework.

Model development has temporarily been halted with a version of the model that has manufacturing industry divided into four sectors inhabited by 150 decision units, 110 of which are real firms. The rest of the economy is a macro 10 sector Keynesian-Leontief model. Products, labor and credit markets are endogenized. The entire model runs on a small bundle of exogenous assumptions. The most important are labor supply, government hiring, four foreign price indexes (one for each sector), a foreign interest rate. The marginal investment/output ratio and labor productivity is exogenously assigned for new vintages of investment. The extent and allocation of investment in individual firms is, however, endogenously determined.

Development work is currently concentrated on estimating the micro parts of the model and building an integrated micro(firm)-to-macro(national accounts) database.

Besides analytical numerical work aimed at studying the properties of the entire model system, the micro-to-macro model has been used provisionally to support quantitative analysis in several areas; the macroeconomic effects of technical change, foreign price shocks and macroeconomic stability (see Policy Making in a Disorderly World Economy above, p. 93), the macroeconomic effects of industrial subsidies (see Carlsson's article), the effects of changing from one tax system to another, etc¹ (see next page).

Project leader: Gunnar Eliasson.

Investigators: James Albrecht, Bo Carlsson, Fredrik Bergholm,
Thomas Lindberg.

Historic simulations have been used to investigate the long-run stability properties of the model economy. Figure 3. illustrates some experiments. The initial year described in the data-base is 1976. Technical change associated with new vintages of investment is projected at the rate estimated for 1955/75 (a 2.5 percent annual increase in labor productivity in best practice plants). The model is parameterized to yield good historic trend tracking over the 60s and 70s. For the external economy, foreign prices are assumed to settle down on a steady trend of 5 percent per year in all markets. The interest rate is set to 7.5 percent, and there is no growth in the labor force. In this model economy we vary the extent of public sector employment growth over a very long historic period, *ceteris paribus*.

When public sector employment is set to grow at 1 percent per year - forcing a decline in manufacturing employment - we obtain the growth path (upper figure) in industrial output called REF.² We make two variations around REF; we reduce the growth rate in public employment to 0 and obtain REF(2) and we increase it to 2 percent per year and obtain REF(3).

¹ Below you find a selected Bibliography on the Swedish Micro-to-Macro Model in chronological order:

- Eliasson, G., 1976, *A Micro Macro Interactive Simulation Model of the Swedish Economy*, Preliminary Documentation, Economic Research Reports B15, Federation of Swedish Industries. (With the assistance of Gösta Olavi and Mats Heiman.)
- Eliasson, G., 1977, "Competition and Market Processes in a Simulation Model of the Swedish Economy", *American Economic Review* 1977:1.
- Eliasson, G., (ed), 1978, *A Micro-to-Macro Model of the Swedish Economy*, Proceedings of a joint IUI-IBM symposium in Stockholm, IUI Conference Reports 1978:1.
- Eliasson, G., 1978, "Relative Price Change and Industrial Structure", in Carlsson-Eliasson-Nadiri (eds.), *The Importance of Technology and the Permanence of Structure in Industrial Growth*, IUI Conference Reports 1978:2.
- Albrecht, J., 1978, "Production Frontiers of Individual Firms in Swedish Manufacturing 1975 and 1976", in Carlsson-Eliasson-Nadiri, op.cit.
- Eliasson, G., 1980, "Experiments with Fiscal Policy Parameters on a Micro-to-Macro Model of the Swedish Economy", in Haveman-Hollenbeck (eds.), *Microeconomic Simulation Models for Public Policy Analysis*, Academic Press.
- Carlsson-Bergholm-Lindberg, 1981, *Industristödspolitik och dess inverkan på samhällsekonomin* (Industry Subsidy Policy and its Macroeconomic Impact), IUI, Stockholm.
- Eliasson, G. - Lindberg, T., 1981, "Allocation and Growth Effects of Corporate Income Taxes", in Eliasson-Södersten (eds.), *Business Taxation, Finance and Firm Behavior*, IUI Conference Reports 1981:1.
- Carlsson, B., 1981, *Industrial Subsidies in Sweden: Macroeconomic Effects*, IUI Working Paper No. 58.
- Bergholm, F., 1982, *The MOSES-Manual*, forthcoming IUI Working Paper.
- Albrecht, J. - Lindberg, T., 1983, *The Micro-Initialization of MOSES*, forthcoming IUI Working Paper.

² This experimental design of REF is explained in detail in Eliasson: "On the Optimal Rate of Growth", in *Policy Making in a Disorderly World Economy*, IUI Conference Report 1983:1. In this paper some other historic analyses of the model using different market regimes, are also discussed.

External conditions for firms have been set to define a balanced capital market with nominal rates of return and interest rates roughly in line, after adjustment of initial supply structures for the unbalanced state in 1976. We allow the experiment to run for 200 quarters, or 50 years, to see how the market adjustment process takes place under the assumption of no further Government interference.

REF(3) is the public sector growth and employment oriented policy scenario. It succeeds more or less on the employment score. Open unemployment stays at low, "Swedish levels" throughout the period. Manufacturing output lags behind throughout the simulation and goes into a nose dive after some 30 years. At the end of the period manufacturing output (the size of the sector) in the no public employment growth scenario REF(2) is between 3.5 and 4 times as large as in REF(3). Part of what happens is mirrored in the growing labor's share in total output (or a steadily decreasing profits share, see lower part of figure). Manufacturing employment in the end is very small (less than 10 percent of what it was in 1976). Most firms have shut down. Only the best remain, and average productivity is very high.

Historic runs like this are of course only theoretical in nature and designed to study the properties of the model under an abstract environmental design. No forecast is implied by the projections. For instance, if a government had embarked on an industrial promotion program like REF(2), unemployment consequences during the first few years might have made it change its mind quite soon in the direction of REF(3). However, besides that both REF and REF(2) do resemble balanced growth scenarios more or less for the whole 50 year simulation. In REF(3), however, foreign and (not shown) public deficits reach such proportions already after some 20 years that a government without access to a large natural resource rent for a long time – like Norway – would have been forced to do something to correct the situation.

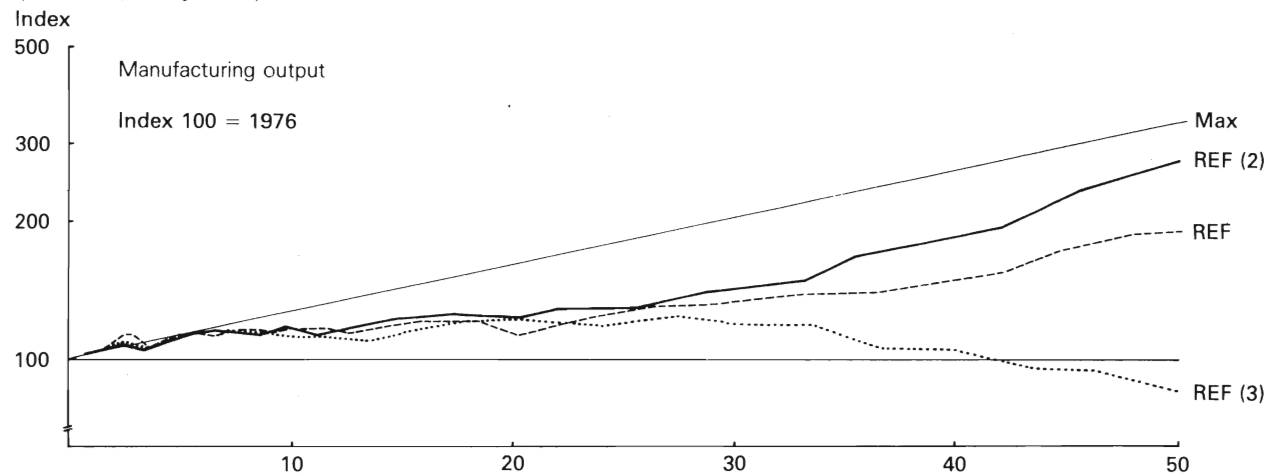
Household Market and Nonmarket Activities (HUS)

– A Comprehensive Study of Household Economics

The HUS-project was started with the ambition to analyze and understand household resource allocation and resource accumulation. A household controls resources in the form of human capital, wealth and time. They are used

- in the labor market to earn money incomes and to invest in human capital (experience),
- in the commodity markets to purchase commodities,
- in the financial markets to accumulate wealth,

A. *Output growth in manufacturing.*
(Index 100 = year 0)



B. *Profit margins and unemployment*

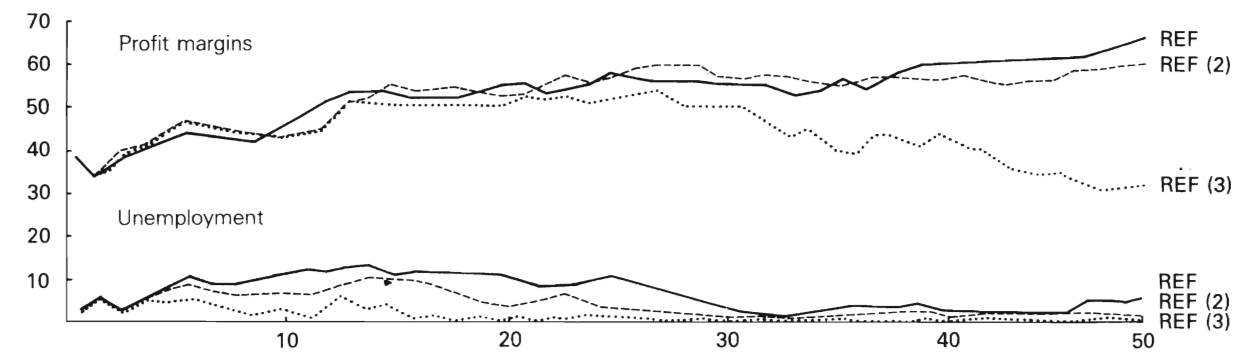


Figure 3 *Historic experiments (50 years)*

- during leisure time to acquire direct utility, and to invest in human capital,
- and also to obtain services from the public sector, which are not sold in markets.

All these aspects of household behavior are more or less interrelated. To study and understand household behavior one has to take this into account. For instance, demand for goods and services do not only depend on incomes and prices but also on the number of household members who have a market job, what kind of job they have, and also how they spend their leisure time. The amount of leisure time depends on each household member's job, the household composition, their stock of durables, etc. Labor supply depends primarily on the choice between leisure and income for consumption but also on the market work of other household members, on the supply of daycare services for children, etc. Without access to information of this kind we cannot expect much success in quantifying the determinants of (for instance) labor supply or saving - vital pieces of information for any policy maker today.

Hence, a study with the ambition to understand important aspects of household behavior *needs a comprehensive data set*. In Sweden cross-sectional surveys cover partial aspects of this data set. For instance, data on household expenditures, savings and labor supply can be obtained from three different sources based on different samples of individuals. There is no single data source which includes all, or most aspects of the economic behavior of households for the analysis of the HUS project.

An important purpose of the HUS-project, thus, is to organize existing data sets into a larger set of household micro data. This could be done by a merge of good register data from tax assessment forms and other administrative files with new survey data. Our plans are to draw a sample from the so-called HINK study (on the income of households) at the National Central Bureau of Statistics (SCB) and carry out complementary interviews on labor supply, expenditures, housing and time-use. HINK is a panel study with good income and wealth data. Each year a sample of 5 000 households is drawn for which data are collected from tax assessment forms and other public files. Each household is followed for a number of years and new data are accumulated. Survey data from the HUS-project, merged with HINK data, would give us an internationally quite unique database. Its usefulness increases even more if it would grow to a longitudinal database, i.e., if we could follow each household in the sample for a number of years.

Another general purpose of the HUS-project is the further development of data collection methods, methods for simultaneous use of several data sets and statistical methods for analysis of economic micro behavior.

HUS is a joint project between IUI, the University of Gothenburg, the Stockholm School of Economics and the University of Stockholm. It is

organized as a number of subprojects.¹

1. Labor supply, labor mobility
2. Job characteristics and individual qualifications
3. Time-use
4. Demand for housing
5. Demand for consumption commodities
6. Household savings
7. Demand for public services
8. Evaluation of tax reforms
9. Statistical methods

A pilot study was carried out in 1981/82. Its purposes were:

- to compare different methods of collecting expenditure and time-use data,
- to get an idea of the likely response rate in a main study,
- to test the questionnaire,
- to develop coding and editing procedures,
- to train the project staff in the entire survey operation.

The pilot study included a sample survey of 310 households from three counties (län) in Western Sweden, including Gothenburg. Time-use, expenditure, labor supply, housing and background data were collected in personal interviews, telephone interviews and by diaries from one, two or three adult household members in each household. The field work was done in April and May 1982 by interviewers from the SCB. These data were later merged with HINK-data.

It will always be a problem to obtain the cooperation of respondents in this kind of survey. The pilot study indicates that with sufficient resources and a careful planning it will be possible to collect these data and still obtain an acceptable response rate. In addition to a good design, well-trained interviewers and various response stimulating activities the HUS project will benefit from the HINK register data. There will be no need for interview questions on incomes and wealth. The HINK file also provides data on nonrespondents which can be used for bias corrections.²

¹ For a more detailed description, see the research program in Eliasson, G., and Klevmarken, A., *Household Market and Nonmarket Activities, Research Program and Proposal*, IUI Research Report No. 12, 1981.

² More details and results from the pilot study can be found in Klevmarken, A., *Household Market and Nonmarket Activities, A Pilot Study*, IUI Working Paper No. 77, 1982.

Plan for the data collection

The data needed for this project can be obtained from register data, in particular SCB's investigation, HINK, and from new surveys. The current plan for data collection is designed in two steps:

Step I (1983)

A random sample of 2 000 households is drawn from the 1978 HINK panel and interviewed by telephone. In this interview we will collect data about housing and labor market status. From the HINK-files and other forms we will get detailed information about incomes, debts, assets and social benefits.

Step II (1984)

- a) We propose that *the same households* be reinterviewed in 1984. We would then ask about changes in housing and labor market status and also ask for supplementary socio-economic information. Each household will be contacted at least three times in 1984. At least two of these contacts will be randomly allocated during the year with the purpose of collecting time-use data and data about consumption expenditures.
- b) Since a sample size of 2 000 households is relatively small we suggest that *a new sample* is also drawn and interviewed in 1984. The information collected from this second sample would be the same as for the first. Both subsamples should be supplemented with register data for 1984.

Current project status

Research in economics, and social science research in general depends to an increasing degree on micro data, most of which will have to be collected through sample surveys. (This argument is elaborated further in Klevmarcken's paper in this volume.) Survey data in most social sciences are the substitute for experimental laboratory data in sciences. Hence, field surveys can be regarded as corresponding to the acquisition of expensive laboratory equipment.

Survey research is very expensive. This is particularly so when sensitive economic data are collected. Much effort has to be invested into good measurement methods, good survey designs and careful training of interviewers, all of which add to costs.

After one year of planning and preparations, our pilot study started in August 1981. (It was jointly financed by two grants of 1 1/2 million SEK in total from The Bank of Sweden Tercentenary Foundation (RJ) and the Swedish Council for Planning and Coordination of Research (FRN)). The

reviews of the project have been very favorable and we have received much interest for it, not in the least internationally. In its originally planned form, and for a period of three years, the whole project was estimated to cost between 10.5 and 17.8 million SEK in 1981/82 prices. The smaller figure included a survey of 2 000 households while the higher figure corresponds to a sample size of 5 000. Of *these* amounts the field survey to be carried out by the National Central Bureau of Statistics, or by another survey institute was estimated to cost 7.2 and 14.5 millions respectively, or roughly 75 percent of the total. The remaining 25 percent are salaries, computer costs, travel expenses, etc.

To make the project less expensive and more in scale with regular research funding, parts of the total project have been selected for steps I and II above. The design has been changed accordingly.

The following approximate estimates indicate the funds needed for a full scale study according to the downscaled design described above, (steps I, IIa and IIb). The field work of the HUS project only will cost (in 1981/82 prices) about 8.5 million SEK. When this is written we have not been able to obtain this funding. In addition to this amount, salaries to cover analytical work, once data are available, would have to be funded.

Project leaders: Gunnar Eliasson and Anders Klevmarken.

Researchers:

From IUI: David Brownstone, Anders Björklund,
Bertil Holmlund, Bengt-Christer Ysander.

From other institutions:

Peter Englund and Mats Persson (The Stockholm School of
Economics),

Lennart Flood and Tommy Johnsson (University of Gothenburg),

Ingemar Torbiörn (University of Stockholm).

The Mobility of Labor

Research during the last decade has placed much emphasis on the labor market as an interrelated dynamic system. The stocks of employed and unemployed are continuously changing in composition; to understand fluctuations in the stocks it becomes necessary to explain *transitions* between them.

