TRACING REGIONAL PATTERNS OF INDUSTRIAL SPECIALIZATION TRENDS IN SWEDEN

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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 second of three focusing on the Swedish case study. In it the author discusses the industrial specialization trends of the urban regions, Stockholm, Gothenburg, and Malmoe. Particular attention is directed at initial patterns of specialization, the corresponding trends of other regions, and the trend in Sweden's international specialization.

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

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ABSTRACT

The analysis of the development of regional industrial specialization can seek to emphasize determinants which are specific to each individual region or those which are common to all regions. These two approaches may not, however, differ only with regard to explanatory variables, but also methodologically.

This study searches for determinants common to all or several regions in Sweden during a period of significant changes in its international specialization. The development of Sweden's three metropolitan regions is emphasized along with the development of areas in which an active regional industrial policy has been pursued. The analysis introduces a conceptual framework useful for the study of specialization trends in the "footloose" industry sector and some basic hypotheses. A regression analysis of these hypotheses is undertaken starting from a set of identities which establish some regional interdependencies in the commodity markets.

CONTENTS

TRACING REGIONAL PATTERNS OF INDUSTRIAL SPECIALIZATION TRENDS IN SWEDEN

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I. BACKGROUND AND AIM OF STUDY

This paper is one in a series of papers on changes in Swedish regional patterns of industrial specialization during the period 1965-1975 with emphasis on the three most densely populated metropolitan regions incorporating Stockholm, Gothenburg and Malmoe, respectively. The focus of this paper is the study of how the industrial specialization trend of each region relates to: a) its initial pattern of specialization, b) the corresponding trends of other regions, and c) the trend in Sweden's international specialization.

The purpose of this study is to capture characteristic features of these trends and how they are interrelated. The search light is thus scanning the industrial specialization relationships in order to reveal whether they may indicate simple, perhaps for all regions common, explanatory factors behind the changes in industrial specialization as opposed to identifying factors typical of each individual region. In particular, can the specialization trends of Sweden's regions be looked upon as a homogeneous entity vis-à-vis the rest of the world?

One determinant of the regional specialization trends is Swedish regional policy, which may induce differing trends

between the regions. In an ensuing paper its possible effects on the regional specialization patterns are analyzed in more depth.

The paper is organized as follows. Section II provides a shortcut into the conceptual framework. It is followed by a section outlining a set of identities underlying the economic analyses of regional interdependencies created by competition in the same commodity markets. Section IV presents the basic hypotheses to be tested, and Sections V - VII presents the results of the tests. The last section gives the conclusions and identifies several intricate problems for further analyses in subsequent papers.

II. A SHORTCUT INTO THE CONCEPTUAL FRAMEWORK

In itself, the analysis of this paper could have been presented almost without a theoretical underpinning. There are two reasons for providing such an underpinning, the first one being that the paper is one of a series. The second reason is that the field of empirical application is chosen to be consistent with a fairly well defined theoretical background. Therefore, the results cannot be fully understood unless a shortcut into the conceptual and theoretical framework is provided. To do this we will first discuss the interrelated concepts of industry, product, and process and then the regional concept.

One of the basic facts of the Swedish manufacturing industry is its heavy international dependence as can be seen by an export ratio of gross output of about 40 percent in 1975 and an import ratio of domestic consumption of manufactures of the same order. However, following the classification of Mennes, Tinbergen and Waardenburg (1969, Chapter 1.), there are local, regional, and national goods which almost never enter into Swedish exports and imports statistics. In this paper we are, for practical reasons, not interested in the regional specialization within foreign trade-sheltered industries. Out of a total of 110 manufacturing

industries, 15 are for this reason excluded.* In addition, 17 trade-exposed industries are excluded because they were judged to be closely tied to raw material production due to large transportation costs, technically integrated production processes, or policy imposed trade barriers.**

This leaves 78 manufacturing industries that could be defined as "footloose" in the sense that they could, in principle, be located at long distances from the core of the markets and from the supplies of used raw materials and intermediate inputs. A common denominator of the footloose producers is, in consequence, that their (price) competitiveness depends fundamentally on the relative costs of the value-added process. In a small, open economy with well functioning commodity and factor markets and efficient producers, the international competitiveness will depend on the relative prices of human and non-human capital and raw labor.

The theoretical idea behind the selection of industries is to classify industries in such a way that they will be roughly consistent with a production system with inter-industry flows, trade-exposed intermediate inputs and outputs exchanged at given world market prices*** and with one original primary factor, namely raw labor, and several produced ones, namely physical capital and categories of human capital or skills. In such a production system, each producer or regional cluster of producers will become quantity adjusters and their modus operandi will primarily be product mix and speed of technique changes with a secondary possibility of adjusting production costs by relocating

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*The exact definition of the foreign trade sheltered industries is provided in Ohlsson (1977a). Suffice it to say that both the export ratio of gross output and the import ratio of domestic consumption had to be less than 10 percent in 1960 and 1970 for an industry to be classified as trade sheltered.

**In the foot producing sector.

***Not included in these market prices are transportation and other transaction costs. Obviously the small country assumption is maintained and expanded to include trade in intermediate goods. Sweden is thus a price taker also for its secondary inputs, leaving the factor prices free to adjust only for its "internally produced" primary factors and raw labor.

the plants within or outside of the country. Another interesting characteristic of such a production system is that the factors of production are usually assumed to be internationally immobile even in the medium and long-run but regionally mobile in the short run.

