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DOMESTIC DEMAND, LEARNING AND COMPARATIVE ADVANTAGE

by Jan Fagerberg*
Norwegian Institute of International Affairs
P.O.B. 8159 DEP
0033 Oslo
Norway

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Abstract

There has always been a strand of thought that has emphasized learning as a potential source of comparative advantage. This tradition points to the learning creating effects that relations between firms or sectors within the domestic economy may have, and the impact of this on the development of the international competitiveness of the country and its specialization pattern in international trade. Burenstam Linder (1961) was the first to discuss the implications of these ideas for trade theory. A recent attempt to construct an evolutionary scheme of economic development based on these ideas is the one by Porter (1990). Building on earlier work by Andersen et al. (1981), this paper presents an empirical analysis of the impact of vertical integration between customers and suppliers (or users and producers) within country boarders on comparative advantage for 16 OECD countries and 23 industries/product groups in 1965 and 1987.

1. INTRODUCTION

Traditionally, most attempts to explain the specialization patterns of countries in international trade have focused on supply conditions. According to the standard neoclassical theory of international trade, countries ought to specialize in areas of production that make intensive use of factors of production with which the country is relatively well equipped. However, empirical research has shown that the explanatory power of this type of theory is rather limited (Bowen et al. 1987).

In spite of the dominant role played by the traditional neoclassical theory in this area, there has always been a strand of thought that has emphasized learning as a potential source of comparative advantage (for an overview, see Dosi and Soete, 1988). This tradition points to the learning creating effects that relations between firms or sectors within the domestic economy may have, and the impact of this on the development of the international competitiveness of the country and its specialization pattern in international trade. Already List (1959) in his famous defence for protectionism pointed to the positive impact that such relations may have in the process of industrialization. Various concepts have been developed to cover (different aspects of) this dynamics. Schumpeter (1934, 1939, 1943) used the concept "clusters of innovations". Other writers in the Schumpeterian tradition use other concepts, such as "growth-poles" (Perroux, 1956) or "development-blocks" (Dahmén, 1970). Starting from a somewhat different perspective, Hirschman (1958) coined the concept "linkages" to cover the positive impact that links between different sectors of the economy may have for economic development. Burenstam Linder (1961) was the first to discuss the implications of these ideas for trade theory. In the case of developed countries, he suggested that it is demand-induced innovation within each country, not supply factors, that determine comparative advantage.

A recent attempt to construct an evolutionary scheme of economic development based on these ideas is the one by Porter (1990). Echoing Burenstam Linder he argues that traditional supply factors, although important in the earlier stages of development, are not among the prime determinants of "competitive advantage" in more advanced countries, where growth is assumed to be innovation-driven. The most competitive industries of an advanced country, he argues, tend to be highly integrated ("clustered"), both vertically and horizontally, with favourable consequences for learning, innovation and "competitive advantage". In Porter's scheme, this typically starts with vertical integration between customers in traditional industries and suppliers of machinery and other types of advanced equipment, and then widens through spill-overs and feed-backs to and from related and supporting industries (Porter, 1990, p. 554-5). In this paper, we will focus solely on the first of these two mechanisms, emphasized by both Burenstam Linder and Porter, i.e. the favourable impact that vertical integration between customers and suppliers (or users and producers) may have on comparative advantage. Building on earlier work by Andersen et al. (1981), the next section outlines how this can be measured empirically. Then the data are examined, a formal test designed and the results presented.

The Burenstam Linder-Porter hypothesis, as outlined above, is intuitively appealing and there is a large amount of descriptive evidence that can be used to support it (Porter 1990). However, in spite of the growing popularity of this approach, many would probably still feel that "clustering" is a phenomenon in search of a theoretical explanation. One possible answer to this request may be found in the modern literature on "networks" (Håkansson, 1987, De Bresson and Amesse, 1991) and "user-producer relationships" (Lundvall, 1988, 1992), combining Schumpeterian insights in the innovation process with analyses of transaction-costs and market behaviour. In this approach,

stable relations between users and producers of technology are analysed as a way to minimize costs related to information and communication and internalize positive external effects. It is argued (Lundvall, 1988) that such relations are especially important in cases where technology is complex (and changing) and the need for close communication and interaction between users and producers of technology is large. Interaction processes of this type involve learning and - in many cases - the modification of an existing or the creation of an entirely new technology. When this happens, the competitive position of the firms involved will normally improve.

