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COMPONENTS OF URBAN INDUSTRIAL
EMPLOYMENT CHANGE IN A SMALL OPEN
ECONOMY: SWEDEN

Lennart Ohlsson

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FOREWORD

Declining rates of national population growth, continuing differential rates of regional economic activity, and shifts in the migration patterns of people and jobs are characteristic empirical aspects of many developed countries. In several instances, they have combined to bring about a relative (and in some cases absolute) population decline of highly urbanized areas, e.g., New York, Tokyo, and Stockholm. In other cases, they have brought about rapid metropolitan growth, e.g., Houston, Miami, and Moscow.

The objective of the Urban Change Task in IIASA's Human Settlements and Services Area is to bring together and synthesize available empirical and theoretical information on the principal determinants and consequences of such urban growth and decline.

This paper is the first of three focusing on the Swedish case study. In it the author examines the pace and degree of success of adaptation to changes in external conditions exhibited by the three largest metropolitan areas in Sweden. Three kinds of external changes are studied: differences in domestic industrial market growth rates, in patterns of comparative advantage, and in conditions of technical change.

A list of related publications in the Urban Change Series appears at the end of this paper.

Andrei Rogers
Chairman
Human Settlements
and Services Area



ABSTRACT

The dense, large urban region has often been assumed to lead a region's structural development because of agglomeration economies and easy access to both a rapidly changing market and a variety of production resources. This paper analyzes whether or not three metropolitan regions of Sweden adapted their industrial sector rapidly and successfully between 1965-75 compared to more sparsely populated parts of the country. The regions include some areas which have received industrial aid during the period.

The analysis of components of urban manufacturing employment change utilizes statistics for 110 industries. However, these industries are classified into various analytical aggregates. First of all, the paper makes a distinction between foreign-trade sheltered industries, trade-exposed raw material based industries, and footloose industries. The latter type of industries are trade exposed but not based on raw materials. Since these industries rely on the competitiveness of the value added process they can be assumed to be most flexible to changes in external conditions that possibly affect the incentives for spatial mobility.

Three kinds of changes which are external to the urban industrial sector are analyzed for the footloose industries; namely, industry differences in domestic market growth rates, changes in comparative advantage patterns and technical change. They are studied with regard to both urban and regional employment consequences and consequences for the demand for skilled labor.



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COMPONENTS OF URBAN INDUSTRIAL
EMPLOYMENT CHANGE IN A SMALL
OPEN ECONOMY: SWEDEN

Lennart Ohlsson

1. BACKGROUND AND AIM OF STUDY*

Urban (and regional) change can be analyzed with respect to internal or external causes and consequences. The analysis can look upon the urban region as a region either with or without spatial extension. The present paper takes the latter approach in an analysis of employment change tied to causes which are primarily external to the urban region and, in some cases, also external to the country of study: the small, open, and spatially extended economy of Sweden.

The purpose of the study is to investigate the adjustment performance of the three metropolitan regions of Sweden in the manufacturing industry and particularly in the so called footloose sector of this industry. The method of investigation is a rather simple comparative analysis of the three regions with other regions, which do not have the same capacity to adapt in the regional capital (human and non-human) formation sectors. However, for pedagogical purposes the starting point has a broader sectorial coverage than the manufacturing industry.

*Most of the empirical analysis in this paper is based on a data bank and earlier computations, which I could not have put together without the able assistance of my programmers Bertil Lindberg, the Expert Group on Regional Studies, Stockholm, and Hans Hertling, the Department of Geography, Stockholm University.

The regional breakdown of Sweden into 11 regions uses the concept of homogenous regions, where the regions are defined to be homogenous with respect to factor endowments and relative factor costs, i.e., to their factor abundance.* The focus of interest with regard to regions, are the three urban regions surrounding and including the three largest cities in Sweden, i.e., the capital city of Stockholm, and Gothenburg and Malmoe, respectively. Each one of the regions is abundant in human capital, but especially Stockholm. All three regions contain universities and other educational and research facilities. They also contain a well developed capital market, although again with a strong lead for the Stockholm region. The three cities lie at the coast and have harbor and airport facilities for international exchange of commodities and people. By and large they should be the most exposed parts of Sweden for changes in international conditions in the footloose industry sector and the regions most flexible in adjustment. Conceptually, they may, in an analysis of long run changes, be looked upon as the most close approximations one may obtain in Sweden to "perfectly functioning" factor markets with regard to the markets for "raw" labor and human and non-human capital.

Although there are some exceptions the sectoral focus in the paper is what we have called above the "footloose industry sector" This sector, which contains 78 industries, is defined so as to ascertain as much as possible a set of industries in which the value added processes are of key importance for the industry-variations in international competitiveness or, comparative advantage. Out of a total of 110 industries 15 were expelled due to too low foreign trade exposure (the trade sheltered sector), and 17 due to the fact that they were judged to be too closely linked to raw material production (the raw material based sector).**

*The regions are defined from 278 local communes but the definitions use a variety of statistics from even more detailed to more aggregate spatial units. For a more in depth discussion about the underlying rationales, methodologies used, and regional definitions settled for, the reader is referred to Ohlsson (1977a).

**The sectoral composition of industries is defined in Ohlsson (1977b). Industries were classified as trade sheltered if and only if the export ratio of gross output *and* import share of of domestic consumption were less than 10 percent in both 1960 and 1970.

The external propelling power of urban employment change to be investigated is a) comparative advantage change, b) variations in demand growth rates, and to some extent in c) technical change as revealed by input/output and input/input ratios. The time period covered is 1965-75.

The analysis is structured in the following way. Section 2 provides a quick introduction to the size and structure of the three urban regions measured by population, size, and employment composition, respectively. Section 3 analyzes the specialization in 1965-75 of the three urban regions in trade sheltered, raw material based and footloose production and compares these patterns with those of other regions. Specialization patterns are here, and throughout the paper, looked at in terms of the employment contribution of the sectors.

In two ensuing sections the specialization changes *within* the footloose sector are approached by looking at four different aggregates of the 78 sectors for each one of two criteria. One criterion is the long-run growth rate of the domestic market--one source of industry variations in output and employment growth. The other criterion is the long-run changes in Sweden's international trade specialization looked upon as a measure of changes in its "revealed" comparative advantage--another source of industry variations in output and employment growth.

Section 6 is devoted to the study of how the number of establishments and their size develop by sector and region. Growth or contraction of the number and size of establishments are looked upon as the sources behind the variations in employment change in the regions. Technical change is another source, and Section 7 analyzes the changing sectoral labor requirements over the period. The following section illuminates the regional variations in the development of the use of skilled labor. Section 9 then concludes the paper and summarizes its main findings.

2. THE SIZE AND STRUCTURE OF THE THREE URBAN ECONOMIES

With a population of eight million, Sweden is one of the smallest industrial countries in the world. Its space is, by far, more sizeable as expressed by the low population density of 17 inhabitants per square kilometer. Only a relatively small mountainous area in the far northwestern part of the country is physically difficult to populate. Apart from its relative abundance of space, it also deviates favorably in economic living standards from other European industrial economies.

The three urban regions chosen for the present paper all lie in the southern, more densely populated part of Sweden (see Figure 1). Two of these regions do not completely intersect with the respective county borders, namely the Stockholm and Gothenburg regions. To give a rough idea of their relative size, Table 1 presents their shares of national population and employment in 1975. Evidently, the Stockholm region is approximately twice the size of the other two regions. The labor force participation rate is, according to the table, higher than the national average in all three regions.

Table 1. Percentage population and employment shares of Stockholm, Gothenburg and Malmoe counties in 1975.

County	% of National	
	Population	Employment
Stockholm	18,2	20,1
Gothenburg (and Bohus)	8,7	9,2
Malmoe	9,0	9,4

Source: Table 3.6 from Göttingborgs kommun (1978)

Table 2 gives an idea of how the sectoral employment composition of the three counties (approximating our three urban regions) deviates from that of Sweden as a whole. The sectoral employment share of total regional employment $(L_{Rj} / \sum_j L_{Rj})$,