The concept behind the aggregation of 278 local communes into 11 regions was that of homogeneous regions. The communes within a given region are chosen to be homogeneous with respect to their factor endowments and/or factor prices. Criteria used in the aggregation were the communes' physical and human capital intensiveness and whether or not they were confronted with a different set of factor prices due to regional aid. The fact that there are 11 regions indicates the existence of several human capital abundant regions, several physical capital abundant regions and several low and unskilled labor abundant regions. The reasons for allowing several regions in each category are size (spatial and industry size), population density, and geographical distance. Most regions are contiguous ones and the individual parts of non-contiguous regions are not separated geographically. Four of the regions approximate so called urban regions, three of which are metropolitan regions surrounding the three largest cities of Sweden, i.e., Stockholm, Gothenburg and Malmoe.*

One important conclusion can be drawn from the definition of regions (and the production system to be studied). It is that these regions constitute a homogeneous (national) entity, *with respect to changes in the industrial mix*, only if:

1. All of Sweden, during the period 1965-1975**, faced the same comparative advantage against the rest of the world***.
2. The comparative advantage is defined with respect to factor requirements of the value added process.
3. The strategic production factors of this process are either regionally mobile enough in the period, or accumulate in a direction tending to even out regional differences in factor abundance (endowment and price ratios).

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*The delineation of regions is reported in Ohlsson (1977b).
**A period of liberalization of international trade barriers but also a period of policy imposed regional barriers in the form of subsidies.
***Taken as a whole.

There are no other known theories which could generate the same regional specialization trends for regions constructed in this way. However, since a number of approximations had to be made there is not a 100 percent guarantee for this statement.

The rest of this paper is solely confined to the study of the kind of links in the interregional and international production system that are established via common commodity markets. Each industry is analytically treated as if it included close substitutes in demand, although not necessarily perfectly homogeneous. Due to the selection of industries (and the underlying features of the production system) it is not fundamentally important to distinguish here between, for instance, consumer, investment, or intermediate goods.

III. CONSUMPTION-DELIVERY IDENTITIES

For a given sector i, and a year without change in stocks, the following identity holds

$$\sum_{r=1}^{m} C_{ri} \equiv \sum_{r=1}^{m} O_{ri} - \sum_{r=1}^{m} X_{ri} + \sum_{r=1}^{m} M_{ri} \quad , \tag{1}$$

where

C = consumption
O = domestic production (gross output)
X = exports
M = imports
r = index for regions
m = number of regions

The lack of regional exports and imports statistics means that this relationship cannot be studied in its full regional breakdown. The following simplification can, however, be studied

$$C_i \equiv \sum_{r=1}^{m} O_{ri} - X_i + M_i \quad , \qquad i = 1,\ldots,78 \quad , \tag{2}$$

where

$$C_i = \sum_{r=1}^{m} C_{ri} = \text{Total Swedish consumption,}$$

$$X_i = \sum_{r=1}^{m} X_{ri} = \text{Total Swedish exports,}$$

$$M_i = \sum_{r=1}^{m} M_{ri} = \text{Total Swedish imports.}$$

As indicated in the preceding section, the sectoral selection has been made in a way that approximates full potential interregional and international mobility of the goods. Hence, from the point of view of regional specialization patterns, the actual spatial direction of exports and origin of imports is of minor importance. Expression (2) is therefore more useful than a quick look at its simplistic structure may indicate. Rewriting it in a form which normalizes for the size of the market in cross-sectional analyses over sectors, we have

$$1 \equiv \frac{O_{1i}}{C_i} + \frac{O_{2i}}{C_i} + \ldots + \frac{O_{mi}}{C_i} - \frac{X_i - M_i}{C_i} \quad ,$$

$$i = 1,\ldots,78 \quad , \quad (3)$$

where the cross-sectoral variation in last term is a measure of Sweden's specialization against the rest of the world. Each one of the other m terms reveals a specific region's specialization pattern against the sum of all other Swedish regions and the rest of the world. Here we are interested in the relationship between long-run trends in these specialization patterns rather than in their values in a given year.

Differentiating expression (3) yields

$$1 \equiv \Delta\frac{O_{1i}}{C_i} + \Delta\frac{O_{2i}}{C_i} + ... + \Delta\frac{O_{mi}}{C_i} - \Delta\frac{X_i - M_i}{C_i} \quad ,$$

$$i = 1,...,78 \quad . \quad (4)$$

Compared over the cross-section of 78 footloose industries this expression relates the pattern of specialization trends for each region to those of each other region and the rest of the world. In this paper, the focus is to reveal whether or not there are certain systematic relationships between the specialization trend of each region and, for instance, that of some other regions.

IV. BASIC HYPOTHESES

Three hypotheses are separately tested in the present paper. The first one is called the "derived-regional-comparative-advantage-hypothesis". It is based on the theoretical argument that a region performs better with industries in which the region is more strongly specialized.* The theoretical underpinning utilizes the concept of (regional) comparative advantages. Whether for natural reasons or because of investment, a region has acquired a competitive strength in certain lines of production. It may be argued that a continued rapid growth along these lines is more likely compared to a rapid growth in other lines of production.** This is at least the case as long as the region's comparative advantage is not fully exploited.

The sectoral selection of the paper excludes explanations based on first the regional supply of immobile natural resource endowments and, secondly, the acquired strength in production

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*See Brown (1972) Chapter 4., Cunningham (1969) and Weeden (1974) Chapter 5. for earlier theoretical or empirical analysis of this hypothesis. This paper avoids calling it the "specialization hypothesis" using instead a concept derived from the underlying theoretical arguments of the paper, since all three hypotheses above relate to specialization and are, therefore, specialization hypotheses.

