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INDUSTRIAL SUBSIDIES IN SWEDEN: MACRO-ECONOMIC EFFECTS AND AN INTERNATIONAL COMPARISON^x

ABSTRACT

Between 1970 and 1978, industrial subsidies in Sweden rose from 4.9 % to 16 % of value added in mining and manufacturing. Most of this increase was due to increased wage subsidies to specific firms facing acute difficulties. The Swedish industrial subsidy program seems to be both larger in relation to industrial output and more selective than similar programs in Great Britain, Italy, Norway, and West Germany. Simulations on a firm-based macro model of the Swedish economy show that a selective wage subsidy yields higher industrial output, employment and export in the short run than alternative subsidy policies but also considerably worse economic performance in the longer term.

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**INDUSTRIAL SUBSIDIES IN SWEDEN: MACRO-ECONOMIC EFFECTS
AND AN INTERNATIONAL COMPARISON^x**

by Bo Carlsson

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I. Purpose

Like many other countries, Sweden was hit by severe economic problems in the mid-1970's. In the deep cyclical downturn in the world economy after the oil crisis 1973-74, the shipping, shipbuilding, steel and mining industries were particularly hard hit. In Sweden, certain parts of the forest-based industries also suffered from acute difficulties. Together, these crisis-stricken industries accounted for some 35 % of total Swedish exports. Many firms and even whole industries were facing bankruptcy or drastic cut-backs. 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.

^x An earlier version of this paper was presented to the European Association for Research in Industrial Economics (EARIE) conference in Basel, Switzerland, September 16-18, 1981. I would like to thank my colleagues Fredrik Bergholm and Thomas Lindberg for their work in connection with this study and especially the book that preceded it. I am indebted also to Robert M. Grant and Alfredo del Monte for furnishing me with data for the United Kingdom and Italy, respectively. I would also like to thank William S. Comanor, Richard R. Nelson, Burton H. Klein, and Wilhelm Paues for valuable comments on earlier versions of this paper. All remaining errors and shortcomings are, of course, my own.

What has been the magnitude and orientation of this industrial subsidy program in the 1970's? How does this program compare with similar measures in other countries? What are the macro-economic effects of the subsidies to ailing firms? What alternative measures could have been taken? These are the main questions in the present paper which is based on a recently published study. (Carlsson, Bergholm, Lindberg, 1981.)²

The paper is organized in the following way. Section 2 presents a brief discussion of industrial subsidies as an element of industrial policy in general and distinguishes between general and specific subsidies. Section 3 gives an overview of the magnitude and orientation of the Swedish industry subsidy program in the 1970s. In section 4, an attempt is made to make an international comparison of industrial subsidy programs. The comparison is limited to a numerical description of the size and character of subsidy programs in various countries; no attempt is made to evaluate the performance or degree of success. Section 5 turns to a description of the selective subsidies given to certain industrial firms in Sweden during the 1970s, and section 6 investigates the macro-economic effects of these firm-specific subsidies. Section 7 presents a summary and some concluding remarks.

2. Industrial Subsidies - An Element of Industrial Policy

Government policy regarding industrial subsidies is but one element of what may loosely be referred to as industrial policy. Without going into the thorny question of how "industrial policy" is or should be defined, it is clear that the objectives of such policies vary greatly among countries and therefore also the means used to achieve those ends. It is also clear that, in addition to industrial subsidies, among the elements constituting industrial policy in various countries, the following are usually to be found, in varying degrees: (1) tariff policy and other forms of protection; (2) direct government ownership of means of production; (3) eco-

conomic planning at the national level; (4) manpower policy broadly defined; (5) regional policy; (6) government procurement policy; and (7) policies regarding research, development and technical training. Thus, it is obvious that any attempt to evaluate the policies and performance of a given country as regards industrial subsidies is bound to give only a partial picture of the country's overall performance in industrial policy in general. The role of industrial subsidies in overall industrial policy also varies.³

Restricting ourselves henceforth to considering industrial subsidies, it is useful to distinguish between general subsidy schemes and specific schemes. General subsidies are those schemes under which the subsidy is given under certain standard rules of procedure to determine the eligibility of applicants and within those rules is available to all comers. On the other hand, specific or tailor-made subsidies are given to particular persons or firms for a particular purpose. (Whiting, 1976, p. 1.) Examples of general subsidies would be tax deductions for investments of a particular type or in a particular region, grants or tax deductions for research and development expenditures, or loans offered below market rates to small and medium size firms.

Specific subsidies typically involve support for a specific project or product or for the restructuring or re-equipment of a firm. The philosophy behind general subsidies is that their availability and value are readily calculable by firms, who can therefore take them into account in planning their activities. They are also relatively straightforward, quick and cheap to operate (ibid., p. 2). Specific subsidies, on the other hand, involve more discretion and more top-level decision making on the part of the government, and the results are much less predictable and calculable.

For these reasons, industrial subsidies have tended to be of the general rather than the specific kind in the countries investigated here. However, in the face of the severe structural adjustment problems that arose during the 1970's the emphasis seems to have shifted significantly towards more specific policies.

3. Magnitude and Orientation of the Swedish Industry Subsidy Program

Sweden provides a good example of this shift in emphasis from general to specific schemes during the 1970's. Structural adjustment policy has played an important role in the Swedish economy since the 1950's. The principal means has been labor market policy which has been designed to alleviate the continuous adjustment generated by the pressures of international competition. Thus, Sweden's labor market policy can be seen as a complement to the country's extensive social welfare programs. But in addition, the "solidaric wage policy" favored by the Confederation of Trade Unions (LO) has actually reinforced the adjustment need by putting increased pressure on low-wage, low productivity firms. This philosophy of the complementary role of adjustment policy and the role of labor union wage policy originated in the so-called Rehn model of economic policy in Sweden which was developed in the early 1950's by LO economists and which placed considerable emphasis on the need for active intervention by government in the labor market (OECD, 1980, p. 189).⁴

However, in the face of the extremely large structural adjustments necessitated by the developments, both international and domestic, in the wake of the first oil crisis, it was widely felt that labor market policy alone was inadequate to deal with the situation, and the political pressure to intervene more directly mounted. The means chosen was dramatically increased selective subsidies to ailing firms and industries.