To the extent that this type of interaction takes place mainly within country boarders, this should be expected to affect patterns of export specialization (or comparative advantage) of countries as well. Since, as pointed out by both Burenstam Linder and Porter, the costs associated with communication and interaction increase with distance and differences in culture, language, institutional settings etc., this may be a reasonable assumption to make. Porter even holds that the importance of the domestic market for competitive advantage is growing. However, it may also be argued that the increasing role of multinationals in world production have reduced the costs of communication and interaction significantly, and that the Burenstam Linder - Porter hypothesis therefore was more relevant in the past than it presently is. Section 4 of his paper considers some of the empirical implications of these two conflicting views.

2. INTERPRETATION, DATA AND METHODS

The hypothesis that a high degree of vertical integration between customers and suppliers (or users and producers) affects competitiveness of the latter positively, needs some further qualification. First, as pointed out in the introduction: it is assumed to hold for advanced countries only. Second, it is of little relevance for suppliers of

relatively standardized products. This was pointed out already by Burenstam Linder:

> "... exceptions to our proposition are likely to occur in those cases (1) where it is easy to become aware of the foreign demand in spite of the non-existence of home demand of the product; (2) where the product as such is available without inventive effort; and (3) where no or little product development work is needed." (Linder, 1961, p. 90).

Third, not all cases of vertical integration are equally conducive to innovation and "competitive advantage". As pointed out by Lundvall: "Being closely linked to conservative users having weak technical competence might be a disadvantage for a producer, and vice versa" (Lundvall, 1988, p. 356). Thus, the mere existence of a home market for a particular product or technology is not enough: A necessary condition is that the domestic users are both sophisticated and demanding.

To test the hypothesis, a relatively large number of exporting sectors, as well as domestic users of the products from these sectors, must be identified and defined. While this may be easy in theory, it is more difficult in practice, since the available statistics are not collected for this purpose. Most "advanced" products are not classified according to users, and even when this is the case it is not always easy to find internationally comparable data for users on a sufficiently disaggregated level. Furthermore, we have to establish what we mean by an "advanced user sector", and decide how this empirically can be distinguished from a less advanced one.

To the best of our knowledge, the only attempt to face these problems is the one by Andersen et al. (1981). The empirical hypothesis considered by them was the following: If internationally competitive producers exist in one sector of the economy, and these producers buy their technology from another sector of the economy, the latter sector should be expected to be internationally competitive too. For instance, if a country is export specialized in agricultural products, it

should also be expected to be export specialized in agricultural machinery. Thus, in the interpretation of Andersen et al. "advanced user sectors" are identified as sectors in which the country has a revealed comparative advantage. This interpretation has the advantage that it enables us to use the same data source, trade statistics, and the same index, revealed comparative advantage (Balassa 1965), to measure the strength of both "producers" (export products) and "advanced domestic users" (home-market sectors).

A problem with this interpretation is that it introduces a bias towards products where the trade statistics allow a link to be made. For export products this implies that most of them belong to the group "specialized machinery" (SITC 71), where users in many cases are relatively well specified. On the user side (home market sectors) the consequence is that users in the non-trading sectors of the economy (or in other sectors not covered by the international trade statistics) are excluded from the investigation. For instance, the possible impact on exports of links between technology producers and public-sector users, which is an interesting issue from a policy point of view, cannot be taken into account.

The empirical methodology adopted in this paper follows generally the work by Andersen et al., but some attempts were made to overcome the limitations of their data. The most important novelty in this respect is the extension of the analysis to three service sectors, not covered by the trade statistics, and the construction for these sectors of special "home-market indexes". These sectors are health care, telecommunications and shipping (two of which are dominated by public-sector services). For the remaining pairs of export products/home-market sectors it was attempted to make the definitions more precise by use of more disaggregated statistics. The resulting sample is larger than that of Andersen et al. (23 pairs compared to 13). However, the group "specialized machinery" (SITC 71) still accounts for around two

thirds of the "export products" included in our sample. Table 1 lists the 23 pairs of products included in the test.