**See Brown (1972) Chapter 4., (including appendices) for a deeper discussion on this point.

for the sheltered local, regional and national markets. In addition, regional definitions are made to distinguish between human capital abundant, non-human capital abundant and raw labor abundant parts of the country. An underpinning of the stated hypothesis based on factor proportions accounts could therefore be the following.

The regional factor markets are functioning in a way which provides a continuted cheap supply of resources which have been for a long time abundant in the region. This means that there exists a spatial segmentation of the markets for raw labor, human and non-human capital, respectively, a segmentation which establishes regional comparative advantages. In turn, it implies continued differences in relative factor prices, a direction of factor migration which is demand-led and does not tend to equalize initial differences in factor abundance and, finally, a non-homogenous comparative advantage vis-á-vis foreign countries.

However, there are other possible accounts of the derived-regional-comparative-advantage hypothesis than the factor proportions account. It may, for instance, be argued that although the latter account may help to historically explain the regional differences in the accumulation of certain factors rather than others, it does not provide a good explanation to the specialization changes during a period in which trade barriers were initially low and rapidly decreasing. Instead the regional industrial performance is then based on the relative size of the producers in the beginning of the period. Large producers have been, and are continuously, able to exploit economies of scale. They have, in addition, a more easy access to both production resources and (distant) markets due to information barriers, etc. Finally, a continued competitive strength may require the rapid introduction of new technical advances, which may be more easily developed or acquired by the large producer than the small.

Whichever underpinning one chooses for the derived-comparative-advantage-hypothesis, one would expect a positive relationship between the specialization trend of a region and its initial pattern of specialization. This hypothesis will be tested for

the relationships between

$$\Delta\frac{O_{ri}}{C_i}_{1965\text{-}75} \quad \text{and} \quad \frac{O_{ri}}{C_i}_{1965\text{-}75}$$

in the footloose industry sector of Sweden.

Normally, the null-hypothesis, i.e., a non-positive relationship between the two variables, does not need to be motivated. However, an earlier study of the changes in Sweden's pattern of engineering trade specialization found a negative relationship between similarly defined measures of specialization for Sweden as a whole.* Moreover, this negative relationship seemed, at least to some extent, attributable to a shift in specialization from a capital and raw labor-intensive specialization towards a skilled labor-intensive one. These results, if they can be generalized to all footloose industries, indicate negative relationships for the regional specialization trends studied, at least for regions which are not initially strong in human skill intensive sectors. Because we are only looking at specialization patterns without testing possible explanatory theories, it is sufficient to keep this underpinning of the null-hypothesis in mind when interpreting the results of the test.

A second hypothesis to be tested is the "regions-as-competitors-hypothesis". Expression (4) of the preceding section shows that an increased specialization of region r in commodity i can only be obtained at the sacrifice of another region or the rest of the world. For the whole cross-section of industries a change in a region's specialization might be accomplished either with effects spreading over all or most other regions/countries, or with a specific negative impact on particular regions or the rest of the world. The regions-as-competitors-hypothesis is based on the latter phenomena. Thus, it presumes the existence of a negative relationship between *some* regional specialization trends. The construction of the region is made in a way that is likely to cause such negative relationships between regions with a similar factor abundance. However, the simple tests in this paper do

*See Ohlsson (1976) and (1977c)

not discriminate between various explanations. The null-hypothesis to the regions-as-competitors-hypothesis is a non-negative relationship. Again, some such relationships may be given a theoretical underpinning: the significantly positive ones. If there are only insignificant and significant positive relationships between a region's specialization trend and those of other regions, it should also imply a non-negative correlation with the international specialization trend measure of expression (4), i.e., with $\Delta\frac{X_i - M_i}{C_i}$. Several regions have simultaneously changed their specialization in a way that primarily affects foreign producers.

Suppose now that similar patterns of relationships are found for each one of the eleven regions. This finding then may be interpreted as a consequence of the functioning of spatially homogeneous incentives for changes in Sweden's international specialization. It would also show up in positive relationships between the $\Delta\frac{O_{ri}}{C_i}$'s and $\Delta\frac{X_i - M_i}{C_i}$. However, such a unified pattern could normally be expected only if the regions had been defined in such a way as to produce diversified regions with a similar initial specialization, which is contrary to what was in fact done, or if no region had fully exploited its comparative advantage. Nonetheless, we shall make use of this possibility in testing a third hypothesis, namely the existence of positive relationships between each

$$\Delta\frac{O_{ri}}{C_i} \qquad \text{and} \qquad \Delta\frac{X_i - M_i}{C_i} \ .$$

This hypothesis will be called the "spatially-homogeneous-comparative-advantage-hypothesis". Its null-hypothesis is that there exists non-positive relationships (at least for regions that are not abundant in human skills).

The following three sections present the results of the basic hypotheses tested by regression analysis. Apart from some general remarks for the regions, the comments will focus on the three urban regions of Stockholm, Gothenburg and Malmoe.

V. THE DERIVED-REGIONAL-COMPARATIVE-ADVANTAGE-HYPOTHESIS

This hypothesis is tested for a linear relationship between

$$\Delta\frac{O_{ri}}{C_i}_{1965\text{-}75} \quad \text{and} \quad \frac{O_{ri}}{C_i}_{1965},$$

estimated for two different industry populations. One population includes all 1978 industries of the footloose sector and the other only those in which there is non-zero production in at least one of the years 1965 and 1975. Only the results for the whole footloose sector are reported in Table 1., since there are only minor differences in results for the two populations of industries. For some unknown reason, the inclusion (or exclusion) of industries with no activities, did not influence the results even for the more narrowly specialized small regions of Boraos and Inner Aid Area.