The changing structure and magnitude of the Swedish industrial subsidy program in the course of the 1970's is reflected in Figure 1. There it can be seen that the industrial subsidies rose from a modest 1.3 % of GDP (or 4.9 % of value added in mining and manufacturing) in 1970 to an extraordinary 3.6 % of GDP (16 % of V. A. in mining and manufacturing) in 1978 (production valued at market prices), declining somewhat in 1979. Virtually the whole

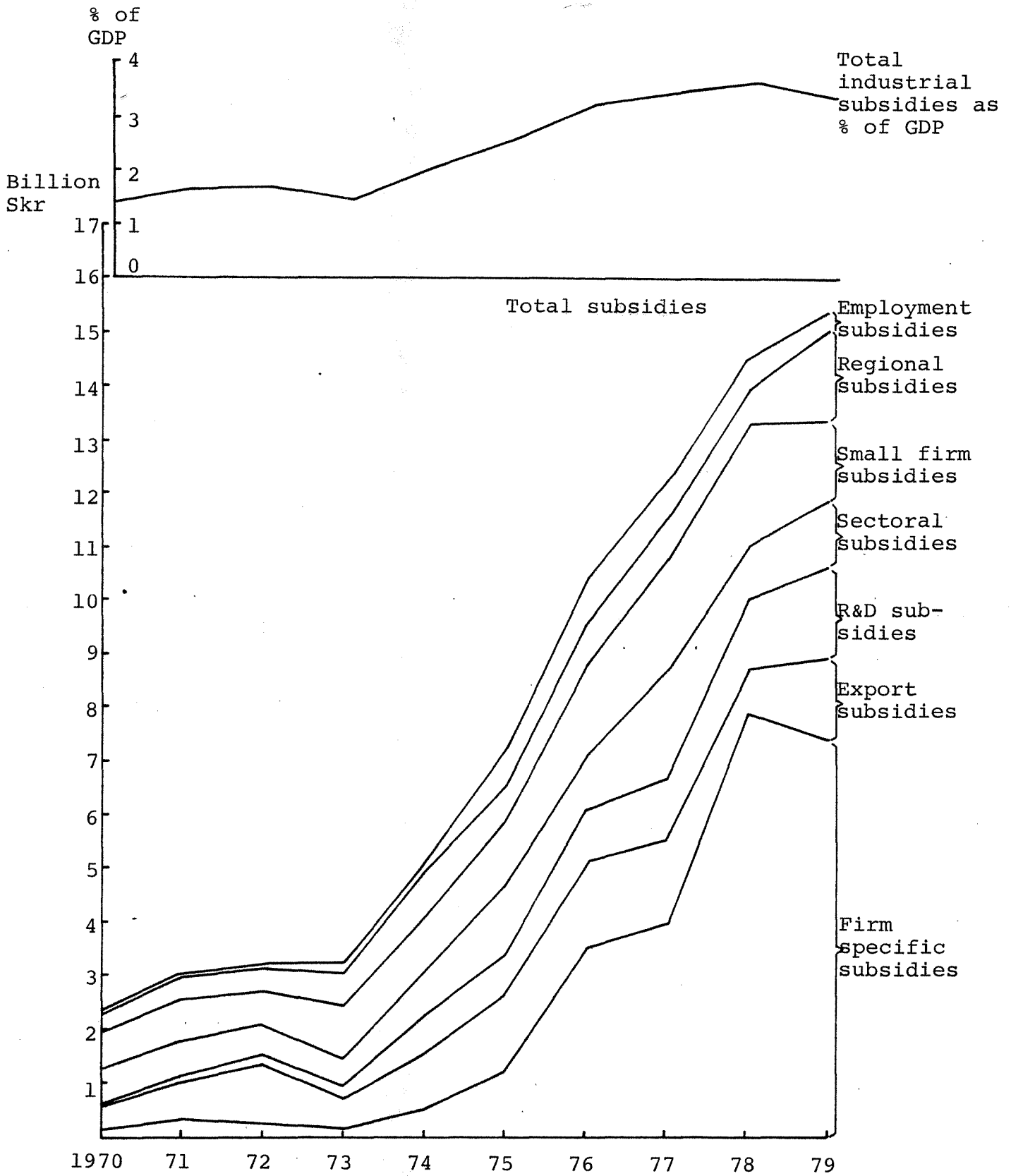
increase can be attributed to an increase in firm specific subsidies of a very selective kind; these grew from practically zero to a peak of 2.0 % of GDP in 1978.

