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Domestic employment effects of direct investment abroad by two Swedish multinationals

by

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The report on which this present working paper is based is one of a number of case studies undertaken on behalf of a Committee for direct investments (Direktinvesteringskommittén - DIRK), investigating the effects on Sweden of international investments. The work of the Committee is described more fully on pages 9 and 10.

Dr. Jordan is a consultant to and Dr. Vahlne the secretary of DIRK. The views expressed in this paper are those of the authors and do not necessarily coincide with those of DIRK.

DOMESTIC EMPLOYMENT EFFECTS OF DIRECT INVESTMENT ABROAD BY TWO SWEDISH MULTINATIONALS

1. Sweden as a home and a host country for MNEs

As a small country it is only natural that Sweden has always had extensive exchanges with the outside world. Exports and imports are roughly equivalent to half of the industrial output and a quarter of GNP. Moreover, operations of Swedish-based MNEs are extensive while the volume of foreign-controlled operations in Sweden is of lesser importance in an international perspective. (See Tables 1 and 2.)

Table 1. Value of direct investment abroad of developed market economies

Country	Relation between value of direct investment abroad and GDP 1976
USA	0.081
Great Britain	0.147
Federal Republic of Germany	0.045
Japan	0.035
Switzerland	0.332
France	0.034
Canada	0.057
Netherlands	0.109
Sweden	0.067
Belgium	0.054
Italy	0.017

Sources: Transnational corporations in world development re-examined, Centre on Transnational Corporations 1978 and Konjunkturläget 1978 : 2.

If a corresponding ratio were established for the manufacturing industry, Sweden would come "close to the top of a ranking list" as this industry dominates the foreign investment activities.

Table 2. Share of employment represented by enterprises or establishment of enterprises with foreign participation in manufacturing industry for certain OECD countries

Country	Year	Percentage employment
Australia	1972/73	23.6
Austria	1973	20.7
Belgium	1968	18.3
Canada	1972	43.7
Finland	1972	2.8
France	1973	14.9
Federal Republic of Germany	1972	22.4
Japan	1972	1.9
Norway	1974	7.8
United Kingdom	1971	10.3
Sweden	1974	4.8

Note: For all countries the degree of foreign ownership is at least 50 per cent with the exception of Belgium and the Federal Republic of Germany for which figures are not available.

Source: Penetration of multinational enterprises in manufacturing industry in member countries, OECD, 1977.

Table 3. Flow of direct investment to and from Sweden 1960-78, current prices, million Sw. Krs.

	Foreign direct investment in Sweden	Swedish direct investment abroad
1960	134	288
1961	167	346
1962	322	430
1963	754	391
1964	360	747
1965	320	537
1966	654	735
1967	584	877
1968	1 039	673
1969	550	1 696
1970	779	1 093
1971	611	1 255
1972	478	1 903
1973	615	1 503
1974	674	2 430
1975	562	2 303
1976	503	3 476
1977	643	4 315
1978	788	3 005

Note: The figures denote authorisation to invest. It is not known to what extent the authorisations are used. See also next page.

Source: Bank of Sweden.

The flow of direct investment is given in table 3. Generally, the outgoing investments are larger and have grown faster than the incoming.

The volume of the foreign operations of Swedish corporations has increased considerably between 1965 and 1974 as shown in table 4. The foreign subsidiaries operating outside the manufacturing sector in 1974 employed 87,000 people. It is interesting to note that while employment in Swedish industry rose by only 0.3 per cent between 1960 and 1974, the corresponding figure for the foreign manufacturing subsidiaries of Swedish NMEs was 5 per cent. Critics began to demand stricter regulation of capital export. The defenders of MNEs then showed that MNEs had managed to keep up employment in Sweden better than had purely national companies and claimed that this was a result of the foreign investment. Some critics, while acknowledging the figures, claimed that this development was more a result of merger operations than of the creation of new jobs. The present authors, on their side, argue that simple descriptive figures do not lend themselves to this type of conclusion which must be based on more thorough analysis of the kind presented in this paper. The reason is that without a closer look at the situation one cannot judge how acquired companies would have evolved had they not been acquired. In some cases the acquisition obviously implied a risky operation which allowed the acquired company to survive; in other cases the acquisition really did not make any change and, in extreme cases, jobs have been lost when the acquired companies closed down to eliminate competition.

Table 4. The size of the foreign operations controlled by Swedish industrial firms

	Number of subsidiaries			Number of employees (1000s)		
	1965	1970	1974	1965	1970	1974
Manufacturing subsidiaries	329	428	481	148	183	220
Sales Subsidiaries	583	905	1 227	25	43	56
Total	912	1 333	1 708	173	226	276

Source: Swedenborg 1976.

In 1974 the share of Swedish industrial exports supplied by the Swedish foreign investors was not less than 73 per cent. In that year, the foreign investors exported 63 per cent of their output. About one quarter of the output was manufactured abroad.

Although more than 100 Swedish corporations have manufacturing activities abroad, the foreign sector is highly concentrated. Whether one uses total assets or the number of employees as a measure, the 10 largest investors account for 75 per cent and the 20 largest for 85 per cent of the foreign manufacturing activities (Swedenborg 1973). Among these companies are Electrolux, SKF, LM Ericsson, Volvo, Sandvik,

Swedish Match Company, Atlas Copco, Alfa Laval and ASEA. In 1978, Electrolux, which is the largest employer, employed 76,000 people of which 48,000 were employed abroad. SKF, the ball-bearing company, had not less than 44,000 of the 54,000 employees working abroad. The relative importance for Sweden of the engineering industries is great, also in terms of foreign manufacturing. The forest industries on the other hand have traditionally relied more on exports (table 5).

Table 5. Distribution of employment in manufacturing subsidiaries 1974 (%)

Food	1
Textile and clothing	3
Paper products and printing	3
Pulps and paper	2
Chemicals	11
Iron, steel, metals and metal goods	12
Machinery	33
Electricity equipment	24
Transportation equipment	5
Other industries	6
	100

Source: Swedenborg 1976.

The more controversial clothing industry which benefits from low wages in other countries, only has a very small share.

Unfortunately statistics on the percentages of the employees working in Swedish multinational companies are not immediately available. One can only say that the 20 largest industrial groups in 1975 in terms of employment abroad employed 281,530 people in Sweden and that the corresponding figure for the total Swedish industry in companies with more than 50 employees was 825,998. The share of the 20 largest is thus one third. If the employment of other Swedish MNEs and of foreign investors were included, the MNE share of Swedish employment would increase considerably. A reliable estimate puts the figure at more than 50 per cent.

Although recently North America has received a growing share of Swedish foreign investment, Europe is by far the most important host (Table 6).

Table 6. Relative distribution of employees in foreign-controlled manufacturing companies according to geographical origin of investment (percentages)

The European Economic Community	53 %
The European Free Trade Area	11
North America	7
Latin America	15
Rest of the World	14
	100 %

Source: National Central Bureau of Statistics. SM F 1977:1.

As can be seen from the international comparison, the foreign controlled part of the Swedish economy is small. Only 2.5 per cent of the employees in the total economy work in foreign-controlled subsidiaries. For the manufacturing industry the corresponding figure is 5.7 per cent (Table 7).

Table 7. Employment, in percentages of total, in companies controlled from abroad, distributed by activity. (1970-1975. For 1975 absolute figures are also given.)

	1970	1971	1972	1973	1974	1975	1975
Agriculture, forestry	0.5	0.5	0.4	0.4	0.3	0.3	430
Mining	1.9	1.9	2.8	2.8	2.7	2.6	
Manufacturing	4.5	4.7	4.9	5.3	5.6	5.7	53 311
Food, beverage and tobacco	5.5	6.0	9.2	9.5	10.1	10.1	7 461
Textile, clothing and leather	3.5	4.0	4.0	4.2	4.4	3.8	2 077
Wood and wood products	0.5	0.5	0.5	0.5	0.6	0.5	342
Pulp, paper and paper products	2.3	2.6	2.8	2.7	3.1	2.2	2 845
Chemicals, petroleum, rubber, plastics	15.0	15.4	16.1	16.6	13.1	14.5	9 032
Non-metallic mineral products	0.7	1.4	1.7	2.1	3.8	3.7	1 368
Basic metal	2.4	2.5	1.9	2.2	2.3	3.0	2 582
Metal products and machinery	5.2	5.2	5.1	5.5	6.3	6.4	27 018
Other manufacturing	5.6	3.8	7.0	6.9	8.8	8.8	586
Electricity, gas and water	-	-	0.0	-	-	0.0	0
Construction	0.3	0.2	0.3	0.2	1.2	0.7	1 389
Wholesale and retail trade and restaurants and hotels	7.5	8.0	8.1	8.0	8.4	8.5	33 166
Wholesale trade	15.9	17.6	18.6	18.6	19.4	20.0	33 169
Retail trade	1.1	1.1	0.7	0.9	1.3	1.1	2 403
Transport shortage and communication	1.0	1.1	1.2	1.3	1.3	1.3	1 432
Financing and insurance	4.2	4.6	4.5	4.7	2.3	2.0	3 524
Community, social and personnel services	0.2	1.4	1.3	1.3	1.9	2.3	3 282
TOTAL	4.1	4.5	4.6	4.7	4.9	4.9	99 534

Source: National Central Bureau of Statistics SM F 1978:8.

The relatively high share in wholesale trade depends on the tendency to use sales subsidiaries as an export channel for sophisticated products. Most of the foreign-controlled firms are small - the largest being the Swedish ITT group with a total of 5,000 employees.

The United States is, not surprisingly, the most important home country for the foreign investors in Sweden (Table 8).

Table 8. Distribution of employment in the foreign-controlled sector in Sweden 1974 by country of origin of the investor (1000's)

United States	40
Great Britain	16
Fed. Republic of Germany	10
Netherlands	8
Denmark	8
Switzerland	6
Norway	4
Other countries	9
Total	101

Source: National Central Bureau of Statistics.

The right of foreigners to establish or acquire subsidiaries in Sweden is limited by a 1916 law which states that they must obtain permission to buy real estate. However, this rule in principle applies also to Swedish joint-stock companies not having an "alien-ownership stock clause" in its articles of association. Such a clause stipulates that not more than 20 per cent of the votes or 40 per cent of the share capital can be controlled by foreigners. About 80 per cent of the companies listed on the stock exchange have such a clause. Such a clause can be removed only by the government. An amendment passed in 1973 lays down that removal of the clause will not be permitted if acquisition of the company's shares by a foreigner (or Swedish companies not having the "alien ownership prohibition clause") conflicts with an essential public interest. However, the application of the 1916 law has been very liberal.

The outgoing direct investment is regulated by the Exchange Control Board of the Bank of Sweden traditionally with the balance of payment consequences in mind. Sweden has for a number of years received a yearly temporary exemption from the OECD capital liberalisation code due to balance of

payment difficulties. Since 1974 the Exchange Control Board is also empowered to take aspects of employment and general industrial policy into consideration. Furthermore, this regulation is very liberally applied. Thus, in 1977 only 13 out of 1,340 applications were refused (Bank of Sweden). However, the existence of these criteria may naturally affect the plans of the companies (or perhaps only the formulations in the applications).