Several ongoing IUI studies deal with the determinants and consequences of events such as mobility between jobs, regions and labor market states. Some of them are explicitly policy oriented. For example, how will

unemployment insurance schemes affect behavior in the labor market? To what extent are current labor market programs able to bring about permanent benefits for those who are enrolled? Is labor supply sufficiently inelastic to ensure backward shifting on wages of payroll tax increases? The project *The Mobility of Labor* is composed of the following five studies.

a) **Labor Turnover and Migration**¹

The causes and consequences of labor mobility belong to the classical topics in labor economics. First, the adaptability of the labor market to changes in demand patterns has implications for the speed at which potential allocation gains can be realized. It is, secondly, clear that mobility across jobs is a device through which workers can improve their economic position; individual wage and income mobility is presumably to a large extent associated with job mobility.

In Sweden, the discussions on labor mobility have undergone several transformations. The early post-war period involved great concern about the alleged costs of "excessive" labor mobility. The idea, briefly stated, was that high or "overfull" employment might lead to productivity losses related to increased absenteeism and high turnover. The concerns about labor mobility during the past few years have been quite different from those of the early post-war period. It seems to be a common view that labor mobility in some sense is "insufficient" to meet predicted structural changes in Swedish industry.

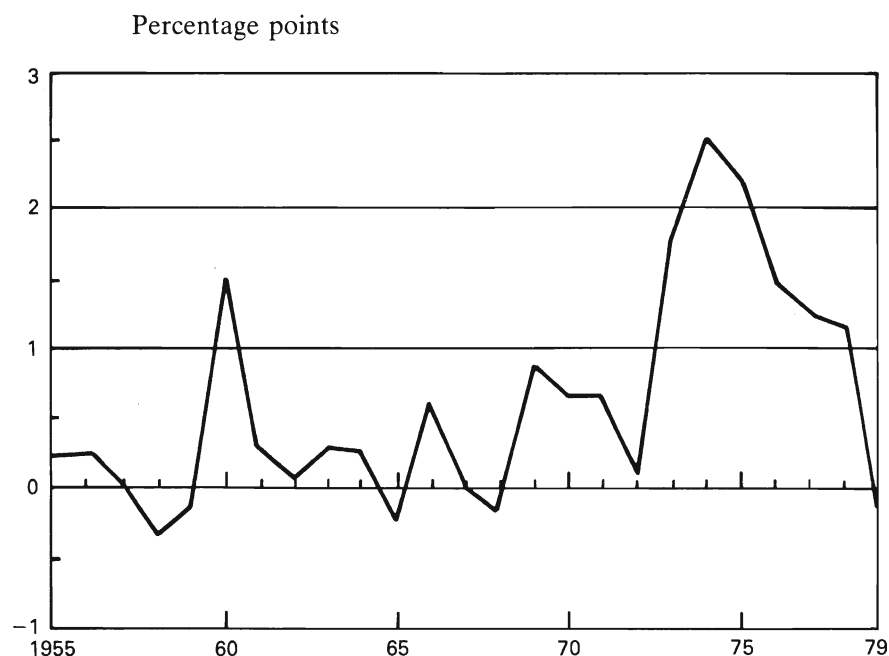
The general purpose of this study is to enlarge our knowledge of the causes and consequences of labor mobility. The focus is on the Swedish labor market of the 60s and the 70s. Several issues are addressed. They fall into categories such as: (i) determinants of quit rate variations over time and across firms; (ii) determinants of quit intentions, as reported by individual workers; (iii) determinants of household migration decisions; (iv) the relationship between labor mobility and subsequent earnings; (v) the functioning of the labor market as an interrelated dynamic system.

The adopted methodology makes it possible, among other things, to explore the role of individual earnings prospects for mobility decisions. To what extent do workers respond to perceived wage gains associated with mobility? Do workers actually gain by changing jobs and location? And to what extent are the movers' gains attributable to stayers, had *they* moved? The data also allow us to compare behavioral relationships at different points in time and, hence, to identify structural shifts that may have occurred² (see next page).

Investigator: Bertil Holmlund.

¹ See further Bertil Holmlund's article in this volume.

Figure 4. *Increases in hourly wage costs attributable to payroll tax changes, 1955–79.*



b) Effects of Payroll Taxes

Payroll taxes levied on employers have played an increasingly important role in the Swedish tax system. Those taxes – including various collective fees agreed upon in central wage negotiations – amounted to about 4 percent of the wage bill of private business in 1950 but had reached 40 percent in the late 70s. The payroll tax increases were quite dramatic during the last decade, with tax rates climbing from 14 percent to 40 percent.

The macroeconomic effects of this development have not been carefully explored. To what extent have the tax increases been shifted back onto labor

² Results from the project have been published in:

Dahlberg, Å. and Holmlund, B., "Internal Labor Migration in Sweden", *Scandinavian Journal of Economics* 1978:1, IUI Booklet No. 89, 1978.

Dahlberg, Å. and Holmlund, B., "The Interaction of Migration, Income and Employment in Sweden", *Demography* 1978:3, IUI Booklet No. 93, 1978.

Holmlund, B., "A Simulation Model of Employment, Unemployment and Labor Turnover", *Scandinavian Journal of Economics* 1980:2, IUI Booklet No. 112, 1981.

Björklund, A. and Holmlund, B., "The Duration of Unemployment and Unexpected Inflation - An Empirical Analysis", *The American Economic Review*, March 1981, IUI Booklet No. 119, 1981. A recent paper by Holmlund on "Labor Mobility and Wage Growth" was presented at the Econometric Society Meetings in Dublin, September 1982 (forthcoming as IUI Working Paper in 1983).

as lower wage increases? To what extent have they been shifted forward on prices? What are the effects on profit margins? It is widely acknowledged that Sweden's unsatisfactory macroeconomic performance during the late 70s partly was linked to the so-called "cost crisis". It has, however, so far been no evidence available on the extent to which the wage cost explosion could be attributed to the payroll tax increases. This study addresses that question.

The analysis focuses on an econometric specification of a wage change equation. This specification is based on a framework that gives interpretations of estimated parameters in terms of underlying demand and supply elasticities.

The basic message of the empirical analysis is:¹ The payroll tax increases have produced some backward shifting on wages, but the shifting appears to be far from complete. A statutory wage cost increase by one percent is associated with an actual wage cost increase of about one half of a percent within a time-span of one year. Figure 1 displays the contribution of payroll tax changes to increases in hourly wage costs in Swedish industry.

Investigator: Bertil Holmlund.

c) Effects of Labor Market Policies

A characteristic feature of Swedish post-war policies has been the extensive application of various selective labor market programs. During the late 70s these programs amounted to 3 percent of GNP and engaged about 4 percent of the labor force.

The need for policy evaluation is of obvious relevance here. As part of the Institute's labor market studies, efforts have been made to explore the effects of various labor market programs. The studies include analyses of the system for temporary jobs (relief works) and the employment preserving policies of the late 70s.²

The Ministry of Labor is currently financing a project on manpower training. To what extent are program participants rewarded by higher wages or lower future unemployment risks compared to those who are not enrolled in such programs?

Investigators: Anders Björklund, Bertil Holmlund,
Bengt-Christer Ysander.

¹ Holmlund, B., "Payroll Taxes and Wage Inflation: The Swedish Experiences", IUI Working Paper No. 68, 1982. (Forthcoming in *Scandinavian Journal of Economics*.)

² Gramlich, E.M., and Ysander, B.-C., "Relief Work and Grant Displacement in Sweden", and Holmlund, B., "Determinants and Characteristics of Unemployment in Sweden: The Role of Labor Market Policy", in *Studies in Labor Market Behavior: Sweden and the United States*, IUI Conference Reports 1981:2.

d) Unemployment Insurance in Sweden

The Swedish government has been actively involved in subsidizing unemployment insurance funds since the middle of the 30s. The government is also responsible for the system of "cash assistance" (KAS) to primarily new entrants in the labor market.

The current study – funded in part by The Expert Group for Studies in Public Economics (ESO) – reviews the Swedish system for unemployment insurance. Which are the major arguments for government intervention in this field? To what extent are unemployed individuals covered by unemployment compensation? What do we know about incentive effects of unemployment benefits? Does the current system implicitly subsidize certain industries more than others? Which are the properties of an optimal unemployment insurance program?

The first phase of the study is broad in scope and attempts to identify the main issues and characterize the prevailing system for unemployment compensation in Sweden. It includes descriptions of the rules and the different forms of benefits. A survey of available empirical knowledge about incentive effects is also given.¹

Investigators: Anders Björklund and Bertil Holmlund

e) Studies in Labor Market Behavior - Sweden and the United States. A Symposium at IUI, July 10-11, 1979

In 1979, the Institute organized a seminar on labor market issues. The proceedings of the symposium have been published in *Studies in Labor Market Behavior: Sweden and the United States*, IUI Conference Reports 1981:2.

The symposium dealt with a number of important issues in a comparative U.S.-Swedish setting. The emphasis was on unemployment and unemployment policies, labor supply and wage determination. Several papers included comparisons between Sweden and the U.S. – two countries with supposedly very different labor markets. A list of contents is given below.

The first set of studies considers the role of labor market policy in Sweden. *Stafford's* introductory paper primarily reviews the major public policies designed to influence unemployment in Sweden and the U.S. and comments on their effects. The basic difference between the labor markets in the U.S. and Sweden turns out to be the much larger emphasis placed on selective labor market policies in Sweden.

¹ Björklund, A., and Holmlund, B., "Arbetslöshetsersättningen i Sverige - motiv, regler och effekter" (Unemployment Insurance in Sweden - Motives, Rules and Effects), IUI Working Paper No. 78, 1983.

Johannesson explores the composition and development of Swedish labor market policy in detail. He shows that expenditures on labor market policy have increased gradually during the post-war period, with marked increases during recessions and with negligible decreases during boom years.

Holmlund's paper investigates the effects of different labor market policy programs in Sweden. The policies considered include traditional programs - such as temporary jobs and manpower training - as well as recent policy innovations, among them the employment security legislation. Holmlund finds, among other things, that the higher separation costs implied by the employment security legislation have decreased layoffs but have also induced more careful screening procedures on the part of firms.

The paper by *Gramlich and Ysander* evaluates the role played by Swedish relief work programs for the local governments' employment demand. To what extent are relief workers performing jobs "normally" carried out by regular employees, thereby reducing normal labor demand? They find considerable displacement effects in the public road work while no such effect is observed for health and welfare relief workers.

The next theme in the volume deals with the determinants of short-run unemployment fluctuations. *Burdett's* study approaches this issue from a search-theoretic viewpoint. The problem addressed is how changes in labor demand affect the outcome of a job search process.

The paper by *Björklund and Holmlund* investigates the extent to which fluctuations in unemployment duration are explained by short-run deviations between actual and expected wages, as predicted by search theory. In addition to these results the study offers a comparison of unemployment patterns in Sweden and the U.S. They find that inflationary surprises can explain some of the short-term unemployment in Sweden although variations in job availability appear to be the most important determinant of unemployment fluctuations.

A third group of studies in this volume is focused on issues related to labor supply. Among these is the paper by *Axelsson, Jacobsson and Löfgren*, which includes estimates of neo-classical labor supply functions on Swedish household data. They find that male labor supply is relatively insensitive to changes in wages and to the presence of children.

The question of labor supply responses to changes in tax rates is in focus in the paper by *Jakobsson and Normann*. Jakobsson and Normann utilize a simulation model of the Swedish system for personal income taxation and investigate labor supply responses to certain policy changes. They conclude that a lowering of the tax rates would increase government income under reasonable assumptions as to labor leisure substitution.

The paper by *Gustafsson* deals with the labor supply issue from a different viewpoint. The focus here is on how previous labor supply decisions influence current wages. Of primary interest is the extent to which male-female wage differentials can be explained by differences in work

history between the sexes. Standardizing for various human capital attributes, it turns out that Swedish women earn about 20 percent less than Swedish men.

The human capital interpretation of the return to education is challenged in *Albrecht's* paper. The basic objective is to develop an econometric procedure to test the *signaling* model and the question is whether employers use education for purely informational purposes in their hiring decisions. The hypothesis is tested – but not supported – by means of a data set that includes information on hired job applicants as well as refused applicants.

The remaining two papers in the volume are both studies of the process of wage changes. *Schager's* paper focuses on wage drift in Sweden, i.e., the difference between total wage increases and centrally negotiated increases. The paper, in which firms' recruitment behavior plays a crucial role, suggests that the *duration* of vacancies should be the variable most closely related to the tightness of the labor market.

The determinants of wage increases are also the topic for *Jonsson's* and *Klevmarken's* paper. Their approach represents an attempt to integrate the human capital wage theory with the Phillips curve framework. The analysis shows that both market changes and the outcome of central negotiations are important in explaining age-earnings profiles.

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Nils Henrik Schager, Swedish Employers' Confederation and University of Uppsala

Applied Microeconomic Projects

Information Technology, Organization and Total Systems Productivity

Discussions on the effects of electronics on manufacturing have focused on:

- (1) the physical (hardware) side of production, and
- (2) labor saving.

This may partly reflect a misconception of some important characteristics of manufacturing firm operations.

First of all, the modern manufacturing firm is to a large extent a service producing entity, covering a wide range of productive activities from the development of new products to the final marketing and distribution end. In the large international corporations the physical production process probably accounts for less, or much less, resource use than 50 percent. Furthermore, industrial robotics in a broad sense (including also NC machines) are mainly allocated to well defined assembly activities that are only a part of the physical production process.

Even within the workshop engaged in physical production, the *organization* of production flows seems to dominate the installation of more efficient equipment in explaining productivity changes. Moreover, major advances in productivity in the workshop are associated with the introduction of new product designs which enable a more efficient use of inputs.

Concentrating on the particular aspects of physical production means that one may overlook the enormous impact (potential and real) that modern, computer based information systems have on the entire business organization. Improvements in coordination techniques and throughput speeds from

the product design end to final customer delivery in a large business organization are very large, albeit difficult to measure properly.

One special aspect of efficiency improvement has to do with the capital use side in total factor productivity growth. Technological change has largely been thought to be of the labor saving type. Such econometric results, drawn from the analysis of highly aggregated economic time-series data, are of a dubious nature since, in fact, productivity change is predominantly a microeconomic organization phenomenon. The great potential of modern information technologies as they are applied in large business organizations seems to be on the capital (notably working capital) side.

These conclusions come from several studies completed or ongoing at IUI, partly for the Computers and Electronics Commission (DEK).¹

This continued work is currently organized within four subprojects:

a) *Large scale management systems and the use of modern information technology*

This project surveys the management systems in large Swedish firms. The ultimate ambition is to measure the productivity consequences at corporate level of various "technical" solutions. This requires that we first build a realistic management model of the firm and that we attempt to verify it in a series of case studies of large Swedish corporations. How are measurement systems within large firms designed and organized? Internal firm databases, analytical systems and the flow and actual use of information in decision making have to be mapped, and computer support in the various functions identified.

Investigators: Gunnar Eliasson, Harald Fries.

b) *The modern corporation*

This and the following projects are based on the management model being developed in project a). The main ambition is to describe and measure the

¹ Among these sources can be mentioned:

(1) Eliasson, G., *Electronics, Economic Growth and Employment - Revolution or Evolution?*, reprint from *Emerging Technologies: Consequences for Economic Growth, Structural Change, and Employment*, Symposium 1981, IUI Booklet No. 131, 1982.

(2) Eliasson, G., *Electronics, Technical Change and Total Economic Performance*, IUI Research Report No. 9, 1980.

(3) Carlsson, B., *The Content of Productivity Growth in Swedish Manufacturing*, in *IUI 40 years: The Firm in the Market Economy*, 1981.

(4) Eliasson, G., *Technical Change, Employment and Growth - Experiments on a Micro-to-Macro Model of the Swedish Economy*, IUI Research Report No. 7, 1979.

various activities that go on within a firm in order to illustrate the growing importance of the service or software content of manufacturing activity. Particular attention is paid to the product development, design, marketing, sales and administrative sides of firm operations. A statistical survey to the largest Swedish firms is planned.

Investigator: Harald Fries.

c) Datacommunication in business information systems

This study takes a closer look at modern networking systems as a part of the larger information system and their use in project a). How are information and computer systems of the various entities in large business organizations distributed and wired together and what particular productivity effects flow from such arrangements. Emphasis this time is more on the technical side, and the development of satellite communication is part of the study. The main area of concern is the ultimate impact on corporate performance. This information technology is still in its infancy when it comes to actual use within companies. The study focuses on particular sub-applications like global inventory and delivery systems, but the aim is to outline how the network of a fully wired company will ideally look during the 80s and what productivity consequences that can be expected.

Investigator: Tomas Pousette.

d) Productivity and efficiency in a large scale construction project

A large scale construction project may be seen as a business organization (a firm) especially set up for its only product; this time a nuclear power plant (Oscar III) in eastern Sweden.

