LINER SHIPPING
and
GENERAL CARGO TRANSPORT

EFI

The Economic Reseach Institute at the Stockholm School of Economics
Address: Sveavägen 65, Box 6501, S-113 83 Stockholm, tel. 08-736 01 20

Basic Orientation

The Economic Research Institute (EFI), at the Stockholm School of Economics is devoted to the scientific study of problems in management science and economics. It provides research facilities for scholars belonging to these diciplines, training advanced students in scientific research. The studies to be carried out by the Institute are chosen on the basis of their expected scientific value and their relevance to the research programs outlined by the different sections of the Institute.

Research Divisions:

A Management and Personnel Administration
B Finance and Accounting
C Managerial Economics
D Marketing Management – Strategy and Economic Structure
F Public Administration
G Economic Geography
I Applied Information Processing
P Economic Psychology – Social and Individual Behavior
S Macro Economics

Independent Research Program:

Program for Studies of Participation and Organizational Development
Division for Applied Research in Business Administration

Additional information about research in progress and published reports is described in our project catalogue. The catalogue can be ordered directly from The Economic Research Institute, Box 6501, S-113 83 Stockholm, Sweden.

Christopher von Schirach-Szmigiel

LINER SHIPPING and GENERAL CARGO TRANSPORT

EFI THE ECONOMIC RESEARCH INSTITUTE
STOCKHOLM SCHOOL OF ECONOMICS

A Dissertation for the Doctor's Degree
in Economic Geography
Stockholm School of Economics 1979

UDK 656.6
656.614.2
ISBN 91-7258-111-5
GOTAB, Stockholm 1979

ACKNOWLEDGEMENTS

The tradition of economic and geographic research in shipping at the Stockholm School of Economics is nearly as old as the school. This tradition was the point of departure for this study.

I am deeply indebted to Professor Gunnar Alexandersson who not only made me understand this tradition but also gave his strong and wholehearted support in moments of doubt and critically scrutinized my ideas and their presentation. I am also grateful to Professor Thomas Thorburn for his critical and encouraging comments to my ideas on shipping. Discussions with Professor Claes-Fredric Claeson and Docent Göran Norström helped me understand the world of models in economic geography. I am also grateful to Rudolf Eckeström for programming assistance and to Stefan Litzberg for help in data collection for the model tests. Shipping companies, agents and port authorities showed great readiness to meet my data needs. I am in debt to my fellow researchers in the Department of Geography for comments on the drafts. Maps and diagrams were drawn by Anna-Clara Gonzalez and Siw Andersson to whom I want to express my gratefulness. Also Ingeborg Wenck and Annika Petersson provided important assistance. I am particularly grateful to Ingrid Rosenvinge who typed the final version, to Barbro Orrung who succeeded in editing the manuscript and to Gun Svanholm for the translation of chapters two and three.

Research grants were recived from the Transport Research Delegation in Stockholm to which is due my warmest thanks.

Hässelby in May 1979

Christopher von Schirach-Szmigiel

CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

In the mid 1960's international liner shipping entered a new development phase. Technical, political and economic changes in sea, land and air transport and in the demand for general and break bulk cargo movements made necessary a far-reaching restructuring of the liner industry.

Since the mid 19th century liner shipping has dominated both deep-sea and short-sea general and break bulk cargo transports, a result of the Industrial Revolution which required a system of regular, public transport services between European countries separated from the mainland by short-seas and between Europe and the overseas markets. Last century transport costs formed a powerful trade barrier restricting transocean trade to high-value commodities and making liner shipping the major form of deep-sea transports. Political factors, such as the development of colonial empires and the settlings of North America, favored regular movements of passengers and cargo, which stimulated the growth of the liner industry.

Short-sea liner shipping in the 19th century was well developed in the Baltic and the North Sea. A system of regular and public services between Scandinavia and United Kingdom on the one hand, and the European mainland on the other was a *sine qua non* for the growth of the Scandinavian industry as well as for the trade between Great Britain and the Continent. The development of railways had only limited impact on the modal allocation of general break bulk cargo flows in the short-sea markets.

The growing demand of the industrialized world for energy and raw materials at the end of the last and the beginning of this century formed the base for development of specialized vessels and increased the need for whole-vessel shipments, creating a division of the seaborne trade into several cargo submarkets. Specialization made possible a relative decrease of transport costs, resulting in an increasing number of low-value commodities entering international trade. The general cargo share in trade declined as did the liner-tonnage share.

The development of long-distance road transports in the interwar and, particularly in the postwar period, had far-reaching influences on the technique, economy and organization of the short-sea liner services. To meet the new market conditions, the short-sea operators had to integrate their services with the land transport system, recognizing the superiority of the wheel for general cargo movements in these markets, adopting the technique and organization of the supplied shipping services accordingly. The new technique changed the structure of general cargo traffic from a flow of heterogeneous units to a fairly homogeneous flow with trucks and containers being the basic units.

The experience of unitized traffic in military and short-sea transports provided experience for unitization of deep-sea transports, which allowed mechanization of general cargo handling and made large vessels economic. The new technique increased the advantages of liner shipping, which in the 1960's and 1970's had to meet growing competition from special carriers in break bulk cargo transports and from land and air transport in the general cargo market. A main result of cargo unitization was increased interdependence between land, port and sea services. Deep-sea and, particularly, short-sea liner shipping has to be viewed as an integrated element of the total transport system.

The system approach is a guide-line of this study. It has a twofold objective: to analyze development tendencies in the international liner industry and to examine changes in the demand for the services for this industry, particularly the modal and port distribution of flows in Sweden in the 1960's and 1970's. Chapter 1 is focused on development tendencies in the liner industry, analyzed in terms of technical, political, economic and organizational changes and their interrelations. The analysis covers the development of international liner shipping from the 1810's to the present. Tradition and historical experience play an important role in technical, economic and organizational thinking and decision-making in this industry. The study of organizational changes on the markets is focused on shipping between Europe and other continents and on the Baltic and the North Sea routes. These markets are of primary importance from the Swedish and European points of view.

The development of the liner industry has been divided into three periods, the first two covering the foundation (1810-1870) and expansion (1870-1965) phases. The third period, the diversification phase, started in the late 1960's. The analysis of the first two periods should give a broad view of the processes which led to the economic and organizational pattern of the modern liner shipping. It is based on printed sources. Often definitions of the industry, markets and ships vary. The lack of standardized definitions and statistics make international comparisons about the liner industry difficult. For fleets and firms national literature has been used as the main source since it provides the most detailed data. The discussion of the shipping policy of individual countries was based on views expressed by both national and foreign authors.

The analysis of the development tendencies in the third period is mainly based on international statistics. Common definitions are used for all countries for vessel type, forms of aid etc., which allows more precise international comparisons of fleets, policy measures and economic results. National and international laws, agreements and documents were used for the analysis of the shipping policy of individual countries. Both data reliability and international comparability are better for the third period than for the first and second.

The first chapter leads to the following conclusions: unitization of general cargo transports caused a rapid productivity jump, which significantly increased competition as the number of vessels required stagnated. It stimulated far-reaching horizontal integration. Several countries then enforced protectionistic measures and introduced broad subsidy programs to guarantee the survival of national liner fleets. The purpose of the subsidies was to reduce capital costs which had rapidly increased as a result of the technical development. New transport techniques became a major weapon in international competition. The protectionistic tendencies were in conflict with the interests of the traditional maritime nations, with the expansion plans of the East European countries and with the convenience registration of fleets and firms in some developing countries. Competition from alternative modes in the late 1960's became a major element in the development of short-sea services and also increased in importance for deep-sea lines. International liner shipping in the 1970's thus came into a phase of growing diversification as regards transport techniques, policies and flag distribution of fleets. Another important tendency was the increased interdependence between liner shipping and other elements in the system for general and break bulk cargo transports.

The second part of the study, Chapters 2-4, is focused on the demand for liner shipping, i.e. on the general and break bulk cargo trade. In the second chapter two questions are raised. The first is about elements and interdepences guiding consignors in their choice of mode and route. The second is focused on models and methods for the analysis of the demand for general cargo transports and port services and the way the applied techniques influence the validity and reliability of the results. Four approaches are discussed: time series analyses, market surveys, consignment studies and multiregional transport methods. Modal and route allocations of general cargo flows are shown to be a function of a complex decision process including consignors, suppliers of transport and terminal services as well as other groups with an indirect but strong influence on the transport market. Methods and models used in the analysis of flow allocation can thus seldom be based on a single explaining variable. The experience of earlier studies indicates that market surveys are useful in short- and medium-term analyses. They can be used with the market share and causal models based on time series analyses. Consignment studies are a valuable complement to the market surveys and time series in the medium-term analysis but are time-consuming and therefore seldom used. Multiregional transport models are a powerful method for medium- and long-term analyses of the demand for individual modes, particularly when simulation of alternative development trends is requested. They are based on a number of quantified interdependences which makes an in-depth analysis of the explicit and implicit assumptions a *sine qua non* in the evaluation of the results.

In the third chapter the modal and port distribution of Sweden's general and break bulk cargo trade is analyzed for the 1960's and 1970's. The discussion is focused on three questions: (1) the relationship between the production pattern and the size and geography of the flows, (2) the modal allocation of flows and (3) the role of individual ports in the seaborne trade with general and break bulk cargo. The analysis showed (1) a considerable surplus of incoming general cargo, which means that transport suppliers have to search for outgoing cargo in the break bulk market, (2) a rapid growth of road transports which resulted in an increased concentration of shipping and rail to the low-value segments, (3) a decline of traffic in the East Coast ports, and (4) a concentration of break bulk cargo flows to a limited number of specialized terminals.

In the fourth chapter a quantitative model is developed to estimate an optimal modal and port distribution of general cargo flows, considering the price, time and capacity of the individual services. The model describes in quantitative terms the volume of demand for general cargo transports, its geographic location and the system of supplied transport services. It can be used both for the analysis of the current situation and to simulate future port and modal allocation of flows, considering planned or expected changes in the geography of demand for general cargo transports and in the networks of supplied services, their prices and time performances. The results indicate that land transports are the optimal alternative for general-cargo shipments from Sweden to the Continent and United Kingdom. However, the results have to be carefully interpreted as they are based on several assumptions about the consignors' optimizing behavior, the pricing system, the value of transport time, and the capacity limits.

1. LINER SHIPPING: GENERAL TENDENCIES

The division of international shipping into two lines of work, liner shipping and tramp shipping, has traditionally follwed the division of seaborne trade into general and bulk cargo.[1] The general cargo trade is regarded as the market for the transport services of liner shipping and the bulk cargo flows for that of tramp shipping. Changes in the organization of supply and demand, in the volume and structure of the cargo flows and in the transport techniques mean that the concepts of liner shipping - tramp shipping and general cargo - bulk cargo vary from time to time and are seldom unequivocally defined.

An analysis of the development tendencies in liner shipping requires a definition of the economic, organizational and technical qualities that make it differ from the other types of sea transports. This analysis is necessary to delimit the sector of sea transports in which liner shipping is most competitive and to illustrate development tendencies in adjacent markets that may form potential expansion areas for the industry. Technical, organizational and political changes like the expansion of road and air freight, the growth of industrial and special shipping, and a drift to economic autarchy in the long run may signify important limitations to the development potentials of liner shipping. Against this background the answer to two questions are sought in this chapter:

- What factors and relations have hitherto governed the development of international liner shipping?
- In what way will these factors influence the development of the industry in the 1980's and 1990's?

The analysis in this chapter and the following discussion on the transport requirements of cargo and on demand models for transport form the basis for the concluding

---

[1] Högbom, 1934, p. 278; Fisser, 1957, p. 8; Encyclopedia Britanica, vol. 20, p. 545.

chapters on the present and future demand for liner shipping in Sweden, its geography and forms of organization.

DEFINITIONS

Liner shipping differs from other forms of work in sea transport by offering all potential consignors regular and scheduled departures on firm routes within a system of base ports. The production units are the lines, as distinguished from tramp shipping in which individual ships form such units. Liner shipping is carried on by independent companies which makes it differ from industrial shipping in which shipping companies are either owned by or by long-term contracts tied up with manufacturing firms.

From the market point of view liner shipping can be divided into cabotage, short-sea and transocean connections. They are noticeably separated from each other as regards cooperation of shipowners, their collaboration with consignors, competition from alternative transport modes and the influence of government, i.e. the degree of market regulation.

Cabotage or domestic liner shipping is traditionally reserved for the national flag according to the *mare-nostrum* doctrine. This holds for all European countries except Great Britain, Benelux, Norway and, partly, Denmark and Sweden. The doctrine is put into practice in most non-European countries, especially the United States, South America, and India. Out of 76 coastal states, 46 applied flag discrimination in domestic shipping at the beginning of the 1970's.[1] In Sweden and most other European countries competition from land transport caused a gradual decline of domestic liner shipping in the 1930-1960 period.[2] However, it is still important in several non-European countries, mostly island countries and the United States. The shift to ro-ro technique and integration with road haulage may lead to a renaissance for domestic liner shipping in European countries with long coastal stretches, like the Nordic and Mediterranean countries. Present flag discrimination will probably also include this traffic. This means that a possible expansion on domestic markets will influence only the growth possibilities of the national shipping companies, and will be of little importance for the development of international liner shipping. Cabotage is therefore excluded from the analysis.

---

1 Committee of Inquiry into Shipping, 1970, pp. 41-42.

2 Thorburn, 1958, p. 215.

Short-sea shipping is here defined as traffic within Europe, including the Levant and the North Coast of Africa. It is similar to current English and German definitions.[1] Short-sea shipping is strongly influenced by the competition from land transport, which increases the interest of the shipping industry in innovations in ships and handling techniques to maintain its competitiveness. The competition from land transport makes it difficult for the shipowners to have a joint control of prices, capacity, and of the cargoowners' loyalty. This has created a decentralized market without much cartel interference. In the analysis the development of shipping in the Baltic and the North Sea will be studied closely. This region is of great importance in the transport supply of Sweden's general and break bulk cargo trade as well as for the employment of Swedish tonnage in general and break bulk cargo outside the transocean markets.

All traffic between Europe and other continents except for North Africa and the Levant is here described as deep-sea liner shipping. The development on this market shows regional dissimilarities in shipping policy, bargaining strength of the cargo owners and in the structure of the general and break bulk cargo flows. These differences are pointed out to emphasize shifts in environment and market terms that confront shipowners active on the deep-sea routes.

In some studies ferry shipping is separated from other liner shipping because of strong relations to land transports and differences in ships and ways of work of the shipowners.[2] Such differentiation is not made here, as ferry shipping fulfills all demands of liner shipping as defined above. Ferries are used for transporting general and break bulk cargo, i.e. they offer transport services in the same market sector as other liner shipping.

PHASES OF DEVELOPMENT

The development of international liner shipping in the past 150 years is here studied in four perspectives: (1) the adaptation of shipowners to the technical development, primarily in the areas of ships and cargo handling;

---

[1] Short-Sea Trade is used to describe the traffic between Great Britain and ports in Northern and Western Europe and in the Northern part of the Mediterranean, Committee of Inquiry, 1970, pp 60-63. In West Germany three kinds of local shipping are separated: "Küstenfahrt, Klein Fahrt und Mittlere Fahrt", Schiffsbesetzungs- und Ausbildungsordnung vom 1970-08-11, § Fahrtgebiete.

[2] Bachman, 1968.

(2) internal cooperation of shipowners, its forms and development; (3) cooperation of shipowners with consignors; and (4) adaption of shipowners to the shipping and economic policies of various countries and its influence on the development of national liner fleets and shipping companies.

The following-up by the shipowners of the technical development - just as in the process industries - led to increased average size in the production plant, the ship. This was completed with increased speeds, reduced manning per transported ton cargo, reduced time in port, and increased safety at sea (reduced transport risks). Liner ships, primarily transocean passenger vessels came to represent a synthesis of the technical development in the second half of last century. This positively influenced creative thinking in the economic and organizational fields and increased the possibilities to recruit technical and business talents to the industry. The passenger ships were the first step towards technical segmentation of the shipping market, which in the long-run led to the development of system transports. The introduction of special ships meant a powerful restriction on the expansion possibilities of liner shipping, through a gradual transfer of more and more goods from general cargo to bulk transports. This process is particularly noticed in this study.

The demand for speed, safety at sea and technical modernization put on liner ships by consignors and by conferences forced the shipping companies to a continuous tonnage change. This and the extensive administration, including networks of agents, contributed to high fixed costs compared to other forms of shipping.[1] High fixed costs and the demand for maintenance of regular sailings irrespective of the access to cargo limited the shipowners' possibilities of cutting prices. It also created a need for a close cooperation between shipowners to counteract competition by price and capacity regulations. The liner conference system, established in the 1860-1890 period, formed the basis for cooperation between deep sea liner companies.

The cooperation between shipowners and consignors was mainly concentrated on averting market conflicts and thereby preventing the transition of cargo to alternative transports. The primary interest of the shipowners was to strengthen the loyalty of the cargo owners to their lines and thereby to stabilize their cargo basis, a prerequisite for the existence of international liner services.[2] Rebates and the shipowner's help in marketing products on the transocean markets developed into two basic elements in

---

1 Thorburn, 1960, p. 113.

2 Thorburn, 1960, p.116; Sturmey 1962, p.235.

the cooperation between shipping lines and cargo owners. They were both launched at the end of the 19th century by the newly formed liner conferences.

The regulation of liner shipping in a national shipping policy has two main purposes: (1) to promote the development of the national liner shipping companies and (2) to guarantee the country a transport supply that is optimal from its own point of view. The shipping policy is also influenced by the political and military aims of the country and is an important element in the economic development plans. A general tendency in the shipping policy of newly established shipping nations is to advocate a stronger regulation of the working terms of international liner shipping. Countries with large and stable liner fleets prefer the market forces as the regulating mechanism. The result is an oscillation of the terms of work of the shipping companies between the *mare liberum* and *mare nostrum* environment, geographically as well as over time. The internationally successful liner companies are characterized by high flexibility and good adaptability in the face of these oscillations.

The development of liner shipping in the past one and a half century can be divided into:

1. The foundation period - first within a regulated and then a free market - in the years 1820-1870;
2. The expansion period within a cartelized market about 1870 - mid 1960's;
3. The diversification period from the mid 1960's.

THE FOUNDATION PERIOD 1820–1870

CONDITIONS OF WORK: REGULATED AND FREE MARKET

The foundation period stretches from the beginning of the 1820's to the first years of the 1870's. The basic forms of work of liner shipping were established in this period.[1] They were: (1) a geographically fixed route plan; (2) scheduled sailings, independent of weather conditions and use of the loading capacity of the ship; and (3) acceptance of all consignments without regard to size and consignor.

The development of regular sea transports on the oceans in the first half of the 19th century should be seen as a condition to the contemporary industrialization of Europe. This brought in an increased dependance on intra- and intercontinental trade.[2] An important condition for the

---

[1] The first transocean line was probably that of the Black Ball Lines between Liverpool and New York which started in 1816; Strømme Svendsen, 1956, p. 292.

[2] "The idea of an international economic order was already by 1860 well established"; Youngston, 1966, p. 171.

industrial breakthrough and progress was the access to a well functioning transport system for people, cargo, and information. The railroads were the core of such a system on land. Liner shipping came to play the same role at sea.

The routes Great Britain - North America and the Continent - North America were the most important for the development of deep-sea liner shipping already in the first half of the 19th century. The rapid growth of emigration followed by an expansion in the demand for European manufactured products, i.e. highvalue general cargo, created a need for high quality transports.

Other important routes were Europe - the Levant, Europe - the Far East, Europe - the West Indies, and Europe - South America.

TECHNICAL DEVELOPMENT

Liner shipping in the first twenty years was based on sailing ships. The steamer was introduced to the deep sea services at the end of the 1830's. American "flash packets" made the New York - Liverpool run in little more than half of the average time needed by British steam vessels in those days. However, in the long-run the steamer meant a technical and organizational break-point in the development of shipping.[1] From the point of view of the economics and organization of transports the steamer gradually came to mean increased security for passengers and goods, less dependence on the weather, as a rule shorter transport time, better regularity, lower costs for manning, and increased ship size. The requirement for speed and regularity characteristic for transports of passengers and expensive general cargo made liner shipping the leader in the use of fast ships, i.e. steamers in the past century and motor vessels in this century.

In the 1850's and 1860's iron and steel more and more replaced wood as ship-building material. This further increased the durability of ships and made it possible to build them even larger. The propeller was the third important technical innovation that from the late 1860's made the steamers able to offer competitive alternatives to sail ships on all deep-sea routes.

The steamers were very capital intensive compared to sail ships. This created a strong financial restriction and need for a developed marketing organization. The traditional family-owned shipping firms were in many cases too small to carry on liner business by themselves. This provided zoom for the development of the modern limited liability

---

[1] The first steamers on the North Atlantic were introduced in 1838, the SS Great Western and the SS Sirius of the British American Steam Navigation Co.; Bonsor, 1955, p. 5.

companies.[1] They became strong competitors to the fleets of merchant houses which dominated the deep sea transport market before the 1830's. Services supplied by these fleets were commonly designed to meet the needs of merchant houses themselves and not of independent consignors.

SHIPPING POLICY, NATIONAL MERCHANT FLEETS AND LINER COMPANIES

During the foundation period the development of liner shipping was totally dominated by British interests as a consequence of the country's position of an industrial and trading nation, colonial power and leader of the technical development. Half the world's fleet was in British possession in the mid 1850's (Table 1:1). Through a strongly protectionistic shipping policy the British merchant fleet had been guaranteed all transports within the Empire for two centuries until the middle of the 19th century.[2] Transports of cargo between Great Britain and other countries, according to the law, were reserved exclusively for British ships or ships from the country of origin of the cargo.

In Great Britain the competitiveness of the national shipping was debated in the 1840's. The debate was influenced by the economic liberalism that ruled the industrial development. The interplay between free trade and free shipping was emphasized and was considered a necessary condition for the continued economic development of the country.[3] This debate led to an acceptance of a more and more liberal shipping policy in Great Britain in the 1840's. The strongly protectionistic regulation from the days of Cromwell was abolished as well as other flag discrimination. This applied to transports within the Empire as well as to third countries.

In order to strengthen the development of private liner shipping the British government in 1837-1840 had transferred the right to carry mail from warships to merchant vessels. This helped Great Britain play a leading role in the foundation of deep-sea liner shipping companies.

A geographical division of markets, between the leading British shipping companies, took place already at the foundation stage. To a great extent it was stimulated by the British government through its allocation of mail subsidies.[4]

---

1 Strømme Svendsen, 1956, p. 153.

2 Navigation Act 1651-1849.

3 Riccardo, 1847, p. 37.

4 For a further discussion of mail subsidies, see pp. 37-39.

Table 1:1. Structure of the World Merchant Fleet 1850-1910, '000 000 tons net

		1850	1860	1870	1880	1890	1900	1910	Average annual growth 1870-1910
World[a]	Sail	6,9	9,9	12,3	12,9	10,2	8,0	6,0	-1.9
	Steam:	0,2	0,7	1,8	4,4	8,6	13,9	21,9	6.5
UK	S	3,4	4,2	4,6	3,9	2,9	2,0	1,1	-3.5
	St	0,2	0,5	1,1	2,7	5,0	7,2	10,4	5.8
Germany	S			0,9	1,0	0,7	0,6	0,5	-1.5
	St			0,1	0,2	0,7	1,3	2,4	8.3
Japan	S				0,0	0,1	0,3	0,4	7.2
	St				–	0,1	0,5	1,2	13.2
Norway	S	0,3	0,6	1,0	1,5	1,5	1,0	0,6	-1.3
	St	–	–	0,0	0,1	0,2	0,5	0,9	7.6
France	S	0,7	0,9	0,9	0,6	0,4	0,5	0,6	-1.0
	St	0,0	0,1	0,2	0,3	0,5	0,5	0,8	3.5
Russia[b]	S				0,7	0,6	0,6	0,6	0
	St				0,1	0,2	0,4	0,5	5.5
Italy	S			1,0	0,9	0,6	0,6	0,4	-2.3
	St			0,0	0,1	0,1	0,4	0,7	6.7
USA[c]	S	1,5	2,4	1,3	1,2	0,7	0,5	0,2	-4.6
	St	0,0	0,1	0,2	0,1	0,2	0,3	0,6	2.8
Spain	S				0,3	0,2	0,1	0,0	-5.8
	St				0,2	0,4	0,7	0,8	4.7
Sweden	S				0,4	0,4	0,3	0,2	-2.3
	St				0,1	0,1	0,3	0,6	6.1
Denmark	S			0,2	0,2	0,2	0,2	0,1	-1.7
	St			0,0	0,1	0,1	0,3	0,4	4.7
Holland	S	0,3	0,4	0,4	0,3	0,1	0,1	0,0	-6.7
	St	0,0	0,0	0,0	0,1	0,1	0,3	0,5	5.5
Austria	S			0,3	0,3	0,1	0,1	0,0	-4.4
	St			0,0	0,1	0,1	0,2	0,5	5.5
Greece	S		0,3	0,4		0,2	0,2	0,1	-4.5
	St		–	0,0		0,0	0,1	0,3	8.9
Belgium	S	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0
	St	0,0	0,0	0,0	0,1	0,1	0,1	0,2	2.3
China	S				0,0	0,0	0,0	0,0	0
	St				–	0,0	0,0	0,1	

a Excluding U.S.-inland and coastal fleet
b With Finland
c Overseas fleet only

Source: Kirkaldy, A.W., 1914, British Shipping, its History, Organization and Importance, London. Appendix 12.

The route to the Mediterranean, the Levant and the Far East in 1837 was allocated to the Peninsular and Oriental Steam Navigation Co., specially established for this purpose. The fight over the mail contract on the leading liner market Great Britain - North America was won in 1840 by the British and North American Royal Mail Steam Packet Co., later renamed Cunard Steamship Co. The same year Royal Mail Steam Packet Co. got the mail contract between Great Britain and the West Indies, South America.

The realization of the free competition doctrine on the world seas stimulated the growth of non-British merchant fleets in the 1850's and 1860's. The United States and Norway appeared as important shipping nations and competitors of Great Britain (Table 1:1). Making the most of their comparative advantage - the long shipyard tradition, the broad sea contact with cod fishing, whale hunting and long-distance trade, primarily with South America, California and China - the American shipping companies continued to emphasize sail ships through the 1850's.[1] Between 1850 and 1860 the United States increased its transocean sail fleet with 5 % a year, and its share in the sail fleet of the world increased from 22 to 24 %. The Civil War 1861 - 1865 stopped this development; in the beginning of the 1870's the Americans had only 11 % of the world sail tonnage. The American share of the steamers was 13 % in 1870, i.e. much less than the British (Table 1:1). This was a consequence of the American shipowners' strong belief in the superiority of the sail ship, especially in tramp shipping, and the government's limited support of transocean mail transports with steamers.[2] The American shipping policy had been liberal already in the first half of the 19th century. By decision in Congress, the discrimination of foreign ships in the transport supply of the country had been abolished.[3] A considerable part of the American fleet was engaged in "cross trading",[4] i.e. U.S. shipping remained competitive until the Civil War.

---

1 "Three years ago we directed attention to the great increase of foreign screw steamers, and showed clearly how they were rapidly taking away the trade that has formerly been carried by American ships ... Today nearly all the mail and passenger, besides a great deal of the goods, traffic, is carried by foreign ships, the great majority of which are iron screw steamers ... We have not a single new Atlantic steamship in the stocks, from one end of the country to the other, while in Great Britain there are 16 000 tons of new iron screw steamers built for the American trade." Scientific American, March 31, 1860.

2 "During the period when the British were building up their first subsidized st amship lines and services, extending their trade and Empire, the people of the Congress of the United States were occupied with westward expansions and did not grasp the situation", Foreign Trade and Shipping, 1945, p.176.

3 Congress Act of May 3, 1815 and Reciprocity Act of 1828.

4 Foreign Trade and Shipping, 1945, pp. 153-165.

The rapid expansion of the Norwegian fleet between 1850 and 1880 was almost solely concentrated to sail ships: a result of comparative advantages - traditions in fishing, whaling and sail shipping, the concentration to tramp shipping, and the low cost of labor - as well as the lack of capital. In 1880 steamers were still a mere 3 % of the Norwegian merchant fleet (Table 1:1).

Also the British sail tonnage increased noticeably until the 1870's. The superiority of steamers over sail ships was not self-evident even among British shipowners before the mid 1870's. Technical innovations, the propeller in the 1860's and the compound steam engine in the 1870's,[1] meant considerable progress in the sea-worthiness and competitiveness of steamers. The latter innovation reduced the fuel need of the steamer, i.e. increased its loading capacity and productivity. The consequence was a keener competition between steam and sail as well as between the steam ship lines. A violent price war followed, primarily on the two leading deep-sea routes: (1) Europe - North America and (2) Europe - India, the Far East, Australia. The freight rates dropped about 40 % on the North Atlantic between 1860 and 1870.[2] This cannot be explained solely by lowered transport costs as a result of the technical development. The price war played an important role. The opening of the Suez Canal in 1869, and the rapid tonnage growth contributed to the drop by one-fourth between 1874 and 1878 in the freight rates on the route Great Britain - the Far East.[3]

Considerable capital investments and high operating costs limited the possibilities of the steamship companies to engage in a long price war. Their profits decreased conspicuously in the 1870's, probably due to diminished freight income.[4] A large number of shipping companies were for economic reasons forced to close down in these years. The threat against continued existence made the companies, operating on the same route, start cooperating at the beginning of the 1870's. This cooperation formed the basis of a new phase in the development of international liner shipping. The free competition that characterized the market between 1840 and 1870 was now replaced by a system of cartels, the liner conferences.

---

[1] "Although success had been obtained with the compound system in vessels built for the Pacific Steam Navigation Co. as early as 1856, it was not until about 1870 that the compound engine came into general use", Murray, 1960, p. 692.

[2] Youngston, 1966, p. 171

[3] Deakin, 1973, p. 16-17.

[4] Hyde, 1967, p. 6.

THE EXPANSION PERIOD 1870–1948

The expansion period 1870 - mid 1960's could be divided into three phases, taking into account two break-points in world history, the First and the Second World Wars. The first phase, 1870-1914, was characterized by British dominance and by a liberal shipping policy comprising most countries. The second, including the two world wars and the interwar period, saw a breakdown of the British dominance as a consequence of increased competition from new shipping nations. The first two phases are analyzed together in this study.

The third phase, the reconstruction after the Second World War, was a period of rapid and comparatively even growth in demand for transocean liner shipping. This phase ended in the mid 1960's, when new tendencies could be discerned on the international liner shipping market as a result of new transport techniques, the shipping policy of the underdeveloped countries, and the appearance of liner shipping companies governed by other than pure business criteria.

CONDITIONS OF WORK: LINER CONFERENCES

In this section the growth of liner conferences is analyzed by the main liner markets in the 1870-1948 period. Special emphasis is laid on the differentiation in the forms of work of the conferences as a consequence of variations in the shipping policy of the governments and the negotiation strength of the consignors.

Liner conferences, a voluntary association of shipowners operating on one route, were established at the end of the 19th century.[1] The purpose of these agreements was to: (1) regulate the tonnage supply and freight level on individual routes; (2) limit the competition from nonmember companies; and (3) tie the consignors to the conference ships through rebates.

The conference system introduced four new elements into the working forms of liner shipping. The most important was tariffs, i.e. pricing through agreements between the shipowners participating in the conference. Thus, the

---

1 The first conference was established at the end of the 1860's by British liner shipping companies in passenger traffic on the North Atlantic. Both passenger and cargo transports were regulated. The first conference exclusively for cargo shipping was established in 1875 on the route Great Britain - Calcutta. Shipowner associations with the purpose of regulating the supply and pricing in domestic and local liner shipping occurred even earlier. Thorburn, 1958, p.96.

traditional price negotiations between individual consignors and shipowners were abolished. The second element was the geographical division of hinterlands. The member lines were reserved traffic to and from individual ports. Home markets were often allotted the national lines. The pool system was the third important innovation.[1] Freight and earning pools were established. The former ment a common sharing of cargo, the latter a common levying of traffic revenues. The aim was to prevent price cuts below the tariff and agreed rebates. The fourth element were the common actions against the competition from nonmembers. Until 1916 all conferences were organized according to the same principle of a closed and selfregulating association. The antitrust policy of the United States in 1916 forced the creation of a new typ of conference, open for all lines and for state control.

The India Trade

Already at the turn of the century the conference system included the most important transocean routes from Europe. The route to India was leading in the number of conferences up to the Second World War, about 100 in 1948.[2] Separate conferences were formed for the sailing between individual ports in India and European countries. The British traffic was even divided into coastal areas. This disintegration gave the consignors a strong position in negotiations with the conferences. To strengthen it, the tea growers created the first shippers' associations.[3] These organizations forced the conferences to introduce in the 1890's the system of rebates. Their main purpose was to strengthen the loyalty of the cargo owners to conference lines. Rebates were offered as "deferred rebates" or "contract freight rates". The former were popular on routes where the negotiating strength of the shipowner noticeably dominated over that of the cargo owner, while the latter were introduced on routes with comparatively even competitive strength.

British companies totally dominated the India conferences up to World War One. In the interwar period German, Scandinavian, and Dutch companies entered but German, Belgian and Dutch ports remained open in the India conferences, i.e. traffic on these ports was not reserved for the domestic lines. At this time 25 % of the profits from the traffic on open ports were divided in a freight pool between the conference members. Offered tonnage was used as the division key.

---

1 Freight pools were introduced in 1884 in the Australian conference and developed rapidly into practice in most other conferences.

2 Deakin, 1973, p.23.

3 The Indian Tea Association as well as the Calcutta Tea Traders Association was formed in 1881.

The introduction of the freight pool meant further strengthening of the cooperation among the shipowners, i.e. mutual control through a detailed supply regulation and a division of net profits, based on agreements and thereby partly independent of carried freights. The freight pools comprised one or several commodities on one route. They were formed on routes where the conferences could not prevent wars between the lines.[1]

The Far East Trade

Conferences for the Far East traffic were formed in the beginning of the 1880's on the initiative of Mr J. Swire.[2] After substantial initial difficulties, which caused their closedown several times, they grew to comprise all liner traffic between Europe and China, Japan, and South East Asia. The competition from tramp shipping and lack of return cargo to Europe at the turn of the century necessitated special discounts for traffic via Europe to the East Coast of North America. The cargo was hauled to North America at no extra cost. Another innovation was a system of individual freight rates for whole ship loads, which strengthened the competitiveness of liners in transport of bulk commodities as return cargo. Freight rates were established individually for each consignment through direct agreements shipowner-discharger, i.e. the same way as in tramp shipping. After the turn of the century and in the interwar period individual freight rates became an important means of competition for liner shipping on routes with a strong imbalance in the traffic.[3]

The rapid growth of the German liner shipping and the expansion of the traditional Dutch and French sea connections with the Far East contributed to the sharpening of the competition for return cargoes on the route. The negotiating position of the British shipowners vis-à-vis the shipowners on the Continent was weaker than in the India or Australia traffic. The result was that traffic of all European ports was reserved for national companies in the Far East conference. Antwerp was the only open base port in Europe as no Belgian company participated in this conference.

Stagnation in the trade between Europe and the Far East, new shipping companies, primarily from Scandinavia and Japan, the rapid reconstruction of the German companies and keen competition from tramp shipping led to a substantial tonnage surplus on the route in the 1920's. More and

---

[1] Marx, 1953, p. 162.

[2] Marriner & Hyde, 1967.

[3] Fisser, 1957, p. 29-33.

more of the shipping companies started offering rebates below conference agreement. Certain companies applied lower rates by noting lower weight than the actual. In order to counteract this practice, the Far East conference formed a system of "sworn measurers". Their task was to check the consignment weights at the quay. These measures were the basis of the freight charging and for fees to the freight pool founded at the same time.

The Australia Trade

As on the India routes the British shipping companies dominated the liner services Europe-Australia. Here also the competition from tramp shipping was very noticeable as regards the return cargo to Europe. It was dominated by wool and meat, i.e. goods for which special ships and general tramps could offer a very competitive alternative to liner shipping. In contrast to the Far East route the Australian consignors were well organized already in the interwar period. This considerably increased their negotiating strength vis-à-vis the conferences and enabled common charterings of tramp tonnage. In negotiating with the conferences the Australian consignors were at an early stage supported by the federal administration, which in 1906 prohibited conference rebates to limit the monopoly tendencies in liner shipping.[1] The prohibition was abolished in the 1920's and was replaced by a negotiating organization (Australian Overseas Transport Association - AOTA). The organization included all participants in the transport market, i.e. consignors, transporters, and authorities. It became a forum for negotiations on freight rates and tonnage supply on the route Australia - Europe. AOTA also became a control institution for freight charging and rebates. In spite of the foundation of AOTA the Australia traffic in the whole interwar period continued to show a considerable tonnage surplus on the return trips as a consequence of imbalance in traffic and competition from tramp shipping.

The Africa Trade

The liner shipping on Africa up to World War I was mostly operated by British, French and Portuguese companies. The drawing up of the lines to a great extent followed the empires. The shipping on French and Portuguese colonies was regulated by the governments, which effectively prevented competition. The traffic on British colonies was operated by a number of British companies in keen competition. In order to counteract this, they introduced the con-

---

[1] Australian Industries Preservation Act of 1906.

ference systems in the 1880's and 1890's.[1] Local authorities, especially in South Africa, in the interwar period, conducted a very active shipping policy with the purpose of increasing the competitiveness of the local industry on the world market through a good and cheap transport supply. Already in 1911 the mail authorities in South Africa were prohibited from using lines, whose actions were supposed to damage the commercial interests of the national industry.[2] In the 1930's this policy was continued with selective subsidies and government contracts for lines considered to be favoring local industry. This policy limited the possibilities of the South Africa conference to make independent decisions about freights, discounts and shipping terms.

The South America Trade

In the 1890's liner conferences were introduced on the route Europe - South America.[3] Until the turn of the century the British companies were responsible for most of this traffic. In the first decade of this century the German companies increased noticeably their traffic as South America became an open continent where several nations competed for economic and political influence. Regular sea connections were very important means to strengthen one's interests. After the First World War the competition sharpened even further as Dutch and Scandinavian lines expanded. This led to a reorganization of the liner conferences with a weakening of the position of the British companies as a result. Traffic on Continental ports was reserved for national lines, Belgium and Holland being exceptions. The South American governments tried to increase their control of the conferences in the U.S. fashion. The Brazilian government in 1933 prohibited rebates and other forms of tying customers in shipping.[4] The prohibition was abolished after five years on the recommendation of the Sao Paolo Chamber of Commerce. The motive was that a general system of rebates favored the Brazilian foreign trade, provided that the rebate period was short, the consignor had the possibility of choosing a non-conference ship when lacking conference tonnage without seeming disloyal, and that Brazilian ships could be chosen before conference ships. This was the beginning of the protectionistic measures in the shipping policy of the South American countries which strongly influenced the policy of other developing countries in the postwar period.

---

[1] South Africa Conference was formed in 1886 and West Africa Conference in 1895.

[2] Marx, 1953, p. 91.

[3] North Brazil Conference 1895, River Plate & South Brazil Conference 1896, West Coast of South America Conference 1904.

[4] Sanderson, 1938, pp. 118-123.

The North Atlantic Trade

The cartel-forming tradition in the liner shipping of the North Atlantic dates back to the 1850's. In 1851 the British Cunard Co., the leading company, agreed with the newly established US Mail Steamship Co. (Collins Line) about minimum freight rates. The companies also formed a freight pool.[1] When the U.S. Post Office Department in 1858 broke off the subsidies of mail to the Collins Line its continued existence was rendered impossible. This was the end of the first attempt to cartelize liner shipping on the North Atlantic. The rapidly increasing tonnage supply on the route in the 1860's and the increase of the number of shipping companies led to the forming of the world's first transocean line conference. It included Liverpool companies trafficking North America.[2] In the 1880's the conference was extended to include also German companies. They later took a leading position in the North Atlantic traffic (Table 1:2) as a result of successful marketing and government support to limit competition from foreign ships in domestic ports. This gave the German companies the greater part of the Central and East Europe emigrants. The strong position of the German companies and the establishment of the American shipping trust International Mercantile Marine led to a dissolution of the North Atlantic conference in 1903. An extensive price war followed. A noticeable decrease in emigrant traffic, 30 % in 1908 from the year before, led to a stop of the price war. A new conference was established and included all passenger lines on the North Atlantic and most of the goods traffic. In connection with this the AA-agreement was introduced, whose purpose was to divide in detail the shares of passenger and goods traffic between the conference members. This regulation was contrary to the spirit of the U.S. antitrust legislation which led to an investigation by the House of Representatives of the activity of the conferences and their negative influence on free competition.[3] The investigation led to new legislation, the Maritime Act of 1916.

This law became the basis of the American shipping policy and attitude to shipping conferences. It brought on federal control of liner shipping on the United States.

---

1 Minimum price for passenger transports were £ 30 for first and £ 20 for second class passengers and £ 7-7-0 for 1 ton of goods. Hyde, 1975, p.40.

2 "There is, at this moment in Liverpool, what they call a Steam Conference of all British steamship owners in Liverpool and Glasgow, whereby all the rates of freight are regulated at the Conference." Proceedings of the Selected Committee on Mail Contracts 1869, § 1457.

3 Committee on Merchant Marine and Fisheries, 1912-1916 (Alexander Committee).

It prohibited "deferred rebates", the use of low price ships for fighting competition, discrimination of disloyal dischargers, use of discriminating contracts, and preventions for entering the conference. The legislation forced a new type of open line conferences that were subject to public observation. In the 1920's these new conferences introduced a system of double freight rates in an attempt to reinforce the rebate system. They also tried to develop secondary competitive obstacles for non-member tonnage, primarily through secret deals with port authorities about priority for conference tonnage and differentiated range additions for further transports in Europe. The Merchant Marine Act of 1936 prohibited such practices.

Table 1:2. Westbound North Atlantic Steerage Traffic by Major Lines 1891

Line	Passengers '000	% of Total
Hamburg-Amerika	76	17
Norddeutscher Lloyd	68	15
White Star	36	8
Cunard	27	6

Source: Aldcroft, D.H., 1968, The Development of British Industry and Foreign Competition 1895-1914, p. 357.

Conclusions

In conclusion, from 1880 up to the First World War self-regulating, closed conferences developed on all Europe routes. The self-regulating conference won the greatest power on routes where consignors were small and scattered over several countries, e.g. the Far East or West Africa. On routes, where one country's consignors dominated and were supported by local governments as part of their export promotion policy, the negotiating strength of the conference was balanced by shippers' associations and by the active shipping policy of the governments.

The American shipping policy created new conference forms with public regulation and better possibilities for non-members to compete. This policy stimulated the interest of other governments, primarily in South America, Australia, New Zeeland and South Africa, to seek greater control over liner shipping in their own ports in the 1910's and 1920's. In spite of all measures to limit competition the conferences seemed to be indispensable for the existence of liner shipping. They created stability in the relations between consignors and lines. This guaranteed the continuity of services and allowed for investments in new tonnage and handling techniques. In the long-run these investments should be useful also to the consignors as the price and time of transport decreased while the quality increased. However, the conferences could only partly eliminate competition between the shipping companies. Open price-wars were replaced by negotiations within the conference where the negotiating strength of individual companies determined the division of cargo and level of prices. A close cooperation in the form of freight-pools became necessary on routes with a permanent tonnage surplus in order to prevent destructive competition that would in the long-run render line traffic on the route impossible. To stabilize the demand even more, the conferences introduced deferred rebates and thereby strengthened the loyalty of cargo owners.

TECHNICAL DEVELOPMENT AND SPECIALIZATION

The technical development in shipping in the period 1870-1948 was characterized by three tendencies: (1) ship specialization which created segmentation of the markets and led to the development of transport systems; (2) increased ship size; and (3) increased speed and productivity.

Special Ships

The general carrier was the only type of vessel in the deep-sea services up to the middle of the 19th century. She transported passengers and goods and could be used in various trade relations. The development of special ships that started in the middle of the 19th century formed the basis for a technical segmentation of the market. The competition between special and universal ships influenced the development of both liner and tramp shipping in the rest of the 19th and in the 20th century. The development of the special ships followed the "trial and error" method; only a few took the step from invention to innovation. Two factors were decisive for the development of a special ship: (1) the access to large and permanent trade in one commodity, and (2) the possibility of lowering the unit cost for the transport shortening cargo handling time.

The Passenger Ship

Passenger ships with only marginal loading capacity for goods were the first type of special ship. They were introduced on the North Atlantic in the middle of the 19th century. Passenger ships representative of the 1850's still had a high quotient deadweight/displacement compared to the ships of the 1880's (Table 1:3). The introduction of passenger ships created a division of the liner shipping market into two segments: (1) passenger and mail transports and (2) cargo transports. Nevertheless, a limited number of combined passenger/cargo vessels continued to link these to market segments also after the 1860's.

The broad introduction of passenger ships on the North Atlantic in the second half of the 19th century should be seen against the background of the rapidly increasing emigration. Up to the mid 1920's, two passenger categories, with separate demands for transport services, could be found on the North Atlantic: cabin passengers and steerage passengers. The cabin passengers preferred speed and travel comfort and were prepared to pay for it. They stimulated the companies to invest in fast ships with large recreation areas and high travel comfort. Speed and comfort were means of competition on a market where prices were regulated by the conference. However, the demand from cabin passengers was not enough by itself to motivate large and fast passenger ships before the First World War. Emigrant transports were therefore decisive for the development of passenger traffic on the North Atlantic. The number of emigrants per decade quituplicated from 1841-1850 to 1901-1910 (Table 1:4). The rapid and relatively even growth of the emigrant flow meant that the tonnage demand on the North Atlantic increased from roughly 40 000 gross tons in 1860 to 115 000 tons in 1880, 245 000 tons at the turn of the century and 500 000 tons in 1913.[1] Thus employed tonnage increased more rapidly than the passenger flow, i.e. with increased ship size the productivity measured per gross ton and year decreased, which shows that the travel comfort increased.

The fixed costs for steerage passengers were relatively small from the shipowner's point of view. They were near the marginal cost for food, if this was included in the price. The demand for additional space was limited. The alternative use of the space occupied by steerage passengers was transport of cargo. It would increase the time in port and therefore was less profitable for large cabin liners. The introduction at the turn of the century of obligatory meal-including tickets meant that reduction of the transport time became an important profit factor also in emigrant transports. Shortened sailing time also meant an increase in the number of journeys a ship could perform in a year, i.e. increased productivity and thereby

---

[1] The calculation was based on technical data for an average ship of the Cunard fleet respective year and a 95 % use of the steerage places in the Westbound traffic. The time in port was estimated at two days and nights per port. The following ships were used: SS Hecla for 1860, SS Cephalonia for 1880, SS Carpathia for 1900, and SS Andania for 1910.

Table 1:3. Passenger Liners in the North Atlantic Services

Data \ Years	1860 China[a]	1870 Oceania	1885 Etruria	1907 Mauretania	1914 Aqvitania	1922 Majestic	1932 Rex
Gross Tonnage '000	3	4	81	31	46	57	51
Deadweight, '000	1.4		4	12	11	15	8
Displacement, '000			13	42	49	64	45
Length m	115	127	157	238	273	290	267
Total Passengers	275	1 166	970	2 150	3 230	4 000	2 050
First Class	150	166	250	570	615	1 060	410
Second Class		-	-	460	615	545	360
Tourist Class	-	-	-	-	-	-	410
Third Class	753	1 000	720	1 120	2 000	2 395	870
Crew			250	850	970	1 100	750
Service Speed, knots	13	14	19	25.5	23	23.5	27
Service HP, '000	4		14	70	56	66	100

a Paddle-Steamer

Source: Bonsor, N.R.P., 1955, North Atlantic Seaway, London.
Christie, J.D., 1935, Liner Development During the Past Fifty Years, London.

Table 1:4. Recorded Immigration to the United States 1819 - 1954 (in millions)

Period	Total	Europe	Germany	Italy	Ireland	UK	Austria-Hungary	Russia	Scandinavia
Total 1819 - 1975	47.1	35.9	6.9	5.3	4.7	4.9	4.3	3.4	2.6
1819 - 1820	0	0	0	0	0	0	0	0	0
1821 - 1830	0.1	0.1			0.05	0.03			
1831 - 1840	0.6	0.5	0.2		0.2	0.1			
1841 - 1850	1.7	1.6	0.4		0.8	0.3			
1851 - 1860	2.6	2.5	1.0		0.9	0.4			
1861 - 1870	2.3	2.0	0.8		0.4	0.6			0.1
1871 - 1880	2.8	2.3	0.7	0.1	0.4	0.5	0.1		0.2
1881 - 1890	5.2	4.7	1.5	0.3	0.7	0.8	0.4	0.2	0.7
1891 - 1900	3.7	3.6	0.5	0.7	0.4	0.3	0.6	0.5	0.4
1901 - 1910	8.8	8.1	0.3	2.0	0.3	0.5	2.1	1.6	0.5
1911 - 1920	5.7	4.4	0.1	1.1	0.1	0.3	0.9	0.9	0.2
1921 - 1930	4.1	2.5	0.4	0.5	0.2	0.3	0.1	0.1	0.2
1931 - 1940	0.5	0.3	0.1	0.1	0	0	0	0	0
1941 - 1950	1.0	0.6	0.2	0.1	0	0.1	0	0	0
1951 - 1960	2.5	1.3	0.5	0.2	0.1	0.2	0.1	0	0.1
1961 - 1970	3.3	1.1	0.2	0.2	0	0.2	0	0	0
1971 - 1975	1.9	0.5	0	0.1	0	0.1	0	0	0

Source: Taeuber, C. & Taeuber, I., 1958, The Changing Population of the United States, New York, p. 53 - 57. Statistical Abstract of the the United States, 1976, US Department of Commerce, Bureau of the Census, p. 104.

decreased need for new ships. From the companies' point of view the productivity increase of the crews was especially important. Costs for wages and food were fixed, independent of the work being done. When the number of sailings increased, the cost was distributed a larger number of passengers. Working hours were only partly regulated, especially those of the dominating hotel and machinery staff, i.e. regulations did not prevent an increase in the number of yearly sailings with the same crew.

Higher speed also strengthened the competitiveness of the companies for the very profitable mail which enabled mail subsidies. The mail between 1850 and 1890 was a very important element in the development of the passenger traffic.[1]

Until the 1950's the North Atlantic remained the dominating route for the employment of passenger ships. Thereafter the air lines completely eliminated passenger shipping on the North Atlantic as well as on other routes. This was pointed out in 1972 by the closing down of the passenger conference for the North Atlantic.

Combined Passenger-Cargo Ships

The demand for passenger transports on other deep-sea routes was seldom sufficient to employ passenger ships. Passengers and high-value goods therefore continued to be moved by the combined vessels (Table 1:5) until the 1960's.[2] Such a combination was a condition for the introduction of large and fast ships outside the North Atlantic. However, rates were higher on those vessels compared to those charged by cargo carriers. The demand for high speed and punctuality led to high capital and operation costs. Punctuality was imperative for passenger and mail transports which limited the possibility of additional calls at en route ports in search for cargo. Prolonged travel time meant, besides inferior service, increased operation costs for food and lower hotel productivity of the crew. The companies tried to reduce time spent in the en-route ports by passenger-cargo vessels through reservations of quays and rapid loading and unloading. The latter limited the market of combined vessels to commodities for which marginal time gains meant more than increased transport costs, i.e. to high-value general cargo and to commodities with limited durability, such as fruit and meat.

---

[1] For a detailed account of mail subsidies, see p. 38.

[2] Combined vessels had a minimum of 13 passenger places, generally over 100. The quota deadweight/displacement was 0.40 or higer. Hardy, 1924, pp. 41-42; Christie, 1935, pp. 273-278 and table 3.

Table 1:5. Combined Passenger Cargo Liners

Trade	Europe - South America				Europe - Far East				Europe - South Africa			
Year	1888	1913	1922	1934	1887	1908	1923	1935	1891	1910	1925	1934
Ship	Alfonso XII	Victoria Eugenia	Flandern	Asturi	Britannia	Morea	Sarpedon	Scharn-horst	Scot	Grantully Castle	Landovery Castle	Bloem-fonten
Gross Tonnage '000	5	10	10	22	7	11	11	18	8	8	11	10
Deadweight, '000t	5	6	7	14		7	11	10	6	9	9	10
Displacement, '000 t	9	13	14	32		17	20	24	12	14	16	17
Length, m	146	160	160		155	200	165	200	165	155	165	160
Passengers:												
Cabin	190	350	315	560	310	600	180	155	310	200	220	90
Tourist	-	-	105	670	-	-	-	155	-	-	190	-
Third Class	840	1 720	890	1 230	460	-	-		100	200	-	-
Crew	150	250	230	460	200	400	160	265	150	150	230	130
Service Speed	14	16.5	14.5	18	15	18.5	15	21	17.8	12	13.5	16
Service HP '000	4	8	6	17	6	11	8	26	10	3	5.8	7.5

Source: Christie, J.D., 1935, Liner Development during the past fifty years, London.

The rapidly increasing consumption of meat and fruit in Great Britain and Western Europe in the gears before the First World War created a market for combined passenger-cargo vessels on routes to the Far East, Australia and South America.[1] The national pattern of the combined passenger-cargo lines well reflected the geography of the empires. The British lines were important on all routes as the colonies of the country were well distributed among the continents, South America excluded. The British lines were especially dominant on the routes to the Far East and Australia and to Africa, foremost South Africa. Dutch ships played an important role on the routes to the Netherlands East Indies and the Dutch West Indies, while the French companies were important on the route to West Africa. These lines supplied the colonial demand for transports of officials, soldiers, weapons and mail besides the movements of commercial goods and thus formed politically and economically important link of the colonial systems at the turn of the century.

In contrast to other continents, South America in the second half of the 19th century was a politically and economically open area. Around the turn of the century it was an important goal for European emigrants,[2] which made a number of European companies establish combined passenger-goods services on this route.

Cargo Vessels: Specialization or Flexibility

Parallel to the development of the passenger ships, a technical specialization began among the cargo vessels in the second half of the 19th century, which created a further segmentation of the international sea transport market. Tankers were the first type of special ships.[3] Until the First World War, oil accounted for only a small part of the seaborne trade (Table 1:6). Coal, grain and ore were the dominating commodities.

---

[1] The first combined passenger-cargo ship with a refrigerator plant was introduced on the route Great Britain - Australia in 1880 (Hardy, p 52). The import of fresh meat from Australia was increased tenfold between 1880 and 1885 and again between 1890 and 1895. The latter period the meat quantities corresponded to a third of the wool, traditionally dominating the route. Deakin, 1973, pp. 16-17.

[2] The number of European emigrants to Argentina was 1.8 million in the period 1901-1910, about 85 % from Italy and Spain. The emigration to Chile rose from 47 000 in 1895 to 78 000 in 1907. Here also, Spanish and Italian emigrants dominated, 25 and 17 %. Economic History of the Argentinian Republic, 1970, p. 24.

[3] Two British fullrigged iron ships, the "Atlantic" and the "Great Western", launched in 1863, are regarded as the first ocean going vessels, whose total loading capacity was adapted to bulk transport of oil. The ships were also equipped with their own pumps. Bjäring, 1967, pp. 11-13.

Table 1:6. Structure of the Seaborne Trade between Continents ('000 000 tons)

		1913[a]	1924[a]	1929[b]	1934[b]	1938[b]
Total		300	314	455	380	470
		Commodities				
Coal		91	80	93	..	71
Oil		11	45	65	..	110
Grains		40	37	47	..	42
Ores		31	23	30	..	30
Wood and Products		26	24	20	..	17
Other		102	105	200		200
		Geography				
Europe	L	221	204	223	178	185
	D	202	163	264	232	266
America	L	43	71	154	152	159
	D	62	109	108	75	100
Asia	L	18	22	59	62	84
	D	19	22	68	58	68
Africa	L	14	12	26	23	28
	D	10	15	23	19	23
Australia	L	4	4	6	6	7
	D	6	5	8	6	9

L Loaded
D Discharged

Source: a Der Güterverkehr der Weltschiffart in den Jahren 1913, 1924 und 1925. 1928 Virteljahreshefte zur Statistik des Deutschen Reichs, Ergänzungsheft zu Heft I.
b Morski Rocznik Statystyczny, 1960, Gdynia.

The large volumes of coal and iron ore in sea transports and technical inventions of new loading and discharging techniques (the roll and the scoop) stimulated the development of special bulk carriers at the turn of the century. But in contrast to the tankers, they had a relatively limited share of the world fleet until the second half of the 1950's. Up to the Second World War they were mostly small and designed for cabotage and near-sea shipping.[1]

---

[1] Special ore vessels were introduced in 1904 by AB Tirfing. Grängesberg AB in 1907 introduced ore ships with machine room in the stern and cargo-holds divided with two "longitudinals", i.e. forerunners of today's bulk carriers. Hardy, 1924, pp. 117-133.

In deep-sea bulk transports, the general tramps dominated until the beginning of the 1960's.[1] By comparison, the special carriers offered limited cost and time savings in the discharging operations. The buckets or clamshells were used for both types of ships. Thus the times in the ports of discharge were identical. However, the special ships made it possible to cut costs and time in the port of loading. Higher loading productivity and better use of the capacity were the motives for the introduction of special ships in coal and iron ore transports on short routes where the share of port time was high. Even a marginal shortening of the loading time therefore became important to the ships' economy. In the deep-sea transports of bulk cargo, port time corresponded to only one fourth of the total turn-around time. A marginal shortening of the loading time, therefore, was of less interest. Cost increases for long journeys in ballast were considerably higher than savings on shortened port time.

The geographic pattern of trade also favored the use of tramps rather than special carriers for deep sea bulk transports. Europe was largely self-supporting in iron ore up to the Second World War. The United States was also self-supporting, excluding the import from Chile to Baltimore. The special carriers gained employment on that route, and in the intra-european ore and coal transports. A guarantee for long-term employment was already in the 1910's and 1920's regarded as a condition for the introduction of special carriers on a route.[2] Short-term speculation in special tonnage was even then considered very risky.