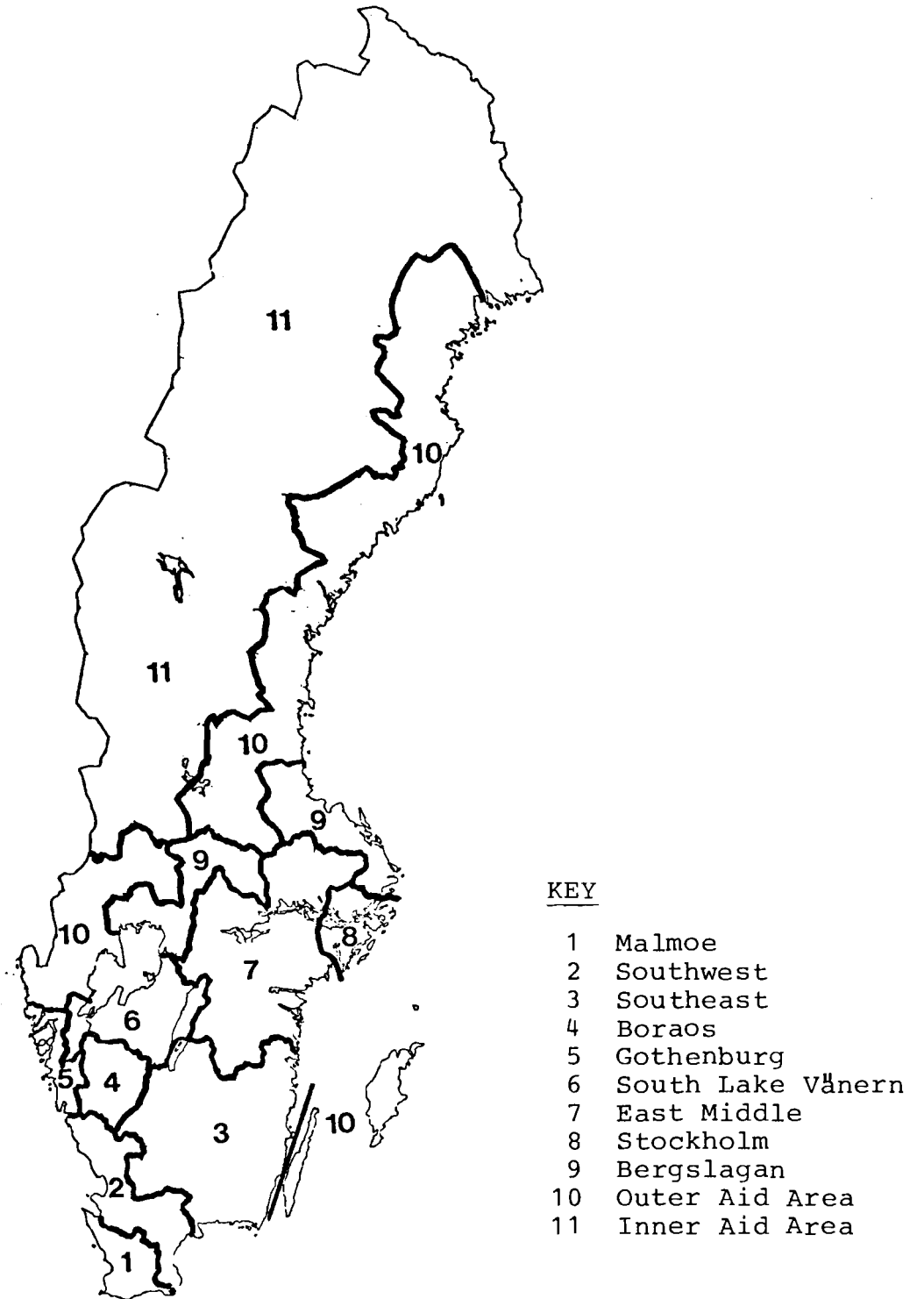


Figure 1. The Eleven Regions.

Table 2. Indices of sectoral employment shares in three urban regions (Index = 100 for the total employment share of the region in national employment), 1970 and 1975.

County	Stockholm		Gothenburg		Malmoe	
	1970	1975	1970	1975	1970	1975
Sector						
Farming, forestry, etc.	17	17	45	38	87	94
Mining, etc.	22	15	35	17	24	11
Manufacturing industry	67	62	95	96	97	94
Electricity, gas, hot water, and water production	123	105	102	98	115	103
Building industry	91	86	101	101	91	93
Trading, hotels, etc.	126	122	122	120	118	115
Communication, mail, etc.	128	126	135	139	103	112
Banking, insurance, etc.	204	190	124	113	99	98
Public and miscellaneous services	122	123	97	97	100	100
All Sectors	100	100	100	100	100	100

Source: Calculations based on Table 3.6 in Goteborgs kommun (1978)

R = region, j = sector, and L = employment) has thus been divided by the analogous share of the country as a whole ($L_j / \sum_i L_j$, L denoting national employment). The ratio has then been multiplied by 100. A value over 100 in Table 2 means that the region has a relatively high employment in the sector, indicating that the region is specialized in this sector (or has a lower than average capital/labor ratio).

It is evident from Table 2 that the Stockholm county is strongly specialized in service production. Contrary to the belief of many, this specialization is not most pronounced in the public services, but rather in the private banking and insurance sector. The latter sector appears to have the strongest spatial concentration of all sectors. Despite its service specialization, the Stockholm county maintains a manufacturing industry which is significantly larger than that of Gothenburg and Malmoe counties, both in employment and output.

The county of Gothenburg managed to enhance its (employment) specialization in the manufacturing industry. Despite its much larger size the Stockholm county had a much more specialized employment profile than the other two counties.

3. URBAN AND REGIONAL EMPLOYMENT CHANGES IN TRADE-SHELTERED, RAW MATERIAL BASED AND FOOTLOOSE INDUSTRIES

The manufacturing industry includes parts that have a strongly varying degree of foreign competition in commodity and intermediate input markets. The location of industries with a very low degree of foreign competition can, to a large extent, be attributed to natural trade impediments, for instance, transportation costs and location of domestic markets, or location of raw material supplies and technical integration of production processes. The study of the determinants of the location patterns of such industries has been the traditional focal point of spatial economic analysis. The primary interest of this paper is instead devoted to the locational development of industries characterized by international competition in both output and intermediate input markets and with relatively mobile primary factors of production.

Due to the limited size and the high degree of openness of the Swedish economy, the domestic producers can, within these industries, be regarded as price-takers with regard to output and intermediate inputs. Each group of regional producers can furthermore be assumed to face given prices and price structures of primary production factors. Adjustment to changing world market conditions or changing domestic primary factor prices and endowments is then, in principle, based on the competitiveness of the value added process. In turn, this process relies almost solely on produced capital inputs (human and non-human capital) and (raw) labor, land being a factor of minor comparative cost importance. The input-output relationships of the footloose industry sector are furthermore characterized by extensive inter-industry flows between relatively many industries (especially between the engineering industries), implying that the existing "production blocks" are rather weak.

To the (foreign) trade sheltered industries belong, for instance, certain food industries, some building material industries, foundries, and two fabricated metal product industries. The raw material based, trade exposed sector includes food industries, and industries based on forest raw materials (and electricity).

The footloose industry sector consists of a total of 80 industries at the national level, aggregated to 78 at the regional level.* About half of the industries are engineering industries.** Table 3 presents an overview of the composition of employment by sector in the three urban regions. For Sweden as a whole, manufacturing employment*** increased by a few thousand employees, or less than 1 percent from 1965 to 1975. It was the footloose sector that gained most in employment, while the raw material based sector experienced a decline. Compared to Sweden as a whole, the Stockholm and Malmoe regions were specialized in trade sheltered industries whereas the Gothenburg region had a strong position in the footloose sector. No urban region was specialized in the raw material based sector although the Malmoe region had a relatively high employment share due to its large food production.

Table 4 shows that Stockholm and Malmoe decreased their manufacturing employment in absolute and relative terms. For the former region, each sector lost employment, whereas Malmoe enhanced its employment in raw material based (read: food) industries. Only the Gothenburg region could maintain its strong position as a manufacturing producer.

A comparison with the other eight regions gives additional insights into the changing industrial role of urban and other Swedish regions. But first, some information about the three features of regional compositional change may be useful. In terms of their contribution to Swedish manufacturing employment, there is a slight tendency for the regions to become more equal in size.

*The aggregation was done by the National Central Bureau of Statistics to preserve secrecy for certain individual large producers.

**Which industries belong to ISIC 38 (International Standard of Industrial Classification.) It is used by the UN and many countries and compares relatively well with the US SIC classification.

***A miscellaneous industry group is excluded with a size of about 4,000 employees and dominated by (local) repair industries in the engineering sector.

Table 3. Employment share of three sectors by three urban regions in 1965 and 1975.

Sector	Stockholm region		Gothenburg region		Malmoe region		All Sweden	
	1965	1975	1965	1975	1965	1975	1965	1975
Trade sheltered	27,3	24,6	16,9	17,9	23,2	24,4	19,0	19,0
Raw material based	6,0	5,9	6,9	5,8	10,5	11,3	13,1	12,2
Footloose	66,7	69,6	76,2	76,3	66,2	64,3	67,9	68,8
Manufacturing industry total %	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
1,000 employees	118	105	80	81	83	78	896	902

Source: Computations of unpublished Swedish industrial statistics.

Table 4. Regional shares of sectoral, national employment in 1965 and 1975 for the three urban regions.

Sector	Stockholm region		Gothenburg region		Malmoe region		All Sweden	
	1965	1975	1965	1975	1965	1975	1965	1975
Trade sheltered	19,0	15,0	8,0	8,5	11,4	11,1	100,0	100,0
Raw material based	6,0	5,6	4,7	4,3	7,5	8,0	100,0	100,0
Footloose	13,0	11,8	10,1	10,0	9,5	8,1	100,0	100,0
Manufacturing industry, total	13,2	11,6	9,0	9,0	9,3	8,6	100,0	100,0

Source: Table 3

The standard deviation of their employment shares thus decreased from 4,62 to 4,42. A second feature is that this decrease was more pronounced for each one of the three sectors, although only slightly so for the footloose sector, which was the largest and regionally least specialized. A third feature is that the raw material based sector has the strongest regional specialization if measured by the standard deviation of the regional employment shares, followed by the (foreign) trade sheltered sector. For obvious reasons, the latter sector seems to have its strongest relative importance in densely populated regions (with the exception of the Gothenburg region) and in the remote, very sparsely populated Inner Aid Area. The raw material based sector is, for equally obvious reasons, most important in sparsely populated and usually sparsely cultivated regions.