The purpose of this project is to describe the technology of managing the nuclear power plant construction project. Special emphasis is put on the organizational factor behind productivity change. Direct measurements at the micro level are facilitated by the fact that the construction site also houses two earlier nuclear power plants in operation, and that the cost accounting systems of all three allow at least a partial "reconstruction" of a standard power plant that will make it possible to estimate the productivity effects associated with scale, costs for additional security, the effects of the rate of interest on the timing of construction work and the trade-off between additional investment spending now and less service costs later.

Investigator: Lars Jagrén.

Rates of Return and Taxes in the Growth Process of Firms

This project is composed of two parts;

- first, an analysis of the dynamic processes that explains the interaction between profits, taxes, investments and the growth of business enterprises
- second, the organization and accumulation of an individual firm data base that will make an empirical analysis of the above questions possible.

The project as such is very broad in scope and approaches and naturally interlinks with parallel, ongoing IUI projects, especially that on corporate taxation, profitability and growth (see p. 179; the two projects have now been merged). Both theoretical and data base work associated with the micro-to-macro model is carried out jointly with this project (see p. 102). Similarly, this project needs knowledge on the technological basis for individual firm growth, notably the application of management technologies. Hence, it feeds extensively on the project "The modern corporation". On the whole, this project, the modern corporation project and the micro-to-macro modeling project define an extensive and in-depth study on the theory and empirical qualities of the firm in an advanced industrial economy.

The Data Base

Building an integrated firm data base means that panel data for a number of - notably large - firms and their constituent parts (divisions) are assembled for a number of years and made consistent on a consolidated basis with the national accounts statistics.

The "planning survey" carried out jointly between the IUI and the Federation of Swedish Industries, beginning in 1974, is a central part of this project as is the micro-to-macro-modeling venture. Another part of the data base work is the external analysis of financing data for the 40 largest Swedish corporations, a panel that began in 1965. To this should be added the separate surveys of Swedish foreign subsidiaries for 1965, 1970, 1974 and 1978 (see p. 144) that will be used extensively.

Analysis

The analysis falls into four categories. First comes the micro-to-macro modeling project presented elsewhere. A second important part is the international tax comparisons project carried out jointly with the NBER (Cambridge, U.S.), IFO in Munich (West Germany) and the University of Birmingham (U.K.). In this study, the different tax-treatment of corporate

investments in the countries is analyzed (see further Lindberg's and Södersten's article in this volume). A third part is the conference on Business Taxation, Finance and Firm Behavior that IUI organized in 1978 and that was published in 1981 (a list of contents follows at the end of this presentation).

Fourth, several individual firm analyses and special inquiries are carried out.¹ One very large such inquiry based on the data assembled within this project and the micro-to-macro model was a recently completed study on the macroeconomic implications of the Swedish industrial subsidy program. (See Carlsson's article.) It appears that the dynamic macroeconomic effects of this program are potentially very large and that this policy orientation towards structure preserving subsidies may in fact be the major reason for the distress of the Swedish economy during the 70s². Since 1973 Swedish industrial output trails all countries in the OECD, with the possible exception of the U.K. industry.

A fifth part of this project is being planned. It concerns the international finance implications for the domestic (Swedish) allocation of investment resources. Most important is the international dependence of domestic rate of return criteria in the investment decision process. To what extent is the domestic interest rate internationally determined? Under what circumstances and for how long can a difference between, on the one hand, rates of return in industry and the interest rate and, on the other hand, foreign and domestic interest rates be maintained? What are the macroeconomic

¹ Some of them have been published in:

Eliasson, G., and Ysander, B.-C., "Picking Winners or Bailing out Losers – A Study of the Swedish State Holding Company and Its Role in the New Swedish Industrial Policy", IUI Working Paper No. 37, 1981.

Eliasson G., "Företag, marknader och ekonomisk utveckling" (Firms, Markets and Economic Development), and Rydeman, A., "Fyra historiska företagsbeskrivningar" (Four Historical Case Studies of Swedish Firms) in *Industriell Utveckling i Sverige – Teori och verklighet under ett sekel*, (Swedish Industrial Development – Theory and Practice during a Century), IUI, 1980.

Eliasson, G. and Granstrand, O., *The Finance of Technological Investments*, IUI Booklet No. 121 (1981) and Eliasson, G. and Granstrand, O., "Venture Capital and Management – a Study of Venture Development Units in Four Swedish Firms", forthcoming as IUI Working Paper 1983. This paper was presented at the Second Conference of Technology and Industrial Policy in China and Europe at Science Policy Research Unit, University of Sussex, Brighton, U.K., September 1982.

² Eliasson, G., "The Micro (Firm) Foundations of Industrial Policy", IUI Working Paper No. 86, 1983. The paper was presented at the Centre for European Policy Studies (CEPS) Conference on *Western European Priorities* in December 1982 in Brussels.

consequences – and their time dimension – of such disequilibrium situations?¹

Productivity Change in Different OECD Countries 1953-1980

In most OECD countries, productivity in industry has not been growing as fast during the 70s as it did during the earlier decade. The aim of this study is to examine this problem, a problem which many economists have been occupied with in recent years.

Production functions are estimated for the manufacturing industry in a number of OECD countries on time series data for the period 1953-80. This period has been divided into sub-periods to make comparisons over time possible. Furthermore, the estimates are built on the same kind of statistical data independent of the country being considered. This means that comparisons can be made not only between periods but also between countries.

The study shows, among other things, that the productivity slowdown in the countries during the 70s was primarily due to decreased capacity utilization. The slowdown, however, was also a result of the fact that technical progress contributed less than earlier to productivity growth. In the countries studied this decrease occurred after capacity utilization had diminished.

Project leader: Gunnar Eliasson.

Investigators: Thomas Lindberg, Jan Södersten, Fredrik Bergholm, Bengt-Christer Ysander, Ronald Teigen, Yngve Åberg and others.

In early 1981 the institute published the edited proceedings from a conference entitled:

Business Taxation, Finance and Firm Behavior

(Eliasson-Södersten, eds.)

This conference preceded the start up of this project and covered the current state of research in its area.

¹ This problem has been discussed in some detail in Eliasson-Södersten, "Business Taxation, Rates of Return and the Allocation Process", in IUI Conference Report 1981:1 (see below) and in Eliasson: "On the Optimal Rate of Structural Adjustment" in Eliasson, Sharefkin, Ysander (eds.): *Policy Making in a Disorderly World Economy*, IUI Conference Report 1983:1.

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Nordic Medium Term Survey

The institute completed its second medium term survey in 1979 (called LB79).¹ The next survey will be a Nordic medium term survey (NLB84), carried out jointly between IUI, ETLA in Helsinki (Finland), IØI in Bergen (Norway) and IFFF in Copenhagen (Denmark). Emphasis will be placed on differences in policy responses among the four countries during the 70s and the consequent growth, unemployment and inflation experiences.

¹ In four volumes: (1) Eliasson, *Att välja 80-tal* (Choosing the 80s), IUI Medium Term Survey 1979, (2) Axell-Gustafsson-Holmlund-Horwitz, *Utrikeshandel, inflation och arbetsmarknad* (Foreign Trade, Inflation and the Labor Market), Special Studies for the IUI Medium Term Survey 1979, (3) Ahlström-Eriksson-Jansson-Lindström-Nordström-Södersten-Ysander, *Kalkyler för 80-talet* (Modeling the 80s), Special Studies for the IUI Medium Term Survey 1979, (4) Normann-Renck-Larsson, *Byggmarknad, sjöfart och varuhandel* (The Housing Market, Shipping and the Wholesale & Retail Trade), Special Studies for the IUI Medium Term Survey 1979.

2. *Productivity, Technology and Resource Use*

The Development of Swedish Industry During the Postwar Period

A comprehensive study of various aspects of Swedish industrial development in the postwar period has been carried out at IUI during the past few years. The project studies the characteristic features of industrial development, the demands for change faced by industry, and how industry has adjusted to these demands. This study is part of the Institute's research program on growth and structural change within the Swedish industry. The study is also an update and a widening of Erik Dahmén's early study on "Entrepreneurial Activity in Swedish Industry in the Period 1919-39".¹ Other projects within IUI and some special research projects have been used as a base. The interaction between technological development, internationalization, financing and economic development is analyzed in this predominantly historical study. Emphasis is put on entrepreneurial activity and changes in its character and meaning brought about by external conditions during the postwar period. The project draws heavily on research dealing with individual firms.²

Investigator: Erik Dahmén.

Under this project title an international symposium on *The Dynamics of Decentralized (Market) Economies* sponsored by *The Marcus Wallenberg Foundation for International Cooperation in Science* is being organized for late August 1983, jointly by the Industrial Institute for Economic and Social Research (IUI) and the Journal of Economic Behavior and Organization (JEBO). The *Organizing Committee* and the editorial group consists of:

Erik Dahmén, Stockholm School of Economics & IUI,
Richard Day, University of Southern California and
Gunnar Eliasson, (chairman), IUI.

¹ Published by IUI in 1950 under the title: *Svensk industriell företagsverksamhet 1919-39* and translated as: *Entrepreneurial Activity in Swedish Industry in the Period 1919-39*.

² The theoretical framework and some results of this study have been presented in the IUI publication: Dahmén, E., "Hur studera industriell utveckling" (How to Study Industrial Development) in Dahmén-Eliasson (eds.), *Industriell utveckling i Sverige – Teori och verklighet under ett sekel* (Swedish Industrial Development – Theory and Practice during a Century), IUI, Stockholm, 1980.

Why a Conference like this?

Two elements underlie the remarkable developments that brought the industrial nations to their present high and unprecedented levels of economic welfare: the *business firm* and the dynamic *market process*. These two mainsprings of economic progress have been at the center of economic advance in all industrial nations, although the exact form of industrial organization has differed from country to country as has the degree of governmental interference with the behavior of markets and firms.

Yet, how much do we understand about the way a market economy works? The erratic and disappointing economic performance in the 70s, the uncertain prospects for the 80s and the 90s and the disagreement among the economists about the reasons for it suggest an inadequate understanding. The conclusion of the IUI seminar in 1979 celebrating the 80th birthday of its honorary chairman, Dr. Marcus Wallenberg, was that business decision units and dynamic market processes do not appear adequately in economic theory.

This conference aims at highlighting and facilitating the development of theories dealing with dynamic market processes and the behavior of their constituent decision-making bodies. Micro-to-macro theory is a key word and the conceptualization of a capitalistic market economy by Joseph Schumpeter (born exactly 100 years ago in 1883) represents one body of thought that signifies our overall theme.

Thus, there are three main reasons for organizing a conference like this:

First, the firm as a decision making entity in the macro economy should be given a more prominent role in economic theory. Research in this area is currently very fragmented. There is a need to bring researchers together with the purpose of sharing experiences and promoting future work.

Second, there is a great need to develop a body of thought that treats the dynamics of firm behavior consistently in a macro setting. Many economic problems of today are best approached at the micro level, especially problems relating to supply, economic growth as well as the stability responses of the macro economy to various kinds of stimuli and disturbances, including economic policy making. In what kind of market environments does entrepreneurial activity thrive? One would hope that this work would formalize and extend the concepts of the dynamic economic processes developed by Joseph Schumpeter in the first part of this century.

Third, an improved understanding of the macro economy requires the development of a body of thought that can be brought to bear on the wealth of high quality micro information that exists, but lies mostly underutilized in most industrial countries.

Hence, the conference will mostly deal with theoretical and conceptual issues. Little empirical research is available so far and what is ready should be

part of the conference. The theme of the conference will, however, be the need to develop a theory that can be efficiently and fruitfully applied to micro-to-macro empirical research, or, in short, the dynamics of the mixed industrial economies.

Condensed Program

Section I	Background on Schumpeterian Economics
Section II	The Theory of Economic Dynamics
Section III	Modeling the Dynamic Economy
Section IV	Adaptive Evolutionary Modeling
Section V	Empirical Inquiries

Economic Growth in Sweden

Technological change in Swedish economic growth 1870-1975 is the central theme of this study. It is based on a model which emphasizes capital as a factor of production. In particular, the model endogenizes depreciation and hence the life of equipment.

By analyzing the interaction between changes in capital stocks, investment and potential production growth during the last hundred years, we find that technological change progressed at a faster rate in the post-World War II period than before. This has caused a sharp decrease in the life-span of capital. The difference in productivity between old and new plants has thus diminished. This, in turn, implies that the amount of investments per unit of output has increased substantially since World War II.¹

Investigator: Ragnar Bentzel.

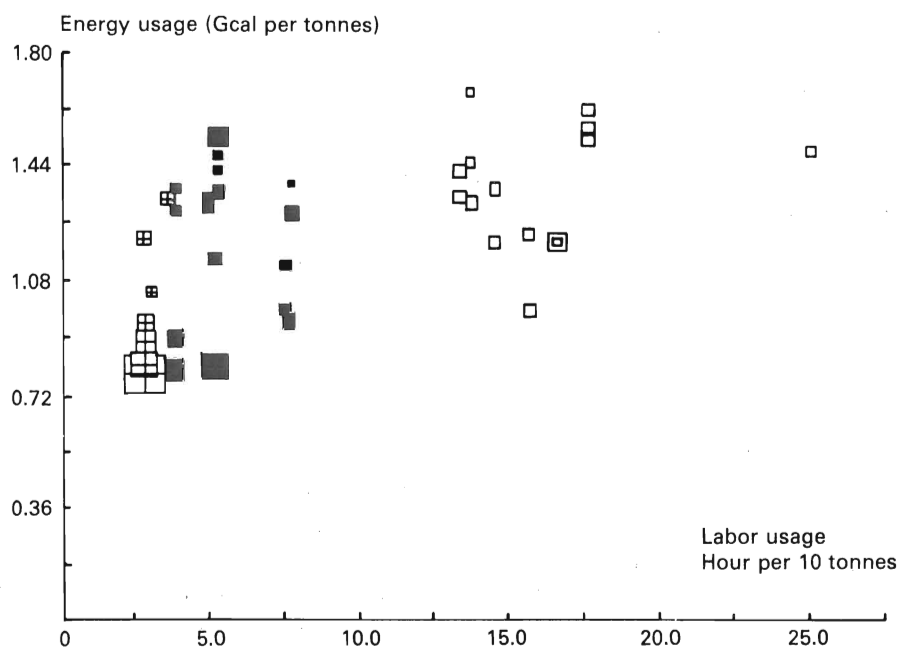
Industrial Structure, Technological Development and Efficiency

Various aspects of industrial structure, technological development and efficiency are analyzed.

The first part of the study is a theoretical discussion concerning the concept of structure and various aspects of structural change. The spread of technology between old and new plants within each sector has been given

¹ Some results from this project have been presented in Dahmén-Eliasson (eds.), *Sveriges industrialisering – Teori och verklighet under ett sekel* (Swedish Industrial Development – Theory and Practice during a Century), IUI, Stockholm, 1980.

Figure 5. *The size of Swedish cement furnaces and their usage of labor and energy 1955, 1974 and 1979*



Note: Empty squares = 1955
 Filled squares = 1974
 Crossed squares = 1979
 The capacity of the furnaces is proportionate to the size of the squares.

special attention. The structural analysis is based on a description of the sectors derived through production function analysis. It also describes plant size as well as its usage of various production resources, for instance the possibility of substituting any factor of production with another, e.g. labor with energy. Such production function analyses at various points in time make it possible to study the development within a sector over time.

One example, shown in Figure 5, describes the size of Swedish cement furnaces and their usage of labor and energy in the three years 1955, 1974 and 1979. Each square in the figure represents a furnace, the capacity of which is proportional to the area of the square. As is evident from the figure, usage of both labor and energy per ton of cement has decreased since 1955. Usage of labor has decreased the most. Plant size, on the other hand, has increased.

A number of different definitions of efficiency are compared in the study,

such as measures of technological efficiency and economies of scale for individual plants and of the structural efficiency in the sector as a whole.

The second part of the study presents an empirical analysis of the structural and technological development within various sectors of Swedish industry. Considerable efforts have been put into computer work for facilitating various types of structural analysis. The results have been published successively.

Recently published studies analyze technological development in the dairy industry, the particle board industry and the cement industry as well as blast furnaces in the iron and steel industry.¹

Investigators: Finn Førsund and Lennart Hjalmarsson.

The Vulnerability of Swedish Industry

The economic and political uncertainty in the world has increased. The crises of Poland, the Falkland Islands and Lebanon are some examples. Trade restrictions are often used to exert political pressure. One example is the American technology boycott against the building of the pipeline from the Soviet Union to Western Europe. The EG-countries' boycott against Argentina during the Falkland war is another.