But one should remember that permission is not needed when the investment is financed abroad and not guaranteed by the Swedish parent or when the investment is financed through profits made by the foreign subsidiary and is to be regarded as "normal consolidation". Therefore our guess is that the Swedish foreign direct investment flow is substantially larger than what can be seen in the statistics of the Bank of Sweden given in Table 3.

2. The ongoing official investigation

The rapid internationalisation of the Swedish economy during the 1950s and 1960s made the government order an investigation into the implications of the activities undertaken by multinational companies. The resulting report, which was published in 1975, took an indifferent position vis-à-vis the MNEs arguing that in an open economy with a number of very large national firms most of the problems connected with these corporations would arise even without them. The unions, in particular, reacted strongly against these conclusions and the Swedish Trade Union Confederation in a letter to the government, demanded a new investigation to be undertaken. In 1977 a committee was appointed (Committee for direct investments, DIRK) and directives were given for an investigation to be undertaken of the long-term consequences flowing from foreign direct investment by industrial firms, in a number of dimensions concerning industrial policy variables.

The Committee was asked to base their conclusions on empirical studies covering both the foreign investments undertaken abroad by Swedish firms and investments into Sweden by foreign-based firms. The industrial policy dimensions, of which DIRK is going to evaluate the long-term consequences, are the following: technical development, international competitiveness, employment - both in terms of numbers as well as skills, volume of exports and imports, productivity and finally the regional balance in Sweden.

It should be mentioned that DIRK has a sister-committee investigating the effects of the Swedish currency regulations including financial activities undertaken by MNEs.

DIRK's empirical work is currently in progress and will be completed towards the end of 1980. Two different approaches are used to arrive at an optimal combination of depth and generality. DIRK has ordered collection of data from all Swedish industrial firms having manufacturing operations

abroad through a postal survey. These data concern certain background information such as R and D - intensity, degree of product diversification and data describing the nature and size of the firm's international operations. As such data has been collected several times before it will be possible to undertake cross-sectional as well as longitudinal studies. These will concern both explanations concerning foreign investments and their implications such as, for example, the degree of substitution between local production and exports from Sweden.

The broad study of foreign investments in Sweden is mainly designed as a comparison between foreign-controlled and Swedish-controlled firms in a number of respects such as R and D intensity, employment, investment, export and import, performance and so forth keeping other explanatory variables such as size and branch under control. This study includes an investigation on how Swedish companies taken over by foreign firms between 1965 and 1978 have developed since their acquisition in comparison to similar Swedish-controlled companies.

Although it is believed that econometric methods will produce reliable results it was decided to undertake in-depth studies to give a better understanding of the role of foreign direct investment as one of several means to strengthen the competitiveness. It was also considered necessary to have in-depth knowledge to be able to apply the "alternative linkages" method for evaluating the consequences of foreign direct investments that DIRK has also decided to apply. The method is described below. The in-depth approach covers both industry studies and studies of industrial firms. Both types are, however, undertaken at the firm level - the difference being that the case studies are less ambitious in their attempts to cover the behaviour of the competitors. Altogether DIRK will undertake six or seven industry studies and twelve case studies of which six are made on Swedish MNEs and six on foreign-controlled firms in Sweden. The presentation below is a short version of a preliminary draft of one of the industry studies.

3. Theoretical background

As will be made clear in the next section, it is necessary to understand the reasons behind foreign direct investment in order to evaluate the effects resulting from it. It is not our intention to give a comprehensive description of the theory, or rather the theories, that have been formulated but just to recapitulate some of the findings in the field of industrial organisation, which according to Dunning (1973) has been the most successful approach so far. We will do this by answering two questions treated in the following pages (see also Sanden and Vahlne 1973).

1. Which firms undertake foreign direct investments?

In many ways the foreign investor is at a disadvantage compared to the indigenous firms with which he is competing. It is natural that if he manages to do this successfully he must obviously possess one or several advantages which more than offset this disadvantage. The advantages must be firm-specific otherwise the local competitors could also obtain them. It was Hymer (1970) who first used this concept as he recognised that foreign direct investment predominantly occurred in industries where there exist barriers to entry and the degree of concentration is high.

Several types of advantages have been found to have the characteristics that can explain why it was possible for a firm to invest successfully in a foreign country. Dunning (1973) has summarised these in the following way (p.304):

(i) an easier or cheaper access to knowledge and information;

(ii) an easier or cheaper access to factor inputs;

(iii) a better access to markets or to the saleable characteristics of products, e.g. brand names;

(iv) economies of scale and vertical integration.

In practice it is the combined impact of the characteristics possessed by a corporation that counts. One could talk about an "advantage package". This allows for dynamic changes in that the value of individual characteristics - as well as the whole package of characteristics - may change in relation to those of the competitors. If the firm is successful in the long run that must mean that it has managed to preserve the relative value of the original "advantage package" or to build up new advantages. We may label this an "advantage cycle" (Sandén and Vahlne 1973). The Swedish firm Sandvik may serve as an example of a firm which successfully exploited an advantage in producing steel by using the Bessemer process. In selling these products Sandvik started to internationalise already during the 1890s and built a marketing network and created stable and intimate relations with the customers, which when the relative value of the original advantage in the steel production was eroded, became the firm's most prominent specific advantage. During the 1950s and 60s the marketing organisation was used to introduce the hard metal products which are now more profitable to Sandvik than the steel products.

Obviously the firm-specific advantages also constitute part of the explanation of the firm's competitiveness which in the long run determines its ability to maintain employment.

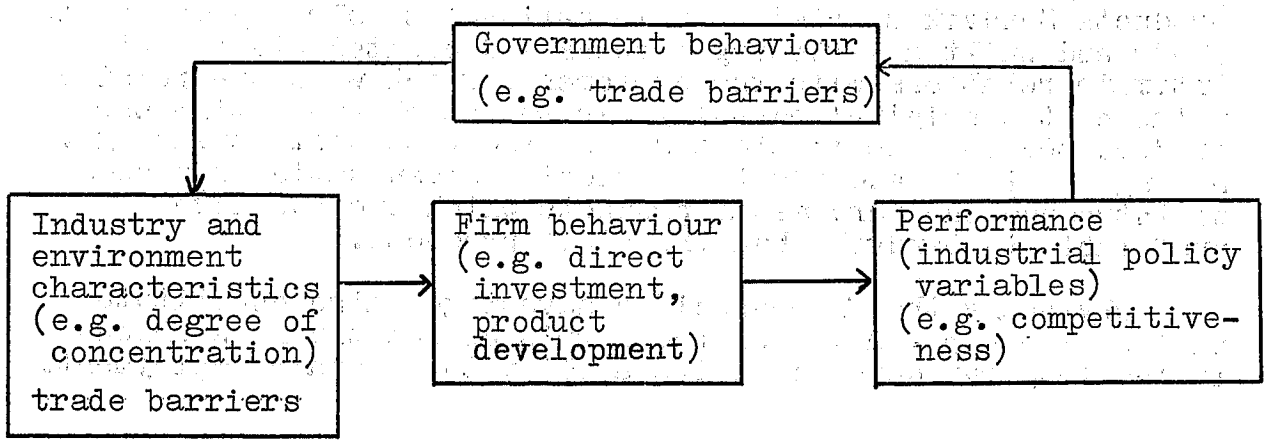
2. Why operations through direct investment?

To undertake a foreign direct investment is to extend the organisation of the firm geographically. Lundgren (1975) argues that the reason why this occurs is, in principle, the same as that which leads all firms to organise themselves to handle economic activities. What Lundgren, in referring to Coase (1937), means is that complexity of production processes and the heterogeneity of input factors makes it more efficient to handle the co-ordination through an administrative system rather than through the market mechanism. Obviously the advantage of the controlled system increases with more developed management techniques and more rapid and reliable communication systems.

But naturally a number of conditions both in and outside the firm affect the way it prefers to or is able to exploit its specific advantages - not least of which are the characteristics of the advantages themselves and behaviour of other parties involved such as the authorities, the unions and the competitors. An example of this is given by Knickerbocker (1973) who showed that the investments undertaken by US MNEs belonging to the same industries seem to be bunched together within a short period of time. Knickerbocker interpreted this phenomenon as oligopolistic reaction - the players watch and match each others moves. We expect the oligopolistic behaviour to be found also in the international competition, that is MNEs from various countries become members of international oligopolies.

The above-mentioned considerations have made us construct our model in the way illustrated below (Figure 1). We regard it as a modified, dynamic industrial organisation model. It only depicts what we consider to be the most important casual relationships, disregarding the complexities of the real world. We have used it as a controlling instrument for our data collection and analysis.

Figure 1. A modified, dynamic industrial organisation model



4. Methodology

The first problem to be dealt with is what should be meant by an "effect" from foreign direct investment. As direct investments are to be seen as endogenous to the economic system it is questionable whether they in themselves can be seen as causes of something. Rather, the effect must be defined as the difference between what actually happened after certain foreign direct investment has occurred and what hypothetically could have happened, had the enterprise been prevented from making the investment (cf. Lundgren 1975). This of course implies that it is not possible to measure the effects directly; it must rather be done by assuming one or several alternative behaviour patterns for the investing firm and by estimating the resulting consequences. That is, one must learn enough about the situation at the time of the investment and the following years to arrive at valid assumptions on which the consequences of alternative behaviour can be based. These assumptions concern the behaviour of other parties involved had the Swedish corporation not undertaken the direct investment. These other parties most often are the customers and the competitors and the most important assumption concerns the volume of export sales of the Swedish MNE that would have resulted from an alternative behaviour.

Therefore, the specific situational factors, partly decided by underlying variables, are the important starting points for the analysis. We are concerned with the different foreign market linkages on which the Swedish MNE has based its operations and which it hopes to be able to generalise, in a non-statistical sense, to the level of the corporation. Finally, after having analysed six or seven industries (in the same way as one industry in this paper) it should be possible to make tentative generalisations for the whole of Swedish industry relying upon the criterias guiding the choice of product areas and behavioural patterns.

The criteria used in this context include degree of concentration on the world market, technological intensity and the stage in internationalisation process. The industry analysed in the present paper, viz. welding industry products, - as an example for which the authors dispose of sufficient data at the present stage of their research - is characterised by a rather low degree of concentration which is somewhat unusual for an industry with multinational companies. The Swedish MNEs surveyed in the welding industry have been international for many years. In this, as in most of the other industries chosen so far for our research (manufacturing of equipment for ventilation, telecommunication and rock drilling) the foreign investments are generally motivated by export market considerations. One major exception seems to be the clothing industry for which the domestic market is relatively more important than the foreign markets.