TABLE 1 EXPORT PRODUCTS AND HOME MARKET INDICATORS

SITC (REV 1)	EXPORT PRODUCT	SITC (REV 1)	HOME MARKET INDICATOR
54	PHARMACEUTICALS		HEALTH[1)]
6291	RUBBER TYRES AND TUBES	732 - 734	ROAD MOTOR VEHICLES, AIRCRAFT
6951	HAND-TOOLS FOR AGRICULTURE AND FORESTRY	04-08(-0814), 24	AGRICULTURAL PRODUCTS, WOOD PRODUCTS
7114	AIRCRAFT ENGINES	734	AIRCRAFT
7115	INTERNAL COMB. ENGINES	732	ROAD MOTOR VEHICLES
7121 7122	AGR. MACHINERY FOR PREPARING SOIL AND HARVESTING	04-08(-0814)	AGRICULTURAL PRODUCTS
7123	MILKING MACHINES	02	DAIRY PRODUCTS
7125	TRACTORS	04-08(-0814)	AGRICULTURAL PRODUCTS
7129	AGR. MACHINERY N.E.S.	04-08(-0814)	AGRICULTURAL PRODUCTS
7151 7152	MACHINE TOOLS FOR WORKING METALS	69	METAL MANUFACTURES
7171	TEXTILE MACHINERY	65	TEXTILES
7172	LEATHER MACHINERY	61	LEATHER
7173	SEWING MACHINERY	84	CLOTHING
7181	PAPER WORKING MACHINERY	25, 64	PULP AND PAPER, PAPER PRODUCTS
7182	PRINTING MACHINERY	829	PRINTED MATTER
7183	FOOD PROCESSING MACHINERY	0 - (00)	FOOD
7184 7185	CONSTRUCTION AND MINING MACHINERY, MACHINERY FOR MINERAL CRUSHING, ETC.	27, 28	CRUDE MINERALS AND METALS
7191	HEATING AND COOLING EQUIPMENT	01 - 03	MEAT, DIARY PRODUCTS, FISH AND EGGS
7249	TELECOMMUNICATIONS		TELE[1)]
726	ELECTROMEDICALS		HEALTH[1)]
7294	AUTOMOTIVE ELECTRICAL EQUIPMENT	732	ROAD MOTOR VEHICLES
735	SHIPS AND BOATS		SHIPPING[1)]
8617	MEDICAL INSTRUMENTS N.E.S.		HEALTH[1)]

1) FOR THE DEFINITION OF THIS INDICATOR, SEE THE TEXT AND APPENDIX 1.

For a particular country and product, the index for revealed comparative advantage (S) is the ratio between the market share of the country on the world market for this particular product and the market share of the country on the world market for all products. Letting *X* denote exports, *j* export product and *i* exporting country, the index for revealed comparative advantage (S) can be presented as follows:

$$(1) \quad S_{ij} = X_{ij} \; / \; \sum_{i} X_{ij} \; / \; \sum_{j} X_{ij} \; / \; \sum_{i} \sum_{j} X_{ij}$$

In principle, this index may vary between zero and indefinitely, although it seldom takes on very high values. It has the property that the weighted mean is identical to unity for each country across all commodity groups, and for each commodity group across all countries. Thus, a country is said to be specialized (have a revealed comparative advantage) in a product if the RCA index exceeds unity.

The "home-market indexes" for the service sectors were calculated in a way that made their structure as close as possible to the RCA index. For instance, if the index for a specific country for shipping exceeds unity, this implies that the market share of the country for shipping services exceeds the market share of the country for goods and services in general. For health services and telecommunication services, which are not traded on the world market to the same extent, the population was used as deflator. Thus, in these cases, a value larger than one implies that the per capita "quality" of these services in the country is higher than the OECD average. For a more detailed account on how these indicators were constructed, including sources, the reader is referred to the appendix.