In Table 1. the regions are reported from South (and West) to North (and East). All regression coefficients are either significantly negative or non-significant. The null-hypothesis of a non-positive relationship cannot be rejected for any region. Instead, the significantly negative relationships give more support to the observation that the negative relationship at the national level may be explained by similar negative ones at the regional level.

There are four urban regions in the table, one of which is the textile and clothing industry region of Boraos. This region was, for a number of years, not stricken as much by the rapid contraction of this sector as were other parts of Sweden. In fact, during more than a decade it was probably giving good support to the investigated hypothesis. However, in the 1970s, this crisis eventually caught up even with the producers in this region. The largest producers moved production and started branches in northern Sweden (with support through regional aid) but particularly to Finland, Portugal (low wage EFTA* countries) as well as several other countries.

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*European Free Trade Association

Table 1. Regressions of regional specialization trends 1965-75, $\Delta\frac{O_r}{C}$, on the pattern of specialization, $\frac{O_r}{C}$ 1965.

Region	No. of producing sectors in 1965 and/or 1975	Constant	Regression coefficient (F value for $\frac{O_r}{C}$ 65	R^2	F-value (degrees of freedom)
Malmoe	69	0,021	-0,163[c] (-3,150)	0,115	9,924[c] (1;76)
Southwest	60	0,014	-0.050 (-0,785)	0,008	0,617 (1;76)
Southeast	63	0,024	0,140 (1,022)	0,014	1,044 (1;76)
Boraos	42	0,005	0,072 (1,125)	0,016	1,265 (1;76)
Gothenburg	61	0,020	-0,215[c] (-4,981)	0,246	24,813[c] (1;76)
South Lake Vanern	56	0,022	-0,195[c] (-2,182)	0,059	4,760[c] (1;76)
East Middle	70	0,016	-0,092[a] (-1,470)	0,028	2,160 (1;76)
Stockholm	62	-0,044	0,187 (0,997)	0,058	0,994 (1;76)
Bergslagen*	53	0,010	0,119 (1,361)	0,024	1,851 (1;76)
Outer Aid Area**	68	0,035	0,066 (0,412)	0,002	0,170 (1;76)
Inner Aid Area**	36	0,009	-0,230[c] (-3,547)	0,140	12,580[c] (1;76)

*This region is almost the same as the so called Grey Zone Aid Area and approximately covering the traditional mining and metal industry area which is part of central Sweden.

**Appointed areas for the regional policy system, which provides more instruments and higher levels of subsidization to the more mountaineous, sparsely populated Inner Aid Area than to the coastal parts of the Outer Aid Area.

[a]Significant at 10 percent level (one tail test for regression coefficients).

[b]Significant at 5 percent level (one tail test for regression coefficients).

[c]Significant at 2,5 percent level (one tail test for regression coefficients).

R = Multiple correlation coefficient.

Of the three densely populated urban regions two had significantly negative specialization relationships: Gothenburg and Malmoe. These two regions have had pretty severe unemployment problems related to the industrial sector during the last few years while Stockholm has managed to keep employment high. The Stockholm region is by far the most human capital intensive one in Sweden, followed by the other two urban regions and the East Middle Region. The composition of the footloose sector in Stockholm is, therefore, hypothetically relatively strong with respect to long run changes in Sweden's comparative advantage. Instead, the decline of manufacturing employment in the Stockholm region is probably attributable to the combination of severe labor shortages* and the attraction of moving production northwards under the auspices of the regional aid system.**

Summarizing there is no statistical support for the derived-regional-comparative-advantage-hypothesis. However, in the following sections we shall maintain the $(O_r/C)_{65}$ variable as an independent variable along with some other independent variables. In that fashion this hypothesis can be further elaborated.

VI. THE REGIONS-AS-COMPETITORS-HYPOTHESIS

Expression (4) implies that a region cannot gain a larger market share unless some other region(s) or the rest of the world take a loss. Over the cross-section of markets or industries investigated here, it is, however, possible that its gains and losses in specialization are not associated with the specialization trend of any other region in particular. This is especially the case in a small, open economy, in which all regions may change their industrial composition in a common fashion vis-á-vis the rest of the world. Obviously, a test of the regions-as-competitors-hypothesis is then far from trivial. The null-hypothesis, tested for each region separately, is that there is a non-negative relationship between the specialization trend of a region and the same trends of other regions.

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*Due to the growth of the service sector and preferences for service jobs on the part of large parts of the labor force.

**See the recent regional policy evaluation SOU: 1978:47 Chapter 8. This issue is planned to be a topic of a subsequent paper.

The tests are carried out with the help of multiple regression analyses, that exclude the international specialization trend variable $\left[\Delta\left(\frac{X - M}{C}\right)\right]$ from possible independent variables. Considering that the export and import ratios of consumption in the footloose sector almost reached the level of 50% in 1975 and that the two ratios varied differently over the cross-section of industries, the exclusion of this variable alone is probably sufficient in order to avoid estimating an identity. As an additional precautionary measure, a stepwise multiple regression analysis was used. As will be seen the risk of exhausting the variations in the dependent variable was, in fact, small. Moreover, the (simple) correlation coefficients between pairs of regional specialization trends was almost without exception below 0,5 (or even 0,4) indicating fairly small risks for multicollinearity.