The principle for choosing the alternative behaviour has been the "second most logical foreign linkage behaviour" from the point of view of the investing firm. This means that a foreign direct investment in manufacturing in a particular foreign country would produce a first set of economic results. If such an investment had been prevented then a second type of linkage would have been used which is the alternative considered here. The secondary alternatives investigated are export sales subsidiaries and licensee linkages.

In this way, one can also assess long-run employment effects (taking account of the change in competitiveness) that can result from the direct investment which, in turn, may affect employment even if this effect is blurred by other "independent variables". It is evident that these relationships are very complicated ones. In our view quantitative estimates would be so uncertain that we prefer only to work with qualitative estimates here. A consideration that is often put forward by the MNEs themselves is that for market reasons the foreign direct investments are necessary to reach a volume big enough to carry the necessary R and D costs required for the development of new products so that the firm might stay on the market. However, indirect effects like international sourcing, are also important, and need to be taken into consideration. It is evident that the nature of these long-run relationships depend very much on the character of the firm-specific advantages and the methods for their exploitation and also calls for the collection of some data regarding the competitors.

It is, however, difficult to calculate the number of jobs lost or gained in the long run from foreign direct investments. If it is done in a way which puts emphasis on the enterprise behaviour it must be done under conditions of non-adjustment in the economy. In addition, it would be difficult to insert the variable of general economic policy which affects adjustments. Thus, it is the task of the public policy to keep up employment (for example, through exchange rate adjustments). It is therefore more relevant in the long run to analyse the structural changes affecting the labour market (for example, trends in skills and job content) than to make hazardous calculations on global job losses or gains.

Clearly, the hypothesis of a non-adjusting economy and of inactive public policy-makers is somewhat unrealistic.

In line with the earlier presented model and the methodological considerations lists of the data needed were established by the authors. Relevant published materials about the industry and the competitors were studied. In addition, detailed interviews were conducted with the Swedish MNEs concerned (in the welding industry these happened to be two but in most other industries there is only one major Swedish MNE) in close co-operation with management. Representatives of the local union were interviewed as well as the representatives of the national trade union organisations and, finally, a few international competitors of the enterprises were contacted at their headquarters.

5. Employment in the Swedish welding industry

One of the main objectives of this study of the domestic economic effects of foreign direct investments has been the determination of the changes in employment in the selected industry. Aggregate employment statistics were collected through a special analysis of official government statistics and by separate study of the two multinational enterprises having production facilities for welding products outside Sweden. The changes in total employment, including production workers, white-collar employees, and foreign employees, were studied for selected years beginning in 1965.

The data set forth in the following tables show that domestic employment in the two MNEs has increased since 1965 whereas domestic employment in the non-MNEs has decreased. The multinational firms show an especially rapid increase in white-collar employment whereas that of production workers declined slightly, but less than for the non-multinational firms.

Table 9 sets forth aggregate Swedish welding products industry employment data for three years selected to cover a 12-year period. There has been a marked decrease in employment in the gaswelding and cutting machines category (shown in Table 9) from 6,851 in 1965 to only 648 in 1977. Electrical welding machines have absorbed part of this decrease while electrode and wire employment has also decreased.

Table 9. Employment in Swedish welding industry

	Year	No. of Plants	Total Employment	Workers	Staff
Machines and Equipment					
Electrical Welding Statistical numbers (05.11.301 + 85.11.990)	1965	9	3 455	2 249	1 206
	1973	18	7 566	5 551	2 015
	1977	17	6 607	4 746	1 861
Gas Welding and Cutting (84.50)	1965	15	6 851	4 430	2 421
	1973	10	1 155	963	192
	1977	7	648	491	157
Electrodes and Wire (83.15.100)	1965	9	7 283	4 489	2 794
	1973	8	3 347	2 116	1 231
	1977	9[1]	4 198	2 709	1 489

Source: Sveriges Officiella Statistik, SCB, Stockholm.

[1] Includes companies which are not directly in the welding industry but do manufacture related welding products although the proportion of employees involved cannot be determined.

The data shown in Table 9 includes the employees of two Swedish companies which produce welding products via foreign manufacturing facilities. Most other companies included in this data are small in size and do not have foreign production. A few of them however are steel companies which produce wire which can be used for semi-automatic welding and rod stock from which welding electrodes can be made by other companies. Thus a few of the other companies listed such as Avesta Jernverks, Sandvik, Uddeholms, and Fagersta are MNEs and sell welding consumables products but are not primarily welding companies. It is not possible to exclude these companies from the data compiled or to determine the proportion of employees to be attributed to the welding products. For these reasons the variations in employment between MNEs and the domestic market-oriented companies are somewhat blurred.

The basic employment data for two multinationals manufacturing welding products has been analysed by comparing the changes over time in the two MNEs against changes in the remainder of the Swedish companies. It is recognised, however, as stated before, that clear conclusions on differences in impact between MNEs and domestic firms producing welding products will not be possible. Table 10 sets forth the aggregate employment data and uses 1965 as the index base year. The total group indices fall after 1965 whereas those for Company A, the first of the two MNEs included in the present study, increase. The index increases are particularly marked for domestic white-collar workers (staff) and foreign employees.

Table 11 gives, year by year, percentage data for all companies and the two MNEs. One trend is that both of the MNEs show higher white collar to total employment percentages than the total welding products group of companies. Company A, the larger in welding, has had a faster increase in foreign employment than company B.

This data analysis indicates that the domestic employment composition in the two MNEs should be of somewhat different character than for the non-MNEs. The staff to total employment percentages of 40 to 73 per cent for the two MNEs contrast sharply with the 23 to 25 per cent for the other companies group.

Over-all, the two MNEs could be said to have increased both domestic white-collar employment, total employment, and foreign employment whereas the non-MNEs group shows declining employment in all categories, except for a slight increase in white-collar employees from 1973 to 1977; but the 1977 white collar total is still 3,000 lower than in 1965.

It is important to note, however, that the entire increase in domestic employment between 1973 and 1977 in the MNEs in question was due to acquisitions.

Table 10. Employment Trends in the Swedish Welding Industry

	All Swedish Companies	% Index	Company A	% Index	Company B	Total TNC (A + B)	Other Firms
1965							
Domestic							
Total	17589	100	1618	100			
Workers	11168	100	828	100			
Staff	6421	100	790	100			
Foreign	-		2438	100			
1973							
Domestic							
Total	12068	68.6	1666	103	483	2149	9919
Workers	8630	77.3	989[1]	119	215	1204	7426
Staff	3438	53.5	677[1]	85.7	268	945	2493
Foreign	-		3157	129.5	598	3755	-
1977							
Domestic							
Total	11453	65.1	1692[2]	104.6	688[3]	2380	9073
Workers	7946	71.1	762[2]	92	185	947	6999
Staff	3507	54.6	930[2]	117.7	503	1433	2074
Foreign	-		3944[2]	161.8	965[3]	4909	-

1 Workers for one plant based on 1975 average employment data

2 1978 data

3 1976 data

Table 11. Percentage Changes in Table 10 for Welding Industry Employment

	All Swedish Companies	Company A	Company B	Total TNC A + B	Other Firms non-TNC
1965	%				
% Workers/total employment	63.5	51.1%			
Staff/total employment	36.5	48.8%			
Abrd/total Swed.	-	150.7			
1973					
% Workers/total employment	71.5	59.4%	44.5%		74.9%
Staff/total employment	28.5	40.6%	55.5%		25.1%
Abrd/total Swed.	-	189	123.8		
1977					
% Workers/total employment	69.4	45%	26.9%		77.1%
Staff/total employment	30.6	55%	73.1%		22.9%
Abrd/total Swed.	-	233	140		-

6. Description of the international welding industry

In order to understand better the home country employment effects arising within the welding equipment industry a brief description of its economic characteristics, such as: the technology and products, demand parameters, degree of concentration, the sizes of the firms and the competitive situation, are necessary. This has been done in the following section.

Technology and products

By far the largest group of welding processes from a market point of view is that which uses heat as an energy input. This energy can be thermo-chemical in the case of gas flame welders, such as oxyacetylene torches or plasma arc units in which the arc does not come into contact with the piece worked but only generates heat (which is transferred to the work in a fashion analogous to the transfer from an envelope of burning gas).

The electric arc process accounts for a very large, and commercially important, set of electrodes and electrode welding machines. The simplest types of hand welding machines use a generator or transformer to supply electric current through a consumable electrode and then through the work pieces. Ambient contamination is excluded by either a molten slag or flux coating deposited during the welding process or by the continuous flow of shielding gas such as argon.

A practical classification for welding machines depends upon the extent to which the welding machine automates the welding task. Units requiring an operator to control both the feeding of a consumable electrode or filler rod into the weld zone and movement of the electrode or rod along the weld joint are termed hand-welding machines. Those which automatically feed the electrode or rod into the weld zone but require operator movement of the welding head along the weld joint are termed semi-automatic units. A third class is the fully automatic units which provide both control and movement but usually an operator must set up the unit for movement along the predetermined weld joint line. The robot welders go a step further and index the welding head at the start position thus eliminating the necessity for continuous operator attention during normal functioning.

The welding industry's products can be broken down into the following six groups:

1. Consumables which include filler metals, flux materials and gases.

2. Welding machines which carry out one of the processes described above.

3. Equipment accessories such as visor helmets, gloves, clamps and holders.

4. Manufacturing equipment for producing consumables and machines.

5. Equipment for handling and positioning heavy sections for welding.

6. Gas cutting machines, which use a stream of oxygen for rapidly oxidising and thus cutting metals. Acetylene is often used as a neutral fuel source to elevate the metal to the necessary 1600 to 1800°F cutting temperature.

While the latter product category does not involve a welding process the same companies often manufacture this type of equipment.

Demand parameters

The growth in the demand for welding products is closely linked to steel consumption since a large portion of steel products are ultimately welded. Estimates of the weight percentages of steel plant products ultimately used for welding at different points in time have been made by a welding industry expert. They amounted to 70 per cent in 1950, 75 per cent in 1960 and 85 per cent in 1976. The last percentage figure would reach 98.6 per cent if steel which is not welded (such as tool steels) is disregarded. The heavy use of welding for joining steel parts has meant that for the last 20 years 0.6 to 1.4 per cent of the total weight of steel construction has been accounted for by the metal itself. Thus the welding industry is at the end of a demand chain which it is not in a position to influence. When, as happened recently, the heavy plate construction industry, e.g. shipbuilding, undergoes a drop in demand the welding products industry also suffers.

The world welding market for both machines and consumables was estimated at 25 billion Skr. in 1977; and the Western European and Scandinavian portions of this market were about 4.2 billion Skr. and 800 million Skr. respectively. The Scandinavian market in 1978 was about equally divided between consumables and equipment. Gas welding machines sales were of the order of 100 million Skr. in that year while electrical equipment sales totalled 300 million Skr. in the local market.