Table 5 presents the details underlying these features. Let us draw attention here to four regions, which have received special attention in Swedish regional policy.* The region with by far the highest priority is the Inner Aid Area--a mountainous remote part in northwestern Sweden. In 1965 it contributed to Sweden's manufacturing employment to only a minor extent. However, it increased its share by more than 50 percent during the ten-year period studied. Each one of the three sectors contributed to this increase, but the most pronounced relative growth came about in the footloose sector. Since the latter sector also obtained a larger share of total manufacturing employment in Sweden, it is clear that the growth rate of that sector in the Inner Aid Area was very high.

The Outer Aid Area is the aid area next in priority. Also this region enhanced its role in Swedish manufacturing employment from 11,8 to 12,9 percent. This increase was attributable to the two sectors in which the region was not specialized, i.e., the trade sheltered and footloose sectors. Clearly, it has obtained a more diversified production structure along with the increased employment.

*Forthcoming papers will highlight means and effects of Swedish regional policy.

Table 5. Regional shares of sectoral, national employment
in 1965 and 1975 for eight regions

Region	1965				1975			
	Trade sheltered	Raw material based	Foot-loose	Manufacturing industry total	Trade sheltered	Raw material based	Foot-loose	Manufacturing industry total
Southwest	5,6	5,6	5,0	5,2	7,2	7,3	4,9	5,7
Southeast	12,8	13,9	12,9	13,0	12,8	14,6	14,0	13,9
Boraos	2,0	0,9	5,8	4,4	1,8	1,2	4,7	3,7
South Lake Vänern	5,3	4,1	5,8	5,5	5,7	4,4	6,6	6,1
East Middle	17,2	9,5	18,8	17,3	16,8	9,5	17,9	16,7
Bergslagen*	5,3	14,0	10,2	9,8	4,5	14,1	9,8	9,3
Outer Aid Area**	10,8	30,3	8,5	11,8	12,8	26,3	10,5	12,9
Inner Aid Area**	2,6	3,6	0,9	1,6	3,7	4,6	1,8	2,5
Sum of Stockholm, Gothenburg and Malmoe regions	38,4	18,2	32,2	31,5	34,6	17,9	29,9	29,2
All Sweden	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0

*This region approximates the so called Grey Zone Area of Regional Policy

**Appointed Aid Areas of regional policy

Source: See Table 3.

The Bergslagen region is almost completely part of the Grey Zone Area, for which soft loans were officially obtainable since 1970. It has traditionally had a strong specialization in forest and metal industries and therefore a composition similar to that in the Outer Aid Area. In contrast to the latter region, the manufacturing employment of the Bergslagen region decreased. Moreover, the Bergslagen region increased somewhat its "unfortunate" concentration on the raw material based sector.

Finally, the Boraos region--an urban region east of Gothenburg--has obtained limited regional aid in terms of soft loans since the early 1970s. In 1965, it was the most specialized of the regions which is not surprising since it is a small, condensed region. Despite its specialization in the growing footloose sector, this region decreased its manufacturing employment and especially the employment of the footloose sector. Obviously, possible structural problems lie within this sector (see section below).

As mentioned above, the employment shares of the footloose sector did not vary as much across the regions as the share of the two other sectors. This may in principle be attributable to the spatial immobility of factors and products underlying the definitions of the latter two sectors. However, another possible explanation is the mere size of the footloose sector, which had a four times larger employment share than each one of the other sectors. In the following two sections the footloose sector is disaggregated into four sub-classes using two different criteria.

4. URBAN AND REGIONAL EMPLOYMENT CHANGES BY FOOTLOOSE INDUSTRIES WITH VARYING MARKET GROWTH RATES

Sections 2 and 3 covered relatively broad aggregates of urban employment composition. As mentioned in Section 1, the footloose industry sector is defined to contain the potentially most flexible part of the manufacturing industry with regard to its adjustment to changing world market conditions--or, for that matter, to changing internal conditions at given world market conditions. In the following sections three sources of differential regional growth rates of manufacturing employment are analyzed,

namely the compositional consequences of varying industry: a) market growth rates, b) labor input coefficient decreases, and c) trade specialization trends. This section compares the regions with respect to how they adjusted their composition of industries with respect to the variations in market growth rates.

The only figures on market growth rates which are available at a detailed industry level are growth rates of domestic (apparent) consumption in current prices. If measured between years of similar phases in business cycles and for relatively long periods of time, the changes in stocks become of little importance. The period accepted here was 1960-75, which contains three business cycles and two end years of full industrial capacity utilization. The initial 80 footloose industries were classified into four sectors of 20 industries according to the industry's rank of domestic market growth rate. Two industries were not available in regional industrial statistics and for this reason were aggregated into two other industries.

Table 6 presents the composition of urban footloose sector employment by footloose industry aggregates with differing market growth rates. For Sweden as a whole, the development of employment shares is better the higher the growth rate of the domestic market. A very drastic reduction in the employment of industries with a stagnating or contracting domestic market is thus obtained. Table 6 reveals that in 1965 none of the three urban regions had a relatively high employment share in industries with a rapid market growth. Instead, their position was best in industries with a good market growth and this was especially true for the regions of Gothenburg and Stockholm. The Malmoe region had a high proportion of its employment in industries with the worst market conditions. It is evident that this fact contributes to the explanation as to why it experienced a decline in the employment share of the footloose sector as a whole.

All three urban regions managed to improve their employment balance in industries with good or rapid domestic market growth. However, according to Table 7, it was only the Malmoe and Gothenburg regions that improved compared to Sweden as a whole. Stockholm, with a better initial industrial composition, obtained

Table 6. Employment composition 1965 and 1975 by footloose industries aggregated after market growth rates 1960-1975.

Region	Year	Footloose sector	% of manufacturing employment of industries in footloose sector with			
			Rapid market growth	Good market growth	Slow market growth	Stagnating or contracting market
Malmö	1965	66,2	9,8	20,5	14,6	21,3
	1975	64,3	14,1	25,3	11,1	13,9
Gothenburg	1965	76,2	6,4	47,1	7,6	15,1
	1975	76,3	9,8	54,9	5,4	6,2
Stockholm	1965	66,7	12,7	34,3	14,3	5,4
	1975	69,6	15,3	36,2	14,0	4,1
All Sweden	1965	67,9	13,6	21,9	17,2	15,2
	1975	68,9	17,6	24,3	16,7	10,3

Note: The market growth rate underlying the classification = $(C_{1975} - C_{1960}) / C_{1960}$, where C = domestic apparent consumption.

Source: see Table 3

instead a larger than average employment increase in industries with poor market growth.

Accordingly, there is no clear evidence that the dense urban regions with assumed well-functioning (factor) markets have adjusted better with respect to demand changes.

The Boraos region had, according to Table 5, the highest employment share in the footloose sector. It lost employment in this sector and Table 7 gives reason to believe that one of the causes of the decline was its extremely bad composition with respect to market growth. This urban region had a more than four times higher employment share in industries with stagnating or contracting markets. This concentration is explained by the high concentration of textile and clothing industries in and around the city of Boraos. During the period 1965 to 1975 when those industries contracted their employment rapidly, the Boraos region was less severely hurt. This finding gives some support to the hypothesis that a region performs better in industries

Table 7. Index of relative employment size by region and sector 1965 and 1975. Index = 100 for all Sweden each year.

Region	Year	Footloose sector	Employment index in footloose industries with			
			Rapid market growth	Good market growth	Slow market growth	Stagnating or contracting market
Malmö	1965	97,5	72,1	93,6	84,9	140,1
	1975	93,3	80,1	104,1	66,5	135,0
Gothenburg	1965	112,2	47,1	215,1	44,2	99,3
	1975	110,7	55,7	225,9	32,3	60,2
Stockholm	1965	98,2	93,4	156,6	83,1	35,5
	1975	101,0	86,9	149,0	83,8	39,8
Southwest	1965	96,3	125,7	67,1	72,1	139,5
	1975	87,2	118,2	63,0	59,3	137,9
Southeast	1965	99,0	169,9	87,7	90,7	61,8
	1975	101,0	141,5	88,9	98,2	65,0
Borås	1965	130,9	48,5	41,6	36,6	440,1
	1975	125,8	55,1	67,1	52,1	505,8
South Lake Vänern	1965	105,6	158,8	109,6	51,7	114,5
	1975	107,0	158,5	105,3	56,9	103,9
East Middle	1965	108,8	136,0	80,4	109,9	124,3
	1975	107,1	123,3	75,7	118,0	135,9
Bergslagen	1965	104,4	36,8	86,3	243,0	34,2
	1975	105,1	51,1	89,3	234,7	25,2
Outer Aid Area	1965	72,2	70,6	45,7	117,4	60,5
	1975	81,6	90,3	46,1	126,3	77,7
Inner Aid Area	1965	56,0	105,9	48,4	43,6	36,8
	1975	72,4	119,3	59,3	50,9	58,3
All Sweden	1965	100,0	100,0	100,0	100,0	100,0
	1975	100,0	100,0	100,0	100,0	100,0

Source: see Table 3

in which it has a good competitive strength.* The Boraos region improved, however, its industrial composition between 1965 and 1975 more than Sweden as a whole. This improvement explains why the total employment loss was relatively limited. To some extent the improvement may be due to regional aid to firms establishing new plants in the region. In fact, the other three regions also receiving systematic regional support improved their industrial composition considerably. Moreover, three aid regions had initially unfavorable compositions. The exception was the Inner Aid Area, which had a relatively large employment in industries with a fast market growth.