The Swedish subsidy figures presented in this paper (including those in Figure 1) refer to amounts actually paid out and include both grants and loans. The reason why no distinction is made here between grants and loans is primarily that it is often difficult to draw the line between them, as e.g. in the case of so-called conditional loans. It is common also in other cases that soft loans are converted into grants. As indicated in Table A in the Appendix, about 58 % of the Swedish industrial subsidies during the 1970's were given in the form of loans. The loan figures, too, represent paid-out amounts; no attempt has been made to calculate the subsidy element by comparing the conditions of the loans to commercial loan conditions.⁵

According to this definition, the total amount of industrial subsidies rose from 2.3 billion Skr (equivalent to .44 billion US dollars) in 1970 to 15.4 billion Skr (3.71 billion US dollars) in 1979. As shown in Figure 1, up until 1973 the level of expenditures was rather stable, and the amount of firm specific subsidies was negligible. However, since then expenditures have risen very fast: more than a doubling (in current prices) between 1973 and 1975, then a doubling again between 1975 and 1978. Over the entire decade of the 1970's a total amount of 75 billion Skr was paid out in industrial subsidies. Measured in 1979 prices this is equivalent to about 100 billion Skr or about 10 billion Skr per year (equal to 2.4 billion US dollars), on the average.

For comparison it may be mentioned that the cost of labor market measures during the period 1970-79 amounted to about 50 billion Skr (in current prices). At the same time, non-industrial policy measures (including e.g. subsidies and other measures directed at the agricultural sector, policies to promote forestry, commerce, and the social infrastructure -- e.g. the state railroad sys-

Figure 1. Swedish Industrial Subsidies 1970-79
(Paid-out amounts in current prices)



tem, the postal service, road services, and the energy supply system) came to a total of about 110 billion Skr. Thus, the total cost to the government of economic policy measures directed at the business sector was about 235 billion Skr for the whole decade.

Within the industrial subsidy program, as shown in Figure 1, the type of measure that has increased the most is firm specific subsidies, i.e. direct measures to save ailing firms. The amount spent for this purpose rose from a modest 127 million Skr in 1970 to almost 8 billion Skr in 1978. Altogether during the decade about 26 billion Skr (out of which 37 % in the form of loans) was spent for this purpose, i.e. about one-third of the total industrial subsidy program. It is this type of expenditure with which we are primarily concerned in this study. A more detailed description of the composition and distribution of these firm specific subsidies is presented below.

There are several forms of general subsidies. Regional subsidies include both grants and loans. Small firm subsidies consist mainly of loans issued by financial institutions such as Industrikredit and Företagskredit and, after 1978, the so-called regional development funds. R&D subsidies consist mainly of grants made to the State Board for Technical Development (STU), tax exemptions from corporate income tax obtained by firms for R&D expenditures, and grants for energy research and energy conservation in the business sector. Export subsidies consist predominantly of export credits issued by AB Svensk Exportkredit. Sectoral subsidies consist mainly of loans issued by the Swedish Investment Bank.

In addition to the above measures, all of which have been financed via the budget of the Department of Industry, certain programs administered by the Labor Market Board (AMS) have been directed at firms -- although the bulk of the Board's activities are directed at individuals in the labor force rather than at

firms and therefore are not considered here. The total of the firm-oriented actions of the Labor Market Board amounted to 3.4 billion Skr during the period 1970-79 and included i.a. support of certain training programs and inventory build-up during 1972 and 1975-76.

It is apparent from the material presented so far that the bulk of the industrial subsidies in Sweden have been designed to promote industrial development in general and small and medium-sized firms in distressed regions in particular. But large and expanding firms have also received support, especially via tax exemptions for R&D expenditures and via export credits. The impact of these general and permanent subsidy programs is difficult to evaluate, since the conditions for receiving support have varied strongly, and since it is difficult or impossible to characterize the recipients. Therefore, it is virtually impossible to specify an alternative policy with which the actual program could be compared. Perhaps the most relevant comparison one could make would be to view these general subsidies as a form of tariff.⁶ In any case, the empirical investigation of Swedish industrial subsidies in the 1970's summarized below is confined to rescue operations to certain crisis-stricken firms only.

4. Industrial Subsidy Programs - An International Comparison

But before we analyze the Swedish data further, how does the Swedish industrial subsidy program compare to those in other countries? In order to answer this question, we undertook a data collection, the results of which will be presented below.

First of all, it must be stated at the outset that collecting data on government subsidies is a difficult, if not impossible. task. The virtual absence of international comparative studies on this topic testifies to this. Data on government subsidies is one type of information which most governments are not eager to divulge

or whose diffusion they sometimes actively prevent. The transparency, and thus the quality, of the data we have been able to obtain, therefore, varies a great deal from one country to another. Accordingly, the figures presented here represent only a first attempt to pull together information which has been made available to us and must be interpreted with extreme care. For example, there are some glaring omissions in the data we have obtained; the institutional arrangements vary greatly, particularly with regard to the tax system, and it is therefore difficult to classify certain measures under any given heading. Also, in some countries, such as e.g. France and Germany, tax exemptions play an important role as a supplement to direct subsidies. However, the impact and magnitude of tax exemptions obviously depend on the characteristics of the tax system, the study of which would take us too far afield. Therefore, except in the German case, we have tried to exclude tax exemptions and included only paid-out or appropriated amounts.⁷ The reasons why tax exemptions in Germany are treated differently from those in other countries are (1) that they seem to be much more specific than those, e.g., in the Scandinavian countries and therefore play a role very similar to that of direct subsidies in these countries; (2) that the German government itself obviously views these tax exemptions as being very similar to direct subsidies; and (3) that estimates of the (gross) cost to the government's budget of tax exemptions are available for Germany but not for other countries.

Secondly, it should be pointed out again that the degree to which government industrial policy relies on subsidies varies among countries. As indicated in section 2, industrial subsidies constitute but one aspect of industrial policy. This means, more specifically, e.g., that the role of indirect subsidies in the form of government procurement arrangements and rules as well as that of trade barriers protecting domestic firms may vary substantially among countries. Such effects are not considered here.

Thirdly, and perhaps most importantly, the aim in presenting this comparison is neither to evaluate individual governments' subsidy

programs, nor to assess the role of subsidies in overall adjustment policies. The goal is rather more modest, namely to get a rough idea of the magnitude and orientation of such subsidy programs in various countries, and to find out to what extent they differ.