One estimate puts handwelding at 40-50 per cent of total welding units sold in 1978, semi-automatics at 20-30 per cent; submerged arc units at 13 per cent, and automatic units including robots at 15-20 per cent.

There is some evidence that the demand for semi-automatic and fully automatic units increased rapidly in the 1970's. This may be due to increased attention to productivity in many metal workshops because of rising labour costs in industrial countries. Also, there has been a simultaneous drive for a better working environment in these shops, which may have contributed to automation.

A large number of consumables and machines are based on wellknown and widely available technical knowhow. Thus flux coated nonalloyed stick electrodes usually called "black electrodes" in the industry can be produced by many manufacturers with low technical sophistication. If a potential producer wants to install a most up-to-date electrode production line he has the choice of five or six equipment producers who can sell the necessary machinery and transfer the operating knowhow. Only the most exotic alloyed electrode compositions do not fall within this same category, but handwelding machines of both electric arc and gas types can also be widely produced. Furthermore, transformers and rectifiers of simple designs can be produced in technically unsophisticated shops.

Semi-automatic units offer the established companies more protection against the severe price competition set off by the numerous smaller producers. Rapid technological changes occur in the advanced semi-automatic and fully-automatic units, including robots, and in machine categories. The customers for these units tend to be the more innovative companies, which market products under conditions of exacting technical specifications and/or price levels.

The market for welding units for production line use and for stick electrode manufacturing equipment, tend to be characterised by a fewer number of competitors, since there are more technological and financial barriers against entry into these markets. The handwelding machines, and particularly the electrode coiled wire, are marketed under much more competitive circumstances.

Degree of concentration

The measurement of the extent of concentration of market shares has to begin with a definition of the market, geographically and by product classification. For the purposes of the present study, the Western European countries have been taken as the relevant geographic market. The product classes used for determining concentration are more difficult to define, since the companies differ widely as regards the emphasis they place on the range of their product lines, on gas or electric machines, or consumables versus machinery. To arrive at a simplified approach, the 1977 market shares for consumables (stick electrodes, wire, fluxes and gases) can be arranged by national markets for the Western European market. This approach then excludes some of the larger machinery producers such as Miller Electric Co. and Victor Equipment Division of Pacific Lumber Co., which have low emphasis on the consumable part of the market, and Union Carbide, which has a low emphasis on welding consumables outside the United States. The market concentration data as determined by interviews are given in Tables 12 and 13 The companies for which market share data was found are listed in the first national table and the market concentration data are presented in the second table. Some companies such as ESAB, Philips and Oerlikon sell into five or more

Table 12. Welding Industry Competitors for Consumables

Company Types	Parent Nationality	Number of Countries for which market share data was collected
1. Wide Product Range welding companies		
1.1	ESAB, Sweden	10
1.2	Lincoln Electric US	1
1.3	Rockweld/Lincoln UK	1
1.4	N V Philips, Netherlands	7
1.5	Hobart, US	0
2. Narrow Product Range		
2.1	Kemppi, Finland	0
2.2	Castolin, Switzerland	1
2.3	Megatronics, Denmark	0
2.4	Elga, Sweden	1
3. Industrial Gas Companies		
3.1	AGA, Sweden	3
3.2	BOC, U.K.	1
3.3	SAF, France	3
3.4	Mesher-Griesheim, W Germany	1
3.5	Norgas, Norway	1
4. Steel Companies		
4.1	Wesphälische Union, W Germany	3
4.2	Böhler, Austria	2
4.3	GKW Arcos, Belgium	2
4.4	Sandvik, Sweden	0
4.5	Kobe, Japan	0
5. Machine Tools		
	Oerlikon, Swiss	5
6. Others		
6.1	Sveiseindustri, Norway	1
6.2	Arcum, Italy	1
6.3	Smitweld, Netherl.	1
6.4	Commercy, France	1
6.5	Siderotermica, Italy	1
6.6	Chemetron, USA	1

Table 13. Concentration of welding products suppliers by countries

Country	Number of competitors accounted for	Percentage of market accounted for
Sweden	4	96
Denmark	5	86
Norway	3	93
Finland	3	90
United Kingdom	5	82
Belgium	6	92
Netherlands	1	50
Federal Republic of Germany	5	86
France	5	71
Italy	6	76
Austria	5	91
Switzerland	1	90

of the national markets for consumables, while others such as Castolin, Elga, Norgas, Sveiseindustri Smitweld and others classified in group 6 are shown to be competing primarily in one national market only. No account is taken of the additional sellers in each market, namely, of the local producers.

The number of competitors in each national market is of considerable relevance to this study. These numbers range from 1 to 6 and it thus becomes possible to apply standard tests to determine oligopolistic concentration. One of these tests defines oligopoly structures as existing in national markets wherein the largest four competititors have at least an aggregate share of 75 per cent of the market volume. Applying this standard to Table 14 shows oligopolistic concentrations of sellers in all markets except for the Netherlands, France and Italy and each of these markets appears to be highly concentrated.

Another standard used more recently in determining international oligopoly structures is that the top eight firms should have an aggregate market share of above 70 per cent. Using this standard definition, it can be roughly estimated that the oligopoly group in Europe is composed of: ESAB, N.V. Philips, SAF/Air Liquide, Oerlikon, Westphälische Union, BOC and Messer-Griesheim. If one adds the United States welding consumables market as well as other markets, such as Latin America and the Middle East, one brings Lincoln Electric Co., Hobart and Union Carbide into the picture. If the Far East market is added, Kobe Steel would also need to be considered.

As regards welding consumables, there are about 12 major international competitors for such markets who, as a group, appear to have the major share of the industrialised markets.

If only the welding machinery market is focussed upon then other companies such as Kemppi (Finland), Megatronics (Denmark), Miller Electric Co. (U.S) and Victor Equipment Co. (U.S.) would need to be added to the list. The welding machinery part of the market is characterised by a much greater number of competitors. For example, there are some 100 electric welding machine producers in West Germany alone, but most of these are of small size.

Thus the consumables welding industry appears to have an oligopolistic structure in most of the national markets and can be viewed as an oligopoly at the international level as well. These national markets probably represent the ideal size for assessing the competitive position due to the short competitive price shipping radius around each producing plant. Buyers in each of these national markets buy primarily from members of a small oligopoly group. There are of course many small welding machine suppliers.

Welding machines of simple design, such as hand and semi-automatic units, constitute products which are sold in non-oligopoly markets and are subject to considerable price competition. One way out of this competitive squeeze is to escalate upward along the technological growth path and cater to users having exacting and unusual needs. The aerospace industry is an example. New welding machines are developed for such purposes and then modified for use in the more traditional commercial markets.

Suppliers of manufacturing equipment for producing consumables and welding machines are much more protected against price competition since the extensive technical know-how and quality control standards required excludes all but the most technologically sophisticated companies.

Size of firms

The wide range of existing welding products renders direct comparison between competitors inconclusive since they focus on different machines and consumables. It may nevertheless be interesting to table firms engaged in such production by the size of their sales. Table 14 accordingly sets forth recent data of this type for 11 international competitors.

Table 14. Turnover Sizes in International Welding Industry

Firm	Total Group	Sales, millions US dollar			
		1969/70	1972	1974	1977/78
ESAB	Sweden	102.6	112.7	203.3	289.1
AGA	Sweden	32.4	34.4	53.1	65.1
ELGA	Sweden	3.3	4.0	4.9	6.0
Oerlikon	Switzerland			85.9	88.6
Miller Electric Co.	USA				100.0 - 300.0
Union Carbide	USA	64.5			100.0
Lincoln Electric Co.	USA				350.0
Hobart Bros. Co.	USA		64.8	85.7	150.0
Victor Equipment Co.	USA			31.0	58.8
British Oxygen Corp.	U.K.	~113			
Messer-Griesheim[1]	F.R.Germany	~138			
SAF/AIR LIQUID	France	~114			

[1] Turnover for the company as a whole, including non-welding sales.

Exchange rates used as an average

US$ 4.5 Skr.
Sw.Fr. 2.0 SKr.

Competitive strategies

The various strategies used to gain and retain customers in the welding industry are difficult to assess because of differences in production lines. These vary widely within the broader categories, such as hobby articles, light industry, shipbuilding, automobile manufacturing, aerospace, nuclear power and heavy machinery. Some customers are price sensitive, others are sensitive to quality, efficiency, safety or technical improvements.

The competitive strategies used by the oligopoly group of MNE's include:

(a) the type of foreign market linkage used ranging from the group of manufacturing subsidiaries, licensing and minority joint venture to various product export links and sales through other companies;

(b) business ideas development such as price competition using low unit cost production or broad product line or narrow speciality product line.

Table 15 sets out a summary of these strategies with respect to the competing MNEs. As will become apparent from the remainder of this section, many development and marketing strategies are used by management teams to structure the positions of special advantage needed to remain vigorous competitors in the foreign market areas. The various competitors seem to have emphasized different strategies from among those mentioned above.

A four-level graduation has been used for most of the strategies shown in table 15 (high, medium, and low usages and a 0 is shown where the strategy seems to be absent). The dashes indicate that adequate data has not been collected on the point. The special production focus has been indicated under category 2.3.

It is of interest to note that the specialty products of a number of these companies are under intense price competition at present. Non-alloyed electrodes and gas welding fall in this category. The issue for these competitors has thus become whether they should diversify within the welding business or turn to other opportunity areas. Under these demand conditions, a pattern shown as 2.2 "high" and 2.4 "low" will probably generate a management response to replace the declining speciality position with other new speciality products. A pattern of 2.2 "medium" or low coupled with a 2.4 "high" would be likely to generate a management response to begin to decrease emphasis on the declining welding product line.

The competitive strategies summarised in Table 15 were developed by considering both the marketing strategies discussed below and the foreign linkage patterns set forth in the next section. These relate to:

Table 15. Foreign market development strategies 1970s

Strategy Type	Sweden		United Kingdom	Fed. Rep. of Germany	Switzer-land	France	Finland	Nether-lands
	ESAB	AGA	BOC	Messer-Griesheim	Oerlikon	SAF	Kemppi	Philips
1. Foreign Market Linkages								
1.1 Manufacturing Subsidiaries	high	high	-	low	med.	-	-	med.
1.2 Licensing	med.	low	-	-	high	-	-	-
1.3 Joint Ventures (minority)	med.	low	-	-	-	-	-	-
1.4 Export Links	high	high	high	high	high	med.	med.	med.
1.5 Sales through other companies	0	0	-	high	-	high	-	-
2. Development Strategies								
2.1 Production process improvements for decreasing unit costs	high	-	-		-	-	high	-
2.2 Single supplier to customer	high	med.	-	high	-	med.	-	-
2.3 Special focus	heavy plates welding non-alloyed elec-trodes	gas shielded arc welding gas welding	gas weld-ing		electrode manufac-turing	gas weld-ing	electric power sources	electric power sources
2.4 Non-welding opportunity areas	low	high	high	-	med.	high	-	high

Table 15. Foreign market development strategies 1970 (cont.)