Those conditions made general carriers the leading vessel type in the world fleet in the first decades of the 20th century (Table 1:7). Their technical construction made possible alternative uses in both liner and tramp shipping (Table 1:8). The division of tonnage into liners and tramps shown in Table 1:8 was based on operational and not on technical differences between the ships.

---

[1] "The First World War and the difficult conditions which followed had the effect of delaying the development of the ore carrier, for the general cargo ship which could take cargoes on both legs of the passage was a more favorable economic proposition. The development of harbours with grab discharging facilities also acted in favour of the tramp, and against the specialized ore carrier with self-unloading apparatus". Murray, 1960, p. 681.

[2] "... ist Vorbedingung für den Bau dieser Schiffe - gemeint Spezialschiffe - dass man dauernd mit derartigen Ladungen meistens nicht mit wirtschaftlichen Nutzen verwenden lassen". Laeisz, 1910, p 60.

[3] "Although it is doubtless possible to design a type of vessel especially suited for tramp ship employment, one should keep in mind that there is no basic difference between a tramp vessel and a liner. Thus practice has proved that quite a number of vessels can be economically used in both trades". Fisser, 1957, p. 7.

Table 1:7. Merchant Fleets by Flags and Vessel Employment ('000 000 gross tons)

Country	Vessel employment	1914	1920	1930	1936	1939
World[1]	Total	49	51	68	64	69
	Liner	24		36		40.2
	Tramp	23		22		16.8
	Tanker	1.4		10		11.6
Great Britain[2]	Total[a]	10.0		15.1	13.1	
	Liner	8.4		10.4	8.3	
	Tramp	2.8		3.3	3.7	
	Tanker	0		1.3	1.4	
Norway[3]	Total	2.1	1.6	2.6		4.3
	Liner	0.2	0.3	0.9		1.0
	Tramp	1.9	1.3	1.2		1.4
	Tanker	0	0.1	0.6		1.8
Germany[4]	Total	5.0				3.8
	Liner	3.6				2.7
	Tramp	1.4				1.2
	Tanker	0.2				0.2

a Foreign-going tonnage only

Sources: 1. Mance, O., 1945, International Sea Transports, p. 68.
2. Isserlis, I., 1938, Tramp Shipping, Cargoes and Freights, p. 96.
3. Fisser, F.M., 1957, Trampshiffahrt, Bremen, p. 220.
4. von Theel, G.A., 1955, Die Deutsche Handelsflotte 1914-1955, Göttingen, p. 18.

However, the share of the general carriers in the world fleet lowered in the period 1900-1948 as a result of the rapid growth of special ships, mainly tankers. At the same time there was also a shift in the employment of general carriers from tramp to liner shipping (Table 1:7). The demand for tramps decreased in the interwar period as a result of the dwindling coal consumption. The relatively slow increase in the demand for deep-sea iron ore and grain transports could not compensate. At the end of the 1930's tankers started to compete with the tramps for grain transports. The decrease in the demand for "heavy bulk cargo" in the 1930's led the general tramps to increasingly seek employment in transports of break bulk and general cargo.

Table 1:8. Use of General Carriers mid 1936

	All General Carriers		Liner Services		Mixed Tramp-liner Services	
	'000 000 gross tons	%	'000 000 gross tons	%	'000 000 gross tons	%
United Kingdom	8.6	55	4.6	29	4.0	26
Germany	2.6	79	1.4	43	1.2	36
France	2.1	77	0.8	29	1.3	48
Japan	1.7	48	0.7	20	1.0	28
Netherlands	1.5	77	0.8	40	0.6	33
Italy	1.5	52	0.5	18	1.0	34
Norway[a]	1.0	28	0.9	25	0.1	3
Sweden	0.7	51	0.6	41	0.1	10
Spain	0.7	62	0.4	35	0.3	27
Denmark	0.4	40	0.1	10	0.3	30
Belgium	0.4	84	0.3	67	0.1	17
Greece	0.2	7	0.1	3	0.1	4

% Percentage of the total merchant fleet
a 1939

Source: Isserlis, L., 1938, Tramp Shipping, Cargoes and Freights. Journal of the Royal Statistical Society, Part 1, p. 96.

The demand for those transports grew rapidly as a result of the gradual industrialization in areas outside Europe and North America. That stimulated competition between liners and tramps on many routes.

The most obvious technical difference between liner and tramp tonnage in the 1920's and 1930's was the service speed on the ships and the gradual change of liners to motor power. Compared with passenger and combined ships, liner cargo vessels were considerably slower through the interwar period (Table 1:9). Their service speed rose from about 9.5 knots at the turn of the century to about 14 knots in the 1930's (Table 1:9), which *ceter paribus* allowed for a 40 % increase in productivity per ton of a ship.

The leading role of liner shipping in the change to motor ships was a result of the consignors' demand for speedy services. The strong financial position of liner companies, in comparison with tramp firms, was also an important factor. Like the previous change to steam in the period 1840-1870 the switch to motor ships was capital demanding. Only solid companies could carry out this change, especially as it came in the shadow of the Great Depression. The result was a significant change in the

Table 1:9. Cargo Liners 1870-1949

Data \ Year / Ship	1871 SS Belendi	1887 SS Benlawers	1900 SS Bendengh	1911 SS Benlamond	1922 SS Paris Maru	1927 MS Chinese Prince	1940 Standard Ship
Gross Tonnage, '000	1	2	4	5	7	7	
Deadweight, '000 t	2	3	6	7	10	10	12
Displacement, '000 t	3	5	9	10	15	14	17
Length, m	90	103	120	130	150	150	150
Speed	9.3	10.5	9.5	11	11	14	15
HP, '000	0.9	1.6	1.6	2.4		7	7

Source: Murray, Y.M., 1960, Merchant Ships 1860 - 1960. The Royal Institution of Naval Architects, Quarterly Transactions, Vol. 102, No. 4.
Hardy, A.C., 1924. Merchant Ship Types, London.

competitive position of national fleets on the international liner market. The British shipping companies were outdistanced in the motorization process by Scandinavian and Dutch companies which in the long-run decreased their competitiveness (Table 1:10). Conservatism in the shipyard industry and among shipowners has been given as the main cause.[1] However, it should be pointed out that British shipping in the late 1920's was in the final phase of the reconstruction after the war. The financial resources for new investments were already strained at the same time as the decrease in demand meant considerably reduced incomes.

Table 1:10. Merchant Fleets* by Flag and Propulsion 1914-1948 ('000 000 gross tons)

Flag		1914	1919	1925	1929	1935	1939	1948	Annual Growth 1919-1939 %
World	Total	49	51	65	70	65	69	80	1.5
	Sail	3.7	3.0	2.3	1.6	1.2	.8	-	-6.4
	Steam (S)	45	48	58.4	62.1	53.0	53.0	63.3	0.5
	Motor (M)			2.6	6.3	11.0	16.6	16.7	14.1
United Kingdom	T	19	17	19	20	17	18	18	0.3
	S	19	17	18	18	15	13	13	-1.3
	M			0.8	1.9	2.9	4.6	5.2	13.3
Commonwealth	T	2	2	3	3	3	3	3.7	2.1
	S	2	2	2.8	2.6	2.6	2.5	3.3	1.1
	M				0.2	0.3	0.5	0.4	9.6
United States Total Fleet	T	7.9	12.9	17.4	16.1	14.7	14.6	33.2	0.6
	S	5.4	10.0	14.5	12.8	11.4	10.8	28.4	0.4
	M		0.4	0.5	1.0	1.1	1.2	2.0	5.6
Foreign Traffic	T	1.1	6.7	8.2	6.3	4.6	3.3	22.0	-3.5
Japan	T[a]	1.7	2.3	3.9	4.2	4.1	5.6	1.0	4.6
	S	1.7	2.3	3.8	4.0	3.3	4.1		2.9
	M	-	-	0.1	.2	.8	1.5		21.3
Norway	T	2.5	1.9	2.7	3.2	4.0	4.8	4.2	4.7
	S	2.0	1.6	2.3	2.2	2.1	1.8	1.7	0.6
	M			0.4	1.0	1.9	3.0	2.5	15.5

(continued)

1 "British shipbuilders and shipowners were generally slower than their Continental rivals to realize the advantages of the diesel engine". Sturmey, 1962, p.82.

Table 1:10. (continued)

Flag		1914	1919	1925	1929	1935	1939	1948	Annual growth 1919-1939
Germany	T	5.4	3.5	3.0	4.1	3.7	4.5	0.3	1.3
	S	5.1	3.2	2.6	3.6	3.1	3.4	0.2	0.3
	M			0.3	0.5	0.6	1.1	0.1	9.7
Italy	T	1.7	1.4	3.0	3.2	2.9	3.4	2.0	4.5
	S	1.5	1.3	2.8	2.7	2.3	2.7	1.7	3.7
	M			0.1	0.5	0.6	0.7	0.3	15.0
Netherlands	T	1.5	1.6	2.6	2.9	2.6	3.0	2.7	3.2
	S	1.5	1.6	2.5	2.5	1.8	1.7	1.6	0.3
	M			0.1	0.4	0.8	1.3	1.1	20.1
France	T	2.3	2.2	3.5	3.4	3.0	3.0	2.8	1.6
	S	1.9	2.0	3.3	3.2	2.8	2.6	2.3	1.3
	M	-	-	-	0.1	0.2	0.4	0.5	14.9
Greece	T[a]	0.8	0.3	0.9	1.2	1.7	1.8	1.3	9.4
	S	0.8	0.3	0.9	1.2	1.7	1.8	1.3	9.4
	M	-	-	0	0	0	0	0	
Sweden	T	1.1	1.0	1.3	1.5	1.6	1.6	2.0	2.4
	S	1.0	0.9	1.0	1.0	1.0	0.9	0.8	0
	M	-	-	0.3	0.4	0.5	0.7	1.2	6.2
Soviet Union	T[b]	0.9	0.5	0.3	0.4	1.1	1.3	2.1	4.8
Denmark	T	0.8	0.7	1.1	1.1	1.1	1.2	1.1	2.7
	S	0.8	0.6	0.9	0.8	0.7	0.6	0.5	0
	M	-	-	0.2	0.3	0.4	0.6	0.6	8.2
Spain	T	0.9	0.8	1.2	1.2	1.2	1.0	1.2	1.1
	S	0.9	0.8	1.2	1.1	1.0	0.8	0.9	0
	M	-			0.1	0.2	0.2	0.3	7.2

x Only fleets of above 1 000 000 g.t. 1939 are shown

a excluding sail ships
b only total data available

Source: For US - Statistical Abstract of the United States, 1926, 1938, 1940, 1946; US Department of Commerce, Bureau of Census, Washington DC. Others - Lloyd's Register of Shipping Statistical Tables 1950, London.

The slow technical restructuring of the British shipping companies strengthened the market position of the rapidly growing Japanese, Dutch, and Scandinavian companies, i.e. contributed to the reshaping of the international liner business.

The influence of technical innovations on the development of liner shipping in the 1870-1948 period can be summed up as follows: (1) technical specialization of vessels resulted in a growing segmentation of the international sea transport markets, (2) development of special carriers decreased the demand for general tramps which sought employment on general cargo and break-bulk cargo markets in keen competition with liners, (3) the continuous increase in speed and size of liners and shift to diesel motors strengthened their competitiveness on the general cargo transport markets, (4) the shift from steam to motor engine resulted in a decrease of the competitiveness of the British liner industry while the Japanese and Scandinavian fleets developed rapidly.

SHIPPING POLICY AND THE GROWTH OF NATIONAL FLEETS

National shipping policy in the majority of countries in the period 1870-1948 was to a large extent directed to problems of liner shipping. Two questions stood in the focus: (1) the effects of the conferences on the national transport supply and export possibilities and (2) the needs of national liner shipping companies and the way governments could promote their development. The discussion here is limited to the latter question.[1]

Shipping policy at the end of the 19th century was strongly influenced by economic liberalism. The use of protectionistic laws, such as flag discrimination and goods preferences, was limited (Table 1:11). Indirect economic control systems replaced the old forms. Operational and building subsidies to the shipping companies and steering of cargo flows to national ports were cornerstones in these systems.

Mail Subsidies

In the period 1860-1910 mail subsidies were the most important form of operational aid to liner shipping. They were introduced in Great Britain in connection with the transfer in 1840 of mail transports from warships to merchant ships (Table 1:12). The conditions for obtaining mail transports was that large, safe and fast steam vessels were used, and that regularity and continuity could be guaranteed for long periods.[2] The mail subsidies became an important incitement for the development of express passenger lines on the North Atlantic and of combined passenger and express cargo lines on other deep-sea routes.

Up to World War I mail subsidies were given by all countries to the national lines (Table 1:11). After the war their importance decreased except for the United States (Table 1:12).

---

[1] For a discussion on liner conferences, see pp. 16-23

[2] Foreign Trade and Shipping, 1945, pp.20-22.

Table 1:11. Subsidies to Shipping

Countries by fleet size 1939	Mail		Operating		Construction		Indirect		Cargo preferences	
	1914	1919-1939	1914	1919-1939	1914	1919-1939	1914	1919-1939	1914	1919-1939
European										
United Kingdom	x	x		x		x		x		
Norway		x		x				x		
Germany	x	x		x		x		x	x	x
Italy	x	x	x	x	x	x		x		x
Netherlands	x	x		x				x		
France	x	x	x	x	x	x	x	x	x	x
Greece	x	x		x						
Sweden	x		x					x		
Denmark	x	x						x	x	x
Spain	x	x	x	x	x	x		x		x
Finland				x				x		
Jugoslavia				x		x		x		
Poland				x		x		x		x
Soviet Union (Russia)	x		x		x		x		x	x
Non-European										
United States	x	x		x		x		x	x	x
Japan	x	x	x	x	x	x		x		
Panama										
Brazil	x	x	x	x		x	x	x		x
Argentina										

Source: Sturmey, 1962, British Shipping and World Competition, p. 27 and 101.

Table 1:12. Mail Subsidies to Liner Shipping in '000 000 dollars

Year	Great Britain	France	United States
1840	1.0		
1845	3.8	-	14 (1840–1850)
1850	3.8	-	
1860	4.4	1.1	
1870	4.8	4.4	7 (1860–1880)
1880	3.4	4.4	
1890	4.3	4.6	
1900	3.4	4.8	30 (1890–1914)
1914			
1920	4.4		5
1930			155 (1930–1939)
1939			

Source: Meeker, R., 1905, History of Shipping Subsidies, New York; Foreign Trade and Shipping, 1945, New York, p. 206.

In the years before and after the Second World War the postal subsidies again supported the development of regular lines, but this time in the air.

The winding up of the combined passenger and express cargo lines on the deep-sea routes in the 1960's and 1970's resulted in the transfer of surface mail to fast cargo liners. However, the income from these transports is only of small importance to modern liner shipping and has no influence neither on the shipping policy of the nations nor on the development of the industry.

Operation and Construction Subsidies

In the 1880's new forms of subsidies were introduced to support operations and investments of the national liner fleets and to contribute to the expansion of the shipyard industry. France was the first to introduce those forms of subsidies with the argument that mail subsidies only favoured certain lines, while others did not obtain any support (Table 1:13). However, the general form of these new subsidies negatively influenced the business acumen in French liner shipping.[1] While mail subsidies led to competition between shipping companies, i.e. increased the quality of the transport services, operation and new-building aid demanded no achievements in return. The result was that French lines became less competitive on the international market. The growth rate of the French merchant fleet was below the world average for the period 1870-1910 (Table 1:11). However, the operation and construction subsidies corresponded to less than half the mail subsidies paid by the French government. Therefore, slow growth of French liner shipping and its poor competitiveness cannot solely be explained by the negative impact of those subsidies.

Table 1:13. Navigation and Construction Subsidies

	Navigation			Construction		
	1881	1890	1900	1882	1890	1900
France ('000 000 $)	0.9	0.6	0.0	1.2	1.6	1.7

Source: See Table 1:12.

1 Meeker, 1905, pp.58-59.

Also Italy and Japan used similar subsidies before the First World War. The rapid development of their steamboat fleets was associated with their increased role in world trade, their emigration and successful company management. Also the Swedish government before World War I gave operational subsidies to the national lines (Table 1:14). They were especially important for the development of the Far East and South America services.

Table 1:14. Subsidies to Liner Companies in Sweden, ('000 $) cumulated values

Company	1906-1912	1913-1915
Svenska Amerika-Mexikolinjen		157
Nordstjernan	230	73
Svenska Ostasiatiska Kompaniet	486	236
Transatlantic		79

Source: SOS Sjöfart, 1912-1916.

In the interwar period, only Sweden and Denmark gave up the support for the national shipping lines (Table 1:11). The Norwegian and Dutch operation subsidies in this period were small, short-lived and applied only occasionaly.

In contrast to other new shipping nations at the turn of the century, the German shipping industry developed with rather limited direct financial support. In spite of this, Germany's share of the world's merchant fleet increased from 7 to 10 % between 1870 and 1910 (Table 1:11). Liners accounted for roughly two thirds of the German tonnage in 1914, i.e. less than Great Britain, but considerably above the world average (Table 1:7). This was a consequence of Germany's rapidly increasing transocean trade. The indirect support through differentiation of railway rates for transports to domestic and foreign ports also played an important role. It steered the German trade away from Antwerp, Rotterdam and Amsterdam to Hamburg, Bremen and Emden, the ports reserved by conference agreements for German lines exclusively. In the emigrant transports across the North Atlantic, the possibility of using the cholera stations along the German-Russian border as ticket offices was an important means of competition. It favored the German shipping in the competition with the British lines.

Increased competition from German, French, and Scandinavian shipping lines forced the British government to introduce building subsidies in the period 1921-1930.[1] The purpose was to support the reconstruction and modernization of the national liner tonnage and to stimulate the shift to motor ships. The traditional resistance of the companies against public interference meant that only a few made use of this aid.[2] In the 1930's British shipping subsidies were given mostly to the tramp and passenger shipping and had no influence on the economy of the liner industry.

Also in the interwar period, France and Italy were leaders in supporting national liner companies (Table 1:11). In France operation subsidies were abolished in 1926. Four years later building subsidies were also done away with. Economic aid was again concentrated to mail subsidies and goods preferences. They put an efficient stop to foreign competition on routes between France and the colonies. The main part of the French liners were occupied in this traffic and therefore worked under protection also in the interwar period in spite of the formal abolishment of the support.

The German shipping policy in the 1920's was directed towards supporting a rapid rebuilding of the merchant fleet that had been reduced in the war to 65 % of the 1914-tonnage (Table 1:10). The rebuilding was to a large extent concentrated to liners. Two forms of support dominated. Until 1926 compensation was given for confiscated tonnage. That year it was replaced by investment loans at low interest. The rebuilding of the liner shipping companies was an important part of the country's expansive foreign trade policy on the transocean markets. Domestic shipping companies offered the national industry lower freight rates as well as an extensive network of contacts which could be used when selling German industrial products. Already in 1929 Germany resumed its third place among the world's shipping nations. The economic crisis 1929-1933 strongly influenced the country's shipping. In 1932 more than one third of the tonnage was laid up. The government prevented economic insolvency in the two leading shipping companies, HAPAG and Norddeutscher Lloyd, by cancelling half of their loans. At the same time it demanded a merger to strengthen their competitiveness. The change of government in 1933 meant new expansion possibilities. Liner shipping became an important part of the general military and economic rearmament. The government introduced 25-per cent operation subsidies to the liner companies and goods reservation clauses. It was a considerable change

---

1 The Trade Facilities Act and the Irish Loan Guarantee Act, House of Commons 1921-1926.

2 A total of £ 29 million was granted. Royal Mail used £ 13 million, Blue Star Line £ 3 million and Bank Line £ 3 million. Sturmey, 1962, pp. 102-108.

in the traditionally liberal German shipping policy. This led to a rapid modernization of German shipping. The fleet of motor ships was doubled between 1935 and 1939. At the same time, the steamship tonnage increased as a consequence of the growth of tramp shipping (Table 1:10). Building and modernization primarily concerned the liner tonnage, which rendered Germany a second place among the world's liner fleets in 1936 (Table 1:8). More than 80 % of the German liner fleet was occupied on deep sea routes, while the near-sea traffic accounted for the rest.[1]

Japanese shipping obtained extensive support for its development already in 1880 (Table 1:11). The rapid economic growth of the country after the war with Russia 1904-1905 led to an increased foreign dependence with imports of raw materials and exports of finished articles. A national merchant fleet became a "sine qua non" for the continued economic growth. The economic crisis of the Thirties and the preparations for the war in Manchuria made the Japanese government intensify even further their direct control of the industry, primarily liner shipping.[2] The mixture of subsidies, direct control from the state, financial connections with merchant and finance houses, and opportunities for cheap ship purchases at domestic shipyards formed the basis for the growth of shipping. Japan became the third largest shipping nation in the interwar period with one of the most modern fleets (Table 1:10). The country's motorship fleet had the highest growth rate in the 1930's. The main part was used in combined liner-tramp shipping (Table 1:8).

The interwar shipping policy of the United States was concentrated on conference regulations[3] and on increased support of domestic shipping companies and shipyards to secure the transport supply of the country. The subsidizing of wage costs on American ships was to make the working terms of American shipping companies equal those of other countries. Until 1936 the mail subsidies were used for this purpose (Table 1:12). They were replaced by operation and building supports. The latter was important to secure the American shipyard industry in spite of its high costs. Even with this support American liner shipping had difficulties in competing, reflected in a low growth rate for the motor tonnage in the 1930's (Table 1:10).

---

[1] Broers, 1974, p. 115.

[2] The only way of navigating safely through the hazy sea of the economic and financial difficulties is to steer Japan correctly and firmly with combined effort of the statesmen and general public. Taji, 1932, p. 423.

[3] See pp. 21-22.

The changes in national shipping policies and in the position by country in world shipping in the period 1870-1948 can be summed up as follows: (1) Liberalism in shipping policy was the guide line from the middle of the 19th century until the First World War, (2) discriminating legislation of the pre 1841 year was to a large extent replaced by economic control and support measures, (3) mail subsidies were the leading form of support until the turn of the century, but were then increasingly replaced by operation and building aid, (4) the British dominance started to decrease already before the First World War as a consequence of the rapid growth of the German merchant fleet, but more noticeably after the war when the British liner fleet became less modern compared with the expanding Dutch and Scandinavian fleets, (5) the renaissance of protectionism in shipping could be discerned in the second half of the 1930's when several countries introduced laws to stimulate the growth of domestic shipping.

THE DEVELOPMENT OF LINER SHIPPING COMPANIES

Mergers

The high rate of new establishments of liner shipping firms in 1840-1870 caused great competition between lines, mostly British, on most deep-sea routes. Conferences and freight pools in the 1870's and 1880's became important market regulating mechanisms. However, on the whole, the period was characterized by extensive close-downs, primarily among British companies. The close-downs gave rise to internal measures in the companies and started the process of concentration in the industry through mergers and acquisitions.

The mergers were carried out with the purpose of limiting competition. Through the merger, most common among companies operating in the same geographic market, the business risks were reduced through decreased competition. At the same time the management and sales resources could be used to serve a larger number of ships, which gave lower fixed costs per journey. The intensity of mergers at the end of the 19th century followed the business cycles. The slow growth rate in world trade in the 1880's and early 1890's gave rise to the most intensive merger period. The mergers generally led to a loss of identity for the individual shipping company.[1] The merged companies in the continued operations were totally integrated and the work was usually carried on under a new or merged name.

Company acquisitions took place as a consequence of a will to expand in the buying company. It wishes either to

---

[1] Sturmey, 1962, pp. 364-365.

start business on new markets, to diversify its product profile or to get rid of a competitor. Better use of financial resources, power ambition of managers and spreading of risks were often quoted as other strategic motives for acquisitions.[1] While the merger reflects worry for the future in the merged companies, an acquisition can be seen as belief in the future in the buying company.

Considerable national differences in the development strategies of liner shipping companies can be discerned in the period 1870-1948. Great Britain was characterized by extensive organizational changes already at the end of the 19th century. The conference system could not prevent competition and the demand for transocean cargo transports increased more slowly in the 1880's than in previous decades. The productivity of the ships rose markedly as a consequence of the technical development. The sharpened competition on stagnating markets stimulated concentration tendencies among British shipping companies. Three large firms, Shaw, Savil, and Albion merged. The mergers dominated until the turn of the century on the Australian route. At the turn of the century the two leading steamship companies on the South African route did the same, the Union and the Castle.

After the turn of the century, company acquisitions became the dominant form of concentration in British shipping. Ellerman Line was the first extensive company purchaser. The goal was to extend its market to all deep-sea routes outside the North Atlantic. In the 1910's two of the original British liner shipping companies, the Royal Mail Co. operating on South America, and the P & O sailing on the Far East, made extensive purchases of other shipping companies operating both in liner and in tramp business[2] The purpose was the same as for the Ellerman Line, i.e. geographic extension of its market and product differentiation.

The economic crisis of 1929-1933 put the rapidly expanding Royal Mail-group in a vulnerable situation. The group had in the autumn of 1926, mainly with the help of borrowed capital, acquired the large White Star Line from the IMM. As a result of all purchases, the Royal Mail at the beginning of the 1930's had at its disposal a large tonnage on a yielding market but the short debts were much larger than the liquid assets, in spite of extensive state subsidies (£ 13 million 1924-1930). The result was that the world's largest shipping group went into liquidation in 1934. The individual lines, previously acquired by the Royal Mail, were taken over by other British shipping companies. The P & O now became the world's largest liner shipping group. A slow growth rate, concentration

---

[1] Penrose, 1958, p. 68; Devine, et al., 1974, pp. 254-264.

[2] Sturmey, 1962, pp. 364

to cargo traffic, the policy of financing growth primarily with its own funds, and fewer new investments in the years just before the economic crisis, gave the P & O group the opportunity to survive the years 1929-1933 and to continue growing for the rest of the interwar period.

This concentration process resulted in a gradually decreased competition between the large British shipping companies. A geographic market division took place between the lines, which limited the conflicts of interest inside as well as outside the conferences. The concentration was also considered to strengthen the competitiveness of British lines against the large and stable German shipping companies and against the rapidly expanding American group, the International Mercantile Marine (IMM). The ambition of the British shipowners to control large corporations and the belief in economies of scale in the liner business seemed to be other important incitements to concentration.

However, the effects of the concentration process on the international competitiveness of the British liner shipping are difficult to evaluate. Its share in the world fleet decreased from the beginning of this century and the modernization process went more slowly than in competing nations. In contrast to the ship for which economies and diseconomies of scale are relatively easy to calculate, the corresponding analysis regarding optimal size of a liner shipping company is considerably more difficult. An American analysis of the development of the British liner shipping companies 1917-1957 did not find any economies of scale.[1] Since the lines belonging to one group, but operating independently, were analyzed as separate units, the results seem not to reflect the reality. It should be pointed out that a financial and strategic concentration not necessarily must lead to a corresponding concentration of the operative side. Many shipping companies acquired at the turn of the century still operate relatively independently. To regard these lines as independent companies and then conclude that large shipping groups grow more slowly than smaller companies does not make sense.

The concentration tendencies at the turn of the century and between the wars were not limited to British liner companies. The same tendency could be observed in German, Italian, and French shipping.

Two companies, Hamburg Amerika Linie (HAPAG) and Norddeutscher Lloyd in Bremen, dominated German Liner shipping since the mid 1880's. HAPAG developed rapidly during

---

[1] "... the evidence indicates roughly constant return over a substantial range of firm size, that is, costs per ton of capacity would be roughly equal for firms with fleets ranging in size from 10 to 40 ships. From 3 to 12 ships costs appear to be roughly constant in serving a single market", Oi, 1961, p. 310.

the pre World War I period. The tonnage of the company grew at 11.5 % per year, or twice the world average. The company reached 1.4 million gross tons in 1913 and became the second among European shipowners surpassed by only Royal Mail. By the number of services (74) HAPAG in 1913 was a world leader among liner companies. This expansion was a result of both excellent management by A. Ballin[1] and of the favorable situation that a large part of the European continent was its home market. The strategy of Ballin was to gain full support of the government, a continuous modernization of the fleet and a gradual acquisition of other German lines operating on routes where HAPAG was not active. Also the Norddeutscher Lloyd (N.L.) developed rapidly in 1880-1915. The tonnage increased from 84 000 to 705 000 gross tons in that period. The company specialized in speedy passenger services over the North Atlantic and in the combined passenger-cargo express services on other routes. It had the policy of buying new tonnage rather than acquiring independent firms.

HAPAG and N.L. started at the beginning of this century a close cooperation with the American shipowners, specially with the world leader IMM. The aim was to limit the power of the British lines. World War I stopped this cooperation. After the war an overwhelming part of the German fleet was confiscated (Table 1:10). Reconstruction of the shipping business started very early. Already in 1920 HAPAG reestablished services to North America and to La Plata region. It was made with the support of the American Harriman group, following the prewar tradition of German-American cooperation against the British domination.

The concentration of ownership in the German shipping continued in the interwar period. Also the N.L. in those years started to acquire smaller firms, including some British, to strengthen its market position (Table 1:15). The share of HAPAG in the German fleet increased from 5 % in the 1880's to 48 % in 1913. The corresponding numbers for N.L. were 7 % and 24 %. Thus, the two firms controlled three fourths of the national fleet. It was the highest degree of concentration among all shipping nations in that period. One of the results of the war was the deconcentration of the German shipping under the pressure of the British competitors. In 1922 the HAPAG controlled only 24 % and N.L. 4 % of the German fleet. That significantly reduced the competitiveness of both firms on the international liner market. In the mid 1920's the German lines regained their prewar membership in the majority of the conferences. Simultaneously they resumed the concentration of ownership. The share of HAPAG had increased to 30 % and of N.L. to 20 % in 1933 as a result of that policy.

The crisis of 1929-1933 strongly hit both HAPAG and N.L. To support the companies, the government remitted all their debts from the reconstruction period and subsequently requested a merger between them. Both kept their

---

[1] Managing Director and President of HAPAG in 1880-1920.

Table 1:15. Growth of the Main Liner Groups under British and German Flags, 1875-1938

Acquiring Groups / Acquired Companies	The Royal Mail Co. est. 1840	Penninsular & Oriental Co. est. 1837	HAPAG est. 1847	Norddeutscher Lloyd est. 1857
Years				
1875			Adler Line	
1886			Sloman-Carr Linie	
1891			Hansa	
1897			Hamburg-Kalkultad	
1898			Kingfin Linie	Scotish Oriental S. Co.
1900			Freitas	East India Ocean S. Co.
1906	Shire 50 %			
1909	Elder Demster	Blue Anchor		
1910	Pacific S.N.			
1911	Shire 50 %			
	Glen			
	Union-Castle			
1913	Nelson			
1914		British India		
1916		New Zealand Shipping		
1917		Union S.S. Co.		
		Hain S.S. Co.		
		Nourse S.S. Co.		
1919	Bullard King	Orient S.N. Co. 50 %		
		Khedival Mail Co.		
1920		General Steam N. Co.		
1925				Holland Linie
1926	White Star		Deutsche-Austral L.	
			Kosmos Linie	
			Hugo Stinnes Linie	
1927			Horn	
1930			HAPAG Lloyd Group	
			Stettiner Danny	
1934	Liqudation	Moss-Hutchinson Line		

Sources: Der Grosse Brockhaus, 1931, Vol. 8 and 13, Leipzig.
Sturmey, S.G., 1962, British Shipping and World Competition, London.

operational independency but under a common strategic financial and marketing management. As a result the merged companies controlled one half of the national fleet and became the most powerful liner group in the late 1930's beside the P & O. The rapid growth of the national economy, increased trade with Japan and South America, and the military ambitions of the Nazi government were other elements that made the German liner firms grow fast in the late 1930's.

Joint Sailings

Joint services[1] appeared in the second half of the 19th century on the deep-sea liner market. Through that form of cooperation the liner companies tried to increase their competitiveness on individual routes and reduce their commercial risk, i.e. to achieve the advantages of a big firm without loosing their economic independence. Reduction of the risk of low utilization was particularly important for passenger services characterized by high fixed and operational costs. Therefore, the joint services became common in the 1870-1910 period among the North Atlantic passenger lines and among combined passenger-cargo services on other routes. They became common on the routes where a conference was not able to keep the competition under control.

Joint services became particularly popular among the Scandinavian liner shipowners. Except for the Johnson Line's service to South America and the Broström's New York passenger traffic all other Swedish deep-sea lines were organized from the very beginning as joint services (Table 1:16). That strategy increased the market base of the services from one to all Scandinavian countries. It widened the contact channels to the consignors and the negotiating strength within the conferences, that is, gave ground for the rapid growth of the Scandinavian liner shipping between the wars.

The forming of joint ventures[2] in liner shipping in the period 1870-1938 was mainly concentrated to passenger shipping on the North Atlantic and on a small scale to combined passenger-cargo lines on other routes. Compared to the joint services alternative the establishment of a joint venture meant higher initial costs and greater demand for new administrative routines. By establishing joint ventures for new and capital-intensive operations, such as passenger shipping in the period 1850-1950, the parent company could achieve greater risk spreading and decrease the financial pressure.

---

1 Joint service is an operational cooperation of independent lines. Vessels keep the identity of individual firms. No separate company is created.

2 Joint venture is a cooperation of independent firms which includes establishment of a joint company which operates a service under a a common signe.

Table 1:16. Swedish Liner Shipping, Major Firms

Parent / Subsidiary / Trade route	Number of Sailings from Sweden 1912 - 1948					
	1913	1920	1930	1935	1939	1948
Broströms						
North America and Mexico Line						
Northern Route		10(25)[ac]	38(64)[ac]	35[ac]	(47)[ac]	49[ac]
Southern Route	14[a]	3(11)[ac]	10(21)[c]	8(22)[ac]	(12)[ac]	14[ac]
North America		15	32	21	24	25
Svenska Ostasiatiska Kompaniet						
Far East	23[b]	14[bd]	16(41)[bd]	14(37)[bd]	10(31)[bd]	13(34)[bd]
India		13[d]	10(20)[d]	10(22)[d]	9(22)[d]	22(46)[d]
Malmros						
West Africa				11		
Nordstjärnan						
South America						
East Coast	19	25	25	51	35	46
West Coast and Caribbean		11	16	20	29	34
Svea						
South America			2	3		
Transatlantic						
Australia, Java		26[bd]	23[b]	39[b]	35[b]	59[b]
South Africa		20(32)[d]	24[d]	55[d]	53[d]	61[d]
West Africa						28
Persian Gulf		8				
North America		16(36)[ae]	28[e]	23[e]	29[e]	16[e]

a Via subsidiary Svenska Amerika - Mexikolinjen and in cooperation with AS Norge Mexico Gulf Linien

b With AS Østasiatiska Kompagni

c With Transatlantic

d With Wilh. Wilhelmsen's

e With Broström's

Source: SOS Sjöfart 1913-1948.

The summing-up reveals that the development of liner shipping companies in the period 1870-1948 were characterized by: (1) a transfer from private firms to limited liability companies due to the increased need for capital; (2) an increase in the cooperation between the shipping companies through joint sailings and joint ventures:, and (3) in most countries an increased concentration in the shipping business.

NEAR-SEA SHIPPING: FERRY LINES

The analysis up to this moment has mainly reflected development tendencies in deep-sea liner shipping. On the regular near-sea liner routes, like the Baltic and the North Sea, a new form of regular sea transport was introduced at the turn of the century - ferry shipping.

Ferry shipping was from the beginning an integrated part of the land transports between insular Scandinavia and the Continent, as well as between Great Britain and the Continent and between Ireland and Great Britain. The routing of the ferry lines and the localization of the terminals was to a large extent a function of the economy of land transports. The first rule for the establishment of a ferry line was to minimize the length of sea transports in the total transport, i.e. to choose the shortest sea stretch and select ports accordingly. Although land transport vehicles are goods carriers also during the ferry voyage, their productivity is nil in that time which explains the shortest sea connection. The roll-on - roll-off technique was the basis for the development of ferry shipping. It demands limited port equipment for cargo handling but vast port areas. The function of ferry shipping in the land transport system can be compared to that of bridges, where the ferry is the bridge span, while the terminals are the bridge foundations. As other parts of this system, ferry shipping is open to all vehicles and passengers, i.e. fulfills the demands put on a common carrier.

Ferry traffic hanged on to the original liner shipping principle that passenger and cargo transports form one market served by one type of a ship. Organizationally, ferry shipping is like other liner shipping, i.e. services are suited to the demands of the whole market and not to those of a particular consignor. Departures take place regularly according to schedule, often with stated hours, irrespective of capacity used on the ship. Prices are based on tariffs. No formal cartel organization exists in ferry shipping. The lack of a conference system means that individual lines compete with each other through price and quality differentiation.

The railway ferries are an exception to the rule of an unlimited right of establishment on international ferry markets. Those services are integrated parts of railway companies, joining them with the transport systems of other countries.

Until the 1890's all passenger, mail, and goods transports on the Baltic and the North Sea were carried on conventional liners. At the end of the 19th century, the Continental and Scandinavian railway systems of primary routes were almost completed.[1] The need for connecting the Scandinavian system with the Continental grew stronger, as it would create new expansion possibilities for the railways. The first national seaferry connections on the Baltic were opened in the 1870's and 1880's to link the Danish railway system.[2] Those and the connection Helsingborg-Helsingör in 1892, linked the Swedish-Norwegian railways with the Continental. In the period 1890-1910 all presently existing rail ferry connections Scandinavia - the Continent were established.[3]

The ferries meant a new form of competition for the conventional liner shipping on the Baltic. They came in a period when the demand for sea transports on this market was sluggish. In order to counteract a price-war and create an efficient protection against the powerful railway companies operating ferries, the liner shipping companies formed the Baltic - White Sea conference which included roughly 230 British, Scandinavian, German, and Russian shipping companies.[4]

The interwar period presented two patterns in the development of ferry traffic. While the number of passengers rose sharply on all routes, the cargo volumes remained fairly constant (Table 1:17). The apprehended threat against the traditional liner shipping did not come true. As a result the liner conference changed character from a traditional closed shipowners' group to an international organization with the purpose of coordinating and cooperation in shipping between national shipowners' associations and dischargers' organizations, primarily with shipping documents and information to members about ports.

The Great Depression caused a stagnation in the early 1930's in the Scandinavian - German ferry traffic (Table 1:17). However, the volume of intra-Scandinavian transports rose conspicuously. The lorry became more and more common for short and medium-sized cargo transports in Scandinavia and private motoring played a more important role. Competition from trains and motor vehicles decreased radically the share of liner shipping in the domestic

---

[1] Aagesen, 1949, p. 61; Hecksher, 1907, pp. 133-141.

[2] The short route Fredericia - Strib was opened in 1872 and Nyborg - Korsör in 1883.

[3] Malmö - Copenhagen 1900, Warnemünde - Gedser 1903, Trelleborg - Sassnitz 1909.

[4] The Baltic and White Sea Conference (BIMCO) 1905.

Table 1:17. International Railway Ferry Traffic on the Baltic

Routes	Opened		1905	1910	1920	1930	1935	1938	1948
Helsingborg - Helsingör	1892	s	6	7	3[a]		6	7.5	6
		rp	406	402	38	48	85	115	1 265
		lp				225	720	902	
		c	113	126	65	57	78	46	263
Malmö - Copenhagen	1900	s	1.3	1.3	1.2	1.5	1.5	1.5	1.2
		rp	-	-		60	73	76	482
		lp	40	60	64	121	177	184	
		c	73	155	180	212	112	107	198
Gedser - Warnemünde	1903	s	1.2	1.5	1.2	1.8	1.5	2.0	-
		p	87	115	96	168	170	196	-
		c	100	148	210	233	150	251	-
Trelleborg - Sassnitz	1909	s		0.9	1.7	1.5	1.5	2.1	0.3
		p		70	97	165	115	176	3
		c		73	208	240	213	274	138

s = sailings; rp = railway passengers '000; lp = local passengers '000; p = all passengers in '000; and c = cargo in '000 tons.

a 1921.

Sources: DSB, Internal Statistics. Statens Järnvägar 1920-1948. Järnvägsstyrelsens Årsberättelse 1905, 1910. Danmarks Statistik, Statistiske Meddelelser, Danmarks Handelsflaade og Skibsfart 1921-1948.

transport supply.[1] The competition for passenger and goods transports across the Baltic was sharpened in the mid 1930's with the introduction of the first car-ferry services.[2] The Second World War meant a temporary break in this development. The postwar period was to be characterized by even stronger competition from the road transports.

In North Sea shipping the traditional passenger and cargo vessels handled all transports between Great Britain and the Continent until 1920. The difference in profile between British and Continental railway carriages made it impossible to use the Continental carriages on the British railway net. The proximity to ports in the widely branched port system and good contacts between the British industry and the liner shipping companies contributed to the strong position of traditional liner shipping on the route Great Britain - the Continent. Increasing passenger traffic and demands for greater travelling comforts forced the opening of the first railway ferry Great Britain - the Continent.[3] The ferries on the Channel route were not suited to ro-ro handling of motor vehicles. Before the Second World War there were no lorry transports on Great Britain. Cars were either transported in railway carriages or in conventional cargo vessels with lift-on-lift-off handling.

In summary: the ferry traffic initially did not much influence the market of conventional liner shipping, neither in the Baltic, nor in the North Sea. But it became a competitive alternative to conventional passenger ships. The lorry transports from the end of the interwar period were the beginning of a new era in ferry shipping.

THE SECOND WORLD WAR

Innovations

From the point of view of liner shipping, the stabilization years 1946-1948 should be included in the war period; the industry went on working according to wartime terms.

As sea transports 1939-1948 were organized under state control, competition between shipping companies ceased and thus the demand for co-operative regulations, i.e. liner conferences. The liberalization at the end of the 1940's meant again increased competition; the liner conferences were reactivated.

---

1 "The disastrous decline of cargo liners must be related to the revolution in domestic land transports with the coming of the lorries." Thorburn, 1958, p. 216 (free translation).

2 Gothenburg - Fredrikshavn 1935 and Fredrikshavn - Narvik 1937.

3 Zeebrügge - Harwich was opened in 1924, followed ten years later by the Dover - Dunkuerque route.

The special wartime demands for rational, rapid, and extensive transfers of material gave rise to several technical and organizational innovations in the transport area. Some of these were to influence the development of liner shipping after the war: production in series of standardized ships; application of the ro-ro technique in deep sea shipping; development of transport systems based on operation analysis (logistic systems); unitization of general cargo and mechanization of its handling in ports.

Until the Second World War deep-sea liners were produced in short series if not individually. The standardization of the technical equipment of the ship and its navigation instruments was low. This resulted in high costs for new tonnage (short series did not allow for economies of scale in the yards) and in high operating costs, especially for goods handling. To make loading plans and organize the work in the hold were complicated, time-consuming and thus expensive operations.

The Second World War was a milestone for standardization and serial production of ships. The extensive tonnage demand and rapid deliveries required standard solutions that could replace individual constructions. A few type of ships dominated the war building program,[1] which meant poor adaptation to the demands of individual routes. The standardized multideck ship of wartime, technically well suited for general cargo, was to be used mainly as a tramp already in the early 1950's. Thus the competition from tramp shipping increased in break bulk and general cargo transports immediately after the war. Wartime mass production greatly influenced building policy after the war. Standard constructions were introduced more and more with the argument that construction costs were lowered and the geographical flexibility of the ship grew which should increase its second-hand value.

The roll-on - roll-off technique was until the Second World War limited to a few ferry lines.[2] Extensive troup and material transports, primarily in connection with the landing of the Allies in France, demanded a ship well suited to transport vehicles. Instant loading and discharging under primitive port conditions was essential. However, the wartime ro-ro vessels were poorly suited for commercial use. But the new cargo handling technique was to play a decisive role for the technical, economic, and organizational development of liner shipping after the war, both on deep- and short-sea routes.

Logistic systems were developed by the Allied forces in connection with the preparations for the landing on the

---

[1] The dominant dry cargo types were the Liberty and the Victory.

[2] See pp. 50-53.

Continent and the "island jumps" in the Pacific. The purpose was to create optimal military transport and distribution solutions.[1] The organization of the transport process was logically linked to other functions in the distribution chain such as stocking, delivery planning, order routines, and packing selection. After the war the logistic view on the organization of cargo flows was transferred to the transport planning of companies. They developed material planning models to optimize cargo flows including transport, stocking and packing functions from the buying of raw materials and components to the distribution of finished articles. Logistics became together with marketing, financing and production, one of the four areas comprised in every producing company's operation.[2] This definition limits the logistic function to the planning of the material flow. Alternatively production is included in the logistic process. In this view, logistics together with control and decision making form the basic components of the activity of every company.[3]

The integrated view on the material handling of the companies stimulated the development of new transport systems. The purpose was to create optimal transport solutions considering the organizational and technical links between the buying, production, selling, and distribution functions of a company. After the war the systems strongly influenced forms of work as well as competition on the international transport market for break bulk and general cargo. Transport buyers started to establish their own transport or signed long-term contracts with companies offering systems based on special vehicles. Hence, these flows disappeared from the deep-sea and near-sea liner markets.

Unitization of general cargo was introduced on a large scale for military transports in the Second World War. The basic thought was to technically standardize the heterogeneous general cargo to ease the mechanization of loading and unloading. Thus transport time could be reduced, the demand for staff in the terminals decreased, as well as

---

[1] The Random House Dictionary of the English Language, 1972, p. 843.

[2] "The term 'logistic systems' may be applied to the entire collection of activities which accomplishes the movement, storage and packing of goods comensing with the purchase of raw materials and ending with the ultimate sale and delivery of the finished products." Fair & Williams, 1975, p. 49.

[3] "The logistic process is concerned with the conversion and transfer of resources obtained from the firms' environments (men, materials, money, information) into products and/or services offered back to the environment. The logistic process is designed and guided by the management process." Ansoff, 1969, p. 13.

the risk for damage or theft. The pallet became the dominant unit load while the container, as defined today, was more rare. Standardized transports strongly influenced the development of transocean liner shipping, primarily in the 1960's, which created a new era in this industry.

Economic and Political Consequences

The Second World War led to considerable economic and political changes which had a strong influence on the development of international liner shipping. Geographic changes following the war, primarily the breakup of the empires and the forming of new political and economic blocs, led to long-term restructuring of the world trade, i.e. of the demand for liner shipping. Furthermore, a new competitive situation on the supply side was created through the wish of the centrally planned economies to lessen their dependence on other countries for the transport supply of their foreign trade. These long-term changes will be discussed further in the next section.

The Second World War had two immediate consequences on the development of liner shipping: a temporary stagnation in the switch to motor ships and considerable changes in the national distribution of fleets.

In spite of heavy war losses the world merchant fleet slightly increased, by 6 %, between 1939 and 1946. The total war losses corresponded to half the 1939 tonnage. The share of motor ships (18 %) in the dry cargo tonnage remained unchanged between 1939 and 1948. Already in 1950 it was 21 %, i.e. modernization was taken up again at an early stage.

War losses and the capture of ships by the Allies meant that German liner shipping had ceased to exist in 1948 (Table 1:10). The total German merchant fleet that year comprised 1/15 of the tonnage of 1939. It consisted mainly of small vessels for cabotage and near-sea shipping, while in 1939 half had been occupied in transocean liner shipping.[1] Also the Italian fleet disappeared as a result of the war. However, the rebuilding program was started already in 1946 with the help of the Allies. In 1948 the fleet corresponded to 60 % of the 1939 tonnage (Table 1:10). The share of motor ships was 17 % as against 25 % in 1939, i.e. rebuilding was not synonymous with modernization and liner shipping remained less important than in the prewar period.

Japan possessed the second largest merchant fleet in the world in 1936, of which 1/4 was occupied in liner traffic and 1/4 in mixed tramp and liner shipping (Table 1:8). In 1946 only 20 % of the tonnage remained, mainly

---

[1] Broers, 1974, p. 115.

small ships in cabotage and short-sea shipping. The start of the rebuilding program was put off until the beginning of the 1950's.

The restrictive policy of the Allies 1946-1950 towards Germany and Japan should among other things be seen against the background of an expected, by certain economists, downgoing trend after the end of the war. A stop for the rebuilding of the German and Japanese merchant fleets would lessen the competitive pressure on the Allied fleets. The lack of a merchant fleet of their own was also considered a guarantee against any ambitions of the former Axis Powers for political and military recapturing of their great power positions.

The detention policy, led primarily by British and French shipping interests, should also be seen against the background of the rapid growth of the American merchant fleet during the war. It had nearly trebled in spite of heavy war losses (Tables 1:10, 1:18). After the end of the war a considerable amount of the American merchant fleet was unemployed. Only a small part of the war tonnage was sold for commercial operation under American flag, in spite of the priority of domestic shipping companies at sales. Most of that tonnage, about 13 million gross tons, was laid up and formed a reserve fleet.[1] Until the mid 1960's this remained a latent competitive threat to international tramp shipping and partly also to liner shipping. That free capacity could at short notice be used in periods when lack of tonnage made the freight rates higher. In spite of the possibility for the American shipping companies to renew their fleets on favorable terms they showed little interest in operating ships under their national flag. The postwar period opened a new possibility for their international activity: the flag of convenience.

The British had more extensive tonnage losses than other warring nations (Table 1:18). They amounted to 1/3 of all ship losses during the war and to 2/3 of the British tonnage of 1939. In spite of an expansive newbuilding program, the British merchant fleet in 1946 amounted to only 2/3 of the prewar size. The capture of German tonnage and purchases from the United States, about 1.6 million gross tons, facilitated a rapid return to the past dominance in world shipping. The fleet reached its prewar size already in 1948, the year when most war-regulations in international shipping were abolished and the industry returned to normal. The share of motor ships in the British merchant fleet went up from 26 to 30 % between 1939 and 1948. However, it remained less motorized than the Scandinavian and Dutch fleets (Table 1:10). The extensive war losses did not substantially influence the economic position of the liner shipping companies, but the war

---

[1] Merchant Shipping, Sales Act of 1946.

Table 1:18. Losses of Merchant Ships in the World Wars I and II

Country	World War I no '000	gross tons '000 000	% of 1914 tonnage	World War II no '000	gross tons '000 000	% of 1939 tonnage
Total	8.5[a]	12.9[a]	29	6.9	33.9	49
UK	5.3	7.6	40	2.1	11.7	65
Japan				1.2	5.3	95
USA	0.3	0.3	7	0.6	3.9	34
Germany				0.7	3.2	71
Italy	0.5	0.9	53	0.5	2.1	62
Norway				0.5	2.0	42
Greece				0.2	0.9	55
France	0.6	0.9	39	0.2	0.9	30
Sweden				0.2	0.5	31
Other				0.5	2.4	

a = excluding the Axes Powers

Source: Encyclopedia Britanica, vol. 20, p. 557.

boom did not mean any excessive profits.[1] The solid economic position contributed to the investment will of the British shipping companies in the first postwar years.

The French merchant fleet showed, besides the British and Greek, relatively the greatest war losses. The tonnage in 1946 only accounted for 44 % of the fleet of 1939. A rapid reconstruction was started in 1946, based partly on confiscated German and Italian tonnage and partly on purchases from the United States. The share of motor ships rose from 13 to 18 % between 1939 and 1948, which indicates that the rebuilding was combined with technical modernization, primarily of the liner tonnage (Table 1:10). This was an important element in the attempts to maintain colonial status quo after the war. Without regular shipping connections the risk would increase that the economic, political and military ties between the metropolis and the colonies would be weakened.

---

1 "Only in 1943 did dividends as a percentage of disclosed capital exceed their 1938 level and through the war they were lower than the annual averages for the periods 1909-1913, 1914-1918 and 1919-1930. On basis of these calculations it does not appear that the liner companies made exorbitant gains during the war." Sturmey, 1962, p. 147.

Among the smaller fleets the Greek had severe losses (Table 1:18). The rebuilding was slow. Already in 1945 Greek shipping companies started to register ships under flags of convenience. The political situation in the country was considered too risky by some shipping tycoons. The Greek shipowners continued to concentrate on tankers and tramp shipping even after the war. Their importance in international liner shipping remained limited.

Among the Scandinavian fleets the Norwegian suffered the most from the war (Table 1:18). During the war the control of the Norwegian merchant fleet in "exile" was transferred to a government authority (NORTRASHIP) situated in London.[1] Transport services were mainly sold to British and American government agencies. Half the freight income was used to finance the war engagement of the Norwegian London-government. The other half covered current expenses and formed an investment fund. NORTRASHIP after the war presented a good financial result as the consignors besides freights also were charged a special war bonus.[2] After the end of the war the Norwegian government payed compensation to the shipping companies according to the freight level for "bare-boat charter". The government compensated the shipowners for tonnage losses. The compensation was 7-8 % above the British.[3] All payments were made in 1946, which gave the shipping companies considerable capital additions at a time when decisions on new investments should be made. Until the spring of 1946 most Norwegian tonnage was occupied with transports according to war contracts.[4] This allowed the necessary time for the transfer of private shipping companies to commercial work and the revival of customer contacts. The "soft" transfer and the good liquidity were favorable for a rapid

---

1 The Norwegian Trade and Shipping Mission (NORTRASHIP) was formed in 1940, including 806 ships of 4 million gross tons.

2 The financial results of NORTRASHIP for the operations during the war:

	'000 million Nkr
Freight income	2.2
War bonus	1.4
Total revenues	3.6
Total expenses	1.4
Remains	2.2

Keilhau, 1948, pp. 84-85.

3 Sturmey, 1962, pp. 153-154.

4 NORTRASHIP signed a contract with the United Maritime Authority (UMA) until March, 1946; Norsk Skipsfart i vårt århundre, 1961, pp. 49-50.

rebuilding of the Norwegian shipping industry. In 1946 the tonnage increased with 30 %, through purchases in the United States (0.8 million gross tons 1946-1950) and orders to Swedish and domestic shipyards. The Swedish orders were placed at favorable prices. They were signed during the war at a time when the Swedish shipyard industry was looking for contracts to protect themselves against the downward trend predicted by certain economists to come after the war. The favorable expansion situation was somewhat weakened after 1948 when extensive currency restrictions were introduced in Norway which lessened the possibilities for ship orders abroad.[1]

The neutrality of Sweden and Spain stimulated the growth of their merchant fleets (Table 1:10). Swedish shipping in particular developed rapidly. It supplied the transport needs of the country and executed transport services for the Allies and the Axis powers. However, due to the German West Barriers after May 1940, no less than 25 % of the Swedish tonnage was laid up. Hardly 10 % was occupied in domestic traffic. Transports Sweden - abroad occupied 50 % of the Swedish tonnage while 15 % were used for cross trading outside the Barrier. Liner traffic between Sweden and countries outside the Baltic was after long negotiations with the two warring parties replaced by safe-conduct traffic (lejdtrafik), which meant a quantitative limitation of the number of allowed departures to 60-80 per year.

In spite of heavy war losses the Swedish merchant fleet maintained its prewar size, i.e. a noticeable rejuvenation was made (Tables 1:10, 1:18). This was a competitive advantage at the postwar transfer to commercial shipping, especially for liners. Even financially and from the market point of view, the Swedish shipping companies had improved their position. Annual freight revenues per occupied gross ton during the war was 20-50 % above the 1938 level (Table 1:19). Profits increased less, as costs for bunker, wages, wages, and insurance had risen. The annual ship investments of the companies nearly trebled between 1939 and 1944, which implies a good economic position, rendering possible compensation for lost tonnage. The Swedish shipping companies, in contrast to their competitors, could to a great extent maintain customer contacts during the war. At the same time new routes based on foreign ports, cross-trading lines, were established primarily in South and North America. This strengthened the competitiveness of Swedish shipping companies even further in the first postwar years.

---

[1] Seland, 1962, p. 13.

Table 1:19. Swedish Shipping 1939-1948

	1939	1942	1944	1946	1948
Tonnage 000 gross tons	1 620	1 397	1 557	1 734	2 046
Average size gross tons	722	668	744	836	941
Age structure %	100	100	100	100	100
- 4 years	26	35	45	52	32
5 - 9					20
9 - 19	32	21	15	11	12
Value of tonnage:					
total, '000 000 Skr	729	982	1 259	1 545	2 005
per gross tons, Skr	450	703	809	891	975
Investments:					
total, 000 000 Skr	69	80	172	218	255
per gross tons, Skr	654	793	1 078	1 146	1 349
Revenues: (000 000 Skr)					
- freights total	417	447	362	886	894
- cargo freights total	390	437	348	830	832
- cargo freights cross trading	110	139	104	308	351
- time charter	23	92	95	45	107
Use of the fleet (000 gross tons):					
domestic	98	113	115	90	88
Sweden - foreign countries	1 312	715	674	1 388	4 573
cross trading	182	319	332	212	345
laid up	10	217	355	22	14
Crews total, in '000	22.5	16.5	15.9	21.3	24.2
- per vessel	10.0	7.9	7.6	10.3	13.4
- per '000 gross tons	13.9	11.8	10.2	12.3	12.0

Source: SOS Sjöfart 1939 - 1948.

Already in 1946 the Swedish shipping companies revived most of their prewar lines (Table 1:16). Many of the cross-trading lines established during the war were retained. This implies that even after the transfer of international shipping to commercial terms, Swedish liner shipping companies could maintain their competitiveness in cross-trading lines in spite of high cost and of the rebuilding of the other fleets.

As a conclusion can be noted that the short term influence of the Second World War on international liner shipping primarily meant national redistribution of the world fleet, the disappearance of East Europe and China as markets generating and attracting general cargo, the arrival of a latent threat of tonnage surplus which had a dampening effect on freights (primarily in tramp shipping) and the emergence of flags of convenience.

THE EXPANSION PERIOD FROM 1948 UNTIL THE MID 1960's

The transition to peacetime conditions on the international shipping market was accomplished at the turn of the year 1948/49.[1] The military control of the distribution of cargo flows on modes, routes and shipping companies was then abolished as well as the price regulation. The result was increased competition between companies operating in trans-ocean liner shipping and between those and tramp and industrial shipping. Technically, economically, organizationally, and politically transocean liner shipping until the mid 1960's developed along the same lines as in the periods 1870-1914 and 1919-1939. Technical innovations were mainly imporvements and not originative, i.e. the rates of productivity increases and cost decreases per ton deadweight was comparable with those of the previous periods.