Being aware of all these limitations, let us turn now to the information at hand, summarized in Table 1. According to the table, the subsidy programs of various countries vary substantially in magnitude, with Britain and West Germany at the low end of the spectrum (1.0 and 1.6 % of GDP, respectively), and Sweden at the high end with 3.5 %, Norway and Italy being in between. It is perhaps surprising that the British subsidy program is found to be the smallest in the comparison. However, this is due partly to the fact that there was a substantial reduction in the British subsidy program from a peak in 1978-79.

Roughly one-half of the industrial subsidies in Italy, Norway and Sweden are of the general type, while general subsidies account for significantly higher shares in the United Kingdom (64 %) and West Germany (82 %). Regional and small firm support programs seem to be the most important types of general subsidies and R&D subsidies the second most important type, with Germany leading in both categories. Export subsidies turn out to be the kind of general subsidy that varies the most in relative magnitude. However, since most export subsidies are given in the form of loans for which the actual subsidy element and the institutional arrangements vary a great deal, the large differences here probably mostly reflect the poor quality or at least poor comparability of the data. General investment and employment subsidies seem to be relatively unimportant. Under the heading "employment subsidies to firms" we have tried to include only anticyclical measures aimed at firms, as well as labor market subsidies available not just to firms in acute difficulties.⁸

It should be pointed out, of course, that the classification of certain types of subsidy schemes is wrought with many problems. Table 1.

Table 1. Industry Subsidies in Great Britain (1979-80), Italy (1978), Norway (1979), Sweden (1979) and West Germany (1980)

	Great Britain 1979-80		Italy 1978		Norway 1979		Sweden 1979		West Ger- many 1980	
	million £	%	billion lire	%	million Nkr	%	million Skr	%	million DM	%
"General subsidies"										
Export subsidies	376	19.4	1 688	31.3	152 ^a	3.2	1 507	9.8	1 750	8.0
R&D subsidies	267	13.8	75	1.4	614	12.8	1 643	10.7	4 450	20.3
General invest- ment subsidies	2	.1	240	4.4	395	8.2	-	-	650	3.0
Employment sub- sidies to firms	209	10.8	-	-	175	2.6	396	2.6		
Regional and small firm support	388	20.0	725	13.4	1 205	25.2	3 134	20.3	12 000	54.8
Subtotal	1 242	64.1	2 728	50.5	2 491	52.0	6 680	43.4	18 850	86.1
"Rescue operations"										
Sectoral subsidies	77	4.0	-	-	1 109	23.1	1 255	8.1	2 650	12.1
Specific firm subsidies	620	31.9	2 671	49.5	1 192	24.9	7 464	48.5	400	1.8
Subtotal	697	36.0	2 671	49.5	2 301	48.0	8 719	56.6	3 050	13.9
Total subsidies	1 939	100.0	5 399	100.0	4 792	100.0	15 399	100.0	21 900	100.0
Total as % of GDP		1.0		2.6		2.0		3.5		1.6
Total as % of value added in mining and manufacturing		3.6		7.1		7.6		16.0		4.0 ^b
"General subsidies" as % of value added in mining and manufacturing		2.3		3.6		4.0		6.9		3.4 ^b
"Rescue operations" as % of value added in mining and manufacturing		1.3		3.5		3.6		9.1		.6 ^b

^a The figure given represents only a minor fraction of total export subsidies.

^b Estimated figure.

Sources to Table 1

Great Britain: Public Expenditure White Paper (March 1981), table 2.4. I would like to thank professor Robert M. Grant, The City University Business School, London, for furnishing me with these data and for helpful suggestions for classification of the data.

Italy: Bank of Italy (1978); Istituto Centrale di Statistica (1978). I am indebted to professor Alfredo Del Monte, University of Naples, for collecting and furnishing me with these data.

According to calculations made by prof. Del Monte, the financial cost to the government budget of the industry subsidy program (calculated as the difference between the market rate at which the government borrows and the favorable rate on the loans offered under the available schemes times the amount of loans outstanding, plus capital grants given during the year) amounted to 1 375 billion lire in 1978.

Norway: Industrifondet, 1980a and 1980b.

Sweden: Data from Industristödsutredningen (Government Committee on Industrial Subsidies) as reported in Carlsson, Berg-holm, Lindberg (1981).

West Germany: Deutscher Bundestag (1979) (7th Subsidy Report); Sjöström and Olofsson (1981).

The German figures were obtained in the following way. The basic source for the allocation of various support programs to the types of programs in Table 1 is the 7th Subsidy Report.

From the total figure for Federal financial support of the industrial sector given in that Report (4 006 million DM 1980), support programs for energy and raw material acquisition were excluded. To the remaining Federal financial support of 3 618 million DM were added an estimated 2 000 million DM in state and local aid, and 2 039 million DM in ERP (= European Recovery Program) measures, all of which were classified as "regional and small firm support". The total tax exemption figure for the industrial sector given in the 7th Subsidy Report is 9 802 million DM (4 616 Federal aid and 5 186 million DM state and local). However, after excluding certain measures applying to the financial sector and certain programs relating to the housing sector, the remaining tax exemption total is 9 184 million DM.

In addition, based on Sjöström and Olofsson (1981), 1 700 million DM in export credit by the Kreditanstalt für Wiederaufbau were added, and also an estimated 3 000 million DM in R&D support in programs financed via the Bundesministerium für Forschung und Technologie, Bundesministerium für Wirtschaft, defense agencies, etc., which are not included in the 7th Subsidy Report,

The figures for West Germany in the Table were also checked against those reported by Jüttemeier and Lammers (1979).