	U S A				
	Miller	Union Carbide	Lincoln	Hobart	Victor
1. Foreign Market Linkages					
1.1 Manufacturing Subsidiaries	low	med.	low	med.	low
1.2 Licensing	low	low	med.	med.	low
1.3 Joint Ventures (minority)	low	0	0	med.	low
1.4 Export Links	high	high	med.	high	low
1.5 Sales through other companies	-	-	high	-	-
2. Development Strategies					
2.1 Production process improvements for decreasing unit costs	high	med.	high	high	med.
2.2 Single supplier to customer	high[1]	low	high	med.	low
2.3 Special focus	electric power	gas welding	cellulose electrodes	welding machinery	gas cylinders welding machinery
2.4 Non-welding opportunity areas	low	high	low	low	med.

[1] Single suppliers for machines.

1. Pricing policy

2. Reproducibility of welding results

3. Convenience and familiarity of markets

4. Welders' safety and health

5. Machine and consumables quality

6. Packaging against moisture damage for coated electrodes and fluxes

7. Servicing facilities

8. New welding capability, such as the needle-like precision of electron beam units.

Strategies 2-5 and 8 all depend upon the product characteristics developed by each firm.

The handwelding machine markets in Western Europe are particularly subject to low price competition due to the large number of producers. The transformer/rectifier power sources, cables, and electrode holders are all based on well-known manufacturing technologies. Semi-automatic machines are also regarded as being producible by a wide range of companies as are gas welding machines.

The non-alloyed welding electrodes and semi-automatic wire markets are similarly subject to severe price competition in many markets. This is partly due to the present low capacity utilisation in many Scandinavian and European plants. The price situation tends to be better in countries such as France which has an administered price structure operated through a trade association. The products characterised by intense price competition have led the competitors to several development strategies including: (a) reducing unit costs by attention to production process improvements, (b) reducing materials costs by substitution of materials, and (c) redesigning for use of lower cost components.

The conservative nature of welding tool designers and users has led to the product characteristics remaining nearly constant over long time periods in the high unit volume segment of the market. This has allowed many welding machine competitors to come into existence. The application of technological advances tends to be slow in this situation. Another group of industry competitors focus on the high productivity demands of industrial customers who use welding to reduce production costs and line time.

A recent development in the arc handwelding machines segment of the market is the use of high voltage solid state switching devices to provide for direct current which can then be transformed and rectified to the required 30-volt direct current used for welding.

These devices allow elimination of about 88 per cent of the weight of transformer coils in transformer/rectifier units and reduce the unit weight in a 400 amp unit from 250 kg. to about 30 kg. Some members of the industry have reported scepticism on the part of welders as to whether such a light weight unit could really do a good welding job. There is, nevertheless, some evidence that the welding characteristics are improved as a result of the new design.

The industrial welding machines sales must be backed up by adequate servicing capability in order to overcome customer problems in use.

Foreign linkage patterns of major field

The major competitors of the two Swedish multinationals under consideration (in both the consumables and machines parts of the welding industry) are linked to wide ranges of foreign markets in the following ways:

A. Manufacturing subsidiaries (50% ownership)

B. Licenses

C. Joint ventures (50% ownership)

D. Contract manufacturing

E_1 Exports to sales subsidiaries

E_2 Exports to affiliated distributors or agents

F_3 Sales through another company's subsidiary and special sales representation by another company.

Out of these types of links found in empirical research A, B, and E_{1-2} are the most frequently used by most of the competitors in this industry.

The above letter code designations have been used to condense the information. Figures for types of linkage used by 14 industry competitors are set out in Table 16 below. These data are based on current information and are subject to changes as more details become available from the ongoing research project. The information presented here is therefore somewhat incomplete.

The Swedish firms considered appear to use type A linkage (i.e. manufacturing subsidiaries) somewhat more than their competitors; but more complete information is needed from the European supplier group on this point. Oerlikon is the biggest user of licensed production. This is confirmed by interview information. Both types of export linkages are frequently used by enterprises in the industry.

Sales representation through the subsidiaries of other companies (type F) are specific to those competitors who have permanent arrangements with other multinational companies. For example, Lincoln has such an arrangement with ARMCO Steel Co which has been in existence some 50 years.

Table 16. Welding industry competitors and numbers of foreign linkages

	LINKAGE TYPE						
	Manufacturing subsidiaries	Licensing	Joint venture	Contract manufacturing	Exports to sales subsidiaries	Exports to affiliated distributors	Sales representation through subsidiaries of other companies
	A	B	C	D	E_1	E_2	F_3
Sweden							
ESAB	10	9	3	1	20	42	
AGA	10	1		3	20	12	
United Kingdom							
BOC[1]	?	?	?	?	25		
Federal Rep. of Germany							
Messer Griesheim	1				8	7	23
Switzerland							
Oerlikon	3	17			14	8	
France							
SAF					3	3	25
Finland							
Kemppi					2	8	
Netherlands							
Philips	7				3		
USA							
Miller	1	3	1		1	25	
Union Carbides	5	3			29		
Lincoln	2	5			7		>20
Hobart	3	6	5		10	6	
Victor[2]	1	3	2			2	
TOTALS	43	47	11	4	142	113	>68

[1] Mostly sales net is identified.

[2] Sales net is missing.

While the numbers of linkages used by the different companies do not show the strategic competitive importance of these various channels it does show the linkage patterns in use. For competitive importance it is useful to analyse the linkages according to frequency of use, the different country markets, the type of products sold by particular firms, and the use being made of different technological developments. Not surprisingly the export linkages E_1 and E_2 are used most frequently by the 14 competitors. The high use of licensing (B) compared to manufacturing subsidiaries (A) is in part due to the heavy reliance on this linkage by Oerlikon.

The linkage to foreign markets through subsidiaries of other companies (F) is a low frequency linkage mechanism since only three competitors rely on this route.

7. Analysis of the employment effects from direct investments abroad

In this last part of the report are reviewed the effects produced by management decisions to locate manufacturing facilities in foreign countries through direct investments abroad.

The set of phenomena here termed the effects produced by direct investments in production facilities abroad on the home country's domestic economy, can be studied by examining differences between the actual recorded employment variables and the changes in these variables under the hypothetical condition that the firms had used an alternative foreign market linkage mechanism in place of the one actually applied. For example, the firms could have used production under license in foreign markets or they could have sold into the foreign market by exporting finished goods produced in Sweden.

The effects of the operations of multinational companies upon production workers in the home country depend directly upon the choice of linkage applied to secure a foothold in the foreign market. Product sales can be made via each of the four linkage mechanisms of a foreign manufacturing subsidiary, production under license, direct export sales, or a minority joint venture. If a given MNE has chosen to link itself to a foreign market through a direct investment in a manufacturing facility, some products will be produced locally and thus export sales and home country employment will be seen to suffer; however, exports of complementary products and other products will probably occur as shown above and these will support home country employment.

One way to treat this effect is to analyse some direct investment manufacturing linkages with respect to variations in domestic employment which would be created if such linkages were replaced by alternative linkages. The issue for this part of the analysis is therefore: would home country production employment gain or lose if an alternative linkage was used?

This type of employment effect analysis as well as other effect dimensions have been analysed for eight different market linkages which include the above four linkage mechanisms. In so doing, European, Middle East and North American markets were covered.

The other effect dimensions considered were:

(1) Flow of manufacturing royalties under the actual linkage as contrasted with the return flow which would occur under the second most logical alternative linkage;

(2) Differences in facing and solving customer problems in order to build international competitive ability within the firm;

(3) Level of net exports available from the compared market linkages; and

(4) Difference in related product sales between the compared market linkage mechanisms.

For each of the eight linkages studied multiple alternative linkages were considered.

It quickly became apparent that different trade and investment factors were important when a linkage regarding the marketing of electrodes was involved as opposed to the marketing of welding machines or the sale of manufacturing equipment. Even within the welding machines marketing sector differences in effects for hand and semi-automatic units, as opposed to automated welding rings, were found. In the marketing of electrodes, differences between non-alloyed (low price) and special alloyed electrodes could be discerned.

The trade and investment factors which had the greatest impact in this analysis were:

(1) transportation costs and barriers, particularly, as to the non-alloyed electrodes;

(2) opportunities to become deeply involved with customer problems and hence to evolve solutions acceptable in the marketplace, particularly in alloyed electrodes and electric welding machines;

(3) official product standards in the market country.

(4) extent of nationalism involved in the purchase decision.

An illustrative analysis relating to a major European country of implantation (country T) is carried out below, followed by a summary of all the market linkage analyses undertaken. The resultant effects shown in the first table have been divided into short term (1-2 years) and long term as it was found that these effects varied considerably according to the time horizon used.

Empirical data base for illustrative analysis

For the empirical effects analysis, Company A was chosen. This company's exports of welding machines, manufacturing equipment, and welding consumables in recent years are set out in Table 17.

Company A's total welding equipment exports for 1976 of 76.31 mkr shown in table 17 came to 42 per cent of aggregate Swedish exports in these categories which totaled 181.6 mkr. This proportion would be even larger if the automatic welding equipment and gas cutting machines for this company were taken into account. In consumables, Company A provided 68.82 mkr in exports for 1976 against the Swedish industry total of 77.94 mkr or 88 per cent.

The export sales data set out in Table 17 for Company A covers 31 countries. Two of these countries have been selected for more in-depth "effect analysis", although the analysis is given for one country only. The individual country exports for this is set out in Table 18 and has been used as the base data for the estimates.

Manufacturing subsidiary (in country T)

The welding company under study established an electrode subsidiary in a European country in 1951. This manufacturing facility produced for the local market and continued to sell products imported from the Swedish parent company.

The company also produced welding machines over the 1958-63 period. In 1967 a new factory was established which raised the electrodes capacity to 22,000 tons/year. Then in 1974/75 more automated equipment was installed. The 1978 book value of this investment was $0.83 million, most of which was production equipment. During the production, a sister company was set up in country T to sell electrodes under local market brand names. This is a somewhat unusual arrangement which was typical for the manufacturing facilities studied. It is, however, a way to obtain a greater share of the market.

By 1977 the subsidiary in question produced over 14,000 tons of electrodes per year which was nearly as much as the highest output of the home country plant. About 5,000 tons of this output was sold as part of the sister company's private branded products. This company had a nearly 30 per cent share of that market for both non-alloyed and alloyed electrodes in 1978.

The country T linkage effects on employment have been studied by focussing on the three alternative hypothesized linkages: (i) export sales subsidiary, (ii) production under licence, and (iii) minority joint venture.

Employment, production and Swedish import figures for this subsidiary are set forth in Table 19. Also given (at the bottom of the table) is the Swedish average productivity rate on the basis of which equivalent home country employment would have been necessary for producing the output of this subsidiary in the home country as hypothesized has been calculated.