How is Sweden affected by different types of international disturbances in which economic sanctions are used? The "oil-crisis" of 1973/74 illustrated how the Swedish economy can be threatened by crises of less severity than wars and warlike conflicts. In a recently published study at IUI the vulnerability of Swedish industrial firms in conflicts below the war level is described and analyzed.² The study focuses on the individual firm and how it adjusts according to its own preferences when such a situation occurs. A number of questions are dealt with. Is it possible for Swedish suppliers to replace foreign ones? How sensitive are the production equipment and the computer systems? Which type of crisis does the firm plan for? Under which circumstances is it appropriate and meaningful for society to intervene?

¹ Førsund & Hjalmarsson, "Frontier Production Functions and Technical Progress: A Study of General Milk Processing in Swedish Dairy Plants", *Econometrica* No. 4, 1979. Also published as IUI Booklet No. 100. "Generalized Farrell Measures of Efficiency: An Application to Milk Processing in Swedish Dairy Plants", *The Economic Journal*, June 1979. Also published as IUI Booklet No. 105. "On the Estimation of Deterministic and Stochastic Frontier Production Functions. A Comparison", *Journal of Econometrics* No. 13, 1980. Also published as IUI Booklet No. 107. *Technical Progress and Structural Change in the Swedish Cement Industry*, IUI Working Paper, forthcoming.

² Jagrén, L., & Pousette, T., *Industriföretagets sårbarhet* (The Vulnerability of the Industrial Firm), IUI Research Report No. 15, 1982.

Firms in two industries considered to represent extreme cases of international dependence (building materials and electronics industries) were chosen for interviews. The most important results are:

- The building materials industry is heavily dependent on certain foreign chemicals and alloys.
- The electronics industry is *at present* highly dependent on imported electronic components.
- Production equipment is comparatively insensitive to disturbances in international trade.
- Computer systems may be a particularly sensitive part. The uncertainty in this area is great.
- The extent and duration of the crisis determines the firms' choice of adjustment.
- There is a range of conflicts for which neither firms nor society is preparing through explicit plans.

Besides the vulnerability today, the future development is discussed. The increasing application of electronics means that the industry's vulnerability in the immediate future will increase. Other sectors, especially engineering industries, will soon fall into the same risk category as the electronics industry. The dependence on imported standard circuits is, however, expected to decrease as a consequence of an increasing use of custom-designed circuits in Sweden. This will probably lead to a reduced vulnerability during the 90s, despite the growing importance of electronic components in both goods and production equipment. The experiences of Swedish firms during World War I and II are also described in the study both to serve as case-studies and as reference points for the analysis.

Investigators: Lars Jagrén and Tomas Pousette.

The Performance of Machine Tool Manufacturers and Users in Sweden and the United States 1960–82

For several years, the slowdown in productivity growth has been a central problem at all levels within firms and in all of manufacturing industry. This problem has affected most industrial countries, although in varying degrees. Despite the numerous studies that have been made, our understanding of the causes of the slowdown and of observable international differences, is limited. It is not difficult to understand why the steel industry in the old industrial countries is having difficulties competing with new, large-scale steelworks in newly industrialized countries which are in the process of

building up their industrial infrastructure. But when similar problems occur in the engineering industries of industrial countries – constituting nearly half of manufacturing industry in those countries – it is important to find out what is actually happening.

Has the "technology gap" between the United States and Europe been reversed, at the same time as the Japanese have surpassed both? What has happened to the competitiveness of U.S. manufacturing industry, and why? How does Swedish industry perform in comparison with that in the U.S and Japan? Has new production technology, incorporating recent discoveries in the field of electronics, so revolutionized the manufacturing process that flexibility has become more important than scale economies?

The present study seeks answers to these questions by focusing on technological change in machine tools (i.e. the power-driven machines used to cut, form or shape metal) and their use in engineering industries. It follows the tradition of micro based productivity studies pioneered by IUI during the last few years. About a dozen interviews have been conducted with machine tool builders in Sweden and the United States with the object of getting a handle on the state of the art of machine tool technology in these two countries. How has the nature and degree of competition changed over the past 20 years? What are the most important innovations, and what brought them about? What has been the role of interaction between builders and users of machine tools?

A second series of interviews have focused on the user side. In what ways do machine tools and their use differ among countries? How does the user side view collaboration with machine tool suppliers? What is the contribution of new or improved machine tools to increased productivity in manufacturing? In what ways do production strategies differ among firms in different countries, and what impact does this have on the choice and use of machine tools?

The study has been carried out partly at the Center for Policy Alternatives at the Massachusetts Institute of Technology. The project is funded by the Swedish National Board for Technical Development (STU), the Institute for Economic Historical Research at the Stockholm School of Economics, and the Marianne & Marcus Wallenberg Foundation.

Investigator: Bo Carlsson.

3. Taxes and Public Finance

Effects of Income Taxes and Transfers on Households

This recently completed project¹ estimates the diminishing growth in real household income expected for the 80s. One particular problem has to do with the relative size of the retired population and its indexed retirement schemes compared to the incomes shares of a relatively shrinking working population and continued low growth prospects. Simulations with the ISAC-model (see p. 101) show how real income is affected by various assumptions concerning, for instance, public sector growth. In the "reference" case a 15 percent increase in real disposable income is allowed during the decade. How much of this growth that accrues to the working population depends on the development and taxation of pension income.

Table 1. *After tax income growth for the working population (employees) during the 80s (10 years)*
(Percent)

	Unchanged taxation of pension income	Raised taxa- tion of pension income
Total real disposable income growth per employee 1980-90	1.7	6.9

Source: Research Report No. 11, IUI, 1980.

The table shows the consequences for income development of different taxation schemes for retirement income.

In the first alternative the average tax rate for pension incomes is assumed unchanged over the 80s. The increase in the number of retired persons as well as their increased real pension income is thus assumed to affect real

¹ The results were reported in IUI's latest medium-term survey and in a research report on public service and industrial growth. Nordström, T., and Ysander, B.-C.: *Offentlig service och industriell tillväxt. Perspektivskisser av svensk ekonomisk utveckling 1950-2000.* (Public Service and Industrial Growth. Scenarios on Swedish Economic Development 1950-2000.), Research Report No. 11, IUI, 1980.

disposable income fully. This implies practically no increase at all – 1.7 percent during the ten years - in the real after tax income of the working population.

The second case is based on an equalized development of real disposable income for all groups of income-earners, making a 6.9 percent increase per capita possible. Tax rates on pensions in this case are set to increase much faster than on income of employees. Such a development of taxation is already built into the special pension income tax rules recently enacted, which are characterized by a relatively low average tax rate combined with a highly progressive tax scale.

Investigators: Tomas Nordström and Bengt-Christer Ysander.

Corporate Taxation, Profitability and Growth

The corporate income tax is often said to have influenced capital formation in a major way. Its effectiveness as a fiscal policy variable for manipulating investment activity was widely accepted for a long time. During the prolonged recession of recent years, many examples of governments' reliance on this measure can be given in most western countries. The worldwide recession has induced politicians to use the corporate income tax as a tool to influence activity levels and to attain short-term goals, particularly regarding employment.

However, judging from experiences in several countries of firms' responses to these tax measures, effects have been rather ambiguous and it may be time to revise some received knowledge on the effects.

The purpose of this recently concluded project has been to investigate the dynamic allocation effects of the corporate tax system.

Firstly, actual performance in Swedish industry during the last decades was mapped through the construction of a database containing aggregate subindustry data as well as micro firm data from the most important industry groups.¹ Analyses of financial flows and structures, growth patterns, tax behavior and profitability have been carried out.

Secondly, IUI's micro-to-macro simulation model has been based on these data sets. Quantitative experiments, under various tax regimes, were carried out. Special consideration was placed on the dynamic, allocative efficiency of

¹ A preliminary presentation of these data was given in Lindberg, T., "Industrial Profits – Their Importance and Evaluation", appearing in *"The Firms in the Market Economy"*, IUI Research Program 1979/80. The complete presentation of the entire data-base project will be made under a different project title (see p. 120).

capital and labor when subjecting this Swedish-like economy to changing environmental conditions, e.g. to increased foreign competition by means of drastically changed relative prices.¹ We found that the misallocated investment itself did not represent more than a small item in the total allocative loss. The major loss occurred when loss operations continued for a long period of time, depriving the rest of the economy of labor resources where they could have been employed with larger contribution to economic growth. The reason was that new, modern plants had been installed on the wrong premises, investment costs were sunk costs, and there was a small contribution to capital costs. From a private point of view it made economic sense to continue. From the societal point of view, the negative output loss was large and growing, and the local employment effect was only temporary. These allocative losses were even larger when the macroeconomic effects of industrial subsidies were studied.

Thirdly, the system of capital income taxation, i.e., both at the corporate and the personal/individual levels has been thoroughly examined. The tax treatment of three different kinds of investment projects were followed from the saver, or the ultimate owner of the financial claims on future profits, via the different possible financial channels to the final real investment. This has been done by identical methods for four countries (the U.S., the U.K. West Germany and Sweden) in the so-called International Tax Comparisons Project.² (See article by Lindberg-Södersten, p. 73.) The project is now completed and further work will be integrated with the larger micro-based allocation study: "Rates of Return and Taxes in the Growth Process of Firms" (see p. 120).

Investigators: Thomas Lindberg and Jan Södersten.

Economic Development and Expenditure Growth of Local Government

In 1962, IUI published a study by Erik Höök on the expansion of the public sector 1913-58. Since then, IUI has continued to study various aspects of government expenditure. Government consumption and investment fore-

¹ These experiments were reported in Eliasson-Lindberg, "Allocation and Growth Effects of Corporate Income Taxes" in Eliasson, G., and Södersten, J., (eds.), *Business Taxation, Finance and Firm Behavior*, IUI Conference Reports 1981:1.

² "Beskattning av kapitalinkomster i USA, England, Sverige och Västtyskland" (Capital Income Taxation in the U.S., the U.K., Sweden and West Germany), IUI Research Report No. 19 contains a more extensive documentation of the Swedish results. The final volume with results for Germany, Sweden, the U.S. and the U.K. will be published by the University of Chicago Press at the end of 1983.

casts have been made for the IUI medium-term surveys. The present project examines further local government expansion in the postwar period and its relation to overall economic growth.

A statistical overview and descriptive analysis of the development of local government expenditures during a period of more than a hundred years is presented in "Att välja 80-tal" (Choosing the 80's).¹

By applying regression analysis to cross-sectional data for 1975, hypotheses concerning the determinants of local government expansion have been tested.²

An econometric model of local government expenditure behavior has been developed within the framework of the project. It was first used for the IUI Medium-Term Survey in 1979. The model is now used in two studies. In one of them, the effects of local government expansion on economic growth and stability are examined. The other study analyzes the degree of price adjustment in the local governments' use of labor, capital and intermediate goods.

As part of this project, IUI arranged (in June 1981) an international conference on "Government Control of Local Government Expansion". This conference is extensively presented in Ysander's article in this volume.

Project leader: Bengt-Christer Ysander

Investigators: Erik Mellander, Richard Murray, Tomas Nordström.

The Effects of General Factor and Commodity Taxation

In this project the economic effects of taxes on value-added, payrolls and capital flows are investigated. Theoretical models as well as econometric methods are used.

In addition to the existing consumption type, value-added tax (CVAT), an income type (IVAT) is also discussed. A reason for this is the current debate in Sweden regarding the so-called production factor tax ("Proms"). This tax can in fact be described as an IVAT where exports are not exempt and imports are not taxed.

In a first report from this project some effects of a tax on capital income have been analyzed. It is argued there that a tax on the rewards to capital

¹ See Eliasson-Carlsson-Ysander et al., 1979, *Att välja 80-tal* (Choosing the 80's), IUI Medium-Term Survey 1979.

² The results are reported in Murray, R., "Kommunernas roll i den offentliga sektorn" (The Role of Local Governments in the Public Sector), IUI Working Paper No. 49, 1981.

taken out at the firm level rather than on households will be ultimately borne by labor in a small open economy. The shifting process involving the international reallocation of capital is expected to come to an end in a few years. This study was published as an expert report to a government committee on taxation.¹

A second report gives a comprehensive treatment of the performance of the existing value-added tax in Sweden. This study was presented to a Brookings Conference on value-added taxation held in Washington in 1980.²

A third, not yet completed, report includes an analysis of the so-called "tax push inflation" hypothesis. This hypothesis states that tax increases will lead to higher rates of inflation. The econometric evidence in the report seems to confirm the hypothesis. A surprising result of the econometric analysis is that an increase of income tax progression appears to be deflationary.

Investigator: Göran Normann.

Capital Gains Taxation

Incomes and capital gains have traditionally been subject to different tax regulations. Capital gains taxes remained at insignificantly low levels in Sweden up to the mid-60s. As taxes on other forms of income continued to rise, this difference in levels of taxation came to present an increasing problem. Above all, the differences in possible rates of return after taxation influenced investment behavior of firms and their choice of dividend payments. This also encouraged individuals to redefine income so as to take advantage of the lower capital gains tax. Hence a capital gains tax on all capital gains accruing from stocks and shares, irrespective of length of holding period, was introduced in the mid-60s. This tax was levied on nominal gains, whereas taxes on capital gains from property, according to the 1967 tax laws, were real and adjusted for inflation. High marginal taxes in combination with high rates of inflation during the 70s deepened the problems associated with an inadequately designed tax system. These problems have created a certain political urgency to design a comprehensive system for the taxation of realized capital gains on property and the sales of stocks and shares, on the one hand, and ordinary income, on the other hand (see for instance the project on expenditure taxation on p. 138).

¹ Normann, G., "Teoretisk analys av reformerad bruttobeskattning", (Theoretical Analysis of a Tax on Capital Income), DsB 1979:3.

² Normann, G., "The Value-Added Tax in Sweden", in Aaron, H.J., (ed.) *VAT. Experiences in some European countries*, Kluwer 1982. An abridged version is printed in Aaron, H.J., (ed.), *The Value-Added Tax. Lessons from Europe*, Brookings, 1981.

The results of this research project - now completed - have been presented partly as a theoretical study¹ and partly as an empirical study.²

The theoretical part looks at the effects on a firm's business transactions of various forms of a capital gains tax. These effects appear to be very dependent on other taxes imposed on returns from capital for the firm.

A simple theoretical model has been built to give an overview of the effects of the taxes mentioned above on a firm which aims at maximizing its market value. The model explicitly takes account of uncertainty, for example, the risk for bankruptcy.

The *empirical study* mainly deals with the effect of the capital gains tax on the rate of return on stocks and shares and, indirectly, with the rates of return demanded by shareholders on capital invested in the firm. The data include 118 firms registered on the Stockholm stock exchange during the period 1965-78, and the tax rules as they applied up to 1976 are analyzed. In this period the nominal rate of return on stocks and shares, expressed as an index, reached 6.7 percent (capital gains and dividends) compared to an average annual rate of inflation in terms of the consumer price index of just over 8 percent. The total rate of return was, thus, negative even before taxes. After taxes it varied from between 3 and 5 percent depending on where, on the marginal tax scale, the share holder happened to be. This reflects a real rate of after tax return between -3 and -5 percent. The total return on stocks and shares before tax has been approximately equivalent to returns on ordinary bank deposits. After tax, however, it has been 1 or 2 percentage points higher, though the real return in both cases has been strongly negative.

Savers in banks and equity have both lost, owing to inflation, in comparison with direct consumption unless investors have made better deals than the average stock market index or managed to combine their investment with suitable financing.

Inflation is clearly an important villain in the tax world. Let us assume that a firm desires to give its shareholders a real rate of return of 2 percent net of all taxes on their investment. The marginal income tax rate for shareholders is assumed to be 75 percent and for firms 50 percent. The firm achieves its goal partly by paying out 8 percent of equity to shareholders annually, and partly by ensuring that the base for these dividend payments remains constant at fixed prices. The firm so to speak absorbs the tax consequences of increasing equity to keep pace with inflation. The results are presented in Table 2. It shows that even with 0 inflation taxes blow up the rate of return

¹ Eriksson, G., "The Effects of Taxation on the Firms Investment Behavior", *The Scandinavian Journal of Economics* (1980:3). Some empirical results from this study have also been presented in Eriksson and Södersten, "The Financing of Industry and the Structure of its Assets", in *Kalkyler för 80-talet* (Calculations for the 80s), Special Studies for IUI's long-term projections 1979, Part II.

² Rundfelt, R., "Capital Gains Taxation and Effective Rates of Return", in *Business Taxation, Finance and Firm Behavior*, IUI Conference Volume (1981:1).