As indicated in the preceding section, the measure of the initial specialization of the region is kept as an independent variable forced to be included in Step 1. of the regressions. Thus the following general form of the regressions was used:

$$\Delta\frac{O_k}{C}_{65\text{-}75} = a_{k0} + a_{k1}\frac{O_k}{C}_{65\text{-}75} + a_{kr}\,\Delta\frac{O_r}{C}_{65\text{-}75} + \mu_k \quad ,$$

where μ_k is the disturbance term assumed to have the usual statistical properties for OLS estimation and $k \neq r = 1,\ldots,11$.

For each region the regression is estimated a) for all footloose industries (78 observations) and b) for industries with non-zero production in the region in 1965 or 1975 (i.e., varying numbers of observations across regions). To preserve comparability over the regions, results from the first approach are reported for all regions, whereas results from the second approach are reported only in cases where the results of the two approaches deviated. The regressions presented contain only significant and close to significant independent variables (Table 2.)*.

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*With the exception of $\frac{O_k}{C}$, which is included in the first step to provide comparability with the results of Table 1.

Table 2. Regressions of regional specialization trends 1965-1975.

Region	Dependent Variable	Constant	Regression Coefficients (with t-ratio) for $\Delta\left(\frac{O_r}{C}\right)_{65-75}$; r =										Regression Coefficient for $\frac{O_r}{C}_{65}$	R^2	F-value (degrees of freedom)
			Malmoe	South West	South East	Boraos	Gothenburg	South Lake Vanern	East Middle	Stockholm	Bergslagen	Outer Aid Area	Inner Aid Area			
Malmoe	$\Delta\left(\frac{O_1}{C}\right)_{65-75}$	0,016	----	0,215[a] (1,461)	-0,117[c] (-2,213)				0,097[a] (1,397)			0,157[c] (2,877)	-0,310 (-1,145)	-0,[illegible][c] (-2,830)	0,336	[illegible]
South West	$\Delta\left(\frac{O_2}{C}\right)_{65-75}$	0,007	0,156[b] (1,884)	----	0,049 (1,190)							0,159[c] (3,873)		-0,100[b] (-1,957)	0,408	12,555[c] (4;73)
South East	$\Delta\left(\frac{O_3}{C}\right)_{65-75}$	-0,006	-0,426[c] (-2,105)		----	1,339[c] (4,362)				0,188[a] (1,525)		0,548[c] (6,769)	-0,730[a] (-1,443)	0,187[b] (1,829)	0,529	13,265[c] (6;72)
	"	0,006	-0,506[c] (-2,077)			1,467[c] (4,357)		0,371[a] (1,307)				0,539[c] (5,063)	-0,767 (-1,277)	0,113 (0,902)	0,514	9,866[c] (5;56)
Boraos	$\Delta\left(\frac{O_4}{C}\right)_{65-75}$	0,000	0,079 (1,150)		0,154[c] (4,499)	----						-0,079[c] (-2,332)		0,091[a] (1,577)	0,232	5,499[c] (4;73)
	"	-0,003	0,244[c] (2,170)	0,222 (1,193)	0,261[c] (5,428)	----								0,092 (1,212)	0,470	8,200[c] (6;37)
Gothenburg	$\Delta\left(\frac{O_5}{C}\right)_{65-75}$	0,014		0,388[b] (1,991)			----	0,477[c] (3,814)						-0,247[c] (-6,240)	0,404	16,709[c] (3;74)
South Lake Vänern	$\Delta\left(\frac{O_6}{C}\right)_{65-75}$	0,020		-0,235 (-1,156)			0,192[c] (2,487)	----	0,142[a] (1,485)			0,136[b] (1,999)		-0,201[c] (-2,376)	0,211	3,849[c] (5;72)
	"	0,011			0,184[c] (2,871)			----	0,148[c] (2,010)					-0,[illegible][c] (-2,557)	0,321	8,[illegible][c] (3;52)
East Middle	$\Delta\left(\frac{O_7}{C}\right)_{65-75}$	0,012	0,280[b] (1,810)					0,180[a] (1,492)	----	0,174[b] (1,695)			0,584[a] (1,385)	-0,099[a] (-1,650)	0,154	2,614[b] (5;72)
Stockholm	$\Delta\left(\frac{O_8}{C}\right)_{65-75}$	-0,017			0,119[a] (1,546)				0,200[b] (1,674)	----				0,019 (0,255)	0,073	1,345 (3;74)
Bergslagen	$\Delta\left(\frac{O_{11}}{C}\right)_{65-75}$	0,018	0,242[a] (1,453)								----	-0,197[c] (-2,885)		0,106 (1,251)	0,124	3,506[c] (3;74)
	"	0,020		0,414 (1,146)				0,806[c] (2,086)			----	-0,320[c] (-2,927)		0,129 (1,226)	0,200	5,002[b] (4;48)
Outer Aid Area	$\Delta\left(\frac{O_{12}}{C}\right)_{65-75}$	0,002	0,646[c] (3,214)	0,834[c] (3,085)	0,497[c] (4,965)	-0,679[c] (-2,041)		0,240[a] (1,661)			-0,385[c] (-2,660)	----		0,183[a] (1,522)	0,606	15,388[c] (7;70)
Inner Aid Area	$\Delta\left(\frac{O_{13}}{C}\right)_{65-75}$	0,010			-0,025[a] (-1,428)				0,030 (1,087)				----	-0,228[c] (-3,540)	0,176	5,270[c] (3;74)
	"	0,017	0,086 (1,109)		-0,089[b] (-1,787)	-0,127 (-1,207)		-0,186[a] (-1,686)	0,051 (1,150)		0,048 (1,013)	0,122[c] (2,475)	----	-0,224[c] (-3,143)	0,460	2,87[illegible][c] (8;27)