Table 17. Company A - exports by product categories, mkr

Products	1973	1974	1975	1976	1977	1978
Hand and Semi-automatic Welding Equipment						
9 Manufacturing subsidiaries			36.93	50.96	40.86	46.48
6 Production under licence			25.4	16.4	10.0	6.0
14 Direct sales markets			3.98	5.35	5.32	8.87
2 Minority joint ventures			4.0	3.6	3.6	1.2
Manufacturing Equipment						
9 Manufacturing subsidiaries	2.19	2.96	2.76	4.91	2.89	3.07
6 Production under licence	0.94	1.40	3.93	6.83	6.40	27.7
14 Direct sales markets	0.26	0.23	3.54	0.29	0.69	0.38
2 Minority joint venture	0	0	0.31	1.41	0.12	0.04
Consumables						
9 Manufacturing subsidiaries	21.36	35.04	28.96	44.37		
6 Production under licence	3.27	5.05	11.56	13.78		
14 Direct sales markets	5.19	6.92	5.68	8.67		
2 Minority joint ventures	0.65	0.32	1.32	2.00		

Table 18. Export sales to selected foreign welding product markets - Company A

Market - Linkage type	1968	1970	1973	1974	1975	1976	1977	1978
Country T - Manufacturing subsidiary								
TOTAL			6 927	8 581	6 804	9 904	8 886	8 851
Consumables								
Machines			X	X	X	X	X	X
Manufacturing equipment								

X - Data removed due to confidentiality.

TABLE 19. Subsidiary T production and parent company imports

Item	1968	1970	1973	1974	1975	1976	1977	1978
1. Employment								
A. Production	126	156	172	183	184	178	175	157
B. Staff	106	173	199	198	202	205	215	201
2. Production								
Consumables, tons	9 000	12 000	15 426	18 050	17 055	18 000	14 300	
3. Swedish imports in employee-year equivalents								
A. Consumables			0.60	1.31	1.00	0.82	1.36	0.65
B. Machines					15.30	18.70	12.90	18.00
C. Manufacturing Equipment			0.11	1.20	2.20	1.46	0.50	0.22
4. Total employment equivalent					18.50	21.00	14.80	18.90
5. Equivalent Swedish productivity man-kr/ton	8.50	8.30	7.40	8.20	9.10	9.90	7.90	8.00
6. Equivalent Swedish employment man-years	46.50	60.60	69.40	90.00	94.30	108.00	68.70	

During the 10-year period covered by the data, 9 to 18 thousand tons of consumable electrodes were produced by 126 to 183 production workers; and 19 to 21 man-years in equivalent employment were created annually in Sweden via the products imported by this subsidiary. The employee-years equivalents are given in point 3, A, B and C in Table 19. Thus, while the established linkage was a manufacturing subsidiary, product export flows occurred which supported home company employment via the products export linkage.

As mentioned above, the table contains the results of calculations for equivalent Swedish employment for the alternative of producing the electrode output in Country T. This data is shown in points 5 and 6. The reason for this is that in order to assess the alternative linkage of export from Sweden to Country T, the relevant figures are those representing the equivalent home country employment, not the actual employment required in Country T (Points 1A and 1B).

The Swedish productivity figures under point 5 can be compared with similarly derived man-kr/ton figures for Country T's production of 20.1 for 1968, 13.6 for 1970, 12.7 for 1973 and 11.9 for 1976. Thus substantially lower productivity was obtained for most of the last 10-year period from this subsidiary production. There would be only a very limited impact on home country production processes for consumables since improvements in output techniques would flow from the home country to this subsidiary.

A major dimension for consideration here is whether the subsidiary in country T has caused the parent company to pursue new technological developments. The main customers during the period investigated were in the nuclear, chemical equipment, petroleum, shipbuilding, and railroad industries, all of which tend to demand high technological standards. Furthermore, armoured car welding products were sold to the military in country T in the early 1960s. This type of sales pattern had the effect of pushing the parent company to improve technology. In particular, these military orders marked the beginning of the successful high alloyed welding products which were then developed in Sweden for all other markets.

Another important point here is that subsidiary T has paid royalties for the utilisation of technology and patents equivalent to about 5 per cent of the value of sales over the evaluation period. The substantial flow of royalties based on an estimated value of 4.5 kr/kg has supported continuous R and D efforts thanks to which competitiveness in high alloyed welding products, for example, was developed. Table 20 sets out these royalty estimates for the actual country T linkages.

Table 20. Production royalty estimates for country T actual linkages

Year	Production volume tons	Royalty tkr
1973	15 426	3 470.0
1974	18 050	4 062.5
1975	17 055	3 837.6
1976	18 000	4 020.0
1977	14 300	3 217.5

Alternative linkage - direct export to country T

As a first step in the analysis of the impact on the level of production employment in Sweden, an alternative linkage of direct exporting from the home country to market T is hypothesized here. It is assumed that rather than setting up electrode production in the early 1950s, the parent company linked itself to the market by creating a sales subsidiary solely for the purpose of handling imports from the home country production lines. The effects are then analysed over the more recent time periods for which data collection has been possible.

The analysis proceeds by recognising that the supply of 9,000 to 18,000 tons per year of electrodes from Sweden would depend on the following factors:

1. Home country productivity.
2. Transportation and tariff costs.
3. Non-tariff import barriers.
4. Extent of nationalism in the purchasing process in Market T.
5. Similar marketing efforts.

Home country productivity

As a result of the higher productivity rates in Sweden only 47 to 108 production man-years would be needed to produce the same output as was made in the country T manufacturing subsidiary during the time period studied. The equivalent Swedish employment is given under point 6 of Table 19. Those figures should be compared to the annual employment data (point 1A).

Transport and tariff costs

Next it must be recognised that a large proportion of the electrodes produced and sold by the country T manufacturing subsidiary was composed of low-priced non-alloyed black carbon electrodes which are under extreme price competition in most markets. Thus the available profit margin would not permit shipping over distances of more than about 500 km. In 1978 the share in production of this class of electrodes in country T was about 90 per cent. This means that 10 per cent of the output was alloyed electrodes which are of higher value added and thus have profit margins which permit shipping over longer distances.

However, the management of Company A has indicated that further analysis of the sales composition is needed to determine the fraction of electrodes which could reasonably have been exported from Sweden. The higher gross margin category electrodes which had the best chance for export are those of medium and high alloys which accounted for 6 per cent of the tonnage. If these were produced in Sweden, small series runs would be used which

would raise unit production costs and delivery times. This would mean that some sales would be lost. The small volume runs would be needed to conform to the official standards in country T. A further negative factor is that the sales to the country T military establishment would probably have been lost since foreign production could not be relied upon. The management derived estimate is that about 1.2 per cent of the total tonnage would have survived in the medium to high alloyed category and 0.8 per cent in the low alloyed category for a total tonnage survival of 2 per cent for alloyed electrodes.

It is also necessary to recognise that if the sole linkage to country T were through export sales some small percentage of non-alloyed electrodes would probably survive because combined shipments of these with the higher margin alloyed electrodes could be made to the same customers. It is not unreasonable to recognise a major export of, say, one per cent of total tonnage to be surviving export sales in non-alloyed electrodes.

These data tend to support an adjustment figure of 3 per cent as a reasonable electrode tonnage which could have survived transportation and tariffs to country T which is closer to the production source in Sweden than are many of the countries to which bigger exports in percentage terms are made. This relatively low level of export survival which is based mainly on Company A management estimates has been used to estimate employee-equivalent support levels for the export sales alternative to the actual manufacturing subsidiary linkage used in Country T. These estimated support levels are in Table 24 below.

A survival of only 3 per cent of consumable sales in a foreign market due to a switch to exporting could seem to be only a nominal survival rate. It is therefore of interest to explore whether higher survival rates for consumables appear to be rational from other data sources. There are several indications that a higher survival rate should be used.

Firstly, other suppliers have higher percentages of their domestic consumables production going into the export markets than would Company A with a 3 per cent survival rate applied to all its foreign production. Company A produced 21,000 tons of electrodes in its domestic facilities in 1977/78 and 113,800 tons in all types of foreign manufacturing facilities. If only 3 per cent of those tonnage sales survived due to using exporting as an alternative to foreign manufacturing only 3,400 tons or 16 per cent of domestic production could have been shipped abroad. A much smaller Swedish competitor with only export linkages has 15 per cent of its home sales constituted by consumables exports which contain a larger proportion of ordinary electrodes than are those of Company A. The expectation would be for a much smaller export percentage. One of the international oligopoly competitors of Company A stated that they expected their export of sales of welding products to a foreign market to increase by a factor of slightly over two when local manufacturing in that market is used as the linkage. This would imply a survival rate of slightly less than 50 per cent. That competitor has nearly an equal mix of machines and consumables sales so that this expectations statement is not restricted to machines alone.

Another factor which indicates somewhat higher survival rates for exports of consumables is that transportation charges to Country T are only 3 to 12 per cent of the export transfer prices and tariffs are zero. Thus for an average 7 per cent price increase a decrease of 97 per cent in quantity sold would indicate a higher price elasticity than for nearly all other differentiated products even in monopolistic competition situations. For example in non-fashion or daily wear clothing two industry estimates collected in recent related research show that a 7 per cent price increase establishes a range of quantity decrease of only 8 to 33 per cent. It seems unlikely that welding consumables in country T could have a price elasticity so much higher than for those products.

In order to take this additional information into account a set of slightly higher survival rates will also be used so that two employment support figures will be generated for the export alternative. For alloyed electrodes 8 per cent of total tonnage will be used (or 2 per cent less than actually sold) and for non-alloyed electrodes 2 per cent of total tonnage will be used (or 88 per cent less than actually sold). Thus 10 per cent will be used as an upper level adjustment figure for consumables sales survival via the export linkage. The two estimate adjustments at 3 per cent and 10 per cent are set out in Table 24 below.

Non-tariff barriers

Electrical and safety codes prevent some exports and these barriers have been encountered by welding machine producers particularly when exporting to the Federal Republic of Germany and Switzerland which have adopted stringent regulations requiring extensive adaptation of Swedish-produced welding machines. Another barrier is that governments and various private technical bodies have set up standards for different aspects of welding. The country T official specification standards have, therefore, been taken into account above.

Nationalism in purchasing power

Some countries stress purchasing only from domestic producers. Both the US ("Buy American" policy) and Canada in the last several years are examples. When government officials can influence the purchase decision this factor can be of great importance. For sales to private companies, as most of these were in country T, the price/quality/service mix is much more decisive than patriotic appeals. This factor does not appear to be of great importance in country T.

Marketing efforts

It is believed that the sales staff in the country analysed could have been reduced under the selected alternative since only those Swedish imports which actually were handled plus the two adjustment flows are involved. Also the marketing methods actually used would have to be somewhat modified under this alternative.