Table 2. *Inflation, rate of return demanded and capital costs (tax rules as they applied up to 1976)*
(In percent)

	Inflation rate		
	0	5	10
1 Rate of return demanded by shareholders net of taxes	2	2	2
2 The same regarding personal income tax	8	8	8
3 Profit on capital subject to corporate income tax, percent of open equity	0	5	10
4 The same before capital gains tax	0	7.1	14.3
5 Nominal cost of capital after corporate income tax	8	15.1	22.3
6 The same before corporate income tax	16	30.2	44.6

demanded to 16 percent. Increase inflation to a modest 5 percent and the rate of return demanded is doubled to 30 percent. An increase in inflation by 1 percent blows up the rate of return demanded by 3 percentage points, and this is still an average for the total operation. When these figures are recalculated to assess demanded rates of return on production investments in the factories, extremely high rate of return requirements before tax are reached. This strongly suggests that, if the government is incapable of coping with the macroeconomic problem of inflation, it is high time that tax rules be applied on a real basis if investment distortions in the firm with long-run consequences are to be avoided.

Investigators: Göran Eriksson, Rolf Rundfelt.

The Economics of Expenditure Taxation

High inflation and rapidly increasing fiscal needs put heavy strains on the nominal income tax system in many countries during the seventies. The interest of tax-reformers became more and more focused on various forms of expenditure taxation as a way of solving some of the most intractable problems of the present income tax system, e.g., the treatment of inflation and of capital gains.

In Sweden a new Royal Commission was recently set up to investigate ways of changing over into an expenditure tax system. The institute has been asked by the commission to make a survey of the economic pros and cons of an expenditure taxation, as indicated by the international discussion in recent years, and to carry out a rough evaluation of the change-over problems in a country like Sweden. The result of this work will be published in English during 1984.

Investigators: Bengt-Christer Ysander and Agnar Sandmo.

4. Profitability, Financing and Capital Market Analysis

Inflation and Growth

IUI has received a two-year grant from The Bank of Sweden Tercentenary Foundation to study the effects of inflation on the growth prospects for the firm. The project is now being completed and a summary of findings will be published in 1983.

In a first stage of the project the effects of inflation on the cost of capital was studied. Emphasis was put on evaluating the impact of several counteracting factors, such as the current practice of basing depreciation allowances on historical costs and the deduction of nominal costs of debt against taxable profits.¹

The second stage of the project, which is not yet completed, began with a study of inflationary distortions on the financing of Swedish industry. On the assumption that firms adjust their debt positions so as to minimize the cost of capital, inflation is demonstrated to have effects similar to a rise in the general level of interest rates. The empirical tests carried out in connection with the latest IUI medium-term survey indicate that inflation *ceteris paribus* in effect has induced industrial firms to reduce their debt financing.²

The second stage of the study also includes theoretical and empirical estimates of the impact of inflation on the short-run adjustment of firms to changes in the size of the long-run optimal capital stock. These problems are dealt with by, e.g., constructing empirical investment functions using variables such as liquidity and retained earnings, which are specified to explicitly capture the effects of inflation on short-run behavior.

Investigator: Jan Södersten.

Industrial Finance and the Transformation Process in Sweden

In this project the transformation of Swedish industry is studied from the point of view of the role of industry finance. The perspective is historical but

¹ See Bergström, V., and Södersten, J., "Inflation, Taxation and Capital Cost" in Eliasson-Södersten (eds.) *Business Taxation, Finance and Firm Behavior*, IUI Conference Reports 1981:1.

² See Eriksson, G., and Södersten, J., "Industrins finansiering och tillgångsstruktur" (Finance and Structure of Assets in Industry) in *Kalkyler för 80-talet* (Modeling the 80s), Special studies, Vol. 2, for IUI's Medium-Term Survey 1979.

emphasis is on the postwar period and the purpose is to provide a deeper understanding of the problems facing Swedish industry since the middle of the 70s. The theoretical basis is the work of Austrian economists, for instance von Hayek, Schumpeter, Kirzner and, in Sweden Dahmén.

After World War I Swedish industry adjusted to peace-time conditions through a severe crisis. This was in fact the most severe crisis that Swedish industry has gone through so far, in terms of production, employment and industry finance. A 50 percent deflation halved the value of material assets, but left the value of debts untouched. A financial crisis occurred, from which Swedish industry emerged financially weak and heavily dependent on the merchant banks. Out of the crisis came the concern for financial consolidation that characterized Swedish industrial firms for thirty years. Financial consolidation continued through the 30s. This decade is the only period in research history during which the manufacturing sector as a whole has had a positive net saving, despite rapidly increasing investments. World War II and the first years of peace meant no interruption.

Thirty years of financial consolidation left Swedish industry exceptionally strong at the beginning of the 50s. During the postwar period, on the other hand, the financial position has weakened considerably. Table 3. summarizes this development. Several factors explain this development, among them a fall in profitability. During the same period, interest rates in Sweden have more than doubled. The result has been a dramatic reversal in the relative profitability of manufacturing vis-à-vis financial placements. At the beginning of the 50s rates of return in the manufacturing sector were more than 50 percent above the effective rate of interest on industrial loans, whereas they were 65-80 percent below at the beginning of the 80s.

One obvious consequence has been a decrease in the relative attractiveness of long-term investments in manufacturing compared to short-term financial placements. A second effect has been the reinforcement of the negative effect on corporate debt leverage.

The informational content of debt/equity ratios is, however, limited

Table 3. *Indicators of postwar industry finance in Sweden*
(Percent)

	1951/60	1961/70	1971/80	1980
Gross margins	10.6	9.0	7.8	7.2
Rate of return on total capital (before taxes)	6.8	5.2	4.0	4.0
Rate of return on equity (before taxes)	8.9	6.5	3.6	2.1
Interest on industrial bonds	4.5	8.1	8.9	11.5
Debt/equity (replacement costs)	46	62	85	87
Debt/equity (historic costs)	57	78	129	144
Times interest earned ^a	11.2	4.7	2.2	1.4

^a Operating income/interest expense.

because of the difficulty to measure the stock of capital. The standard way to do this, through cumulating investments under an assumed rate of depreciation is questionable under conditions when relative prices have shifted considerably, as in the 70s. What capital values should be assigned to Swedish shipyards at the end of the 70s?

A less ambiguous indicator of financial exposure is the flow-oriented interest coverage indicator, i.e., operating income in relation to interest payments. This ratio captures not only the increased indebtedness, but also the effects of rising interest rates as well as of falling profitability. Since the 50s the interest coverage ratio "times interest earned" in Swedish industry has fallen from more than 11 to 2.2 times. In fact, it has deteriorated even more. At the business peak of 1980 operating income was only 1.4 times interest payments that year.

Investigator: Johan Örtengren.

Entry and Growth of Industrial Firms

This project analyzes entry and growth of industrial firms. The analysis is carried out in two coordinated studies.

The first of the two subprojects refines and extends the theoretical and statistical analysis of entry by new firms into 39 Swedish manufacturing industries previously reported in Du Rietz' 1980 study, *Företagsetableringarna i Sverige under efterkrigstiden* (see p. 156). The new firm entry rate in an industry is measured by the end-of-period employment of new firms divided by the beginning-of-period total employment in the industry. For the 1954-68 period, the new firm entry varies widely across industries, ranging from 0 to 26 percent. For the 39 industries as a group, the overall new firm entry rate was 6 percent for this period. A theory is developed to explain how the industry growth rate affects the new firm entry rate. This theory suggests that the entry rate will increase at an increasing rate as the growth rate of the industry becomes larger. A careful statistical analysis confirms this theoretical expectation.

The amount of capital required to build a plant to enter the industry at an efficient level is another important variable that should affect the new firm entry rate. We attempt to measure these capital requirements indirectly by the average employment of all new plants constructed by new firms, by firms diversifying into another industry to building a new plant, and by old firms already in the industry. We find that the new firm entry is much lower in industries where the average size of new plants is significantly larger, a result confirming our expectation that large capital requirements retard entry by new firms. This finding is reinforced by our discovery that new plants built by old firms in the industry tend to be more than four times the size of plants built by new firms. By way of contrast, the new plants of old firms already in

the industry only tend to be about 1.3 times as large as new plants built in the industry by diversifying firms, and the statistical tests suggest that large capital requirements are not so important in limiting entry by diversifying firms.

Several other variables, including a measure of internally generated technological change and a measure of monopoly also appear to affect the new firm entry rate in the expected direction.

The second subproject attempts to determine some of the factors responsible for the extent to which major firms in the same industry have similar patterns of growth. In some industries, the growth rates of the largest firms are very similar, in other industries, they differ widely.

Firms in the same industry presumably have similar information on trends in industry demand and industry costs, and have similar technology. Therefore, we would expect a strong tendency for these firms to expand or contract in similar patterns over time, even in the absence of any deliberate coordination of their output and growth decisions. However, in an uncertain world, independent decisions by the firms would make the correlation of their outputs or growth rates substantially less than one. But if the firms were engaged in explicit cooperation or coordination, one should observe a greater similarity in these decisions.

This study examines some variables reflecting industry characteristics that might be related to the variability of large firm growth rates in the same industry, making this variability differ across industries. It examines other variables that might reflect explicit cooperation of the firms or might indicate the costs of achieving such cooperation. We then estimate the quantitative relationship between these variables and the log of the growth rate variance of the four largest firms in each of 18 Swedish manufacturing industries over three periods of time between 1954 and 1968.

These statistical calculations indicate that the variability of the large firm growth rates tends to be substantially less in industries where output is concentrated within a few large firms. The variability is reduced by nearly 60 percent for industries with a registered cartel agreement. These results suggest that explicit or implicit cooperation of the largest firms in the same industry tends to make their growth rates more similar, although the direction of causality between growth variability and cartels is unclear.

Other statistical comparisons between the largest firms and somewhat smaller firms do not reveal different patterns in the variability of their growth rates that might be expected on theoretical grounds if the larger firms are engaging in more cooperation.¹

Investigators: John Hause and Gunnar Du Rietz.

¹ Some results from this project have been reported in Hause, J., *The Fine Structure of Earnings and the On-the-Job Training Hypothesis*, *Econometrica* 1980:4, IUI Booklet No. 111, 1980.

5. *Household Economics*

Demand for Consumer Goods

Complete systems of demand functions form an important part of many econometric macro models and they are also a useful tool for demand analysis in its own right. Econometric aspects of the application of these models are the subject of this project. It includes discussions of data quality, model specification, choice of model, estimation and prediction. All applications are based on Swedish data.

The project is completed and reported in Klevmarken, A., 1981, *On the Complete Systems Approach to Demand Analysis*. The results suggest, that the most important issue in demand analysis, is not that of finding the most general utility function, but rather to find means of including constraints imposed on consumption by particular properties of commodities and markets, and also taking into account sometimes sizable errors in data.

Investigator: Anders Klevmarken.

The Demand for Printed Matter

This completed study of the printing industry is reported in Lindström, B., *Trycksaksmarknaden under 80-talet* (The Market for Printed Matter in the 80s), IUI Research Report No. 13, 1981. For a presentation of the project, see pp. 112-113 in *The Firm in the Market Economy*, IUI Research Program 1979/1980.

Investigator: Bertil Lindström.

Household Market and Nonmarket Activities (HUS)

This project is extensively presented under the heading "Medium Term Projections and Large Coordination Projects" (p. 141 ff.).

6. *Foreign Trade, International Specialization and Multinational Business Activities*

Effects of Foreign Manufacturing Investment on the Domestic Economy

In the last decade IUI has published a series of studies on the international operations of Swedish manufacturing industry. The most recent of these, *Svensk industri i utlandet* (Swedish Industry Abroad), by Birgitta Swedenborg was published in the spring of 1982. The project was financed by a government committee appointed to evaluate the effects of international investment on the domestic economy.

The study is based on census data regarding Swedish manufacturing firms and their foreign affiliates which have been collected at IUI. The earlier data covering the years 1965, 1970 and 1974 have been supplemented with data for 1978 for the purpose of this study. Thus, it has been possible to describe the growth of foreign operations in the period 1965-78 and to analyze the implications of these operations for the Swedish economy over a relatively long time period. No previous econometric analysis of these relationships – either in Sweden or abroad – has been based on such a rich body of data.

Many of the effects with which the study has been concerned derive from the relationship between foreign production, firm size and exports from Sweden, which was also the subject of Swedenborg's prize winning dissertation (1979).¹ The results of the continued analysis of these relationships which are based on regression analysis on combined cross-section and time-series data, broadly confirm those obtained earlier in cross-sectional analysis. They show that the exports of the investing firms are higher than they would have been had the firms not decided to produce abroad. Although foreign production leads to a small decrease in non-complementary exports this negative effect is more than outweighed by a positive effect on complementary exports. The net effect is positive: exports increase on average by SEK 10 when foreign production is allowed to increase by SEK 100.

These results mean that foreign production almost entirely constitutes a net addition to the foreign sales of the investing firms. In fact, total foreign sales are larger by both the size of foreign manufacturing and by the positive net effect on Swedish exports.

¹ In a competition arranged by IRM-Institute de Recherche et d'Information sur les Multinationales.

The positive effect on exports means that employment in the investing firms in Sweden is also, on average, higher as a result of foreign production. This, of course, means a changed *pattern* of employment in Sweden, not a changed level. The *level* of employment depends on economic policy.

The increase in overall firm size may be expected to have positive longer-term effects on the competitiveness of investing firms and these effects are likely to be more important than the direct effect on exports. Larger and more specialized firms can invest more in R&D and in an international sales organization, since the fixed costs for such investments can be spread over a larger sales volume. The benefits of such investments will also accrue to the parent firms located in Sweden.

The data show that Swedish foreign investors account for a disproportionately large share of total industry R&D in Sweden: approximately 70 percent as compared to the same firms' share of manufacturing employment and exports of less than 50 percent and 60 percent, respectively. Their R&D intensity has, furthermore, increased dramatically in the period 1965-78. R&D expenditures relative to total sales have increased from 1.8 to 2.3, while R&D expenditures relative to the sales of the Swedish parent groups have increased from 2.5 to 3.8.

To the extent that the higher R&D intensity in the Swedish group can be attributed to foreign production, this should probably be counted as the most important effect of foreign production. The empirical results indicate that a 1 percent increase in R&D intensity leads to a 0.4 percent increase in Swedish exports.

Investigator: Birgitta Swedenborg.

The International Competitiveness of Swedish Industry and Sweden's Long-Term Balance of Payments

In this study long-term changes in the patterns of Sweden's international trade are explained. The demand for Swedish exports has been analyzed using a constant-market-shares technique. This method allows us to take the commodity, as well as the country composition into account, when Swedish market shares in international trade are calculated.

The project consists of four parts. The first part, already concluded,¹ is an

¹ See Horwitz, E.C., "Världshandeln, marknadsandelar och svenska kostnader" (World Trade, Market Shares and Swedish Costs), in Axell-Gustafsson-Holmlund-Horwitz, *Utrikes-handel, inflation och arbetsmarknad* (Foreign Trade, Inflation and the Labor Market), Special Studies, Vol. 1, for IUI's Medium-Term Survey 1979.

Horwitz, E.C., "Swedish Export Performance 1963-79. A Constant Market Shares Analysis", IUI Working Paper No. 52, 1981.

analysis of the interaction of foreign market and Swedish export growth.

The second part was a more methodologically oriented analysis of price elasticities in foreign trade as part of the updating of the macroeconometric model (see p. 101) at the institute¹.

A recent third extension of this study includes a comparison between the four Nordic countries Denmark, Finland, Norway and Sweden for the Nordic Medium-Term Survey (see p. 124).

In a fourth extension of the project we plan to study the supply characteristics of Swedish exports at the micro level, using the unique firm and establishment data base, that has been collected at the institute.

The study on the Nordic countries shows that market shares have been lost in world trade for the Nordic countries in general. However, the export performance of Swedish industry, measured as flows of goods from Sweden to our main OECD trading partners, has been much less competitive than that of our Nordic neighbors. The actual increase in exports has been *above* the growth to be expected, given the structure of exports for Denmark, Finland and Norway, whereas Sweden has lost market shares between 1970 and 1980.