Deep-sea liner shipping maintained its traditional organization until the mid 1960's. After the Second World War, conferences again became the main forum for internal cooperation of the shipping companies and for the negotiations with consignors. The conference system was supported by the dominating European and Japanese liner companies. Their strong negotiating position on the market and the generally liberal trade policy of the 1950's and 1960's made the liberal doctrines guide international shipping policy until the mid 1960's.

---

[1] Sturmey, 1960, p. 155.

However, in this period a radical structural change was begun in the short-sea liner shipping of the Baltic and the North Sea. This was a consequence of the expansion of motorism in long distance passenger and goods transports. It demanded a new technique and organization of shipping in which the main principles were: minimized journey at sea, traffic between two ports and a renaissance of the double transport function of the ship (passengers and goods). In the 1960's ferry shipping became the dominant form of liner traffic between Scandinavia and the Continent and between Great Britain and the rest of Europe.

THE TECHNICAL DEVELOPMENT

The technical development influences the competitive situation of liner shipping in three ways, as previously mentioned: (1) through innovations that increase productivity and decrease labor input in liner shipping and general cargo handling; (2) through special ships for goods previously carried in liners; and (3) through alternative modes of transport(s).

General Carriers

The technical development in the period was mainly concentrated to a continued switch from steamships to motor ships, an increase in the speed and size of ships, larger loading space, and a modernization of hatches and loading equipment on board.

The share of motor ships in the world fleet of general carriers rose from 17 to 56 % between 1948 and 1965 (Table 1:20). Since the interwar period Swedish shipping companies led this process. The Broström group, the largest Swedish liner company, had only three cargo steamers in the beginning of 1950 and none in 1955, while Transatlantic, the other large shipping company, had switched completely to motor ships already in 1940.[1] The change was much slower among British liner shipping companies, which still dominated the world market completely. As late as in 1955, steamers added up to 46 % of the British liner tonnage.[2] The conservatism of the company owners, lower wages, and the favorable market situation throughout the 1950's were the main causes.[3]

---

[1] Two small steamships that were included in the Transatlantic fleet between 1951-1954 were an exception.

[2] Fisser, 1957, p. 221.

[3] Sturmey, 1960, pp. 83, 182.

Table 1:20. The World Dry Cargo Fleet by Propulsion 1939-1977 (bulk carriers excluded; '000 000 tons gross)

	1939	1948	1950	1955	1960	1965	1970	1975	1976	1977
Total	57	63	66	72	85	87	95	102	107	112
Motor ships	10	11	14	20	35	49	69	86	92	97
Steam-ships	47	52	52	52	50	38	26	16	15	15
of which Turbine	7	10	13	16	14	14	19	15	14	14

Sources: Lloyd's Register of Shipping, Statistical Tables 1963-1977. Swihen, W., 1963, Strukturwandel in der Weltankerflotte und seine Ursachen, Bergen. Morski Rocznik Statystyczny 1960-1975, Warszawa. Shipping Statistics 1966-1977, Bremen.

In difference to previous periods, the size of the general carriers remained fairly constant in the 1950's. A slight decrease could be noted in the period 1946-1955 (Figure 1:1). Thereafter the size of the ships again started to increase slowly. The tonnage development of the two leading Swedish liner companies show a similar pattern. At the end of the 1950's, general carriers over 10 000 tons deadweight gained ground more and more. They accounted for 41 % of the newly ordered liner tonnage in 1958 (Table 1:22). Orders for general carriers over 15 000 tons deadweight were still rare at this point, about 1 %.

The average speed of the general carriers increased rather slowly in the period 1948-1965. There is no detailed world statistics available. The analysis is based on data from the two previously mentioned Swedish liner companies, AB Transatlantic and the Broström group. In addition, data on the average speed of all liner ships ordered per January 1st, 1958 was used. A grouping of the liner tonnage of the two companies by year of delivery and size shows that the speed was almost constant in the 1950's, about 16-17 knots for ships between 6 and 10 thousand tons deadweight, and roughly 18-19 knots for larger tonnage (Table 1:21) The

---

[1] Fisser, 1957, p. 221.

[2] Sturmey, 1960, pp. 83, 182.

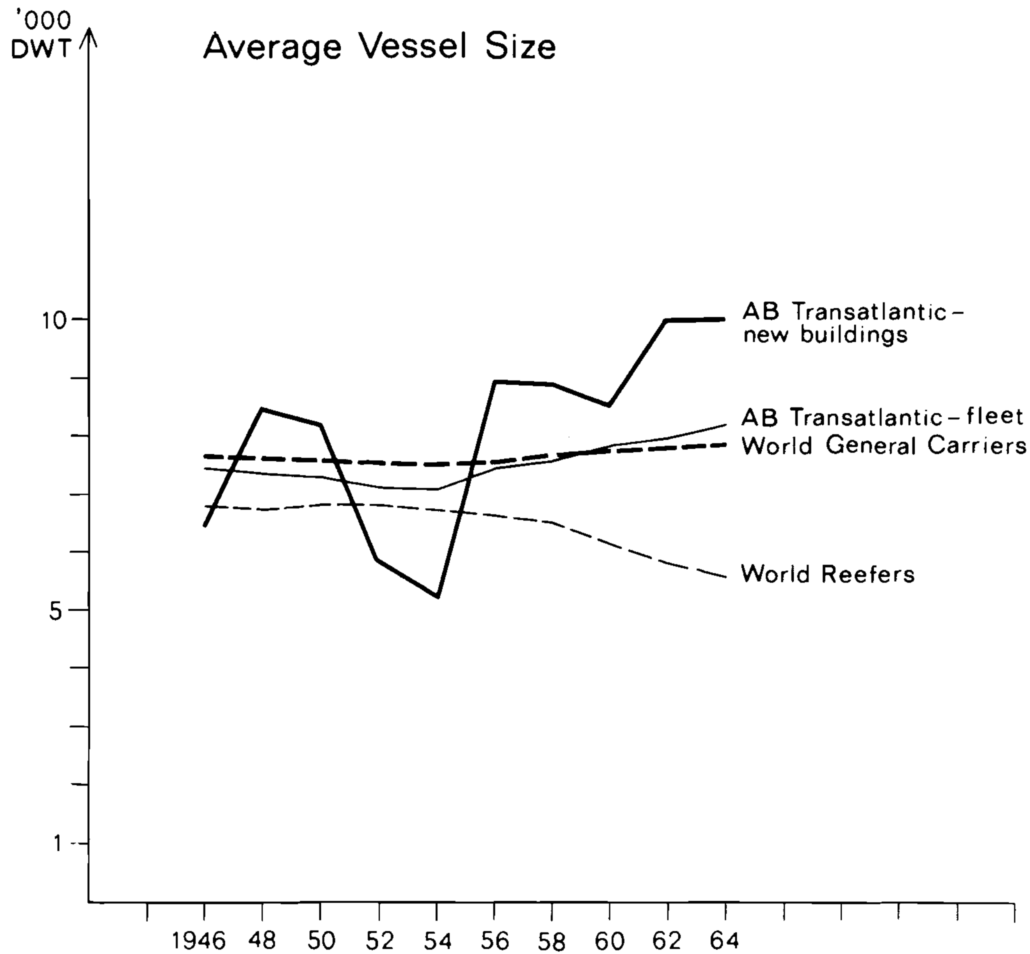


Figure 1:1. Average Vessel Size

Table 1:21. Average Size and Speed of Liners of AB Transatlantic and Broströms'[a]

Size groups ('000 dwt.)		46/47	48/49	50/51	52/53	54/55	56/57	58/59	60/61	62/63	64/65
		Years of building									
1-4.99	average size	-	3.3	3.4	-	3.9	3.2	-	-	-	-
	average speed	-	16.0	12.3	-	11.9	12.0	-	-	-	-
5-9.99	average size	8.7	8.2	7.9	8.1	8.8	8.4	-	8.9	8.1	-
	average speed	16.8	18.3	16.8	17.1	16.3	16.3	-	17.0	16.2	-
10-15	average size	-	-	10.2	10.5	-	12.1	-	11.3	11.5	10.8
	average speed	-	-	19.5	17.7	-	17.5	-	17.5	17.8	17.5

a Vessels of AB Svenska Amerikalinjen and AB Svenska Ostasiatiska Kompaniet

Sources: Lloyd's Register of Shipping, 1955-1956 and 1965-1966, Appendix. Annual Reports of AB Transatlantic, 1945-1965. Annual Reports of Tirfing, 1945-1965.

Table 1:22. Liners on Order 1958

Size group ('000 dwt.)		ALL	Speed (knots)			
			14	14-18	18	Unknown
Total	no	518	38	293	53	134
	'000 dwt.	4 759	226	2 876	506	1 109
	average	9 187	5 947	9 816	9 547	8 276
1-5	no	87	21	28	11	28
	'000 dwt.	360	88	112	43	116
5-10	no	277	6	148	22	91
	'000 dwt.	2 422	50	1 372	201	798
10-15	no	151	11	106	19	15
	'000 dwt.	1 912	129	1 342	246	195
15-20	no	3	-	2	1	-
	'000 dwt.	48	-	32	16	-

Source: Morski Rocznik Statystyczny, 1960, Gdansk interval 14-18 knots dominated the world orders for liner ships in the beginning of 1958 (Table 1:22). It is probable that the relative stability of the speed of the Swedish liner tonnage was also valid internationally. The lack of technical innovations that radically could shorten the loading and discharging time seems to have been the main cause. Time in port was 40-50 % of the total travelling time on most of the transocean routes in the mid 1960's,[1] i.e. nearly unchanged since the turn of the century.[2] Ten % increase in the ships' speed would have given a mximum of 5 % productivity increase. At the same time, the machine cost would have increased with 20-25 % and the fuel cost with 10-15 % for a ship of 12 000 tons deadweight.[3] These cost increases could partly have been neutralized by increasing the ship's size. But this would mean increased port time, as the loading and discharging time increased in proportion to the goods volume.[4] Changes in the speed of the liner ships to a great extent were influenced by the judgements of the shipowners as regards the demanded departure frequency. When the departure frequency was established and the techniques of loading and discharging given, then the speed of the ships was also given.

The strong relations between departure frequency, ship size and speed on the one hand and time in port on the other led to considerable technical experiments in new cargo handling methods in the 1950's. These included improvements of ship hatches and lifting equipment and the introduction of standard units in general cargo shipments. Traditionally the ship hatches consisted of fore and after wooden boards and tarpaulins. The taking off and putting on these hatches was very time-consuming. The costs for those operations were onerous for the shipping companies, especially after World War II, when more and more ports demanded that they should be done by stevedores instead of the crew. This stimulated the development of patent hatches on the main deck and of steel flush hatches on the lower decks. The result was, strongly shortened time for operation of hatches and an increased possibility for the crew to do it. The time for loading and discharging could also be shortened as the flush hatches could quickly be covered and opened, which increased the mobility on the lower decks. At the same time it was attempted to make the ships as open as

---

1 Getz, et al. 1968, p. 6.

2 Steneroth, 1971, p. 271.

3 Getz, et al. 1968, p. 6-16.

4 Committee of Inquiry into Shipping, 1970, p. 104.

possible to increase the manoeuvering space for the crane in the hold, i.e. limit the need for manual stowing work.[1]

In order to make loading and discharging even more efficient, the traditional fixed derricks were to a great extent replaced by deck cranes at the end of the 1950's. These were more flexible when it came to placing the cargo in the hold and demanded less deck space, i.e. allowed making general carriers more 'open'.

General cargo shipments by tradition were heterogeneous in weight, volume, and shape. Until the mid 1950's every unit was stowed by hand in the hold. Units were hoisted on board or enclosed in rope nets. The process was labor intensive; 15-20 men served each crane. Productivity was low, 10-15 tons per gang-hour.[2] The loading of 3 000 tons of general cargo with three gangs thus required 100 working-hours. The gross working-hours at this time accounted for 50 % of the total time in port of the general carriers; i.e. the total time in port in the example was eight days.

The slow cargo handling in the 1950's thus formed a powerful obstacle for developing competitive liner ships to meet the increased competition from special ships and from air and land freight. This led to extensive research and experiments to standardize general cargo consignments, i.e. decrease the time and costs of loading and discharging.

The preslung unit was the first step toward unitization of general cargo, put into practice in the deep sea shipping in the 1950's. Individual units were tied together and the sling followed the cargo from door to door. This resulted in less time for stowing and more rapid goods sorting in the hold and on the quay. The preslung unit became the leading form for unitizing of break bulk cargo, i.e. pulp, rolls of paper and steel and iron products. Shipments of these commodities are relatively homogeneous as regards size and shape. Through preslinging large units could be formed. They required more lift and transport capacity by cranes and trucks, but in return productivity increased considerably per gang hour, i.e. reduced time in port for the ship.

---

[1] The increased "openness" of the break bulk cargo carriers can be illustrated with data from the tonnage of the AB Transatlantic.

Year of building	Ton deadweight	Hatches	
		Number	Dimension in metres of the largest
1945-1946	9 270	5	9.8 x 5.5
1950	10 220	6	9.8 x 6.4
1962	9 055	7	12.2 x 6.4

[2] Hölcke, 1953, p. 170-173

Preslinging was less suitable for unitizing of general cargo shipments which considerably vary in form and weight. The pallet was the real start of unitizing general cargo in shipping as well as in land transports.[1] It was introduced in deep-sea liner shipping in the second half of the 1950's as a result of favorable experiences from military transports in World War II and the Korean War. A prerequisite for the use of the pallet in shipping was that ports invested in the new handling equipment, the fork truck. The main advantage of the pallet was that it offered a standardized through-cargo-carrier for transports from shipper to receiver. In combination with fork trucks, the pallet allowed a rapid mechanization of general cargo handling in ports and in the inland terminals and warehouses. This resulted in decreased labor requirements and increased productivity. For deep-sea liners it was calculated to 20-30 % compared to traditional cargo handling methods.[2]

The pallet was suitable for transports in conventional general carriers and in most of the land modes, which contributed to its rapid expansion. In order to increase productivity even further, special pallet ships were introduced in the late 1950's. They had side gates and lifts for rapid loading and unloading with the help of forks. The space on lower decks was adapted to the height of the loaded pallets which made possible maximum use of the loading capacity of the ship. The loading/discharging time for a pallet ship of about 11 000 tons deadweight was calculated at one-third of the time required for a conventional general cargo carrier.[3] The pallet ships were introduced primarily by Norwegian liner companies with the Fred Olsen Lines at the head. This company thought in the mid 1960's that pallet transport with special ships was the cheapest alternative for port-to-port as well as door-to-door transport of general cargo on deep-sea routes. The estimates of the company for a 7 000 nautical mile journey (Europe - East Coast of North America) was a total cost for the door-to-door alternative with a pallet ship 50 % below that of a conventional ship (Table 1:23). The considerably reduced handling costs and time motivated the introduction of faster and larger ships, i.e. lower capital cost per ton transported cargo. In spite of this and similar estimates, the number of transocean pallet ships remained small.

---

[1] Several types of pallets were introduced in the 1950's and 1960's. In international transports the Europe-pallet was the most common. It was built of wood, in size 800 x 1200 mm, with a maximum load of two tons and an average load of roughtly one ton.

[2] Burg, 1969, p. 25; The change into pallet handling of goods in bags increased the productivity from 17 to 27 tons per gang-hour in Manchester at the beginning of the 1960's. Corresponding increases were attained in several European ports. At the same time the size of the stevedore gangs was decreased, in Stockholm from 13 to 7 men (Steneroth, 1971, p. 2715).

[3] UNCTAD, 1970, p. 23.

Table 1:23. Cost Structure of Liner Services - Quay to Quay
(Total capacity 800 000 cu. ft., 7 000 miles round trip)

Characteristics	Services				
	Conventional	Pallet		Container	
		Port-Port	Door-Door	Port-Port	Door-Door
No. of vessels	8	4	4	3	3
Speed (knots)	11	15	15	19	19
No. of ports	6	6	6	2	2
Cost per ton cargo (US $)	27.1	15.8	12.6	23.6	17.1
of which:	Percentages				
capital costs of ships	10	16	20	11	15
Fuel	1	3	4	3	5
Running	13	15	19	8	11
Port expenses	2	5	6	1	1
Cargo handling	73	58	48	22	28
				42[a]	-
Equipment	-	1	1	12	39

a Stuffing, receiving and delivery of goods.

Source: Getz, J.R., Ericksen, S., Heirung, E., 1968, Design of a Cargo Liner in the Light of the Development of General Cargo Transportation, The Society of Naval Architects and Marine Engineers, New York, Paper No. 6, June.

The parallel development of the container system played a decisive part in this.

The discussion about the advantages and disadvantages of the container, based on experiences from military transports in World War II and the Korean War, started in the latter part of the 1950's. The first container lines were established at this time on domestic routes in the United States.[1] In the beginning of the 1960's containers were introduced in deep-sea transports.[2]

---

[1] Pan American Steamship Co., renamed Sea-Land Service in 1960 and owned by the McLean Industries, in April 1956 opened the first sea-container trade between New York and Houston, in the same year extended to Puerto Rico. The containers were loaded on conventional general cargo carriers. Special container ships were introduced on the route in 1962. Matson Navigation Co. in August 1958 opened a container line between San Francisco and Honolulu. Container ships were introduced on this route in 1960.

[2] See footnote on next page.

However it was not until the mid 1960's that the container systems turned from the experimental to the commercial stage and extensively influenced operations in liner shipping. This was the beginning of a new era for the liner industry. Therefore, the economic consequences of this innovation are discussed in the section on the development of liner shipping after the mid 1960's.

Special Ships

The specialization of ships, which began at the turn of the century, increasingly influenced the development of liner shipping in the period 1948-1965. Special ships took over cargo that had previously been carried in liners, primarily refrigerated goods, wood and wood products, and cars. This increased competitive pressure on the general tramp ships. Hence, this tonnage more and more sought employment in the market of liner shipping.[1]

The switch of general cargo to special shipping meant that the basis for some lines was reduced. The cause was the same as for the change to tank and dry bulk carriers in the previous periods, i.e. an extensive and stable trade in a commodity with special requirements for mode of transport and technical innovations in the cargo handling that reduced the port costs more than the costs increased for ballast voyages. Also the growth of the multinational companies in the food, car, and wood industries after World War II, stimulated the development of transport systems based on special ships. The transport needs of these companies were big enough to justify a switch from buying transport services in the liner or tramp markets to the establishment of their own transport systems based on long-term charters or purchases of modes and terminals.

Beside the general tramp ships, the refrigerated vessels from the 1930's were the most severe competitors of the conventional liners. The demand for deep sea transports of refrigerated cargo was to a great extent generated by multinational corporations, i.e. the market was relatively stable and guaranteed a continuous employment for the special ships. The leading commodities were meat and fruit, especially bananas and oranges (Table 1:24). High capital and running costs for the refrigerator equipment and the sensitivity of the commodity to long transports motivated high speeds and a limited number of stops en route.

---

2 (footnote from foregoing page)
In 1960 the American President Lines opened the first transocean container line between the West Coast of the United States and the Far East.

1 Fisser, 1957, p. 23.

Table 1:24. International Meat and Fruit Trade ('000 000 tons)

Cargo (SITC) Regions	1950[a]	1956	1960	1965	Annual Growth 1950-1965 %
Meat					
Total	1.2	1.8	2.3	3.5	7.7
Exporters					
Europe	0.2	0.4	0.7	1.3	15.2
Oceania	0.5	0.6	0.7	1.0	4.2
Latin America	0.4	0.5	0.5	0.7	4.0
North America	0.1	0.1	0.2	0.3	8.3
Importers					
Europe	1.0	1.4	1.8	2.5	6.3
North America	0.0	0.1	0.3	0.3	14.0
Japan	0.0	0.0	0.0	0.1	48.4
Bananas					
Total	2.3	3.0	4.0	4.8	4.9
Exporters					
Latin America	1.9	2.4	3.3	3.7	4.6
Asia	0.0	0.1	0.1	0.4	20.0
Africa	0.2	0.4	0.4	0.4	0.0
Importers					
Europe	0.6	1.2	1.6	2.2	8.6
North America	1.4	1.7	2.1	1.7	-
Japan	-	0.0	0.0	0.4	38.6
Oranges					
Total	1.6	2.0	3.0	3.7	5.4
Exporters					
Europe	0.7	0.6	1.2	1.5	4.9
Africa	0.4	0.6	0.9	0.9	5.8
Asia	0.2	0.4	0.5	0.7	9.1
USA	0.2	0.4	0.2	0.2	-
Importers					
Europe	1.3	1.8	2.5	3.0	5.5
Canada	0.2	0.2	0.2	0.2	-

a average 1948-1952

Source: FAO, Trade Yearbook, 1950-1967, Rome.

It created the characteristic combination of refrigerated and passenger transports in the same vessel. They remained competitive on most transocean routes until the early 1950's. The rapid technical development and lowered prices of air transports, the labor intensity of shipping and the change in the structure of transocean passenger traffic, from emigrant and "grand tour" tourist to short-time tourist and business trips, i.e. the increased maginal value of travelling time meant that shipping became less competitive on this market. The number of combined passenger-refrigerated vessels in the world fleet decreased from 76 to 45 between 1951 and 1965 at the same time as their transport capacity was reduced by half (Figure 1:1). These ships were replaced by 'pure' refrigerated vessels ('reefers') which increasingly competed with conventional general carriers having refrigerated holds and with air transports. The lorry became the chief competitor on the inter-European routes. The very even growth rate of the world fleet of refrigerated vessels was more rapid than that of general carriers, roughly 5 % a year in the period 1950-1965 (Figure 1:2). Already in 1965 "pure reefers" supplied almost half of the total refrigerated capacity in the world fleet (Table 1:25). These ships were registered and few flags with Great Britain, West Germany and Sweden at the top, i.e. they were operated by high wages and well-established-on-the market firms.

The rapid increase in the demand for seaborne refrigerated transports 1950-1965 was mainly a consequence of the growing meat imports of Japan and the United States (Table 1:24). This heavy demand resulted in a high growth of the medium-sized "reefer" tonnage on the routes Australia - Japan and Argentina - North America. The growth rate for large refrigerator vessels, on the other hand, was slow, which resulted in a decreased average vessel size (Figure 1:1). However, the speed rose from about 15 knots to roughly 18.[1] The low degree of mechanization in the port handling of refrigerator products limited the economies of size in the reefer fleets.

The expanding intercontinental trade in cars, primarily from Europe to North America, and later also from Japan to North America, formed a very important cargo basis for a number of lines in the period 1950-1965 (Table 1:26). These flows consisted mainly of assembled cars, in contrast to the period between the wars when the car trade was strongly dominated by parts and components from American mother companies to assembly plants in most European countries and elsewhere.

---

[1] Svensk Sjöfartsgidning, September 1, 1960.

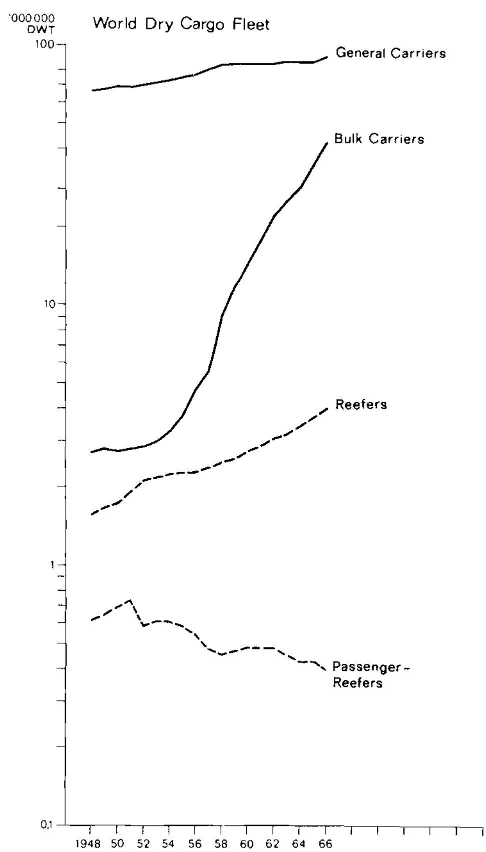


Figure 1:2. Development of the World Fleet by Vessel Type 1948-1966.

Table 1:25. World Fleet of Reefers and General Carriers with Refridgerated Cargo Space

Flag		1959	1963	1965
World				
Total	no	241.0[b]	2 965	3 113
	mill. tons gross	16.1[b]	19.7	20.2
	mill. cu. ft.[a]	179.2[b]	213.8	241.8
Pure Reefer	no	311[b]	410	546
	m.t.g.	1.3[b]	1.6	2.1
	m.c.f.	57.7[b]	75.2	104
UK				
Total	no	333	565	566
	m.t.g.	3.9	5.1	4.9
	m.c.f.[a]	85.0	88.3	90.7
Pure Reefer	no		53	59
	m.t.g.		0.4	0.4
	m.c.f.		17.8	18.7
W. Germany				
Total	no	62	211	206
	m.t.g.	0.2	1.1	1.2
	m.c.f.[a]	8.7	15.5	18.4
Pure Reefer	no		65	72
	m.t.g.		0.2	0.2
	m.c.f.		10.8	13.7
Sweden				
Total	no	107	178	172
	m.t.g.	0.5	1.0	0.9
	m.c.f.[a]	10.3	15.7	17.9
Pure Reefer	no		35	37
	m.t.g.		0.2	0.2
	m.c.f.		8.0	9.9
USSR				
Total	no	27	47	.
	m.t.g.	0.1	0.1	.
	m.c.f.[a]	2.5	4.4	16.0
Pure Reefer	no		10	38
	m.t.g.		0.0	0.2
	m.c.f.		1.3	9.3

a refrigerator space only
b 1957
Total = Pure Reefers and other vessels with refrigerated cargo space

Sources: Shipping Statistics, Yearbook 1966, Bremen, Shipping Statistics, Monthly Statistics, 1958:4, 1959:7, 1963:11, 1966:10.

Table 1:26. International Car Trade ('000 units)

	1950	1955	1960	1965
Total	674	1 160	2 450	3 598
Europe - North America		40	609	600
Japan - North America		-	-	27
Japan - Europe		-	-	14
Intra-European		300	681	1 411
Exporters				
Germany	67	356	886	1 516
UK	343	322	538	627
France	88	136	492	486
Benelux	7	28	102	360
Italy	18	61	192	157
Japan	-	-	-	118
USA	127	219	128	112
Sweden	1	3	51	94
Canada	24	12	-	78
Importers				
Western Europe	172	412	718	1 712
USA		58	471	596
Africa	23	110	154	241
Canada	82	49	171	136
Asia	3	49	86	120
Oceania	3	49	38	96
Latin America	17	39	63	89

Sources: Statistisches Jahrbuch für die Bundesrepublik Deutschland, 1952-1967, Wiesbaden; Trade by Commodities, Series C, 1960-1966.

The structural change in the postwar trade was caused by increased scale economies in the assembly of cars and decreased transport costs for ready made units. It made the European industry concentrate the assembly to a few plants, primarily in the mother-country. The American cars with their large size and high fuel consumption had a limited market in Europe, while European cars started finding a market in America. The increased volume of sea-transported cars, the possibility of stowing more units by introducing several decks adjusted to the height of the car and the concentration of the demand to a few companies, primarily Volkswagen AG, favored the development of special ships for car transports in the second half of the 1950's. They were mostly rebuilt bulk carriers and tankers. Loading and discharging was conventional, by the "lift-on - lift-off" method, i.e. costs and time in port increased in proportion to the size of the ship. In spite of that, larger ships were introduced to meet the needs of the rapidly growing trade. The changes in average size of ships acquired by AB Wallenius, one of the leading shipping companies in the car trade, show the trend clearly. The size of purchased car carriers increased from 2 800 deadweight tons in 1955 to 6 900 tons in 1959 and to 25 000 deadweight tons in 1963. The speed of these vessels was somewhat below that of liners of corresponding size, some 12-14 knots. The slow loading and discharging technique, the origin of the ships as bulk carriers, and the strong integration of the whole distribution system in a logistics chain were the main causes.

Since loading and unloading were bottlenecks in car transports, great efforts were made in the late 1950's and early 1960's to replace the conventional crane with a new technique. The "roll-on - roll-off" principle gave the best results and was introduced in inter-European connections in the early 1960's.[1] The method was based on experiences from military vehicle transports and from the rapidly expanding ferry shipping. Loading and unloading costs were reduced by 50-60 %, and the productivity of tonnage increased rapidly. The "ro-ro" technique also brought on a considerable reduction of cargo damages previously incurred when loading and unloading by crane. The positive experiences of the "ro-ro" technique on inter-European routes stimulated the introduction of the same ship types in deep sea relations in the mid 1960's.[2] The analysis of their economic consequences for transocean liner shipping is therefore made in the section on the post-1965 period.

Sea transports of wood and wood products has traditionally been dominated by intracontinental trade. Inter-European and inter-American trade amounted to roughly 75 % of the world trade in these commodities in 1959 (Table 1:27). This share decreased steadily in the 1950's as a consequence of the rapidly expanding export from Africa. In the 1960's the Soviet wood export to Western Europe and Japan increased rapidly. This meant a rising share of inter-European flows on the world market for wood and wood products.

Liner and tramp shipping competed for the inter-European transports of wood and wood products. The large number of relatively small production plants with coastal location, characteristic of the Nordic timber industry in the 1950's,[3] meant that tramp shipping with small ships

---

1 AB Wallenius in 1963 introduced the first MS Aniara, 1 059 dwt. in inter-European transports of Volkswagen cars.

2 The first transocean "ro-ro"-car carrier was the MS Dyvi Atlantic, put in traffic in 1966 with a capacity of 1 400 cars.

3 Alexandersson, 1967, p. 112.

Table 1:27. International Trade in Forest Products

Commodity (SITC)	1950	1955	1960	1965	Annual Growth 1950-1965 %
Wood (mill. m^3)					
Total	38.5	56.5	73.0	101.0	
N. America - Europe	1.1	1.7	0.6	3.4	
Asia - Europe	0.2	0.3	0.4	0.9	
Africa - Europe	0.7	2.0	3.4	5.2	
Latin America - Europe	0.1	0	0.1	0.5	
Inter-European	16.7[b]	12.7	14.5	37.0	
USA - Canada	13.0	7.2	5.8	16.1	
Pulp (mill. tons)					
Total	5.7	7.8	9.7	12.5	
N. America - Europe	0.1	0.7	1.0	1.2	
Europe - N. America	0.6	0.3	0.3	0.3	
USA - Canada	1.6	1.8	1.9	2.6	
Inter-European	2.9	3.7	4.8	6.1	
Paper (mill. tons)					
Total	5.5	7.7	8.4	8.9	
N. America - Europe	0	0.4	0.4	0.4	
Europe - N. America	0.2	0.3	0.1	0.2	
Europe - Latin America	0.2	0.3	0.2	0.2	
Europe - Asia	0.1	0.1	0.1	0.2	
USA - Canada	4.4	4.7	4.8	5.5	
Inter-European	0.3	0.6	0.8	1.9	
Plywood, Fiberboard (th.t.)					
Total	0.6	1.2	1.9	2.9	
N. America - Europe	0	0	0.1	0.2	
Europe - N. America	0	0.1	0.1	0.2	
USA - Canada	0	0	0	0	
Inter-European	0.3	0.5	0.8	1.1	

a Wood = Logs, pulpwood, pitprops, lumber
b excluding trade between East European countries

Sources: FAO, Yearbook of Forest Products Statistics, 1950-1966, Rome.

was competitive. Relatively irregular deliveries and the customer habit of building large stocks increased the advantages of tramp shipping even further. Also the low ton-value which made wood and wood products more sensitive than other break bulk cargo to high transport costs favored the use of tramps. Intra-European liner shipping could compete in wood transports only from production plants situated in large general cargo ports or their primary hinterland. For most lines to "Norden", wood and wood products formed the most important return or filling cargo in the 1950's and early 1960's. Certain lines based their whole traffic on wood transports. The risk for competition from tramp shipping was reduced through long-term contracts, including shipments from the forest industry and in-transports of chemicals used by the pulp industry.

The deep-sea transports of wood and wood products outside the North Atlantic were dominated by the imports of Tropical hardwoods to Europe and North America and the exports of forest products, primarily paper, in the opposite direction. Consignments were relatively small, which made liner shipping the most competitive alternative.

In loading and unloading of wood and wood products cranes were used. In the 1950's the preslung unit was widely introduced in these transports, which enabled a considerable productivity increase in the stowage work. Packaged timber was suitable for transporting on weather deck. This stimulated the development of special ships with higher freeboards, primarily for shorter routes, like Norden - the Continent. As the lift-on-lift-off method was used, the special ships could only achieve limited cost or time advantages in port operations. The distribution of the demand on many transport buyers kept back the technical specialization in wood transports, both as regards ship types and handling methods. However, organizational specialization was pronounced. Several small shipping companies sought to stabilize their operation through long-term contracts with the wood industry. The structural changes in the 1960's in the Nordic wood industry resulted in a considerable concentration of production plants, mergers and acquisitions of companies and increased internationalization through localization of production units abroad. The customer demand for more frequent and safer deliveries also helped form the basis of new transport systems.

The discussion about new transport systems for the wood industry started in the mid 1960's. The take-off was not until the late 1960's and early 1970's. Therefore, the analysis of the consequences for liner shipping follows under the post-1965 period.

Alternative Modes

The technical development in the modes alternative to liner shipping resulted in increased competition from lorries in the inter-European general cargo transports and in the loss to airlines of passenger traffic on deep-sea routes where it had been an important complement to the transports of high-value and fragile general cargo.

The technical development of increased size and speed of the lorries meant competition in long-distance transports. The organizational structure of the road transports with a strong dominance of small firms with one or a few lorries[1] was an important obstacle for operation on the international transport market. The market organization was too weak for the procuring of return cargoes and caused high costs. In order to strengthen their competitiveness in long-distance transports, the small lorry firms formed joint companies with the purpose of organizing marketing, sales, routes designing and running of terminals for long-distance traffic. These companies also work as consultants to their members in matters of economy and vehicle investments, i.e. to strengthen their power as regards purchases of lorries and decrease the load of administrative work. A condition for the development of lorry transports in the relations Norden - the rest of Europe and Great Britain - the rest of Europe was a broad introduction to ferries. Ferry shipping developed very rapidly on these routes and in the 1950's and 1960's gradually replaced traditional liner shipping.[2]

The most important elements in the technical development of air transports was the introduction of larger and quicker planes and of special air freighters. The introduction of the jet motor in the 1950's meant a doubling of speed and a considerable increase of range (Table 1:28). At the same time the loading capacity of the planes increased tenfold. This created a surplus capacity on the market, since the demand had a much slower increase (Table 1:29). The consequence was a considerable reduction of the price calculated per capacity unit. The technical development allowed for a considerable lowering of costs, which enabled the companies to continually invest in new types of planes in the whole period. From the end of the 1950's the companies started a more offensive marketing of their freight services. The basis was an assumption that air transport decreased the total distribution costs of the consignor allowing reduction of buffer-stocks and more rapid turnover of the goods.[3] However, until the mid 1960's the volume of air transported cargo remained small, i.e. high-value goods to a large extent left liner shipping.

---

1 As late as in the mid 1960's, lorry firms with up to five lorries were responsible for 95 per cent of the lorry stock in Norway, and between 60 and 70 per cent in West Germany, Denmark and Sweden; Kritz, 1976, p. 179.

2 See pp. 116-124.

3 Sletmo, 1972, p. 39.

Table 1:28. Technical Progress in Air Cargo Carriers

Cargo Carrier	Year	Payload tons	Speed km/h	Productivity ton-km/hours flown	Utilization hours/day
C-46	1946	5.6	300	1 680	5.6
L-10 49C	1953	14.1	395	5 570	5.3
DC-7B	1955	16.2	434	7 031	4.9
DC-8F	1963	35.1	796	27 940	6.8
DC-8 - 63F	1968	50	800	39 800	6.8

Source: Sletmo, G., 1972, Demand for Air Cargo, Bergen.

Table 1:29. Utilization, Rates and Costs in Air Transports by ICAO

Years	Weight Load Factor %	Rates[a] US cents	Costs[b] US cents
1948		33.6	30.7
1950	53	23.2	25.0
1955	44	25.6	23.7
1960	39	22.9	22.9
1965		18.2	17.5
1968		16.8	15.6

a per tonkilometer air freight
b per available tonkilometer, passenger and freight services

Source: See Table 1:28.

Conclusions

The influence of the technical development on the operation of international liner shipping in the period 1948-1965 can be summarized as follows: (1) the speed and size of liner ships increased rather slowly; (2) the share of loading-unloading operations in the total voyage time remained almost unchanged, since the increased productivity in cargo handling reached by the introduction of the pre-slung unit and pallet was absorbed by the increase in ship size; (3) pallet was developed as a first profitable form of unitization of general cargo while the "ro-ro" technique was tried as an alternative to the conventional "lift-on - lift-off" method for the loading and unloading of general cargo; (4) special shipping developed rapidly, primarily reefer vessels and car carriers, as a consequence of lower transport costs and the consignors' interest in closer control over their flows, which in turn reduced the cargo basis for several deep-sea lines; (5) increased size and speed of lorries and new company forms made road haulage a strong competitor to traditional liner shipping in Europe and stimulated the growth of ferry shipping; (6) airlines developed into the leading mode of intercontinental passenger transports, which considerably reduced the operational basis for combined passenger - cargo liners, at the same time as the new freight planes meant increased competition for high-value general cargo which used to be the cream of the cargo flow on most transocean routes.

MARKET ORGANIZATION AND COOPERATION FORMS

The liner conferences in the late 1970's reestablished their role as the main form of cooperation between liner operators as well as between lines and consignors. To counterbalance the growing power of the conferences, the consignors in most European and Overseas countries in the early 1960's started to organize themselves in national and international shippers' councils which covered a much wider part of the market than the branch associations of earlier periods.

Conferences

The organization of the liner conferences, their methods of work, control and pricing remained largely unchanged in the first two postwar decades. There was no internal pressure for changes as the technology and economy of liner shipping were very much the same as before. On the other hand, many externalities were changing as a result of the decolonization process, the ambition of new countries to increase their economic independence by acquiring their own fleets and regulating shipping practises, and the negative attitude of the Soviet Union to the conference system.

The number of liner conferences increased from about 250 in the late 1940's to about 360 in the mid 1960's.[1] New markets were opened which had been closed for international services by colonial regulations and competition for general cargo increased from vessels operated as industrial carriers or tramps. The conference system gave liner operators a strong weapon with which to meet this competition.

---

[1] Croner, 1965.

The India Trade

The independence of India, Ceylon and Pakistan 1947-1950 created new operating conditions for the hundred port-based conferences active in the Indian trade in the late 1940's. The governments of the new countries from the very beginning put strong pressure on the conferences to accept the national lines as full members. The political division of the subcontinent created a new port distribution of flows and required reorganization of the conferences, from a dispersed system based on ports towards a more concentrated one with the whole subcontinent as the base of operation.

From early days the government of India treated the regulation of the conference system as a vital part of its shipping policy, aiming at a powerful national merchant fleet to promote exports and strengthen economic independence. Three methods were used to influence the activities of the conferences: (1) the establishment of state-owned lines who from the inside could influence the work of the conference; (2) the introduction of laws and regulation of conference practises; and (3) flag discrimination in the general cargo trade. The state-owned lines were established in the early 1950's,[1] and enrolled in the conferences under government pressure. The government also gave strong financial and political support to the private Indian line operators[2] in membership negotiations with the conferences.

The support included subsidies for tonnage investments[3] and far-reaching tax and depreciation allowances.[4] As a result, both the private and the state-owned fleets of India grew rapidly during the 1950's and early 1960's. The growth rate was twice the world average (Table 1:30). In the mid 1960's about half the fleet was used in liner services. Government pressure and rapid tonnage growth forced the conferences to accept Indian operators as full members on the trade Europe - India.[5] However, the con-

---

1 The Eastern Shipping Co., established in 1960 as a line operator, was merged in 1961 with the Western Shipping Co., created in 1956 for tramp shipping. They formed the Shipping Corporation of India.

2 Scindia Steam Navigation Co. and India Steam Ship Co.

3 Private shipping companies were allowed to accumulate up to 40 % of the new-building value in tax free funds during a period of 7 years, Glersen, 1967, p. 74.

4 The Shipping Development Fund created in 1951 granted loans up to 95 % of the new-building value, at 3 % annual rate and with a 16-18 year depreciation period, ibid., p. 72.

5 Scindia was a conference member since the mid 1930's, but only with one vessel.

Table 1:30. Indian Shipping 1948-1965 ('000 gross tons)

	1950	1955	1960	1965
Private	356	436	695	1 202
State-owned	16	44	162	335
Total	372	480	857	1 537
of which				
Foreign going	167	255	577	1 122
Liners				700

Sources: UNCTAD, 1967, Liner Shipping in India's Overseas Trade, Geneva, p. 135. Sløersen, E., 1967, Skipsfart i India, Skipsfartøkonomisk institutt, Bergen, p. 64. Shipping Statistics, Yearbook 1966, Bremen.

ferences did not accept the new members as participants in the "way-port" agreements, i.e. excluded them from cross trading en route. This was motivated by the risk for tonnage surplus and lack of business tradition. To strengthen the position of the national lines, the Indian government in the late 1950's introduced laws discriminating foreign flags in the movement of government cargo.

The Freight Investigation Bureau (FIB) was created to control conference pricing and coordinate cooperation between consignors and liner operators. Parallel to the FIB, a special committee was established to negotiate with conferences about freight rates and conditions for government cargo.

The result of this policy was decreasing capacity utilization among non-Indian members of the India/Pakistan conferences. The slow growth of the foreign trade of India and Pakistan in the late 1950's and early 1960's aggravated the situation. The conferences in 1960/1961 decided to change the organization of the trade. The port-based conferences were brought together into four geographic ranges, liner operators formed national groups and a revenue pool was established. The Indian lines obtained 40 % of the traffic and they were supposed to achieve 50 % in 10 years. Rate differentiation between base ports was abandoned and unit prices were introduced for ports on the East and the West Coasts of the subcontinent. Hence, the political division no longer influenced the pricing of services.

The reorganization of the conference system strengthened the power of the foreign operators. In 1962 they required a rate increase by 12-15 %. It was refused by the Indian government. A new negotiation practice or discussions formula was established. Every price rise had to be discussed with consignors and accepted by the government. Price rises could not be more frequent than once every second year.

The policy of the Indian government toward liner conferences in the late 1950's and early 1960's was not unlike those of interwar Australia and South Africa, i.e. the interests of national operators and shippers were given increasing support, the difference being that India also chose the policy of active participation in business. This formed the basis for a world-wide discussion about the organization of liner services in the ensuing period.

The Far East Trade

After World War II the external conditions of work of the Far East Conference changed more dramatically than those of any other market. The new regime in China introduced a policy of economic autarky, which resulted in a slower growth of its foreign trade, and a shift towards the European centrally planned economies (Table 1:31). These countries established their own services in close cooperation with the Chinese government. Third flag vessels were gradually excluded from this traffic. Like other centrally planned economies China adopted the policy of "cif exports" and "fob imports", i.e. to keep total control over the transport choices for its foreign trade. It gave a strong bargaining position in the negotiations with the conferences, even for flows between China and Western Europe. The Far East Conference in the mid and late 1950's was forced to accept far-reaching rebates without any loyalty agreements in return. Expectation of better conditions and profitable traffic in the future was the main motive for the conference to continue its services during the 1950's and 1960's.[1]

Table 1:31. The Foreign Trade of Japan and the P.R. of China (mill. $)

	Japan			P.R. of China		
	1955	1960	1965	1950	1960	1965
Total Trade	4 180	8 546	16 622	1 210	3 990	3 880
Western Europe	355	835	2 160	118	634	690
Soviet Union	4	130	431	431	2 582	415
Eastern Europe	12	11	40	12	758	349

Sources: UN, Yearbook of International Trade Statistics, 1966, New York. de Vylder, S., 1974, Foreign Trade and Selfreliance in China, the Economic Research Institute at the Stockholm School of Economics, Stockholm.

[1] Deakin, 1973, p. 51.

In its relations with consignors from market economy countries, the Far East Conference maintained a strong bargaining position, characteristic of the previous periods. The governments of the Far East countries, except Japan and the Philippines, during the 1950's and early 1960's applied a passiv conference policy. They neither established state-owned liner fleets, nor passed laws restricting conference practices. This policy and the large number of relatively small general cargo consignors, divided among several countries, made shipper cooperation in the Far East region difficult. It strengthened the position of the conference. The Korea and Indochina Wars caused rapid growth in the demand for general cargo transports to the Far East and created significant tonnage shortages on the route. Weak external pressures and substantial growth of demand allowed the Far East Conference to maintain in the 1950's and early 1960's its relatively loose organizational form. Until the mid 1960's there was no revenue pool on the route. Traffic was allocated through regulations on ports of call, amount of cargo and number of sailings.

As mentioned before, Japan and the Philippines in the late 1940's adopted more restrictive policies towards the shipping conferences. Under the influence of US legislation, price control was introduced, rebates below 10 % were prohibited as well as deferred rebates. The conference agreements were put under the control of government authorities.[1] It caused a withdrawal of the Japan services from the general agreements of the Far East Conference and the creation of special subconferences, The Japan Homeward Freight Conference and the Japan Outward Freight Conference.

The Japanese conference policy changed in the late 1950's under the pressure of the rapidly growing national lines.[2] The injunction against deferred rebates and fighting ships were abolished in 1959. Two years later, conferences were given the right to refuse new memberships, providing they would create risk for substantial tonnage surplus. Their status was shifted from an open to a closed conference. These changes were supported by the Japanese Ministry of Transport, which took the views of the national shipowners. The Fair Trade Commission, appointed by the government to control conference pricing and practices, was in favor of a more restrictive policy, protecting the interest of national shippers.

In the early 1960's the Japanese traders increased fob-sales and cif-purchases. They could thus avoid using conference tonnage for movements of cargo which could be shipped cheaper by other vessels without loosing deferred rebates for the trade carried by conference ships. The conferences tried to strengthen the shippers' loyalty by

---

[1] Law no. 54 of April 14, 1947, Tokyo.

[2] Frihagen, 1963, p. 366.

introducing an extra disount payable as long as they refrained from using the fob-clause and by threatening that they might loose their deferred rebates.[1] The Fair Trade Commission forced the conferences to drop these practices.

The general tendency in Japan's conference policy of the late 1950's and early 1960's was a declining state interference under the general assumption that a system of self-regulating conferences provides a useful framwork for the development of the national liner industry without harming the interests of shippers.

The Australia Trade

During the 1950's the position of the United Kingdom as the leading trade partner of Australia was weakened, that of the other European countries also decreased in exports but slightly increased in imports (Table 1:32). It had a strong impact on the activities of the Australia conferences. Meat, wool and butter dominated the westbound general cargo traffic, which in 1960 had three times the tonnage of eastbound ships. It made the Australian trade very attractive for specialized and general tramps which strongly influenced the pricing policy and conditions offered by the conference.

Table 1:32. Foreign Trade of Australia and New Zealand with Europe 1953-1965

Trading Area	Imports				Exports			
	1953 %	1955 %	1960 %	1965 %	1953 %	1955 %	1960 %	1965 %
U.K.	50	46	35	28	50	41	33	25
Other Europe	9	12	14	14	24	19	19	18
World Total	100	100	100	100	100	100	100	100
'000 000 $	1 831	2 260	3 020	4 030	2 638	2 640	2 790	3 910

Source: Yearbook of International Trade Statistics, 1955, 1967. U.N., New York.

In the early 1950's the meat trade to the U.K. was based on government agreements. The British Food Ministry organized transports and, in cooperation with AOTA,[2] negotiated prices and conditions with the conference. The AOTA's role was to control that the Ministry did not agree on rates higher than those agreed by AOTA for other trades.

---

[1] Deakin, 1973, p. 51.

[2] See p. 19.

The government meat trade terminated in 1954, which resulted in a decline of meat shipments from Australia to Europe. The development of synthetic fibers and Japan's growing demand for wool resulted in declining wool flows to Europe in the same year. The conference tried to compensate the drop in the demand by increased rates, but the AOTA refused and asked the Australian government to intervene. The government allowed a small rate rise but introduced a negotiation formula according to which operational accounts of all voyages had to be delivered to independent accountants by all conference members. Ships doing en route calls were excluded. In spite of this cost control, including both fixed and variable costs, the rates in the Australian trade increased at the same speed as those of the Far East Conference, i.e. government interference seemed to have little influence on the development of conference prices.[1]

The Africa Trade

The West African shipping scene in the late 1950's and early 1960's changed from a colonial to an open market, when 14 countries along the West Coast of Africa gained political independence. This strongly influenced the external conditions of work of the operators. However, the geography of African trade in the mid 1960's was still strongly influenced by links with their former mother countries. About half the general and break bulk exports of the former French colonies were destinated to France (Table 1:33). The East African and particularly the South African submarkets were much less influenced by the decolonization process.

Table 1:33. Europe - West Africa: General and Break Bulk Cargo Trade ('000 tons 1965)

Trading Areas	Northbound					Southbound				
	France	W Germany	U.K.	Other West European	Total	France	W Germany	U.K.	Other West European	Total
French speaking	1 624	1 022	229	873	3 748	546				
English speaking	184	543	1 090	633	2 450			242		
Portuguese	29	48	27	77	181					
Total	1 837	1 613	1 346	1 583	6 379	809	209	433	734	2 185

Source: UNCTAD, 1967, The West African Shipping Range. New York.

[1] Deakin, 1973, p. 104-123.

The relations between the United Kingdom and her former colonies showed similar proportions. They were even higher for imports, i.e. the former metropolises played a major role supplying the West African countries with investment and consumption goods, which strongly influenced the organization of the liner services between Europe and West Africa. British lines, which traditionally were leaders on this market, were organized in the West African Lines Conference (WALCON), while the French had a separate conference (COLINAV).[1] Traffic with the Portuguese colonies was organized in a third conference. Unlike other deep-sea conferences, the West African covered both legs of the traffic. It strengthened their bargaining position in negotiations both with Trading Houses, which had a strong influence on the West African trade even in the postcolonial period, and with the governments. In the struggle with the conferences some Trading Houses established their own fleets.[2]

In the early 1950's both English and French conferences faced increasing competition from the Scandinavian lines, which traditionally used the policy of joint sailings[3] and tonnage specialization[4] as their main modes of competition. The Scandinavians substantially cut the rates and after a short price-war were accepted as conference members.[5]

The independence of West Africa brought four new elements to the work conditions of the conferences: (1) increased pressure to include at least one base port in each country on the sailing lists, (2) the establishment of national liner fleets, (3) the creation of Produce Marketing Boards, which organized trade and shipments of agricultural products, and (4) the development of East European lines.

---

1 Conférence des Lignes de Navigation servant la cote ouest Africaine

2 The United Africa Co. - established in 1910, a unit of the Unilever Group - since 1929 has been the major British trader in the area. J. Holt of Liverpool since the early 1930's has operated its own fleet of general carriers. Unlike the British, the French Trading Houses did not establish their own fleets but had close cooperation agreements with the French lines, often under the supervision of the government.

3 The Scandinavian West Africa Line was established in 1945 by the Norwegian Bergen Steamship Co., Fearnly & Egers of Oslo, and the Swedish Transatlantic AB.

4 The Høegh Lines of Oslo used reefers and specialized vessels for log transports.

5 The Høegh Lines left the WALCON conference in 1963 but remained in the COLONAV.

The pressure for calls at several ports and the shortage of southbound cargo made services between Northern Europe and West Africa rather uneconomic.[1] The establishment of national fleets,[2] which in 1964 moved about 10 % of the cargo on these routes, and the development of East European services,[3] which in 1965 supplied 5 % of the total capacity, focused attention on the overcapacity problem and resulted in a sharp profit decline for the traditional operators. The development of national fleets led to growing requests for cargo sharing from West African countries - a major political issue in liner shipping in the late 1960's and early 1970's.

The decolonization process had less influence on the organization of the East African shipping range. The route East Africa - Europe was traditionally dominated by the British operators who often organized services to East Africa as a part of their services to South Africa[4] or to India and the Far East.[5]

In the late 1940's and early 1950's the American lines had high market shares on these routes.[6] To counterbalance this, the British operators established joint ventures that strengthened the power of the conferences.[7] The conference organizing traffic from East Africa to Europe also included the ports of the Red Sea as there was a traditional shortage of northbound cargo on this route.

---

1 UNCTAD, 1967, p. 75.

2 The Black Star Line of Ghana, established in 1957 as a joint venture between the government and the Israeli Zim Line with capital shares 60 and 40 % and management contract held by the Israelis was the first national operator of West Africa. The Nigerian National Shipping Line was established in 1959 as a joint venture between the government and the two big lines on the route, the Elder Dempster and the Palm Lines. The equity division was 51, 33 and 16 %.

3 The Polish Steam Ship Co. in 1958 established a regular line to West Africa. In 1961 the Deutsche Seerederei of Rostock started regular services. In the same year the two companies created a joint service "Uniafrica", the first in a long series of close cooperation agreements between East European operators.

4 The Union Castle Line, the main operator in the South African trade was also the leader in the East African traffic round the Cape Horn.

5 The British India Steam Navigation Co. and the P & O.

6 The Farrell Line, leader among the American operators, in the late 1940's annually carried about 1 million tons in the South and East African trade, while the British lines carried about 200 000 (Krzyzanowski, M., 1967, p. 151).

7 The Europe and South and South East Africa Conference, the East Africa Homeward Conference and the East Africa Outward Conference.

The two coastal countries of East Africa, unlike the many countries of West Africa, chose to integrate their planning and investments in transports and ports.[1] Hence, there was no pressure on the conferences to increase the number of base ports after the decolonization of Kenya and Tanzania. The other important difference between the development of the East African and the West African shipping ranges was the decision of the East African countries not to develop their own liner fleets. The conferences could operate rather freely. The establishment of East European lines until the early 1970's had little influence on competition, particularly as they decided to join the conferences after only a short period of outside operations.

The South African government in the 1948-1965 period continued its prewar shipping policy of close control of the pricing and practices of the conferences. It tried to extend this control in the mid 1950's, but both shipowners and consignors opposed and the government withdrew its draft. In return the conferences[2] agreed to keep low freights and abandon deferred rebates. In consequence the operation conditions on the South African route more and more became like those on the North Atlantic, but the conferences succeeded in keeping their closed status, i.e. they could rather easily refuse applications for new membership.

The South America Trade

Growing government interference and a changing flag structure were the two main postwar tendencies on the route between Europe and South America. The South American governments continued their prewar policy of public control of conferences and introduced the element of flag discrimination. Colombia, Ecuador and Argentina were the first to follow the example of the United States and in the late 1940's introduced flag discrimination in shipments of government cargo. According to these laws, 50 % of cargo purchased by a government authority or through government credits had to be carried by the national flag and the other 50 % was reserved for the flag of the selling country. Chile and Brazil passed similar laws in the late 1950's and the rest of South America in the early 1960's. These regulations made a strong impact on the work of the conferences as general cargo accounted for a major part of government purchases which amounted to about one-fourth of the imports.

---

[1] The East Africa Common Service Organization, established in 1961, was the main coordination authority.

[2] The South Africa - Europe Conference and the Europe - South and Southeast Africa Conference.

To strengthen the position of their national liner fleets on the open market the South American governments in the late 1950's and early 1960's developed a system of direct and indirect shipping subsidies, including tax reductions, lower port dues and charges and reductions of customs and consular fees for shipments in national vessels. The export credit policy also promoted the use of national ships.

In the early 1960's the Latin American countries began to develop a common shipping policy within the Latin American Free Trade Association (LAFTA). The first steps were total cargo reservation for national carriers in intra-Latin-American trade and creation of a common shipowners association (ALAMAR) to strengthen the national lines in conference negotiations.

A new element after World War II was the rapid development of state-owned liner fleets. In Brazil the, leading maritime nation, more than four-fifths of the tonnage was state-owned in the mid 1960's.[1] More than half was used for general cargo movements. (Brazil was the only country to have established a state-owned liner company prior to World War II.[2]) Also in Mexico and Peru about four-fifths of the merchant tonnage was owned by the state, while in Argentina the government controlled 60 % of the tonnage.

Four main motives can be discerned behind the postwar shipping policy of the South American countries: (1) the tonnage shortage during World War II hampered the development of their foreign trade and resource supply, (2) the pressure of domestic industries on governments to increase their control of the prices and conditions of liner services, (3) the need for improved balances of payments, freight expenditures amounting to 13-15 % of the fob-value of exports, and (4) the lack of private initiative in shipping.[3]

The creation of state fleets and the increasing government interference resulted in a new flag distribution on the route between Europe and South America. The development of the Europe - La Plata Conference well illustrates this tendency. In the early 1950's all services were run by European operators with the Dutch line as leader, taking over the prewar position of Germany (Table 1:34). Pressure from the Argentinian state line,[4] supported by the govern-

---

[1] Harff, 1970.

[2] Lloyd Brazileiro was established as government company already in 1910, but its substantial growth occurred in the interwar period.

[3] Tresselt, D., 1967, pp. 3-10; Brown, R., 1966, pp. 94-107.

[4] Empresa Lineas Maritimas Argentinas started deep sea liner operations to Europe in late 1947, Fairplay, 1973.02.08.

Table 1:34. Major Latin American Fleets, Structure and Ownership (000 Dwt.)

	1958				1965				
	Total	Passenger cargo	General carriers	Reefers	Total	Passenger cargo	General carriers	Reefers	State owned % of total
Brazil	1 070	110	678	0	1 575	76	800	7	80
Argentina	1 161	120	550	18	1 457	92	522	18	59
Mexico	218	0	17	0	364	0	81	0	81
Venezuela	351	0	69	0	370	0	80	0	20
Chile	267	14	171	0	370	27	149	0	13
Colombia	122	0	108		158	0	154	0	18
Peru	125	0	98	0	187	7	140	0	78
Uruguay	91	4	44	0	162	10	88	0	60

Sources: Maritime Administration, Department of Commerce, New York.
Harff, P., 1970, Der Beitrag nationaler Handelsflotten zur wirtschafflichen Entwichlung der lateinamerikanischen Länder, Göttingen.