GDP, value added in mining and manufacturing: OECD (1981).

This is particularly true of sectoral subsidies. It might be argued, for example, that government support of the aerospace industry is a sector-oriented type of program and should be thus classified. Yet we have chosen to classify such support under "R&D subsidies", while support of the steel and shipbuilding industries, perceived to be of a rather different, "rescue type" character, are regarded as sectoral subsidies. In some countries, support of the steel industry has been industry-wide, while in others it has been firm specific. Therefore, it has been judged more useful to distinguish between "rescue operations" and other types of industrial subsidies than to try to differentiate between industry-wide and firm specific subsidies to, say, the steel industry. Hence the division into "rescue operations" (rather than "specific subsidies") and "general subsidies" in Table 1.

What is left, then, under "rescue operations" is principally support of ailing firms and industries. But because of lack of sufficiently detailed data, it is possible that there are some other elements also included here. The sector composition varies greatly: two-thirds of the rescue operations in Germany are directed toward the coal mining industry, which is also a large receiver in Britain, along with autos, shipbuilding and steel. In Norway, about one-half of the rescue operations involve the shipbuilding industry. In Sweden, as we will see in more detail below, three-fourths of this type of selective measures are directed toward shipbuilding and steel. It has not been possible to determine the distribution by sector in Italy.

It appears from the table that the Swedish subsidy program in 1979 was substantially larger than that of any other country in the comparison. This is true for both general subsidy schemes and rescue operations, but particularly for the latter. Could it be that the Swedish figures are simply more complete than the others -- or are the differences genuine? Could it be that Sweden, traditionally a proponent of free trade, faced greater difficulties during the 1970's than the other countries and, having disarmed

itself of other protective measures, had to resort to subsidies as a remedy? The answer is that we just do not know. Before any firm conclusions can be drawn from an international comparison such as this, it is clear that substantially more work is required to ensure the quality and comparability of the data. The effort made in this paper is only a beginning.

5. Distribution by Sector of the Swedish Specific Firm Subsidies

Let us turn now from the international comparison to a closer examination of the Swedish subsidy program in the 1970's. More specifically, we are concerned henceforth only with rescue type operations, leaving aside all general subsidy schemes.

As already noted, the firm specific industrial subsidies in Sweden amounted to about 26 billion Skr during the 1970's, all but a minor fraction being paid out during the latter half of the decade. According to Table 2, over 20 billion Skr was paid out during 1977-79. As already noted, three-fourths of this amount went to the shipyards and the steel industry and the remainder to the forest-based industry, the mining industry, and the textile and apparel industry. The shipyards alone received nearly half of these firm specific subsidies.⁹ During the three-year period 1977-79 the shipbuilding subsidies corresponded to 120 % of the total wage bill, or approximately 280 000 Skr per employee. During 1978 and 1979, the 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 (Hamilton, 1981, pp. 8-9)! In the steel industry and the mining industry, the subsidies corresponded to 30-40 % of the wage bill or about 100 000 Skr 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

Table 2. Firm Specific Subsidies by Receiving Sector in Sweden
1977-79

(Sum of grants and loans. Paid-out amounts. Credit guarantees not included.)

	Million Skr	In relation to		
		Value added %	Total wage-bill %	No. of em- ployees, thousands of Skr
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 manu- facturing	20 238	6.9	8.5	21

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 % 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 Skr -- 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 Skr (about US\$ 500) per individual in Sweden or about 5 000 Skr (US\$ 1000) per person employed in the whole economy. Nearly half of this went to the shipyards.

6. Macro-Economic Effects of Firm-Specific Subsidies

What, then, has been the macro-economic impact of the firm-specific subsidies? In order to answer that question one needs to specify some alternatives to which the implemented policy can be compared. This can be done with the aid of a model. A model can also be used as an analytical tool in trying to understand the basic mechanisms at work in various policy alternatives.

Appendix 2

The model used in the present study is a micro-(firm-)based simulation model of the Swedish economy.¹⁰ For a brief description, see Appendix 2. One of the central features of the model, and which distinguishes it from other models, is that it is based on data for individual firms. It is possible to characterize firms within the model and study how they behave under various conditions. Thus, what happens in the markets is determined endogenously in the model rather than directly via assumptions.

There are normally about 140 real firms in the model, covering about 70-75 % of Swedish manufacturing output. In the present simulations we have added eight subsidized firms: two based on data for two forest-based firms (Södra Skogsägarnas Cellulosa AB and NCB), one based on data for the merged commercial steel company (Svenskt Stål AB), one based on data for the Swedish shipyards (Svenska Varv), and four textile and apparel "firms", each representing a subsector within that industry.

The purpose of the simulations has been to illustrate a few fundamental relationships which illuminate the macro-economic effects of subsidies, not to simulate the actual development or the impact on individual subsidy recipients. The experiments on the model represent an attempt to estimate the order of magnitude and the distribution over time of the macro-economic effects after allowing for the adjustments made as a result of the subsidy program, i.e. taking into account both direct and indirect effects. All such calculations are necessarily hypothetical in nature. However, we are not aware of any other way to illustrate and quantify the macro-economic impact than through a model based on the behavior of micro units.

The point of departure for the simulations has been to compare the result of the policy actually conducted with that of other alternatives. All exogenous variables have been exactly the same in all the simulations except the specification of the subsidy pro-

gram. 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.

The subsidy program actually carried out has been 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 Skr. 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 raise. However, most of the income tax revenue comes towards the end of the simulation, i.e. after the subsidies have been phased out.