[a] Significant at the 10 percent level (one tail test for regression coefficients)
[b] Significant at the 5 percent level (one tail test for regression coefficients)
[c] Significant at the 2,5 percent level (one tail test for regression coefficients)

For each region there is a potential total of 10 independent variables of the type $\Delta\frac{O_r}{C}_{1965-75}$. Each population of industries has, therefore, potentially a matrix of 110 regression coffi-cients up to testing. The population, including all 78 foot-loose industries, obtained for the 11 regions, 25 significantly positive regression coefficients, 8 significantly negative, and the rest insignificant. With only 8 out of 110 coefficients negative, the null-hypothesis can be rejected. There is little indication that the pattern of specialization changes of one region is associated with the reversed pattern in other regions. In a narrow sense, therefore, regions do not appear to be close competitors to each other in the period 1965-1967.

Obviously, there are many more significantly positive regres-sion coefficients. This indicates that clusters of regions have changed their industrial composition similarly against the rest of the country, and the rest of the world. The attention here is primarily concentrated on the three urban regions of Malmoe, Gothenburg and Stockholm, but to some extent also on the aid areas.

One observation from the regression results is that the three urban regions do not change specialization in a way systematically related to the changes of the other two urban regions. The specialization trend of the Stockholm region is in fact not re-lated *closely* to any other regions, as indicated by the low R^2 coefficient. Recalling that Stockholm was the most human skill intensive region and that the country as a whole has been switch-ing towards a human skill-intensive trade specialization pattern, it is interesting to note the following facts.

The first fact is that Stockholm's specialization trend does not have a negative relationship with its 1965 pattern. A second finding is that this region has diminished the number of employees in the manufacturing industry. A possible consequence of this is, *ceteris paribus,* a less strong tendency towards a more human skill-intensive total Swedish output and export composition. A third observation is the positive relationship with the trend of the East Middle region, also one of the most skill-intensive-regions and the South East region. The latter region, a small firm

dominated, but not human skill intensive, region has been recognized for many years in Sweden as a successful, adjuster to changing world market conditions. The fourth fact is that the compositional changes of the Stockholm region are not (negatively) correlated to those of the aid areas. Therefore, a possible contribution to aid areas either through the outmigration of firms or through competition leading to declining market shares, does not seem to have been biased towards sectors of increasing or decreasing importance to the Stockholm region.

Neither in 1965 nor in 1975 was the Stockholm specialization significantly correlated (at the 5 percent level) to that of any other single region. As indicated by the following simple correlation coefficients, it had in 1965, and even stronger in 1975, a significant positive correlation with the measure of Sweden's trade specialization (78 observations):

	$[O_8/C]_{65}$	$[O_8/C]_{75}$
$[(X-M)/C]_{65}$	0,20	0,22
$[(X-M)/C]_{75}$	0,30	0,40 .

This information indicates the important part that the Stockholm region has played in the transformation of Sweden's industrial sector into a different role in the international division of labor. However, a further analysis of this new role is not a topic for this paper (see Ohlsson [1979]).

The Gothenburg and Malmoe regions are the remaining two human skill-intensive, densely populated regions in Sweden. As noted above, their respective specialization trends do not correlate with each other. Both trends are negatively correlated with the initial pattern of specialization of the region, indicating a move towards a systematically different industrial composition. This move was particularly pronounced for the Gothenburg region.

Another interesting fact is that the specialization trends of both urban regions are positively correlated with those of

neighboring regions, even though the same group of regions do not have similar initial patterns of specialization (Table 3.). Instead, there was originally a fairly close correspondence between the Gothenburg and Malmoe regions which, however, diminished during the 10 years studied.

According to these results it seems as if the industrial development of the three urban, skill-intensive regions has taken different paths. Moreover, a comparison between the regions with respect to how their *initial* specialization correlated with Sweden's trade specialization in 1965 and 1975, taken as a measure of the country's revealed comparative advantage, suggest the following. The Stockholm region had a more competitive composition in 1965 according to the revealed comparative advantage measure of 1975, than according to the same measure for 1965. The opposite was true for the two other urban regions. Combined with the observation that only the latter two regions had a specialization trend which was negatively correlated with the initial specialization of the respective region, this result gave further evidence of a modern, well adjusted industrial composition in the Stockholm region. However, a competitive industrial composition is only a necessary condition to a growing manufacturing employment. For a region in a small, open economy, the potential threat from foreign competitors is only one of several major obstacles to industrial growth.

Finally, it is of some interest to note that the specialization trend of the Outer Aid Area is significantly, positively correlated with those of the three most southern regions, but negatively correlated with the neighboring Bergslagen region. Since the Bergslagen region and the Outer Aid Area had, initially, a similar industrial composition also within the footloose industry sector ($r = 0,33$) and since both received different types of regional aid, the diverging patterns of specialization might reveal interesting information about the effects on industrial composition of the policy imposed and other distortions of regional and national factor markets.

In summary there are few indications supporting the notion that Swedish regions at large, through direct competition in the

Table 3. Correlation coefficients for the 1965 patterns of regional specialization (78 observations).