Table 1:35. Flag Distribution of Europe - La Plata Conference Traffic

Flag	1939	1953	1965 North-bound	South-bound
British	8	13	0	0
German	35	18	19	17
Belgian	16	8	6	6
Dutch	25	51	27	31
French	15	9	9	7
Swedish	-	-	0	9
Argentine	-	-	30	40

Source: Fairplay, No. 4668, 802, 1973, p. 37.

ment, resulted in a bilateral shipping agreement, which divided on a 50/50 basis all traffic between la Plata and France. This gave the Argentinian company about one-third of the conference traffic to the Continent. Other conferences on routes Europe - Latin America faced similar pressures. It was particularly strong in Brazil and provided for a total reorganization of the conference system on this route in the late 1960's.

In general, the shipping policy of the 1950's and early 1960's in the Latin American countries was a corner stone for the new maritime policy of the developing counties in the following period.

The North Atlantic Trade

The North Atlantic routes in the postwar period continued to be the main submarket of international liner shipping. About 100 operators supplied services in the early 1950's. Their working conditions did not change much compared to the interwar period. About 80 % of the services were organized in conferences of which there were 15 in the Westbound traffic and 15 in the Eastbound.[1] The U.S. government continued its prewar policy of close control of conference pricing and practices based on the 1914 and 1936 shipping acts which only allowed open conferences. As a result, the North Atlantic liner market was characterized by poor loyalty from the consignors, which provided for high mobility of cargo as regards its port allocation. This in turn resulted in a strong competition between ports of different conferences. The lack of a powerful shipowner cartel gave much wider opportunities for tramp

[1] Marx, D., 1953, pp. 168-186.

operators to act on the general cargo market to find additional return loads. It also allowed non-conference lines to operate more freely in their relations with consignors.

To counteract competition, the conferences tried to coordinate their practices through inter-conference and port associations. The Trans-Atlantic Associated Freight Conferences became the most important forum for conference cooperation on the North Atlantic. It covered traffic from the northern part of the U.S. East Coast to Europe and included 8 member conferences[1] and had indirect cooperation agreements with two conferences.[2] A personal union was established between members, the chairman of the association was also appointed chairman of all member conferences. Also the conferences on the Gulf - Europe route joined a 4 member association. Traffic from the southern part of the U.S. East Coast and from the West Coast to Europe was relatively small. Therefore only one conference operated on each of these routes.

Services from Europe to North America were organized in 15 conferences, but only two of them joined the Trans-Atlantic Association. The rest operated on an independent basis. The difference between the organization of the eastbound and the westbound services was a result of U.S. shipping policy. It gave American shippers a strong bargaining position and allowed for a rather free change of transport supplier without taking much risk for higher transport costs. The European shippers had much less support from their national legislations. Therefore, their bargaining position against conferences was much weaker, i.e. westbound conferences had no need to organize a formal cooperation.

Under the influence of independent operators, the U.S. government in the late 1950's made an attempt to extend its control over the conferences and to repeal the system of dual rates under the patronage contracts.[3] They gave shippers 10-20 % immediate discount for loyalty to the conference tonnage. Under pressure from the American ship-

---

[1] The Trans-Atlantic Freight Conference (New York, 47 members), the North Atlantic - Mediterranean Freight Conference (29 members), the North Atlantic - Baltic Freight Conference (17 members), the North Atlantic - U.K. Freight Conference (13 members), the North Atlantic - Continental Conference (11 members), the North Atlantic - French Atlantic Coast Freight Conference (7 members), the North Atlantic - Red Sea and Gulf of Aden Conference (7 members).

[2] The North Atlantic Spanish Conference (3 members) and the North Atlantic Portuguese Freight Conference (15 members).

[3] Federal Maritime Board, v. Isbrandtsen: 356. U.S. 481.

owners who argued that a system of dual rates was necessary for their survival in international competition, the Senate gave its support to the dual rate system following the argument that benefits of an administrated price system would accrue largely to foreign lines, while its costs would be borne largely by American exporters.[1]

After World War II the U.S. government and affiliated organizations became one of the most important general and break bulk cargo consignors both on the North Atlantic and on other routes. Aid shipments dominated eastbound flows on the North Atlantic until the mid 1950's. Military shipments dominated the westbound U.S. government cargo and after the mid 1950's also the eastbound general and break bulk flows. All these transports were subject to the cargo preference laws,[2] which aimed to assure at least 50 % of the cargo for U.S. commercial vessels. As a result, these vessels in 1955 carried about two-thirds of the government cargo and this proportion remained rather stable throughout the first two postwar decades.[3] The share of the U.S. liners in these shipments amounted to about 40 % during that period, much above the rate in commercial trade which decreased from 37 % in 1938 to 28 % in 1962. On the North Atlantic route it was even lower, 20 % in 1963.[4] Most significant for this development was the rapidly increasing contribution of preference cargo in the total tonnage handled by U.S. liners, both on the North Atlantic and on other deep-sea routes. In the mid 1950's it was about 30 % and ten years later it had risen to 60 %, i.e. American lines to a high degree used government cargo in addition to direct subsidies to strengthen their competitiveness on international liner markets.

To counterbalance the favorable position of U.S. operators and the American interference with European operators on the North Atlantic, the Committee of European Shipowners was created in 1958. It was outside the conference system which also included U.S. lines. The Committee examined the influence of U.S. legislation on the conference activities and represented the views of the European operators in negotiations with U.S. government authorities, particularly the Federal Maritime Commission.

In the mid 1960's two new elements started to influence the organization of the liner market on the North Atlantic. These were the increasing competition from East European countries, particularly the Soviet Union and

---

[1] Lawrence, 1966, p. 201.

[2] The Military Transportation Act, 56th Congress, April 28, 1904; Public Law 664-83rd Congress, August 26, 1954.

[3] Lawrence, 1966, p. 360.

[4] Ibid.

Poland, and the containerization. However, the effects of these processes became significant only in the late 1960's and particularly in the 1970's, i.e. during the following period.

The National Shippers' Councils

In the late 1950's the first national shippers councils were organized in Europe. Their aim was to coordinate on a national basis the interests of general and break bulk cargo consignors and support them in negotiations with liner conferences. Unlike previous shippers organizations, which were organized on a product or branch basis, the national shippers councils included all consignors who purchased liner services.

Since conferences are organized as international bodies and most ranges include several countries, the national shippers councils rather soon after their establishment faced a need for closer cooperation on a continental level. A European association of national shippers councils was established in 1963 to coordinate the activities on the national councils and supply them with information on conference pricing and practices gathered by the documentation centre of the association. The association supports the national councils in negotiations and disputes with conferences according to an agreement reached between the European conference lines and the National Shippers councils,[1] which establishes a machinery suitable for the maintenance of fair practices and forms for the discussion of matters of mutual interest. Regular negotiations should be carried on between shippers councils and shipowners on broad issues of common interest, but the day-to-day disputes should be solved through direct negotiations between individual consignors and conferences. The councils were to intervene only in cases when the disputes could not be settled through direct negotiations. Until the mid 1960's the influence of the national shippers councils and their European association on the working conditions of European conferences was rather limited. However, the creation of these organizations was one of the marks of a new period in the organization of the international liner industry.

Conclusions

Liner conferences continued to dominate all deep sea routes to and from Europe also in the postwar period. However, their external work conditions changed compared with the prewar period as a result of increasing state interference, particularly from developing countries, and of the growing cooperation between consignors who created national associations to counterbalance the power of the conferences. The

---

[1] Note of Understanding, 1963.

negative attitude of the U.S. government to the closed conferences gradually spread among developing countries, specially in South America. Several developing countries saw the establishment of state-owned liner shipping as the main target of their shipping policy and a precondition for economic growth. They forced the conferences to accept national lines as members on favorable conditions.

NATIONAL LINER FLEETS AND FIRMS

The development of lines and liner fleets will be analyzed here for the main European and overseas maritime nations against the background of the national shipping policy. The negotiations fall into five groups: (1) liberal countries in Western Europe which follow a policy of limited interference in international shipping, (2) industrial countries, the United States, Canada, Australia, Japan, and South Africa which put the interests of the domestic shippers in the focus of their maritime policy and protect national shipowners from foreign competition, (3) socialist countries which develop state-owned liner fleets under non-market conditions, (4) developing countries which try to limit the laissez-faire conditions on the liner market by laws on cargo protection and flag preferences favoring the development of national, commonly state-owned fleets, (5) flags of convenience, including Liberia, Panama, Honduras, and Lebanon which allow foreign shipowners to use their flags which for a company means favorable taxes and limited control of firm and vessel.

As mentioned, it was difficult until the late 1960's to technically separate liners from general carriers used in tramping or industrial services.[1] Therefore, data on general carriers are used for the analysis. Whenever possible, they were broken down by type of employment.

The world fleet of general cargo carriers for deep-sea traffic (vessels above 1 000 tons gross) increased annually by 2.6 % between 1948 and 1959, but stagnated afterwards (Figure 1:2). The growing fleet of specialized bulk carriers after the mid 1950's made general carriers less and less competitive in tramping.[2] Their employment was increasingly concentrated to movements of general and break bulk cargo, i.e. to the liner and semi-liner markets. However, only multi-deck vessels could successfully compete on these markets. In the mid 1960's about half the world fleet of general carriers was employed in liner services, 20 percentage units below the 1939 level (Table 1:7 and 1:36). Also the flag distribution changed in that period.

---

[1] See pp. 63-71.

[2] Fisser, 1957, pp. 52-62.

Table 1:36. General Carriers by Flag and Employment

		1958		1965					
		Total	%	Total	%	Liners	%	Average size th.g.t.	Average age years
World	a	11 027		10 959		5 439			
	b	57 964	100	60 899	100	31 931	100	5.8	13
OECD Europe	a	5 361		4 844		3 493			
	b	25 195	43	25 141	41	21 056	66	6.0	
U.K.	a	1 347		1 049		903			
	b	7 883	13	6 671	11	7 376	23	8.2	13
Netherlands	a	363		318		357			
	b	2 047	4	2 055	3	2 232	7	6.3	9
France	a	340		266		324			
	b	1 552	3	1 349	2	1 755	6	5.4	10
W. Germany	a	700		639		489			
	b	2 571	4	2 782	5	1 733	5	3.5	9
Norway	a	695		623		263			
	b	3 160	5	3 403	6	1 455	5	5.5	9
Sweden	a	388		259		229			
	b	1 308	2	1 267	2	1 139	4	5.0	10
Italy	a	440		263		131			
	b	2 250	4	1 310	2	1 033	3	7.9	16
Denmark	a	240		228		210			
	b	1 060	2	1 107	2	984	3	4.7	7
Non-European ind. countries	a	175		182					
	b	675	1	714	1				
Japan	a	660		826		340			
	b	3 550	6	4 315	7	2 475	8	7.3	8
U.S. private	a	450		567		481			
	b	3 231	6	4 817	8	4 149	13	8.6	15
Developing countries	a	832		980					
	b	3 276	6	6 359	10				
India	a	103		169		111			
	b	527	1	1 040	2	697	3	6.3	10
Flags of convenience	a	831		977					
	b	5 380	9	5 667	9				
Socialist countries	a	827		1 215		556			
	b	2 558	4	5 342	9	2 552	8	4.6	
USSR	a	546		709		262			
	b	1 767	3	2 874	5	1 168	4	4.5	14

a = number, b = thousand gross tons.

Sources: U.S. Maritime Administration Shipping Statistics, Yearbook 1966.

The Liberalists

The European OECD countries saw their share in the world fleet of general carriers decrease slightly between 1958 and 1965, but were still the leading group. Over 80 % of the West European general carriers in 1965 were employed in liner operations, while the world average was about 45-50 %.[1]

The British fleet kept its prewar position as leader of the world liner industry with 22 % of the tonnage both in 1939 and in 1965 (Tables 1:7 and 1:35), but its growth was very slow in the 1950's (zero 1950-1954 and 1.6 % a year 1955-1960). Between 1960 and 1965 the British fleet rapidly declined from 8.6 to 7.4 million gross tons.[2] Profitability of the industry which in the 1950's remained rather constant at about 14-16 % profit before taxes on employed capital decreased sharply in the early 1960's. Of the six years in the 1960-1965 period, the industry showed losses in four, equalling 1-2 % of the employed capital.[3] Also internationally the results of the British liner industry were rather poor (Table 1:37). Only the leading and rapidly growing Peninsular and Oriental Group showed economic results comparable with those of the major European liner firms. It was one of three among the top eight British lines that showed substantial tonnage growth in the early 1960's (Table 1:38). Poor results, fear of growing international competition and the lack of managerial dynamics probably were main reasons for the decline of the British liner industry, which in the mid 1960's operated the oldest tonnage in Europe beside Italy (Table 1:36).

The same reasons caused a slowdown in the concentration process of the liner industry. Acquisitions among British lines traditionally were the sign of optimism and growth strategy. During the 1950's only three acquisitions occurred among large British lines.[4] The corresponding

---

[1] Tonnage data on general carriers in Table 1:36 include vessels above 1 000 gross tons, while the estimation of the employment in liner services includes all vessels above 500 gross tons. Thus, the tonnage of the liner fleet may in some cases exceed the tonnage of general carriers registered under individual flags.

[2] Shipping Statistics, Yearbook 1966.

[3] Sturmey, 1962, p. 182 and Committee of Inquiry into Shipping, 1970, pp. 462-467.

[4] The main acquisitions in the 1950's were: 1952 Henderson by Ocean Steam and Shipping (now Ocean Transport & Trading), 1956 Union Castle by British & Commonwelth, and 1960 Bruce by Ellerman Lines; Committee of Inquiry into Shipping, 1970, pp. 430-436.

Table 1:37. Operating Results of Main European Lines 1958-1961 (annual average)

Lines	Vessels		Net Book value of fleet	Vessel operating profit	+ Other income	− Interest and taxes	= Cash flow	− Depreci-ation	= Net earnings	Vessel Op. profit/th.g.t.	Net earnings/th.g.t.
	No.	Th.g.t.	U.S. $ million							$	$
Peninsular & Orient	290	2 000	409	53	4	7	50	39	10.9	27	5.5
Cunard	84	947	137	11	1	0.0	13	12	1.5	12	1.6
Furness	80	840	98	12	2	1	13	9	4.3	14	5.1
Hansa	50	270	54	7	1	2	5	5	0.2	26	0.7
Nordd Lloyd	45	300	57	9	1	2	8	8	0.2	30	0.7
Holland America	35	230	24	6	2	0	8	7	1.4	26	6.0
Wilhelm Wilhelmsen[a]	67	530		20	0.5	6	14	13	1.2	38	2.2
Compagnie Generale Transatlantique	80	520	93	13	1	2	12	11	1.4	25	2.7
Transatlantic	39	190	9	6	1	1	6	6	0.3	32	0.2
Broströms[b]	55	327	26	10	4	2	12	6	6.6	31	2.0

a Average for years 1962-1965, including results from liner and tanker shipping operating profits from liner services were $ 12 million.

b AB Svenska Orient Linien, AB Svenska Amerika Linien, AB Svenska Ostasiatiska Kompaniet.

Sources: Lawrence, S., 1966, United States Merchant Shipping Policies and Politics, p. 368.
Tirfing AB, Annual Reports 1958-1962.
Transatlantic, Annual Reports 1958-1961.
W. Wilhelmsen, Annual Report 1965.

Table 1:38. Tonnage of the Main British and German Liner Companies

	1960 000 gross tons	1965 000 gross tons
U.K.	8 600	7 376
P & O	2 007	2 262
Furness	1 300	953
Ocean Transport & Trading (Blue Funnel)	971	949
Cunard	947	820
British & Commonwealth	769	845
Ellerman	631	544
The Vesty Group (Blue Star Line)	466	338
The Inverforth Group (Bank Line)	366	462
Germany	1 927	2 127
Hamburg Amerika	288	
Norddeutscher Lloyd	297	
Hamburg Süd	273	
DDG Hansa	271	

Sources: Broers, P., 1974, Die Strukturwandlungen in der Deutschen Seeshiffahrt, Berlin. Chrzanowski, I., 1975, Concentration and Centralization of Capital in Shipping, Prescot. Statistik der Schiffahrt, Yearbook 1966; 1968. Sturmey, G., 1962, British Shipping and World Competition, London, p. 360.

number was nine in the 1910's and seven in the 1920's.[1] The high degree of concentration that characterized the industry in the late 1940's, and the absence of technical innovations that would have required new investment capital probably were other important reasons for the slowdown. Although the industry declined, the British government continued its laissez-faire policy. The only aid were loans for new buildings in domestic shipyards (Table 1:39). On the other hand, depreciation rules were less favorable in Britain than in Scandinavia, the Netherlands or France.[2]

The fleets of general carriers under other West European flags stagnated in the late 1950's and early 1960's (Table 1:36). The only exception was West Germany which recovered rapidly after the early postwar confiscations. By 1965 it was second in Western Europe. About 40 % of the West German

---

[1] Sturmey, 1962, pp. 365-382; Committee of Inquiry into Shipping, 1970, pp. 430-436.

[2] Maritime subsidies, 1971.

Table 1:39. Government Interference in Liner Shipping 1950-1965

Country	Preferences					Subsidies			
	Coastal trade	Deep-sea cargo	Bilateral agreements	Exchange control	Tax, port concessions	Operating	Construction	Indirect	State ownership
Norway									
U.K.								X	
Netherlands								X	
Sweden								X	
Denmark								X	
West Germany	X						X	X	
Italy	X		X			X	X	X	X
France	X	X	X		X	X	X	X	X
Japan	X		X			X	X	X	
USA	X	X				X	X	X	
India	X		X		X		X	X	X
USSR	X	X	X	X	X	X	X	X	X

Sources: Maritime Subsidies, 1971, Maritime Administration, U.S. Department of Commerce, Washington DC.
Sturmey, 1962, British Shipping and World Competition, London, pp. 189-194.

general carriers were employed in liner services.[1] The average size of German liners was much below that of other flags, but increased significantly.[2] German liners were to a large extent employed in short-sea services. After World War II industry was deconcentrated. The two leaders HAPAG and Norddeutscher Lloyd regained operational independence. In the early 1960's the four major groups controlled 58 % of the liner tonnage (Table 1:38). Twelve of 25 liner firms operated ten vessels or less (Table 1:40). Only Italy and France among the leading maritime nations had a higher share of small firms in the liner business. However, it should be stressed that four major Italian firms, although operationally independent, were owned by a state holding company which allowed close coordination of strategies and long term investments. In practice Italian shipping was highly concentrated, but this did not stop the downward trend. The fleet decreased by 40 % between 1958 and 1965 (Table 1:36).

Table 1:40. Size of Liner Companies in 1957

Flag	Number of vessels				Number of firms
	1-10	11-30	31-60	61-	
U.K.	25	29	10	1	65
West Germany	12	9	4	0	25
U.S.A.	8	13	3	0	24
Norway	6	11	3	0	20
Italy	13	5	1	0	19
France	9	6	2	1	18
Sweden	5	7	4	0	16
Japan	6	9	0	0	15
Netherlands	2	5	6	0	13

Source: Strømme Svendsen, A., 1978, The Concentration of Capital in Shipping and the Optimum Size of Shipping Companies, Geojournal 2.2, p. 166.

Also the French fleet of general carriers showed a substantial decline in that period. To counterbalance, France strengthened its policy of state interference in

---

[1] The liner fleet of West Germany, vessels over 100 gross tons, increased from 274 vessels of 0.9 million gross tons in 1955 to 491 vessels of 1.9 million gross tons in 1960 and 485 vessels of 2.2 million gross tons in 1965. Broers, 1974, p. 225.

[2] The average size of West German liners increased from 2.2 thousand gross tons in 1955 to 4.4 thousand in 1965.

the shipping industry. The monopoly of national lines in coastal trade and in the services to overseas territories was maintained in the postwar period. France was first among the OECD countries to sign bilateral preferential agreements with developing countries and those of Eastern Europe. These agreements gave only minor, if any, trade to third nations. Beside preferential treatment, French shipping firms obtained substantial direct subsidies for investments in new tonnage. According to the general industrial policy that the state should control major firms in industries of national importance, the two major liner companies were put under such control.[1] The decline of the French fleet in spite of this aid policy was commonly explained by high wages.[2] According to French estimates wage costs, including social charges, for a crew on a Liberty-type vessel under French flag in 1958 were 25 % above the costs for similar vessels under British or Italian flags and 42-46 % above the costs in Norway and West Germany (Table 1:41). The aid was not sufficient to counterbalance these differences.

The Interventionists

The fleet of general carriers under U.S. flag was the second largest in 1965 (Table 1:36).[2] It increased by 50 % between 1958 and 1965. Most was used in liner services. Both average size and age of U.S. liners were much above the corresponding numbers in other fleets, i.e. the technical structure of the U.S. and British liner fleets were rather similar. However, the operation conditions differed. The U.S. flag was protected from foreign competition in the home trade, but this volume declined rapidly in the 1950's and early 1960's, as a result of growing competition from trucks.[3] The U.S. lines thus increasingly became dependent on deep-sea services. The U.S. foreign trade in general cargo increased from 26 million tons in 1938 to about 50 million in the mid 1960's, i.e. more slowly than the tonnage of general carriers.[4] To protect the national flag facing high labor costs, the U.S. government reinforced several laws giving cargo preferences to the U.S. fleet and increased direct and indirect subsidies to the shipping industry. Including social obligations, vacation grants and

---

[1] The state controlled 63 % of the shares in the leading line, Compagnie Générale Transatlantique.

[2] The data exclude the U.S. reserve fleet which was seldom used for liner operations.

[3] In 1938, 400 dry cargo vessels were operated in U.S. coastal trade, the number for 1950 was 150, and in 1963 it had decreased to 50. Lawrence, 1966, p. 85.

[4] Ibid., p. 87.

Table 1:41. Size of Crews and Annual Labor cost on "Liberty-type" Vessels (1958; U.S.$)

	France	Italy	U.K.	Germany	Norway
Crew size	39	30	42	34	40
officers	10	11	13	8	10
deck	14	9	14	12	13
engine	9	7	8	8	11
catering	6	3	7	6	6
Average wage	1 800	2 320	1 730	1 530	1 400
Average costs	2 000	1 460	880	830	730
Total labor cost per vessel	148 200	113 300	109 635	80 240	85 200

a 1949 data

Sources: Statistik der Schiffahrt, 1960:B, p. 21.

other fringe benefits, the difference in labor costs between the United States and the main European flags increased from about 50 % in 1939 to about 500 % in the early 1960's.[1] As labor costs in the late 1950's were about one-third of the total operating costs of a liner,[2] the U.S. fleet could not compete in the open market. Increasingly, it relied on market segments closed to foreign competitors by cargo preference laws.[3]

While cargo preferences were of a general character, i.e. gave equal employment opportunities to all vessels flying the U.S. flag, the operating subsidies were concentrated to a limited number of lines. The prewar policy, stating that only one line on each route essential to the U.S. trade could obtain an operational subsidy, was abandoned. According to the new policy, subsidies could be granted to several lines on each route, providing they were necessary to maintain adequate participation of the U.S. flag.[4] In spite of this change, the number of lines which obtained subsidies did not increase substantially: 12 in the early 1950's and 15 in the mid 1960's.[5] On the other hand, the lines became increasingly dependent on this aid. In the early 1950's operational subsidies amounted to 14 % of the revenues from shipping operations of the subsidized lines. In 1960 this share had increased to 26 %, while in 1965 it was 32 %, i.e. the competitiveness of the subsidized lines gradually declined. Measured per ton of carried cargo, the operational subsidies increased from 5 dollars in 1955 to 16 dollars in 1965 (Table 1:42).

While operating subsidies were given to a limited number of lines, construction subsidies were open to all shipowners flying the U.S. flag. Although their main purpose was to support the national shipyard industry, they also gave advantages to the shipowners by lowering the amount of capital required for new investments. The value of these subsidies increased rapidly between 1955 and 1962, when they reached a peak of 142 million dollars. Subsequently, they stabilized at the level of 80 million dollars a year. The value of all subsidies to general carriers flying the U.S. flag, thus, increased from 22 dollars per gross ton in 1955 to 50 dollars in 1965 (Table 1:42). In other words, the increase in the U.S. general carrier fleet in the late 1950's and early 1960's was the result of growing subsidies and cargo preferences rather than growing competitiveness of this fleet on the international market.

---

1 Lawrence, 1966, p. 91.

2 Strømme Svendsen, 1958.

3 See pp. 94-97.

4 Lawrence, 1966, p. 132.

5 Ibid., p. 133 and Kilgour, 1975, p. 79.

Table 1:42. U.S. Maritime Subsidies to Liner Shipping

		1955	1960	1965
Operational subsidies	$ million	115	153	213
Construction subsidies	$ million	5	74	88
Cargo carried by U.S. liners	million tons	19.4	17.0	13.4
thereof preference cargo	%	42	56	63
Private general carriers[a]	million gross tons	5.4	5.3	6.0

a Including combined passenger-cargo ships

Sources: Kilgour, J., 1970, The U.S. Merchant Marine, New York. Lawrence, S., 1966, United States Merchant Shipping Policies and Politics, Washington DC. The U.S. Merchant Marine Today, 1970, The Labor-Management Maritime Committee, Washington DC.

The Japanese general carrier fleet was second in size among the developed countries exercising a policy of state interference in shipping industry (Table 1:36). Its postwar reconstruction was rapid. By 1955 the fleet reached 3.5 million gross tons, twice its prewar size (Table 1:8 and 1:36). By the mid 1960's it was 4.3 million gross tons occupying the third position in the world. Nearly 60 % of the general carriers were employed in liner operations. The average age of liners was among the lowest in the world, while the size was above most averages (Table 1:36). The high share of large liners was a function of the geography of the Japanese general cargo trade, strongly oriented towards North America and Europe. Out of 100 trips made by Japanese liners in January 1965, 40 were on the North America route, which gave them 40 % of the market. The share in the Europe traffic was much lower, 22 %. The weak position of Japanese lines was one of the main motives for the government to put strong pressure on the Far East Conference to create better shipping conditions for the Japanese shippers and support the interests of the national lines in conference negotiations, resulting in the creation of special subconferences for the Europe-Japan services.[1] To strengthen the position of the national lines, the government in 1963/1964 pushed through a reorganization program, but without introducing state ownership. In the late 1950's no Japanese line ope-

[1] See pp. 85-87.

rated more than 30 vessels (Table 1:40), i.e. the liner business was run by small and medium-size firms. Through the reorganization, most of the liner tonnage was concentrated in six companies.[1] The aim was not only to strengthen the national lines in the competition for cargo between Japan and other countries but also to promote their export potentials. In the mid 1960's only 5 % of all voyages by liners of the six leaders were cross trading.[2] It made the government introduce cross trading subsidies.[3]

To stimulate the concentration process, the goverment created favorable investment loans for the merged companies.[4] Special scrapping and modernization subsidies were introduced in the early 1960's. Their aim was to stimulate the demand for ships, i.e. to support the growth of the domestic shipyards and to modernize the Japanese merchant marine.

The result of this policy was a growing concentration and continuous modernization of the liner industry. The strong home cargo base and the close cooperation with the shipyard industry and trading houses provided the Japanese lines with room for expansion in the following period.

Among other industrialized countries with a policy of state-interference in shipping, only Israel developed a liner fleet of importance.[5] Its geopolitical and military situation made a strong national fleet a precondition for national survival. The liner industry was given high priority as general cargo weighed heavily in exports and imports. One company dominated the industry.[6] To support its growth

---

1 Mitsui O.S.K. Lines, Nippon Yusen Kaiska, Kawasaki Kisen Kaiska, Japan Line, Yamashita Shimnihon Steamship, Shewa Kaisun.

2 Shipping Statistics, Yearbook 1968, p. II/69.

3 The subsidies were as follow: 3 % of cross trade freight revenue during the initial two years of service, 2 % in the third year and 1 % in the fourth and fifth year; Maritime Subsidies, 1971, pp. 85-88.

4 Low interest governmental loans covered 65 % of costs of new liners ordered by merged companies, while the grants for non-merged lines were only 35 %; Ibid.

5 The Israelian fleet of deep-sea general carriers increased from 130 thousand gross tons to 288 thousand between 1955 and 1965. Over 95 % were employed in the liner industry.

6 Zim Navigation Co. was created by the state which controlled 30 % of the stock. Jews abroad owned 50 %, the trade unions 10 % and the Jewish Agency 10 %.

the government introduced operational and construction subsidies as well as strong control to prevent the chartering of foreign vessels by Israeli shipowners. The aim of this policy was to develop a modern and competitive national fleet, which also played an important role in the creation of economic and political links with the developing countries. The Israeli company participated in the establishment of national fleets in several developing countries, particularly in Africa.[1]

No other developed country described here as interventionist showed up a liner fleet of significant size. They relied on foreign lines for their transport supply. However, all exercised strong pressure on conferences and independent shipowners to promote the interests of national shippers and to assure them a satisfactory level of transport services.[2]

The East European Fleets

Autarky until the mid 1950's was a recurring theme in the economic policy of the Centrally Planned Economies of Eastern Europe. This and a lack of maritime tradition limited their interest in shipping. The change in economic policy about 1955 had a strong impact on the industry. The USSR, Poland and East Germany started ambitious programs of maritime investments based on economic, political and military reasons. The volume of trade with countries of the West and the developing world started to increase, resulting in a substantial growth of the demand for sea transports. Lack of hard-currency called for substitution of foreign carriers for national fleets. In the longer perspective they were also supposed to become an export industry providing hard currency.

The growing aid to developing countries, mainly in Africa, the Middle East and South East Asia, was the other stimulator of the demand for sea transports. The policy of both parties was to reduce the share of third flags in their mutual trade. The East European countries followed a general transport policy, requiring cif exports and fob imports, which allowed the saving of hard-currency expenditures for services which could be organized by domestic firms. This provided national fleets with a growing cargo base for their expansion. The deep-sea liner market and the short-sea transports were given highest priority.

The deep-sea lines more than tramping promote national exports to overseas countries, which in most cases were new markets for the East European countries. An important by-

---

[1] See pp. 90-91.

[2] See pp. 97-98.

product of the liner industry was the network of agents through which continuous trade contacts could be kept with foreign markets.

Politically the liner services expressed the interest of the East European countries in establishing more permanent links with overseas countries. It strengthened their influence on the political development in these areas. Services to West Africa, Tanzania, Indonesia and Cuba were of that character. Also from the operational point of view, liner business was superior to deep-sea tramping for the East European flags. Planned route systems allowed for the creation of their own bunker and food stations en route, i.e. reduced the hard-currency expenses for vessel operation. Also organizationally the liner market was better suited for the "planned economy" than tramping. The tonnage need as well as costs and prices were well known in advance, i.e. the business risk was lower than in tramping.

The Soviet lines from the beginning chose to operate outside the conference system, treating it as a monopoly of private interests directed against the interests of shippers, particularly in countries of the developing world and Eastern Europe.[1] The Polish and East German lines already at an early stage accepted the conference system as an indispensable element of the international liner market. They put in applications and became full or associate members of all conferences on their routes.

The Soviet fleet of general carriers increased from 1.0 to 1.5 million gross tons between 1950 and 1955, to 2.6 million tons in 1960[2] and to 4.0 million tons in 1965, an annual growth rate of 5 % in the early 1950's and 9 % in the early 1960's. However, the share of deep-sea vessels in the general carrier fleet declined from 88 % to 72 % between 1958 and 1965, i.e. short-sea shipping in the early 1960's was given higher priority than deep-sea services. About 40 % of the deep-sea general carriers were employed in liner operations in 1965. Their average size was much below the averages of other flags (Table 1:36), which stresses the importance of short sea routes among Soviet lines. The concentration of investments on small tonnage resulted in a high average age of the Soviet deep-sea liners (Table 1:36), which, combined with a lack of maritime experience and tradition in contacts with consignors in foreign markets, was a heavy drawback that limited the attractiveness of low-priced Soviet services competing for cross trade between developed and developing countries. Therefore, until the mid 1960's the Soviet deep-sea lines in reality were a minor competitor in the international market. The 1955-1965

---

1 Morskoj Transport, 1960.

2 Statistik der Schiffahrt, 1961:8, p. 19.

period can be described as the learning years in the development of the Soviet liner industry. This period was of a similar character in the development of the other East European liner fleets.

The Polish and East German fleets of general carriers also started to increase rapidly in the mid 1950's.[1] Over 70 % of this tonnage was employed in liner services.[2] The average size of the East German liners in 1965 was 3.2 thousand gross tons, i.e. similar to that in the West German fleet, which means that both fleets to a high extent were oriented towards the short-sea markets. The average size of the Polish liners in 1965 was 5.3 thousand gross tons, i.e. deep-sea services were given high priority. Substantial new investments made both fleets technically modern in the mid 1960's, but the size of crews was much above average for West European vessels. It was partly a result of lower productivity but also expressed the need for training of seamen for the rapidly growing fleets.

The Soviet liner fleet was run by several companies divided geographically, each having responsibility for the ports in its area. The Polish and East German fleets were highly concentrated, which was seen as necessary to strengthen their position in negotiations with conferences. It also gave a wider range of shipping knowledge to managers and administrative staff who in most cases lacked previous experience in the shipping industry.

The Developing Countries

The decolonization process in Asia in the early 1950's, and in Africa in the late 1950's and early 1960's created a new goups of flags. The base for their shipping policy was a strong political wish to become less dependent on foreign flags. It was considered an important step toward general independency. Thus, their maritime policy included: (1) state interference in conference practices, (2) subsidy programs to stimulate the development of national fleets, often with considerable state ownership, (3) protection of national lines against foreign competitors and (4) priority to liner shipping in the development of a national shipping industry. As the countries of South America applied similar policy, they can be included into the group of developing maritime nations. While policy issues were similar, experience in shipping and financial resources varied considerably from country to country. South American ship-

---

[1] Annual growth rates in % were as follows:

	1950-1955	1956-1960	1961-1965
Poland	11.9	14.7	8.7
East Germany		70.1	23.8

[2] Majczyno, 1970, p. 246.

owners operated relatively large liner fleets already prior to World War II, while the new countries in Asia and Africa had limited knowledge and weak financial resources.

Among general carrier fleets in Latin America of more than 100 thousand gross tons those of Brazil, Colombia, Cuba, and Peru increased in the late 1950's and early 1960's.[1] The Brazilian fleet went up from 453 thousand to 549 thousand gross tons between 1958 and 1965 which placed it first in Latin America. The Argentinian fleet in the same period declined from 476 thousand to 377 thousand tons, but was still the largest in liner shipping. The average size of the Argentinian liners was 7.1 thousand gross tons indicating that the fleet was highly concentrated in deep-sea shipping. The Brazilian liners were much smaller, 4.2 thousand tons on the average, which points towards specialization in short-sea operations. Booth fleets were very old, the average being 20 years, one of the highest in the world. The stagnation in Latin America's deep-sea trade in general and break bulk cargo put the national lines in a weak market position. The Latin American governments in that situation interfered and following the United States' example introduced preferences and operational and construction subsidies. Like the East European countries they signed bilateral shipping agreements with each other and with other developing countries. They also put strong political pressure on the conferences to back up their national lines,[2] and especially in the 1950's increased state ownership.[3]

The shipping policy of Latin America should be seen against the large transport deficits of these countries (Table 1:43). In 1960 freight and insurance payments were 10 % of the export value. The transport deficit was one and a half time the trade surplus. The operation of a domestic fleets draws foreign currency costs, but these are seldom more than 30-40 % of the freight receipts.[3] Including the foreign currency contribution of foreign vessels through payments to the national ports and cross trading revenues of the national fleet, the net contribution of shipping to the balance of payments of Latin America was 30-35 % of the gross freight payments.[4]

Among developing countries in Asia, India, the Philippines, Pakistan and Indonesia in the late 1950's and early 1960's showed a substantial increase in their general

---

[1] All data are based on Lloyd's Register, Statistical Tables 1950-65.

[2] See pp. 91-94.

[3] Brown, 1966, p. 99-100.

[4] Ibid., p. 101.

carrier fleets (Table 1:36). The Indian and Pakistan governments put the development of the liner industry in the focus of their maritime plans. More than 60 % of the Indian deep-sea general carriers were employed in liner services. The average vessel size was 6.4 thousand gross tons indicating an orientation towards the deep-sea market.[1] The average vessel age was rather low, ten years, which made this fleet technically competitive. The country had access to a large number of experienced seamen at low wage levels, which gave the Indian fleet economic strength. The high degree of concentration and substantial state ownership were the other elements that consolidated the position of the Indian lines on the international market. Three major companies, one of them a government corporation, operated the liner tonnage under Indian flag.[2]

Table 1:43. Deep-Sea Trade, Receipts and Payments on Account of Freight and Insurance of the Developing Countries in 1960 (US $ '000 million)

	Latin America	Africa	Middle East	Asia
Exports	8.60	4.35	5.22	7.50
Imports	8.24	5.26	4.39	9.83
Freight and insurance:				
Receipts	0.13	0.10	0.02	0.11
Payments	0.79	0.53	0.25	9.64

Sources: Babassa, B., 1964, Trade Prospects for the Developing Countries.
UN, Statistical Yearbook, 1962.

While strong government support, high technical standard and cheap labor were comparative advantages of the Indian fleets, its drawback was the lack of tradition in the contacts with foreign consignors. Bilateral trade agreements were a way of overcoming this. The development of other Asian liner fleets to a large extent followed the organizational and economic pattern of the Indian fleet. However, the interference of the government was less pronounced and the concentration slightly lower.

In the mid 1960's the African continent was still going through the decolonization process. Only two countries,

---

1 Employment of the Indian liners in the mid 1960's was as follows: India-Western Europe 46 %, India-United States 31 %, and India-Eastern Europe 14 %. Gløersen, 1967, p. 49.

2 The tonnage distribution of the Indian liner fleet in 1965 was as follows: Scindia Co. 42 %, Shipping Corporation of India (state-owned) 37 %, and India Steamship Co. 21 %. Gløersen, 1967, p. 49.

Ghana and Nigeria, started to develop national liner fleets, organized as joint ventures between the state and foreign shipowners.[1] The Ghanian fleet increased rapidly and by 1965 was the largest in Africa. It was heavily subsidized by the government. Until the change of regime in 1966, a strong protectionistic policy favored the national line. Consignors using Ghanian vessels were given priority in export-import licences and credits.

The development of the Nigerian fleet politically and economically differed from the Ghanian model. The state was the initiator and kept 51 % of the stock of the company, while the rest was shared by the main lines operating on the route,[2] i.e. Nigeria chose cooperation instead of confrontation with traditional operators. No special preferences were given to the national line. Its operation was based on equal competition with foreign lines. The two countries exemplified the two approaches to the development of national lines that characterized the developing countries in the early 1960's: Ghana, the agressive type of policy in which state interference is the major element, and Nigeria, a more passive type in which the role of the state is limited to aid in the initial phase.

The Flags of Convenience

Flags of convenience became a major political issue in the development of postwar shipping. The size of general carrier fleets under these flags increased rapidly in the early 1950's.[3] Subsequently, they stabilized at 5.5 million gross tons. The highest average of vessels in the world was recorded for one of those flags, Panama, in 1965. Carriers under Liberian flags were slightly newer and larger. They were owned mainly by the U.S. shipowners who tried to escape the high labor costs under the home flag and by Greek shipowners who feared the political instability at home. No data are available to indicate what share of this tonnage was used in liner operations. It was probably rather low. The lack of a home cargo base, required by most conference agreements, the relatively high degree of government supervision of international liner services and the high price stability of the market made flags of convenience much less attractive for liner shipping than for tramping and industrial shipping.

---

1 See pp. 90-91.

2 See p. 90.

3 General carriers under flags of convenience; (thousand gross tons):

	1952	1958	1965
Liberia	250	3 719	3 296
Panama	1 750	1 633	1 568

Conclusions

The analysis of the development of general carrier fleets and of liner firms in the 1948-1965 period leads to the following conculsions: (1) the slow growth of the world general carrier fleet, particularly after 1958, was a result of increasing vessel productivity and growing competition from special carriers in break bulk transports, (2) the flag redistribution of fleets between five groups of countries indicate that state interference was a successful way of stimulating the development of national fleets, (3) the development of new shipping countries caused significant changes in the balance on the international liner market and, politically, a move from laissez-faire toward protectionism, and (4) the concentration paradigm was accepted by new maritime nations in the organization of their liner industry. It was assumed to give the firms a stronger market and financial position, allow for better coordination of investments, give a wider range of experience to managers, and enable better utilization of the agent networks.

THE SHORT-SEA MARKET

The introduction in the late 1930's of car ferries, a wide experience of the ro-ro technique during World War II and the development of specialized carriers for break bulk transports were main technical elements influencing the postwar development in the short-sea liner market of the Baltic and the North Sea. The growth of the small vessel fleets under East European flags was another important element.

Traditional Lines

In 1950 the number of international ferry connections on the Baltic was the same as in 1939. During the 1950's eleven new lines were opened,[1] and on the North Sea only three. The traditional liner services remained most important for general and break bulk cargo movements on these short-sea routes. To meet the rapidly growing labor costs and increasing competition from ferry lines, operators of short-sea lines used two methods: technical innovations and reorganization of service.

One of the main goals of the technical development was to increase the carrying capacity of vessels without changing their gross tonnage, the latter being the base of manning rules in most Baltic and North Sea countries. In Scandinavia vessels below 500 gross tons could use two watches, i.e. the crew was 8-11 people, while vessels over 500 gross tons had to apply a three-watch system (Table 1:44).

---

[1] Bachman, 1968, pp. 28, 37.

Table 1:44. Manning Rules and Short-Sea Fleets of Dry Carriers

Country	Vessel class, gross tons	Minimum crew	Tonnage '000 g.t. 1958	Tonnage '000 g.t. 1965	Vessels no. 1958	Vessels no. 1965	Average age 1958	Average age 1965
U.K.	100- 499		412	320	1 582	1 310	21	12
	500- 999	12[a]	527	408	750	606	12	15
	1000-1999		615	535	429	375	12	10
	2000-4000	19	862	637	301	214	11	12
	Σ		2 416	1 900	3 062	2 505		
West Germany	1	10[b]	328	397	1 139	1 250	8	9
	2	14[c],	243	238	340	322	6	9
	3	17[c]	377	312	250	211	8	10
	4	19[c]	709	806	251	277	8	9
	Σ		1 657	1 753	1 980	2 060		
Norway	1	11[d]	258	262	1 154	1 139	16	16
	2	16[e]	116	101	165	147	10	14
	3	17[e]	278	235	182	152	12	12
	4	20	546	458	193	157	8	9
	Σ		1 198	1 056	1 694	1 595		
Netherlands	1	...[f]	349	351	1 098	1 044	8	9
	2	...	137	149	248	279	5	7
	3	...	92	79	60	51	10	9
	4	...	245	200	87	67	11	12
	Σ		823	779	1 493	1 441		
Sweden	1	9	120	130	505	519	20	10
	2	16	32	19	42	33	24	4
	3	17	241	108	155	70	16	12
	4	20	456	295	157	100	13	10
	Σ		849	552	859	722		
Denmark	1	8	70	110	307	458	22	8
	2	13[g]	38	35	55	53	14	8
	3	18[g]	140	130	91	89	20	8
	4	21	300	317	101	105	10	9
	Σ		548	592	554	705		
Finland	1	...[h]	22	39	93	137	26	17
	2	...	11	13	16	15	26	20
	3	...	160	159	102	100	27	9
	4	...	209	238	79	87	27	16
	Σ		402	449	290	339		

(continued)

Table 1:44. (continued)

Country	Vessel class, gross tons	Minimum crew	Tonnage, '000 g.t. 1958	1965	Vessels no. 1958	1965	Average age 1958	1965
USSR	1	...[i]	61	20	222	62	27	12
	2	...	249	153	367	231	20	9
	3	...	317	360	210	246	27	8
	4	...	890	1 835	311	589	27	6
	Σ		1 517	2 368	1 110	1 128		
Poland	1	...[i]	19	26	16	105	20	8
	2	...	20	57	29	81	5	7
	3	...	38	55	24	40	25	7
	4	...	80	187	29	63	7	5
	Σ		158	325	159	289		
Total, market economy countries			7 893	7 081	9 932	9 367		
Grand Total			9 567	9 774	11 201	10 784		

a 700-500 gross tons, only deck and engine staff
b Two-watch system
c Three-watch system
d North Sea routes
e 500-1200 and 1200-2000 gross tons
f size of crew determined by the length of vessel and power of engines
g 500-1400 and 1400-1999 gross tons
h No law on minimum crews
i Data not available

Sources: Lloyd's Register of Shipping, Statistical Tables 1958, 1965, London
Kustsjöfart, 1974, Chalmers Tekniska Högskola, Göteborg

In West Germany the engine power also influenced the crew size. In the Netherlands the vessel length and engine power were determinants, while in the United Kingdom the tonnage of the vessel and its area of operation were main criteria for manning regulations. This lack of international unity provided for significant variations among Baltic and North Sea countries in the structure of their short-sea fleets. Shipowners of each country invested in tonnage that gave optimal manning costs.

Consequently, the tonnage distribution between size classes was even in the United Kingdom, while in Scandinavia and West Germany the class below 500 gross tons was much larger than the class 500-1000. Also the system of port and canal charges and register fees promoted investment in vessels with large deadweight capacity and low gross tonnage. One result was the development of general carriers with shelter deck and, in Germany, of "free-deck" vessels. In Scandinavia the "paragraph" vessel became very common in the 1950's. Its gross tonnage was slightly below 500 tons, i.e. it could sail with two watches, while carrying capacity could reach 1200-1300 deadweight tons.[1]

In spite of these innovations, the short sea fleets of most Baltic and North Sea countries showed a significant decline in the late 1950's and early 1960's (Table 1:44), most pronounced in the United Kingdom and Sweden. The Norwegian and Dutch fleets showed a slight decline, while those of Denmark and Finland stagnated. The West German and the East European fleets increased substantially. West German operators on coastal routes could use a two-watch system on vessels up to 1000 gross tons, giving them significant economic advantages and resulting in an even class distribution of the tonnage. The strong and rapidly growing home cargo base was another element that stimulated the expansion of the West German short-sea fleet. As in other countries it was traditionally a small-firm industry. Marketing of services was based on personal relations between shipowners and consignors rather than agent contacts. Therefore, a strong home-cargo base was one of the most important conditions for the development of national short-sea fleets.

Ferry Lines

The development of ferry shipping in the postwar period was a function of the rapidly growing long distance road movements of passengers and cargo. Increasing demand for holiday trips between the Continent, Scandinavia and United Kingdom and the structural and geographic changes in the location, production and distribution systems of the manufacturing

---

[1] In extreme cases a 300 gross tons general carrier under Norwegian flag could reach a carrying capacity of 1100 tons, Den mindre skeppsfarten II, 1975, p. 11.

industries formed the base for the rapid growth of car ferry shipping. It started in the early 1950's, but the real "take off" began in the early 1960's. Twenty-one new car ferry lines were opened on the Baltic between 1960 and 1965. The corresponding number on the North Sea was six.[1] By the mid 1960's these services were one of the major elements of the transport system in these areas.

In most cases car ferry lines were established by the change of tonnage on existing passenger lines. The geography of the latter was commonly based on the principle of the shortest sea transport, as already in the interwar period land transports were superior to shipping in terms of travel time. Both elements of demand for ferry shipping, passengers and general cargo, showed high time elasticity. Passengers were used to find certain connections at certain ports. A shift of traffic to a new port required an intensive information campaign causing additional costs and increasing the risk for lower capacity utilization in the initial period. Therefore, operators establishing new services also tended to locate them on traditional passenger routes.

Operationally, the ferry services on the Baltic and the North Sea can be grouped into five submarkets: the Gulf of Bothnia, the Åland Sea, the South Baltic, the Baltic Approaches and the North Sea (Table 1:45).

The Baltic Submarkets

The Baltic Approaches were by far the most important submarket. The annual growth rate in the 1950's was 21 % for passenger traffic and 25 % for truck cargo. For railway cargo it was only 1 %. Three short sea routes traditionally dominated the traffic: Helsingborg-Helsingör, Copenhagen-Malmö and Rödby-Puttgarden.[2] They were the major road and railway links between Scandinavia and the Continent. Until World War II the railway companies dominated the ferry traffic. The postwar development of car ferry services brought strong competition among a number of independent operators, who introduced new elements into the geography of ferry shipping: longer sea routes and calls at ports en route.

The rapid development of ferry traffic in the Baltic Approaches to a large extent was the result of an explosion in the number of shopping trips between Sweden and Denmark and between Denmark and West Germany. Longer holiday and business trips were only a minor part of the demand, but also this category showed a substantial growth. The number of passenger cars on ferries in the Baltic Approaches increased by 18 % annually in that period. However, most

---

1 Bachman, 1968, pp. 28-37.

2 von Schirach-Szmigiel, 1973, pp. 85-90. The last route had a predecessor in the 1950's.

Table 1:45. International Ferry Shipping on the Baltic and the North Sea

Submarkets	Year	Round trips no. th.	Passenger th.	Road Cargo th.ft.	Railway Cargo th.ft.	Cars th.	Trucks th.	Average truck load tons
Gulf of	1950[a]							
Bothnia	1960	0.3	40	0	0	5	0	0
	1965	0.3	110	2	0	13	0.2	10.0
Åland Sea	1950	...	177	0	0	2	0	
	1960	1.7	560	2	0	41	0.3	6.7
	1965	3.6	1 737	170	0	119	16.0	10.6
South[b]	1950	1.5	5	0	242	0	0	0
Baltic	1960	2.0	330	2	861	20	0.3	6.7
	1965	3.7	421	19	1 470	58	1.8	10.5
Baltic	1950	12.5	2 431	43	1 129	128	7.1	6.0
Approaches	1960	74.1	17 141	416	1 254	640	60.6	6.9
	1965	106.3	24 310	2 618	3 102	1 495	248.6	10.5
U.K. -	1951	...	2 282	0	417	65	0.1	1.8
Continent	1960	...	4 766	39	502	333	2.9	13.4
	1965	...	6 600	220[c]	851	711	14.1[c]	15.6

a Only passenger ships
b To the line Trelleborg-Sassnitz
c 1972:5, Copenhagen

Sources: DS: Statistiske Meddelelser 4:147,3; 1962:2;
HMSO: Annual Abstract of Statistics 1965, 1966, London.
SOS: Sveriges Järnvägar 1950, 1960, 1965, Stockholm
SOS: Sjöfart 1950, 1960, 1965, Stockholm
U.N.: Annual Bulletin of Transport Statistics of Europe, 1953, 1965, New York

striking was the growth of truck cargo reporting a tenfold volume increase during the 1950's. It went up by 600 % between 1960 and 1965 (Table 1:45). The number of trucks carried by ferries increased at a slower rate, particularly during the early 1960's, a result of the increased carrying capacity of the trucks. Their average load increased from 6.7 tons in 1960 to 10.5 tons in 1965. This in turn registered the introduction of large ferries, particularly on longer routes. The average size of ferries built in the 1950's for this submarket varied between 1500 and 2000 gross tons.[1] In the mid 1960's it reached 2000-3000 gross tons.

---

[1] Milchert, 1970, pp. 18-20.

Measured in tons of shipped cargo, the South Baltic was second among the five ferry submarkets in Northern Europe (Table 1:45). Railway cargo strongly dominated, while road transports developed very slowly. Traffic growth in this submarket was much slower than on other routes, a result of the political division of Europe and of the slow growth of road transports in Eastern Europe. To avoid time-consuming border checks truck transports between Sweden and the Continent were routed through Denmark or via direct services Sweden-West Germany rather than through the Trelleborg-Sassnitz route, although this often was shorter. Sassnitz lost its prewar position as the main Swedish "bridgehead" on the Continent. In the early 1960's, the establishment of direct ferry services between South Sweden and West Germany caused a significant decline in the traffic on the Trelleborg-Sassnitz route. As in previous periods the national railway companies of Sweden and East Germany operated this service jointly, which gave them a monopoly position on this submarket. The situation changed in the mid 1960's when a ferry service was established between Sweden and Poland by a private operator. After two years it was taken over by a Polish state shipping company. It represented a new trend in the shipping policy of Poland, giving priority to the development of a ferry fleet for the Baltic and the North Sea services.

The ferry services on the Åland Sea and the Gulf of Bothnia increased rapidly after 1960. The character of the Åland Sea traffic was similar to that in the Baltic Approaches. Daily shopping and leisure trips between Stockholm and the Åland Islands dominated. Migration from Finland to Sweden and tourism by car were two other important elements of the passenger demand. In the late 1950's and early 1960's, new tonnage was introduced on the routes, opening them for trucks. They also provided a new choice for road transports between Finland and Western Europe, breaking the monopoly of the traditional lines.[1] Until the early 1960's, the Swedish and Finnish operators worked in close cooperation on this submarket.[2] In the early 1960's, a new Finnish company entered the market, introducing modern tonnage and a low price policy.[3] To fight the competitor, the two traditional operators formed a joint venture and lowered their prices. Consequently, the ferry services between the Stockholm Region and the Åland Islands became the cheapest in Northern Europe. Revenues from tax-free sales of alcoholic beverages and tobacco became an important element in the economy of these lines.

---

[1] The Helsinki-Copenhagen-Travemünde ferry line, opened in 1954, until the mid 1960's carried only passengers and passenger cars.

[2] The Svea Line and the Bore Line.

[3] The Viking Line.

The North Sea Submarket

The development of ferry services on the North Sea was slower than on the Baltic Sea (Table 1:45). Railway ferry services were created much later in this area than in the Baltic.[1] The lift-on-lift-off method was used until World War II for handling passenger cars on the United Kingdom-Continent routes. A strong market position of the traditional lines, a well developed system of ports, relatively poor road standards and the left-hand traffic in the United Kingdom were main obstacles against the development of road transports between the United Kingdom and the Continent. The ferry connections on these routes were traditionally monopolized by national railway companies, which was an additional reason for the slow growth of road transports.

In the late 1940's the first ro-ro ferry lines were opened, using war-time tank-landing ships. In 1950 only 100 trucks carrying 200 tons of cargo were moved between the United Kingdom and the Continent, an average load of 2 tons compared to 6.2 tons for the Baltic Approaches. The first ro-ro terminal for North Sea traffic was opened as late as 1953 at Dover.[1] In the late 1950's, ro-ro terminals were built in most traditional passenger-ferry ports on both sides of the North Sea and the Channel, but the road cargo increased slowly. In 1960, only 40 000 tons of cargo were moved by trucks over these connections, one tenth of the traffic over the Baltic Approaches. In 1965, some 220 000 tons were trucked between the United Kingdom and the Continent, about 1 % of the British general cargo trade on short-sea routes.[2] The domination of state-owned operators remained unchanged in the 1950's and 1960's, which was very different from the Baltic. Ten of 16 North Sea ferry services were controlled by state-owned companies in 1965.[3] Four of the remaining six lines were operated by either Scandinavian shipowners or managers from Scandinavia.[4] All

---

[1] Bachman, 1968, p. 34.

[2] Committee of Inquiry into Shipping, 1970, p. 63.

[3] Leading operator was the state-owned Atlantic Steam Navigation Co., the pioneer in ro-ro technique on the North Sea. The company operated following services in the 1965: Felixstowe-Rotterdam, Felixstowe-Antwerpen, Tilbury-Rotterdam and Tilbury-Antwerpen. The British railways ran the services Harwich-Zeebrügge and Dover-Boulogne and in cooperation with the French railways (S.N.C.F) the Dover-Dunkerque and the Newhaven-Dieppe lines. The French railways operated the Dover-Calais line and the Belgian railways the Dover-Ostende service. Shipping Statistics, Yearbook 1966, p. 74.

[4] The Swedish Tor Line operated the Immingham-Amsterdam service and the Swedish Lion Ferry the Parkestone-Bremerhaven service. The U.K. registrated Thoresen Car Ferries Ltd., run by Norwegian managers, operated the Southampton-Cherbourg and the Southampton-Le Havre lines. Ibid.

ferry lines between the United Kingdom and Scandinavia were operated by Scandinavian shipowners.

The lack of interest in the ro-ro technique among private short sea operators in Britain is difficult to explain, but the dominating position of the British Railways could be one explanation. However, the rapidly growing international road transports in Europe should have indicated to British shipowners that the car ferry market on the North Sea had substantial growth potentials, which was utilized by the Scandinavians. Lack of management dynamics and traditionalism were often used to explain the poor development of the British deep-sea liner industry in the postwar period. Similar explanations seem to have been valid also for the postwar development strategy of the private short-sea operators in Britain.

Conclusions

The development of car ferry lines, particularly after 1960, had a strong impact on the economy, geography and organization of short-sea general cargo transports. Traditional liners had to search for employment either in break bulk cargo-movements on the Baltic and the North Sea or in technically less developed markets outside Northern Europe. The role of many small ports decreased as ferry lines tend to concentrate to a few ports. The organization of the ferry market followed the tradition of free competition characteristic of the traditional short-sea liner shipping. However, the strong position of nationalized industries, growing competition from large deep-sea operators seeing the growth potentials of the ferry market, and high investment and crew costs made it difficult for short-sea operators, who traditionally were small, to enter the ferry market.

THE DIVERSIFICATION PERIOD AFTER THE MID 1960's

The mid and late 1960's saw a break in the development trends of international liner shipping, which became much more diversified in techniques, organization and policy. Also the flag distribution of the world liner fleet changed. Tradition which until the mid 1960's was a useful variable to explain interdependences and trends in the industry lost much of its value. Technical development and flag redistribution resulted in growing competition within the liner industry and from other forms of shipping and transport modes. At the same time investment needs increased rapidly. Consequently, the business risk increased and to counterbalance this, the industry introduced farreaching organizational changes, in many cases supported by the policy of the home country, but discouraged by those of other nations. Thus, the liner market after the mid 1960's became a forum for rapidly growing business and political conflicts following geo-political and economic changes on the world map.

THE TECHNICAL DEVELOPMENT

After the mid 1960's unitization became one of the major elements determining the economy and organization of the liner industry, directly through new vessels and cargo handling systems, and indirectly because it changed the industry's competitiveness towards other modes.