The object of the simulations has been to compare this policy package to other alternatives, keeping the magnitude and time profile of the subsidy program constant (about 70 billion Skr during the period 1977-84), changing only the type of policy measures used.

As an alternative to the extremely selective actual subsidy program (support given to specific firms in specific circumstances) we have specified a more general alternative, namely where 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.

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 would have to be about 10 %. Alternatively, the payroll tax would have to be reduced from about 40 % to about 20 % 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.

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 need for an income tax increase either.¹¹

Through the selective subsidies, the recipient firms survive in the simulation at least until the subsidies begin to be phased out in 1983. In 1983-84 in this simulation, one of the forest based firms as well as the commercial steel firm and the shipyards are closed down. 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 1970's. 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.¹²

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 the subsidized firms or the unemployment pool (which is reduced because of the subsidies). This causes generally higher wages, lower profits in non-subsidized firms, and therefore fewer incentives for expansion. The result is that the adjustment to

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

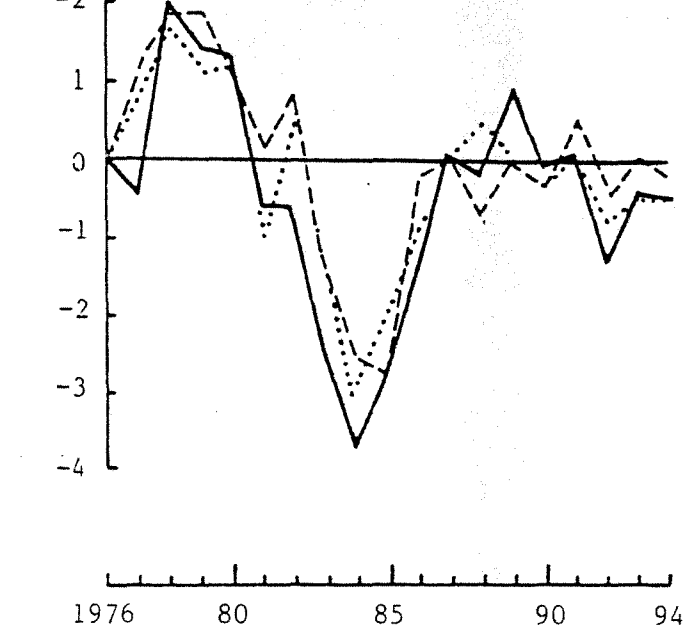


Figure 2b Manufacturing output
(Index, selective policy = 100)

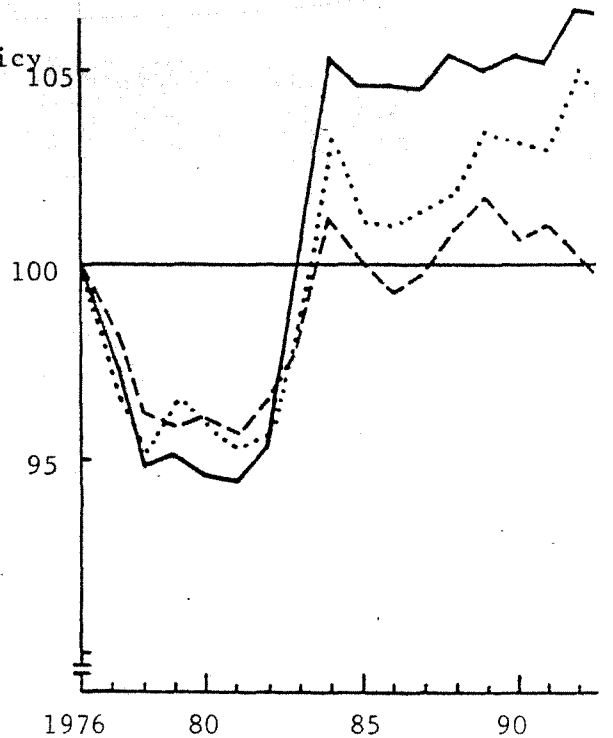


Figure 2c Net Trade Balance in Percent of GNP
(Index, selective policy = 100)