The findings of the comparison of export performance in the Nordic countries indicate that about two-thirds of the decline in the Swedish market share in OECD imports, illustrated in Figure 6, can be explained by structural factors, i.e., a concentration to slowgrowing commodities and

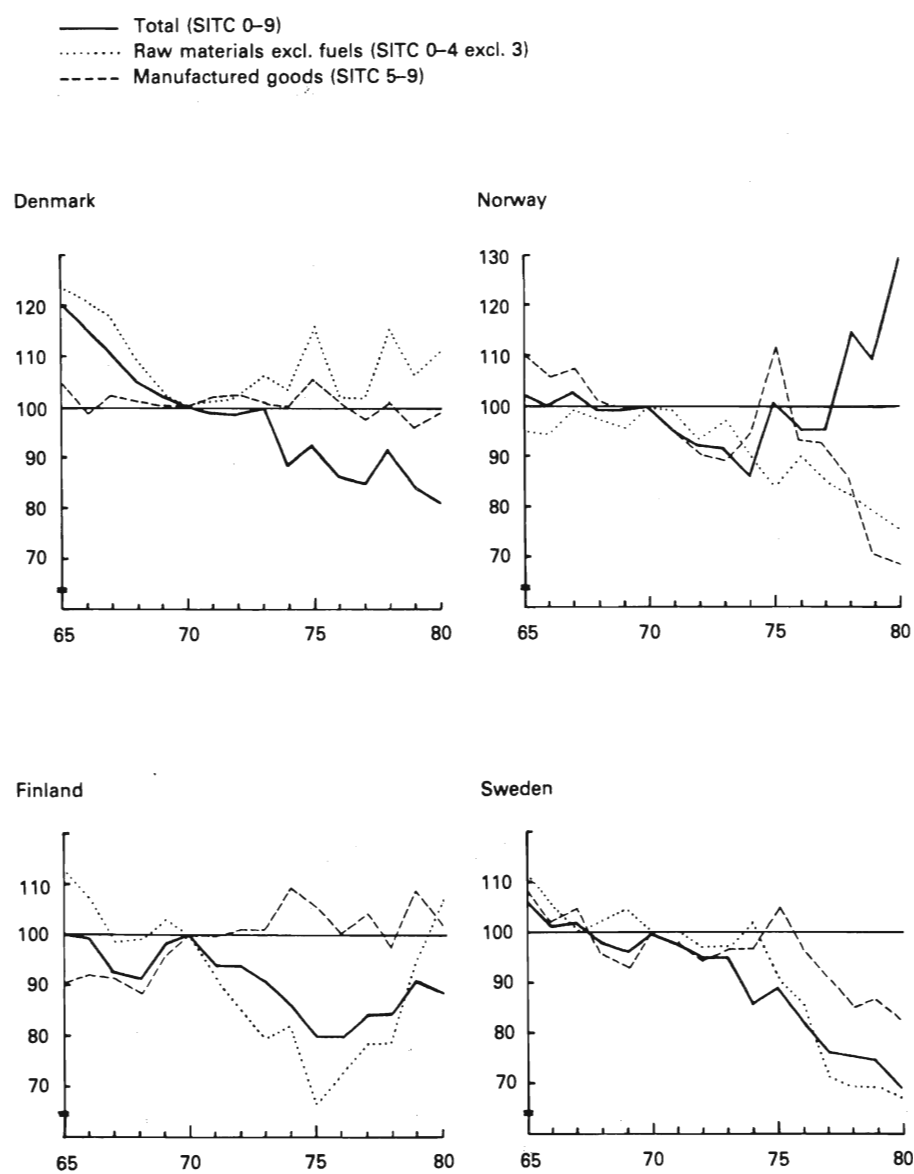
Table 4. *Upper and lower bounds of export demand price elasticities*

	Upper bound	Lower bound
1 USA	- 0.87	- 1.77
2 Germany (Ge)	- 0.49	- 2.61
3 UK	- 0.28	- 1.76
4 France (Fr)	- 0.79	- 5.19
5 Japan (Jap)	- 1.11	- 2.28
6 Italy (It)	- 0.88	- 8.54
7 Belgium (Be)	- 0.97	- 4.07
8 Canada (Ca)	- 0.97	- 4.07
9 Netherlands (Ne)	- 0.23	- 5.85
10 Sweden (Sw)	- 1.23	- 1.92
11 Switzerland (Sz)	- 0.27	- 4.81

Note: The table is based on regression results for exports as a function of relative prices, world exports and a non-price factor. Column 1 is based on the assumption of perfect elasticity of supply. Column 2 is based on the reverse assumption of totally inelastic supply. A discussion of these values, the upper and lower bound of the true price elasticity of demand, is found in Horwitz, *Estimates of Bounds for Export Price Elasticities in an Underidentified Simultaneous Two Equation System*, forthcoming IUI Working Paper.

¹ Reported in Horwitz; "Price Elasticities in Foreign Trade", in *Policy Making in a Disorderly World Economy*, IUI Conference Report 1983:1.

Figure 6. *Nordic countries shares of imports to the OECD market*
 1965–80
 (Index 1970 = 100)



slowgrowing markets. The remainder must be attributed to a genuine loss of markets. This is in sharp contrast to the result of the constant market shares analysis for the other three Nordic countries, which shows that the whole decline of market shares can be explained by structural factors.

The reasons for this decline in competitiveness of Swedish industry will be further investigated at the micro level. Indeed, estimated price elasticities of demand for exports from Sweden as well as for ten other industrialized countries exhibit a wide spread.

Results from estimating export price elasticities from export demand functions for different countries suggest, that Swedish exports are more sensitive to changes in relative export prices than exports from other countries. See Table 4. column 1.

The inclusion of the supply side, however, and allowance for a less than perfectly elastic supply, dramatically changes the estimates for the export demand elasticities. Now, no support is found for the idea that Swedish exports should be the most sensitive to changes in relative prices.

An analysis of the fall in the Swedish market shares and poor export performance, due to the deterioration of the relative cost position of Swedish industry in the mid 70s, necessarily involves a better understanding of the supply-side of exports. Aggregate supply equations tend to explain actual exports rather poorly. Using the disaggregated data for exports, used in the constant market shares analysis and the individual firm data, available from several IUI surveys, it should be possible to obtain more accurate information about supply relations in Swedish exports.

Investigator: Eva Christina Horwitz.

The International Growth and Investment Decision in Large Swedish Companies

This study has three aims.

First, to investigate foreign investments in production and marketing as part of the general growth decision of the company.

Second, to quantify to the extent possible the macroeconomic growth effects of Swedish foreign investments.

Third, to investigate the possibilities to influence the microeconomic choice to achieve different macroeconomic objectives.

This project continues earlier investigations on the domestic production

effects of foreign production investments.¹ Much of the inquiry will be devoted to integrating several IUI databases on individual firms, to make it possible to formulate and estimate a model for the internal corporate group investment allocation decision. Part of this problem will be to look at the market investment decisions and how that affects foreign export shares and export growth. Econometric research will be backed by several case studies to unveil more fine details in the decision process.

Investigators: Gunnar Eliasson, Fredrik Bergholm, Lars Jagrén.

¹ Swedenborg, B., 1979, *The Multinational Operations of Swedish Firms. An Analysis of Determinants and Effects*, IUI, Stockholm.

Bergholm, F., *Svenska företags investeringar i maskiner och byggnader i utlandet 1974–78* (Swedish Foreign Investments in Machinery and Buildings 1974–78), IUI Research Report No. 19, 1983.

7. Labor Market Studies

The Mobility of Labor

See project with the same title under coordination projects (p. 109 ff.)

Compensation Schemes and Wage Differences – A Comparison Between Sweden and the United States

A detailed study of compensation schemes at the local level, primarily for large companies in the U.S., is the first part of this study. It has been published in early 1983 as *Lönbildning och Lönestruktur* (Determination and Structure of Salaries), Anders Klevmarken, IUI, Stockholm. Information was partly collected by personal interviews with compensation managers in a number of American companies. Compensation administration in the U.S. is then compared to pay setting in Sweden. For blue collar workers the American system with labor grades, seniority roles, etc. appears to be less flexible than the piece rate systems commonly used in Sweden, while the salaries for white collar workers in the U.S. are set more by the market than in Sweden and with almost no union influence. Pay setting by job and performance evaluations is done more systematically in large U.S. companies than in Sweden.

Wage and salary differences are the subject of the second part of this study. Occupational differences and differences by schooling and experience are compared for the two countries and for the past 4-5 decades to the extent data permit.

At an aggregate level a comparison of wage differences in the two countries shows many similarities, but there are also differences. According to Tables 5. and 6. the occupational wage differences have decreased in both countries. In the U.S. this change primarily took place before the 60s, while in Sweden the occupational differences in pay decreased also during the 60s and 70s. In both countries changes in the supply of labor as a result of more investments in schooling and differences in the size of birth cohorts have influenced wage differences. The combined effect of an expansion of higher education and large postwar birth cohorts explains a strong decrease in relative pay for high school and college trained in Sweden (see the first part of Figure 7.). In the U.S. there was no contemporary decrease in the relative pay of people with a higher education, probably because the expansion in the U.S. came earlier.

The differences in pay between experienced and unexperienced workers did not change exactly as expected (the second part of Figure 7.). In Sweden

Table 5. *Wage differences by occupation in the United States 1939–1978*
(Non-farm laborers = 100)

	1939	1955	1967	1973	1978
Professional and technical workers	212	174	156	154	152
Managers and administrators except farm	227	180	176	172	167
Sales workers	146	160	122	118	120
Clerical workers	157	134	98	94	91
Craft and kindred workers	157	152	141	141	145
Non-farm laborers	100	100	100	100	100

Table 6. *Wage differences by occupation in Swedish industry 1938-1980*

	1938/39	1955	1967	1973	1980
<i>Salaried employees</i>					
Technical, managerial and supervisory work	157	145/168	192	178	167
Sales workers	242	183/158	168	162	153
Clerical workers	102	90/82	90	98	105
<i>Blue collar workers in manufacturing</i>					
Craft and kindred workers	117	116	117	113	107
Workers	100	100	100	100	100

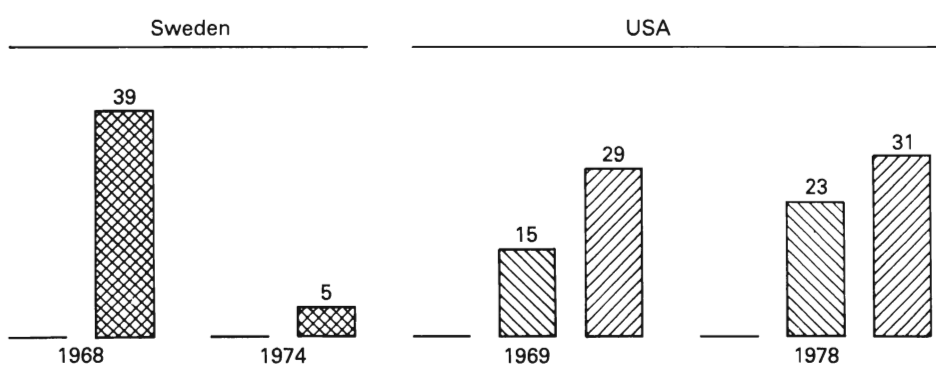
Note: For salaried employees the figures before and after 1955 are not comparable because the occupational definitions changed. For 1955, salary statistics are available by both definitions.

this difference decreased for workers with elementary schooling while there was no change for workers with a higher education. This is not what could be expected as a result of the increased supply of young well educated workers. A likely explanation is that the egalitarian wage policy of the Swedish Unions has been successful. Young workers, clerical workers and manual workers have increased their relative pay in Sweden during the last decade which has no correspondence in the U.S.

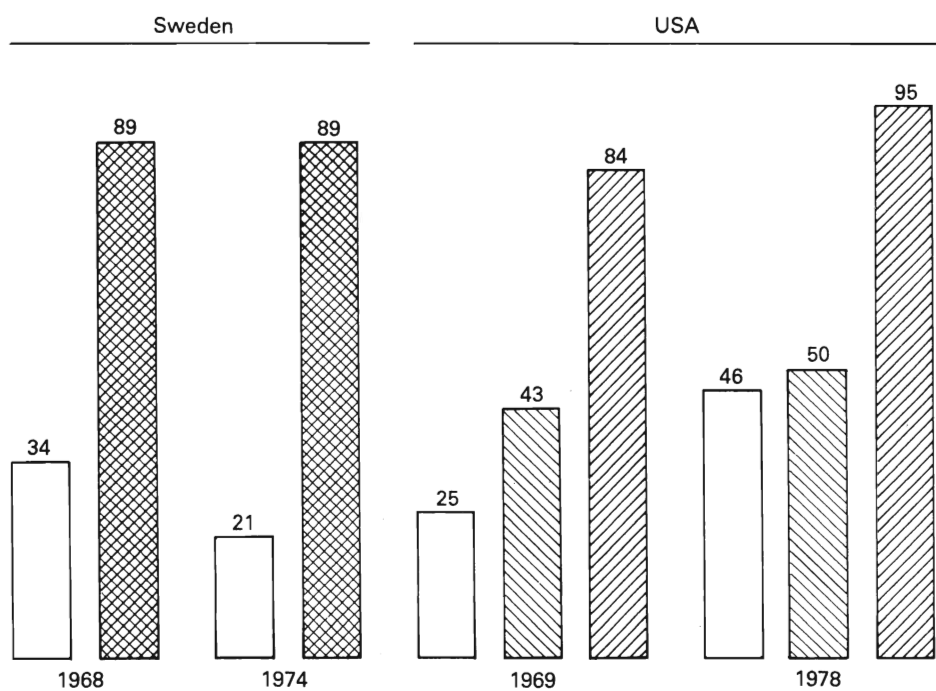
It is more difficult to identify the effects of changes in demand for labor. The increased automation and computerization of the manufacturing and service industries have probably contributed to a decreased demand for workers with basic schooling only, which should explain the relative decrease in pay for this group in the U.S. The trendwise decrease in the relative pay of

Figure 7.

Percentage wage differences due to schooling for 25 years old male workers



Percentage wage differences between 45 and 25 years old male workers by schooling



craft and journey men and the relative increase for high-school graduates might be given a similar explanation. The old manual crafts are less demanded in a highly technical and industrial society while for instance computer experience, systems knowledge and proficiency in foreign languages, which require a high school education, are in high demand. The labor market for college graduates is relatively small and more or less specialized, particularly in Sweden, which makes these wages relatively sensitive to changes in supply and demand.

Investigator: Anders Klevmarken.

Wages and Work-Demographic Differentials in Sweden

For some time, IUI has been engaged in research on women's position in the Swedish labor market. These research efforts have been presented in several publications.¹ The remaining part of this project is to summarize the results reached in one volume, and to indicate where further research is needed to clarify a number of unresolved issues. Therefore, a fairly extensive discussion on the theoretical basis for analyses of labor supply and earnings differentials will be included. The book will also present the most recent statistics on wage and earnings differentials between men and women, and research results explaining those differentials. In addition, statistical descriptions of the increase in female labor force participation over time by cross sections and cohorts will be given.

In another related project on the structure and determinants of unemployment the shift of the burden of unemployment towards the young is investigated. Whereas unemployment rates for adult men have not increased, youth unemployment has increased from 2-6 percent in the 60s to 6-10 percent in the beginning of the 80s. It is suggested that the normal difficulties in the transition from school to work have been exacerbated by

¹ The following papers are available in English:

Gustafsson, S., 1981, "Male-Female Earnings Differentials and Labor Force History", in Eliasson-Holmlund-Stafford (eds.), *Studies in Labor Market Behavior, Sweden and the United States*, IUI, Stockholm.

Gustafsson, S., "Lifetime Patterns in Labor Force Participation", forthcoming in *Human Resources, Employment and Development, Volume 3: The Problems of Developed Countries and the International Economy*, edited by Burton A. Weisbrod and Helen Hughes.

Gustafsson, S., and Leighton, L., *Differential Patterns of Unemployment in Sweden*, IUI Working Paper No. 76, 1983.

labor market policies that emphasize job security and by an increase in relative wages for the young, which is mainly the result of the equalitarian so-called solidarity wage policy. The extremely narrow wage and salary dispersion in Sweden compared to other countries, which is the consequence of this policy, has been observed in several other studies¹.

Investigators: Siv Gustafsson, Petra Lantz, Linda Leighton.

Wage Formation at Plant Level in Swedish Industry

Wage negotiations in Sweden are highly centralized. There exists, however, no government imposed incomes policy. Nonetheless, a considerable amount of wage increases regularly take place outside the central agreements - so-called wage drift. They occur at a yearly rate varying between 3 and 7 percent for workers in the private sector. Consequently, there also exists a decentralized wage formation process which is determined by the specific situation at firm or plant level. The aim of the present study is to investigate the influence of such specific factors on wage formation. Thus, this microeconomic study is based on cross-sectional data for a large number of firms within Swedish manufacturing industry.

In the theoretical framework used firms are modeled as setting their wages to regulate the flows of hires and quits in order to maximize total profits over time. Hence, the firm's wage policy is the solution to a dynamic optimization problem and it is the ambition of the author to treat it in terms of a Markov decision process, where stochastic elements are explicitly taken into account.

More heuristically stated, we may expect that a firm's propensity to increase its wages is positively related to the level of its marginal profit from expanding its employment and to the degree of wage level sensitivity of changes in employment. The Phillips-curve resembling relations between the aggregate amount of wage drift and some measure of the aggregate state of demand, in the labor market over the business cycle, can be interpreted as the result of such influences at work at the micro level. However, the problem of finding data that correspond, to the most important variables governing the wage formation process, at plant level is a tricky one and cannot be completely resolved. Some satisfactory results concerning the

¹ See the labor mobility project p. 109 and Klevmarken's comparison between wage and salary setting practices in the U.S. and in Sweden, see p. 150 above.

sensitivity of the hiring rate to wage differences have nevertheless been obtained.