The South Lake Vänern region appears to have had the best industrial composition with respect to the market growth rate of the industries. Moreover, it was the only region with a good composition which did not obtain a relative deterioration in this respect.

Summarizing, it is far from true that the three urban regions had a more favorable adjustment with respect to the varying demand conditions of the industries. Furthermore, this was not attributable to a particularly good, initial industrial composition. On the contrary, several regions of southern Sweden had then a more favorable specialization. The regions that improved most were instead regions that had the worst initial composition and that, due to employment problems within or without the industrial sector, received regional aid during at least part of the period. Although the instruments and the degree of subsidization varied between the latter regions, they all obtained investment aid in the form of "soft" loans.** By and large, Tables 6 and 7 suggest that in 1975 the market conditions of the footloose sector of the regions were more equalized than in 1965. However, these market conditions have been measured by the growth rate from 1960-75 of the domestic market.***

*Cf. Ohlsson (forthcoming) for a general test of this hypothesis.

**The industrial relocation and regional employment shifts achieved through Swedish regional policy is the topic of a forthcoming paper.

***Another forthcoming paper will treat the inter-periodical stability in market growth rates.

According to our results, the variations among industries in market growth rates seem also to be reflected behind the employment changes. This is not at all self-evident since there are two possible countervailing powers, namely the industry variations in international competitiveness and in labor/output ratios.

5. URBAN AND REGIONAL EMPLOYMENT CHANGES BY FOOTLOOSE INDUSTRIES WITH VARYING INTERNATIONAL COMPETITIVENESS

In the footloose sector, the links between variations in industrial production growth and growth of the domestic market may be weak due to large exports and/or imports. The following analysis therefore looks at the compositional changes in the employment of the sector in industries classified after their long-run changes in international specialization (1960-75). The measure of specialization changes chosen is the ratio $\Delta[(X-M)/C]$ where X = exports, fob; M = imports, cif; and C = domestic apparent consumption. Apparently, this measure complements the market growth rate of the preceding section. In addition, it maintains the ideas behind revealing a country's comparative advantage by its foreign trade specialization (cf. Balassa, 1965). The main difference to earlier studies of revealed comparative advantage is that comparative advantage is looked upon here as a non-static concept, i.e. the specialization measure is chosen so as to reflect *long-run trends* in comparative advantage, trends which affect production and, indirectly, employment development.

In accordance with the market growth classification, the classification of footloose industries after revealed comparative advantage, also makes a difference between four classes of industries. Table 8 presents the employment shares in 1965 and 1975 by these classes for the three urban regions and Sweden as a whole.

In 1965 almost 30 percent of manufacturing employees in Sweden were employed in footloose industries with declining or even strongly declining international competitiveness. Almost 40 percent were, instead, employed in industries which strengthened their competitiveness. By 1975 the former share had

decreased by five percentage points and the latter expanded by six percentage points. Employment-wise, the gains of industries with enhanced international competitiveness was not very strong since it merely compensated for the loss of employment in non-competitive footloose industries.

Table 8 also shows that only the Stockholm region had a better than average industrial composition in 1965 of the three metropolitan regions. The Stockholm region had then about 50 percent of its manufacturing employees in industries with a strengthening competitiveness. It was, however, only in industries with a strongly enhanced competitiveness that this region managed to grow its employment (with about 5,000 employees). This absolute employment growth meant an even stronger upward trend in the employment share of these industries.

The Gothenburg region began the period with a poor competitiveness composition due to its large producers of ball bearings and ships. This dependence of large firms in industries with a

Table 8. Employment composition 1965 and 1975 by footloose industries aggregated after changing international competitiveness 1960-1975.

Region	Year	Footloose sector	% manufacturing employment in industries with			
			Strongly increased international competitiveness	Increased international competitiveness	Weakly increased or decreased international compet.	Strongly decreased international competitiveness
Malmoe	1965	66,2	18,6	17,3	7,5	22,9
	1975	64,3	21,0	17,9	6,0	19,5
Gothenburg	1965	76,2	19,1	8,9	8,0	40,2
	1975	76,3	29,3	9,8	5,1	32,1
Stockholm	1965	66,7	33,1	17,5	7,4	8,7
	1975	69,6	42,0	15,1	6,3	6,3
All Sweden	1965	67,9	18,1	20,8	12,0	17,0
	1975	68,9	24,8	20,1	10,5	13,5

Note: the changing international competitiveness is measured by $\Delta[(X - M)/C]_{1960-1975}$, where X = exports, fob, M = imports, cif, and C = apparent domestic consumption.

Source: see Table 3

declining competitiveness was not balanced by the expanded Volvo assembly plant.

The Malmoe region also had a relatively large dependence on industries with a poor international performance. Moreover, its industrial composition did not improve particularly well from 1965 to 1975.

Summarizing, there is again little evidence that the urban regions adjusted better than the rest of Sweden with respect to the variations in the industries' international competitiveness. By and large, it seems as if the urban regions, in a ten year period, are relatively locked in with the industrial composition they had in the first year of the period. The fact that the Stockholm region performed structurally better than the other two is consistent with this hypothesis since it had by far the best composition of all urban and non-urban regions.

Table 9 presents figures on the relative employment size of all regions. The variations in performance across regions are similar to those discussed with respect to the market growth rate in Section 4. The comments on Table 9 can, for this reason, be restricted to what follows.

First, the Boraos region had by far the worst industrial composition, also with respect to the industries' revealed comparative advantages. Another regional aid receiving area with a similar bad composition was the Inner Aid Area. Both regions, but particularly the latter, managed to improve their industrial composition more than Sweden as a whole. However, even their relative strength in industries with a strongly decreased international competitiveness was enhanced until 1975. Obviously, this could mean future employment problems unless regional and industrial subsidies continued to keep a protectionist shield around these industries.

The Bergslagen region and the Outer Aid Area had, in 1965, a better industrial composition. However, for both regions this is largely due to their specialization in the metal industries which successfully , but with decreasing profitability, adjusted to decreasing relative world market prices throughout the 1960s. Especially in the past few years the world-wide problems of this

Table 9. Index of relative employment size by region and sector 1965 and 1975. Index = 100 for all Sweden each year.

Region	Year	Footloose sector	% manufacturing employment in industries with			
			Strongly increased international competitiveness	Increased international competitiveness	Weakly increased or decreased international compet.	Strongly decreased international competitiveness
Malmö	1965	98	103	83	62	135
	1975	93	85	89	57	145
Gothenburg	1965	112	106	43	66	236
	1975	111	118	48	49	239
Stockholm	1965	98	183	84	62	51
	1975	101	169	75	60	47
Southwest	1965	96	63	68	183	105
	1975	87	68	62	172	94
Southeast	1965	99	107	80	135	89
	1975	101	100	87	138	95
Baraös	1965	131	26	47	244	266
	1975	126	35	71	242	286
South Lake Vänern	1965	106	148	74	128	83
	1975	107	156	47	166	61
East Middle	1965	109	106	111	110	108
	1975	107	107	116	104	97
Bergslagen	1965	104	20	252	86	27
	1975	105	24	252	82	53
Outer Aid Area	1965	72	79	109	57	31
	1975	82	93	109	70	30
Inner Aid Area	1965	56	50	34	70	79
	1975	72	74	51	67	106
All Sweden	1965	100	100	100	100	100
	1975	100	100	100	100	100

Source: see Table 3

sector also reached Sweden, and were there reinforced by the sudden contraction of the domestic shipyards and the stagnation of the domestic car production. It is generally believed that the problems of the metal industries are not only of a short-run nature. The lack of private risk capital led to a half-nationalization of the three largest basic steel producers in 1978. At the same time, they were merged and a contraction plan was decided which implies a substantial loss of employment in the Bergslagen region and the Outer Aid Area. The former region is also struck by a rapid contraction of several quality steel producers.