Unitization

Unitization has a long history in the liner industry. Containerization is part of this process, having much wider technical and economic consequences than any previous innovation in this area.

The basic idea of containerization was to homogenize general cargo flows, allowing mechanization of traditionally labor-intensive cargo-handling operations in terminals. It also opened liner shipping to economies of scale in vessels and ports, the ideal system being a door-to-door transport of loaded containers on a balanced route.

The first step was to determine an optimal size of units. They had to satisfy the requirements of both consignors and transport suppliers. The former commonly wanted small but frequent shipments, while the latter tended to increase the size of units to reach economies of scale. In the initial period several container types were introduced in international shipping. In the long-run this plurality would result in low flexibility of the system, cause underutilization of its capital-intensive transport and handling equipment, and consequently ruin its economic advantages. Therefore, the standardization of containers was a *sine qua non* for the creation of a world wide container system. After initial experiments in the mid and late 1960's, two types of deep-sea containers became widely accepted.[1]

The experience of the initial period showed that the door-to-door concept, although most economic in theory,

---

[1] The ISO standard containers are defined as follows: A freight container is an article of transport equipment of a permanent character and accordingly strong enough to be suitable for repeated use. It is: (1) specially designed to facilitate the carriage of goods by one or more modes of transport without intermediate reloading; (2) fitted with devices permitting its ready handling, particularly its transfer from one mode of transport to another; (3) so designed as to be easy to fill and empty; (4) having an internal volume of 1 m^3 or more. The term freight container includes neither vehicle nor conventional packing:(ISO-Recommendations R-668). The size of the two most common deep-sea containers are 8 x 8 x 20 and 8 x 8 x 40 ft.

was difficult to apply in practice. A vast number of general cargo consignors were unable to fill whole containers in each shipment, unless rare deliveries could be accepted. Few consignors were willing to accept infrequent shipments, which would significantly increase the total distribution cost, as much capital would be tied in commodities. A collecting-distributing container terminal had to be introduced into the system. Its function was to collect and consolidate small export consignments into large units, and to break large units into individual parcels for local distribution. As the economy of container transport was based on the movements of standard units, the primary location criterion of container terminals was proximity to origins and destinations of small consignments. In most cases, this meant an inland location. Thus, the collecting, distributing, warehousing and cargo control functions, traditionally located at sea ports, were moved to inland terminals.

High costs of vehicles and handling equipment and high ton-value of cargo made short turnover-time in container transports, a basic condition to realise the economy of the system. This in turn required close coordination of the whole process and stimulated far-reaching horizontal and vertical integration of sea and land transports. Joint ventures among lines and upstream and downstream expansion of their activities to terminal operations and landtransports became frequent. The other element was a concentration of flows to fewer ports.

Joint ventures were a prerequisite for survival on a market characterized by a decrease in the number of vessels required, as a result of the productivity jump, and by rapidly increasing capital intensity. In the late 1960's, the building costs of a first-generation container vessel, including necessary containers,[1] were three times those of a conventional liner (Table 1:46). On the other hand, the carrying capacity of the container vessel was more than three times that of a conventional vessel. On a 10 000 mile route, four container vessels could replace seven conventional liners, keeping weekly services and doubling the carrying capacity of the line (Table 1:46). Assuming that each shipowner participated with one conventional vessel in that traffic, containerization of the route would require either a withdrawal by three operators or joint ownership of vessels. Considering the high costs of new tonnage and the risk for low utilization - doubling of the carrying capacity could seldom be matched by an equal growth of demand - the creation of a horizontal joint venture was the

---

1 First generation container vessels had a carrying capacity of 700-1000 twenty-feet containers (TEU) and each vessel required 2.5 sets of containers in normal operations.

only way for the lines to stay in the market. Horizontal ventures in the 1970's became the leading form of operation on most deep-sea liner markets.[1]

Table 1:46. Economics of Unitized Transports

Items	Vessel Types		
	Conventional	Container	Barge Carrier
Deadweight, '000 tons	11	15	43
Bale Capacity, '000 m^3	10.3	20.4	33.0
Speed, knots	16.0	22.0	16.5
Crew	36	30	30
Building costs[a], $ '000 000	3.0	9.1[b]	18.1[c]
Port time per round voyage, days	23[d]	9[e]	6[e]
Sailing time, 10 000 n.m. round voyage, days	26	19	22
Yearly carrying capacity[f] of a vessel, '000 m^3	146	510	825
Number of ships required for weekly service	7	4	4
Capacity of the line, '000 m^3	1 030	2 040	3 300
Capital costs per freight[g] ton of 1 m^3, $	2.3	2.5	2.48
Operational costs per freight ton of 1 m^3, $	3.81	2.47	1.61
Total costs per freight ton of 1 m^3, $	6.11	4.97	4.09

a Prices estimated at 1968 level
b Including 2.5 sets of containers, 1750 units
c Including 2 sets of barges, 146 units
d 6 ports
e 4 ports
f Weekly sailings, vessels operated 50 weeks per year
g Vessels - 16 years depreciation at 8 % rate of interests; containers, barges 10 years depreciation at 10 %

Source: UNCTAD, 1970, Unitization of cargo, pp. 21-25.

---

[1] See pp. 148-151.

Close coordination of terminal and transport functions in deep-sea container movements could be achieved by either vertical integration or long-term agreements between independent lines, terminal operators and land transport suppliers. The first strategy was more rare. It required much capital and large organizations. Only a few large liner companies can successfully manage integrated container systems.

The ongoing horizontal integration should be seen against continuously increasing size of container vessels between 1968 and 1978 (Table 1:47). Vessels of the first generation, up to 20 000 deadweight tons carrying 700-1000 TEU,[2] strongly dominated in 1970 (Table 1:48). In 1974 the second generation of cellular vessels with a capacity of about 1500 TEU became the main group. About that time vessels of the third generation with a carrying capacity of 2500-3000 TEU were introduced.

The development of very large container vessels was much slower than expected. In 1978 the share of medium-sized vessels had increased while that of large carriers had decreased (Table 1:48). This tendency was even more pronounced in the order stock. Only four vessels, i.e. 9 % of ordered tonnage, were above 40 000 gross tons (Table 1:47). In other words, the economies of scale of deep-sea cellular vessels seem to have reached a maximum in the class between 20 000 and 30 000 gross tons. Although containerization resulted in almost 2000 % productivity jump in cargo handling compared to the conventional method,[3] there was only a limited increase in the productivity of these operations between medium-sized and large cellular vessels.[4]

---

[1] Sea-Land Line, one of the pioneers of containerization, and the leading liner company under the U.S. flag, consistently follows the strategy of integrated ownership of container systems.

[2] TEU - Twenty-feet container equivalents is a common measure of the carrying capacity of the cellular vessels.

[3] The following productivity data were collected by the British Port Council:

Technique	Manpower	Shift length (hours)	Production (tons)	Productivity (tons/m.h.)
Conventional	90	8	1 200	1.7
Pallets	50	8	1 800	4.5
Containers	20	10	6 000	30.0

Source: National Ports Council, Port Progress Report, p. 79.

[4] Typical gross handling rates are as follows:

Vessel size TEU	No. of lifts per day
2 500	500
1 250	370
200	265

Laing, 1975, p.57.

Table 1:47. World Fleet for General Cargo Transports

	1966	1968	1970	1972	1974	1976	1978	On order 1978
Number of vessels								
General carriers[a]	11 807	11 868	11 875	11 950	12 007	12 062		395
Container[b]	20	75	167	312	412	443	531	374
Barge carriers	0	0	3	18	24	28	29	2
Ro-ro[c]	0	6	17	27	35	42	72	68
Tonnage, '000 000 gross tons								
General carriers[a]	69.5		70.4	68.6	66.7	71.6		4.1
Container[b]	0.2		1.9	4.3	6.3	6.7	8.7	3.0
Barge carriers	0	0		0.5	0.7	0.8	0.8	0.1
Ro-ro	0	0.1	0.2	0.4	0.5	0.6	0.9	1.0
Carrying capacity								
General carriers, '000 000 dwt.[a]	90.5	91.0	91.2	92.0	93.7	95.3		
Container, '000 TEU[b]	1.2	17	72	218	308	406	510	220
Barge carriers, '000 000 dwt.	0	0	0.1	0.6	0.8	1.0	1.0	0.1
Ro-ro[c]	0	0.1	0.3	0.5	0.6	0.8	1.3	1.5
Average size, '000 gross tons								
General carriers[a]	7.7	7.8	7.7	7.7	7.8	7.9		
Container[b]	1.2	4.5	8.6	13.9	14.9	18.3	19.2	11.9
Barge carriers	0	0	33.3	33.3	33.3	35.7	34.5	44.0
Ro-ro[c]	0	16.7	17.6	18.5	17.1	19.0	18.1	22.1

a Vessels above 1000 gross tons
b Only new built fully container vessels
c Deep-sea ro-ro carriers, excluding car carriers

Sources: Lloyd's Register of Shipping, Statistical Tables, 1966-1978, London.
Shipping Statistics, Yearbooks 1968-1977, Bremen.
U.S. Maritime Administration, A Statistical Analysis of the World's Merchant Fleets, Biennial, 1966-1976, Washington, DC.

Table 1:48. Generations of Deep-Sea Cellular Carriers

Generation	Tonnage classes, '000 gross tons	Averages			Share of world fleet			
		Capacity TEU	Length m	Speed knots	1970	1974	1978	On order 1978
First	10 - 19	800	170	18	68	22	20	39
Second	20 - 40	1 500	220	21	32	42	48	55
Third	40 -	2 800	270	22	0	36	32	7

Sources: Containerization International, Yearbook 1976, 1978
Lloyd's Register of Shipping, Statistical Tables 1974, 1978, London.

The traditional linear relationship between port time and vessel size that made the introduction of large vessels in the conventional liner trade uneconomic is also valid for the container traffic and forms an important restriction on the growth of cellular vessels. Other important elements that restricted this growth were: (1) the slow increase in demand, which did not correspond to the rapid growth in supply caused by the productivity jump, (2) the consignors' preferences about the frequency of service, and (3) the cost of feeder transports and the risk for congestion in central container ports.[1]

Further increase in the size of liner vessels would require larger cargo units and new cargo handling techniques, which would increase the productivity of the loading and discharging operations and would make vessels more flexible as regards types of carried cargo, i.e. open new market segments.

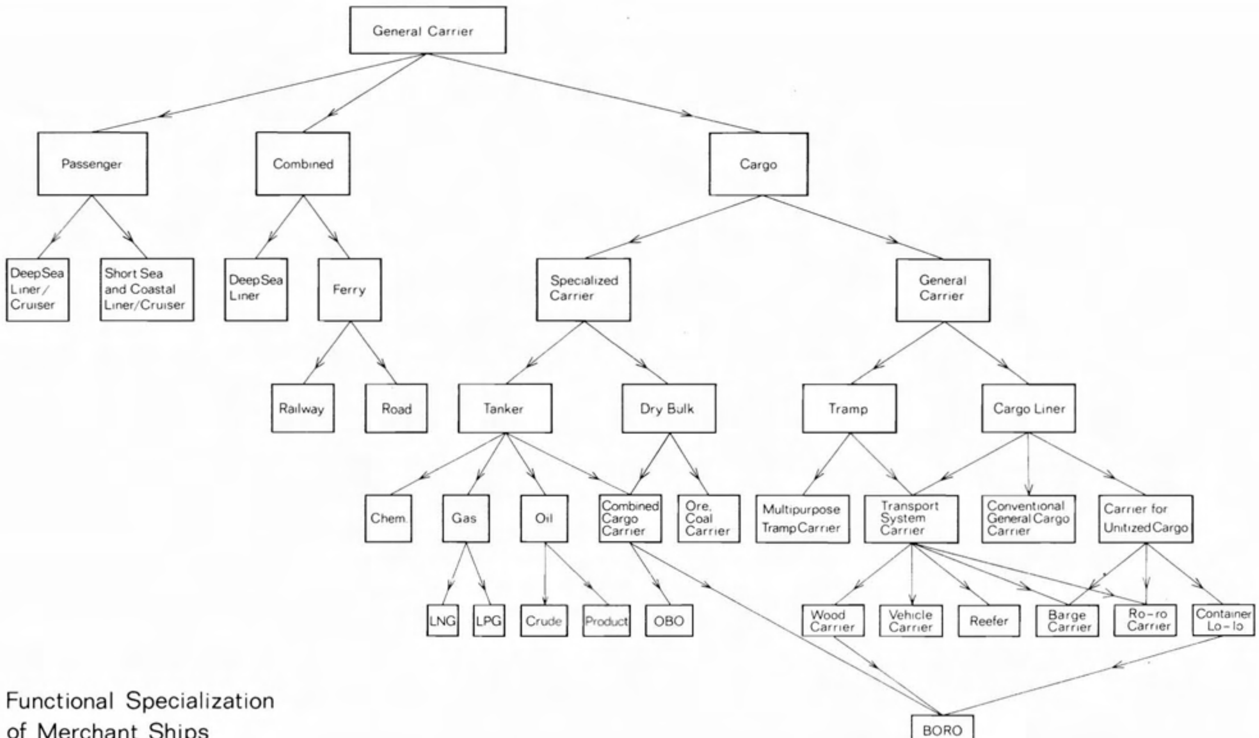
The development of cellular carriers followed the principle of close vessel adaptation to the transport needs of an individual cargo group. On the one hand, it provided lower cost and shorter time of cargo handling as well as higher utilization of the vessel's carrying capacity, but on the other, it limited the cargo base of the vessel.

Barge carriers and ro-ro techniques introduced to deep-sea shipping in the early 1970's aimed at increasing the productivity of the handling operations without limiting the vessel's cargo base, i.e. expressed the philosophy of higher flexibility at the expense of lower utilization (Figure 1:3).

---

[1] Johnson & Garnet, 1972, pp. 35-60.

Figure 1:3.



Functional Specialization of Merchant Ships

Table 1:49. Speed and Size of Container and Ro-Ro Deep-Sea Carriers[a] on Order, August 1978

Speed,	Number of vessels	
knots	Cellular	Ro-ro
15 - 17	3	9
18 - 20	27	26
21 - 23	49	33
24 - 26	2	1
Total	81	62
Size, '000 dwt.		
10 - 14.9	13	29
15 - 19.9	35	18
20 - 24.9	15	13
25 - 29.9	14	6
30 - 34.9	11	3
35 - 39.9	7	
40 - 44.9	1	
45 - 49.9	3	
Total	99	69

a Vessels above 10 000 tons deadweight

Source: Fairplay, August 17, 1978.

The basic principles of the barge system are: large cargo units, flexibility of carrying several types of cargo, independence of ports, and utilization of inland waterways for distribution in the hinterlands. Two parallel barge systems have been developed: the LASH-system, based on 400-ton and 30-40 thousand deadweight ton "mother"-carriers which can carry 61 or 73-83 barges, and the SEABEE-system. The latter is based on 900-ton barges and 30 000 deadweight ton "mother"-carriers. Barges are either floated or lifted aboard the "mother"-ship. In 1975 ten of 27 vessels were barge carriers proper, the rest were combined barge-container carriers.

In the mid 1970's about two-thirds of this tonnage was employed in traffic between the United States and developing countries (Table 1:50). The rest was used on

Table 1:50. Employment of the Barge Fleet, 1975

Market	Operator	Introd. year	No. of vessels	Dwt. '000	Capacity in barges '000 tons	Vessel type
North America/ West Europe	Central Gulf	1969	2	43	27	B[a]
	Lykes Br.	1971	3	27	32	BC[b]
	Combi Line	1972	2	43	30	B[a]
North America/ Mediterranean	Prudential Groue Liner	1970	5	30	22	BC[a]
North America/ Red Sea, Indian Ocean	Waterman St. Co.	1974	3	39	27	BC[a]
U.S. West Coast/ Far East	Pacific Far East Line	1971	4	30/22	23	BC[a]
U.S. East Coast/ Far East	Central Gulf	1974	3	43	27	B[a]
U.S. Gulf/ East Coast South America	Delta Lines	1974	3	39	27	BC[a]
U.S. West Coast/ Australia	Farrell Line	1973	2	30	23	BC[a]

B Cargo carrier
BC Combined cargo/container carrier
a LASH-system
b SEABEE-system

Sources: Laing, E.T., 1975, Containers and their Competitors, Liverpool.
Hilling, D., 1977, Barge Carrier Systems, London.
UNCTAD, 1976, Technological change in shipping and its effects on ports, Geneva.

routes between the United States and developed countries. As in the introduction of containers, U.S. operators were also pioneers in the development of the barge system. In the mid 1970's only one operator was non-American[1] (Table 1:48). High investment costs and the rapid growth of the carrying capacity created by the massive introduction of barge carriers without corresponding growth of demand, made this technique very risky. Also, the large capacity made the barge system more suitable for break bulk markets based on long-term government or industrial contracts rather than for traditional liner services. The American operators could find a stable market for a limited number

[1] Combi Line was a joint venture created by the German Hapag-Lloyd and the Dutch Holland America Line.

of barge carriers in aid shipments and in the transport needs of large processing industries.[1] Another important element that stimulated the development of these vessels under the U.S. flag was a 44 % construction subsidy to the operators. The barge system was given high priority in the national plans for the development of a modern merchant fleet.[2]

Unlike cellular or ro-ro fleets the world tonnage of barge carriers stagnated after 1975 (Table 1:47). The system seems to have two important disadvantages: large size of units and technically difficult feeder transports. Should the system be operated according to the door-to-door principle, whole barge loads must be supplied by individual consignors and sent either directly to the destination point or to a proxy barge terminal. The capacity of the barge is much above the average size of general cargo consignments, which means that shippers have to accept either less frequent services or consolidation of cargo in en route terminals, i.e. longer transport time, higher pilferage or damage risk and additional cost for loading and discharging at the terminals. The feeder transport of barges is limited to waterways, the nets of which are even less dense than those of railways, not to mention roads. For open-sea traffic special vessels are required.[3] Towing along inland waterways is technically hazardous, because even a small impairment of a barge makes it impossible to load it on the "mother" ship.

The majority of barge carriers are of combined type, i.e. operators anticipate a mixed container-break-bulk cargo base for their services. However, the two types of cargo are different as regards the role of transport time on the service. In addition, the break bulk transports are more and more organized as systems adjusted to the needs of individual consignors. The mixed container-barge transports can only with difficulty meet the requirements of both general and break bulk cargo consignors and therefore should be less competitive than specialized carriers. The economies of scale of the two cargo units, barge and container, seem to be too different to allow a competitive system mixing the two. In the long run break bulk and bulk markets seem to be the major fields of employment of barge carriers.

---

[1] Hilling, 1977, pp. 45-55.

[2] Merchant Marine Act of 1970.

[3] The BACAT carrier was the first experiment in feeder barge carriers. A catamaran was used to carry 10 small barges and 3 LASH barges in North Sea traffic. Several other systems were developed with a general tendency to increase the size of feeder carriers. Hilling, 1977, pp. 68-78 and Möncke, 1975, pp. 16-18.

They should be particularly competitive on routes where sea or inland waterway feeder is superior to land transports, e.g. for handling wood and wood products whose plants are commonly located along the coast or in river mouths. The market for that type of deep-sea transports was limited in the 1970's, the main reason for the relatively slow growth of the world barge fleet.

The ro-ro technique was well developed in short-sea transports when introduced into the deep-sea markets in the late 1960's. In addition, five years experience was accumulated from the deep sea operation of ro-ro car-carriers.[1] The basic ideas of the ro-ro technique were the elimination of time-consuming and costly lift-on-lift-off operations and increased vessel flexibility. Compared to cellular carriers, the ro-ro vessels have a much wider cargo base, including containers, pallets, individual items of general cargo as well as unitized and non-unitized break bulk cargo. The ro-ro technique does not require concentration of consignments to large units. The size of individual shipments may be well below a container load or outside its standards, which makes ro-ro vessels the most flexible general cargo carriers. The advantages of flexibility and short loading and discharging time to some extent are reduced by the cost of lower utilization of the vessel's carrying capacity.

One of the consequences of the ro-ro technique is the redistribution of investments between liner operators and ports. Investments in a ro-ro terminal in 1975 were about 25 % below the construction and equiment cost of a terminal for handling cellular vessels (Table 1:51).[2] In ro-ro transports investments in gantry cranes can be avoided. When a third-generation ro-ro carrier is employed, the ports can even avoid the investment in the ramp, which is carried by the vessel. The ro-ro technique should gain support from port authorities, particularly in developing countries facing congestion in general cargo areas and being short on investment funds.

In the late 1970's a system of multi-container units was developed, the LUF-system.[3] It increased the productivity of loading and discharging, i.e. shortened port time of the vessel and allowed for higher utilization of cargo handling equipment (tugmasters, forklift trucks). The system is based on the pallet concept. Four or six containers are assembled on a metal frame with a large number of small

---

1 Atlantic Container Line (ACL), the pioneer in deep-sea ro-ro traffic, was a joint venture between six shipowners. One of them was the Wallenius Line, a leader in deep-sea car transports.

2 The costs of land were not included as they considerably vary between locations. Measured per ton of handled cargo, the surface requirements of conventional berth are slightly above ro-ro and lo-lo berths.

3 Lift Unit Frame system (LUF), introduced in 1977 in Gothenburg, Fairplay, 78-12-21, p. 37.

Table 1:51. Capital Costs of a General Cargo Terminal in Developing Countries, 1975

Items \ Berth type	Conventional		Lo-lo		Ro-ro	
	Physical requirements	Total cost, $ 000	Physical requirements	Total cost, $ 000	Physical requirements	Total cost, $ 000
Annual throughput, '000 tons	120		840		840	
Quay, m	175	2 100	250	3 000	250	3 000
Surfacing, '000 m^2	21	735	120	4 200	120	4 200
Shed, '000 m^2	10	960	3	240	4	320
Total infrastructure		3 795		7 440		7 520
Cranes: conventional	4	800	0			
gantry	0		2	4 000	0	
mobile; light 5/10 tons	1	62	0		0	
Ramps	0		0		1[a]	300
Forklift trucks:						
light 3-5 tons	12	300	2	280	3	420
heavy 25 tons						
Straddle carriers[b]	0		12	2 160	12	2 160
Tugmasters	0		8	296	12	444
Tractors	4	68				
Trailers	12	66	36	198	54	297
Weighing bridge	1	50	2	100	2	100
Total cargo handling equipment		1 346		7 034		3 721
Grand total		5 141		14 474		11 241

a Introduction of vessels with their own ramps would reduce this cost.
b The LUF-system, which was not in operation in 1975, decreases the number of required straddle carriers.

Source: UNCTAD, 1976, Technological change in shipping and its effects on ports.
Internal material of the Swedish Port Group, Stockholm.

wheels which is towed aboard the ro-ro vessel. It allows large ro-ro vessels on routes with sufficient cargo base, as the time of cargo handling is lowered without influencing the size of individual consignments. The LUF-system does not force consignors to change their distribution system. The main disadvantages are: need for plane surfaces in the ports, higher costs of ramps which have to carry much heavier units than in conventional loading and discharging of ro-ro vessels and a 3-5 % reduction of the carrying capacity of the vessels. Reconstruction of terminals is often needed as, in most cases, rails separate the quays from the cargo storage depoes. Introduction of larger vessels is stimulated which may counterbalance capacity losses.

According to British estimates, the transport cost per ton containerized cargo in a ro-ro vessel in 1971 were between two percentage units (North Atlantic) and ten percentage units (Australian route) above the cost for movements in a fully cellular vessel of corresponding size (Table 1:52). These differences were much lower in 1975, i.e. the ro-ro vessels achieved further savings with the development of the technique. The multi-container handling-method was not considered in these estimates. Expectation of further cost decreases and increased economies of scale in ro-ro vessels following the higher productivity in loading and discharging, possibility of carrying different cargo, port congestion in many developing countries, which also influenced container services, and the cost savings in port investments favored the introduction of the ro-ro technique in deep-sea shipping and formed the base for the rapid growth of the world deep-sea ro-ro fleet after the mid 1970's.

In the 1968-1974 period the number of ro-ro vessels on deep-sea routes increased from the initial 6 to 35. The carrying capacity grew from 100 000 to 600 000 deadweight tons (Table 1:47). The average vessel size increased rather slowly and was below the average for cellular carriers. Between 1975 and 1978 the deadweight tonnage of ro-ro vessels had an annual increase of 21 %, while the rate for cellular vessels was 13 %, and for conventional deep-sea general carriers only 1 %.

By 1978 the carrying capacity of the world ro-ro fleet was 10 % of the cellular fleet, but 34 % as regards the order stock that year (Table 1:49). This means that the position of the ro-ro carriers in the liner shipping of the world will significantly increase in the early 1980's. The average size will considerably increase (from 18 000 to 19 000 deadweight tons in 1978/1979 to 22 000 - 23 000 deadweight tons in the early 1980's (Table 1:47). The speed of 21-23 knots dominated both among cellular and ro-ro vessels on order in 1978, but oil price increases form a barrier to further speed growth.

Competition between ro-ro and cellular vessels in the late 1970's became the major technical issue in the inter-

Table 1:52. Costs per Ton for Dock-Gate to Dock-Gate Transports

Type of Vessel	Routes from Europe to:																	
	United States		Japan via Panama		via Cape		Australia		South Africa		South America		India		West Africa		East Africa	
	1970	1975	1970	1975	1970	1975	1970	1975	1970	1975	1970	1975	1970	1975	1970	1975	1970	1975
	£		£		£		£		£		£		£		£		£	
Conventional 12 500 dwt.	28.6	41.9	22.7	42.7	24.2	46.1	38.2	62.2	17.0	28.4	18.0	31.8	19.5	36.3	15.4	24.7	19.3	33.0
Container																		
750 TEU	15.1	24.1	21.3	42.8	23.2	47.2	25.5	48.3	16.2	29.0	18.9	34.9	21.6	42.0	14.1	23.8	18.5	34.4
1 250 TEU	15.3	23.7	20.1	37.9	21.5	41.5	24.2	43.7	16.0	27.4	18.3	32.2	20.6	37.8	14.2	23.1	17.9	31.7
2 000 TEU	15.6	24.9	19.5	39.0	20.9	42.5	23.7	44.6	16.1	28.5	18.2	33.3	20.1	38.9	14.5	24.3	17.8	32.8
3 000 TEU	15.8	24.7	18.9	36.6	20.0	39.6	22.8	41.9	15.9	27.6	17.8	31.8	19.5	36.6	14.5	23.9	17.4	31.3
LASH, 67 barges	23.4	34.0	20.7	39.5	22.4	43.2	33.6	55.6	15.2	25.3	16.4	29.0	18.1	34.0	13.4	21.3	17.7	30.2
Ro-ro																		
10 000 dwt.	16.2	24.5	23.7	43.6	25.9	48.1	28.0	49.4	17.6	29.6	20.7	35.6	24.0	42.9	15.1	24.3	20.2	35.1
20 000 dwt.	16.1	24.8	21.3	39.2	22.9	42.9	26.7	45.4	17.0	28.7	19.5	33.6	21.9	39.4	15.0	24.4	19.0	33.2

Source: Laing, E.T., 1975, Containers and their Competitors, Liverpool.

national liner industry. The views followed clear national lines.[1]

Special Deep-Sea Break-Bulk Carriers

The development of special car carriers in the mid 1960's was a new element in the competition between liners and specialized carriers.

The world fleet of deep-sea car carriers increased rapidly in the 1970's. Vessels were of two types: pure car carriers and car-bulk carriers (Table 1:53). The former are based on the ro-ro technique, while most of the latter use the lo-lo system for loading and discharging cars.[2] The pure car carriers are comparatively small, the average size in the mid 1970's being only slightly above the average for conventional deep-sea general carriers (Table 1:47 and 1:53). Frequent and regular shipments are of greater importance in car transports than the economies of scale of the vessels. Car-bulk carriers were much larger than pure carriers measured in deadweight tons, but this was a function of their carrying capacity for bulk cargo. The car capacity was similar to that of pure carriers. Most of the car transports in the 1970's were organized through special systems. Vessels were either owned by the consignors[3], or the transports were based on long-term contracts. One of the main problems was the unbalanced geography of flows which stimulated the use of combined car-bulk carriers. Unlike the majority of car-bulk carriers, which were elderly converted bulk vessels, the combined car-bulk carriers were specially designed to solve the problem of unbalanced traffic.[4]

The development of pure car carriers resulted in a partial separation of car transports from the general cargo market. The development of car-bulk carriers linked car movements to the bulk market. These tendencies were an important threat to several lines, who either based much of their services on car transports or treated this market as an area of high potential growth (Table 1:54). The introduction of ro-ro liners gave the liner industry an opportunity to regain their former position in car transports. Also

---

[1] See pp. 160-172.

[2] Drewery, 1972, p. 2.

[3] Volkswagen in the late 1960's established its own transport company, the Wobtrans.

[4] MS Aida and MS Otello introduced in 1974 by Wallenius for round-the-world routes including movement of cars from Japan to Europe and from Europe to North America and of phosphate or iron ore from South America to Japan. A similar system was developed by the Johnson Line on the route Europe- North America; wood products were used as return cargo for car carriers.

Table 1:53. World Fleet of Break-Bulk Carriers

	1966	1970	1974	1978
Reefer fleet				
Total refridgerated space in world fleet, '000 000 cu. ft.	245	282	295	326
Deep-sea reefers (above 150 000 cu.ft.)	288	361	435	
carrying capacity, '000 000 cu. ft.	68	98	127	
average size, '000 000 cu. ft.	0.23	0.27	0.29	
Car carriers				
Pure car carriers[a]				
no.	0	10	36	75
carrying capacity, '000 SVE	0	27	104	236
average size, '000 dwt.		10	11	12
Car-bulk carriers				
no.	87	158	254	280[b]
carrying capacity, '000 000 dwt.	2.1	4.0	6.8	7.7[b]
average size, '000 dwt.	24.1	25.3	26.7	27.5[b]

a Only deep-sea vessels, carrying 1000 or more passenger cars.
b 1976.

Sources: SVE-Standard Vehicle Equivalent.
Drewery, 1977, The Growth of the Car-Carrying Fleet.
Statistik der Schiffahrt, 1966-1978, monthly publications, Bremen.

the geography of the ro-ro lines, commonly based on calls at four or six ports should make them an attractive alternative to car-bulk transports. The opportunities of the liner industry in this market became a question of marketing efforts rather than of cost and technical disadvantages against specialized vessels.

The reefer fleet traditionally was a major competitor of liner shipping.[1] The containerization strongly influenced this situation. Closed systems for movements of freezed cargo were established, which decreased the perishability

---

[1] See pp. 71-75.

Table 1:54. Deep-Sea Trade with Cars

Routes	Passenger cars, '000 units			
	1966	1970	1974	1976
Europe - N. America		968	1 017	
Japan - N. America	22	324	683	1 573
Japan - Europe	0	114	344	483

Sources: The Bank of Japan, Economic Statistic Annual, 1978, Tokyo.
Drewery, H.P., 1977, The Growth of the Car-Carrying Fleet, London.
Japan Statistical Yearbook, 1970-1978, Tokyo.

risk. In the mid 1970's about 15 % of the total reefer capacity were supplied by reefer containers. The total reefer capacity of the world fleet increased by 15 % between 1966 and 1970, but stagnated afterwards (Table 1:53). The introduction of reefer containers caused the decline of reefer capacity in traditional liners. The world fleet of pure reefers nearly doubled between 1966 and 1974. The containerization and specialization resulted in a doubling of the productivity of one cubic feet of reefer space in the world fleet, but did not create unbalances on the market. The rapidly growing deep-sea trade in meat and fruit filled this jump in supply.

The average size of deep-sea reefers increased in the late 1960's, but stagnated in the 1970's. Apparently, they reached an optimal size when the advantages of larger vessels were balanced by the disadvantages of the longer port time. The increasing competition between pure reefers and container transports made the question of unbalanced trade patterns a major issue on the reefer market. The rapidly growing demand for shipment of passenger cars created new potentials for reefers to find return cargo. This meant increased competition with liner shipping for which cars were an important cargo. One of the main difficulties in merging reefer and car transports was the different organization of the markets. Meat and fruit required regular and scheduled services to keep the delivery times and avoid building large stocks, and cars required a high geographic flexibility of the tonnage. The introduction of ro-ro liners on the routes where reefers compete for car transports should increase the competitiveness of liner shipping for this type of cargo.

Alternativ Modes

Until the late 1960's shipping was the only mode for general cargo movements in intercontinental trade. This has changed in the 1970's. Containerization recreated continental railway bridges. Port congestion and the growing role of trucks in intra-continental transports formed the base for their introduction on intercontinental routes. The development of special cargo aircrafts, specially the jumbo-type, opened new perspectives for air cargo movements.

Two railway connections are of particular importance in competition with the deep-sea general cargo routes: the Transsiberian Railway and the U.S. "mini-bridge". The Transsiberian route was opened for scheduled container traffic in 1970. The average number of containers carried monthly on this route increased from about 1 000 to 4 000 between 1970 and 1976, i.e. 20 % of the sea-borne container traffic on the route Europe-Far East.[1] The freight rates in 1974 were about 30 % below the shipping rates Europe-Japan and the transport time 15 days shorter. The pricing policy of the Transsiberian Railway is a question of internal priorities for the Soviet authorities. This railway competes not only with foreign shipping lines, but also with the rapidly growing cross trade of the Soviet deep-sea services. Selling rail transports should be superior to the selling of liner services for hard-currency-earnings. No hard-currency expenditures are required by the rail services. On the other hand, the development of Siberia requires large transport efforts. The Transsiberian Railway is often the bottleneck in these plans.[2] The extent to which it can be used for the transit of foreign cargo between Europe and the Far East becomes a matter of national priorities, the need for hard-currency-earnings against the development of new industrial regions in Siberia.

The "mini-bridge" across the United States shortened transports between Europe and Japan by seven days compared with the route via the Panama Canal. It also created an alternative to the Panama route for general cargo from the U.S. East Coast to the Far East and from the U.S. West Coast to Europe. The development of the "mini-bridge" was strongly opposed by port authorities, particularly those of the East Coast, and by liner operators. The introduction of ro-ro liners and increasing fuel costs may increase the competitiveness of the bridge. The Panama Canal restricts the size of cellular and ro-ro carriers to 40 000 dwt. The introduction of larger carriers on the North Atlantic and Pacific routes should give combined ro-ro and rail transports new opportunities. The U.S. transport policy, particularly stimulation of railway investments and close coordination of services will determine the competitiveness of

---

[1] Maritime Transports, 1977, pp. 12-14.

[2] Schabad & Mole, 1977, p. 65.

the "mini-bridge". A renaissance of the combined rail-shipping companies may be a necessary condition to meet the organizational needs of the combined ro-ro and rail services.

The rapid growth of the intercontinental road transports in the 1970's was mainly concentrated to the Europe-Middle East route, a result of the growth of demand for general cargo in the Middle East, which created heavy port congestion.[1]

Direct road transports and ro-ro services were the alternatives to reach acceptable delivery times. Road transports not only guaranteed shorter transport time but also increased the certainty of delivery and decreased the risk of pilferage and damage to cargo. However, direct trucking from Europe to the Middle East cannot compete with ro-ro services in the long-run. In the future this market will probably follow the pattern of the North Sea and the Baltic markets, i.e. ferry shipping and ro-ro lines will become the major modes.

The technical development of air cargo transports in the 1965-1978 period was concentrated to larger and more efficient air crafts and to further progress in unitization. The introduction of "jumbo-carriers" in the early 1970's (Table 1:55) was an important step towards increased economies of scale in air cargo transports. It also increased the cargo base. Parallel with this development, the airlines introduced the concept of total distribution costs (TDC) in their marketing. The aim was to show that air transports, although expensive, are competitive when all distribution costs are considered by the consignor. The lines asked potential consignors to make a comparative analysis of total transport costs for alternative modes including prices, time, costs of keeping stock, risks for damage or pilferage, and delay.

These technical and marketing innovations had a strong impact on the growth of air cargo transports. The average annual growth rate in the mid and late 1970's reached 10 % for volume of carried cargo and 12 % for transport work (Table 1:56), which means that long movements expand most rapidly. The growth rate for the North Atlantic was less than half that for the Europe - Far East route (Table 1:56).

The share of pure cargo lines in the total air cargo transports remained rather constant during the 1970's, i.e. the introduction of large cargo aircrafts did not

---

[1] Waiting time in Middle East ports in the mid 1970's reached 200 days for conventional general carriers.

Table 1:55. Technical Progress in Air Cargo Carriers

Aircraft	Year of introduction	Payload, tons	Speed, km/h	Productivity, ton-km/hour flown, '000	Utilization, hours/day
DC-8-63F	1968	50	800	39	6.8
B-747F	1972	125	800	99	6.8
DC-6B		181	800	145	6.8

Source: See Table 1:28

Table 1:56. International Air Cargo Traffic

	1970	1974	1977	Annual growth rates 1970-1977
All International Traffic				
Million tons[a]	2.5	2.7	3.4	4
Th. million ton-km:				
combined services	5.7	10.0	12.8	12
cargo services	2.2	4.0	5.4	14
Load factor, %	51	55	56	
Freight operating revenues[b]				
U.S. cents per ton-km	16.5	19.2	22.2	
North Atlantic				
Million tons	0.4	0.6	0.7	8
Th. million ton-km:				
combined services	2.5	3.2	3.8	6
cargo services	1.2	1.4	1.6	4
Load factor, %	53	55	58	
Europe - Far East				
Th. million ton-km:				
combined services	0.7	1.6	2.3	19
cargo services	0.1	0.4	0.8	35
Load factor, %	54	58	58	

a Only scheduled services b Domestic and international services

Source: IATA, World Air Transport Statistics 1966-1977, Geneva.

change the structure of the market. Compared with the liner, the carrying capacity of the aircraft is small, which excludes the use of standard containers in combined air-land systems.[1] The unitization in the air cargo transports, which until the mid 1970's developed independently of the surface systems, will continue to do so in the future, as economic links between the two systems are missing.

In spite of technical developments, the market profile of air cargo remained fairly constant in the 1968-1977 period. No world data are available on tonnage and value of intercontinental trade with break-down by transport mode, but an analysis of Sweden's foreign trade can be used to exemplify the trends. The ton-value index of air imports and exports of Sweden did not change much between 1967 and 1975. Air transport grew with the demand within its traditional market segment rather than expand into new segments. The increasing role of intraregional trade is an important trend that may limit the growth potential of air cargo transports. On the other hand, the rapid growth of technology-intensive industries, e.g. micro-electronics, biotechnics should increase the demand for high-speed transports.

Conclusions and Future Perspectives

The technical developments in liner shipping of the 1965-1978 period - revolutionary changes in cargo handling - allowed a 40-60 % decrease in the vessel's port time. The container was by far the most important element. Experiments in larger units, although promising as to the economies of scale in vessel operations, seem to be rather unacceptable as regards the needs and preferences of the consignors. Mixing break bulk and container loads in the same vessel is difficult from the market point of view. The two cargo types have different transport requirements.

The first step towards containerization was the introduction of cellular carriers based on the lift-on-lift-off technique. It meant a farreaching specialization of the liner fleet, which limited its cargo base. The increased productivity in loading and discharging allowed the introduction of larger vessels than conventional liners. However, the productivity jump was a single phenomenon. The linear relationship between vessel-size and port time was also characteristic for cellular carriers.

The ro-ro carriers, on the other hand, were a step toward increased flexibility of liners, increasing their cargo base and further decreasing port time. But they implied partial transfer of cost for cargo handling equipment from ports to ship-operators, which made this technique particularly attractive for port authorities.

---

1 Large cargo aircrafts can carry up to six standard containers. The loss of carrying capacity is 30 %. Burg, 1975, pp. 190-192.

Unitization led to radical changes in the cost structure of liners. Compared with conventional carriers, the share of loading and discharging costs on cellular or ro-ro vessels declined by 15-30 percentage units (Table 1:57). On the other hand, the share of capital costs, including containers, increased by 10-20 percentage units. The crew costs declined by 2 to 5 percentage units and became one of the minor items but still with influence on the competition between individual lines. The difference in cost structure between cellular and ro-ro carriers of the same size is minor.

The cost analysis of the current fleet provides guide-lines for the discussion about future innovation efforts in liner shipping. Capital and port costs, including cargo handling, are by far the most important items, the third being fuel costs. Consequently, the greatest efforts in the technical development of liners should be to get cheaper vessels. This cost structure also explains why credit terms became the most important competitive weapon among shipyards. These terms strongly influence the economy of the shipping enterprises, although being macro-economic transfers of resources rather than technical progress lowering the cost of transports. Research to build cheaper vessels with acceptable standards should be the major effort for shipyards and the shipping industry. Innovations decreasing the crew-size may be of smaller importance considering the low share of this item in the total vessel cost. The unmanned vessel may be sience fiction more than economic priority.

Port costs and the loading and discharging costs were the other important items, particularly the costs of transport packings, including the containers. Handling costs can be slightly lowered by the use of larger units, e.g. a shift from 20 to 40 feet containers.[1] However, this does not often agree with the requirements of the consignors and results in fewer door-to-door transports. Therefore, and considering the negative experience of very large units (barges), it seems reasonable to anticipate that the size of containers in the 1980's will not change much from the standards of today.

The ro-ro technique eliminated the traditional lift-on-lift-off method and introduced the idea of wheels in shipping. Today it is difficult to point out any forthcoming invention that would lower loading and discharging costs in liner shipping to the same degree as the container and ro-ro techniques, and have the same revolutionary impact on the organization and economy of the industry. Productivity, costs and technology in liner shipping will in the 1980's remain similar to the present situation.

---

[1] Laing, 1975, pp. 14-15.

Table 1:57. Cost Structure of Liners in 1975. (Per ton carried cargo, in percentage)

Cost items	Vessel type															
	Conventional 12 500 dwt.		Cellular TEU 750		1750		2500		LASH barges 67		Ro-ro dwt. 10 000		20 000	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Capital (ship)	16	34	24	29	25	29	25	28	12	29	25	33	29	36
Capital (units)	0	0	10	12	12	14	14	15	4	9	10	12	12	14
Crew	4	8	4	5	2	2	2	2	1	3	4	6	3	3
Provisions	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M + R	1	3	2	2	2	2	2	2	1	2	2	3	2	3
Insurance	2	4	3	4	3	4	3	4	2	4	3	4	4	5
Residual	1	3	0	0	0	0	0	0	2	4	4	5	1	1
Fuel	6	20	15	32	13	30	12	30	7	23	10	22	8	20
Port charges	4	2	14	5	14	6	14	6	5	2	14	5	14	6
Cargo handling	65	26	28	11	28	12	27	13	68	25	28	11	27	12
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100

A U.K. - U.S.
B U.K. - Japan

Source: Laing, E.T., 1975, Containers and their Competitors, Liverpool.

in the 1980's. The main issues will be changes of market and political conditions which will influence the position of flags as well as firms.

ORGANIZATION OF THE MARKETS

The technical development and new trends in the maritime policy of several nations in the late 1960's and 1970's have required reorganization of the liner markets to strengthen the position of the liner industry in negotiations with consignors and governments and to avoid the development of overcapacity.

Joint Operations

As mentioned before, the introduction of containers and ro-ro techniques caused a rapid increase of the carrying capacity of the liners, and forced the companies to large investments, often beyond their financial capability, making risk reduction one of the major issues in the strategy of the liner industry.[1] Horizontal integration, often including vessel sharing, was the major form of organizational restructuring of the liner industry in the late 1960's and early 1970's. The creation of joint operations closely followed the geographic diffusion of containerization. The pattern was parallel to the restructuring of the liner industry in the 1870-1890 period. In that case also the rapid expansion of capacity, following the introduction of new technology - large steamers with triple-expansion engines - led to large investment needs and created the risk for overcapacity, pushing the development of the conference system.

In the 1960's, this system seemed too weak to meet the need for market stability and increased bargaining power, necessary for an industry facing new technology and a changed political environment. Joint operations developed as the next step in the monopolization of international liner shipping.

Four main types of joint operations can be distinguished among container lines: cartels, syndicates, consortia and joint concerns (Table 1:58). In cartels all operational activities in sea transports are performed jointly, while marketing, inland operations, investments and ownership are separate. Slot charter agreements form the organizational base for cartel operation. They assign the space reserved for each operator in every vessel. The tonnage to be supplied by each operator is determined either on the basis of past performance or according to the home market. Joint operations require a fairly homogeneous fleet as regards technical standards and economies

---

1 The Future of Liner Shipping, 1976, pp. 263-266.

Table 1:58. Cooperation Forms of Container Lines

Cooperation Areas	Cartel	Syndicate	Consortium	Joint Venture
Service scheduling	common	common	common	common
Operation of:				
vessels	common	common	common	common
terminals	common	common	common	common
Tariffs	common	common	common	common
Revenues	common	common	common	common
Name	common	common	common	common
Marketing	individual	common	common	common
Inland container operations	individual	common	common	common
Management	individual	partly common	common	common
Investment plans	individual	partly common	common	common
Ownership:				
vessels	individual	individual	individual	common
terminals	individual	individual	common	common
Examples of joint operations	Trio Group Asia Container Europe (ACE) Scan Australia Caribbean Overseas Line (CAROL)	Scan-Dutch Australia/Europe Container Service (AECS) South Africa Group	Atlantic Container Line (ACL) Associated Container Transportation (ACT) Dart Container Line Atlantica Sp. A.	Overseas Container Ltd. (OCL)

of operation, *ipso facto* a close coordination of investments although not formally included in the cartel agreements. Container cartels became most common on routes where conferences traditionally had a strong position, e.g. the Far East and the Caribbean,[1] indicating that the

[1] The largest cartels, the Trio Group and the Asia Container Europe Group (ACE) operate on the Far Eastern route, while the Caribbean Overseas Line (CAROL) operates on the route to the Caribbean.

main reason for cartels was to diminish financial and overcapacity risks rather than fear of competition from other lines and political pressure of consignors and governments.

The container syndicate, unlike the cartel, also includes marketing and hinterland operations, i.e. elements of both horizontal and vertical integration (Table 1:58), and a closer financial coordination of new investments. Some vessels may be jointly owned by the syndicate members. Consequently, a syndicate has stronger managerial cooperation than a cartel. The development of syndicates was a question not only of limiting financial risks but also of diminishing competition on the container market. Common marketing and inland operations gave better control over the total market, which strengthened the position of the syndicate against other lines and prevented the development of internal competition. The syndicates were established on markets characterized by a strong bargaining position of consignors, e.g. Australia[1] or South Africa,[2] or on markets in which the syndicate members were not in a leader position, e.g. the Scan-Dutch Syndicate in the Far East traffic which was dominated by the Trio cartel.

The consortium is the third type of joint operation in the container market. Unlike the two previous types, which are not separate enterprise units, the consortia are business firms which cover all transport operations and act as independent units in the financial market. Type and size of vessels is determined by the consortium, but the fleet is owned separately by the members. The consortium became common on routes characterized by weak conferences and keen competition, e.g. the North Atlantic.[3] It also appears as an alternative to the syndicate on routes characterized by competition between large groups and a strong position of consignors, e.g. the Australia trade.[4]

The joint concern represents the closest form of joint operation between independent lines. Besides common management of operations, it also has common vessels and financial policy (Table 1:58). While the activities of the first three types are commonly limited to one market, a joint concern may act on a world-wide basis. It can even become a partner in other joint operations, e.g. Overseas Container Ltd., a joint concern of five major British lines is a member of the Trio cartel and of the AECS syndicate. Joint concerns represent the highest possible degree of cooperation without loss of independence. The next step would be a merger. The choice between coopera-

---

[1] Scan Austral

[2] Südafrika Gruppe

[3] Atlantic Container Line and Dart Line

[4] Australia Europe Container Services (AECS)

tion in a joint concern and a merger seems to be a question of partner size, extension of other activities than those included in the joint operations, the general financial situation of the firms and the fear of diseconomy of scale arising from the merging of large lines with business distributed in several areas. The development of joint concerns is often seen as the most efficient mean for rationalization of a national liner industry, adopting new, capital-intensive techniques.[1]

Maritime Policy and the Liner Markets

As mentioned earlier, changes in maritime policy and technical innovations were the two moving forces in the reorganization of liner shipping after the mid 1960's. Political changes influenced both the organization of the liner market and the development of the national liner fleets. The latter issue is analyzed in the next section of this chapter. The maritime policies of the developing countries, the United States and the Soviet Union in the late 1960's and 1970's were corner stones in the reshaping of the political conditions regulating the international liner markets.

The developing countries after the mid 1960's increased their political pressure on the international liner industry. They required government control of the liner industry and a changed market organization. According to them the traditional dominance of private agreements as regulatory mechanisms of the liner markets was disadvantageous for the consignors and should be replaced by bilateral and multilateral government agreements. The most important international manifestation of this political change was the convention on a code of conduct for liner conferences adopted by UNCTAD in 1974. This convention was a logical consequence of UNCTAD's work in the field of shipping since the mid 1960's.[2] From the very beginning regulation of liner markets had been in the focus of the work of UNCTAD's Shipping Committee. Its first document was heavily concentrated on this issue.[3] It was followed by an intense debate between developed, developing and centrally planned economies. The main question was the optimal organization of the liner markets and the role of the conferences.[4] Several studies about conference practices, pricing and systems had

---

1 Committee of Inquiry into Shipping, 1970, p. 316; The Future of Liner Shipping, 1976, p.22.

2 Sturmey, 1974, p. 5.

3 Common Measures of Understanding in Shipping, 1964.

4 UNCTAD, 1972.

been carried out by UNCTAD in the late 1960's and early 1970's.[1] In 1972 the Shipping Committee of UNCTAD had presented a preliminary draft of a code which aimed at forming the base for international regulation of the liner industry.[2]

To counterbalance the political pressure of the developing countries, the Committee of European and Japanese Shipowners' Associations (CENSA) had in cooperation with the European Shippers' Council (ESC) prepared an alternative code on conference practices. In addition to this code, a number of joint recommendations had been issued by these organizations,[3] aiming at a voluntary regulation of the cooperation between shipowners and consignors and thereby avoiding a politicalization of the question. The developing countries had rejected the CENSA code, arguing that it was worked out without their participation and that the principle of selfregulation of markets, which formed the base of the CENSA code, did not protect the consignor's interests.[4] The developing countries had decided to formulate their own code which, together with the recommendations of the UNCTAD working group, formed the base for discussion in 1972-1974. The convention on a code of conduct for liner conferences adopted in 1974 was a compromise between the interests of developing and developed countries. Its basic objectives were: (1) to remove the arbitrary power of conferences as regards decisions about who can operate on liner markets, (2) to introduce bilateral cargo sharing agreements, (3) to increase public control over pricing in liner shipping and (4) to create a law which would form a base for settling disputes between governments and consignors on one side and the lines on the other. According to the code, all conferences should be of the open type. The flags of exporting and importing countries should each be guaranteed 40 % of the mutual trade, while the remaining 20 % should be left to competing third flags. In the case when one of the trading nations is not operating on the route, his share of the trade should be distributed among the lines in proportion to their share of the total trade. The national shares can also be passed on to other flags through bilateral or multilateral agreements. The code accepts the system of loyalty agreements between consignors

---

1 UNCTAD, 1969, UNCTAD, 1970.

2 UNCTAD, 1972.

3 Until the mid 1978, 19 recommendations were issued. They covered the following matters: port congestion, surcharges, availability of conference. They and the CENSA code were accepted by all conferences on routes between Europe and other continents, ESC, 1978, pp.7-9.

4 Sturmey, 1974, p. 8.

and lines which makes the code differ from U.S. maritime legislation. According to the code, tariffs and conference agreements should be easily available to consignors and government authorities. The conferences should produce annual reports commenting on changes in tariffs and conditions. According to the code, consultation between lines and consignors should regulate tariffs, surcharges, port classification and other conditions of trade. The national authorities should be given the right to participate in these consultations. Rates and tariffs should equally consider the interests of consignors and lines. Rate increases should be based on mutual agreements between lines and consignors and should not be changed more frequently than every ten months.

The code will enter into force six months after the date on which at least 24 states with a combined tonnage of general cargo carriers, corresponding to 25 % of the world tonnage, have ratified the documents. The base for the estimation of the tonnage was to be Lloyds' data on general carriers, container vessels and passenger-cargo carriers. The tonnage on which ratification conditions are based, thus is much larger than the actual liner fleet of the world as Lloyds' data include all types of general carriers irrespective of their employment in liner shipping or other forms of shipping. The question whether this might influence the acceptance of the code requires a detailed analysis by flag of the employment structure of the general carrier fleet.[1] Until mid 1978 the code was signed by 28 contracting parties which had 5.7 % of the world general carrier fleet. None of the major maritime powers had reached final decision about the code by the end of 1978.

In addition to this multilateral approach to the reorganization of the liner markets, many developing countries tried to increase their influence in these markets by establishing their own lines and entering into bilateral agreements which often included cargo-sharing clauses. In some cases the ambition was to completely exclude third flags from the trade, assuming that this would create a base for the expansion of the national lines. Beside national protectionism also the maritime agreements within economic blocs are important regulators of the liner markets. They should find strong support not only among national lines, but also among consignors who may consider cooperation with these lines an important marketing channel to overseas markets. Also the macro-economic balance-of-payments and employment aspects, and, in some countries, support of the national shipyard industry through orders placed by national lines are other elements which in the 1980's may make bilateral bloc-agreements the main regulatory mechanism in the deep-sea liner markets.

---

[1] For this analysis, see pp. 160-180.

The position of the EEC toward the U.N. code has not been defined as yet, because of a conflict of interest between Britain opposing the idea of the code, and Germany and France, which believe the strong home-cargo base of the Community should favor their liner industry under the rules of the code.

The main argument of the British lines against the code is based on the economy of scale in the liner services. This is particularly valid in container transports which require a concentration of cargo to a few ports. This makes a 40-40-20-sharing of cargo difficult unless the ownership of each vessel is distributed among several countries in which case it would not be easy to establish a clear relation between the flag of the vessel and its share of the national trade. The other alternatives are regional agreements or pooling of national shares. In the late 1970's pooling became one of the major issues in the shipping policy of the economic blocs, not only in the EEC but also in developing countries.

The United States continued in the 1965-1978 period its traditional policy of close control of the conferences. However, the maritime legislation of 1970 was mainly concentrated on subsidies.[1] It had only indirect influence on the organization of liner markets, but increased the competitiveness of American lines. Parallel with the discussion about the development of national lines, pressure was built up in the United States for further regulation of conference practices. In 1977 a detailed government study was published in this area.[2] It argued that conferences are discriminating monopolies which exert a restricting influence on trade and cause a waste of resources, forcing consignors to pay higher rates than motivated by costs; the low elasticity of demand for general cargo transports, particularly of high-value commodities, strengthens the bargaining position of the lines and gives the conferences a broad margin for price increases above those motivated by costs.[3] The report points out that interconference agreements, common in the North Atlantic trade, represent an increasing monopolization of the markets. It also argues that containerization has resulted in a decline of tramp competition in general cargo movements, has increased the cost of entry into the industry, and additionally strengthened the position of existing lines. The tradition of long-term contacts with the market is a major element in the "know-how" of liner shipping. Competition is very costly to newcomers as it is very time-consuming to become established on the market. The report underlines that the growing number of joint operations have increased the monopoly-power of existing lines and conferences as it is easier to effec-

---

[1] Navigation Act of 1970.

[2] U.S. Department of Justice, 1977.

[3] Ibid., pp. 214-233.

tively cartelize a small number of large multinational firms than a large number of smaller national lines.[1] In its recommendations to the U.S. Congress, the report concludes that a competitive liner market would be more effective, guarantee stability of prices and services equally well as a conference system, but decrease the risk of monopoly pricing and favor the interests of consignors.[2] European and Japanese shipowners feared that these recommendations might be accepted by the U.S. Congress and result in far-reaching restructuring of the liner routes to and from North America. The Council of European and Japanese National Shipowners' Association (CENSA) asked one of the European maritime research institutes to examine the U.S. study and leave its own recommendations about the organization of the liner markets. The CENSA study[3] concluded that indivisible costs cover a large share of total costs in liner shipping, making it different from other shipping and requiring some form of market agreement to stabilize prices and organize appropriate services.[4] This stability is beneficial to consignors.[5]

The report argues that the competition from outsiders and the low costs of entry into the liner business create necessary competition to prevent conferences from monopoly pricing. In its recommendations the CENSA-study rejects the idea of unilateral regulatory systems of the liner markets. It recommends strengthening of the conference system, including clauses on limited membership, dual rates and increased penetration into the organization of transports in hinterlands.[6]

This strong reaction of the European and Japanese shipowners against the U.S. report resulted not only from fear of changed market conditions on the North Atlantic, but also from the fear that the U.S. analysis of the conference system would stimulate other political forces attempting to reorganize the liner markets in the 1980's, especially as it was in line with the earlier critiques delivered by the developing countries and by the Soviet Union. The recommendations of the U.S. report reached far beyond the suggestions of the U.N. Code of Conduct,

---

[1] Ibid., p. 215.

[2] Ibid., p. 237.

[3] Liner Shipping in the U.S. trade, 1978.

[4] Ibid., p. 150.

[5] Conferences are not endowed with any degree of monopoly power and they charge rates that reflect real costs of supplying shipping on a long-term basis. Ibid., p. 150-151.

[6] Ibid., p. 153.

the main proposal being the liquidation of the conference system and free competition on the liner market. The latter is against the idea of cargo sharing through a bilateral agreement which creates a conflict between the American view and that of the developing countries. This conflict will strongly influence the organizational changes in the liner industry in the 1980's. The Soviet view may become a keystone in the resolution of this conflict.

The *Soviet* lines, in the 1965-1978 period, continued to operate mainly outside the conference system, which was considered a monopoly organization in conflict with the interests of consignors and developing countries. Soviet membership in some conferences is merely a matter of temporary pragmatism, not long-term changes of policy. The benefits of cross-trading can only be reached by Soviet lines with cheaper services outside the conference system, unless these lines achieve such bargaining power within the conference system that they can claim cargo shares corresponding to their development ambitions. The negative attitude of the Soviet Union, although often hidden behind positive comments at conferences, is clearly demonstrated by a decreasing share of conference operations in the total employment of the liner fleet. From 38 % in 1970 it fell to 20 % in 1977 (Table 1:59).