Thus, it is hoped that a careful study of the basic data will make it possible to establish to what extent wage drift at individual plants can be explained as the result of rational firm behavior as set out in the model. Such wage drift that is left unexplained may then be taken to indicate the influence of institutional forces (within the firm or in the labor market) on the amount of wage drift.

Investigators: Nils Henrik Schager.

8. Other Research Projects

The Determinants of the Establishment of New Firms

A unique database on the establishment of firms in Swedish industry has been collected at IUI. The time period covered is 1954-70, and the industries studied - plastics, primary metals and engineering - account for almost 50 percent of total manufacturing employment. The firm concept refers to the financial decision unit (the group).

An analysis of the determinants of the entry of new firms is presented in *Företagsetableringarna i Sverige under efterkrigstiden* (Firm Establishments in Sweden during the Postwar Period), Gunnar Du Rietz, IUI, 1981. This report concludes the project.

Entry of firms into a certain industry may come about through:

- (i) Establishing new firms.
- (ii) Change of industry classification (of an entire firm, or of one establishment of a multi-establishment firm into an industry new to the firm).
- (iii) Diversification entry, i.e. setting up a branch establishment in an industry new to the firm.

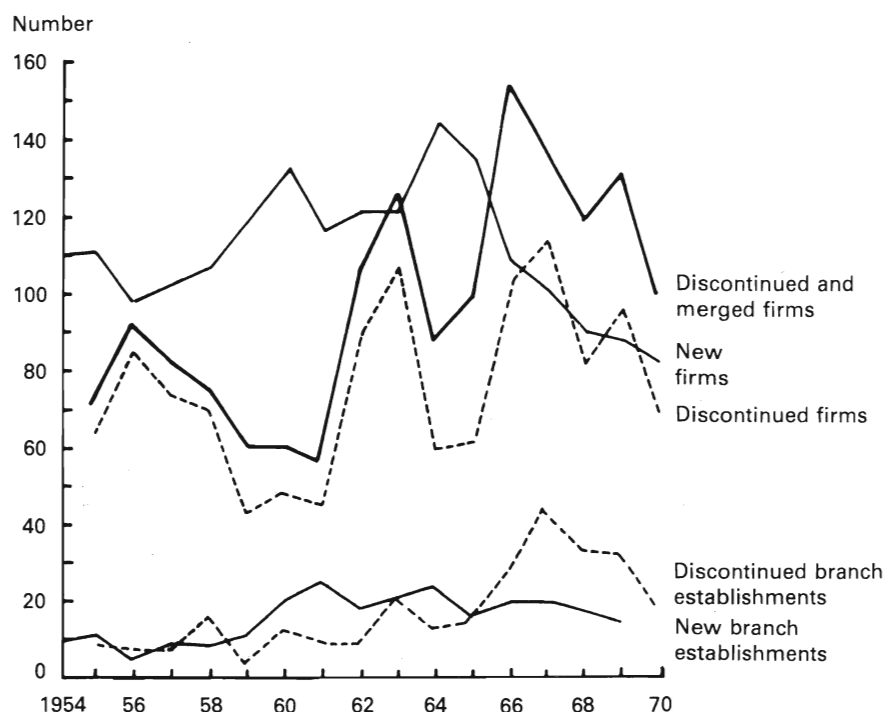
Exit of firms are subdivided into corresponding categories.

In Figure 8. the year to year figures for entries and exits of firms and branch establishments during the period 1954-70 are presented. The number of new firms 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. The decline that followed cannot be explained solely by the recession in 1966-67. There has been no corresponding decrease in the number of new branch establishments. This type of entry has been maintained at about twice a level during the 60s as during the 50s.

The analysis of the database suggests that entry into an industry is very sensitive to the expansion rate in the industry and increases more than linearly with the industry growth rate. Especially the new firm entry is extremely dependent on the expansion rate, and responds much more strongly to the expansion rate than diversification entry. As the industry growth rate increases, a larger and larger part of the total industry growth rate is accounted for by new firm entry.

But new firm entry plays a role only for industries where the capital requirements for efficient production is low to moderate. In industries where

Figure 8. *New and discontinued firms and branch establishments in the plastics, primary metals and engineering industries 1954–70*

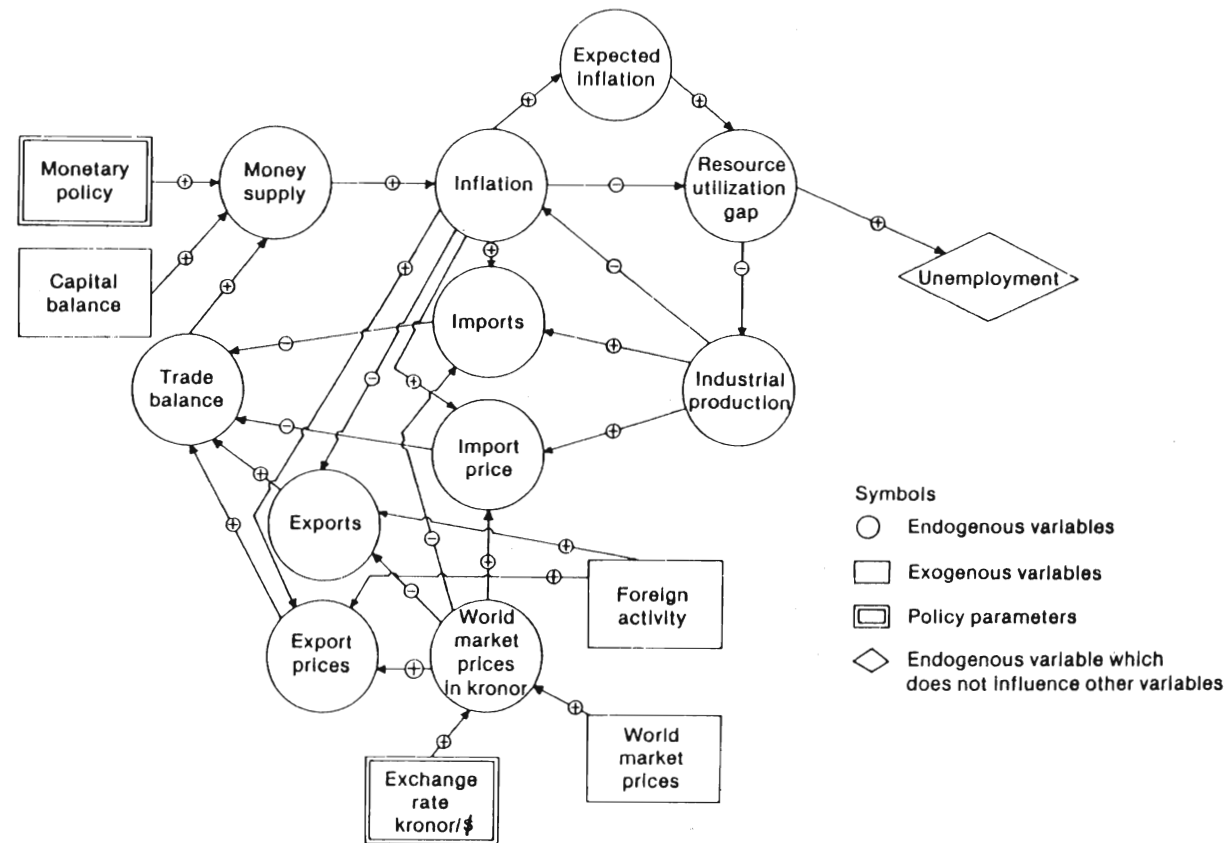


the average firm size (or average new firm size) is above normal and the ratio of engineers among all employees is also typically high (many of these industries in Sweden are also heavily concentrated and cartelized) entry is zero or very insignificant, no matter how high the growth rate is. In this case entry may take place as diversification, when growth is rapid.

The technical personnel ratio works as a barrier both for the entry of new firms and for the diversification of already established firms.

Large average size of new establishments seems to deter new firm entry but not diversification entry. Many registered cartels in an industry, finally, seem to make new firm entry more difficult, but have no negative effect on diversification. The innovation variable did not produce any significant effect on entry.

Investigator: Gunnar Du Rietz.

Figure 9. *Overview of the model*

Price Controls in Sweden

This project investigates the effects of price and incomes policies in a broad sense. One part of the project is empirical, and primarily studies the influence of price controls on general inflation. A second part is theoretical, emphasizing the allocation effects of price controls. A third part will attempt a more popular overview of what we know of and how one should look at the effects of attempts to control or fix prices in an economy.

The first part of the project¹ is traditional and corresponds to what has been done in several international studies in this area. The effects of price controls have been analyzed by estimating an inflation model and adding a dummy variable for the price control periods. A 7-equation model based on Friedmans idea of a positively sloped Phillips curve was used. The model has a good forecasting record. It was used in the 1979 long-term survey of IUI and predicted the decrease in inflation from a relatively high level, down to a turning point at approximately 5 percent in the middle of 1979. It picked up the rapid increase to 14 percent in 1980 and 12 percent in 1981. The results on price controls were that the price increases during the general price stop 1970-71 were as large as they would have been without the price stop. Once the price stop was lifted, price increases were *higher*, than could be explained from the model.

The second, theoretical part follows up our earlier studies at IUI of the effects of rent controls.² The traditional partial supply-demand model for the pricing in the housing market is now replaced by a more ambitious model of market pricing, which goes beyond the traditional textbook model. Prices are set in a market where there is no clearing auctioneer and where agents do not have perfect information.

It is quite easy to describe the situation with price controls. The problem is to describe the reference situation to compare with - the situation with free market pricing. We prefer not to assume a perfect auction market, where the price is set by an auctioneer (a "price controller") and where trade is permitted only at that price, which is also the one that clears the market. Research during the last decade on pricing without an auctioneer rather suggests that the free market pricing equilibrium is either a price dispersion

¹ Reported in Axell, Gustafsson, Holmlund & Horwitz, *Utrikeshandel, inflation och arbetsmarknad* (Foreign Trade, Inflation and the Labor Market), Special Studies, Vol. 2, for IUI Medium-Term Survey 1979.

² Bentzel, R., Lindbeck, A., Ståhl, I., *Bostadsbristen. En studie i prisbildningen på bostadsmarknaden* (The Housing Shortage. A Study of Price Formation on the Housing Market), Stockholm 1963.

or the monopoly price.¹ The allocation effects of price controls are then no longer obvious. In the free market case there are negative effects like search processes and unemployment which are to be compared with shortages, inflexibilities and lack of reliable price signals in the price control case.

Work on building models for pricing without an auctioneer - search theoretical models - is important not only for analyzing the effects of price controls, but also as a theoretical underpinning for e.g. labor market studies with partial-partial search.² (Cf. Holmlund & Björklund projects on p. 109 ff.)

Investigator: Bo Axell.

A Study of the Size and Implications of the Unobserved Sector of the Swedish Economy

The unobserved sector consists of those economic activities (legal or illegal, market or non-market, monetary or barter) which escape the purview of the society's statistical measurement apparatus. A large and growing unobserved sector can have important consequences for public finance and macroeconomic policy insofar as official government statistics on national income, prices, productivity, unemployment and taxable income become distorted as a result of the omission or understatement of the unobserved sector.

Growth of the unobserved sector is believed to be encouraged by high rates of taxation, increased costs of regulation and compliance, and by a growing sense of social and political alienation from constituted governmental authority. Given Sweden's high rates of taxation and its extensive regulatory

¹ See:

Diamond, P., 1971, A Model of Price Adjustment, *Journal of Economic Theory*, Vol. 3.
Axell, B., 1977, Search Market Equilibrium, *Scandinavian Journal of Economics*, Vol. 79, pp. 20-40.
Salop, S., and Stiglitz, J., 1977, Bargains and Ripoffs: A Model of Monopolistically Competitive Price Dispersion, *Review of Economic Studies*, Vol. 44, No. 138.
Salop, S., 1981, A Theory of Sales: A Simple Model of Equilibrium Price Dispersion with Identical Agents, Working Paper, Princeton.

² Within the theoretical part of the project has been produced:

Axell, B., *On Unexplained Price Differences*, IUI Working Paper No. 25, 1980.
Axell, B., *Imperfect Information Equilibrium - Existence, Configuration and Stability*, IUI Working Paper No. 34. Presented at Econometric Society European Meeting 1981.
Albrecht, J., Axell, B., *General Search Market Equilibrium*, IUI Working Paper No. 63, 1982. Presented at ESEM 1982 and ESAM 1982.

system, it is clear that significant economic incentives exist for the development of an unobserved economy. A counterweight to these economic incentives is the traditional cohesion and sense of social responsibility historically manifested by the Swedish citizen.

The purpose of this study is twofold: First, to develop a conceptual framework of analysis capable of describing the implications of an unobserved sector for public finance and macroeconomic policy and second, to undertake alternative empirical measurements of the unobserved sector's size and growth.

To date, the study has produced a model of an economy containing both an observed and unobserved sector, from which it is possible to simulate the shape of the Swedish Laffer Curve and to determine where the Swedish economy is located on its Laffer Curve under different assumptions concerning the size of the unobserved sector. Under the most plausible parameterization of the Swedish economy, the results suggest that for unobserved sectors ranging between 5 percent and 20 percent of the total economic activity, Sweden has already surpassed the peak of the Laffer Curve, suggesting that it is possible to reduce tax rates in Sweden without reducing total tax revenues as a result of both supply side effects and shifts of unobserved activity to the observed economy. Not only could tax revenues be maintained, but total income could be increased between 10 and 15 percent as a result of across the board tax decreases.

Since the shape and position of the estimated Laffer Curve is dependent on estimates of the unobserved economy, empirical estimates of its size are being undertaken by various methods. At the present time, it appears that different methods of estimating the unobserved sector yield widely different results. The estimates range from 5 percent to over 20 percent, and display different time paths relating to the growth of the unobserved sector. Efforts are now underway to evaluate these alternative findings in order to narrow the range of disagreement on this issue.

Investigator: Edgar L. Feige.

Teaching at IUI

A. Economic Doctrines

In March and April 1982 and in conjunction with the Department of Economics at the University of Uppsala, IUI offered a graduate course for university credit. The course was taught by Hans Brems, Professor in Economics at the University of Illinois at Urbana-Champaign, and covered some highlights in the history of economic theory since 1600 - from mercantilism to monetarism.

As a research institute IUI is unique in Scandinavia in two respects. Its support is private, and its method is a Schumpeterian micro-to-macro approach. The coverage of the course should be broad enough to reflect the unique methodology at IUI. At the same time a short course must have a clear focus. These two objectives were met as follows.

Economic theory may, perhaps, be seen in three dimensions. First, its subject-matter may be quantity or price. Second, its degree of aggregation may be macro or micro. These two dimensions will give us a simple two-by-two matrix with four key research areas emerging:

	M a c r o	M i c r o
Q u a n t i t y	Unemployment theory	Allocation theory
P r i c e	Inflation theory	Theory of relative prices

A third dimension, in which each of the four areas may be seen, is the time dimension: Is time absent as in static theory or is it present as in dynamic theory?

These three dimensions gave the course its focus: Each meeting looked at a period and the dimension, or the dimensions, of that period. Specifically, the contents of the meetings were:

- 1 *Introduction*. Seventeenth-century unemployment theory: The mercantilists.
- 2 *Eighteenth-century inflation theory*: The quantity theory of money; Say's Law.

- 3 *Eighteenth-century allocation and relative-price theory* (Cantillon); sector interdependence and circular flow (Quesnay).
- 4 *Early nineteenth-century relative-price theory*: The labor theory of value and distribution.
- 5 *Late nineteenth-century allocation and relative-price theory*: The theory of general economic equilibrium.
- 6 *Turn-of-the-century capital and inflation theory*: Böhm-Bawerk, Wicksell, and Fisher.
- 7 *Early twentieth-century unemployment theory*: The Stockholm School and Keynes.
- 8 *Late twentieth-century inflation theory*: Monetarism.
- 9 *Twentieth-century economic dynamics*: Schumpeter; Cassel-Harrod-Domar; the Cambridge-Cambridge controversy.

The primary course material was the excellent anthology by the late Mogens Boserup: *Deres egne ord*. Here, each writer speaks his native tongue as long as the latter is English, French, German or Swedish. Consequently, its fine selections are ideally tailored to the needs of Swedish-speaking students, and the austere brief introductions by Boserup himself are accessible to such students. Supplementary course material was the instructor's own attempts at mathematical restatements of some of the important paradigms of economic theory - published as well as forthcoming.