The analysis of the effect produced by the decision to use a manufacturing subsidiary rather than the hypothesized export sales linkage now proceeds by taking for granted that the employee-year equivalents shown for each year in Points 3A and B of Table 19 would also have occurred under the alternative linkage. These figures have been derived from consumables and machinery imports from the parent Swedish company. The sales subsidiary would probably have made these even if no other electrodes were produced in country T. The manufacturing equipment sales; however, would probably not have occurred under the assumed alternative (Point 3C).

Since the export of welding machines provides the largest cross-linkage effect of Points 3 A, B and C in Table 19, it should be noted that no loss in these sales is likely to occur in switching to a sales subsidiary approach. In country X (discussed in a subsequent section) the sales subsidiary has been able to maintain between 4 to 6 per cent market shares in handwelding machines and 24 to 30 per cent in semi-automatics in a market having a strong state-subsidised competitor. Comparable market shares for the two manufacturing subsidiaries T and W are 1.2 to 1.7 per cent and 0.7 to 1.6 per cent for handwelding units and 4.7 to 7.8 and 3.0 to 3.9 per cent for semi-automatic, respectively. While the markets have many different aspects these data all relate to Western European countries, two of which are EEC members. Machine exports are not expected to suffer under a sales subsidiary linkage.

The base employment support is then as shown in line 1 of Table 21 and to this is then added 3 per cent of the Swedish equivalent employment from Point 6 of Table 19 for the exports of the alloyed electrodes and for survival exports of non-alloyed electrodes. The total employment equivalent in Point 4 could then have been also expected under the alternative export linkage.

Points 5-7 set forth the estimated employee-equivalents using the higher survival assumptions. Points 5 and 6 at the higher estimated survival rates are then added to the base employment figures in Point 1 to get total employment high estimate.

The employment-equivalents calculated from the actual foreign direct investment manufacturing linkage can be graphically presented and compared to totals in Table 21. This has been done in Figure 2.

The conclusion from this analysis as shown in Figure 2 is that some additional production employment could have resulted over the period studied if the alternative export sales linkage had been chosen rather than the manufacturing subsidiary which was actually used.

The consumables export levels under this hypothetical sales subsidiary linkage would be only 3 per cent of the tonnage figures shown in Table 19 under the low survival percentage, for example 270 tons for 1968, 542 tons for 1974 and 429 tons for 1977. Under the high survival estimate the tonnages would have been 900 in 1968, 1,805 in 1974 and 1,430 in 1977.

Table 21. Employment equivalents for Country T - alternative linkage of export sales, employee-years

Employee-equivalents estimates	1968	1970	1973	1974	1975	1976	1977	1978
1. Base employment (Points 3 A and B from Table 19) from actual exports			0.60	1.30	16.30	19.50	14.30	18.70
2. Exports of alloyed electrodes at 2 %	0.92	1.22	1.38	1.80	1.88	2.16	1.36	-
3. Exports of survivable non-alloyed electrodes at 1 %	0.46	0.61	0.69	0.90	0.94	1.08	0.68	-
4. Total employment low estimate	1.38	1.83	2.67	4.00	19.12	22.74	16.34	-
5. Exports of alloyed electrodes at 8 %	3.72	4.85	5.55	7.20	7.54	8.64	5.50	
6. Exports of non-alloyed electrodes at 2 %	0.93	1.21	1.39	1.8	1.89	2.16	1.38	
7. Total employment high estimate	4.65	6.06	7.54	10.30	25.73	30.3	21.48	

It can be said that since the country T military sales would probably not have occurred the medium and high alloyed consumables business would not have developed as fast and this would have retarded the support of production employment by the export of these products in subsequent years. A large fraction of the employees were supported by medium and high alloyed electrode sales since the non-alloyed sales would be small, consistent with the above statements.

The loss of production royalties would have a very negative effect. For example, annual amounts of from 3.2 to 4 million Skr. would have been lost in total R and D expenses for 1974. This loss of technological change efforts would have had a significant effect on competitiveness in subsequent years towards which R and D activities in those years were directed.

Alternative linkage - licensing for country T

A second alternative linkage is hypothesized to be that of licensing. For this alternative it will be presumed that the entire consumables production over the period of analysis is carried out by a licensee. No additional Swedish production employment would have been generated to replace the missing subsidiary production because no additional consumables exports can be rationally presumed.

The basic assumption for this alternative is that the licensee would have produced the same output in country T in an identical manner to that which actually occurred in the manufacturing subsidiary. It is further assumed that the licensee's ability to market Swedish imports would have been the same as that of the manufacturing subsidiary.

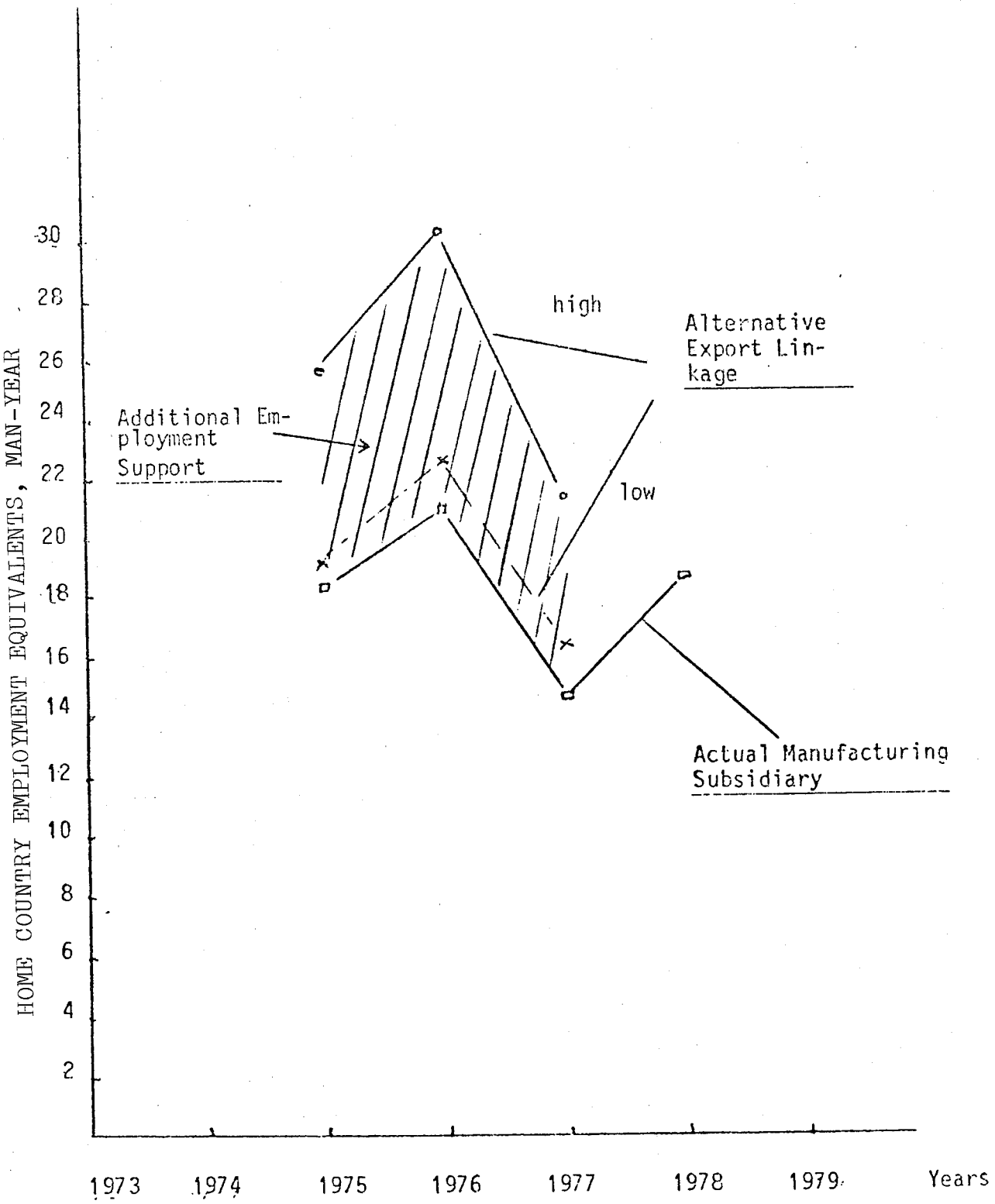
The factors relevant for this licensee linkage alternative are the following:

1. Flow of license royalties which the parent company would have received.
2. Ability of a licensee to produce the fairly large volume of electrodes which were actually produced by the manufacturing subsidiary.
3. Ability of the licensee to sell the product volumes actually imported from Sweden, i.e. similar marketing efforts.
4. Sales of manufacturing equipment to the subsidiary.

License royalties

There would have been a substantial royalty flow generated under the alternative at a rate of about 2 per cent of sales value from arm's length bargaining licenses rather than the higher 5 per cent when a wholly-owned subsidiary is involved.

Figure 2. Alternative linkage diagram for export sales - country T



The average value of welding electrode exports from Sweden to four representative countries during this time period was about 4,500 kr/metric ton. Using this value the royalty flows over several recent years can be estimated as is shown in Table 22.

These substantial royalty flows over one million kroner in each year accrue to the parent company and can be used to support research and development activities by which new products are developed, thus in turn generating productive employment to be supported through product exports. This cycle of licensing - innovation - export - production employment support is used as a strategic management practice in the licensor company. The employment support effect has not been quantified but it exists qualitatively. In addition there are one-time fees generated for down payments and documentation. It should also be pointed out that license royalty flows are also derived from the manufacturing subsidiaries and thus there would be a small, if any, differential home country employment impact from this royalty flow.

Licensee production volumes

Another point is whether a licensee could produce the large 9 to 18,000 ton output. Through another licensing linkage 10,000 tons are produced so that the levels suggested are not deemed unreasonable. Most licensees produce in the 2-5,000 ton range which indicates that licensing flows as large as those shown in Table 22 would be above the expected norm for most license linkages.

Marketing efforts

It is necessary, as a next step, to study whether a licensee would be able to sell sufficient imported products to support the annual equivalents of 15 to 21 man-years for Swedish production employees shown in Table 19. Market share figures for country T are given in Table 23.

Market share data for licensee operations is scarce. In 1976 one geographically close licensee had a 47 per cent hand-welding machine share and a 14 per cent semi-automatic share in its market. The few comparative licensee figures developed here indicate that it would not be unreasonable to expect market shares of the magnitudes attained in country T by the present manufacturing subsidiary if production were handled instead by a licensee located in that country.

Export of manufacturing equipment

The licensee would have had the opportunity to purchase the manufacturing equipment for the electrode lines from several competitors which offer similar product lines: Oerlikon, British Oxygen and Philips.

Some export sales could have been lost through such optional purchases, particularly after the 1975 relative export price increases in Sweden. A 30 per cent fall in manufacturing equipment exports is assumed from 1976 onward due to this increased price competition. This means that the manufacturing equipment exports to country T would be reduced by 30 per cent from 1976 through 1978 to levels of 379,400 kr., 130,000 kr., and 58,000 kr. respectively, for the years 1976, 1977 and 1978.