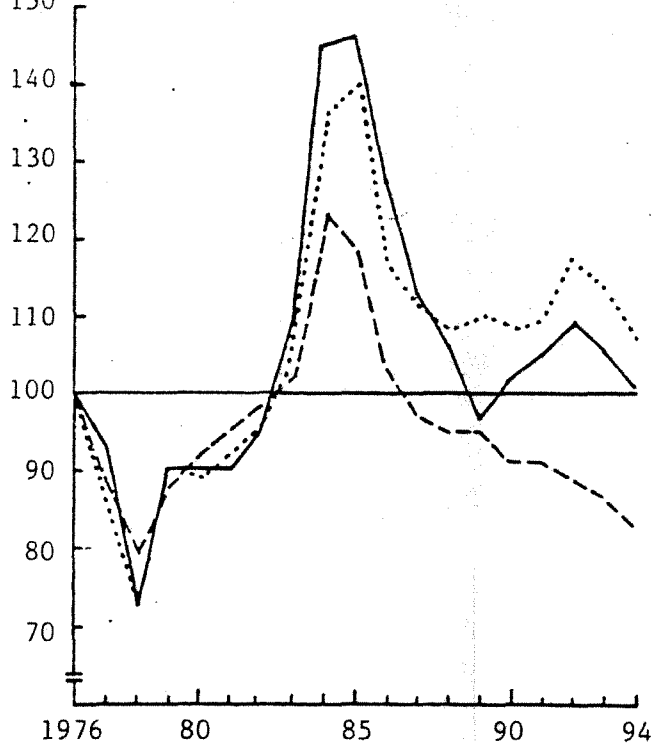
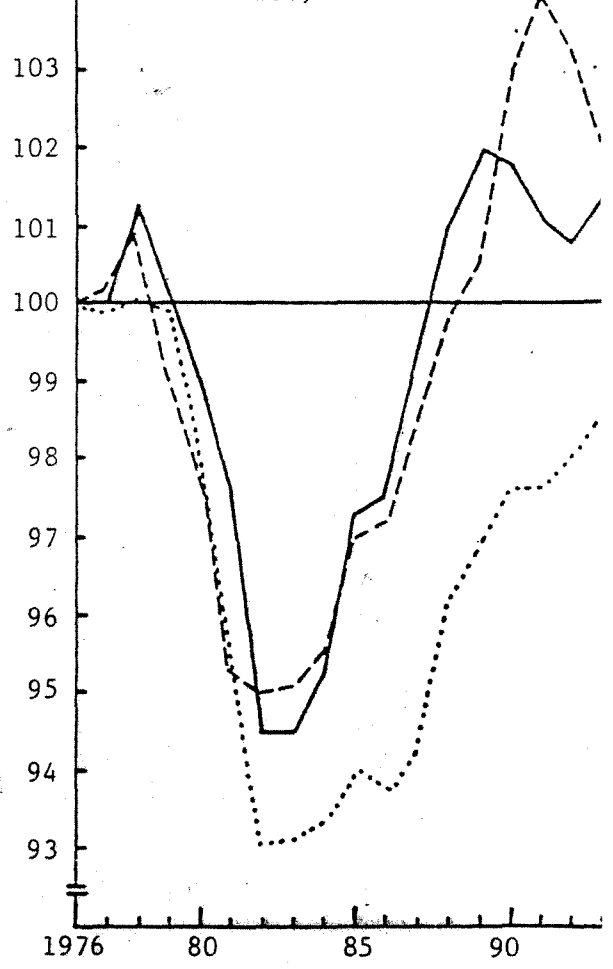


Figure 2d Private consumption
(Index, selective policy = 100)



- Selective wage subsidy 1977-84
- - - General wage subsidy 1977-84
- Export subsidy 1977-84
- . - . Laissez-faire

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 80's 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 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.

It is worth noting that even if subsidies had been given of the same order of magnitude but of a less selective type, it would have taken some time before industrial production started to rise. Most of the large recipient firms would have been forced to close down, as already noted. This would have meant a further loss of demand in addition to that created already by the extremely low trough in the international business cycle. This would have resulted in large overcapacity which would have delayed the expansion and increase in investment for which the subsidies per se would have provided stimulus. Even though profits would have increased, firms would have waited to increase their investment until an acceptable level of capacity utilization had been reached. Only towards 1980-81 would a rise in investment have occurred, resulting in a strong expansion in production in 1981-82, according to Figure 2b. In conjunction with the phase-out of the subsidy program in 1983 and 1984, further expansion is held back.

Nevertheless, the level of industrial production after 1983 is substantially higher and grows faster in the general wage subsidy (reduced payroll) case than in the selective subsidy case.¹³

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.

An alternative policy might have been to impose tariffs or import quotas in the stricken industries. However, such a policy has not been investigated because import restrictions would not be of much use in these heavily export oriented industries and have never been contemplated in the Swedish debate. Roughly $3/4$ of the output of Swedish shipyards and $2/3$ of the output of forest products is exported. Even prohibitive tariffs on imports would not guarantee a large enough domestic market for the sick firms

in these industries to survive. Also, such tariffs would violate GATT rules and would run counter to the whole postwar development. It is likely that the distortions resulting from such a policy would have been even worse than those resulting from subsidies because import restrictions would have led to both lower domestic consumption (through higher prices) and higher costs to using sectors, as well as a homemarket bias (see Corden and Fels (1976), pp. 215-222) detrimental in the long run to the international competitiveness of Swedish industry. In other words, the negative impact on firms' incentives seem likely to be greater when tariffs are imposed than when subsidies are used - but this is clearly a question for future research.

7. Summary and 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 re-structuring, 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). In comparison with these alternatives, therefore, the selective subsidy program yields negative long-run effects.

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 relative to the laissez-faire policy are underestimated. However, a laissez-faire policy seems neither politically attractive nor economically or socially desirable, based on the results of our investigation.

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 compared to conventional macro models, the question of incentives within firms has been handled here only by assumption. Thus, here remains an important topic for further research.

A comparison of the development of industrial production in the various policy alternatives shows that the selective policy gives an immediate stimulus while more general measures take longer before they yield results; on the other hand, the long-term results are much more favorable. Expressed differently, a dosage of temporary wage subsidies to all manufacturing firms yields more favorable long-term effects than a similarly large dosage of temporary subsidies to non-competitive firms. However, as far as the short-run effects are concerned, the reverse is true, since the non-competitive firms would have failed without subsidies and their production, exports, and employment would have been lost.

Thus, our study sheds light on some of the issues involved in industrial policy making. The results show that it is difficult, if not impossible, to both prevent unemployment in the short run and facilitate re-structuring with one single policy. They bring out the differences in the consequences of selective and general policies. And they illuminate the conflict between short-run and long-run policies. There is little doubt that the political choices made in Sweden in the latter part of the 1970's concerning adjustment policy have involved highly selective, short-run policies. These policies have undoubtedly allowed Sweden to escape in the short run from certain adjustment problems at the cost of delayed adjustment and slower future growth. The question is how long it will take to reverse these policies, and how much permanent damage will have been done in the process. The problem for the future is exacerbated by the fact that Sweden's subsidy program appears to have been both considerably larger in terms of industrial output and more heavily oriented towards rescue operations than those in other European countries, creating greater destruction of incentives and contributing to greater uncertainty for firms' decision making in Sweden than elsewhere.