Four of the 14 deep-sea services in 1970 were operated within conferences. The proportion in 1977 was 9 out of 35. The Soviet Union thus in practice demonstrated its negative attitude towards the conference system by increasing its outsider operations.

The policy of Poland and East Germany was different. The share of conference-operated tonnage increased rapidly in both fleets (Table 1:59). This difference in conference policy among the Socialist countries is probably a matter of different home cargo bases and management traditions. The Soviet Union seemed to be unwilling to accept the conference system which restrains its ambition to be a great power also in the economic field. The two smaller countries seemed to accept that they must adopt themselves to international rules.

The negative attitude to conferences formed a base for mutual understanding between U.S. antitrust legislators and Soviet shipping-policy makers. However, the Soviet policy of bilateral agreements is in conflict with the American ideas about free competition in the market. It is difficult to see how these two nations could act jointly in the field of international shipping policy. In the long-run, the UNCTAD policy of bilateralism hamper the development of Soviet liner shipping, limiting its cross-trade opportunities. To counterbalance such a threat, the East European countries seem to use two strategies: (1) bilateral maritime agreements with developing countries lacking domestic lines which transfer the role of national carrier to the East European fleet; (2) creation

Table 1:59. Participation of East European Lines in Conference Traffic

		No. of conference services	Total no. of deep-sea services	Tonnage in conference traffic, '000 dwt.	Percentage of total deep-sea liner tonnage, '000 dwt.	Cargo carried by conference tonnage, '000 dwt.	Percentage of total cargo carried by deep-sea liners, '000 dwt.
East Germany	1970	2	11	71	14	377	12
	1977	8	10	706	81	1 175	82
Poland	1970	4	13	301	37	840	32
	1977	8	12	684	83	2 298	86
Soviet Union	1970	4	13	255	36	603	26
	1977	9	35	482	20	1 132	12

Source: TGM, 1978:10, pp. 588-591.

of joint services between East European lines with lines of developing countries and with lines of developed nations. In the short-run, these operations also increase the bargaining power in conferences of the East European lines.

Bilateral regulation of shipping, according to the Soviet Union, should create greater stability on markets, i.e. make the foreign operations of the East European fleets more adaptable to the planned economy. It should also give the East European countries a better market position. They can merge shipping proposals in bilateral negotiations with other matters considering trade and industrial cooperation. A similar merging of interests is more difficult to reach for the market economies as government and business are independent systems, and government negotiators cannot reach agreements with purchase- or delivery-obligations for private industry.

The development of joint operations among East European lines started in the mid 1960's. The chief reasons were: to increase the bargaining power in conferences, to create a larger cargo base, and to utilize marketing and administration better. The number of joint operations increased rapidly in the late 1960's but stagnated afterwards (Table 1:60). About one quarter of the total deep-sea liner tonnage of the East European lines was employed in joint services. Roughly one-tenth of the tonnage was used in joint operations with developing countries and 2-3 % in joint services with lines of developed market economies. The latter share in the volume of cargo was 7-8 %, i.e. the tonnage productivity in these services was eight times that of services run jointly with developing countries, and four times that for the joint services between the East European lines. For the East European liner industry, close cooperation with lines from the industrialized countries gives better tonnage utilization than other types of joint services. This experience may cause a partial change in the maritime policy of Soviet Union in the 1980's, making it more inclined for closer cooperation with established lines and the conference system. However, a change of maritime policy would have far-reaching repercussions on the general and military policy of the Soviet Union in its relations with the Third World.

Conclusions and the Future

The technical and political developments in the late 1960's and early 1970's formed the base for far-reaching organizational changes of the international liner markets. Main elements were: (1) an increasing role of joint operations, (2) growing bilateralism limiting the cross-trade market, (3) political pressure to restrict the power of conferences, and (4) growing influence of the Soviet lines on the organization of the international liner markets. These

Table 1:60. Joint Operations of the East European Lines

Type of cooperation		No. of joint services	Total liner services	Tonnage employed in joint services, '000 dwt.	% of total liner tonnage	Cargo carried in joint services, '000 tons	% of total liner cargo
With other East European countries	1970	13	93	608	24	3 577	22
	1977	9	141	1 164	22	4 595	20
With developing countries	1970	5	93	262	10	1 581	10
	1977	9	141	625	12	1 398	6
With developed countries	1970	10	93	66	3	1 245	8
	1977	14	141	91	2	1 587	7

Sources: TGM, 1975:10, pp. 584-586 and 1978:10, pp. 590-591.

tendencies at many points are in conflict, e.g. the U.S. policy of increasing competition versus bilateralism, or the Soviet expansion in cross-trading versus the Code of Conduct, etc. These conflicts will probably continue to exist in the 1980's. Negotiations at government or regional-bloc level will probably to a large extent replace the role of conferences as the major regulatory mechanism in liner shipping. On the other hand, the role of joint operations should increase as regards operational and tactical decisions, e.g. choice of tonnage, design of services, etc. Pricing and conditions of shipments will increasingly become a subject for direct negotiations between consignors and lines. Consequently, the role of conferences should decline in comparison with previous periods.

NATIONAL LINER FLEETS AND FIRMS

After the mid 1960's the division of international shipping into five political blocs, increasingly influenced competition in the liner markets and *ipso facto* the development opportunities of national fleets and firms. The technical development in the late 1960's and 1970's caused a diversification of the previously fairly homogeneous general carrier fleet. Four main vessel types could be distinguished: conventional carriers, cellular vessels, ro-ro vessels and ferries.

Conventional carriers were still the dominating vessel type in deep-sea liner shipping in the late 1970's. As these vessels can be used alternatively in liner, tramp or industrial services, it is not possible to state precisely the size of the world liner fleet. Also national maritime statistics are unprecise as regards vessel classification by employment. They may be misleading in international comparisons. The division of conventional carriers into singledeck and multideck vessels introduced in Lloyd's statistics in 1977 helps to outline more exactly the size of liner fleets after that year. However, even these data are an approximation. Multideck carriers may be employed in other than liner services. They accounted for 67 % of the world general carrier tonnage in 1978, but there is no evidence that this proportion was the same in earlier periods. No attempt has been made to break down the available data for earlier periods into multideck and singledeck tonnage. The following analysis is approximate as regards size and structure of the liner fleets. The share and employment of multideck vessels may vary considerably between flags.

Liberalists

In the mid 1960's about 40 % of the world's general carrier fleet was operating under the flags of the European OECD countries (Table 1:35). In 1978 the share of the West European flags had declined to 32 % which was one of the basic reasons for the gradual changes in the political conditions on the liner market.

The decline of the West European general carrier fleet was a result of the rapid decrease in the tonnage of conventional carriers (Table 1:60). The container and ro-ro fleets under these flags showed slower growth than the world averages, which further weakened their position in the international liner market. The position of individual flags in the OECD bloc changed significantly between 1965 and 1978 (Table 1:35 and 1:60). National assistance programs, cost differences, size and structure of the home cargo base and managerial abilities in individual firms were the main elements that caused these changes. As previously shown for the 1970's, capital, cargo handling, and fuel were the main cost components in the operation of liners.[1] The share of crew costs decreased with growing capital intensity of the industry. Of these components the capital and crew costs vary between flags, while the others are highly flag independent. The costs of capital may be influenced by three factors: (1) investment financing assistance, i.e. low interest loans, loan and interest subsidies and loan guarantees; (2) tax allowances, i.e. depreciation allowances, tax free reserves, and tax exemptions; and (3) direct subsidies, i.e. operational and construction aid to the lines.

The British flag showed the largest decline in the general carrier fleet among all OECD countries (Table 1:60). Its innovation efforts were concentrated to cellular vessels. Financial assistance per ton of British shipping was slightly below that for the other major European fleets in the early 1970's, Norway being the exception (Table 1:61). Modernization of the fleet was stimulated through decreased capital costs, direct subsidies being the main form. They took the form of cash investment grants, which in the 1965-1970 period covered one-fifth of the costs for ships purchased for registration under the British flag.[1] In the 1970-1975 period the average yearly value of these grants reached U.S.$ 190 million or $ 53 per gross ton of newbuildings, which resulted in a rapid modernization of the British conventional general carrier fleet. In 1978 it reached an age structure equal to that of several other OECD fleets, i.e. the situation had changed significantly compared with that in 1965 (Tables 1:35 and 1:60). The

---

[1] The Maritime Aids, 1977, p. III-16.

Table 1:61. General Carrier Fleet (million gross tons)

Conventional

Flag	1970	1974	1978 Total a	1978 of which m-deck b	% b	Average age years	Annual growth rate	On order 1.1.79 mdwt.
World	72.4	68.7	78.0	60.4	100	14	1.0	10.1
OECD Europe	28.9	24.8	24.4	21.3	35		-2.0	3.4
Greece	4.5	6.4	9.4	8.1	13	18	9.6	0.8
U.K.	7.5	5.0	3.8	3.1	5	12	-8.1	0.4
W. Germany	4.1	2.7	2.7	2.4	4	9	-5.1	0.5
Norway	2.5	2.0	1.5	1.2	2	12	-6.2	0.5
France	1.4	1.3	1.5	1.4	2	12	0.9	0
Italy	1.5	1.1	1.1	0.9	1	20	-3.8	0.2
Netherlands	2.4	1.9	1.6	1.3	2	12	-4.9	0.3
Denmark	1.2	1.1	1.1	0.9	1	8	-2.2	0.3
Sweden	1.3	1.1	0.9	0.7	1	11	-4.5	0.1
Developing	9.5	12.2	15.0	14.0	23		5.9	3.0
India	1.2	1.3	1.8	1.6	3	14	5.2	0.4
Brazil	0.8	1.0	1.2	1.0	2	13	5.2	0.5
Socialist	9.5	10.6	14.3	8.8	15		5.3	1.6
USSR	5.9	6.9	7.5	4.9	8	12	3.0	0.7
Poland	1.0	1.1	1.3	1.2	2	11	3.3	0.2
China	0.7	1.3	2.8	2.6	4	21	18.9	0.3
Yougoslavia	0.9	1.0	1.2	1.1	2	15	3.7	0.1
Convenience	6.2	10.7	15.6	10.8	18		12.2	1.3
Panama	1.6	3.7	7.6	4.6	8	15	21.5	0.3
Liberia	3.4	3.4	3.8	2.7	5	12	1.4	1.0
Singapore	0.3	1.3	2.2	1.8	3	16	28.3	0.1
Cyprus	0.9	2.3	2.0	1.7	3	21	10.5	0
Non-European Developed	18.3	10.4	8.7	5.5	9		-8.9	0.7
Japan	7.4	5.4	4.3	1.6	3	9	-6.6	0.6
U.S.	9.9	3.9	3.5	3.3	5	16	-12.5	0.0

(continued)

Table 1:61. (continued)

Cellular

Flag	1970	1974	1978	%	Annual growth rate	On order 1.1.79 mdwt.
World	1.9	6.3	8.7	100	21.0	2.8
OECD Europe	0.8	2.9	4.1	47	18.4	0.8
Greece	0	0	0	0	0	0
U.K.	0.4	1.4	1.8	20	19.8	0.1
W. Germany	0.2	0.6	0.9	10	20.7	0.1
Norway	0.1	0.1	0.1	1	0	0
France	0	0.1	0.3	3	20.0	0.2
Italy	0	0.1	0.2	2		0.1
Netherlands	0	0.2	0.2	2	25.7	0.1
Denmark	0.1	0.2	0.5	6	0	0.1
Sweden	0.1	0.2	0.1	1	0	0
Developing	0	0.1	0.6	7		0.7
India	0	0	0.0	0		0
Brazil	0	0	0.0	0		0
Socialist	0	0	0.2	2		0.2
USSR	0	0	0.2	2		0.2
Poland	0	0	0	0		0
China	0	0	0	0		0
Yougoslavia	0	0	0	0		0
Convenience	0	0.2	0.7	8		0.3
Panama	0	0	0.2	2		0.1
Liberia	0	0.2	0.3	3		0.2
Singapore	0	0.1	0.2	2		0.2
Cyprus	0	0	0	0		0
Non-European Developed	1.2	3.1	3.3	38		0.8
Japan	0.2	1.0	1.3	15	26.4	0.0
U.S.	0.9	1.9	1.7	20	8.3	0.8

(continued)

Table 1:61. (continued)

Ro-ro[c]

Flag	1976	1978	%	On order 1.1.79	Cellular and ro-ro vessels share of general carrier tonnage
World	1.3	2.0	100	2.1	15
OECD Europe	0.7	1.1	55	0.9	20
Greece	0	0	0	0	0
U.K.	0.2	0.3	15	0.1	40
W. Germany	0.1	0.1	5	0.1	30
Norway	0.1	0.1	5	0.3	14
France	0.1	0.2	10	0.1	26
Italy	0.1	0.1	5	0.1	25
Netherlands	0	0	0	0.0	13
Denmark	0	0	0	0.0	36
Sweden	0.1	0.2	10	0.3	30
Developing	0.1	0.2	10	0.1	5
India	0	0	0	0	0
Brazil	0	0	0	0.0	0
Socialist	0.1	0.1	5	0.9	3
USSR	0.1	0.1	5	0.2	6
Poland	0	0	0	0.4	0
China	0	0	0	0	0
Yougoslavia	0	0	0	0.0	0
Convenience	0	0	0	0.1	6
Panama	0	0	0	0.1	4
Liberia	0	0	0	0.0	10
Singapore	0	0		0	10
Cyprus	0	0	0	0	0
Non-European Developed	0.3	0.5	25	0.1	41
Japan	0	0.1	5	0.0	47
U.S.	0	0.3	15	0.1	38

a Million dwt.
b Including specialized break bulk cargo carriers e.g. reefers, car carriers etc.
c Deep sea and short sea carriers
d 1976 averages
e Conventional multideck vessels, cellular and ro-ro carriers

Sources: Lloyd's Register of Shipping, Statistical Tables 1970-78, London. Statistics of Shipping, Yearbook 1977 and No. 09, 1978, Bremen. Fairplay 16.2.1979, U.S. Maritime Administration.

Table 1:62. Assistance Programs to Major Fleets 1971-1975

Items		U.K.	Norway	Japan	Sweden	France	W. Germany
Investment Financing Assistance	Yearly average, million $	28	a	101	4	64	2
	Range, million $	24-38		90-106	3-4	64-64	2-3
	Average per gross ton, $	0.9		2.8	0.7	7.6	0.2
	Trend	increase		level	increase	level	increase
	Forecast	increase	increase	decrease	increase	decrease	increase
Tax Allowances	Yearly average, million $	101	269	83	125	36	32
	Range, million $	73-120	198-333	0-167	35-296	35-37	32-32
	Average per gross ton, $	3.3	9.0	2.3	20.8	4.3	3.9
	Trend	variable	variable	variable	variable	level	level
	Forecast	decrease	decrease	decrease	decrease	decrease	decrease
Direct subsidies	Yearly average, million $	191	0	0	0	21	64
	Range, million $	94-254				6-42	22-110
	Average per gross ton, $	6.3 (530)[b]				2.5 (20)[b]	7.7 (64)[b]
	Trend	decrease				increase	variable
	Forecast	decrease				increase	decrease
Total	Yearly average, million $	320	269	208	128	121	99
	Range, million $	234-381	198-333	104-357	39-300	107-142	56-145
	Average per gross ton, $	10.6	9.0	5.8	21.3	14.4	11.9
	Trend	variable	variable	variable	variable	increase	variable
	Forecast	decrease	decrease	decrease	decrease	increase	decrease

a Introduced in 1976
b Per gross ton of newbuildings

Source: The Maritime Aids of the Six Major Maritime Nations, 1977, U.S. Dep. of Commerce, Washington, D.C.

policy of the British government was to replace direct subsidies by tax allowances and investment financing assistance. These two forms were more in agreement with the *laissez-faire* ideology of the British maritime policy. The average tax allowances per gross ton of the British fleet in the 1970-1975 period were lower than in other OECD countries. The main form was a free depreciation schedule, but capital gains were taxed as in all other industries, i.e. shipowners were forced to reinvest the same year they sold a vessel, which limited their opportunities to speculate in best new ordering times. Tax allowances are a significant financial assistance only to an industry that shows profit. Major British lines had low profitability in the early 1970's,[1] which meant that tax allowances could not be fully used. Therefore, the government in 1972 introduced the investment financing assistance to the shipping industry in the form of government loan guarantees for newbuildings. By 1976 the government's risk exposer through these guarantees reached U.S.$ 1 800 million, i.e. $ 500 per gross ton newbuilt vessels. By the mid 1970's the profitability of the major British lines had reached the international level (Table 1:62). The government then started to reduce the investment financing assistance to the industry as similar results could be reached through tax allowances.

Beside financial assistance the British lines enjoyed the advantage of low labor costs, both for administration and crews. International comparative data are not available on administration costs in the liner industry. Proportion between office and aboard employed vary between lines. On average it can be estimated at 1:3. Assuming that wages for office staff are slightly above those for aboard employed and considering other office costs, the total administration costs in liner shipping can be estimated at 5-10 % of the total operation costs of a container line. Office wages in the late 1970's were generally lower in Britain than in most OECD countries. It is reasonable to assume that this was the case also in the liner industry. International differences in crew costs were better known than administration costs. British costs were considerably below the Scandinavian and West German levels and for ro-ro carriers even below the standards determined by the International Transport Federation (Table 1:63)

Growing capital needs and overcapacity risk stimulated British lines toward increased cooperation either through joint operations or mergers. As a result, the largest British lines in the mid 1970's operated 70 or more general carriers, much above the levels of the 1950's and 1960's (Tables 1:40 and 1:62).

The future development of the British liner industry will primarily depend on its technical progress, cost advantages, market position and organizational flexibility.

---

[1] Committee of Inquiry into Shipping, 1970, p. 114.

Table 1:63. Operating Results of Main European Lines, 1975-1976 (million dollars)

Line		All Vessels		General Carriers										
		No.	'000 gross tons	No.	'000 gross tons	Gross revenue	Operating profit	Other gains/ losses	Depre-ciation	Taxes	Net earnings	Operating profit 1000 g.t.	Depre-ciation 1000 g.t.	Net earnings/ 1000 g.t.
P & O	1974	148	2 498	91	1 050	1 085	157	17	59	14	101	63	24	40
	1975	145	2 438	99	1 180	1 620	134	-40	73	20	1	55	30	0.4
	1976	132	2 299			1 254	154	-38	59	19	38	67	26	17
Ocean Transport of Trading	1974	124	1 456	80	862	678	81	23	38	36	30	55	26	21
	1975	104	1 263	75	750	634	63	20	32	21	30	50	25	24
	1976	99	1 211	72	731	647	67	20	30	34	24	56	25	20
Brit. Comm. Shipping	1974	41	600	31		278	45	7	21	16	15	75	35	25
	1975	34	531	27	224	300	38	12	22	7	21	72	42	40
	1976	30	474	22	201	369	41	12	22	10	21	87	47	45
HAPAG-Lloyd	1974	56	808	60	900[a]	733	76	0	48	18	10	95	60	12
	1975	59	900			691	67	0	46	15	6	74	51	7
	1976	57	1 084			793	87	0	57	20	10	81	53	9
Netherlands Scheepvaart Unie	1974	146	2 239[a]			939	184	-13	81	30	63	82	36	28
	1975	139	2 638[a]	110	1 457	821	118	5	73	9	41	45	28	16
	1976	130	2 653[a]	103	1 391	955	140	7	85	16	46	53	32	17
Wilhelm Wilhelmsen	1974	61	2 245[a]			313	57		40	4	9	25	17	4
	1975	62	2 247[a]	33	477[a]	329	60		41	4	3	27	18	1
	1976	62	2 359[a]	31	456[a]	346	65		47	2	2	27	20	1
Broströms	1974	67	1 501	39	403[a]	313	86	-54	38	0	-6	57	25	-4
	1975	61	1 365	40	448[a]	406	37	18	55	2	-2	27	40	-1
	1976													
Trans-atlantic	1974	22	277[a]	23	250[a]	91	21	-4	17	0	1	75	60	4
	1975	24	423[a]	21	251[a]	98	15	3	12	0	0	35	29	0
	1976	20	419a	17	221[a]	127	15	3	16	1	1	36	38	2

a Deadweight tons.

Sources: Annual Reports of the Companies' World Shipping Yearbook, 1975-76, 1977; The Financial Times, London. Fairplay World Shipping Yearbook 1978, A Financial Times Publication, London.

Table 1:64. Crew Size and Costs, 1977

Flag	Crew Coefficients[a]				Costs per month, U.S. $ 000		
	Officers		Seamen		Conventional[b]	Cellular	Ro-ro
	Cellular	Ro-ro	Cellular	Ro-ro			
Sweden	2.1	2.0	1.7	1.8	76	84	43
Netherlands	1.7	1.7	1.6	1.6	..	64	63
West Germany	1.4	1.4	1.4	1.4	..	65	49
United Kingdom	..	..	..	..	46	..	33
ITF	1.1	1.1	1.1	1.1	33	65	43

a Crew coefficients show how many people are required for each position on board, including stand-by men.
b 1976.

Sources: SOU 1976:44, Sjöfart och Flagg,
Sjöfartspolitiska Utredningen, Promemoria 1979-01-30

Hitherto the modernization of the tonnage has been highly concentrated to cellular vessels. However, in the late 1970's the ro-ro tonnage increased considerably. In 1979 the ro-ro tonnage ordered by British lines equalled their orders for cellular vessels (Table 1:60). It indicates an increased diversification of the British liner fleet in the coming years, which should strengthen its international competitiveness. It is difficult to foresee changes in government financial assistance and in the wage policy. The tendency of substituting tax allowances for subsidies and financial guarantees might result in increased capital costs and provide lower profitability, which in turn might slow the modernization process. On the other hand, aid to the national shipbuilding industry may be more restricted to primarily favor the orders of the domestic shipowners, which would decrease the capital costs of British lines. The market position of the British lines in the 1980's should not be weakened, provided a political agreement can be reached within the EEC, recognizing the special role of United Kingdom as the main supplier of shipping services to the whole Community. This may prove difficult, considering the growth ambitions of other Community flags. The attitudes of West Germany and France will be the key elements in designing the EEC shipping policy.

Liner shipping traditionally was an important element in the export expansion of the German industry. It played that role prior to both the First and the Second World War. After a rapid expansion in the 1950's and 1960's,[1] the German general carrier fleet in the 1970's showed a significant decline in the tonnage of conventional carriers, like the rest of the OECD flags (Table 1:60). The development of the container fleet was slower than the British but more rapid than other West European fleets. In 1974 cellular vessels corresponded to 22 % of the German conventional tonnage. The same number for Great Britain was 28 %. It varied between 10 and 18 % for other OECD countries (Table 1:60). This rapid modernization of the German liner fleet was supported by the government through direct subsidies, tax allowances and, to a minor extent, by investment financing assistance. Construction and interest subsidies for new tonnage were by far the most important aid forms (Table 1:61). In the early 1970's they reached up to 10 % of the total costs of new vessels registered under West German flag. After 1975 their share increased to 17 % of the new-building price.[1]

The German new-building subsidies were small compared with the British, about U.S.$ 64 per gross ton, only one-tenth of the British aid. Favorable depreciation rules, 40 % of a vessel's value could be written-off in the first

---

[1] Maritime Aids, 1977, p. VI-13.

year, and deferred taxes on capital gains when vessels were sold, were other important aids. Measured per gross ton they equalled the British levels. As in Great Britain, investment financing assistance was the smallest but an increasing aid to shipping. It was the most acceptable form of aid, consistent with the general liberalism of the West German trade and maritime policy. It was also easier to merge with the aid to the shipbuilding industry. The total financial aid of West German shipping was slightly above the British and Norwegian levels but below those of France and Sweden. It seemed to have, as regards technical standards, positive effects on the German general carrier fleet, as it was one of the youngest in Europe in the late 1970's. Cellular and ro-ro vessels in 1978 made up 30 % of the general carrier tonnage, one of the highest percentages in Western Europe (Table 1:60).

Deep-sea liner shipping in Germany has traditionally been concentrated to few firms with HAPAG and Norddeutscher Lloyd as the two leaders. Their interwar merger was partly unmade after World War II, but increasing international competition called for its renaissance in 1970. This brought together about one-third of the West German general carrier tonnage (Tables 1:60 and 1:62). The new group applied the policy of extremely high depreciations to create resources for a continuous fleet modernization.

The increasing capital costs could partly be counterbalanced by government assistance, but the German lines in the 1970's also faced a growing labor-cost problem, which partly was eased by rather liberal rules about the size of the stand-by crew (Table 1:63), but they did not help much against the growth of administration costs.

The future of the West German liner fleet will depend on government policy within the EEC and international regulations of cargo preference practices. Growing capital costs can be counterbalanced by financial assistance from the government, but the continuous revaluation of the Mark and increasing labor costs, particularly on the administration side, are serious threats. However, they can be counterbalanced by cargo preferences provided German lines can prove that they are important marketing channels for the national exports.

Scandinavian and Dutch flags form the third important group in the bloc of OECD countries. The fleets under these flags are strongly export oriented. As in Britain, Liberalism is the guide line of the maritime policy of these nations. The conventional general carrier tonnage showed a rapid decline both in Scandinavia and the Netherlands (Table 1:60). Cellular vessels dominated in the modernization of the Dutch and Danish fleets. Norway and Sweden chose the ro-ro technique. This difference in the modernization strategy is difficult to explain, particularly among Scandinavian lines who have a long tradition of joint services on the same routes where they have had similar experiences.[1] Growing capital intensity of the liner industry and increasing competition on the markets forced the Scandinavian lines to increase cooperation. They formed cartels (Scan Austral), syndicates (Scan Dutch), and consortia (HCL).

High labor costs in the late 1960's and particularly in the 1970's became the main economic drawback of the Scandinavian and Dutch lines. Crew size required by legislation and by trade union agreements was higher than in West Germany or in ITF regulations (Table 1:63). The high income level made Sweden the leader of the crew cost statistics. Even more pronounced were the administration costs, as the seaman tax was much lower than average income tax in the country. To counterbalance the high wages and salaries, these countries applied favorable rules for tax allowances (Table 1:61). Their fleets were modern with ro-ro and cellular carriers in 1978 accounting for 36 % of the Danish and 30 % of the Swedish general carrier tonnage (Table 1:60).

The Danish, Swedish and Dutch liner industries were highly concentrated. In the Netherlands NSU, the leading group, controlled about 70 % of the national general carrier tonnage (Tables 1:60 and 1:62). In Denmark the two leading lines, AP Møller and East Asiatic Co., controlled 60 %.[2] The situation was similar in Sweden (Tables 1:60 and 1:62). The high degree of concentration promoted international cooperation of these lines and gave them a stronger cargo base in their home markets.

The future development of the Scandinavian and Dutch lines will depend on their ability to meet increasing capital and labor costs and to secure a sufficient cargo base. Tax allowances traditionally have been the main aid for capital accumulation. Declining profitability limits the power of this assistance. Other forms of financial aid must then be increased to equal the conditions of other flags as regards costs of capital. To secure a sufficient cargo base, the Norwegian and Swedish lines will probably have to ask for government assistance in the EEC negotiations. The Dutch and Danish lines will probably follow the policy of the British, i.e. try to strengthen their position as transport suppliers to the whole Community. Rotterdam's and Amsterdam's role as major European liner ports may give some strength to the Dutch requirements in that context.

A second method to secure a greater cargo base is a further increase of joint operations with foreign lines, particularly in the developing countries. The aim should

---

[1] See pp. 48-49.

[2] Søfart Foreningen, 1975, p. 11.

be to get the status of national carrier in those countries. Government assistance will be necessary in such negotiations to meet similar efforts from other "cross trading" flags, particularly those of Eastern Europe.

The third method is a closer vertical integration between lines and export-import companies, i.e. the merchant house model. Scandinavian lines should have strong marketing potentials in the export promotion of small and medium sized industries, giving them a stronger position in their home market. Two large Scandinavian lines are operated as integrated parts of merchant houses, which seems to give them several advantages.[1]

Interventionists

The maritime policy of non-European developed countries in the late 1960's and 1970's was characterized by various forms and degrees of state interference. The aim was not only to protect the interests of national consignors through the regulation of liner markets but also to support the development of national lines.

The Japanese interference was mostly indirect and much less pronounced than that of other countries in this bloc. The Japanese fleet of general carriers in the 1970's was strongly dominated by single deck vessels, i.e. considerably differed from the structure of other "developed flags" (Table 1:60). Much of the Japanese general carrier tonnage thus was employed outside the liner market. In 1978 Japan was third with her cellular fleet, while her deep-sea ro-ro tonnage was very limited. Japan was the only developed maritime country that in 1979 showed no orders for this tonnage. The Japanese liner industry seems to be strongly convinced of the economic superiority of the cellular technique in deep-sea shipping, in spite of the rapidly growing role of the ro-ro technique in the coastal shipping of the country.[2]

The decrease of the Japanese conventional carrier fleet was not only a question of modernization but also of a policy to adopt the rapidly increasing costs of operations under the Japanese flag. After 1972-1973 Japanese operators have increasingly used chartered vessels. Their proportion in 1976 reached 45 % of the total operated tonnage and 31 % as regards liner services.[3]

To meet the growing competition from cheap flags of South East Asia, the Japanese firms have applied the policy of a continuous modernization of their tonnage. The

---

1 Norwegian Shipping News, 1978.

2 Mayer, 1978, pp. 39-42.

3 Shipping Statistics, Yearbook 1977, p. 130.

concentration of the industry into six major consortia, the result of a reorganization in the early 1960's,[1] formed a powerful financial and organizational base for the modernization process. The Japanese cellular fleet registered the highest growth rate in the world (Table 1:60). The six operators were given strong investment financing assistance through loans covering all new-building costs at rates 50 % below the prime rate of the country.[2] Under international pressure the Japanese government in 1970 increased the level of self-financing required from shipowners, but in the mid 1970's it was still no more than 10 % of the total new-building costs of a conventional carrier and 5 % for container and ro-ro vessels. Tax allowances were other important forms of financial assistance to shipping (Table 1:61). However, measured per gross ton they were much lower than for other major OECD fleets. The level of the total financial aid to the Japanese shipping industry was below the European averages measured per gross ton of the operated fleet (Table 1:61), but it was to some extent compensated by indirect marketing aid. Although no formal flag discrimination exists in Japan, the government encourages national consignors to export cif and import fob. Close organizational links between the lines and the merchant houses that dominate Japanese imports and exports, and the government's control of the conference practices[3] form this additional and indirect marketing aid, which supports the national liner industry. Its future development will strongly depend on Japan's foreign trade with general cargo. World pressure on Japan to reduce export surpluses is a threat to the industry as it would reduce its cargo base. Growing competition from cheap flags and the difficulties of the national shipbuilding industry will probably result in increased financial aid to shipping, maybe through direct subsidies, which until now have not been used. The degree of self-financing is already low and a further decline would not be of much help. The profitability of the industry is decreasing and the low price for second-hand tonnage limit the advantages of tax allowances.

The U.S. fleet of conventional carriers showed a rapid decline in the late 1960's and early 1970's, a result of massive scrapping of the war-built tonnage that had been kept in mothballs. In 1978 about 50 % of the U.S. registered conventional general carriers were inactive,[4] i.e. formed a military reserv. The active fleet of U.S. registered general carriers in the late 1970's was technically

---

[1] See pp. 108-110.

[2] Maritime Aids, 1977, p. II-15.

[3] See pp. 86-87.

[4] Shipping Statistics, 1978:1, p. 33.

the most advanced among all flags; cellular carriers accounted for 50 % and the deep-sea ro-ro vessels for 9 % (Table 1:60). This high technical standard was based on substantial operational and construction subsidies to U.S. shipowners (Table 1:64). The subsidies were concentrated to a limited number of lines, 12-13, which in 1970 operated 247 liner vessels. The non-subsidized lines operated 110 liners in the same year.[1] Among the latter was Sea-Land, the major operator of container tonnage under the U.S. flag. Out of 97 U.S. registered cellular carriers in 1978, 45 were operated by Sea-Land.[2] It shows that U.S. lines can be competitive even without subsidies. They could also use tax allowances to create special funds for fleet modernization. The Maritime Act of 1970 to some extent limited the subsidies, but extended the system of tax-exempt reserv funds available for liner operators.

Table 1:65. Financial Aid to U.S. Shipping

Differential Subsidies	Cumulated Total 1965-1970, million $	Yearly Average per dwt., $
Operating	1 174	15.6[a]
Construction	531	870.5[b]

a Per dwt. of the privately owned fleet
b Per dwt. of newbuildings

Source: Kilgour, J.G., 1975, The U.S. Merchant Marine, New York, p. 88. Jantscher, G.R., 1975, Bread upon the Waters, Washington D.C., pp. 17-68.

The capital costs are high not only because of the increasing capital intensity of the industry, but also as a result of the requirements to build in U.S. yards which have 40-50 % higher costs than those in other developed countries.[3] The disadvantage of high labor costs have been the main reason for the operation subsidies under the U.S. flag. Able seaman wages in 1970 were nearly two and a half times the level in Norway, five times that of Greece and seven times the Hong Kong level.[4] Therefore, a vast number of U.S. shipowners operated under foreign flags, particularly under flags of convenience. Until the late 1960's, it was

1 Kilgour, 1975, pp. 71-81.

2 Fairplay Shipping Yearbook 1978, p. 190.

3 Kilgour, 1975, pp. 197-199.

4 Ibid., p. 10.

mainly the tanker and dry bulk tonnage, but during the 1970's their share in the world general carrier fleet increased rapidly, strongly concentrated to the flag of Panama (Table 1:60). U.S. operators dominated in these registrations.

The future of the U.S. registered general carrier fleet to a large extent will depend on the aid to the industry and on protectionistic tendencies in world shipping. Political *status quo* in maritime transports will probably result in increased operations of U.S. lines under flags of convenience. The liberal maritime policy of the U.S. government strongly supports this situation as it rejects any form of link between home cargo base and the flag of a vessel, both as regards conference agreements and government regulations. Increased protectionism would force U.S. operators to register vessels under the home flag, i.e. substantially increase their cost, but on the other hand, it would guarantee them a big share of the seaborne general cargo trade of the world.

The East European Fleets

The East European general carrier fleets developed rapidly in the late 1960's and 1970's (Table 1:60). Until the mid 1970's, there was no cellular ro-ro tonnage in these fleets, i.e. their technical standard was considerably below the requirements of consignors from most developed countries. However, in the mid 1970's the situation changed. Both the Soviet Union and Poland realized the advantages of the ro-ro technique and started to rapidly modernize their fleets. In 1979 Poland was the leader as regards the size of ordered ro-ro tonnage (Table 1:60). In other words, the technical disadvantage of the East European lines which strongly has limited their competitiveness, particularly in the early and mid 1970's, when low prices no longer could totally counterbalance the consignors' requirements for certain technical standards, will start to disappear. The other element that has increased the competitiveness of these fleets is a growing know-how about liner business, much of which is time-consuming market contacts. The 1960's and early 1970's can be described as the introduction and learning period of the East European lines. Since the mid 1970's their market knowledge seems to be sufficient to compete for cargo on all deep-sea routes.

No data are available about the volume of cargo carried by these lines on individual markets, but OECD estimates indicate a particularly rapid growth of traffic to developing countries lacking domestic fleets, e.g. East Africa, and on the North Atlantic where the antitrust U.S. legislation gives great expansion opportunities for low-pricing Soviet lines (Table 1:65). The total cargo volume carried by the Soviet lines more than doubled between 1970 and 1977, while the movements of the Polish and East German lines remained

Table 1:66. The COMECON Deep Sea Liner Industry

	COMECON		USSR		Poland		East Germany	
	1970	1977	1970	1977	1970	1977	1970	1977
Fleet								
Vessel, no.	426	695	132	349	150	156	89	115
Capacity, '000 dwt.	2 523	5 322	870	2 955	854	978	525	903
Deep Sea Liner Services								
Number of services	44	64	13	35	13	12	11	10
Capacity, '000 dwt.	2 228	4 540	705	2 463	810	817	507	878
of which								
Container services								
Vessel no.	0	26	0	21	0	5	0	0
Capacity, '000 dwt.	0	308	0	260	0	48	0	0
Ro-ro services								
Vessel, no.	0	4	0	4	0	0	0	0
Capacity, '000 dwt.	0	25	0	25	0	0	0	0
Performance of the Deep Sea Lines								
All markets, th. tons	10 541	14 678	4 121	9 166	3 123	2 665	2 590	1 426
North Atlantic, th. tons			0	402[a]				
% of total traffic			0	4.4[a]				
Trans-Pacific, th. tons			153	410[a]				
% of total traffic			2.9	7.0[a]				
Europe-East Africa								
% of total, southbound				16[a]				
% of total, eastbound				8[a]				
Europe-Far East								
% of total								
Transsiberian Railway				8[a]				
Sea Lanes				2[a]				

a January-June, 1977.

Sources: Maritime Transport, 1977, OECD, TGM, 1975:10, 1978:10.

fairly constant until 1976.[1] They declined substantially in 1977 (Table 1:65).

The competitiveness of the East European lines was traditionally based on (1) a strong home cargo base through a trade reservation system (cif-exports and fob-imports), (2) low capital costs as most of the liners were supplied by either domestic shipyards at costs determined by political priorities rather than by world prices, or by foreign yards at favorable agreements based on government-to-government long-term credits, (3) low fuel costs and (4) low labor costs both for crews and administration. All these elements, except for the favorable government-to-government credits, will remain unchanged in the 1980's, i.e. the competitiveness of the East European lines should increase. Increasing foreign currency in debtedness of the East European countries required intensified exports. Shipping seemed to be among the industries which may successfully compete in the world markets. The development of domestic lines means decreased foreign currency expenditures and could create new marketing opportunities for export industries through the networks of overseas agents. The lines politically form an important link in the relations with the developing countries. The ro-ro technique makes the fleets particularly useful for military planning, probably an important reason for the rapid growth in the late 1970's.

In the earlier section of this chapter it was pointed out that the development of the East European lines in cross trading is in conflict not only with the interests of other lines but also with the protectionistic tendencies of the developing countries and that the latter conflict might be solved through bilateral maritime agreements. Therefore, the future growth of these lines will be a question not only of their comparative advantages but also of the ability to reach agreements with governments in the developing countries. To ensure the development of their lines, the East European countries will have to convince the developing countries about the economic superiority of their services over the alternatives, e.g. the creation by the developing countries of national liner fleets or long-term contracts with shipowners operating under flags of convenience.

The Developing Countries

As shown in earlier sections of this chapter, developing countries in the late 1960's and early 1970's tried to increase their control over the organization of the international liner markets. One reason was to protect or develop national fleets, which increased rapidly in that period, particularly in Asia and Latin America. In 1978 about one-

---

[1] TGM 1975:10, pp. 583-589 and 1978:10, pp. 580-591.

fourth of the conventional general-carrier tonnage in the world was operated under the flags of the developing countries (Table 1:60). Their share in the deep sea cellular and ro-ro fleets was 10 %, i.e. the technical standard was below world average. The growing capital intensity of the liner industry puts a limit to the ambitions of these countries to establish national fleets. The relative decline of crew costs and the opportunities supplied by flags of convenience make developing countries less attractive to West European, U.S. and Japanese lines for registration of modern vessels. Therefore, protectionism for many of these countries seems to be the only way of controlling their transport supply. However, protectionism can be applied without creating capital-intensive national fleets through long-term government agreements with foreign lines, giving them the privileges of national carriers. That way the government can control the market without spending resources on a capital-intensive but labor-extensive industry. The alternative is to decrease the capital intensity by using conventional vessels. This argument is often used by the lines of the developing countries when they advocate the use of conventional carriers in deep sea services.[1] However, no country has yet been able to prove that the establishment of a liner fleet promotes the exports to such an extent that it could motivate the allocation of scarce national resources to the shipping industry. In that perspective, the development of liner shipping under flags of convenience may be positive from the developing countries' point of view. Provided they succeed in their protectionistic efforts, they may find lines operating under flags of convenience better partners for long-term agreements than East European or OECD lines.

"Lines of convenience" should be able to supply cheaper services than the OECD lines and create lower risk for political dependence than the East European lines. They can also be incorporated into the economy of the developing countries through various joint company agreements, not being limited by national rules on foreign investments or by trade union agreements. Therefore, the negative attitude of the developing countries towards flags of convenience,[2] which has been characteristic, seems baseless from the economic point of view, unless the developing countries deliberately choose to invest in this capital-intensive industry.

It seems reasonable to anticipate that the developing countries will change their attitude towards the flags of convenience and increase their cooperation with those lines.

---

[1] This view was presented by, among others, the Indonesian line P.T. Djakarta Lloyds at the Europoort 1976 Conference in Amsterdam, TGM:1978:12, p. 763.

[2] UNCTAD's meeting on flags of convenience, 1978-02-06-10.

This would result in a slower growth for the general carrier tonnage of the developing countries except for those countries in Asia and Latin America which for political rather than economic reasons promote the growth of their national shipping industries.

The Flags of Convenience

General carrier fleets under flags of convenience in the 1970's showed the highest growth rates among all blocs as regards conventional vessels (Table 1:60). It was particularly high for Singapore which served as a flag of convenience for Japanese operators and for Panama which played a similar role for U.S. operators. As the share of crew costs is much higher on these vessels than on cellular or ro-ro carriers (Table 1:57) their registration under flags of convenience became attractive for OECD operators already in the early 1970's. Crew costs could be less than half those under, for instance, the Swedish flag (Table 1:65). After the mid 1970's also modern cellular and ro-ro tonnage was registered under flags of convenience. The decreasing relative importance of crew costs should limit the advantages of these registrations, particularly as they exclude access to national financial aid. However, the situation changes if the company is also registered and operated from a "country of convenience", which might decrease taxes on profits. This is the main reason for the registration of large container joint-ventures in the "areas of convenience".[1] Registration of lines and location of head offices in "areas of convenience" may become an important competitive element in international liner shipping. Through a policy of keeping national flags, but moving head offices to such areas, the companies avoid conflicts with both the conference - they can point to a home market - and the seamen's union.

The development of liner shipping under flags of convenience may in the long run be a threat to the competitiveness of the East European fleets in cross trading. Consequently, the East European countries support the negative attitude of developing countries toward the flags of convenience.[2] This policy is understandable, considering that these flags in the long run not only limit the profit margins of the East European lines, but also may become politically acceptable partners of the developing countries.

---

1 The ACL and Dart Line are registered in Bermudas.

2 UNCTAD's meeting, 1978-02-06-10.

The future growth of liner shipping under flags of convenience will thus be a political question, dependent particularly on the maritime policies of the United States and the developing countries. Another important factor is union policy of OECD countries, generally negative to that type of vessel registration.[1] However, none of these elements will limit the registration of international liner consortia in "areas of convenience". Therefore, this trend is likely to continue stronger than the registration of liner vessels under flags of convenience.

Conclusions and the Future

The productivity growth caused by the container and ro-ro technique, which resulted in a rapid decline of the conventional general carrier fleets, will result in a further decline of these fleets in the 1980's. One consequence will be increased competition in the market. As a counterbalance, the OECD lines will seek to increase horizontal and vertical integration. The latter may cause an increased range of activities of the lines and include the functions of merchant houses.

The growth of the East European fleets to a large extent will depend on the protectionism of developing countries and the liberalism of the United States. These fleets are even more sensitive to protectionism than those of the OECD flags. Also the growth of lines under flags of convenience will depend on the maritime policies of the United States and developing countries. However, increased protectionism does not necessarily mean decline of these lines.

SHORT-SEA MARKETS

The development of short sea liner services in the Baltic and the North Sea in the 1965-1978 period followed the trends of the two first postwar decades.[2] The main elements were (1) the rapidly declining role of conventional general carriers, (2) the further development of the ro-ro technique, and (3) growing competition between firms and flags.

Conventional Fleets

All Baltic and North Sea countries, except the Soviet Union, Denmark and the Netherlands, showed a substantial decline of their short sea tonnages of general carriers (Table 1:66). It was most pronounced in the tonnage class 2 - 4 thousand

---

1 SOU 1976:44, pp. 99-100.

2 See pp. 116-124.

Table 1:67. Short-Sea General Carrier Fleets of the Baltic and the North Sea Countries (thousand gross tons)

Country	Year	Tonnage classes in g.t.				
		1-499	500-999	1000-1999	2000-4000	Σ
United	1970	168	309	485	439	1 401
Kingdom	1978	216	209	533	370	1 328
Change, %		29	-32	10	-16	-5
West	1970	443	216	313	760	1 732
Germany	1978	267	265	223	192	947
Change, %		-40	23	-29	-75	45
Norway	1970	216	59	185	328	1 238
	1978	293	66	187	195	741
Change, %		36	12	1	-40	-40
Nether-	1970	239	119	119	136	613
lands	1978	63	111	339	102	615
Change, %		-74	-7	180	-25	0
Denmark	1970	171	37	81	241	530
	1978	172	46	173	151	542
Change, %		0	24	113	-38	2
Sweden	1970	99	12	62	172	345
	1978	61	10	51	139	261
Change, %		-39	-17	-18	-19	-24
Finland	1970	39	15	87	216	357
	1978	26	7	50	120	203
Change, %		-33	-53	-43	-45	-43
USSR	1970	187	130	430	1 632	2 379
	1978	182	189	592	2 070	3 033
Change, %		-3	45	38	27	27
Poland	1970	23	9	44	218	294
	1978	22	19	53	189	283
Change, %		-5	111	20	-15	-4
East	1970	25	26	97	123	271
Germany	1978	25	20	22	80	147
Change, %		0	-23	-77	-35	-46

Source: Lloyd's Register of Shipping, Statistical Tables 1970, 1978, London.

gross tons, i.e. among vessels traditionally used in short sea liner shipping. West Germany, Finland, the Netherlands and Sweden showed a decline in the tonnage class 100-150 gross tons. The technical innovations in vessel construction which in the 1950's resulted in the development of competitive paragraph vessels,[1] in the 1970's no longer

[1] See pp. 116-119.

were sufficient to keep them competitive against rapidly growing ferry and ro-ro services. Norway and the United Kingdom were the only countries that showed an increase for that tonnage category, probably a result of the growing demand for medium-sized supply vessels for the offshore industry.

The stable Danish and Dutch short-sea fleets (Table 1:66) had a rapid growth of tonnage in the 1 - 2 thousand gross ton class. There is no simple explanation of this development but a strong home market, favorable depreciation rules and lower seamen wages[1] were important elements.

The Soviet short-sea fleet of conventional general carriers was the only one in the area showing a substantial growth in the 1970-1978 period. The data covers all vessels under the Soviet flag. An analysis of Soviet participation in the short-sea traffic of Swedish ports indicates a stable pattern (Table 1:67). It can be assumed that the situation was similar in other Baltic and North Sea ports. It might be concluded that the rapid development of the Soviet short-sea fleet did not cause the decline of the corresponding tonnage under other flags in the Baltic-North Sea area.

Table 1:68. Flag Distribution of Small General Carriers. Calling at Swedisch Ports (100 - 4 000 gross tons; percentages)

Flags	1971	1976
All (gross tons)	20 382	21 188
Swedish	19	20
West German	26	23
Finnish		5
Danish	8	9
Soviet	17	15
British	-	4
Norwegian	7	8
Dutch	-	5

Source: SOS Sjöfart, 1971, 1976.

The company structure of conventional short sea shipping in Scandinavia, West Germany, Benelux and United Kingdom has traditionally been dominated by small firms.[2]

1 Mindre Skeppsfarten i Norden, 1978, p. II-2 and Kustsjöfart, 1974, p. 155.

2 Alexandersson, 1978, p. 97-105, Grindhaug & Hannevok, 1977, pp. 4-45.

In Scandinavia "shipping partnerships" have been a common form. Owners have often been working on board. The small size of these companies limited their possibilities of raising capital necessary for investments in modern ro-ro tonnage. Consequently, the decline of the conventional tonnage was followed by a rapid decrease in the number of small independent shipping firms in the Baltic and North Sea countries, i.e. the situation was analogous to the interwar period when a great number of shipping companies operating coastal lines disappeared.[1] The decline of conventional tramping also had a strong effect on the traffic in a number of small ports along the Baltic and the North Sea coasts. Their traditional role of local export-import terminals for break bulk cargo disappeared. Some of them specialized in handling one commodity and became industrial terminals, but most showed a continuous traffic decline[2] as the ferry traffic was concentrated to a few terminals.[3]

Ferry and Ro-Ro Services

The role of road transports in the foreign trade of the Nordic countries and United Kingdom increased rapidly in the 1970's (Table 1:68). It was made possible by the steep increase of ferry and ro-ro services on the Baltic and the North Sea. The 1965-1978 period was characterized by a continuous growth of the ferry ships, increased service distances, the introduction of third ports into the traditional port-to-port pattern and the increasing role of ro-ro services for cargo.

The average size of ferry ships increased rapidly on all routes (Table 1:69). The carrying capacity of these vessels increased more slowly, particularly as regards passengers, which reflects the changing structure of the demand for short sea transports. Movements of passengers with cars increased much more rapidly than movements of passengers using ferries as part of the public transport network. The growing size of the ferries was used to increase the standards of passenger decks and to supply more space for car, bus and truck transports. Increased car space and passenger standards were the main means of competition between the ferry lines. Price wars would create great economic risks, considering the high capital and crew costs of the industry.

---

1 Thorburn, 1958, pp. 221-223.

2 For the analysis of the situation in Sweden, see chapter 3, also Handbuch der Europäischen Seehäfen, 1967-1974.

3 von Schirach-Szmigiel, 1973, p. 83.

Table 1:69. General and Break Bulk Cargo Imports and Exports by Truck

		1970		1976	
		'000 tons	% of all modes	'000 tons	% of all modes
United Kingdom	imports	1 532	5	5 361	14
	exports	1 187	7	4 915	22
Sweden[a]	imports	1 713	19	2 898	24
	exports	2 001	13	2 849	17
Finland	imports	247	5	660	10
	exports	118	1	289	3

a Excluding trade Sweden-Norway

Sources: Annual Bulletin of Transport Statistics, 1971, 1976, U.N.
Unpublished Transport Statistics for Sweden, 1970, 1976, SCB.

Table 1:70. Average Size of Ferries and Passenger Vessels by Route Type

Route type	1964	1970	1976	On order 1979
	Thousand net tons			
Short				
Helsingborg-Helsingör	0.2	0.4	0.5	
Copenhagen-Limhamn	0.2	0.6	0.8	
Middle				
Finland-Stockholm	1.3	1.8	2.9	
Travemünde-Trelleborg	1.5	1.8	6.6	
Long				
Gothenburg-Great Britain	-	3.3	6.6	
Gothenburg-Amsterdam	-	3.2	7.7	

Source: SOS Sjöfart 1964, 1970, 1977.

Until the late 1960's ferries were the only type of vessels that could carry trucks. In the late 1960's short-sea cargo-carriers of ro-ro type were introduced in the Baltic and North Sea markets. This introduction was a result of the rapidly growing costs of ferry services and the risk for huge losses if the demand for truck transports should determine the size of ferry services also in out-of-peak periods for passenger transports. By the development of ro-ro carriers, the lines could diversify the structure of supplied services and keep a frequency of sailings required for truck transports. This vessel type in the mid 1970's became common in most Baltic and North Sea fleets (Tables 1:70 and 1:71). It was employed on longer routes than ferries as the time element was not as important as in ferry services. Most ro-ro lines were based on three ports, which was necessary considering the larger carrying capacity of the carriers (Table 1:69 and 1:72).

Table 1:71. Ferry and Ro-ro Fleets of the Baltic Countries

Flag		Ferries[a]		Short-sea Ro-ro	
		No.	'000 g.t.	No.	'000 g.t.
Sweden	1972	88	193		
	1976	90	254	18	51
	1978	88	250	28	104
On order	1979		20		80
Change, %	1972-78		29		
Denmark	1972	94	203		
	1976	92	236		
	1978	82	230		
On order	1979		20		30
Change, %	1972-78		13		
Finland	1972	40	115		
	1976	41	161	19	71
	1978	39	134	18	71
On order	1979		17		0
Change, %	1972-78				
USSR	1972	153	253[b]		
	1976	188	284[b]	15	54
	1978	196	358	26	77
On order	1979		170		20
Change, %	1972-78		42		
Poland	1972	5	11		
	1976	13	16		
	1978	24	27		
On order	1979		40		10
Change, %	1972-78		145		
East Germany	1972	10	29		
	1976	13	28		
	1978	14	32	2	9
On order	1979		0		0
Change, %	1972-78		10		

a Including short-sea passenger vessels
b Only passenger vessels

Sources: Fairplay, Ships on order 1979: Lloyd's Statistical Tables 1972, 1976, 1978, London.
Shipping Statistics, Yearbook 1977 and No. 1978:7, 1978:9.

Table 1:72. Ferry and Ro-ro Fleet of Selected North Sea Countries

Flag		Ferries		Short Sea Ro-ro	
		No.	'000 g.t.	No.	'000 g.t.
U.K.	1972	141	304		
	1976	150	321	59	165
	1978	151	286	63	184
On order	1979		0		20
Change, %	1972-78		-6		
Norway	1972	284	212		
	1976	317	218	19	27
	1978	325	175	19	32
On order	1979		20		38
Change, %	1972-78		-18		
West Germany	1972	85	85		
	1976	92	115	37	
	1978	97	83		54
On order	1979		40		11
Change, %	1972-78		-2		
Netherlands	1972	15	39		
	1976	20	67		
	1978	17	61		
On order	1979		0		
Change, %	1972-78		56		

Sources: See Table 1:70.

The flag distribution of ferries and ro-ro carriers among the Baltic and North Sea countries was different from that of conventional cargo carriers (Tables 1:66, 1:70 and 1:71). United Kingdom was the leader in both cases, while West Germany played a minor role in the ferry and ro-ro markets. The Nordic countries, particularly Sweden, occupied a strong position. A long tradition, rapidly growing transports - which provided the Nordic lines with a strong domestic market base - and favorable depreciation rules - which favored capital-intensive investments - gave these lines comparative advantages in ferry and ro-ro cargo shipping. However, the high proportion of crew costs in ferry shipping (Table 1:73) is an important comparative disadvantage of the Nordic lines, making them sensitive to competition from low-wage flags. As the crew-cost share can be partly decreased by increased size of ferries, Scandinavian operators continuously buy larger vessels and intensify the development of ro-ro cargo carriers for which the crew-cost share is much lower.

Table 1:73. Ro-ro Lines on the Baltic and the North Sea

Route	No. of lines	Tonnage employed '000 g.t.	Average size, '000 g.t.	Vessel speed, knots	Type: no. of trucks	Average no. of ports per line
Short						
200-500 miles	11	42	2.4	18	100	3
Middle						
500-900 miles	15	44	2.7	17	170	3
Long						
900- miles	5	34	3.4	18	200	3

Sources: Containerization International Yearbook 1976, London.
Svensk Sjöfarts Tidning 1976:8.

Conclusions and the Future

The development of the short sea liner services on the Baltic and the North Sea in the 1965-1978 period followed the trends of the two first postwar decades. The conventional carrier fleets declined as a result of growing competition from ro-ro transports. The increased size of ferries and the introduction of ro-ro carriers allowed for rapid development of international road transports between the United Kingdom and the Continent and between Scandinavia and the Continent. The ro-ro carriers also increased the competitiveness of containers as an alternative to road transports.

The development on these markets in the 1980's will probably be characterized by further growth of the cargo fleet, while the ferry tonnage is likely to stagnate, at least for the West European flags, as a result of the growing competition from ro-ro carriers.

The large orders for ferries placed by operators of East European flags in the late 1970's, particularly the Soviet Union and Poland (Table 1:70), indicate an increased competition in these markets. Low wage-costs should give these flags comparative advantages which may be difficult for Nordic operators to counterbalance even with favorable depreciation rules. A growing role of the East European lines can thus be foreseen as regards ferry services on the Baltic and the North Sea. They can supply cross services without loosing their home base by including two foreign and one home port into their services.

Table 1:74. Costs in Ferry Shipping[a]

	Type of Vessel		
	A	B	C
Nrt., '000	3	4	6
Dwt., '000	1.5	2	2.5
Length, m	130	150	180
Passengers, '000	1	1.2	1.6
Port calls per day	2	2	2
Sea-time, hours	8	8	8
Speed, knots	15	18	21
Engine, hp. '000	6.6	13.5	24.5
Price, 1976 level, U.S.$ million	12	19	30
	Cost Structure, %		
Capital	33	37	40
Crew	34	26	20
Fuel	13	19	24
Administration	9	7	5
Port costs	6	5	5
Maintenance	3	4	4
Insurance	2	2	2

a Based on data from Swedish and Finnish operators.

Source: von Schirach-Szmigiel, Ch. & Woysman, J., 1977, Utbuds- och Kostnadsstrukturen för Färjetrafik, Stockholm.

The comparative advantage of the East European flag is considerably lower in ro-ro cargo services where crew costs are proportionally much lower. These services also require a longer tradition of contacts with the market, which favors national operators. However, the success of the Soviet deep-sea lines in establishing necessary market contacts may be reproduced in the short sea markets. Considering the greater growth potential of the cargo services and their comparative advantages in these services, it may be assumed that the expansion of the Nordic, West German, British and Benelux short-sea fleets in the 1980's will primarily be concentrated to ro-ro vessels, which would increase the competition on this market. Increased cooperation among the lines, similar to that in the deep-sea container services, may prove necessary in such a situation.

2. DEMAND FOR GENERAL CARGO TRANSPORTS: VARIABLES AND MODELS

The first chapter was focused on the competitive position of liner shipping in an era of vast technical, organizational and political changes. The strong influence of shifts in the demand on the development of the liner industry was underlined. The following chapters deal with the demand for international transport of general and break bulk cargo with two questions being asked here: (1) What elements and interrelations determine the modal and route distribution of cargo flows? (2) What methods and models can be used to estimate the demand for individual transport modes and ports?