Considering the metal industry as an exception, it seems safe to conclude that even with respect to revealed comparative advantages the regions receiving regional aid appear to be relatively fast adjusters. It did not seem to matter substantially that the initial industrial composition was ordinarily not good. Consequently, one of the important keys to a better understanding of regional industrial change may obviously be the Swedish regional policy and its interregional employment distribution effects.*

6. RELOCATION OF ESTABLISHMENTS AND CHANGES IN SIZE OF ESTABLISHMENTS AS SOURCES OF EMPLOYMENT CHANGE

The preceding section produced the hypothesis that the existing industrial composition in 1965 seemed to explain much of whether or not a given urban region had a good or bad composition in 1975. The indication that the urban regions did not appear to be particularly fast adjusters may in fact be attributable to *either* the existing market and competitiveness characteristics of large firms with a low adaptability and a resistance to discontinue production *or* to a slow formation of new firms. Although for data reasons it is impossible to study the urban industrial change by categories of firms, i.e., entries, exits, and permanent firms, some further insights may be gained by looking at the change in average establishment sizes and number of establishments. It must be emphasized here that Swedish industrial statistics include only establishments with at least five

*This issue is one of the topics of a forthcoming working paper.

employees. Apart from this, the data sources are pretty reliable from the point of view of reflecting the true development between the years 1965 and 1975 of the number of establishments.

Table 10 gives the figures for Sweden as a whole. Recalling that the footloose sector gained employment, that the trade sheltered sector had a constant employment (and employment share) and that the raw material based sector lost in number of employees, it is evident that the comparatively good performance of the footloose sector is associated with a smaller decrease in its number of establishments. Both the other sectors had a larger increase in the average number of employees per plant.

Table 10. Changes in the number of establishments and employees per establishment 1965-75 in Sweden as a whole.

Sector	Number of establishments			Employees per establishment		
	1965	1975	Change in %	1965	1975	Change in %
Trade Sheltered	4845	3968	- 18	35	43	23
Raw material based	1786	1311	- 27	66	84	27
Footloose	6908	6383	- 8	88	97	10
(A) with						
1.Strongly increased competitiveness	1472	1803	22	110	124	13
2.Increased competitiveness	1811	1712	- 5	104	105	1
3.Slightly increased or decreased competitiveness	1698	1551	- 9	62	62	0
4.Strongly decreased competitiveness	1927	1317	- 32	79	92	16
(B) with						
1.Rapid market growth	1924	2158	12	63	74	17
2.Good market growth	2106	2076	- 1	97	110	13
3.Slow market growth	1100	1046	- 5	131	133	2
4.Stagnating or contracting markets	1778	1103	- 38	78	87	12

There is a rather common belief that the increased plant size in the manufacturing industry is attributable to growing economies of scale and/or optimal production scale inducing longer production runs. If this can be taken for granted the limited foreign competition in trade sheltered industries did not seem to prevent the utilization of these scale economies. According to Table 10, a relatively large number of *small* establishments were discontinued between 1965 and 1975. However, in 1975 the trade sheltered sector had still, on average, less than half of the number of employees per plant in the footloose sector.

The raw material based sector also experienced a relatively large contraction of small sized establishments. This development would probably have been much more evident had not the energy crisis in 1973 brought about a tremendous rise in the relative prices of raw materials and raw material intensive products.

The intersectoral differences are even more striking within the footloose sector disaggregated as above by industry groups varying with respect to changes in international competitiveness and demand growth rates. In industries with a strongly improved competitiveness (and with a rapid market growth) the number of plants increased rapidly. In addition, the number of employees per plant grew more than on average. The lower the industries were ranked with respect to these growth criteria, the more they lost establishments. The industry group with the worst rank enhanced the relative plant size. Probably this was due to a more rapid discontinuation of small plants.

Obviously, an increase in the number of establishments in a sector is not to be interpreted as an increase in the number of firms. On the other hand, even the establishment figures of Table 10 seem to reflect the very strong influence of the two criteria behind the comparative growth performance of industries and firms. The earlier indications that the urban regions did not adjust particularly well may be reappraised by looking at their establishment changes. Table 11 presents the appropriate figures.

Almost without exception, the number of plants decreased all over Sweden in the trade sheltered, raw material based, and footloose industries, the exception being the footloose industries in

Table 11. Changes in number and size of establishments 1965-1975 by trade sheltered, raw material based, and footloose sectors, and by region.

Region	% change 1965-1975 in number of establishments			Employees per establishment % change 1965-1975					
	Trade sheltered sector	Raw material based sector	Footloose sector	Trade sheltered sector	Raw material based sector	Footloose sector	Trade sheltered sector	Raw material based sector	Footloose sector
Malmö	-18	-38	-13	43	85	91	19	62	3
Gothenburg	-20	-22	-19	36	54	114	33	9	25
Stockholm	-18	-31	-14	50	91	82	-4	25	7
Southwest	-13	-30	-4	28	41	63	50	73	5
Southeast	-22	-25	-5	33	40	60	30	30	17
Boraos	-10	-26	-17	24	17	59	0	76	0
South Lake Vänern	-27	-26	-13	31	66	82	45	35	33
East Middle	-18	-26	-8	41	56	118	20	27	6
Bergslagen	-22	-24	-4	32	142	202	9	24	1
Outer Aid Area	-15	-28	8	27	98	98	41	13	15
Inner Aid Area	-11	-15	42	18	36	31	61	42	48
All Sweden	-18	-27	-8	35	66	88	23	27	10

the two aid areas. In general it is also true that the decrease was smaller for the latter sector. In only one of nine possibilities an urban region had a smaller decline than Sweden as a whole. Typically, the three urban regions did not perform well in this dimension in the more expansive footloose sector.

Only in two out of nine possibilities were the average number of employees per establishment lower in a metropolitan region than in Sweden as a whole. In only a third of the cases, the percentage increase in plant size was larger in these regions. Therefore, the three metropolitan regions lack of employment growth in the manufacturing industry appear to be associable to a lack of a better than average performance with respect to both creation of new plants and growth of existing ones. In both respects the two regional aid areas had a better record, especially the most highly subsidized Inner Aid Area.

Table 12 provides the same figures as Table 11, but for footloose industries aggregated with respect to changing international competitiveness. These figures and also similar figures for footloose industries classified after market growth rates* underscore the results of Table 11. The metropolitan regions had a more unfavorable development in the number of plants than other Swedish areas, particularly the regional aid areas. Both the Malmoe and Stockholm regions had, in addition, a lower increase or even decrease in the average number of employees per plant. The Gothenburg region favorably differed from the other two which may account for the fact that it was the only metropolitan region that managed to maintain its manufacturing employment from 1965 to 1975.

Table 12 provides again striking evidence about the good performance of the Aid Areas and, particularly, the Inner Aid Area. They were able to enhance the number of plants especially in industries with an improved competitiveness and in addition subsequently increase the average plant size. In a forthcoming paper it will be made clear whether or not regional policy may account for this good record.

*Not presented here.

Table 12. Changes in number and size of establishments 1965-75 by various competitive and non-competitive footloose sectors and regions.

Region	% change 1965-75 in no. of establishments				Employees per establishment in 1965				% change 1965-75			
	Strongly increased competitiveness	Increased competitiveness	Slightly increased or decreased competitiveness	Strongly decreased competitiveness	Strongly increased competitiveness	Increased competitiveness	Slightly increased or decreased competitiveness	Strongly decreased competitiveness	Strongly increased competitiveness	Increased competitiveness	Slightly increased or decreased competitiveness	Strongly decreased competitiveness
Malmö	19	-7	-18	-41	125	70	50	126	-11	0	4	32
Gothenburg	-10	-9	-7	-47	108	47	63	232	71	17	-27	54
Stockholm	5	-20	-15	-36	129	57	67	64	6	-11	0	-2
Southwest	21	-5	1	-23	54	98	63	45	33	-5	-8	2
Southeast	35	-1	-18	-21	97	58	38	70	2	12	21	14
Borås	63	-9	-11	-30	49	51	81	53	-4	39	-19	2
South Lake Vänern	21	-1	-9	-41	171	106	47	53	35	-29	51	9
East Middle	22	-1	2	-42	141	148	99	93	10	-3	-16	17
Bergslagen	27	-7	-11	-27	46	379	155	66	22	1	-12	106
Outer Aid Area	44	7	8	-28	107	173	60	42	23	-2	12	19
Inner Aid Area	109	47	32	12	37	29	37	25	57	66	0	56

Summarizing, the analysis of the comparative plant development of urban regions gives reason to conclude that the relative slow adjustment of urban regions with regard to the changing employment composition hangs together with a) a lack of strong expansion of the number of plants in industries with improved competitiveness, as well as b) a lower than normal increase in the average plant size, especially in these industries. The good industrial composition in Stockholm in 1975 appears to be attributable to an already good composition in 1965 and an unusually bad development in all industry sectors except those with a strongly improved competitiveness more than a successful expansion of existing and new plants/firms in such growth industries. This combination helps to explain why the Stockholm region lost 11 percent of its manufacturing employment in a ten-year period.

The fact that the Gothenburg region succeeded in maintaining its manufacturing employment was attributable to a substantial growth in the average plant size in each sector. This increase counteracted the employment losses due to an initially poor industrial composition as well as the relative scarcity of new establishments creating new employment.

By and large, there is no indication in the footloose sector that there exists strong threshold values for new and small plants associated with increased scale optimum or minimum plant size levels. It is the smallest rather than the largest plants that appear to have grown more. However, on this point the conclusions are uncertain due to the combination of possible aggregation problems and poor measures of establishment development.