B. Industrial Economics

This course, designed and organized by Gunnar Eliasson and Bo Carlsson at IUI and Lennart Hjalmarsson at the University of Gothenburg, attempts to fill a gap in the current repertoire of teaching at Swedish universities. The course also fills a need for training young researchers at IUI. The ambition has been to move away from the traditional, product market oriented text book designs and to emphasize also factor markets and the dynamics of the allocation process and the long-term supply determinants in an economy. There the theory of the firm becomes central together with technical change in microeconomic growth processes. Market performance and the micro-economic implications of market distortions (like subsidies) and the idea, design and implication of the so-called Swedish industrial policy model were part of the teaching. The concept and the measurement of productivity change played an important part of the course. The theoretical framework was represented by the micro-to-macro theoretical work going on at IUI.

The course was taught as part of the graduate program in economics at the University of Gothenburg by Carlsson, Eliasson and Hjalmarsson in the fall of 1981 and at Chalmers Institute of Technology by Eliasson and Hjalmarsson in the fall and spring 1982/83.

C. Microeconometrics

A course in microeconometrics much along the themes presented in this yearbook is planned for 1983. This course caters for a badly needed professional training program to support the kind of research that goes on at IUI.

Other Activities

Gunnar Eliasson is a member of the Advisory Committee to the Swedish Government's Long-Term Survey, of the monetary committee of the International Chamber of Commerce, of the Research Council of the State Industrial Board, of the Swedish Computers and Electronics Commission, of the Royal Swedish Academy of Engineering Sciences (IVA). He is also associate editor of The Journal of Economic Behavior and Organization (JEBO) and a member of the board of Sparbankernas Aktiesparfond AB (The Savings Banks' Trust Fund).

Bertil Holmlund was visiting professor at the University of Michigan, Ann Arbor, 1980-81. He is associated with the Expert Group for Labor Market Research at the Swedish Ministry of Labor. From 1983 he is one of the two editors of the journal "Ekonomisk Debatt".

Anders Björklund is visiting scholar at the University of Wisconsin-Madison during 1982-83. He is associated with the Expert Group for Labor Market Research at the Swedish Ministry of Labor.

Bo Carlsson was visiting scientist at the Center for Policy Alternatives, Massachusetts Institute of Technology, during 1982. He is a member of the Government Investigation on National Statistics, member of the steering committee of the European Association for Research in Industrial Economics (EARIE), substitute member of the Nordic Economic Research Council, associate editor of the Journal of Industrial Economics and of the Rivista di Economia e Politica Industriale.

Bengt-Christer Ysander is a member of the Government Committee on Household Savings, a member of the Board of the Swedish Economic Association and of the Expert Group for Studies in Public Economics.

Nils Henrik Schager was an expert to the Government Committee on Wage-Earners' Share in Capital Formation during 1980-82.

Foreign Guests

On the resignation of Dr. Marcus Wallenberg as chairman of the Institute's Board of Directors IUI received a donation from the Marianne and Marcus Wallenberg Foundation set aside to enable the Institute to invite foreign researchers to IUI.

Within this program the following persons visited IUI during 1981 and 1982:

Jim Albrecht, Columbia Univ.
Vsevolod Altaev, CEMI, Moskva
Marvin Bartell, Univ. of Manitoba
Ernst Berndt, MIT
Hans Brems, Univ. of Illinois
Murray Brown, State Univ. of New York
David Brownstone, Princeton Univ.
William Comanor, Univ. of California
Greg Duncan, Univ. of Michigan
Jean Pierre Foresti, Ministaire de l'Industrial, Paris
Hans Genberg, Institut Universitaire de Hautes Etudes International
Edward Gramlich, Univ. of Michigan
John Hause, Univ. of New York
James Henderson, Univ. of Minnesota
Saul Hymans, Univ. of Michigan
Qian Jiajun, Chinese Academy of Science, Peking
Anne Kreuger, Univ. of Minnesota and World Bank
Linda Leighton, Fordham Univ.
Axel Leijonhufvud, Univ. of California
Glenn Loury, Univ. of Michigan
Edwin Mansfield, Univ. of Pennsylvania
Keith Pavitt, Univ. of Sussex
Guy Peters, Tulane Univ. and Univ. of Strathclyde
Cliff Pratten, Cambridge Univ.
Ann Robinson, Cardiff Univ.
Alexej Semenov, CEMI, Moskva
Mark Sharefkin, Resources for the Future, Washington D.C.
Ronald Teigen, Univ. of Michigan

Conferences Arranged by IUI

In June, 1981, IUI hosted an international conference on the theme *Is Local Government Spending Out of Control?* Experiences from the U.S., U.K. and Sweden on the control of local government expenditures were discussed and evaluated. The conference is further presented in Ysander's article in this volume. Papers presented at the conference are listed below.

Tomas Nordström and Bengt-Christer Ysander, IUI

Local Government Economic Stability and the Effectiveness of Fiscal Policy, IUI Working Paper No. 44.

Edward M. Gramlich, University of Michigan

Excessive Government Spending in the U.S. - Facts and Theories, IUI Working Paper No. 87.

Wallace E. Oates, University of Maryland

An Assessment of the U.S. Experience, IUI Working Paper No. 90.

Richard Murray, University of Stockholm

Central Control of the Local Government Sector in Sweden, IUI Working Paper No. 56.

Peter Jackson, University of Leicester

Fiscal Containment and Local Government Finance in the U.K., IUI Working Paper No. 89.

Noel Hepworth, CIPFA

Control of Local Authority Expenditure - The Use of Cash Limits, IUI Working Paper No. 88.

For late August 1983, an international symposium on *The Dynamics of Decentralized (Market) Economies* is being organized jointly by IUI and the Journal of Economic Behavior and Organization (JEBO). For further information about this symposium, see pp. 125-127.

IUI

Publications

For a complete list see IUI 40 years, 1939–1979. Firms in the Market Economy. IUI Research Program 1979–1980.

Books

Policy Making in a Disorderly World Economy (eds. G. Eliasson, M. Sharefkin, B.-C. Ysander). IUI Conference Reports 1983:1. 417 pp.

Lönebildning och lönestruktur. En jämförelse mellan Sverige och USA. (Determination and Structure of Salaries. A Comparison between Sweden and USA.) N. Anders Klevmarken. 1983. 93 pp.

Studies in Labor Market Behavior: Sweden and the United States. Proceedings of a Symposium at IUI, Stockholm, July 10–11, 1979. IUI Conference Reports 1981:2. 442 pp.

Svensk industri i utlandet (Swedish Industry Abroad), Birgitta Swedenborg. 1982. 299 pp.

Industrin inför 80-talet (Swedish Industry Facing the 80s). Bo Carlsson, Johan Örtengren, Petra Lantz, Tomas Pousette, Lars Jagrén, Fredrik Bergholm. 1981. 495 pp.

Industripolitik och samhällsekonomi. Verksamheten 1981. (Industrial Policy and Macroeconomics. Activities 1981.) 1982. 127 pp.

Business Taxation, Finance and Firm Behavior. Proceedings of a Symposium at IUI, Stockholm, August 28–29 1978 (eds. G. Eliasson, J. Södersten). IUI Conference Reports 1981:1. 435 pp.

On the Complete Systems Approach to Demand Analysis. N. Anders Klevmarken. 1982. 91 pp.

Industriöstödspolitik och dess inverkan på samhällsekonomin (Industry Subsidy Policy and its Macroeconomic Impact). Bo Carlsson, Fredrik Bergholm and Thomas Lindberg. 1981. 153 pp.

Företagsetableringarna i Sverige under efterkrigstiden (Establishments of New Firms in Sweden in the Post-War Period). Gunnar Du Rietz. 1980. 194 pp.

Byggmarknad, sjöfart och varuhandel. Specialstudier för IUI:s långtidsbedömning 1979. (Construction, Shipping and Retail Trade. Special Studies for IUI Medium-Term Survey 1979.) Part 3. Göran Normann, Olle Renck and Folke Larsson. 1980. 239 pp.

Engineering Trade Specialization of Sweden and Other Industrial Countries. A Study of Trade Adjustment Mechanisms of Factor Proportions Theory. Published by North-Holland. 1980. 284 pp.

Industriell utveckling i Sverige. Teori och verklighet under ett sekel (Industrial Development in Sweden. Theory and Practice during a Century), (eds. E. Dahmén, G. Eliasson). 1980. 407 pp.

Micro Simulation – Models, Methods and Applications. Proceedings of A Symposium in Stockholm, September 19–22, 1977 (eds. B. Bergmann, G. Eliasson, G. Orcutt). IUI Conference Reports 1980:1. 409 pp.

Kalkyler för 80-talet. Specialstudier för IUI:s långtidsbedömning 1979. (Modeling the 80's. Special Studies for the IUI Medium-Term Survey 1979). Vol. 2. B.-C. Ysander-L. Jansson-T. Nordström, B. Lindström and G. Eriksson & J. Södersten. 1979. 299 pp.

The Multinational Operations of Swedish Firms. An Analysis of Determinants and Effects. Birgitta Swedenborg. 1979. 287 pp.

Utrikeshandel, inflation och arbetsmarknad. Specialstudier för IUI:s långtidsbedömning 1979. (Foreign Trade, Inflation and the Labor Market. Special Studies for the IUI Medium-Term Survey 1979.) Vol. 1. B. Axell, S. Gustafsson, B. Holmlund, E. Ch. Horwitz. 1979. 199 pp.

Internationella energimarknader. Prognosmetoder och framtidsbedömningar.¹ (International Energy Markets. Forecasts and Forecasting Methods Energy and Economic Structure). Research report No 1. Alf Carling, Olle Björk, Sten Kjellman. 1979. 160 pp.

Att välja 80-tal. IUI:s långtidsbedömning 1979. (Choosing the 80's. IUI Medium-Term Survey 1979.) G. Eliasson, B. Carlsson, B.-C. Ysander. 1979. 393 pp.

Teknik och industristruktur – 70-talets ekonomiska kris i historisk belysning (Swedish Technology and Industrial Structure – the Crisis of the Seventies in Historical Perspective). Bo Carlsson, Erik Dahmén, Anders Grufman, Märtha Josefsson, Johan Örtengren. IUI, IVA. 1979. 194 pp.

Teletjänster – priser och investeringar. En samhällsekonomisk studie (Telephone Services – Prices and Investments. A study in welfare economics.) Tomas Pousette. 1979. 172 pp.

The Importance of Technology and the Permanence of Structure in Industrial Growth (eds. B. Carlsson, G. Eliasson, I. Nadiri). IUI Conference Reports 1978:2. 237 pp.

A Micro-to-Macro Model of the Swedish Economy (ed. G. Eliasson). IUI Conference Reports, 1978:1. 240 pp.

Teknisk utveckling och produktivitet i energiomvandlingssektorn (Technical Change and Productivity in the Energy Conversion Sector). Anders Grufman. 1978. 186 pp.

Skattepolitisk resursstyrning och inkomstutjämning. En analys av företagsbeskattning och indirekt beskattning. (Income Distribution, Resource Allocation and Tax Policy. An Analysis of Business Taxation and Indirect Taxation.) Göran Normann, Jan Södersten. 1978. 197 pp.

Growth and Finance of the Firm. Göran Eriksson. 1978. 176 pp. (Distributed by Almqvist & Wiksell International, Stockholm, and John Wiley & Sons, New York).

Utländska direkta investeringar i Sverige¹ (Foreign Direct Investments in Sweden – An Econometric Analysis). Hans-Fredrik Samuelsson. 1977. 202 pp.

IUI:s långtidsbedömning 1976 Bilagor (Supplements to the IUI Medium-Term Survey 1976). 1977. 324 pp.

¹ English summary.

*Svensk verkstadsindustris internationella specialisering*¹ (Patterns of Engineering Trade Specialization in Sweden 1960–1970 – with an International Comparison). Lennart Ohlsson. 1976. 388 pp.

*Transportpolitiken och lastbilarna*¹. En studie av regleringar och deras effekter (Transport Policy and the Lorries – A Study of the Effects of Regulation and Deregulation). Lars Kritz. 1976. 230 pp.

Handelshinder och handelspolitik. Studier av verkningar på svensk ekonomi.¹ (Barriers to Trade and Trade Policy – Studies of the Effects on the Swedish Economy.) Lars Lundberg. 1976. 410 pp.

IUI:s långtidsbedömning 1976. Utvecklingsvägar för svensk ekonomi fram till 1980. (The IUI Medium-Term Survey 1976.) 1976. 324 pp.

Emission Control Costs in Swedish Industry. An Empirical Study of the Iron & Steel and Pulp & Paper Industries. Johan Facht. 1976. 227 pp.

*Lönebildning och lönestruktur inom den statliga sektorn*¹ (Determination and Structure of Salaries in the Government Sector of Sweden). Siv Gustafsson. 1976. 260 pp.

Industriforskningens utveckling och avkastning (Industrial Research and Development – Growth and Returns). Anita Du Rietz. 1975. 130 pp.

*Företagens tillväxt och finansiering*¹ (Growth and Financing of the Firm). Göran Eriksson. 1975. 277 pp.

*Etablering, nedläggning och industriell tillväxt i Sverige 1954–1970*¹ (Entry, Exit and Growth of Firms in Swedish Manufacturing Industry during the Post-War Period). Gunnar Du Rietz. 1975. 116 pp.

Booklets

140. *Optimization Under Non-Linear Constraints*. Leif Jansson and Erik Mellander. Reprint from Economics Letters 11 1983. 4 pp.
138. *On the Stability of Age-Earnings Profiles*. N. Anders Klevmarken. Reprint from Scand. J. of Economics 84. 1982. 24 pp.
137. *Sambandet mellan företagens rekrytering, lönsamhet och löneutveckling* (The Relationship between the Recruitment, Profitability and the Wage Development of the Firms). Nils Henrik Schager. Reprint from Löntagarna och kapitaltillväxten 10. SOU 1982:47. 16 pp.
136. *Taxation and Real Cost of Capital*. Villy Bergström and Jan Södersten. Reprint from Scandinavian Journal of Economics 84 (3). 1982. 14 pp.
135. *Public Budgeting Under Uncertainty. Three Studies*. Ann Robinson and Bengt-Christer Ysander. Reprint from Public Budgeting & Finance 2/3 1982. 42 pp.
134. *Structure and Effects of the Swedish Value-Added Tax*. Göran Normann. Reprint from VAT Experiences of some European Countries 1982. 45 pp.

¹ English summary.

133. *Arbetsmarknad och strukturomvandling i de nordiska länderna* (Labor Markets and Structural Change in the Nordic Countries). Bertil Holmlund. Reprint from *Långsam tillväxt – strukturproblem och ekonomisk politik*. 1981. 18 pp.
132. *ISAC: Modellbeskrivning och kalkylexempel 1981–1985* (ISAC: Model Description and Experiments 1981–1985). Tomas Nordström. Reprint from *Underlagsmaterial till SOU 1982:14*. 80 pp.
131. *Electronics, Economic Growth and Employment – Revolution or Evolution?* Gunnar Eliasson. Reprint from *Emerging Technologies. Symposium* 1981. 1982. 26 pp.
130. *Industrins sårbarhet och flexibilitet* (The Vulnerability and Flexibility of the Industry). Lars Jagrén, Tomas Pousette. Reprint from *Kungl. Krigsvetenskapsakademiens Handlingar och Tidskrift nr 4/82*.
129. *Accelerated Depreciation and the Cost of Capital*. Jan Södersten. Reprint from *Scand. Journal of Economics*, Vol. 84, 1982. 5 pp.
128. *The End of Welfare?* Gunnar Eliasson, Bengt-Christer Ysander. Reprint from *Urban Welfare Res. Inst. Tokyo* 1981 and *Journal of Economic Literature* No. 1 1982. 20 pp.
127. *A Note on Changes in Payroll Taxes – Does Legal Incidence Matter?* Bertil Holmlund. Reprint from *National Tax Journal* No. 4 1981. 4 pp.
126. *Missing Variables and Two-Stage Least-Squares Estimation from More than One Data Set*. N. Anders Klevmarken. Reprint from the 1981 *Business and Economic Statistics ASA*. 7 pp.
125. *Sparande, industriell kompetens och ekonomisk tillväxt* (Savings, Industrial Competence and Economic Growth). Gunnar Eliasson. Reprint from *Sparande och ekonomisk politik*. 1982. 21 pp.
124. *Sweden – Choosing the 80 's*. Gunnar Eliasson. Reprint from *IFO München* 1981. 31 pp.
123. *The Content of Productivity Growth in Swedish Manufacturing*. Bo Carlsson. Reprint from *Research Policy*. Vol. 10 No. 4, 1981. 21 pp.
122. *The Value-Added Tax in Sweden*. Göran Normann. Reprint from *The Brookings Inst.* 1981. 13 pp.
121. *The Financing of New Technological Investments*. Gunnar Eliasson, Ove Granstrand. Reprint from *Occasional Report Series No. 3. Research Policy Inst. Lund* 1981. 23 pp.
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