Region	Malmoe	Gothenburg
Malmoe	1,00	0,45*
South West	0,02	-0,05
South East	0,00	-0,02
Boraos	-0,03	-0,08
Gothenburg	0,45*	1,00
South Lake Vanern	-0,16	-0,13
Outer Aid Area	-0,10	-0,02
Inner Aid Area	-0,02	-0,09
Sweden's Trade Specialization:		
in 1965	0,41*	0,54*
in 1975	0,29*	0,31*

*Significant at 5 percent level (one-tail test).

domestic and foreign commodity markets have behaved as competitors. Instead, there are more grounds for a hypothesis that certain regions changed their specialization in the same direction. Only the Stockholm region had an initial industrial composition with a pronounced future competitiveness. That composition was further strengthened until 1975. However, no other region moved its specialization strongly in the same direction as the Stockholm region. On the contrary, two out of three other skill intensive regions, i.e., the urban regions of Malmoe and particularly Gothenburg, had signs of a comparatively bad performance. The next section provides more information on this point.

VII. THE SPATIALLY-HOMOGENEOUS-COMPARATIVE-ADVANTAGE-HYPOTHESIS

The spatially-homogeneous-comparative-advantage-hypothesis is derived from a somewhat different theoretical framework, although it is related to the counter hypotheses of the two preceding ones. Recall that these counter hypotheses drew on

certain results of earlier studies, which indicated the possibility of an ongoing reversal of Sweden's trade specialization. Moreover, these studies provided the conclusion that at least during the 1960s the partial reversal tendency might be attributable to a comparative advantage change associated with a change in Sweden's factor abundance. Typically, a small open economy can arrive at such a change, as a consequence of either its own growth process or its internal factor market response to changing world market prices (or, more generally, world market conditions).

Whichever explanation is true, the factor market adjustment process is in itself time-consuming. One possible reason for this, in a spatially extensive economy like the Swedish one, is that the spatial diffusion of the incentive changes requires time. This is especially the case if there is a pronounced interregional division of labor, implying non-diversified regions and the possibility of intervening governmental actions aimed at restoring a regionally balanced development, but introduced without a proper diagnosis of the problem and therefore functioning as a conservational industrial policy in retarded regions instead.

As discussed in Section II, the 11 regions of this paper are defined in such a way as to pick up *both* the differences in the internal division of labor between specialized Swedish regions *and* the policy imposed factor market distortions introduced to create a more balanced regional development during the period of study. Seven regions received negligible regional aid. Four regions were appointed aid areas as a whole, as the Outer and Inner Aid Areas or partially with respect to both space and time. There is little reason to believe that the first mentioned seven regions will have a similar change in industrial specialization against foreign countries, unless the changing factor abundance is spread at least smoothly over the regions perhaps even to the extent that initial dissimilarities were leveled. Initially, only the Malmoe/Gothenburg regions and the South East/South Lake Vanern regions had similar industrial specialization in 1965. Indeed, all other simple correlation coefficients were not significantly different from zero. Seemingly, the starting conditions for the seven differently specialized regions do not

at all suggest a common direction in specialization trends. Nonetheless, a certain common denominator was found between some regions in the preceding section.

In what follows, an interrelated test is carried out. The hypothesis is that the seven regions share the same incentives to change their specialization against foreign countries. The changing Swedish comparative advantage is, according to this hypothesis, diffused to the seven regions, which should then all tend to move their pattern of specialization in the opposite direction to foreign producers. Recalling that $\Delta\left(\frac{X-M}{C}\right)$ was a measure of Sweden's aggregate trade specialization, this measure should be positively related to each one of the (O_r/C), $r = 1,2,3,5,6,7,8$.

However, $\Delta\left(\frac{X-M}{C}\right) \equiv \Delta\left(\frac{O}{C}\right)$. Because of some measurement problems the latter variable is therefore being used in the tests. The variables X, M, O and C can all be obtained from statistical sources based on commodity classifications, but O is also obtainable from a source based on industrial activity classifications. Since regional production statistics, and therefore O_r, is derived from the latter source, it seems preferable to use the corresponding definition of O also at the national level. This choice is not eliminating all errors in variables, but there will at least be consistent definitions of dependent and independent variables.

In the tests, therefore, we are using the following regression form:

$$\Delta\frac{O_r}{C}_{1965-75} = a + b\frac{O_r}{C}_{1965} + c\Delta\frac{O}{C}_{1965-75} + \mu_r \quad .$$

The initial specialization pattern is again maintained in the testing procedure. The tests are to be looked upon only as a first step in a sequence. The null-hypothesis for the seven regions is that there are non-positive relationships between $\Delta\frac{O_r}{C}$ and $\Delta\frac{O}{C}$.

For the remaining four regions that have obtained regional aid during the 1965-1975 period, the hypothesis formulation must consider both the extent and form of aid. Due to the limited extent of aid of the Boraos and Bergslagen regions, and the fact that it was limited to the later part of the period, it is also reasonable to retain the above hypothesis for these regions.* The Outer and Inner Aid Areas received support throughout this period and it was particularly extensive for the latter region. There is, however, two difficulties involved in the hypothesis formulation for these two aid areas: 1) the difference in instruments used, and 2) the change of instruments between the first and second halves of the period. It was therefore decided to abstain from specifying hypotheses for the two aid areas. As a consequence, a correspondingly higher degree of caution has to be paid in interpreting the respective regression results.

Table 4. presents the regressions for the eleven regions and the sample of industries which have non-zero production in at least one year. In this case, these selections rather than all 78 industries were considered appropriate for the following reason. Basically, we are testing here a hypothesis of a common incentive system for all parts of Sweden, affecting the structural composition of the footloose sector. For each sample of the population of 78 (or more at lower details of aggregation) the same result is supposedly obtained. The eleven regional samples may be looked upon as eleven samples of different sizes and stratified to generate very different starting conditions from the point of view of regional factor abundance and initial specialization. Such a stratification decreases the chances of rejecting the null-hypothesis of the basic spatially-homogenous-comparative-advantage-hypothesis.