7. TECHNICAL CHANGE AS A SOURCE BEHIND CHANGING SECTORAL LABOR REQUIREMENTS

Within the footloose sector, two sources behind changes in in the employment composition were introduced as more or less independent, self-contained causes to these changes. Obviously, a third cause is technical change. Variations in technology between industries* and technical change** affect and may also be affected by the comparative advantage of the industries. The

*That is, differences in production functions.

**Here technical progress or change is treated as if it is usually not causing shifts in industry production functions.

ensuing analysis brings in technical change as a source of employment composition changes without introducing the full complexity in the relationships between technology, comparative advantage and demand. Put another way, technical change is introduced as a third, independent and self-contained cause of the employment development, but is not utilized in a separate classification of industries.

To compare variations in technology between sectors affecting the use of labor is easily done with the statistical data at hand. A cross-sectoral comparison of how technical change has affected labor use changes, and therefore employment composition by sector, is far more intricate. The main reason for this is that the 1965-75 period was an inflationary period, which involved relative price changes and that input and output price data at the sectoral level cannot be obtained. Even without price data some pieces of information can be captured.

Table 13 presents some aggregate technological characteristics by sector for Sweden as a whole. Recalling that changes in the international competitiveness and differences in market growth rates primarily affect the development of sales, the table shows the levels in 1965 and relative changes in 1965-75 of the value added/sales and value added/employee ratios. The variations in the latter ratio in a given year are partially explained by variations in the capital labor ratio, which is measured with two proxy variables published by Swedish industrial statistics. Before commenting upon the footloose sector a few notes can be observed regarding the differences between this sector and the other two.

The value added/sales ratio was substantially higher in the footloose sector than in the other two sectors in 1965. Together with a lower labor productivity this explained the then much larger labor use per crown of sales in the footloose industry. Despite a clear tendency towards a leveling of the value added/sales ratios from 1965 to 1975, these differences remained large even in 1975.

Table 13. Some characteristics of sectoral technology variations and technical change in Swedish manufacturing industry 1965-75.

Sector	Index (1965 = 100) for 1975				1965 values of			
	Value added/sales	Value added/employee	Motive capacity/employee	Electricity consumption/employee	Value added/sales	Value added/employee	Motive capacity/employee	Electricity cons./employee
Trade sheltered	123	266	133	151	39	3742	582	1128
Raw material based	103	320	142	142	35	4039	3056	8814
Footloose	89	251	105	139	52	3510	819	2073
A) with								
1.Strongly increased comp.	78	220	104	162	58	4254	458	1089
2.Increased comp.	88	245	108	134	51	3562	1488	4214
3.Slightly incr. or decr. competitiveness	100	267	101	127	52	3283	550	796
4.Strongly decr. comp.	107	283	127	169	45	2815	570	1365
B) with								
1.Rapid market growth	104	263	104	116	46	3426	627	2077
2.Good market growth	81	234	101	130	57	4007	666	1967
3.Slow market growth	86	234	102	130	51	3616	1565	3063
4.Stagn. or contr. markets	102	276	128	239	49	2746	441	1204

The lower value added/employee ratio in the footloose sector in 1965 compared to the trade-exposed raw material based industry can also be compared with the much larger measured differences in capital intensities (and electricity consumption/employee). If the international competition was working well, the much smaller productivity difference should be attributable to a higher human capital intensity in the footloose sector. As will be demonstrated below, the latter is true, but may not be the whole truth. Up until 1975, the relative value added/employee ratio increased much faster in the raw material based sector than the simultaneous relative increase in capital (and electricity) intensities might account for. The probable explanation is the drastic relative price increase of raw material based products after the energy crisis in 1973, an increase that followed a twenty year long decline in the same price ratios (again after the boom during the Korean war). Over the period 1965-75, the relative changes in labor use per crown of sales were about the same in the two trade exposed sectors.

Within the footloose sector the industry differences are most interesting for the decomposition using the revealed comparative advantage classification. In 1965 both the value added/sales and the value added/employee ratios were higher the better the industries comparative advantage ranking. The labor productivity variations were not then positively correlated with the non-human capital intensity variations. In a well functioning world market this would imply a closer, positive association with the human capital intensity.

Between 1965 and 1975 the two value added ratios increased relatively more the worse the competitiveness ranking of the industries were. *Ceteris paribus* these changes counteract each other in their effects on the labor use per crown of sales value. However, given that the differences in the value added/sales ratio changes were the larger ones, the combined results are that the relative labor use declined more in industries that improved their international competitiveness than in industries with a deteriorating international performance. Since there were no systematic relationships between the changes in competitiveness and the capital/labor ratio changes, it is possible to conclude that the broad characteristics of technical development tended to counterbalance the influence of a changing comparative advantage on the changes in the employment composition.

The changing sectoral composition and differences in technical change among the sectors also have implications on the kinds of labor demanded. Table 14 provides some information about this. The increased emphasis on products from the footloose sector have apparently stimulated the demand for non-manual labor more than the demand for manual labor. It has also meant a strongly enhanced demand for technical personnel, e.g. engineers rather than for management and sales personnel. There was, in addition, an increase in the proportion of technical personnel in all three sectors.

Within the footloose sector, the changes in the international competitiveness (but not the market growth rate) were associated with the use of various labor skills. It is evident that the international competitiveness improved with higher non-manual labor intensity in 1965 (or 1975) and that the variations in this intensity was largely attributable to the technical personnel intensity. The growth of industries with an improved comparative advantage must therefore have meant a particularly large demand growth for technically educated manpower. There is also evidence that it must have implied a strong increase in the demand for skilled workers.* Finally, the demand for technicians was stimulated by the enhanced proportion of technical personnel in all sectors.

This information about the national/sectoral nature of technical change and structural development provides a background for the analysis of the possible regional differences in the demand for labor. It has been mentioned that the urban regions were, in the middle of the investigated period, the most abundant in human capital together with the East Middle region. This was especially true for the Stockholm region. Since all three metropolitan regions (and the East Middle region as well) were also the most well

*See Ohlsson (1976) ch. 6, or Ohlsson (1977c), which show that within the engineering industry Sweden increased its specialization in skilled manual worker-intensive production. Also, since the share of this industry in exports increased more than in imports and since it had a much higher skilled manual worker-intensity than other industries, it is clear that the above conclusion must hold.

Table 14. Shares of certain non-manual labour in total employment 1965 and 1975 by sector in Sweden as a whole

Sector	1965 share (in %) of			1975 shares (in %) of		
	Total non-manual labour	Technical personnel	Management and sales personnel	Total non-manual labour	Technical personnel	Management and sales personnel
Trade sheltered	25	3	4	27	4	5
Raw material based	18	3	2	21	5	3
Footloose	27	8	2	29	10	2
A) with						
1.Strongly increased comp.	31	12	2	31	13	2
2.Increased comp.	29	9	2	31	10	3
3.Slightly incr. or decr. competitiveness	25	6	3	28	8	4
4.Strongly decr. comp.	21	6	2	23	7	2
B) with						
1.Rapid market growth	26	7	3	27	9	3
2.Good market growth	30	11	2	31	12	2
3.Slow market growth	27	8	2	29	10	2
4.Stagn. or contr. markets	23	6	3	28	10	3

developed with respect to the formation of new human capital as well as new non-human capital, one would presume that they would have the best capacity to transform their industrial composition into a more human skill oriented specialization profile. According to Table 14, this generates the already rejected hypothesis that the metropolitan regions would have a particularly rapid expansion of the two footloose sectors that had improved their international competitiveness. Instead, it was the Aid Areas which had the best sectoral adjustment performance.

It may, however, still be the case that the metropolitan regions were the most well-behaved in this respect if it can be shown that their intrasectoral adjustment meant that the most human skill intensive industries and activities remained and flourished in these regions and that other regions and the Aid Areas in particular had a rapid growth in the least skill intensive parts. This issue will be studied in the following section especially for two groups of labor skills: technical personnel and management and sales personnel. The latter group of non-manual workers is, overall, a firm-specific labor which is not closely integrated with the physical transformation of purchased inputs into finished products. It may or may not therefore be a typical activity of city and metropolitan regions.

Technical personnel is, on the other hand, in most cases typically associated with activities at the plant level. In certain industries technical personnel is also used intensively in R & D departments, a firm level activity. To the extent that the latter activity dominates over the former, the metropolitan concentration of technical personnel would be expected to be larger.

8. URBAN AND REGIONAL VARIATIONS IN THE USE OF SKILLED LABOR

Table 15 presents the variations between regions in certain skill intensities, all of which are non-manual. The three metropolitan regions all have higher proportions of non-manual workers than in the Swedish manufacturing industry as a whole. However, it is only the Stockholm region that deviates considerably in this respect, mainly due to its substantially higher intensities

Table 15. Regional variations in certain non-manual skill intensities 1965-75.