The trade data for the years 1965 and 1987 used in this paper were collected from OECD Trade Series C. Since the theory is not expected to hold for developing or semi-industrialized countries, we excluded the industrially less developed of the

OECD countries from the sample (Greece, Iceland, Portugal, Turkey and Yugoslavia). Australia and New Zealand were excluded due to lack of data for 1965. The countries included in the sample are: Canada, USA, Japan, Austria, Belgium, Denmark, Finland, France, Germany, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland and Germany.

3. A PREVIEW OF THE DATA (1987)

Before moving to a more formal test, it may be useful to take a closer look at the data. The data set consists of 16 countries and 23 pairs of "export products"/"home-market sectors". For each year this gives us a total of 368 observations of the link between the home market sector and the export product. For exploratory reasons, we will in this section limit the examination to the most recent year (1987) and the home-market sectors where the specialization is highest, irrespective of the country of origin. Only home-market sectors with a specialization index of 2.0 or higher, i.e. at least twice as large as the mean, were included. Table 2 ranks these home-market sectors, in descending order of the specialization index, together with the associated export products, for the year 1987.

TABLE 2.EXPORT SPECIALIZATION AND HOME-MARKET INDICATORS (1987)

COUNTRY	EXPORT PRODUCT	SPECIALIZATION		HOME MARKET SECTOR	RANK
		EXPORTS	HOME		
FINLAND	PAPERWORKING MACHINERY	8.3	9.8	PULP & PAPER, PAPER PRODUCTS	1
DENMARK	HEATING AND COOLING EQUIPMENT	2.5	8.1	MEAT, DIARY PRODUCTS, FISH AND EGGS	2
SWEDEN	PAPERWORKING MACHINERY	2.6	4.8	PULP & PAPER, PAPER PRODUCTS	3
NORWAY	SHIPS AND BOATS	8.1	4.6	SHIPPING	4
CANADA	CONSTRUCTION AND MINING MACH.	0.7	4.5	CRUDE MINERALS AND METALS	5
NETHERLANDS	MILKING MACHINERY	1.3	4.4	DIARY PRODUCTS	6
DENMARK	MILKING MACHINERY	11.8	4.4	DIARY PRODUCTS	7
SPAIN	LEATHER MACHINERY	1.0	4.2	LEATHER	8
DENMARK	FOOD PROCESSING MACHINERY	3.3	4.1	FOOD	9
USA	AIRCRAFT ENGINES	0.8	3.9	AIRCRAFTS	10
ITALY	LEATHER MACHINERY	8.0	3.9	LEATHER	11
ITALY	SEWING MACHINERY	1.1	3.8	CLOTHING	12
CANADA	PAPERWORKING MACHINERY	0.4	3.6	PULP & PAPER, PAPER PRODUCTS	13
NETHERLANDS	HEATING AND COOLING EQUIPMENT	0.6	3.3	MEAT, DIARY PRODUCTS, FISH AND EGGS	14
SPAIN	AGRICULTURAL MACHINERY n.e.s	0.3	3.2	AGRICULTURAL PRODUCTS	15
SPAIN	AGR. MACH. (PREP. SOIL, HARVEST)	0.4	3.2	AGRICULTURAL PRODUCTS	16
SPAIN	TRACTORS	0.4	3.2	AGRICULTURAL PRODUCTS	17
SPAIN	HAND TOOLS (AGR. AND FORESTRY)	2.1	2.7	AGRICULTURAL PRODUCTS, WOOD PRODUCTS	18
NETHERLANDS	FOOD PROCESSING MACHINERY	2.1	2.6	FOOD	19
NORWAY	HEATING AND COOLING EQUIPMENT	0.4	2.6	MEAT, DIARY PRODUCTS, FISH AND EGGS	20
CANADA	HAND TOOLS (AGR. AND FORESTRY)	0.2	2.2	AGRICULTURAL PRODUCTS, WOOD PRODUCTS	21
AUSTRIA	PAPERWORKING MACHINERY	1.6	2.1	PULP & PAPER, PAPER PRODUCTS	22
SPAIN	FOOD PROCESSING MACHINERY	0.8	2.1	FOOD	23
ITALY	TEXTILE MACHINERY	1.8	2.1	TEXTILES	24
NETHERLANDS	TRACTORS	0.1	2.1	AGRICULTURAL PRODUCTS	25
NETHERLANDS	AGRICULTURAL MACHINERY n.e.s.	1.7	2.1	AGRICULTURAL PRODUCTS	26
NETHERLANDS	AGR. MACH. (PREP. SOIL, HARVEST)	1.1	2.1	AGRICULTURAL PRODUCTS	27
JAPAN	AUTO-ELECTRICAL EQUIPMENT	1.9	2.0	ROAD MOTOR VEHICLES	28
JAPAN	INTERNAL COMBUSTION ENGINES	1.8	2.0	ROAD MOTOR VEHICLES	29
FRANCE	MILKING MACHINERY	0.5	2.0	DIARY PRODUCTS	30
AUSTRIA	METALWORKING MACHINERY	1.2	2.0	METAL MANUFACTURES	31