Table 4 presents ten significantly positive regression coefficients for $\Delta \frac{O_r}{C}_{1965-1975}$. The exception is the Bergslagen region, which almost coincides with the Grey Zone Area of regional

*See SOU 1978:47 Chapter 2.

Table 4. Regression results on the regional-international trade specialization relationships.

Region Number	Dependent Variable $= \Delta \frac{O_r}{C}$ for 65-75 region	Constant	Regression Coefficient (t-ratio) for $\frac{O_r}{C}$ 65	Regression Coefficient (t-ratio) for $\Delta \frac{O}{C}$ 65-75	R^2	F-value (degrees of freedom)
1	Malmoe	0,010	-0,128[c] (-2,506)	0,059[c] (3,744)	0,270	12,235[c] (2;66)
2	South West	0,013	-0,126[c] (-2,158)	0,085[c] (6,524)	0,437	22,151[c] (2;57)
3	South East	0,007	0,157[a] (1,307)	0,219[c] (7,111)	0,464	25,982[c] (2;60)
4	Boraos	-0,000	0,108 (1,281)	0,087[c] (4,222)	0,316	9,022[c] (2;39)
5	Gothenburg	0,008	-0,216[c] (-4,882)	0,113[c] (4,140)	0,425	21,451[c] (2;58)
6	South Lake Vanern	0,006	-0,133[c] (-2,188)	0,070[c] (4,527)	0,362	15,021[c] (2;53)
7	East Middle	0,004	-0,104[b] (-1,691)	0,092[c] (4,047)	0,217	9,288[c] (2;67)
8	Stockholm	-0,033	0,050 (0,624)	0,101[c] (3,598)	0,186	6,723[c] (2;59)
9	Bergslagen	0,012	0,114 (1,021)	0,016 (0,516)	0,025	0,630 (2;50)
10	Outer Aid Area	0,020	-0,145 (-1,159)	0,271[c] (8,417)	0,523	35,606[c] (2;65)
11	Inner Aid Area	0,017	-0,207[c] (-2,793)	0,020[a] (1,636)	0,263	5,881[c] (2;33)

[a]Significant at 10 percent level (one tail test for regression coefficients).
[b]Significant at 5 percent level (one tail test for regression coefficients).
[c]Significant at 2,5 percent level (one tail test for regression coefficients).
R = Multiple correlation coefficient.

policy.* The aid provided in that area was primarily soft loans to going establishments, which has a similar industry specialization as the Outer Aid Areas. Recall also that the latter region's specialization changes were negatively correlated with those of the Bergslagen region (and the Grey Zone Area). It seems therefore safe to disregard the result of the Bergslagen region and consider it to be the direct and indirect consequence of regional policies. The null-hypothesis is thus rejected. Although the test itself is not very powerful, there is at least weak support for the hypothesis that all of Sweden shares the same comparative advantage vis-á-vis foregin countries and despite differing historically determined industrial compositions. For at least nine of the regions the results are not sensitive to the inclusion or exclusion of the 1965 specialization pattern, $\frac{O_r}{C}_{1965}$, as an independent variable.**

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*The corresponding regression for the Grey Zone Area is

$$\Delta(O_{GZ}/C)_{65-75} = \underset{}{0,008} + \underset{(2,520)}{0,321}\ (O_{GZ}/C)_{65} - \underset{(0,431)}{0,013}\ \Delta(O/C)_{65-75}$$

$$R^2 = 0,113$$

$$F(2;50) = 3,183$$

**This could be seen because a stepwise multiple regression program was used and that in 9 out of 11 cases the $\Delta(O/C)_{65-75}$ was already included in the first step.

SUMMARY AND CONCLUSIONS

The focus of this paper was to analyze regional patterns of industry specialization trends during 1965-1975 in their relationships to a) the 1965 specialization pattern of each respective region, b) the trends of other regions and c) to Sweden's international trade specialization trend. The analysis used OLS regression analysis to test two relatively straightforward hypotheses discussed in regional economic literature. The tests were undertaken for the "footloose sector" of the Swedish manufacturing industry at a level containing a maximum of 78 industries.

The assumption that a region manages better in industries in which it had a strong initial specialization did not receive support. Instead most of the 11 regions, which were constructed to have different factor abundances and which had a varying degree of industry diversification, population density and space, developed their specialization in the opposite direction to their initial pattern.

The assumption that individual regions may act as competitors to each other within given commodity markets is, perhaps, natural for large, relatively autarkic countries. In the small open economy of Sweden, it did not, however, receive support. Instead

it was evident that clusters of regions moved their specialization in the same direction and in a way which did not seem attibutable to how their initial specialization patterns were related to each other.

A third assumption, almost following from the lack of support of the other two, was that the regions shared the same incentives, or comparative advantage, to alter their specialization against foreign countries. This assumption received strong support although the construction of the test was not very powerful.

The conclusion of the tests is that the regional specialization trends are consistent with the finding of an earlier study that Sweden experiences a change in its comparative advantage as revealed by its trade specialization patterns. The nature of that change was indicated in the paper in commenting on the trends of the three most densely populated urban regions. The Stockholm region seemed to have a very competitive industrial composition already in 1965, while the Gothenburg and Malmoe regions underwent structural changes suggesting more non-competitive initial industrial compositions. Subsequent analysis will reveal the possible underlying determinants of the varying experience of the three urban regions.

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