Region	% Non-manual labour 1965	% Managerial and sales personnel 1965	% Technical personnel 1965	% Clerks 1965	% Foremen 1965	% Non-manual labour 1975	% Managerial and sales personnel 1975	% Technical personnel 1975	% Clerks 1975	% Foremen 1975
Malmö	27,3	3,5	6,3	12,7	4,2	30,8	4,0	8,4	13,4	4,1
Gothenburg	27,9	2,7	8,2	12,2	4,4	31,7	2,7	10,8	13,8	4,0
Stockholm	37,2	3,6	10,8	17,5	4,3	42,7	3,7	14,4	19,2	3,9
Southwest	20,4	3,0	3,7	9,3	4,0	22,3	3,5	4,8	9,6	4,1
Southeast	20,3	2,9	4,2	8,8	4,1	23,1	3,2	5,8	9,7	4,0
Borås	17,2	3,6	2,1	7,5	3,9	21,3	4,5	3,5	9,0	4,0
South Lake Vänern	21,5	2,2	5,7	9,2	4,2	22,2	2,1	6,8	9,0	4,0
East Middle	27,3	2,3	8,4	12,0	4,4	29,5	2,3	10,2	12,5	4,1
Bergslagen	24,0	1,3	7,6	10,5	4,4	26,4	1,7	8,9	11,0	4,6
Outer Aid Area	19,6	1,9	4,3	8,4	4,5	22,2	2,2	5,9	9,0	4,5
Inner Aid Area	17,6	4,0	1,9	6,9	4,2	18,5	3,5	3,4	6,9	4,3
All Sweden	25,3	2,7	6,6	11,2	4,3	27,8	2,9	8,4	11,8	4,2
Mean value	23,66	2,82	5,75	10,45	4,2	26,43	3,04	7,54	11,19	4,15
Standard deviation	5,91	0,83	2,81	3,02	0,19	6,89	0,89	3,39	3,39	0,23
Coefficient of variation	0,25	0,30	0,49	0,29	0,04	0,26	0,29	0,45	0,30	0,05

of technical personnel and clerks. The latter category is dominated by low- and unskilled labor and the former with very high skilled labor. The other high skilled labor category is the proportion of managerial and sales personnel. Evidently this category is not as concentrated in the urban regions as technical personnel. Even in the case of technicians the concentration is merely related to the extreme values of the Stockholm region at one end and the Boraos region and Inner Aid Area at the other. From the point of view of a varied local or regional labor market, the concentration of clerks appears therefore to establish a larger problem related as it is to the availability of low skilled jobs for female labor.

From 1965 to 1975, the proportion of non-manual labor increased by about 10 percent at an almost stable total employment. The only skill category within this labor group which had a more rapid growth was technical personnel (+ 27 percent). The expansion of the latter category in total employees did not, however, mean a further regional concentration. The coefficient of variation dropped slightly instead, despite an above average increase in the technical personnel intensities of the three urban regions. Instead, the leveling was attributable to particularly the Boraos region and the Inner Aid Area, both of which enhanced their technical personnel intensities at a rate higher than double that of all Sweden.

Relating these results with findings of earlier sections the following picture emerges: the increased technical personnel densities of the metropolitan regions and especially the Stockholm region appears to be at least partially attributable to the rapid decline of employment in non-competitive sectors. In the case of the Stockholm region, the absolute decline in employment in all sectors except the footloose sector which had a strongly improved international competitiveness, worked clearly in this direction, since the latter sector was by far the most technical personnel intensive (in Sweden as a whole). It has also been shown earlier that the regional aid areas in general and the Inner Aid Area in particular obtained the fastest improvement in their sectoral composition implying either a higher than average increase in technical personnel intensities or interregionally varying technical personnel intensity rankings.

The finding of a higher technical personnel intensity in metropolitan regions is, according to Table 16, not due to a higher intensity in *every* sector. This does not hold true for the Malmoe region although it is most often respectively always true for the Gothenburg and Stockholm regions. With regard to the Stockholm region, it is therefore possible to conclude that its very high share of technical personnel is attributable to both an intersectoral specialization in sectors where this share is high and an intra-sectoral specialization in industries or activities with a high technical personnel intensity.

A comparison between the coefficient of variation over regions (see Table 16) with the corresponding coefficient estimated for each region over six sectors (trade sheltered, raw material based and four footloose sectors) reveals that the intersectoral variation* in technical personnel intensities was often higher than the interregional in 1965. Between 1965 and 1975, the interregional relative differences declined in all sectors except in the sector with the initially smallest differences, in which sector they remained stable. Accordingly, the growth of the Swedish technical personnel intensity involves a tendency towards declining regional (relative) differences.

Table 16 suggests that the intersectoral variations in technical personnel intensities are similar across regions. It is always true that the footloose sector has a higher intensity than the other two, and it is usually the case that the raw material based sector has the second highest value. The two footloose sectors which have improved their international competitiveness have in ten out of eleven regions higher shares of technical personnel than the other two sectors. This intersectoral stability is all the more surprising since a) the principles of aggregation of the 110 industries do not take account at all of the factor intensities of production, b) the varying size of the regions causes differences in their degree of production diversification and c) one of the leading principles of spatial aggregation into regions was the differences in human skill intensiveness of spatial micro units.

*Notice that the number of sectors is only 6 compared to 11 regions. The regions have also been defined in order to enhance the regional differences while the aggregation of industries has followed other principles. The intersectoral deviations in technical personnel intensities are therefore probably much larger at a level of, say, 11 sectors aggregated with respect to the variations in technical personnel intensities.

Table 16. Regional variations in technical personnel intensities (in %) by sector in 1965.

Region	Footloose industries with						
	Trade sheltered	Raw material based	Foot-loose	Strongly increased international congestiveness	Increased intern. comp.	Slightly incr. or decr. intern. comp.	Strongly decreased intern. comp.
Malmö	2.4	5.2	7.8	7.9	7.8	6.1	8.4
Gothenburg	2.5	3.4	9.9	13.4	9.3	4.3	9.5
Stockholm	3.6	6.6	14.1	18.5	10.5	10.2	8.0
Southwest	2.4	2.9	4.3	4.0	6.7	3.7	1.7
Southeast	3.2	2.7	4.8	7.0	4.8	2.7	4.3
Boraas	1.1	0.5	2.3	3.9	4.4	2.7	1.4
South Lake Vänern	2.7	3.0	6.9	9.7	8.0	4.5	2.6
East Middle	2.6	2.8	10.4	16.1	11.7	7.7	4.8
Bergslagen	1.8	3.6	9.5	4.8	10.0	11.6	3.1
Outer Aid Area	2.1	2.7	6.1	7.0	7.3	3.8	1.6
Inner Aid Area	1.5	1.3	2.8	4.0	6.7	1.0	1.2
All Sweden	2.7	3.3	8.4	12.2	8.9	5.7	5.6
Mean value in 1965	2.35	3.15	7.17	8.75	7.93	5.30	4.24
Standard deviation in 1965	0.72	1.66	3.60	5.13	2.30	3.29	3.07
Coefficient of variation 1965	0.30	0.53	0.50	0.59	0.29	0.62	0.72
Mean value in 1975	3.56	4.42	9.07	10.26	9.17	7.92	5.86
Standard deviation in 1975	1.02	2.18	4.39	5.27	2.69	4.43	3.33
Coefficient of variation 1975	0.29	0.49	0.48	0.51	0.29	0.56	0.57

In conclusion, these results appear to indicate that the intersectoral variations in technical personnel intensities remain stable between regions and that these variations may be one of the most important factors behind the changing international competitiveness in the footloose sector. The former result compares well with an earlier finding for about half of the footloose industries, namely that 33 engineering industries had remarkably stable *relative* differences in the technical personnel intensity between 1954 and 1968.* The latter result conforms also well with an earlier finding that the Swedish engineering industries increased their international specialization in the technical personnel intensive production between 1960 and 1970.* The results of the present paper adds the regional dimension of this industrial adjustment process showing that all regions seem to share common incentives and that also in this respect the most backward regions managed to improve the most while the seemingly good adjustment capacities of the urban regions did not in fact lead to a rapid urban industrial adjustment. Moreover, there are indications that the differences in adaptability are associated with the regional variations in the creation of new establishments and the locational incentives of Swedish regional policy.

Table 17 presents the relative change in the technical personnel intensities by sector and region. There is a clear tendency that these intensities increased more the lower the initial value of the sector/region in 1965. This is also true for the Malmö and Gothenburg regions in footloose industries with strongly decreased competitiveness since this sector had unusually high initial values in these two regions.

Thus, Table 17 suggests two tendencies of a leveling of the technical personnel ratios. An indication of a slight such tendency was found for the above mentioned 33 engineering industries between 1959 and 1968 (see Ohlsson, 1976, ch. 6 and 1977). Two different kinds of interpretations were offered. One was based on the assumption of an exogenously given, biased technological change and the other that the intensive factor saving bias in Sweden's technical change was endogenously determined. The former

*See chapter 6 of Ohlsson (1976) or Ohlsson (1977c).

Table 17. Percentage changes in the technical personnel intensities 1965-75 by sector and region.