The results reported in table 2 appear to be consistent with the hypothesis of a positive impact of the home market on export specialization. In particular, for the top ten of table 2, a strong relation between export specialization and home-market specialization seems to exist, with 7 (out of 10) pairs specialized in both the export product and the home market sector. For the remaining pairs of export products/home-market sectors the evidence is weaker, although still not inconsistent with the underlying hypothesis (12 out of 21 specialized in both). A similar exercise was carried out at the opposite tail of the distribution, i.e. pairs with a value of the home market specialization index below 0.2. Here the evidence was even stronger: of the 30 pairs in this category, 24 were "unspecialized" in both (in fact, in all 24 cases, the specialization figure of the export product was below 0.7).

The table reveals several illustrative examples, some of these from the Nordic countries, of high specialization in both the home market sector and the related export product. For Denmark, there appears to be a strong link from the agricultural sector to the machinery sector (milking machinery, food processing machinery and heating and cooling equipment). A similar relation holds for the Netherlands. For Sweden and Finland, a relation was found between specialization in wood products/pulp and paper and specialization in exports of paper-working machinery. In the Norwegian case, shipping and exports of ships seem to be the most prominent example. Other examples are Italy (leather products/leather machinery, clothing/sewing machinery and textiles/textile machinery) and Japan (cars and auto-electrical equipment).

However, the failures are equally interesting. Table 2 includes 13 pairs with a specialization figure of the export product equal to 1.0 or less. These are not evenly distributed across countries: three countries count for 10 failures, with Spain in the lead (5 failures) followed by Canada (3 failures) and the Netherlands (2 failures). As noted above the observations for

the Netherlands are generally not failures: in four out of six pairs included in the table, the outcome was the expected one. In contrast, the three pairs for Canada included in the table are all failures. Although no attempt was made to verify this possibility, it would not be surprising if some of the producers benefitting from Canadian demand for advanced equipment were situated at the other side of the US-Canadian boarder. Clearly, in this case, the differences in language, culture etc. - not to mention distance - are quite small. Spain was represented six times on the list and failed in five of them. As in the case of Denmark, Spain has a strong agricultural sector, but in contrast to the Danish example, Spain is not specialized in exports of agricultural machinery. The only exception is exports of handtools for agriculture and forestry, clearly the least advanced class of agricultural machinery included in the test. Arguably, what this shows is that Spain, as "the poorest among the rich" countries of our sample, has not reached the same degree of industrial maturity as the other countries. This does not necessarily imply that the hypothesis of a positive impact of the home market on industrial development has no explanatory power in the Spanish case, but it suggests that there may be important differences across countries in how this mechanism works. However, to explore this issue further, more refined techniques are needed.

4. A FORMAL TEST

In a general form, the model to be tested is the following:

$$(2)\quad S^{t}{}'_{ij} = f(S^{t}{}'_{ik})$$

i= 1..n (Countries)
j= 1..m (Commodities) ("export")
k= 1..m (Commodities) ("home-market")

In principle, the choice of functional form should be based on theory, but in this case we have no particular theoretical reasons for preferring one specific functional form. However,

the data may give some guidance. Despite its many desirable properties, the index of revealed comparative advantage (S) has one important disadvantage when it comes to statistical work: it has a skew distribution, with a long tail to the right. This creates problems in regression analysis, because it violates the assumption of normality. A logarithmic transformation of the data reduced this problem significantly, but since there were zeros in the data matrix, we had to add a small positive number to all observations to allow the transformation to be made. Thus, the tested model is the following:

$$(3)\quad \log(S^{t}{}_{,ij}+0.1)=a_0+a_1\log(S^{t}{}_{,ik}+0.1)$$

i= 1..n (Countries)
j= 1..m (Commodities) ("export")
k= 1..m (Commodities) ("home-market")

The questions we want to ask are:

1) Is there a positive relationship between the two specialization indexes, as argued by Burenstam Linder and Porter (i.e. is the coefficient a_1 positive)? The 5 % level of significance was chosen for the test.