Footnotes

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

2 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.

3 In addition to these industrial policies, most countries pursue with varying vigor policies to maintain competition and efficiency and to fight collusion and monopoly.

4 For a survey of Swedish industrial policies in the postwar period, see Ohlin (1974) and Eliasson-Ysander (1981).

5 On the other hand, all forms of guarantees are excluded from the presentation here, except insofar as incurred losses have had to be covered. Still outstanding guarantees are not included.

6 For a discussion of the equivalence of tariffs and subsidies, as well as an empirical investigation of their relative importance in Germany and Britain, see Corden and Fels (1976).

7 It has not been possible, except in the case of Italy (see note to table 1 below), to obtain estimates of "the subsidy element" of loans given at less than market rates of interest. Therefore, the "gross" amounts are included in table 1.

8 In addition to the figures reported here, an estimate has been made by Mr. J.P. Foresti for France (1979), based on information obtained from the French Ministry of Budget. The total figure for industrial subsidies is approximately 26 billion francs, corresponding to 1.1 % of GDP and 3.9 % of value added in mining and manufacturing. Over 70 % of these subsidies were classified as "rescue operations". Thus, the French subsidies appear to be of the same general magnitude as those in Britain and Germany, but they also appear to be much more selective in nature.

9 The shipyards also received some "general subsidies", but their share of total subsidies was considerably smaller than their share of firm specific subsidies. For a more detailed analysis of the subsidies to the shipbuilding industry, see Hamilton (1981).

10 The model, which is named MOSES, has been described in several publications, especially in Eliasson (1978). A brief presentation of the model with special application to the present subsidy simulations is found in Carlsson-Bergholm-Lindberg, (1981) esp. ch. 4. A more detailed description is given in the appendices to the same volume: "The Investment Finance Decisions" (by Thomas Lindberg), "The Development of Sales" (by Fredrik Bergholm), and "An Example of Firm Behavior" (by Thomas Lindberg). The pro-

gramming of the model is done in APL, but if it were FORTRAN, the program would require some 5-10 000 lines. About 50 variables are determined each quarter for each firm in the model. A 15-year simulation requires about 30 CPU minutes on a DEC 20 computer.

11 Yet another case of selective subsidies to ailing firms but on conditions that differ from those in the selective subsidy case mentioned above has also been examined but is not reported on here for reasons of brevity and clarity of exposition.

12 Public sector employment is assumed to be the same in all of the simulations.

13 The fact that the decline in industrial production is smaller in the laissez-faire case relative to the selective policy alternative than that in the other policy cases is explained by 1) the fact that there is no income tax raise suppressing total demand, and 2) the fact that general subsidies are relatively powerless in the poor cyclical conditions during the first few years of the simulation.

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APPENDIX 1.

Table A. Swedish Industrial Subsidies 1970-79.
Billion Skr, current prices

	Grants	Loans	Total
Firm-oriented employment subsidies	3.4	-	3.4
Regional subsidies	3.1	3.6	6.7
Small firm subsidies	.4	13.0	13.4
Sectoral subsidies	1.1	8.5	9.6
R&D subsidies	7.1	-	7.1
Export subsidies	.7	10.0	10.7
Firm specific subsidies	16.1	9.6	25.7
Total, billion Skr (%)	9 (42)	44.7 (58)	76.6 (100)

APPENDIX 2

Brief description of the model

The model used in the analysis of Swedish industrial subsidies is a micro-(firm)-based simulation model of the Swedish economy, named MOSES. What follows is a short description of some of the most central features of the model designed to facilitate the interpretation of the results reported in the main text. For a more complete description of the model, the reader should turn to the references given in footnote 10.

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

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 Skogsävarnas Cellulosa AB and NCB), the consolidated company formed by merging the three large Swedish commercial steel firms in 1977 (Svenskt Stål AB), the consolidated Swedish shipyards (Svenska Varv), 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 1970's, with the exception of the iron ore mines. The mining sector is outside manufacturing in MOSES and is therefore 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 not subdivided into industries or regions, mobility in the labor market is probably overestimated. This is important in interpreting the results.

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 assymetry 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.

Since the adjustment of both export and import shares takes place over several quarters, price differences between the domestic and export markets can arise and last for several years. This is a source of cycles in the model: if the export price exceeds the domestic price, firms try to increase their exports. Since they are always able to sell their export supply at the going (exogenous) export price, this provides stimulus to the firms. However, the stimulus is limited by the fact that the price difference between the domestic and export market has been constrained to $\pm 2\%$. This causes the export and import shares to be relatively stable. As far as exports are concerned, this is not too surprising, since the export prices have been assumed to change smoothly. But there is considerable turbulence on the import side in these runs which arises when certain large firms are not able to reach their profit target and use up their equity capital so that they are forced to close down. This causes a loss of supply which leads to a price rise in the domestic market. Since the price differential has been constrained to be less than 2% , and since the change in the import share is not instantaneous, only some of the

supply loss is replaced with increased domestic production in other firms and with increased imports. In order to satisfy domestic demand in spite of this, temporary "extra imports" are allowed which do not affect the "regular" import share and which remain until domestic demand can be satisfied through domestic production and "regular" imports.

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. The absence of competition among firms for capital causes the effect of subsidies on investment to be more favorable than would otherwise be the case.

The public sector is treated in the following way. 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. Therefore, the public sector can be said to be neutralized in these runs. The reason for neutralizing this block in the model is that it simplifies the analysis of the industrial development. Thus, public sector employment is the same regardless of the size and direction of subsidies.

The exogenous variables 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) and the rate of change of prices in the export markets. The rates of change of 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.

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