This translates into employee-year equivalents of 1.02 (1976), 0.35 (1977) and 0.154 (1978) in the terms of Table 19, point 3C.

The best result for home country production employment under this analysis is that the local electrode production would be carried out by licensee employees rather than subsidiary employees and that about the same levels of exports would be attained.

Table 22. License royalty estimates for country T alternative linkage

Year	Production volume, tons	Value per ton	Product value, tkr.	Royalty 2%, tkr.
1973	15 426	4 500 kr/ton	69 417 kr.	1 388
1974	18 050	" "		1 625
1975	17 055	" "	76 748	1 535
1976	18 000	" "	76 748	1 620
1977	14 300	" "	64 350	1 287

Table 23. Market share positions in Country T

Product	1973	1974	1975	1976	1977
Non-alloyed electrodes, tons	% 17.9	% 20.0	% 19.6	% 20.5	%
Handwelding machines, units	1.7	1.6	1.3	1.2	1.2
Semi-automatic machines, units	5.5	5.9	4.7	7.8	6.8

The base employment support would then be as shown in Point 1 of Table 24 below since consumables and machines imports have been taken to be at the same levels. The only adjustment made is a 30 per cent reduction in equipment sales for 1976-78. There is some evidence that machine sales to licensees may have decreased in 1978, but sufficient data has not been collected on this point.

Table 24. Employment-equivalents for Country T - Alternative linkage of licensing, in employee years

Employee-Equivalents	1973	1974	1975	1976	1977	1978
1. Base employment (Points 3 A and B from Table 19) from actual exports	0.60	1.30	16.30	19.50	14.30	18.70
2. Exports of manufacturing equipment	0.11	1.20	2.20	1.02	0.35	0.15
3. Total home country employment-equivalents	0.71	2.50	18.50	20.52	14.65	18.85

These home country employment support totals are closely equivalent to the totals in Point 4 of Table 24 which are the actual country T figures. So one conclusion is that a licensee linkage has nearly the same impact as a manufacturing subsidiary. Not withstanding this short run generality there is a long-term phenomenon which has to be handled qualitatively at this point and that is the observation that licensees often begin to export their products to the other markets of the licensor. Thus decrease in sales and in some home country employment can occur. This effect should be minimised if the licensee continues to purchase semi-manufactured goods (mainly within the consumables class) and to sell the licensor's machines on the export markets. It is frequently observed, according to managers, that licensees, being less controllable, begin to purchase locally and from other lower-priced multinational competitors. Over a period of time a decrease in home employment support due to this shift in purchase patterns is believed to occur.

The promotional thrust of the medium and high alloyed welding products developed through military sales to the country T could still have occurred through a licensee linkage. However, it must be recognised that as a result of the interposition of an extra management group, communications of the original needs, customer problems and company solutions thereto, would suffer. It is also possible that the licensee would view the discussions between the parent licensor R and D people

the country T military technical personnel as being a threat to their market position. Licensee management would have less interest in new sophisticated products since these would exceed their special advantage position.

Under the licensing alternative a negative effect on technical development could almost certainly be expected where the country market in which the licensee manufactures has increasing technical specification needs.

A similar analysis was carried out for the country X linkage and the other six linkages studied. The results are those summarised in Tables 25 and 26 below.

Summary of employment effects

The employee-equivalents calculated in the various analyses and shown graphically in Tables 25 and 26 are viewed as short term since they are based on analyses of export survival rates for welding consumables, machines and manufacturing equipment to foreign markets taking into account the constraints of buyer requirements, transportation costs, and market shares achievable in similar markets using the hypothesized linkages. However, the more important issues are, in our opinion, the long-term strategic considerations which can only be treated qualitatively at this stage. In general, a short-term employment gain could be achieved by using a non-manufacturing foreign linkage; but then a loss of strategically important market opportunities would have occurred with clear negative long-term effect also on employment.

Table 25 is an attempt to present in synoptic form the individual elements supporting this general conclusion. The top portion of each cell position is the employee-equivalent man-years gained (+) or lost (-) derived from two of the eight analyses and the lower portion covers the more important strategic market opportunity which would have been lost in the long run by going to the alternative linkages. The man-years have been averaged over the year ranges for which comparative data was developed.

The alternatives (cells 1 and 2) to a manufacturing subsidiary (country T) show a slight positive or at least equal employment effect in the short run, but have negative market and license income effects on the firm which may then lead to failure to develop competitive strength in time. This long-term effect may threaten the future employment security of the firm's employees.

Country X, a sales subsidiary, shows a short-term negative employment effect if a manufacturing subsidiary is used (cell 4), but would produce three positive long-term effects. Changing to a license linkage for country X is estimated to produce a small short-term employment loss and negative long-term market effects (cell 5). Only the license royalties would lead to long-term positive effects.

Table 25. Summary of short and long-term employment effects

Foreign Markets	Actual Linkage	Manufacturing Subsidiary Alternative Linkage	Export Sales Subsidiary Alternative Linkage	Licensee Alternative Linkage
Country T	Manufacturing Subsidiary		1 Short term + 1.30 to + 7.74 man-year employment gain per year --- Long term - much Slower development of medium and high alloyed consumables for use by entire group Loss of production license royalties	2 Short term negligible employment loss --- Long term - Slightly slower development of medium and high alloyed consumables for use by group. Slightly lower production royalties
Country X	Export Sales Subsidiary	4 Short term - 2.7 man-year employment loss per year --- Possibility to pursue new business of type described for the entire group. Better consumables market share and knowledge of customer problems. Gain of production royalties.		5 Short term - 2.7 man-year employment loss per year --- Lower consumables and welding machine sales. Lack of customer problems knowledge. Gain in production royalties.

These trends favour recourse to manufacturing subsidiaries in preference to the other alternatives because of long-term effects. No clear trend favouring sales subsidiaries or license linkages over one another has been found in the long-term for the cases studied. The sales subsidiary linkage results in better market information which could be very important strategically although this type of situation was not encountered. The second linkage, i.e. licensing, produces production royalties which can be used to support production innovation efforts by the parent company and thus generate new competitive strength. When the linkage is to an industrial country a sales subsidiary is probably preferable over licensing due to the improved market information flow which will allow the firm to understand the customers' technical needs more quickly.

Summary of international competitive ability effects

In Table 26 the long-term effects on competitive ability of the choice between four different linkages to foreign markets are set forth. Taking non-alloyed electrodes, row 1.1, as an example, the linkage which results in the most positive effect relative to the three other linkages shown is a manufacturing subsidiary. This result needs some additional explanation in view of Company A's rather extensive use of the licensing linkage during the 1970s. The analysis showed that compared to the manufacturing subsidiary linkage, the licensing linkage had negative effects for Sweden as an economic entity. This licensing activity does result in temporary, short-term domestic employment increases when the manufacturing equipment is sold to the licensee company and does provide licensing royalties to Company A; but the long-term competitive effects would be more positive if manufacturing subsidiaries were used, provided that the political and financial investment risks are not unacceptable in the foreign country.

Table 26. Summary of foreign market linkage effects

Business Segment	Competitive Economics Basis	Foreign Market Linkage Effect on Competitive Ability, Manufacturing Subsidiary	Export Sales	Licensing	Minority Joint Venture
1. Welding Consumables					
1.1 Nonalloyed electrodes and wire	Low marketing & Distribution unit costs	Large positive [2]	Negative	Negative [3]	Negative
1.2 Special (alloyed) consumables	R & D availability	Small positive	Small negative	Negative	Large negative
2. Electrical Welding Machines					
2.1 Hand & Semi-automatic units	Low manufacturing costs Low marketing & distribution costs	Negative	Small positive	Negative	Negative
2.2 Automatic & robot units	R & D availability Low costs per engineered application	Negative	Large positive	Negative	Negative
3. Gas Welding Equipment	Low manufacturing costs Low marketing & distributions costs	Negative	Positive	Negative	Negative
4. Manufacturing Equipment	R & D availability Low manufacturing costs	Negative	Positive	Large negative	Large negative

[1]

For notes, see p.53.

Notes for Table 26

(1) The linkages having the most positive effects for Swedish competitive ability are indicated by the dashed line boxes.

(2) In the case of a country likely to have foreign exchange shortages a manufacturing subsidiary could lower competitive ability for the Swedish parent company since earnings could not be repatriated. This would also mean that export sales would not be usable. Licensing is the safest linkage although royalty payments in convertible currency may not be possible as in a country with severe foreign exchange constraints.

(3) In the situation described under (1) above, licensing will achieve relatively more positive results as to competitive ability than will a manufacturing subsidiary.

Table 26 is of interest as it demonstrates that the most desirable non-alloyed electrode foreign market linkage for long-term competitive ability (row 1.1) is a manufacturing subsidiary. This was found for both Companies A and B. The only exception seems to be when the foreign country involved has currency exchange shortages as detailed in Table 26.

Notes 1 and 2 - This linkage is particularly necessary in the case of large growing and technically sophisticated markets. This finding from the empirical investigations also agrees with the competitive economics basis of low distribution costs since the non-alloyed electrodes cannot be shipped over long distances.

The special alloyed consumables (row 1.2) are slightly different in that many of these have value to weight ratios which are high enough to allow shipment from Sweden. Retaining production in Sweden would give support to short-term employment but longer-term innovative actions of the Swedish parent company based on deeper customer involvement could have a negative impact on long-term competitive ability. With extensive use of foreign-based product specialists this negative effect on export sales could be reduced, hence the designation "small positive" has been used for the manufacturing subsidiary linkage. The critical economic factor seems to be the knowhow for solving customer problems by producing the correct high quality consumables. R and D availability is the controlling business economics cost factor and location of manufacturing can vary.

The linkage effects for rows 2-4 all seem to favour export sales based on Swedish production. Company A follows this model in electrical welding machines by manufacturing in Sweden and exporting to all foreign markets. Company B does the same with other products in long series runs. It does not, however, conform to this effect analysis in the case of one of the linkages. It can be said that the positive effects for rows 2.1 and 3 stem from the ability of the companies to

produce long series runs in highly automated Swedish plants. Some sourcing of components and simple machines abroad might be necessary to reduce manufacturing costs. Hence the designation of"small positive" has been used to describe the competitive ability effect of the linkage of domestic manufacturing followed by export sales for row 2.1.

The automatic and robot welding units (row 2.2) are based on technical knowhow (R and D availability) and involve low costs per engineered application. They are production equipment used in a customer's manufacturing line. These customers will purchase at the lowest cost from a reliable source. Both companies A and B are in this welding business segment and each must strive to become internationally known as the best and lowest cost source for certain engineered solutions to welding problems.

The only rational way to handle the sales of manufacturing equipment (row 4) is through the export linkage or in the case of manufacturing subsidiaries by additional equipment investments. In either case production should occur in Sweden to obtain the best competitive ability effects.

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