2) Does the model explain the past specialization patterns better than the present?

3) To what extent does the introduction of a time-lag for the independent variable (S_{ik}) improve the explanatory power of the model?

To answer these questions separate regressions were carried out for 1965, 1987 and 1987 with lag (1965 independent variable). There are alternative ways to group the sample. We can run a cross-sectional regression for each pair of export product/home- market sector, using the countries as units or a cross-sectional regression for each country, using the pairs as

units. The alternatives partly reflect different questions or interpretations of the model. For instance, in a cross-sectional regression for each product pair we ask for which pairs the model is most relevant. However, the focus of Burenstam Linder and Porter was mainly on the specialization pattern of countries and the results from the previous section suggest that there may be important differences across countries in how these patterns are shaped. Thus, what will be presented here is a cross-sectional regression for each country (for an attempt to explore the other alternative, a cross section for each pair, see Fagerberg, 1992).

Table 3 contains a summary of the results with respect to the impact of the home-market variable (s_{ik}). Only the estimate of coefficient a_1 and its t-value are reported, but with only one independent variable (and a constant term), the relation between the t-value and the fit (F-statistics or restricted R^2) is relatively straightforward. The most important results are the following:

1) For most countries (13 out of 16) there is some support for the hypothesis (a significant positive effect in 1965, 1987 or both years). The three countries with no support at all for the hypothesis under test are Austria, France and the United Kingdom.

2) In most cases the results improve from 1965 to 1987: of the 13 countries where some support was found, 9 report higher absolute t-values and fits in 1987 than in 1965. Thus, if anything, the explanatory power of the model is higher in 1987 than 1965.

3) The introduction of a time-lag for the independent variable did not alter the results very much. The absolute t-value and fit improved in 7 cases and detoriated in 6 cases. Thus, on this question the results are inconclusive.

Table 3. THE HYPOTHESIS TESTED[1]

	1965	1987	1987 with lag
	Home[2]	Home[2]	Home[2]
Canada	0.28 (1.45)	0.42 (2.09) *	0.44 (2.52) *
USA	0.43 (2.10) *	0.38 (2.47) *	0.57 (3.46) *
Japan	0.77 (4.03) *	0.51 (2.65) *	0.79 (3.88) *
Austria	0.26 (1.44)	0.16 (0.75)	0.07 (0.36)
Belgium	0.13 (0.40)	0.43 (2.34) *	0.39 (1.34)
Denmark	0.58 (3.33) *	0.77 (4.58) *	0.71 (5.16) *
Finland	0.50 (3.32) *	0.51 (2.01) *	0.52 (3.26) *
France	-0.20 (0.75)	-0.01 (0.01)	-0.34 (1.16)
Germany	0.31 (1.86) *	0.31 (1.98) *	0.10 (1.11)
Italy	0.20 (0.98)	0.54 (2.68) *	0.40 (1.72) *
Netherlands	0.10 (0.36)	0.36 (2.06) *	0.37 (1.91) *
Norway	0.42 (2.77) *	0.60 (3.35) *	0.44 (2.84) *
Spain	0.33 (2.21) *	0.23 (1.18)	-0.03 (0.27)
Sweden	1.00 (4.51) *	0.10 (0.40)	0.35 (1.61)
Switzerland	0.77 (2.95) *	1.12 (4.29) *	0.92 (3.55) *
UK	-0.16 (1.12)	0.39 (0.86)	0.04 (0.20)

1) 23 observations, one for each pair of export product/home-market sector
2) Estimate of coeffecient, absolute t-value in bracket.
*) Positive, 5% level of significance, one-tailed test.