Region	Footloose industries with							
	All Sectors	Trade sheltered	Raw material based	Foot-loose	Strongly increased international congestiveness	Increased intern. comp.	Slightly incr. or decr. intern. comp.	Strongly decreased intern. comp.
Malmö	33	63	54	29	30	29	67	19
Gothenburg	32	104	65	26	15	17	63	19
Stockholm	33	19	21	31	19	15	69	23
Southwest	30	29	69	26	38	13	32	47
Southeast	38	47	44	33	47	46	33	28
Borås	67	82	60	65	36	59	19	93
South Lake Vänern	19	67	10	13	-9	-18	78	73
East Middle	21	35	29	20	-8	19	47	33
Bergslagen	17	28	17	15	35	17	5	126
Outer Aid Area	37	38	52	26	23	14	63	63
Inner Aid Area	79	93	69	50	33	85	230	83
All Sweden								
Mean value	36.9	55.0	44.5	30.4	23.5	26.9	64.2	55.2
Standard deviation	19.7	28.7	21.8	15.2	18.2	27.5	59.6	35.4
Coefficient of variation	0.52	0.52	0.49	0.50	0.77	1.02	0.93	0.64

case implies that the comparative advantage differences due to the factor abundance of the country and skill intensity differences between industries declined during the period.

If on the other hand, the intensive factor saving bias was endogenously determined, one possibility would be that it was explained by a change in Sweden's factor abundance and/or relative prices, meaning an increased comparative advantage in human capital intensive production. Such a change creates incentives for the producers of non-human capital intensive production to lower production costs and/or alter the product mix. In both cases technical personnel are the key category upon which the possible success of the adjustment depends.

In the latter perspective the relatively large increases of the technical personnel intensities in the least intensive sectors may be looked upon as an intrasectoral and interactivity change in specialization within sectors losing in comparative advantage. For sectors gaining in comparative advantage there are no strong incentives for a similar intraindustry or interactivity specialization change.

The tendency towards a regional leveling of the technical personnel intensities came during a period which, in its first years, experienced a balanced market for engineers for the first time in at least 15 years. In the latter part of the period there were even excess supplies leading to a further increase in the density of engineers in manufacturing employment over and above the increased technical personnel intensity. It is not surprising that such an alteration of market conditions is associated with a rapid increase in technical personnel intensities even in the most backward regions. However, there is enough evidence from the analysis above of a relatively successful adjustment of these regions regarding their industrial composition, entries of new plants etc., to suggest that this increase may not merely be a lagged adjustment of initially low technical personnel intensities.

Table 18 and 19 provide the same figures for the managerial and sales personnel intensities as Tables 16 and 17 for the technical personnel intensities. In the manufacturing industry as a whole, the former intensity was at least as high as in all Sweden

Table 18. Regional variations in the sectoral intensities (in %) of managerial and sales personnel in 1965.

Region	Footloose industries with							
	All Sectors	Trade sheltered	Raw material based	Foot-loose	Strongly increased international congestiveness	Increased intern. comp.	Slightly incr. or decr. intern. comp.	Strongly decreased intern. comp.
Malmö	3.5	3.4	5.7	3.2	1.8	3.9	6.2	2.7
Gothenburg	2.7	4.3	3.2	2.3	1.8	5.3	5.6	1.1
Stockholm	3.6	3.8	5.7	3.4	2.7	4.1	4.6	3.5
Southwest	3.0	4.4	3.2	2.6	2.8	2.1	2.8	3.0
Southeast	2.9	4.0	2.2	2.7	1.7	2.7	3.9	2.9
Boraos	3.6	4.1	4.3	3.5	3.5	4.5	3.0	3.6
South Lake Vänern	2.2	3.6	1.7	1.9	0.8	1.8	2.7	3.3
East Middle	2.3	3.2	2.8	2.0	1.3	1.9	3.1	2.0
Bergslagen	1.3	4.0	1.1	1.0	2.1	0.8	1.3	1.8
Outer Aid Area	1.9	4.3	1.1	1.6	1.3	1.2	2.6	2.9
Inner Aid Area	4.0	5.4	2.1	4.4	2.9	3.1	5.4	5.5
All Sweden	2.7	3.8	2.3	2.4	1.8	2.2	3.5	2.5
Mean value 1965	2.82	4.05	3.01	2.60	2.06	2.85	3.75	2.94
Standard deviation 1965	0.83	0.59	1.64	0.98	0.82	1.45	1.52	1.14
Coefficient of variation 1965	0.30	0.15	0.54	0.38	0.40	0.51	0.41	0.39
Mean value 1975	3.04	4.70	3.62	2.60	2.32	3.28	3.87	2.64
Standard deviation 1975	0.89	0.73	1.82	0.93	1.03	1.54	1.62	1.03
Coefficient of variation 1975	0.29	0.16	0.50	0.36	0.45	0.47	0.42	0.39

Table 19. Percentage changes in the sectoral changes of the intensities of managerial and sales personnel 1965-75 by region.

Region	Footloose industries with							
	All Sectors	Trade sheltered	Raw material based	Foot-loose	Strongly increased international congestiveness	Increased intern. comp.	Slightly incr. or decr. intern. comp.	Strongly decreased intern. comp.
Malmö	14	32	26	3	39	21	-5	-30
Gothenburg	0	21	13	-9	-17	-2	11	-9
Stockholm	3	13	0	-3	-19	17	39	-6
Southwest	17	-9	19	19	25	14	14	23
Southeast	10	30	18	4	24	37	3	-14
Boraos	25	46	23	23	20	16	33	17
South Lake Vänern	-5	6	35	-11	13	78	-22	-21
East Middle	0	16	32	-5	-8	0	6	0
Bergslagen	31	38	55	20	24	13	46	-33
Outer Aid Area	16	7	9	13	15	33	-4	14
Inner Aid Area	-13	-9	29	-30	14	-19	-43	-40
All Sweden	7	18	26	0	0	18	6	-8
Mean value	8.91	17.36	23.55	2.18	11.82	18.91	7.09	-9.00
Standard deviation deviation	13.25	18.11	14.69	16.02	18.61	25.15	26.28	21.13
Coefficient of variation	1.49	1.04	0.62	7.34	1.58	1.33	3.71	-2.35

in the metropolitan regions but also in the Inner Aid Area, and some other non-urban regions. In fact, it is difficult to find any systematic pattern at all in the two tables. The managerial and sales personnel intensity is obviously not playing the same role for the changes in Sweden's international competitiveness nor for that matter the regional division of labor. In fact, the variations in the employment shares of the low-skilled category clerks appears to be more important in the latter respect.

9. SUMMARY AND CONCLUSIONS

The purpose of the study was to investigate the industrial adjustment performance of Sweden's three metropolitan regions. These regions have a good internal capacity for human and non-human capital formation and have in addition been able to attract immigration of at least labor.

The focus of the analysis was to study changes in the manufacturing employment composition. Instead of using aggregated levels of industrial classification systems, the paper utilized analytical aggregates of 110 manufacturing industries. Two categories of industries were the foreign trade sheltered and the trade exposed, raw material based industries. The remaining 78 industries are called the footloose sector. It was divided into four sub-classes after two different criteria, one of which was the long-run growth rate of the domestic market, and the other was the long-run changes in comparative advantage patterns.

One of the main findings of the study is that the three metropolitan regions did not manage to switch over their employment relatively fast to sectors which either had a high market growth rate or had gained much in comparative advantage. The largest metropolitan region (the Stockholm region) had already, in the beginning of the period, a favorable employment composition especially with respect to the latter criterion but improved it most of all as a consequence of a rapid contraction of employment in sectors which ranked low on both growth criteria.

An analysis of the changes in number and (employment) size of establishments suggested that the bad performance of the metropolitan regions were probably associated with a relatively small number of new firm entries and/or outmigration of establishments

in industries ranking high on the two growth criteria. In addition, two of these regions had only small increases in the average employment size of the plants.

The study provides good underpinning to the conclusion that the best adjusters were not the metropolitan regions but rather regions which received regional aid because of employment problems within or without the industrial sector. Since these regions usually had an initially poor employment composition, this result implies a leveling of the regional differences in employment composition.

Technical change is looked upon as a third source of employment change in the above discussed industry classes. At the start of the period 1965-75, the footloose industry had a much larger labor requirement per crown of sales than the foreign trade sheltered and raw material based industries. This difference diminished somewhat during the period. Within the footloose sector the changes in labor requirement counterveiled the influence of comparative advantage changes on the employment growth. In other words, industries which gained in comparative advantage and therefore tended to expand sales *and* employment more had a more rapid decrease in labor requirements per crown of sales.

Industries which gained in comparative advantage where more intensively using skilled labor and especially technical personnel. Therefore, the interindustry and interregional adjustment to changing international conditions implied, *ceteris paribus*, also a leveling of the regional differences in the abundance of skilled labor.

The much higher technical personnel intensities in each sector of the Stockholm region imply a pronounced intersectoral or even interactivity specialization in production requiring a high proportion of technicians. However, the other two metropolitan regions did not favorably deviate in this respect from other regions and in all sectors. In fact, the regional differences in sectoral technical personnel intensities are shown to diminish during the ten year period.

Although the intersectoral skill intensities remain stable, the interregional relocation of production and the intersectoral,

interregional leveling of these intensities have brought about a higher relative growth of realized demand for skilled labor in regions which were initially scarce in this labor. Since this leveling occurred during a period when there was at least not an excess demand for engineers (and technical personnel), it appears as if educated labor has tended to move as a response to the out-migration of industrial production out of the metropolises.

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