DEMAND FOR CARGO TRANSPORT - BASIC FEATURES

The demand for cargo transports is derived. The movement of goods is not demanded for its own sake but because it enables the commodities to allow direct demands to be satisfied.[1] The function of cargo transports can be defined as an economic activity which opens places for trade interaction by surmounting the "obstacle of distance". In that role transport cannot be substituted for by any other economic activity, i.e. the elasticity of demand for transport is low until the comparative advantages of moving a product from A to B (for sale, processing or warehousing) are larger than the disadvantages caused by distance. The only substitute for transport would be a relocation of demand and supply of commodities to increase regional autarchy. But such reallocation is of academic interest only in modern society. Such location pattern of supply and demand can never be obtained, that no international transport of commodities would be needed. On the contrary, the economic development requires new industries, i.e. increased demand for transports, at least measured in tons.

---

[1] Gwilliam & Mackie, 1975, p. 56.

This non-substitutability has in many cases given the transport industry a monopolistic position in relation to its customers. But as demand is derived, competition in transport becomes sharp when more than one transport alternative is available, i.e. the cross elasticity of the transport demand is high. This includes both competition between modes and between terminals and firms operating in the same modal system.

Two other elements sharpen competition: (1) the low alternative value of the transport facilities in other activities and (2) the necessity for a close timing of the transport supply with the needs of the consignors.

The tendency toward technical specialization in sea transports and its impact on the market segmentation was discussed in the previous chapter. The conclusion was that growing specialization resulted in increased segmental competition as the specialized transport facilities are uncompetitive outside their segment. This particularly holds for terminals and networks which are geographically geared to the demand of the surrounding area (hinterland), while the carriers can search for employment in other geographic markets.

The use of transport facilities outside the transport market is even more common. For carriers the only alternative occupation is in the warehousing of commodities. Terminal facilities can be reshaped, e.g. for use as industrial plants, but there is no alternative use for the network facilities outside the transport market. As a result, operators of carriers and terminals are keen to strengthen the competitiveness of their facilities by investments and organizational changes. A switch from transport to other industries is costly, time consuming, and demands a lot of new knowledge.

Transport services as such cannot be stockpiled. Hence, the time element has a strong influence on the economic value of supplied services. The only time adjustment of supply to demand in the transport market is between transport and warehousing. The increasing cross substitution in the transport market and the tendency to lower the size of the buffer stocks strengthen the influence of the time element on the consignors' choice of transport.

The result of these tendencies is a continuous shift in the last twenty years in the "balance of power" on the international transport market in favor of the consignors. This strongly influences the character of the needed studies on the demand for international cargo transports. The traditional focus on the geographic commodity flows based on foreign trade data is no longer sufficient for the estimation of the demand for liner shipping by port. It must be complemented with detailed studies of the transport choice. Among questions to be raised in such studies, the following are of particular importance: (1) What alternatives are available on the market? (2) Who are the decision makers on the transport market and in what way do they influence the modal, terminal, and company distribution of cargo flows? (3) What variables and interdependences influence the consignors' short- and long-term transport decisions? (4) How can these variables and interdependences be measured?

TRANSPORT MARKETS AND DECISION MAKERS

The concepts of an overall demand for transports and of a total international transport market represent highly aggregate levels of economic analysis. They provide an outline of the need for international services but no basis for a detailed analysis of the shipping markets. Such analysis requires a break-down of the total demand on more homogeneous units, i.e. distinction of market segments based on similarities and transport characteristics of commodities and consignors. Such demand-oriented segmentation of the market should better reflect its competitive conditions than the division by modes of transport. As for the transport characteristics of commodities and consignors, three major market segments can be distinguished - bulk, break bulk and general cargo transports - and several subsegments.

The main characteristics of the demand for general cargo transports are: high ton-value, small consignments, relatively high perishability, need for protective and unitizing transport packing, vastly spread origin and destination patterns, and a large number of consignors (Table 2:1). Bulk cargo is very different in its transport needs. It is easy to draw the line between these two segments of the international transport market.

Definition of the break bulk segment is more difficult as it covers commodities and consignors with transport needs partly like the ones of bulk cargo and partly the ones of general cargo. Therefore, all types of shipping and land modes search for additional cargo in this market segment.

For bulk transports an analysis of the global demand is a meaningfull first step. Bulk carriers can be employed world-wide as technical and organizational restrictions are few. The situation is different in the markets of general and break bulk cargo. Vessels are often specialized to suit the port and route conditions of individual

Table 2:1. Cargo Grouping for Transports

Variables	Bulk cargo	Break bulk cargo	General cargo
Density	Varying	Varying	Varying
Ton-value	Low	Medium	High
Average size of consignment	Large	Large	Small
Perishability	Low	Medium	Medium/high
Function of transport packing	None	Standardizing	Protective, standardizing
Transport techniques	In bulk	Packaged or separate units	Palletized, containerized, or separate units
Handling techniques	Dumping/ pumping	Lifting/rolling	Lifting/rolling

trades, i.e. they are geographically more adapted than bulk carriers. The cartelization of the liner services means that changes in the demand in one area have a limited impact on other geographic markets. Therefore, the global analysis of the demand for general cargo transports is useful only as a basis for comparison of changes in the development of geographic markets and for the analysis of liners price changes.

The geographic design of markets in international general cargo transport is a function of (1) the pattern of liner services, (2) the competitiveness of ports and (3) the transport policy of the origin, destination and transit countries. According to the pattern of liner services three types of general cargo transport markets can be distinguished: coastal, short-sea, and deep-sea.[1] The previous chapter showed the historical process that created the current pattern of general cargo transports through changes in supply. The demand for those transports can be obtained from foreign trade data. Demand for coastal traffic requires trade data by province.

However, this macro-approach does not explain the distribution of flows among modes, terminals, and suppliers of transport services. Until the mid 19th century multipurpose ships were the exclusive mode of international seatransports. Poor land connections limited inter-port competition. The hinterland of each port formed a rather closed market, shaped by the geography of its river system, and sometimes modified by political boundaries. Port

---

[1] See p. 7 - 8.

competition to some extent existed between large ports, regarding their transit function. However, the most pronounced competition in that period was the one between shipowners. Prior to the Steam Age, deep-sea services were strongly dominated by merchant houses which often had monopoly on the foreign trade of their home country in a given geographic market, i.e. the competition on the shipping market was often a matter of national interest.

The railways brought modal and route competition to international cargo transports. Medium-sized ports started to compete for cargo from the same area when the restraints of poor land transports gradually were removed. The development of road transports in the interwar period created total accessibility for all places and resulted in an increased competition in the general cargo market. It was further strengthened by the introduction of air cargo services in the late 1950's. Hence, the distribution of international general cargo flows between competing modes, terminals and transport suppliers became the function of complex decisions.

Eight main groups of decision makers can be distinguished in the general cargo market. Four operate directly in the market while the other four have a strong but indirect influence. The first four are: (1) consignors, i.e. buyers and sellers of commodities, (2) operators of short and long distance transport fleets, (3) terminal operators, including suppliers of cargo handling services and (4) agents representing either the interests of the consignors, forwarding agents, or the transport suppliers, carrier agents, (Figure 2:1). Decision makers with an indirect influence on the transport market are: (1) the control groups, i.e. government agencies designing the transport policy of countries or supranational communities, (2) financial groups supplying resources to the transport business, (3) professional associations, including trade unions, guiding labor supply and policy in the transport business, and (4) research and development institutes which advance technical, economic and organizational development of the transport industry. The latter four groups primarily influence medium- and long-term developments on the transport market, while the decisions of the first four make an impact on all types of developments.

General cargo consignors, at least in theory, face three main alternatives when organizing their transport supply: (1) create their own transport fleet, (2) develop a specialized transport system jointly with an independent transport supplier or (3) buy services in the transport market through an independent forwarding agent or their own forwarding office.

GENERAL CARGO TRANSPORT MARKET

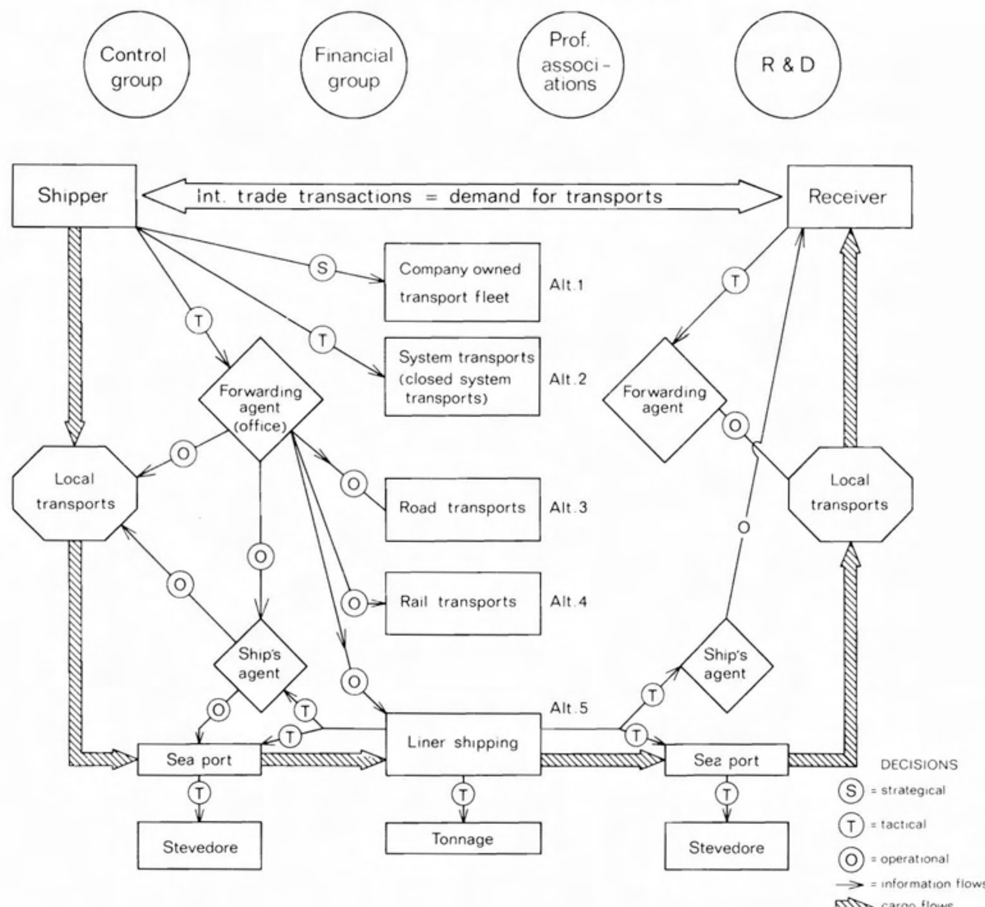


Figure 2:1. General Cargo Transport Market

When the consignor establishes his own transport fleet of land or sea carriers, he moves into a new field of business, i.e. transport, with a long-term impact upon his tactical and operational decisions in the field of logistics. For the transport industry, this decision of the consignor has two important consequences: (1) it decreases the volume of demand for services supplied in the transport market, and (2) it creates a potential risk for competition since the new services can be introduced in the open market after the initial period.

The consignors who are most likely to establish their own fleets for international transports are characterized by having a strategy for international growth and industrial diversification, large volumes of homogeneous cargo, stable origin and destination patterns, significant economic benefits through the use of specialized carriers and terminals, experience of operating their own fleet for local transports, and a general feeling that their own fleet will be superior to long-term contracts with independent transport suppliers.

It is understandable that the oil industry was first to establish its own transport fleet. A question of interest for this study is whether general cargo and break bulk cargo consignors will follow the transport strategy of the bulk producing industries and establish their own fleets.

As shown in chapter one the 1950's and 1960's saw a considerable vessel specialization for break bulk cargo, e.g. cars and wood products, which resulted in a partial shift of these commodities from general cargo to a bulk type of transports. Some firms in these industries decided to introduce their own fleets as an alternative or supplement to long-term contracts with independent shipowners.[1] The strategy of establishing fleets by the "break bulk" producing industries should be seen against their technical and organizational restructuring in the 1960's. The multinationals have always dominated the car industry, but the economy of scale in production stimulated international plant specialization. The high costs of retooling a car factory became an acute problem with the more frequent shifts in models. This in turn increased the demand for interplant movements of parts

---

1 Volkswagen AG in the late 1960's established a fleet of car carriers operated by the company's own transport subsidiary. A similar strategy was adopted by the leader in the Swedish wood industry, Svenska Cellulosa AB (SCA). The company developed its own transport system based on three vessels and two terminals in Sweden and three at the market. The reason was a technical rationalization of the transports and a more effective distribution to the customers. SCA, Annual Report, 1967/68.

and components. It encouraged consignors to closer managerial control over supplied transports. The shift to company vessels remained limited to a few large firms in the break bulk industries. The middle-sized firms chose to develop specialized transport systems through long-term contracts with independent shipowners.[1] These contracts gave the consignor all technical advantages of specialized transports, stability in supply and prices without increasing the demand for capital and management-resources of the firm.

The other long-term threat to the common carriers is the establishment by general cargo consignors of long distance truck fleets. Investment in and operation of a truck fleet is less demanding as regards both capital and management. Trucks can be used for a much wider range of transports than ships. Therefore, even middle-sized firms can establish their own truck fleet. Speed of delivery, certainty of timing and lower costs are main reasons for the use of company trucks rather than common carriers.[2]

However, the ownership of a truck fleet does not restrain general cargo consignors from using common carriers. This particularly holds for large firms which have a wide range of transport requirements, but it differs significantly among industries. Companies producing high-value or perishable goods tend to use their own trucks more frequently than others.[3] Nevertheless, the share of company trucks in long-distance transports remained small in Europe in the 1960's and 1970's because of difficulties in obtaining return cargo, particularly in international traffic.[4] The vast majority of general cargo consignors use common carriers as the main source of supply for their transport needs, i.e. the modal, route and supplier distribution of general cargo flows is a question of both operational decisions of cargo owners or their forwarding agents and of tactical and operational decisions of transport

---

1 Most of the Japanese car manufacturers in the 1960's signed long-term contracts with independent Scandinavian and Japanese shipowners creating specialized systems for shipments of their products to Europe. Similar contracts were signed in the late 1960's and 1970's between Scandinavian and North American wood industries and independent European and North American shipowners.

2 Gwilliam & Mackie, 1975, p. 59.

3 Bayliss & Edwards, 1970, pp. 61-63.

4 Kritz, 1976, pp. 128-130.

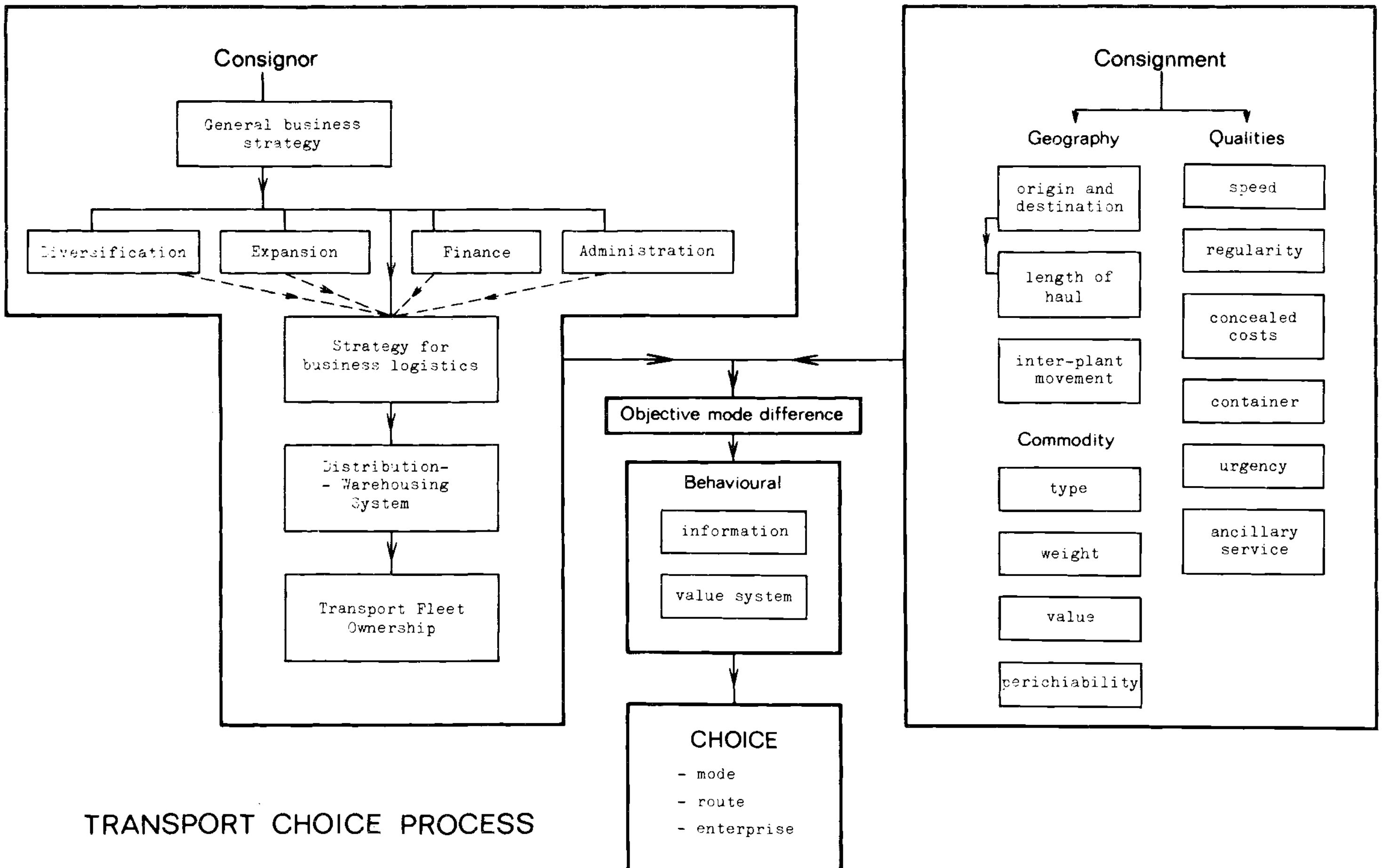
suppliers as regards the patterns of supplied transport services (Figure 2:1). For consignors the choice of mode and supplier, in most cases, is the primary issue. It determines the route and terminal distribution of flows in the short-term. However, in the long-run the price and service policy of terminals have a strong impact upon the geography of general cargo flows.

THE TRANSPORT CHOICE

Variables that influence the consignor's choice in the transport market can be grouped under four headings: consignor, consignment, mode differences and behavioral elements (Figure 2:2). The first includes variables that describe the consignor's long-term logistic strategy expressed in the decisions about the structure and pattern of the distribution system, the size of inventories and the ownership of transport facilities and equipment. They provide the framework for the consignors' operational choice in the transport market. However, the main source of explanation of that choice is the analysis of the transport characteristics of consignments, of objective mode differences and of the behavioral elements.

Three elements are of importance as regards the transport characteristics of consignments: the commodity structure, the geography of shipments and the quality requirements. The relationship between commodity structure and required transport was discussed in connection with the division of commodities into cargo groups. The basic geographic elements that influence the choice of transports are the location of the origin and destination points in relation to transport networks and terminals, the length of the route and the place of the commodity in the logistic chain, i.e. whether the demand for movement is part of the raw material assembling, of manufacturing or of the final product distribution. In most cases the assembling transports are in low need for speed as the stocks of raw materials are built up at the plants. Interplant movements of semimanufactured goods have significantly changed character in the latest two decades as a result of increased international plant specialization and the tendency to keep low in-production stocks. This increased the demand for speed frequency and punctuality of services. Similar changes have also been characteristic in the demand for transports of final products, i.e. quality elements have become more decisive in the transport choice while the importance of costs has decreased as their share in the total cost of manufacturing has diminished in all industries during the latest hundred years.

Figure 2:2. Transport Choice Process



Regularity of shipments, urgency and the need for ancillary services are other quality variables that have a strong impact upon the choice of transports. The consignment variables and the ones describing the consignors jointly form the transport preference vectors which characterize the demand in individual submarkets. Thus, the transport choice can be described as matching these vectors with the ones that describe price, physical pattern and qualities of supplied transports. Models and methods that can be used to predict the results of these matchings, i.e. to estimate the pattern of the transport demand and its modal, route and terminal distributions are discussed in the second part of this chapter.

STUDIES ON MODAL AND ROUTE CHOICE

Competition between deep-sea lines and land and air transports is a recent phenomenon. Most earlier studies on the demand for international liner services were based on the analysis of foreign trade data without much attention to modal competition. However, several studies are available on the modal choice for long distance general cargo transports at the national level. In spite of their national character, they are of methodological interest for the analysis of the demand for international liner shipping.

Considering the methods of analysis and of data collection, studies on interregional cargo flows and their modal distribution can be divided into four main groups:[1] (1) multiregional transport models, (2) consignment studies, (3) market survey studies, and (4) time series analyses.

MULTIREGIONAL TRANSPORT MODELS

Multiregional transport models were developed after 1960 with a quantitative system analysis as the methodological starting point. The purpose was to estimate volume and structure of interregional cargo flows and their modal distribution under the assumption of a general equilibrium in the regional and national economies.

Multiregional transport models commonly include four steps (Figure 2:3): (1) the estimation of demand and supply of commodities by sectors of the national economy; (2) the sectorial data distributed by regions; (3) the calculation of the geographic pattern of the interregional flows; and (4) their modal and route allocation.

---

[1] Bayliss, 1973, pp. 19-22.

Fig. 2. Multiregional Transport Models

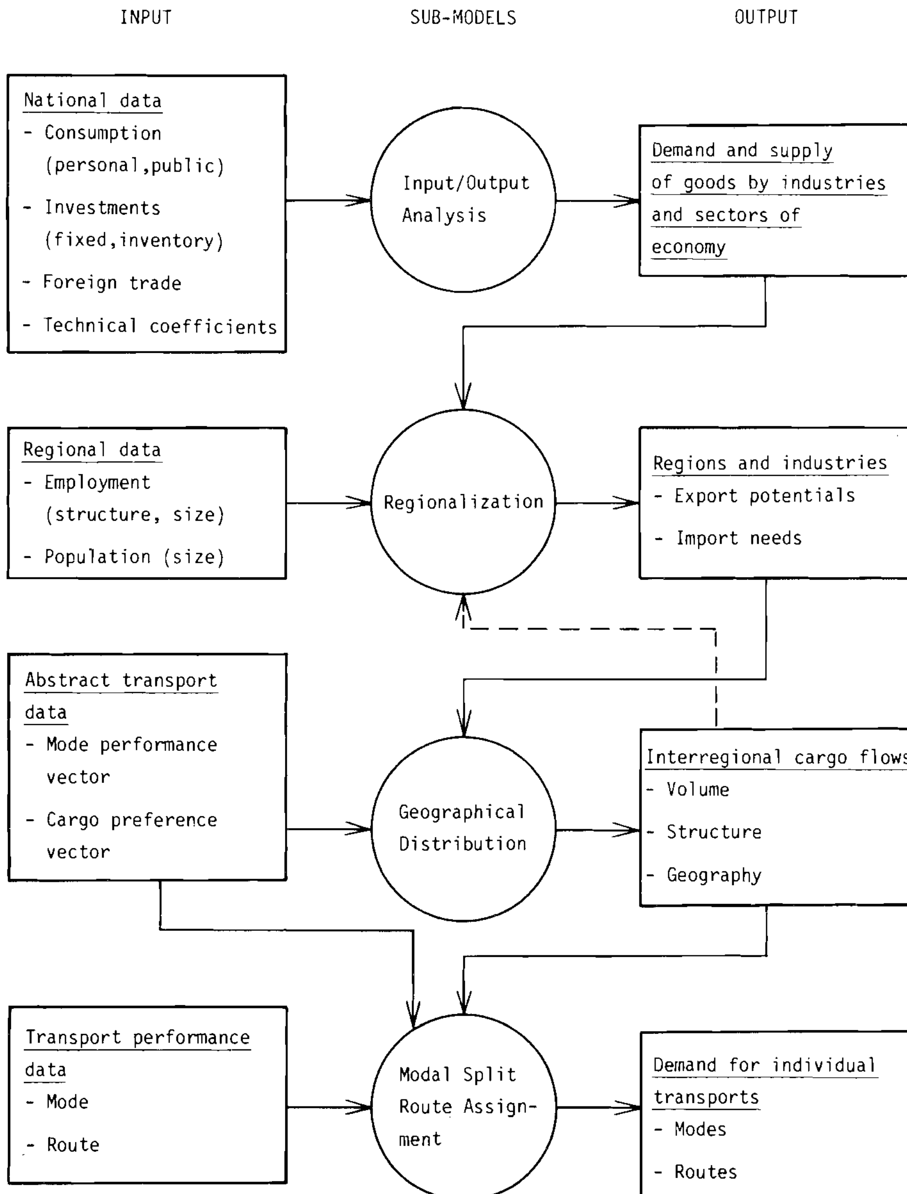


Figure 2:3. Multiregional Transport Models

National Demand and Supply

The structure of commodity supply and demand is estimated by sectors of the national economy through the input-output method, which allows alternative prognoses based on various assumptions about consumption, production and foreign trade.

The first attempt to use this method in a multiregional transport model was made in 1960 in a study on interregional flows of commodities in the United States.[1] It was followed by a number of studies both in the United States and in Europe.[2] The total picture of demand and supply of commodities in a national economy is estimated, considering the capacity restrictions in the production of individual manufacturing branches, in the transport sector and in the labor market. The input data also include information about public and private consumption and foreign trade.[3] These data are gathered in an input-output matrix with technical coefficients stating the volume of inputs required per output unit in each branch.

An essential question in transport models is the degree of aggregation of the manufacturing branch in the input-output matrix, as the commodity flows should be calculated in physical terms and not by value. Theoretically, the best solution is obtained when every manufacturing branch accounts for one homogeneous product. However, it is unrealistic, especially for general and break bulk cargo. The Standard International Trade Classification system (SITC) has 1 312 commodity posts, 625 commodity sub groups and 177 commodity groups. Most of them are general cargo. The number of manufacturing branches in the input-output analysis of the multiregional transport models has varied between 10 and 30, i.e. the technical coefficients express only the average values for large industry groups which makes it difficult to express them in physical terms.

An implicit assumption in the input-output analysis is a linear relation between the volume of inputs and the number of produced units, i.e. the economy of scale is neglected as regards use of raw materials and components in the production process.

---

1 Moses, 1960.

2 Meyer, et al., 1972; Bronzini, et al., 1974; Mortensen 1974; DSB 1975.

3 Moses, 1960, p. 374.

Regional Demand and Supply

Estimation of the volume and structure of the cargo flows generated by individual regions is carried out in the second step of the models. It is based on the results of the national input-output analyses which are transformed with the help of population and employment data to the regional level. This method assumes that the technical coefficients in the national input-output tables reflect the production technique in all regions, i.e. a regional equality in the technical development is implied. The technical innovation process, in other words, is seen as a momentaneous phenomenon without a spatial dimension. The calculations of the regional consumption is also made from national data with the same assumption about regional equality.

The breakdown of national input-output tables to a regional level demands information regarding the input needs of the transport sector. They should be in proportion to the performed intra- and interregional transport work and divided by industries and distances.[1]

It means that the results from the third step of the model, i.e. estimations of the geographic distribution of the cargo flows, should be brought back as input information into the second step before the next optimizing attempt (Figure 2:3). This feedback allows for calculation of the technical coefficients considering regional differences in input prices according to transport costs.[2]

The division into regions is another important problem in the dimensioning of the input-output analyses in the multiregional transport models. As the regional distribution of national input-output data is carried out with the help of indirect variables, population and employment, the regions should be similar to the national economy as regards consumption pattern and industrial structure, i.e. they should be few. However, this opposes the purpose of multiregional transport models. Few regions mean that many long distance transports will be excluded from the analysis, as they become intraregional flows.

The regional division in the transport model is strongly influenced by the access to employment and population data. The administrative division of the country thereby forms an important restriction in the models, as it is commonly the basis for the preparation and reporting of the employment and population data. In most studies the number of regions was small and varied between 9 and 15.[3] Foreign

---

[1] Moses, 1960, p. 375.

[2] Bronzini, 1974, p. 47.

[3] See footnote 2 on p. 201.

countries were regarded either as one or two regions or they were excluded, i.e. the national economy was treated as a closed system.

The Geography of Flows

The estimation of the geographical pattern of the cargo flows are covered in the third step of the models. It is based on an assumption that every industry seeks the lowest production costs by a continuous search for the most profitable purchases of input goods and that the regions are homogeneous regarding the supply and demand structure within individual branches of industry. Gravity models, linear programming and simulation techniques are used in these estimations to find the optimal patterns of flows.

They are computed as the products of the cargo preference and network performance vectors.[1] The first refers to the average transport preferences of each cargo group, expressed by the cost of underway and terminal time, the cost of delay and the ton value of the commodity. The network vector is used to estimate the cost of cargo hazards (damage, pilferage or loss) during transport. The network performance vector shows the price and quality of transport and terminal services supplied on each route. It includes freight rates, total transport time, including waiting time in transit terminals, and the probability for delay, damage and loss of cargo characteristic of each route. These values represent averages and allow for the construction of an abstract mode.

The basic idea behind the abstract mode approach is that transport services should be defined in terms of qualities and not in the commercial manner of train, lorry, etc.[2] An advantage of this approach is that it allows a forecast of the effects of the introduction of a new mode upon the total geographic flow pattern. With the help of this method the theoretic economic distance between each pair of regions can be estimated. An alternative method is to use the physical distance as an approximation of total transport costs.

The choice between linear programming and the gravity model depends on the needs of the user and on the restrictions put on the model. If the purpose is to estimate a potential pattern of flows based on the criteria of minimizing the total cost of commodity production and transport, and to meet current capacity restrictions within the transport system, linear programming offers a suitable technique.[3] The method is strongly deterministic; the

---

[1] Meyer, et al., 1972, p. 49.

[2] Bayliss, 1973, p. 35.

[3] Moses, 1960, pp. 373, 374.

estimated pattern of flows is the only possible solution in view of assumed restrictions.

A probabilistic estimation of the flows is obtained through the gravity approach. It has an implicit assumption that no capacity restrictions exist in interregional transports. In the gravity model the flows are estimated separately for every pair of regions without taking into account the total flow pattern or the total transport costs. It assumes that the cargo flow between two regions is a function of their consumption needs and production potentials and of the distance between them. Differences in prices between the potential regions of supply are not taken into account in the gravity models. A change in price structure thus has no effect on the geographic distribution of the cargo flows.[1]

Modal and Route Distribution

An analysis of the modal and route distribution of cargo flows is the fourth and last step in the transport models. The costs for the transport alternatives are compared with the demand preferences of the consignors of individual cargo groups. Each transport alternative supplied on a route is described in terms of total costs and qualities, i.e. the same variables are used as for the characteristics of the abstract mode in step three.

Through a comparative analysis of the performances of individual modes and of the transport preferences of various groups of consignors, the share of each transport alternative is computed. The estimations are based on relative differences in price, time and service quality. Consideration is also given to capacity restrictions that characterize each transport solution.[2]

---

[1] Heggie, 1969, p. 100.

[2] This can be expressed by the following function:

$p_k(x_{cij}) = F\,(C_k^{a1}\; T_k^{a2}\; F_k^{a3}\; R_k^{a4})$ where $p_k(x_{cij})$ = the share of estimated flows of cargo group C between the regions i and j that will be transported by mode k.

And the following constraints

$$\Sigma_k\, P_k\, (x_{cij}) = 100 \qquad (1)$$

$$\Sigma_c x_{ijk} \leq Y_k \qquad \Sigma_c\, x_{cij}\ ? \qquad (2)$$

Y_k = Maximum transport capacity for transport by mode k

C_k = Lowest rate by all available modes/mode k

T_k = Shortest time by all available modes/time by mode k

F_k = Best frequency of service/frequency of service by mode k

R_k = The share of consignments arriving on schedule

a 1-4 = Coefficients to be estimated

As in the third step of the model, a linear relation between the volume of transported goods and the cost of transport services is implied. That is, price and time are independent of the size of the consignment within a given cargo group and transport market. This assumption can be modified by dividing the price and time data into classes by size of consignment.

Calibrating Parameters

Beside the cost and time data the consignors' confidence in a certain mode can be included into the analysis. This confidence can be expressed as the probability that additional traffic shall be sent by the mode that was previously chosen.[1]

That probability expresses the degree of mode loyalty of the consignor. The "loyalty factor" can be used to modify the results of the optimizations which are exclusively based on the analysis of cost and time data. This modification can make the estimated modal and route distribution of the flows better fit the actual results of the behavior of the consignors. They do not always look for optimal choices. Transport costs and time are seldom the only criteria in their decisions.

The "loyalty factor" belongs to the family of calibrating parameters which are used in all steps of the multiregional transport models. These parameters express the influence of the unpredictable variables and their values are based on empirical observations. They create significant restrictions when functions computed on the historical data are used for forecasting the future pattern of commodity flows and their modal and route distribution.

Applicability

The multiregional transport models are theoretically the most advanced method for the analysis and forecast of the demand on the transport market. The high computation capacity and flexibility which characterize these models make them a powerful tool of analysis, provided that extensive and detailed economic and technical data from all commodity producing industries are available. Furthermore, a thorough investigation of existing transport patterns is necessary, including restrictions regarding capacity, economy, and organization.

The starting point for using transport models in forecasts of the demand on the transport market are assumptions regarding the constancy of technical production coefficients over time and space and for all companies in the same industry. Furthermore, the geographic pattern of the cargo flows is estimated as a function of optimal action of the buyers, who base their choice solely on cost minimizing.

---

[1] Asp, 1975, p. 245.

Hence, the value of the prognosis based on a transport model to a large extent is influenced by the range and up-to-dateness of available input data. To be useful, they should be gathered regularly, divided into groups of industry, and reflect the present technical level in the manufacturing and transport industries. The access to such input data is currently limited in most countries of Western Europe.[1]

The lack of international input-output data means that transport models only with difficulty can be used to estimate the demand for intra-European transports. In the transport models the impact of the location of the wholesale warehouses on the geography of flows is left out. It might be acceptable for the analysis of export flows, as shipments are commonly made directly from the factory or a nearby distribunal. However, the geography of import flows, particularly those of general cargo, is strongly influenced by the location of the wholesale warehouses. Therefore, the regional input-output data used in the transport models should include detailed information about wholesale trade.

Lack of data, high cost of model development,[2] extensive programming work and high demands on computer time are probably the main obstacles that until now have restricted the use of transport models in the analyses of the demand for interregional and international transports. However, the increasing availability of international input-output statistics, particularly within the European Community, should allow for a wider use of transport models in the future.[3]

CONSIGNMENT STUDIES

In the consignment studies the structure and pattern of the total cargo flows and the elements and interdependences that rule their geographical and modal distribution are estimated on the basis of a sample of consignments. They can be divided into two groups, one focused on the properties of the consignments (size, value per ton, type of

---

[1] An input-output matrix for 1968 has been published in Sweden. In Denmark the published input-output data refers to the technical status of 1966. Leading countries as regards publishing current input-output data are the Netherlands and France. See UN, ECE, 1975; SOU 76:51; DSB 1975.

[2] The Netherland Economic Institute has recently been instructed by the EEC commission to carry out a study of the demand for transport services, based on an input-output analysis including 100 regions in the membership countries. FLEUR Project - see Molle, 1975, p. 8.

[3] The cost for the transport models previously referred to, developed within the DSB, was 1.5 million DKr. After the end of the trial period, De Danske Statsbaner decided not to use the model on the grounds that the observed transport quantities corresponded very little to the calculated quantities.

commodity and transport packing, distance and the demand for special transport service) and the other on the consignor's behavior on the transport market.

Studies focused on consignment data only represent the traditional method, applied in several investigations on the demand for individual modes and in the analysis of port-hinterland relations. The method includes three steps: sampling and collecting of consignment data, analysis of regional interactions that explain the pattern of commodity flows, and analysis of modal and route distribution of flows.

Consignment Data

Consignment data include origin and destination of shipments, weight, value per ton, mode of transport and possibly length of route, and number and locations of transit terminals.[1] It may be completed with information on the shippers' and receivers' access to alternative modes of transport[2] and with cost data.[3]

Consignment data can be collected from three sources: from the transport firms, by the analysis of loads; from the transport vehicles, by the census of their employment; and from the consignors by the examination of outgoing and incoming shipments. The choice of source is commonly determined by the access to data and by the aim of the study. If the subject is an analysis of transport needs for general cargo trade between several regions, it is usually necessary to limit the collection of data to a few samples. In such cases the sampling should cover either the majority of transport firms active on the market, or it should be based on the census of vehicle employment. However costly, those methods are less demanding than the sampling of data from a large number of general cargo consignors. The latter approach is more appropriate for the analysis of the transport needs of the break bulk trades in which the number of consignors as well as the range of modes and routes is commonly smaller. In many cases the transports are organized by the consignors themselves, often through long-time charters of specialized systems. Therefore, gathering of consignment data from transport firms may then give a biased picture.

Seasonal variations in the commodity trade may strongly influence the results of a consignment study. This is particularly important as regards interregional or international general cargo trade which often includes several agricultural products, characterized by strong seasonal

---

1 Chisholm & O'Sullivan, 1973.

2 Norström, 1973.

3 Clevensjö & Williamson, 1972.

variations in supply and demand. The pattern of seasonal variations should therefore be examined before the sampling of consignment data. The sample periods should either represent a yearly average of general cargo flows or the maximum and minimum values.

Regional Interactions

The pattern of interregional trade is estimated in the second step of the consignment studies. Data about the economic structure of the regions are the main input. They include population, structure of employment, value added, production of individual industries and their needs for raw materials and components. The data are gathered empirically which allows testing the hypothesis about the relation between interregional cargo flows and the economic structure of the regions. The results of those tests not only form the base for the third step of the consignment studies - modal distribution - but might also be used to measure the validity of the transport models in which national input-output data are regionalized with the help of population and employment data.[1]

In Table 2:2 a few results from three consignment studies are given. Population seems to give a better explanation of the pattern of cargo flows than employment data. The English study was limited to domestic flows, while the Swedish surveys were focused on the foreign trade with break bulk and general cargo.[2]

As a complementing variable to population and employment the turnover of wholesale trade was used in the English survey to estimate the regional need for transport services. The explanatory value of this variable was considerably below that of the others ($R^2 = 0.65$), but a strong correlation could be proved between the number of employed and the turnover of the wholesale trade (r 0.94) and between the wholesale trade turnover and the population (r 0.92).[3] The explanatory value of employment data as a measure of the regional exports potential and imports need was especially high for goods here defined as general and break bulk cargo. The correlation between the number of employed by region and the volume of generated and attracted bulk cargo was low. This is explained by a strong concentration of bulk cargo flows to a few origin and destination regions.

The Swedish studies used three measures: weight, value and number of consignments; the English used only weight.

---

1 See pp. 201-203.

2 Chisholm & O'Sullivan, 1973; Norström 1973 and 1977.

3 Chisholm & O'Sullivan, 1973, p. 47.

Table 2:2. Population and Employment as Determinants of the Demand for Long Distance Interregional Transports

Independent variable	Dependent variable					
	Number of consignments (R^2)			Weight (R^2)		
	Imports	Exports	Total trade	Imports	Exports	Total trade
1. *Number of employed in industry*						
Sweden[x] 1965						
Counties (24)	.85	.85	.89	.85	.57	
B-regions (138)	.80		.85		.61	.76
Sweden[x] 1973						
Counties (24)	.85	.86	.91			
A-regions (70)	.52	.63	.79			
2. *Number employed*						
United Kingdom[xx] Transport zones (78)				0.70	.66	
3. *Population*						
U.K. Transport zones (78)				0.79	0.74	

x Sweden - Foreign trade
xx U.K. - Domestic interregional trade

Sources: Chisholm, M., & O'Sullivan, P., 1973, Freight Flows and the Spatial Aspects of the British Economy, p. 42.
Norström, G., 1973, Transportgeografiska studier i svensk utrikeshandel, pp. 338-343.
Norström, G., 1977, A Gravity Model of the Regional Distribution of Sweden's Foreign Trade, pp. 12-14.

The best correlation between cargo flows and regional economy was reached for the number of consignments to and from a region and the number of employed in the manufacturing industry. The consignments concerned general and break bulk cargo in Swedish foreign trade, which justified the use of the employment in wholesale trade as an additional explanatory variable. The foreign trade in general and break bulk cargo was assumed to be concentrated to a few wholesale regions. The hypothesis was confirmed for county *län* level, but not for smaller regions. However, it is necessary to underline the high correlation between wholesale and industry employment existing at the county level, i.e. the adding of wholesale does not much improve the explanatory power of the dependent variable.[1]

The consignment studies use gravity models and linear programming to estimate the geographic pattern and intensity of cargo flows. In the British study[2] both methods were used, which allowed a comparison of the results. The gravity model was traditional. The flows between pairs of regions were estimated by the demand for imports and the potential for exports per region. The distance between the regions was corrected by an empirical parameter, varying between 0.8 and 0.6 for the cargo groups, and between 1.3 and 4.8 for the total regional trade.[3] It was not possible to establish any systematic difference between these parameters for general and bulk cargo. The hypothesis that the bulk trade decreases more rapidly than the general cargo trade with increasing distance could not be confirmed. On the other hand, the hypothesis that the relative location of the region influences the intensity of its participation in interregional trade could be proved. The distance parameters for the peripheral regions were nearly twice those of the average.

The possibility of a discriminating influence of distance on the regional foreign imports and exports was also examined in the Swedish consignment studies.[4] A positive correlation was established, i.e. Northern regions showed less propensity for exports and imports than those of Southern Sweden, assuming that the distance to the Ruhr Region can be accepted as an average for the markets of the Swedish foreign trade.

The linear programming model of the British study estimated the geographical pattern from the following assumptions: the decisions of the transport buyers were rational and based on minimizing costs; supply and demand for goods in regions were not price elastic; and the transport cost was a linear function of distance and consignment size.[5]

---

[1] Norström, 1973, p. 341.

[2] Chisholm & O'Sullivan, 1973, pp. 66-100.

[3] The formula was: $T_{ij} = kO_i D_j dij^{-b}$, where

T_{ij} - flows from region in toj

O_i - population (employment) in the origin region

D_j - population (employment) in the destination region j

dij - distance

k,b - calibration coefficients

[4] Norström, 1973, 1977.

[5] Chisholm & O'Sullivan, 1973 pp. 76-81.

The estimated pattern showed a great similarity to the empirically mapped one (Table 2:3). Exceptions were the commodity groups "Other cargo" and "Coal and coke".

The comparison between linear programming and gravity models is given in Table 2:3. The results of the British study suggest that gravity models in general perform less well than linear programming in describing the intensity and geographic pattern of commodity flows. The determination coefficients for the estimated flows compared to the actual ones were usually below 0.5, i.e. much lower than the corresponding values for the linear programming approach.

Table 2:3. Gravity Models and Linear Programming as Tools for Designing the Flow Pattern of the British Domestic Trade

Commodity groups	Gravity models	Linear programming	
	R^2	R^2	Percentage of cells occupied in the matrix
Oil	.37	.69	20
Coal and coke	.49	.39	18
Scrap	.28	.87	9
Steel	.24	.89	37
Building materials	.60	.81	41
Chemicals	.31	.51	33
Other crude materials	.45	.82	35
Transport goods	.41	.79	40
Food	.62	.82	40
Other manufactures	.43	.57	61
Other cargo	.51	.28	41
Total flows	.50		

Sources: Chisholm, M. & O'Sullivan, M., 1973, Freight Flows and Spatial Aspects of the British Economy, London, pp. 75-78.

Modal Split

An analysis of the modal and route distribution of flows is the third and last step of the consignment studies. Since transport cost data usually is not collected in those studies, the transport distribution of cargo flows is analyzed on the basis of hypotheses about a close interrelation between distance and mode of transport, and between type of commodity and mode of transport.

The British study proved that the type of commodity influenced the choice of transport mode, even within the same cargo group, but no clear relation could be established between mode and distance.

The Swedish study, focused on foreign trade, showed that with increased distance the probability increased that sea and air transports were chosen before land transports. It also showed that consignment size, commodity value and regional accessibility to alternative modes were important explanatory variables when analyzing the modal distribution of general and break bulk cargo flows.[1]

Consignors

In the consignment studies, including the analysis of the consignors, the modal distribution of the cargo flows is in the focus while the structure and geographic pattern of the flows are given less attention.

The consignor data is collected through interviews. They include information on the general business strategy of a consignor, his production and markets, annual volume of shipped and received cargo, total costs of transports and access to alternative transports, e.g. ownership of lorries and ships; the long-term transport contracts; access to side tracks at the factory or warehouse. The collected information might also include "soft data" describing what consignors think about the competitiveness of alternative transports. These data are commonly collected *ex* post and include the consignors' ideas about prices, times, and the damage or delay hazards. They are compared with similar information from the bill of lading on actual performances. Thus, it is possible to examine to what extent consignors behave rationally in their choice of transports.

In a British study shipments of 1 013 industrial companies were studied during one week.[2] The sampling of consignors was made according to location and branch criteria. Half of the surveyed companies were sampled geographically in the metropolitan regions of London, Liverpool, Glasgow, and Newcastle, and with the help of a grid technique in the sparsely populated areas of south-eastern England. The other half consisted of a national sample, covering five branches: food, chemicals, iron and steel, electronics, and the paper industry.

An analysis of the modal choice among the surveyed companies was carried out with the help of probability calculations and cross tabulations. The probability figures used in the calculation were obtained from a multiple regression analysis. This comprised 24 variables in three

---

[1] Norström, 1973, pp. 354-357.

[2] Bayliss & Edwards, 1970.

groups: consignment data, transport buyer data, and the transport buyers' subjective views on alternative transports. Probability numbers were used to estimate the probability of a certain consignment from a given company type taking place with a given transport mode.[1]

The result showed that: the probability of transport services being bought increased with the distance, when the alternative was to use the firm's own transports; distance was of limited importance in the choice between road and rail transport; a larger consignment increased the probability that rail was chosen instead of road transport; larger consignment size increased the probability that the firm's own mode of transport was being chosen; the price elasticity was low in the choice between transport alternatives; time of transport was not significant for the modal distribution of cargo flows according to ex post measurements, although three-fourths of the interviewed firms considered speed the most important criterion; the commodity combination only to a limited extent influenced the choice of transport mode; quality, transport packing, and damage or loss hazards had a relatively small influence on the choice of transport solution.

These results were based on the estimated probability calculations and were verified by the cross tabulations. The findings stand in sharp contrast to the transport buyers' subjective views on factors and relations ruling their choice of transports as shown by market survey studies.

A Dutch consignment study[2] including consignment and consignor data, resembling the British as regards choice of variables and calculation methods, reported the following results: proximity and access to quay-berth, yearly cargo volume and price determine the choice between inland waterways and land transports in the bulk cargo trade; time of transport, and to a certain extent, consignment weight and price, guide the choice between inland waterways and road haulage in general cargo trade.

---

1 The probability model was as follows:

$y_m = f(x_1, x_2, \ldots\ldots\ldots x_n)$ where

y = the probability that transport solution m is chosen before other alternatives

x = regression coefficients for the variables 1 to n

Since the regression coefficients were not weighed, the calculated probability could be larger than 1. In such cases those explanatory variables were used in the model whose regression coefficients show the highest values.

2 Bayliss, 1973, p. 61.

The importance of the time factor as a determinant in the transport choice rank differently in the Dutch and British studies. It implies that only large time differences have an influence.

Applicability

Consignment studies are static, based on a momentaneous picture of the transport market which limits their value as a tool for long-term forecasts of the future geographic and modal distribution of flows. The consignment method does not allow for dynamic sensitivity analyses of possible reallocations of flows caused by changes in market conditions, prices, techniques, service networks or organizational patterns. However, the addition of the information about elements that guide consignors' transport choices and about their evaluation of the transport alternatives should give a dynamic perspective to the consignment approach and thereby increase its usefulness in forecasting under the assumption that stable relations exist between the consignors' modal preferences and their actual decisions. The extensive data gathering needed and their static character mean that the consignment approach is not very commonly used in the analysis and forecast of the demand for interregional and international transports.

MARKET SURVEY STUDIES

The market survey study is the second most common method of studying the demand in the cargo transport market. Its purpose is to ascertain the views of the consignors about the alternative transport solutions and subsequently to segment the market by groups of consignors with a common need of transports. The survey method is often used as a parallel or complementary method to consignment studies.

Data Collecting

Collecting of data is carried out either with the help of an inquiry among consignors or through the Delphi technique (a group of experts are asked to evaluate factors and interdependences that guide the consignors' choices of transports). These studies are solely based on the subjective views of the consignors; no empirical survey is included to show the actual modal distribution of flows. The reason for using this method is the assumption that the choice of transports is a recurrent decision, i.e. consignors have a good knowledge about alternatives supplied in the transport market, which was not proved by the results of the consignment studies,[1] and that the subjective elements that cannot be solely explained in terms of transport economy have a strong influence on actual choices.

---

[1] See p. 213.

The grouping of consignors is commonly made according to industries under the assumption that firms producing the same type of goods should have similar needs of transports and act the same way in the transport market.

The alternative is to select firms that recently made a radical change of transport solution on the assumption that they have good knowledge about the alternatives and that their change was based on empirical studies of the advantages and disadvantages of the alternatives and that their evaluation was rational. However, this method can seldom be used, as radical changes of the transport system are rare among manufacturing companies, particularly as a limited time span is required so that the comparison can be made within one transport technique and under similar organizational conditions.

The inquiries can be carried out with the help of standardized or unstandardized questionnaires or via interviews. Choice of the method might have a strong influence upon the results of the study.[1] In the unstandardized questionnaires the transport buyer is asked to name and rank factors influencing his choice of transport solution. In the standardized form the transport buyer ranks factors already defined in the questionnaire. This ranking can be made in absolute terms, i.e. the factors are shown as number one, two, three, and so forth, or with the help of a relative ranking according to a value scale. The latter method makes it possible to examine the elasticity between individual factors, i.e. answers the question to what extent changes in one factor can influence the choice between the transport alternatives.

Evaluation of the Results

Table 2:4 and 2:5 summarize the results of several market survey studies, the majority of which were based on questionnaires, some on interviews with the consignors and only two on the Delphi-technique. The variables used can be gathered into four groups: cost, time, consignment characteristics, and quality of the supply.

As there are strong interdepencences between the variables, the answers may be influenced by implicit assumptions of the interviewed that one variable is given. Others are then valued in relative terms, making it difficult to interpret the answers. The risk for an implicit relativity is especially large when unstandardized questionnaires are used to analyze the structure of the demand without a close specification of cargo group or transport distance.

As can be seen from Table 2:4, there are big differences between individual studies as regards the selection and definition of variables influencing the consignors' choice of transports. These differences should be noted particularly when comparing the results of the studies covering

---

[1] Wärneryd, 1967, pp. 102-107.

Table 2:4. Reasons for choosing mode of transport by industry, ranked according to importance

Variables	EMNID		Inst of Transp Münster		BDI	IHK		Ministry of Transp Vienna	EEC	Inst of Transp Cologne			HHS	SOU 75			IFV	Samf.
	Industry	Commerce	I	II		Bonn	Osnabrück			Industry	Commerce	Experts		Bulk cargo	B-b cargo	General cargo		
Costs																		
Charge for transp	2	1	3	4	3	3	2	3	1	2	3	1	2	–	–	–	1	1
Terminal cost	–	–	4	3	4	3	3	–	–	–	–	–	–	–	–	–	–	–
Total dist cost	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	1	–	–
Packing cost	–	4	5	2	5	5	4	7	–	9	11	8	–	–	–	–	–	–
Time																		
Speed	1	2	1	1	–	–	–	2	2	3	4	4	1	–	–	–	3	3
Delivery in time	–	–	2	–	1	1	1	–	–	1	1	2	3	–	–	–	–	2
Consignment																		
Size	4	3	–	–	–	–	–	–	6	10	10	5	4	–	–	–	–	–
Location of firms	–	–	–	–	–	–	–	4	5	11	12	12	–	–	–	–	–	–
Length of haul	6	–	–	–	–	–	–	–	–	12	8	9	7	–	–	–	–	–
Type of com	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	3	–	–
Cond of delivery	–	–	–	–	–	–	–	–	–	–	–	–	–	2	2	2	–	–
Com buyers transport preferences	–	–	–	–	–	–	–	–	–	–	–	–	–	3	3	2	–	–
Transport services																		
No transshipment	5	–	–	–	–	–	–	–	–	4	5	3	–	–	–	–	–	–
Immediate poss. for substitution	–	–	–	–	–	–	–	1	–	5	2	11	–	–	–	–	–	
Safety	3	3	6	–	6	4	3	6	4	6	9	6	6	–	–	–	2	–
Regularity	–	–	–	–	–	–	–	3	3	7	7	–	5	–	–	–	–	2
Service to customer	–	–	–	–	2	2	–	8	–	8	6	7	–	–	–	–	4	–
Advertising	–	–	–	–	7	6	6	5	7	13	13	13	–	–	–	–	–	–
Lack of alternative	–	–	–	–	–	–	–	–	–	–	–	–	–	2	4	3	–	–

Sources: European Conference of Ministers of Transport, 1973, Report: Demand for Freight Transports, Paris, p. 48, Handelshögskolan i Stockholm, 1974, Utbud och efterfrågan på internationella godstransporter, Rapport 3, Stockholm. Empiriska studier av företagets val av godstransportmedel, 1977, Kungliga Tekniska Högskolan, Stockholm.

Table 2:5. Reasons for Major Changes of Transport Modes in Germany[a]
(No. of firms)

Reasons	From rail to road	From road to rail
Freight charge	3	22
Speed	3	-
Security	-	3
Reliability	-	1
Flexibility/independence	2	-
Service	4	5
Special vehicle/wagon	4	8
Customer decision	3	-
Favorable loading times	-	1
Private siding	-	5

a No definition of a major change was given.

Source: European Conference of Ministers of Transport, 1973, Report: Demand for Freight Transport, Paris, p. 51.

choices in individual phases of the transport process with the holistic ones, i.e. door-to-door transports. As seen from the table, terminal costs were treated as a separate variable in five studies and included into either transport or distribution costs. The singling out of the terminal function complicates the interpretation of the influence of individual variables on the consignors's evaluation of the competitiveness of the transport alternatives. In most cases, consignors probably consider total cost or time for door-to-door transport as a measure of an individual transport solution's competitiveness without distinguishing between transport and terminal phases. Where price was defined as the total cost for door-to-door transports, this variable was always ranked as most important when choosing among transport alternatives (Table 2:4). Transport time and punctuality were second only to price. Others (consignment size, packing cost, transport distance and terms of payment) seem to play a less important role in the consignor's choice of transports.

Table 2:5 shows the results from an inquiry to companies which recently made extensive changes in their transport systems. The price seemed to be the decisive argument when turning from road to rail. Transport time, low punctuality, price, demand for better cargo protection and delivery on time were the dominating reasons for changing from rail to road.

The results given in Table 2:4 and 2:5 show only small differences, i.e. "feelings" of average consignors, closely correspond to the views of the firms which recently changed their transports. The latter have a good knowledge about the competitiveness of alternatives which indicates that the "feelings" of average consignor well reflect the actual differences on the market.

Applicability

The market survey method is based on "soft" data, i.e. consignors' opinions about interdependences and elements that guide their transport choices. Its reliability depends strongly on the definitions of variables and decisions. In some cases a decision situation may be missing, i.e. the choice of transport is not regarded as decision by the interviewed consignor. In such a situation his answer will be based solely on theoretical considerations and not anchored in reality. Difficulties with definitions of variables and processes may also negatively influence the reliability of the study. Consignors' may include varying activities under the transport process which in turn may influence their valuation of the influence of individual variables on their transport choices. Relativity in the valuations may also decrease the reliability. Consignors may imply that an important variable has a given value, which means that the others are estimated in relative terms.

These difficulties arise primarily when using standardized inquiries. Unstandardized ones allow for more flexible answers but the obtained information is less systematic which makes statistical treatment more difficult. Therefore, standardized inquiries are most commonly used in the market surveys in spite of their weakness.

TIME SERIES ANALYSES

The time series analysis is the most common method for the study of the demand in the transport market. It may be carried out with the help of trend and market share analyses or causal with models. It may be used in the study of the total demand for transports and of its modal and route distribution. The aim is to design the historic patterns and interdependences and thus form a basis for forecasts. Every time series of economic data is a function of four components - trend, business cycle, seasonal, and stochastic variations. In the analysis it is necessary to examine the influence of each, as their impact on the prognoses varies with the length of the forecasted period. In long time series, the trend and business cycle are the most important explanatory variables. The trend states the direction of the long-term development tendency, while the business cycle component can be used when explaining recurrent, long-term (4-7 years) variations around the trend.

In some studies of the long-term changes in the demand for sea transports the theory of the long business cycles, about 50 years, was used to find out and explain regularities in booms and depressions of international shipping.[1]

Trend Analyses

The trend analysis of foreign trade data is by far the most common form of studies of the demand for international transports. The historical trends are extrapolated to find the future volume and structure of cargo flows. In many studies it is implied that the historical interdependences will be valid also in the future. This conflicts with the theory of the product life cycle, which states that each product and service goes through four demand phases: introduction, growth, maturity, and decline. It seems to be particularly valid for changes in the demand for manufactured products, i.e. in the demand for general cargo transports. As discussed in the first chapter, the technical development in transportation resulted in increased competition on this market. Consequently, the demand for some traditional transport alternatives declined and the product life cycle after World War II[2] became a pronounced phenomenon also in the transport industry. This stimulated the development of the market share and causal models in forecasting the demand for international transports.

Market Share Models

The market share method is used as a completing instrument to correct the trend extrapolation and include the impact of the product life cycle. It is performed in two steps: (1) trend extrapolation of the total demand for general or break bulk transports within a given geographic market, and (2) the market share method to estimate the modal and route distribution of flows according to the future attractiveness of individual transport solutions. The method is based on qualitative judgements about the future competition on the market. The competitiveness of individual modes and terminals is estimated according to the life cycle theory. In quantitative terms this may be done with the help of a time series showing changes in the relative

---

[1] Rzepecki, 1975, pp. 35-48.