The results reported here may be compared with those reported by Andersen et al. (1981), although it must be kept in mind that their sample was much smaller (11 countries and 8-10 observations for each country). They reported results for 1954, 1960, 1966 and 1972, using both rank correlation and ordinary least squares (a linear formulation was used). No attempt was made to test for lags. As in the present study, the best results were reported for the most recent years. For these years a significant relationship was reported for approximately one half of the countries included in the sample, compared to around two thirds in the present study. The countries for which they found no support for the hypothesis, were Belgium, France, Italy and the United Kingdom (Austria was not included). These results are in accordance with the results for 1965 reported here.

5. CONCLUDING REMARKS

The view that domestic demand may have a positive impact on the competitiveness of a country (the Burenstam Linder-Porter hypothesis) is by no means a new one. Indeed, as pointed out in the introduction, it has been widely held for at least a century. In spite of this, modern (neoclassical) trade theorists normally regard it as "theoretically unsound" and as a cover for protectionism. This paper has argued that, based on modern innovation and industrial organization theory, it is possible to give a plausible micro-economic foundation for the Burenstam Linder-Porter hypothesis. Basically, the explanation offered is the following: (1) Innovation is the most important competitive factor in advanced industries. (2) Communication and interaction between advanced users and producers of technology play a vital role for innovation. (3) Proximity, a common language, a common education system etc. make the

process of communication and interaction much easier. Hence, it is suggested that in the case of advanced products, countries tend to specialize in areas where, by a comparative standard, there are many advanced domestic users.

Based on an empirical methodology developed by Andersen et al. (1981), a formal test of the Burenstam Linder-Porter hypothesis was made on data for 1965 and 1987. For a large majority of the countries included in the test, the results were supportive. This holds both for the largest countries in the sample (USA and Japan) and the smallest ones (Denmark, Finland, Norway and Switzerland). The least satisfactory results were reported for Austria, France and the UK. An interesting question for further research is why the factors affecting trade patterns of these countries appear to diverge from most other developed countries, although it cannot be excluded that these results may be caused by imperfect data or methods. For France and the UK a possible explanation may be that their trade patterns are influenced by their colonial past.

An interesting finding, which is also supported by earlier studies, is that the explanatory power of the Burenstam Linder-Porter hypothesis improves over time. The only clear counter-examples are Spain and Sweden. This finding suggests that the increasing economic integration in the developed world from the early 1960's onwards has strengthened, rather than weakened, the importance of domestic linkages and learning processes for comparative advantage in advanced products. As pointed out by Porter:

> "While globalization of competition might appear to make the nation less important, instead it seems to make it more so. With fewer impediments to trade to shelter uncompetitive domestic firms and industries, the home nation takes on growing significance because it is the source of the skills and technology that underpin competitive advantage." (Porter, 1990, p. 19)

One implication of this is that, contrary to common belief, the

increasing role of multinationals in world trade has not eroded the benefits accruing to comparative advantage from advanced domestic users. Probably, the relation between multinational activity and country-specific learning capabilities is a complex one. However, it is not possible to resolve this problem within the context of this paper.

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Appendix 1

The trade data used in this paper were calculated from OECD Trade Series C (value data) using the IKE data base on trade statistics at the Aalborg University Centre. Data for health care were taken from OECD: Health Care Systems in Transition, OECD, Paris, 1990, data for merchant fleets and telephone lines were taken from UN Statistical Yearbook, various editions. Other data from OECD National Accounts.

Construction of home-market indicators (I)

Tele and Health

$$T_J = \textit{Telephone lines in country}_j, \quad j \in i,\ i = 1..j..n$$

$$N_j = \textit{Number of inhabitants } j$$

$$I_j = (T_j / N_j) * (\sum_i N_i / \sum_i T_i)$$

Similarly for health services, where T_j = *health services in country*$_j$ *(in common currency)*

Shipping

$$S_J = \textit{Fleet of country}_j, \textit{ in 1000 tons}$$

$$X_J = \textit{Total exports of country}_j \textit{ (goods and services)}$$

$$I_j = (S_j / \sum_i S_i) * (\sum_i X_i / X_j)$$