[2] The theory of the product life cycle is the postwar development of the logistic growth curve introduced into the research on the international commodity trade by I. Högbom and P.W. Kuznets around 1930. The product life cycle can be seen as the lengthening of the logistic curve to include also the down period.

index of competitiveness. This shows whether a transport solution increases or decreases its market share.[1]

The results of the market share models are commonly given as a minimum and a maximum with a wide range of alternatives in between.

Causal Models

In the causal models the volume, commodity and geographic structure of the flows and their transport assignments are analyzed with the help of quantitative methods. It is assumed that commodity movements and their modal and route distribution are determined by quantifiable economic factors, and that the irregularities of the time series may be captured by explicit relationships between cargo flow data and one or more explanatory variables. These are based on international trade theory and the theory of economic interdependences in transports.

The following variables are most commonly used to "explain" the changes in international general cargo flows: gross national or domestic product, relative import and export prices, indexes of industrial production, employment and population data. The relation between those variables and the volume and structure of the commodity flows are expressed in quantitative terms with the help of regression analysis. Elasticity calculations are frequently used as a complementary method. They show to what extent changes in the volume of cargo corresponds to changes in the independent variable.

Causal models are an attractive approach to the studies of the demand for transports by the international general cargo trade. They not only provide the description of changes in the demand over time, but also explain economic phenomena and interrelations that cause the changes. Causal models are based on "hard" data which are commonly well defined and available in most countries of the world. However, the causal models have some important drawbacks: limitations in the relevant economic theory; exceptional events are not easily accounted for (strikes, economic crises, political trade restrictions); and difficulties in assuming whether quantified relations are significant.

---

[1] Index of Competitiveness (IC) = $\dfrac{V_x\ t1\ {}^{V}x\ t0}{V_x\ t0\ V_x\ t1}$ where

$V_x\ t1$ - volume of cargo carried by transport solution x during the examined period t1

$V_{x\ t0}$ - volume of cargo carried by transport solution x in the basic period

$V_x\ t0$ and $V_x\ t1$ are the total volumes of cargo in the examined and basic period.

A transport solution with an index below 1 during a long period is in the down phase of its life cycle, while an index value higher than 1 indicates the phase of expansion.

PORT – HINTERLAND STUDIES

Seaports have a strong impact on the geographic organization of international general cargo transports. Their location and competitiveness have a strong influence on the patterns of cargo flows and liner services. Port investments are costly; most port facilities can not be used for other services than the handling of cargo and ships. Therefore, the analysis of the demand for port services is an important element in the studies of demand for international sea transports.

Port demand studies are either integrated into the modal choice analysis or carried out separately. The central problem is the size of the port hinterland and its export potential and import needs. A port demand study can be limited to an individual port or cover a range of ports, constituting either a national port system or shipping market. Demand studies limited to a single port, i.e. excluding geographic competition, are useful only for bulk transports. The highly specialized land transport and port facilities in most cases prevent competition between bulk ports.

General cargo flows have become more and more mobile with the development of long-distance land transports, and the competition between general cargo ports increased both at nationally and continental levels. Hinterlands of general cargo ports can thus not be defined with the same geographic accuracy as those of bulk ports. A general cargo port often has several hinterlands, varying with the commodity group and destination.

Considering the pull of a general cargo port on the surrounding region, the following types of hinterlands can be distinguished: local, primary, secondary, and transit.[1]

The local hinterland includes the port town with the port as the dominating alternative.[2] It should be noticed, however, that small ports of today lack general cargo traffic and thus a local hinterland. The primary hinterland covers the area for which the port is the most advantageous alternative. Only relatively small quantities of the seaborne general and break bulk cargo trade, destinated to or shipped from that area, are handled in alternative ports. Secondary hinterlands are the areas where several ports compete for traffic. Transit hinterlands are foreign parts of a secondary hinterland.

---

[1] Morgan, 1951, 1958; Weigand, 1958; Bird, 1968, 1971.

[2] Kenyon, 1970, p. 8.

Cargo attracted by a port from transit hinterlands are the outcome not only of competition but also of the transport, trade and foreign policies of the country generating or attracting transit traffic. Its transport policy can be directed to promote domestic ports through discriminating legislation or with the help of economic measures, e.g. differentiated land transport rates or custom tariffs. Such measures are against the principles of free trade and have diminished in postwar Western Europe. The whole area can be regarded as a secondary hinterland of major ports competing for deep-sea general cargo traffic. Liberal transport policies and the development of container and roll-on - roll-off deep-sea services focused the analysis on the competitive position of general cargo ports in Western Europe.

Two approaches are common: qualitative methods based on descriptions of the interaction between port and hinterland, and quantitative methods in which these interactions are formalized with the help of econometric models.

The Qualitative Approach

The descriptive analyses of port-hinterland interactions are based on surveys of the economic development of regions that form the potential hinterland and on studies of the supplied land and sea transports. General cargo flows that may be attracted to a seaport are commonly estimated through the analysis of the following variables: location and structure of the manufacturing industry, pattern of foreign trade, location of import warehouses, the inland transport network and the applied pricing system, the pattern and prices of shipping services calling at the competing ports, and the price and quality of cargo handling services supplied.

The qualitative analyses are either static or dynamic. The first aims to find the optimal location of a seaport within a given pattern of demand for sea transports. The main criteria usually is to minimize total transport costs. "The law of transport refraction" based on the traditional location theory is the methodological ground of this approach.[1]

---

[1] The basic "transport refraction model" is as follows:

$$f(C_T) = \Sigma D_i^L \; Q_i^L \; C_L \; + \; \Sigma D_j^S \; Q_j^S \; C_S + Q_P \; C_P \longrightarrow \min$$

where:

C_T - total transport costs

D_i, D_j - distances between port and origins/destinations in the hinterland, and to and from all ports

Q_i, Q_j - quantities of cargo carried by land and sea transports

C_i, C_j - costs per ton of land and sea transports

Q_P - quantity of cargo handled by the port

C_P - cost of cargo handling

Its static character, limitation to only the optimization criterion and the lack of port competition make the refraction model rather useless in the analysis of demand for general cargo ports. Therefore, a dynamic approach has been used. It tries to explain the genesis of a hierarchical port system as a result of the development of economic growth poles in the hinterland and of inland and sea transport networks.[1] According to this view the competitive position of general cargo ports changes continuously. Hence, only few major ports occupy a relatively stable position in the general cargo trade, while the medium ones tend to show large fluctuations. The stable position of the large ports is a result of their well-established commercial, financial and organizational structure which may lead their traffic upward via a "nothing-suceeds-like-success spiral".[2] In the dynamic approach the shape of hinterland is designed by several calculations of isodistances, isochrones and isovectors, reflecting the influence of changes in the transport network upon the competitive position of ports.

In most studies, the hinterland of general cargo ports is designed after an analysis of the performance of the inland transports only.[3] Hence, the price for the sea transport to a given destination is presumed to be the same for all competing ports, an assumption valid only for the base ports of the lines located in the same geographic area.

However, there are significant differences between base ports, as regards the frequency of sailings, and the quality of cargo handling services. These differences have a strong influence on the competitive position of the ports and should be considered when calculating the hinterlands. For non-base ports the differences in shipping costs, as well, influence the size of the port hinterlands.[4] All phases of the transport process should thus be included to reflect as realistically as possible the competitive situation in the market. This especially holds for short-sea traffic to and from countries with long coasts and a well developed port system.

Econometric Hinterland Models

Econometric hinterland analyses are based on quantitative models. The starting point is an assumption that all important factors and interdependences that determine the

---

[1] Taffe, et al., 1963, pp. 503-519; Rimmer, 1967

[2] Bird, 1971, p. 132

[3] Högbom, 1934, pp. 36-37; Hölcke, 1952, p. 185; Barczuk, 1966, p. 43

[4] Unger, 1973, p. 155; Gilman & Wiliams, 1976, pp. 137-145

distribution of general and break bulk cargo flows between competing ports can be quantified with the help of mathematical functions and integrated into an operational model.

Gravity models, linear programming and simulation techniques are used to design the pattern of cargo flows between port and hinterland. The gravity models explain the distribution of cargo flows, departing from two hypotheses: (1) with increasing distance the competitiveness of the port decreases, and (2) large ports exert greater attraction on cargo than smaller ones because of the economy of scale in general cargo services. The value of gravity models for estimation of the demand for port services was empirically tested in a British study.[1]

The formula was a modified version of the classic gravity model.[2] The total cargo turnover of the port and the export potential of the regions were used as measures of the masses in the gravitation model. The distance was expressed as the crow flies. The maximum cargo handling capacity of a port was assumed to equal the volume of actual turnover. An assumption was also made that all export traffic from the regions was taking place via the examined port.

Besides the gravity model, cross tabulation and gradient methods were used in the British study. The result indicated that local and primary hinterlands can be distinguished only for large ports. The small ports only have

---

[1] Portbury, 1966

[2] The Portbury formula of the gravity model was as follows:

$$T_{ij} = A_i\ B_j\ O_i\ X_j^a\ f\ (d_{ij},\ b)$$

where

T = Estimated cargo exports from region i through port j

O = Total exports from region i

X = Total export volume handled in port J

d = Distance between port j and region i

a = Calibrating model parameter for reshaping the port component

b = Calibrating model parameter for reshaping the distance component

A,B = Constant expressing the power of attraction of the port considering both the competitiveness of other ports and the propensity of the regions to use the port rather than alternative ports.

$$A = \frac{1}{\sum_k B_k\ X_k^a\ f(d_{ik},b)} \qquad B = \frac{X_j}{\sum_k A_k\ O_k\ f(d_{kj},b)}$$

secondary hinterlands, as they are within the gravity fields of the large ports. London and Liverpool, the two leading general cargo ports of Britain, accounted for 80-90 % of their primary hinterlands, delimitated with a 40 km isoline. The corresponding values for smaller ports, like Hull, Southampton and Bristol, were much lower (50, 31 and 38 % respectively).[1] The general conclusion of the study was that the major part of the country could be regarded as a secondary hinterland, i.e. the British general cargo ports are in strong competition for cargo. The best adaptation between model results and empirically observed flows was obtained by correcting the distance component with a parameter b = 1.25 and the port component with a parameter a = 1. It should be pointed out that the importance of distance as criterium for hinterland delimitation is dependent upon the location of the export industry in relation to the ports. In the British study the area within a 160 km circle covered 80-90 % of all traffic through ports. However, a study of the hinterlands of Polish ports shows that only 5-10 % of the cargo turnover in the ports can be derived from regions situated within 200 km. A 600 km isoline is necessary to delimit 80-90 % of the cargo traffic in Polish ports.[2] This shows that no general rule can be stated about physical distance between ports and the core of their hinterlands.

In a study on the cargo traffic in South African ports the usefulness of gravity models was compared with that of isodistance and isovector methods.[3] The areas of theoretically estimated hinterlands were compared with the empirical consignment data. The gravity model gave the most realistic approximation of the hinterland of individual ports ($r^2 = 0.90$ and distance deviations from empirically mapped limits was about 85 km). The result was somewhat inferior with the isodistance method ($r^2 = 0.81$ and a distance deviation of 112 km). The isovector method gave the poorest approximation of the port hinterlands ($r^2 = 0.56$ and a distance deviation of 135 km).

Although good for the explanation of the current pattern, the gravity models have several drawbacks as regards their use for prognoses of the future attraction of ports. The calibrated parameters reflecting the influence of unknown variables might influence the result considerably. Their values are based on empirical investigations of current conditions and cannot be estimated for the future. A direct use of gravity models in forecasts without changing the parameter value means that the present

---

1 Portbury, 1966, p. 51.

2 Barczuk, 1975, p.48.

3 Shaffer, 1965.

influence of unknown variables upon the distribution of cargo flows is assumed to be valid also in the future.[1]

As alternatives to gravitation models, linear programming and simulation techniques have been used to build quantative models of port hinterlands. Linear programming and its usefulness for hinterland studies is discussed further in chapter 4.

Simulation models are mainly used to plan port investments and are focused on the internal work at the port.[2] Analysis of the hinterland is generally a secondary problem, although it is the most important single item affecting discussions relating to the operations of, and investments in, the port.[3]

In the simulation models, data on cargo flows to and from the hinterland are regarded as exogene variables, which are obtained through time series analyses of national and regional production and foreign trade data. The simulation techniques are used to adjust type of ships and their sailing frequences to the structure, volume and seasonal variations in the cargo flows handled in a port, but do not cope with the question of volume and geographic pattern of the demand for port services.

CONCLUSIONS

In the first part of this chapter was shown that modal and route allocation of general and break bulk cargo is complex, a function of decision-making by consignors as well as producers of transport and terminal services and by several groups with a strong although indirect influence on the transport market. Neither in the short nor in the long perspective can modal and route allocation of flows be viewed as a function of a single variable. Models and methods used in the analysis should reflect this complexity.

The methods can be divided into four groups: multiregional transport models, consignment studies, market surveys and time-series analyses. Port-hinterland studies form a separate subgroup seeking to estimate demand for services supplied by a port or a system of ports. In this chapter the interest has be focused on the influence of assumptions made, particularly implicit ones, on the result of the studies.

---

[1] Heggie, 1969, p. 102.

[2] Development of Ports, 1969; Gulbrandsen & Eidem, 1973; Lawrence, 1973; Eidem, 1974.

[3] Development of Ports, 1969, p. 16.

No approach is always "best" for the analysis of the modal and route distribution of general cargo flows. The time series analysis in most situations is easiest. Causal models based on time series analyses use aggregated trade, production, transport and other economic data and cannot be used to answer questions about the consignors' motives for transport choices made, nor explain interdependences between type and geography of shipments on the one hand and modal and route choices on the other.

The consignors' evaluation of individual transport alternatives can be analysed through market surveys. The reliability of the results of this common approach varies as the definitions of variables and the forms for interviews differ considerably between individual studies making comparisons difficult. It is undoubtedly the easiest way to map the consignors' opinions about their transport alternatives. Consignment studies combined with the market-share approach are particularly useful in short- and medium-term analyses of the modal and route allocation of cargo flows.

Consignment studies are used to find the interrelationship between type and geography of shipments, the characteristics of consignors and the modal and route allocation of flows. To obtain a sample of consignment data, this very time-consuming but the reliability and comparability of the results is much higher than for market surveys. The method of sampling may influence the results. The consignment approach is a useful complement to the market surveys, particularly for medium-term analyses, but it is to expensive for short-term studies and too static for long-term projections.

Multiregional transport models are methodologically most advanced and require computer facilities and detailed information about variables and interdependences influencing modal and route allocation of cargo flows. They are based on the findings of the other methods. Multiregional models form a powerful method for the medium- and long-term forecasts of the demand for individual transport alternatives. Simulation of various alternatives in the supplied transport services and in the pattern of commodity production and trade is required. The main difficulty of this approach is to make adjustments of quantified interdependences on the transport market to future developments. The results of this approach should therefore include an in-depth analysis of the validity of explicit and, particularly, implicit assumptions made.

3. TRANSPORT OF GENERAL AND BREAK BULK CARGO TO AND FROM SWEDEN

This chapter is focused on changes in the demand for general cargo and break bulk cargo transports in the foreign trade of Sweden during the 1960's and 1970's and on the perspectives for the 1980's. The analysis is concentrated on three questions: (1) the relationship between production pattern and location of industries in Sweden and size, structure, and geography of flows, (2) modal reallocation of flows, and (3) the role of individual ports in the seaborne general cargo and break bulk cargo trade of the country. The results of this analysis form the empirical background for a model study of port and modal competition described in the next chapter. Particular stress is put on flows between Sweden and the rest of Europe which is the most competitive market in the transports of Sweden's foreign trade in general and break bulk cargo.

The analysis is carried out in three steps. The first covers the demand derived from the total trade data. It provides a general framework for the second step, detailed studies of tendencies in the general and break bulk cargo markets. The third step of the analysis is the modal and port distribution of flows.

The flow analysis is the basic method in this chapter. It includes trend and regression models and series of indexes showing the relative traffic gains and losses by modes and terminals.

THE TRANSPORT DEMAND OF SWEDEN's FOREIGN TRADE

Among important changes in the world economy after 1960 that have influenced the foreign trade of Sweden are:

- An internationalization of the national economies, i.e. foreign trade as in earlier decades rose along a steeper curve than the GNP.

- Regionalization of trade as a result of the creation of trade blocs.
- The four-fold increase in energy costs announced in the fall of 1973.
- Increased differentiation among countries in terms of economic growth.
- Inflation and economic stagnation, "stagflation", especially after 1972, in several countries.
- Increased government support to export industries from 1974 which restrains private and public consumption.
- Protectionistic tendencies, especially for industries with structural problems, leading to non-tariff trade barriers and, in some instances, quota restrictions.

PATTERN OF TRADE

In the 1960's and 1970's the Swedish economy was continuously internationalized, i.e. increased its dependency on the economic development in other countries, measured by both the flows of goods, services, and production factors across national boundaries and by the internationalization of institutions.[1] Although the commodity trade is the most important source of information in the analysis of the demand for transports, the flows of production factors should also be considered in a long-term study on the structure and volume of cargo flows. This is especially true as regards general cargo.

Sweden's foreign trade in the 1960's and 1970's grew faster than the GNP and industrial production (Figure 3:1). The annual growth of the GNP was 3.6 % for the whole period and 4.5 % for the 1960's, while both exports and imports increased by 7 %.

Thus the GNP-elasticity of exports increased from 1.7 for 1960-1970 to 3.0 for 1970-1975, while the changes in the imports elasticity were less pronounced, 1.4 and 2.0, i.e. the dependency of the Swedish economy on exports grew faster than on imports.[2]

As pointed out in Chapter 2, both GNP and industrial production can be used as independent variables in the explanatory models of foreign trade.[3] In Sweden GNP provides a slightly better explanation than industrial production

---

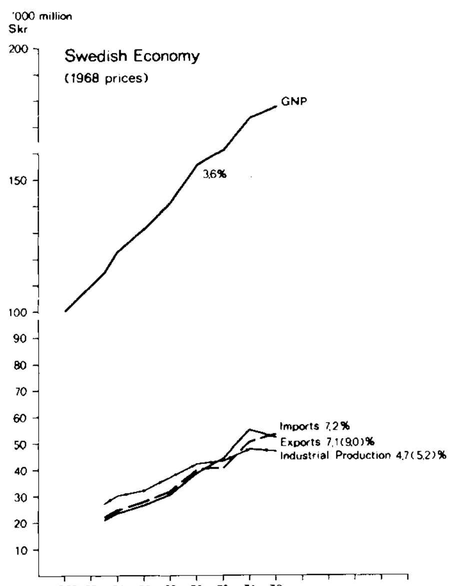
[1] SOU 76:27, p. 155

[2] GNP-elasticity of exports (imports) = $\dfrac{\text{exports (imports) growth rate}}{\text{GPN growth rate}}$

[3] See pp. 220.

for the development of imports 1960-1976.[1] For exports the two variables are equally powerful. The difference is probably explained by the great importance of private consumption in the demand for imports.

In spite of a higher growth rate for exports than for imports and unchanged terms of trade, deficits in the trade balance were reported throughout the period. It was 1.73 billion kronor in 1960 and 1.10 billion in 1970 (Figure 3:2). In relation to the value of the exports the trade deficit decreased from 13 to 3 % between 1960 and 1970. The deficit was balanced mainly by exports of services. The balance of payments thus was no restraint on imports in the 1960's.



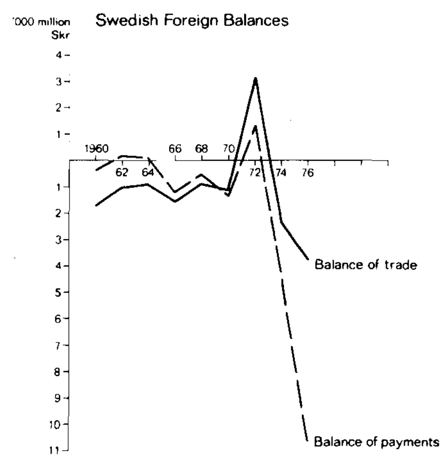


Figure 3:1. Swedish Economy

Figure 3:2. Swedish Foreign Balances

[In these and following figures the numbers show the yearly growth rates for period 1960-1976, those in brackets show the trends for the 1960-1974 period, i.e. before the oil crisis.]

---

[1] The regression equations read as follows:

$y_{exp} = 0.541\ x - 43,49 \qquad r^2 = 0.97$

$y_{exp} = 1.602\ z - 25.30 \qquad r^2 = 0.97$

$y_{imp} = 0.514\ x - 40.06 \qquad r^2 = 0.98$

$y_{imp} = 1.500\ z - 22.17 \qquad r^2 = 0.86$

where: x - GNP, 1968 prices, z - value added by industry, 1968 prices.

The relatively smooth postwar development of the Swedish economy in the 1970's ran into greater variations. The annual growth of the GNP was 1.7 % 1970-1971, increased to 3.7 % for 1972-1974 and was reduced to 1 % 1975-1976 (Figure 3:1). For the latter two years industrial production actually showed a negative development (-1 %).

These rapid changes in the economic development had strong repercussions on the foreign trade. The first two years of the 1970's had a rather moderate annual growth of exports, 6.7 %, followed by a rapid expansion 1972-1974 with 11.5 % and a decrease in 1975-1976 (Figure 3:1). Imports also registered a stagnation 1970-1971, a rapid expansion 1972-1974 (11.6 %) and a slow growth 1975-1976 (2.2 %).

As a result, the balance of trade shifted dramatically from a great surplus 1972-1974 to an even greater deficit 1975-1976 (Figure 3:2). These changes were accompanied by a rapid increase in export and import prices which contrast with the stability of the 1960's (Figure 3:3). The rise of export prices after 1974 was higher than that of imports. The unfavorable price developments and the stagnation in the world economy were the main causes for the decline of the exports in 1975 and its very slow growth in 1976. This led to a changed balance in the demand for transport services. Traditionally the volume of exports was larger than that of imports, i.e. the former gave the frame for estimating the transport needs of Sweden's foreign trade. But in 1975 imports were 16 % above the exports (Figure 3:4) as a result of a rapid fall in bulk (iron ore) and break bulk (wood products) shipments.

Two tendencies in the 1960's and 1970's were of particular importance for the transport allocation of Sweden's foreign trade: (1) the changing commodity structure, mainly the shift of exports toward more valuable goods (Figure 3:4), and (2) the concentration of trade to the Nordic countries (Table 3:1).

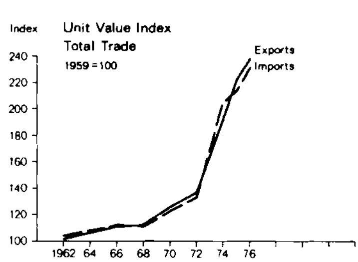


Figure 3:3. Unit Value Index Total Trade

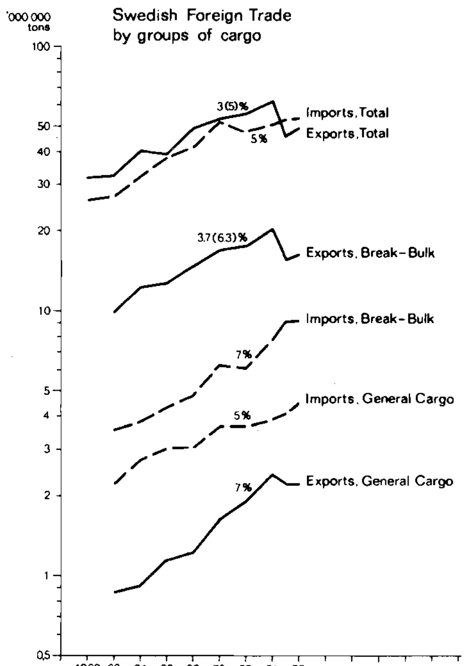


Figure 3:4. Swedish Foreign Trade by groups of cargo

The growth rate of the Swedish exports in 1968 prices, in the 1960's and 1970's was twice its growth in tons (Figure 3:1 and 3:4). The commodity structure of the imports was more stable with a growth rate by value only one percentage unit above that by volume.

The geographic pattern of trade was fairly constant with a domination for Europe (Table 3:1). Already in 1958 as much as 75 % of the exports by value were destinated for Europe. The share of imports from that region was nearly the same. Unfortunately, no tonnage data are available for the early 1960's, but in the mid 1960's the share of exports in tons to Europe was as high as 96 % (iron ore). It remained near that level during the whole period. The share of imports from Europe was much lower because of the oil flows from the Middle East and Latin America.

Although the total share for Europe was fairly stable, there was in the 1960's and 1970's a significant concentration to the Nordic countries, while the British market dropped in importance, particularly measured by tons of exported commodities. The share of the Continent, excluding the Centrally Planned Economies, also tended to decrease in the 1970's for exports but was stable for imports.

The transocean trade by volumes was evenly distributed in 1975 between North America, Asia and Africa. The share of exports to Africa and Asia had increased significantly, but with different structural changes. The average ton value in exports to Africa remained rather constant between 1965 and 1975 while it tripled to Asia (Table 3:1). The latter in 1975 was the second highest among all destinations and surpassed the average ton-value for exports to North America, the trade route traditionally dominated by high-value commodities.

MODAL DISTRIBUTION

The changed relations between bulk, break bulk and general cargo in the exports, and the concentration of trade to the Nordic countries further strengthened the competitiveness of the truck. The modal split of the Swedish foreign trade in the 1960's and the first half of the 1970's was characterized by three main tendencies: increasing role of trucking, stable share of railways, and declining share of shipping, excluding ferry services.

The market share of trucking in exports increased from 1 % in 1960 to 5 % in 1970 and 9 % in 1976, an annual growth of 20 % in the 1960's and 8 % in the first half of the 1970's[1] (Figure 3:5). Trucks in 1976 accounted for 36 % of the Swedish exports by value or four times as much as by weight. In other words, the trucked cargo was worth four times as much per ton as the average export cargo (Table 3:2). In the imports trucks registered a slower increase. They accounted for 2 % in 1960, 4 % in 1970 and 7 % in 1976 (Figure 3:5), which means an annual increase of 15 % in the 1960's and 11 % in 1970-1976. Measured by value the trucks accounted for 34 % of imports, which means a ton-value five times the average for the Swedish imports (Table 3:2). The ton values in recent years have been going down relatively both for imports and exports by trucks as they have widened their market share by transporting cheaper cargo. Throughout the period exports by road exceeded imports. Some 30 % of the truck capacity needed for exports cannot be utilized on the return trip (Figure 3:5).

Rail cargo kept pace with total foreign traffic 1960-1976; its five per cent market share, excluding iron ore transports to Norway which are treated here as seaborne trade, remained constant (Figure 3:5). Just as for trucks the export cargo dominated on the railroads until 1975 when imports exceeded exports by weight with 10 %. In 1976 the traffic was balanced. The average value of railroad freight

---

[1] Swedish transport statistics show what carrier was used when cargo passed the national border.

Table 3:1. Geography of Sweden's Foreign Trade

Region of Trade		Quantity											
		Million tons			%	%	%	Th. million Skr			%	%	%
		1965	1970	1975	1965	1970	1975	1965	1970	1975	1965	1970	1975
World	exports	41.2	52.7	45.5	100	100	100	20.5	35.1	72.0	100	100	100
	imports	34.0	50.9	52.9	100	100	100	22.6	36.3	74.9	100	100	100
Europe	exports	39.7	50.2	42.4	96.4	95.3	93.2	16.6	28.2	55.1	81.0	80.3	76.5
	imports	22.8	33.8	36.0	67.1	66.4	68.1	17.1	28.2	58.1	75.7	77.7	77.6
Nordic	exports	4.9	8.5	9.2	11.9	16.1	20.2	5.3	9.5	19.5	25.9	27.1	27.1
	imports	4.3	6.5	8.4	12.6	12.8	15.9	3.2	6.8	14.4	14.2	18.7	19.2
U.K. and Ireland	exports	9.2	7.6	6.2	22.3	14.4	13.6	2.8	4.5	8.2	13.7	12.8	11.4
	imports	4.7	7.1	4.6	13.8	13.9	8.7	3.3	5.0	8.3	14.6	13.8	11.1
Eastern Europe	exports	1.5	1.6	4.5	3.6	3.0	9.9	1.4	1.9	5.1	6.8	5.4	7.1
	imports	5.7	8.4	9.5	16.8	16.5	18.0	0.9	1.8	4.7	4.0	5.0	6.3
Other Europe	exports	24.1	32.5	22.5	58.5	61.7	49.5	7.1	12.3	22.3	34.6	35.0	31.0
	imports	8.7	11.8	13.5	25.6	23.2	25.5	9.7	14.6	30.7	42.9	40.2	41.0
U.S. and Canada	exports	0.6	0.5	1.0	1.5	0.9	2.2	1.5	2.6	5.0	7.3	7.4	6.9
	imports	1.7	1.7	1.8	5.0	3.3	3.4	2.3	3.5	5.3	10.2	9.6	7.1
Latin America	exports	0.3	0.3	0.4	0.7	0.6	0.9	0.7	1.2	3.2	3.4	3.4	4.4
	imports	5.4	4.5	2.0	15.9	8.8	3.8	1.5	1.5	2.2	6.6	4.1	2.9
Asia and Oceania	exports	0.5	1.1	0.9	1.2	2.1	2.0	1.0	1.9	5.7	4.9	5.4	7.9
	imports	3.1	6.4	9.3	9.1	12.6	17.6	1.2	2.1	7.5	5.3	5.8	10.0
Japan	exports	0.0	0.5	0.1	-	0.9	0.2	0.1	0.3	0.6	0.5	0.9	0.8
	imports	0.1	0.2	0.6	0.3	0.4	1.1	0.3	0.7	2.1	1.3	1.9	2.8
Africa	exports	0.2	0.4	0.8	0.5	0.8	1.8	0.6	1.3	2.9	2.9	3.7	4.0
	imports	1.0	4.4	3.7	2.9	8.6	7.0	0.4	0.8	1.8	1.8	2.2	2.4

Source: SOS, Utrikeshandel, Del II, 1965, 1970, 1975, Statistiska Centralbyrån, Stockholm.

Table 3:2. Sweden's Foreign Trade: Value per Ton (VT) and Index (I) (Skr)

	Exports[a]						Imports					
	1967		1970		1975		1967		1970		1975	
	VT	I	VT	I	VT	I	VT	I	VT	I	VT	I
Sea	374	70	380	60	890	60	380	60	380	50	760	50
Rail	1 560	300	1 530	230	3 070	190	3 358	520	3 260	460	3 350	240
Road	2 444	460	3 070	460	5 240	340	4 083	630	4 500	630	7 000	500
Total	528	100	666	100	1 582	100	650	100	713	100	1 398	100

a Exports of iron ore via Narvik included in the sea transports

Sources: Statistiska Meddelanden, Serie T 1977:22, 1978:5, SCB, Stockholm.

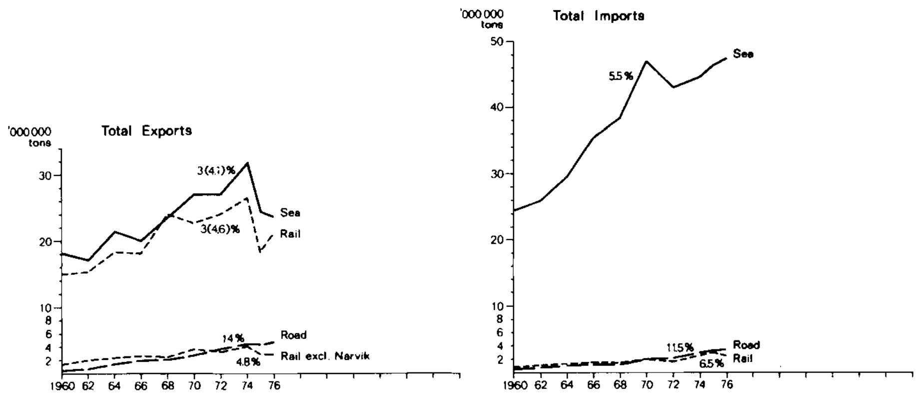


Figure 3:5. Total Exports and Imports

increased at a lower rate than total freight, i.e. the market segment of railways became more concentrated to low-value commodities (Table 3:2).

Seaborne cargo dominates Swedish foreign trade both for imports and exports (Figure 3:5). This is especially true when the ore exports by way of Narvik are considered seaborne. However, the dominance of seaborne export cargo was reduced from 93 % in 1960 to 85 % in 1976 as a result of the expansion in trucking. For import cargo the seaborne share declined from 95 % in 1960 to 88 % in 1976. The cargo balance in Swedish ports traditionally show a dominance for imports over exports because of the large oil receipts and the recording of the Narvik ore as rail freight.

The average value per ton of seaborne trade was low and declining in comparison with the average for the total trade both for exports and imports, i.e. reduced competitiveness of shipping was concentrated to high-value goods that were being taken over by trucks (Table 3:2).

FUTURE TRADE

Projections of the future development of the Swedish foreign trade were made much more difficult by the conspicuous deviations from the trend 1974-1976. The oil crisis in the fall of 1973 stands out as a great breaking point in international trade.

In a Swedish government report,[1] submitted in the summer of 1975, an optimistic projection shows a higher growth rate for the second than for the first half of the 1970's, while a pessimistic projection shows a lower rate (Table 3:3). Industrial production would have a higher or

---

[1] SOU 75:89.

an unchanged growth rate according to the two alternatives. In both a more rapid growth is foreseen for industrial production than for the total economy.

Table 3:3. The Future of the Swedish Economy. Annual Rates of Growth 1975-1980 (1968 prices).

Sector	Alternatives	
	Optimistic	Pessimistic
GNP	3.2	2.5
Industrial Production	5.2	4.2
Commodity Imports	6.6	5.5
Commodity Exports	8.8	7.7
Service Imports	5.2	2.7
Service Exports	-0.6	-0.6

Source: SOU 1975:89.

The years 1975 and 1976 had a low increase of GNP, 0.8 and 1.5 %, and 1977 was the first year in the postwar period with a decreasing GNP, -2.5 %.[1] Industrial production decreased all three years. The values of the quoted report based on data available in the summer of 1975 should therefore be adjusted downwards for the base year. Estimations in the report of 1975 can now also be compared with observed data for the first two years of the projection, 1976 and 1977. Industrial production was 5.2 - 6.2 percentage units below the projected values in 1976 and GNP 1 - 1.7 units below (Figure 3:1). Deviations for 1977 were even more pronounced, 3.6 - 9.6 percentage units for industrial production and 4.9 - 5.7 units for GNP.

Sweden's foreign trade showed even larger deviations from the projected values. Instead of the estimated increases, exports decreased by 10 % in 1975 and increased by 4 % in 1976 which means a negative deviation of 3.7 - 4.8 percentage units for the first year of the projection (Figure 3:1). During 1977 the exports were at the 1976 level.[2] Imports were below the projected values in 1975 with a decrease of 1 %, but in 1976 they showed an increase of 6.2 %.

The large deficit in the balance of payments 1975-1976 resulted in a decrease of imports by 2.9 % in 1977. Economic policy will give priority to export expansive measures, restraining private consumption which will hold

---

[1] Statistiska Meddelanden, Serie N 1978:8.1.

[2] Statistiska Meddelanden, Serie H 1978:11.

back imports. The 1975-1977 development suggests that the pessimistic projection in the 1975 report is more realistic than the optimistic alternative for estimating exports in the coming years.

Expressed in weight, Swedish exports grew at an annual rate of 5 % in the 1960's and 4.3 % in 1970-1974 (Figure 3:4). In 1975 it registered a drop of 27 % and a 6 % increase in 1976 (Figure 3:4). Imports increased by 9.3 % a year in the 1960's. Between 1970 and 1972 imports dropped from 50.9 million tons to 47.3 million tons, but in 1972-1975 registered an annual increase of 5 %.

In the early 1970's both imports and exports grew faster in fixed prices than in weight. Projections for estimating future cargo flows must therefore also have assumptions about future relations between fixed prices and weights, which require detailed studies of the cargo structure and changes in ton-values in fixed and current prices. It can be reasonably assumed that Swedish exports also in the future will record increasing ton-values slightly above the past and, *ipso facto*, lower growth rates for weight than for value. For imports these relations are more difficult to predict. Prices of raw materials and Sweden's industrial specialization are important parameters. Increased specialization means increased imports (and exports) of manufactured products.

In the following estimation of the foreign trade by weight, the GNP is used as an alternative to trade data by value. The 1960-1974 data show a close correlation between GNP and Swedish exports by weight and somewhat less for imports.[1] However, the determination coefficients were higher for foreign trade by value.[2] Projections in Table 3:4 are based on the 1976 data, which means that the consequences of the oil crisis were at least partly included.

Table 3:4. The Future Volume of Sweden's Foreign Trade (million tons)

	Alternatives			
	Optimistic ΔGNP 3.2 %		Pesimistic ΔGNP 2.5 %	
	Imports	Exports	Imports	Exports
1980	63	73	61	71
1985	77	88	71	82
1990	92	105	83	96

---

[1] The regression equations are:

$y_{exp} = 0.436\ x - 14.74 \quad r^2 = 0.95$

$y_{imp} = 0.036\ x - 14.18 \quad r^2 = 0.93$

x - Value of GNP in 1968 prices.

[2] See footnote on page 230.

The maximum alternative assumes an annual growth of 3.2 % of GNP until 1985, the minimum 2.5 %. According to this projection export flows again will surpass import flows. The decline in exports by weight for 1975 is here considered an exception from the trend. According to the projection the export weight should increase by 3.1 - 3.5 % a year and the import tonnage by 3 - 3.7 %. The official projection[1] of exports until 1980 in fixed prices gives 7.7 - 8.8 % a year and somewhat less for imports, 5.5 - 6.6 % (Table 3:3). By weight the exports should increase with 3.8 - 4.4 % a year and the imports with 6 - 7 %, assuming that the historic quotients for increase of foreign trade by fixed prices and by weight remain unchanged. The projected increases are higher with this method than with GNP as explanatory variable. However, it has to be underlined that all these prognoses are very uncertain as the repercussions of the oil crisis and of the inflation, as regards the size and structure of the world trade in the early 1980's, still are difficult to forecast.

DEMAND FOR GENERAL CARGO TRANSPORT

General cargo accounted for only 2.7 % of Swedish exports by weight in 1960 (Figure 3:4). In the 1960's it had an above average annual growth rate which led to a share of 3.1 % in 1970. This trend continued in the 1970's. The decline in exports for 1975 was less for general cargo (-5.4 %) than for total exports (-27 %) and general cargo increased its share to 5 % in 1976. Imports of general cargo increased at slower rates (Figure 3:4) and its share of total imports remained fairly unchanged for the period 1960-1976.

Although not so important by weight it should be underlined that general cargo constitutes about half the Swedish foreign trade by value. The high ton-value is an important element influencing modal and port distribution of general cargo flows.

The difference in commodity structure between imports and exports of general cargo may be a major reason for their distinctly dissimilar modal distribution (Figure 3:6). Shipping in 1976 lost first position in exports as a result of rapid growth in road transports. A switch of general cargo from sea to land transport occurred already in the first half of the 1960's, but data are not fully comparable. In 1967 a uniform data base was introduced. Shipping accounted for 46 % of the general cargo exports and for 62 % of imports that year. Rail transports had 27 and 18 % and road 27 and 20 %. Corresponding numbers for 1976 were: sea 42 % for exports and 46 % for imports, rail 11 and 17 %,

---

[1] SOU 1975:89.

while the share of road transport increased to 46 % in exports and 36 % in imports (Figure 3:6). The declining shares of shipping and rail results from trucking widening its market by attracting cheaper goods.

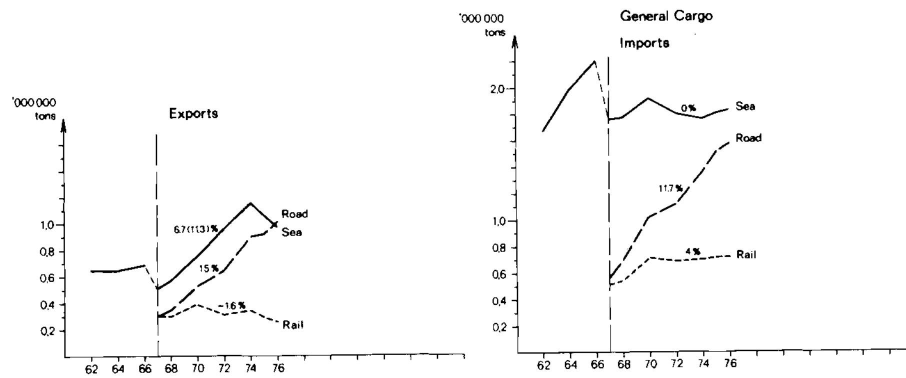


Figure 3:6. General Cargo. Exports, Imports

The long-term changes in the modal and port distribution of general cargo flows discussed above are caused by:

- A differentiated growth in the production and consumption of commodity groups as well as changes in their geographical pattern;
- A changed competitive situation between modes as a result of differences in technical and organizational developments in the transport industry;
- Concentration of trade to the Nordic countries.

An identification of changes in the demand for transports requires an analysis in depth of production trends and location patterns of individual manufacturing industries generating and attracting general cargo and of the geography of trade. For imports the consumption pattern is also a major factor. In-depth studies are necessary for discussion of future modal and port distributions of general cargo flows, i.e. for the analysis of demand for shipping and port services.

The fairly heterogeneous general cargo group can be divided into three main subgroups more homogeneous in their transport characteristics:[1]

- Machinery and transport equipment (CTSE 18) and manufactured metal articles (CTSE 17);

---

[1] For the discussion on commodity grouping for transports, see the first section of Chapter 2.

- Food and agricultural products (CTSE 2 and 3);
- Other general cargo, including crude materials and semimanufactures (CTSE 10, excl. 10.18) and miscellaneous manufactured articles (CTSE 19 excl. 19.40 and 19.41).

MACHINERY

Machinery is by far the most important subgroup by value of general cargo. By weight food is leading but only for imports. Machinery exports had a high and even annual growth rate in the 1960's, some 10 % in fixed (1968) prices (Figure 3:7). The 1970's showed large deviations from the trend. The engineering industry topped the total export growth by 2 percentage units for the 1970-1976 period (7.2 and 5.2 %). Exports had a higher growth rate than production. Export markets accounted for half the output of this industry. The annual growth of investments was 9.8 % for 1970-1975, less (7.0 %) if the shipyards are excluded.

The government long-term projection[1] (LU) assumes annual investment increases for the industry, excluding shipyards, of 5.9 - 7.0 % for 1975-1980, production increases of 5.4 - 6.5 %, and export increases of 8.7 - 10 %, i.e. a continued internationalization of the Swedish engineering industry. Some 60 % of the exports from this industry are investment goods, 30 % part and components and only 10 % durable consumer goods. Expansion opportunities are thus primarily influenced by industrial investments in the importing countries. Growth in investments abroad is the main business cycle indicator for the Swedish engineering industry. Changes in private consumption are of minor importance.

Even if prices may be of somewhat subordinate role in the choice of investment goods,[2] it should be pointed out that price increases were lower for exports than for imports within this commodity group (Figure 3:8). Roughly the same type of products were exported and imported. The Swedish engineering industry remained highly competitive in the international market until 1975. However, in the latter year prices for exports increased much faster than for imports. In 1976 for the first time in the postwar period, the price index for exports was on a higher level than for imports. Average price increases those two years were lower abroad than in Sweden. The changed price relations were of great importance for the export opportunities of the Swedish engineering industry.[3] They also influenced

---

[1] SOU 75:89.

[2] Ibid., pp. 208-210.

[3] SOU 78:78.

demand in the domestic market by stimulating imports. More indirectly, the price changes influenced the volume of Swedish foreign trade by stimulating Sweden-based corporations to increase their foreign investments[1] and cause foreign firms in Sweden to decrease their activity.

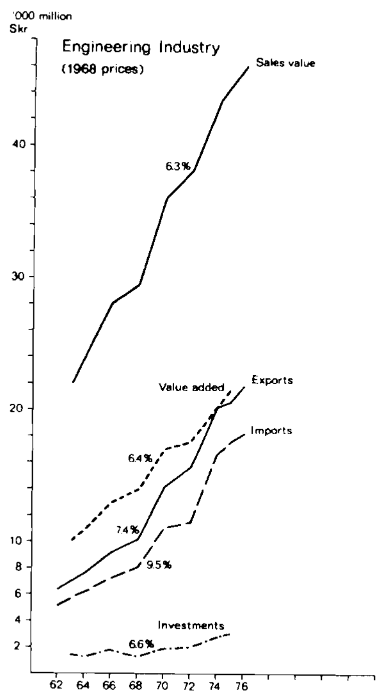


Figure 3:7. Engineering Industry

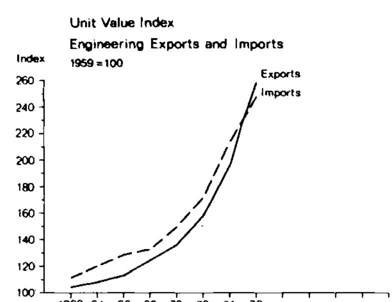


Figure 3:8. Engineering Export, Imports

The imports of engineering products in the period 1960-1976 increased at a slightly lower rate than exports (Figure 3:7). There was also a structural difference between incoming and outgoing flows. Parts and components accounted for 50 % of imports, investment goods for 30 % and durable consumer goods for the remaining 20 %, i.e. twice as much as in exports. Port distribution of imports is influenced not only by the location of industry but also of population and of the central import

---

1 Hörnell, et al., 1972, pp. 48-66.

warehouses of consumer durables. The influence of the latter two elements increased in the late 1960's and early 1970's as the structure of the demand for engineering products changed. Machine investments increased by 6.6 % a year in the first half of the 1960's but only by 4.1 % in the period 1965-1975, i.e. less than the production of the engineering industry (Figure 3:9). The consumption of consumer durables had the reverse development, 3.6 % and 5 % respectively. Its structure also changed. New cars declined from 42 % in 1964 to 30 % in 1975, which influenced the demand for shipping since cars are mainly moved in special vessels.

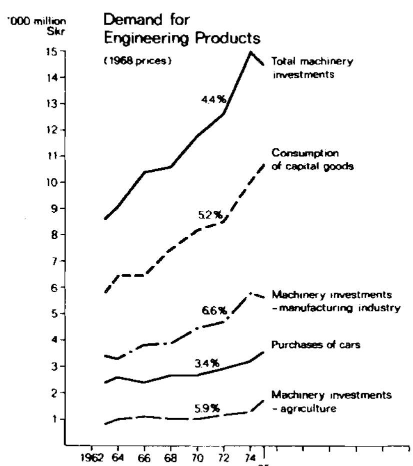


Figure 3:9. Demand for Engineering Products

Measured by weight the imports of engineering products increased by 5 % a year in the early 1960's, by 7.9 % in 1965-1970 and by 7.3 % in 1970-1975 (Figure 3:10), i.e. less than by value.

The structure of imports changed in 1960-1976 in favor of high-value goods (Table 3:5). The ton-value increased from 9 340 Skr in 1963 to 11 850 Skr in 1975, in fixed prices. The ton-value in fixed prices of the exports of engineering products remained constant, some 13 000 Skr for the whole period 1962-1972, i.e. the transport quality requirements of exports and imports became more equal.

Engineering products can be divided into two groups, according to ton-value: high-value goods, i.e. machines, apparatus and transport equipment (CTSE 18) and low-value goods, i.e. works of metal such as constructions, tools and simple products for domestic use (CTSE 17).

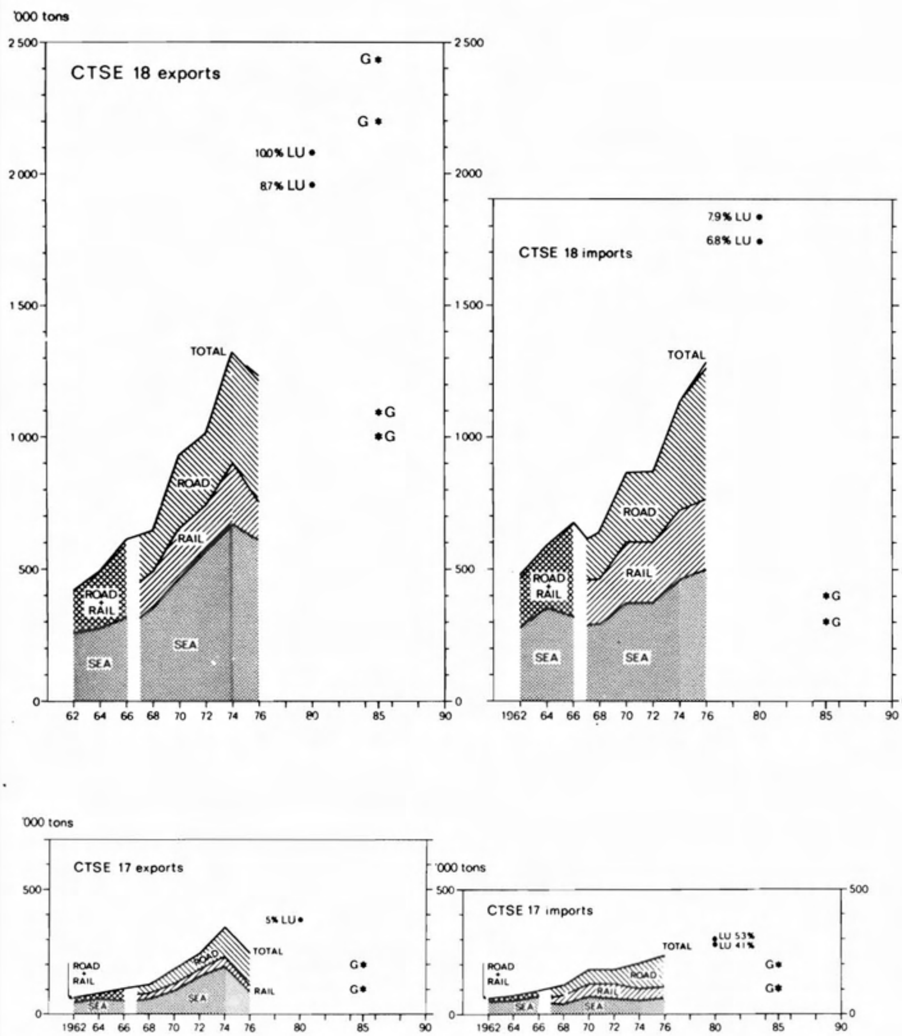


Figure 3:10. CTSE 18 exports, imports. CTSE 17 exports, imports

G - Prognosis of the seaborne trade including maximum and minimum alternatives made in 1974 by Godlund and Godlund for the Swedish Maritime Authority.

LU - Prognosis of the total trade including maximum and minimum alternatives computed from the governmental economic forecast in 1975.

Table 3:5. Commodity Structure of the Swedish Trade with Machine and Metal Manufactures

SITC	Commodity	Imports 1962 weight %	Imports 1962 value %	Imports 1975 weight %	Imports 1975 value %	Exports 1962 weight %	Exports 1962 value %	Exports 1975 weight %	Exports 1975 value %
69	Metal manufactures	11.7	7.1	15.4	8.5	13.9	9.6	18.9	8.8
71	Machinery, non electric	37.9	39.9	37.1	47.8	49.4	55.2	32.8	42.4
	Power generating machinry, non electric	4.6	4.9	5.4	5.9	5.3	5.5	3.4	4.4
711.5	Internal combustion engines not for aircrafts	3.5	3.2	4.3	4.0	3.0	3.1	2.6	3.2
712	Agricultural machinery	5.3	3.2	5.1	2.9	5.9	3.9	3.0	2.8
712.5	Tractors	2.0	2.1	0.9	1.1	1.0	1.3	0.3	1.1
714	Office machines	0.5	4.6	0.4	4.9	1.3	6.6	0.7	4.3
715	Metal working machinery	7.7	5.2	5.0	3.9	3.2	2.7	2.2	2.1
718.1	Paper mill and pulp mill machinery	2.6	2.3	1.0	1.2	2.3	2.6	1.0	1.4
719.2	Pumps and centrifuges	2.4	3.4	3.1	4.8	3.2	4.9	2.5	3.9
719.3	Mechanical handling equipment	3.3	2.3	5.0	3.8	3.6	2.4	6.3	5.2
719.7	Ball, roller or needle-roller	0.2	0.5	1.4	2.2	3.8	4.5	1.2	2.2
722	Electric machinery	13.6	21.3	14.3	24.1	11.2	15.2	12.2	21.6
722.2	Electrical power machinery	3.5	6.1	3.8	6.5	3.6	3.9	3.4	4.4
724	Telecommunication apparatus	0.9	4.6	1.4	5.4	1.7	5.9	2.3	10.0
725	Domestic electrical equipment	1.6	2.0	2.6	2.3	1.5	1.5	2.1	1.9
73	Transport equipment	36.8	31.6	31.5	29.1	27.3	18.6	38.3	26.6
732	Road motor vehicles	34.8	23.5	28.7	20.3	25.0	17.2	33.6	25.1
732.1	Passenger cars	23.2	15.0	13.8	11.3	12.0	7.5	10.3	3.7
732.8	Bodies, chassis frames and other parts of motor vehicles	12.0	6.5	12.9	6.9	2.3	2.4	8.1	5.7
		100	100	100	100	100	100	100	100
	Total	546[a]	4 965[b]	1 485[a]	24 214[b]	472[a]	4 824[b]	1 595[a]	30 513[b]

a weight in 000 tons
b value in 000 000 Skr

Source: SOS Utrikeshandel, Del 2, 1962, 1975.

The export and import of the engineering industry was clearly dominated by the first group. The ton-value of machinery was considerably lower for import than for export (Table 3:6). In spite of this difference, sea transport had a larger share of export than of import - 54 % and 39 % - as a consequence of geographical differences in outgoing and incoming flows. The transocean flows accounted for 30 % of exports, but only for 10 % of imports (Table 3:7). Shipping maintained its share in spite of a conspicious rise in the ton-value of exported machinery. The annual growth rate for shipping was 10 %.[1] The market profile of the seaborne import remained unchanged with the traditional concentration to low-value cargo. Its share declined from 48 % to 39 % (Figure 3:10). In spite of a declining share, seaborne export showed an annual increase of 6.6 % in the period 1967-1976.

The period 1962-1975 was characterized by a conspicuous redistribution of seaborne machinery exports between ports (Figure 3:11), a direct consequence of changes in the geographic pattern of production and of technical and economic developments in transports. The relocation of the engineerring industry from the Stockholm region and the rapid expansion along the West Coast and the Southwest caused a geographic change to West Coast ports. The five *län* (counties) around Lake Mälaren and the Östergötlands *län* accounted for a reduced share of production value, from 41 % in 1968 to 38 % in 1974. The largest decrease was in the Stockholm *län*, while Södermanland, Örebro and Västmanland each decreased 0.5 %. The West Coast *län* increased their share from 24.5 to 29.7 % and the Southern *län* decreased from 13.7 to 12.1 %.

However, changes in production patterns were much smaller than the redistribution of shipments between ports. Those of the East Coast declined from 38 % in 1962 to 13 % in 1975, while the West Coast ports increased from 58 to 77 % (Figure 3:11). Provided the propensity for export were the same for all *län*, the East Coast share of the seaborne machinery export should add up to roughly 40-50 % in 1975. In reality it was 30 units lower. The relative traffic loss corresponds to 250 000 tons, i.e. two and a half times the actual turnover.[2] Land transport was the second important source of competition, besides the West Coast ports, for shipments via the East Coast ports. The machinery tonnage exported overland from the East Coast *län* was estimated at 350-380 thousand tons in 1975.

---

[1] The trend lines for seaborne trade 1967-1976 in machine goods are as follows:

$$y_{exp} = 0.369e^{0.10\,x} \quad r^2 = 0.98$$

$$y_{imp} = 3.367e^{0.066\,x} \quad r^2 = 0.95$$

[2] See footnote on p. 248.

Table 3:6. Value per Ton (VT) and Index (I) of the Swedish Trade in Machinery and Transport Equipment (Value in Skr)

	Exports						Imports					
	1967		1970		1975		1967		1970		1975	
	VT	I	VT	I	VT	I	VT	I	VT	I	VT	I
Sea	11 941	99	12 059	93	18 886	87	8 082	74	8 648	73	13 377	76
Rail	9 843	81	10 744	83	18 448	86	9 954	91	10 287	88	14 782	84
Road	12 877	106	13 782	107	23 923	111	14 015	129	13 369	115	19 612	111
Average	12 040	100	12 889	100	21 517	100	10 893	100	11 698	100	17 657	100

Sources: See Table 3:2.

Table 3:7. Geography of the Swedish Trade with Machines and Transport Equipments (CTSE 18)

Trading Areas		1967 '000 tons	%	1974 '000 tons	%	1976 '000 tons	%
Total	exports	609	100	1 318	100	1 228	100
	imports	620	100	1 118	100	1 272	100
Europe	exports	397	65.2	904	68.6	862	70.2
Total	imports	576	92.9	1 035	92.6	1 146	90.0
Nordic	exports	189	31.0	354	26.8	342	27.9
	imports	135	21.7	236	21.1	245	19.3
U.K. and	exports	37	6.0	135	10.2	102	8.3
Ireland	imports	120	19.3	179	16.0	167	13.1
West	exports	118	19.4	288	21.8	318	25.9
Europe	imports	285	46.0	487	43.6	601	47.2
South	exports	36	5.9	81	6.1	55	4.5
Europe	imports	26	4.2	56	5.0	65	5.1
East	exports	17	2.8	46	3.5	45	3.7
Europe	imports	10	1.6	71	6.3	68	5.3
U.S. and	exports	99	16.0	164	12.0	139	11.3
Canada	imports	43	6.9	50	14.7	63	4.9
Asia and	exports	42	6.9	113	8.6	126	10.3
Oceania	imports	6	1.0	32	2.9	54	4.2
Japan	exports	5	0.8	9	0.7	8	0.7
	imports	5	1.0	32	2.9	54	4.2
Africa	exports	17	2.8	26	2.0	27	2.2
	imports	0	-	0	-	0	-
Latin	exports	26	4.3	60	4.5	60	4.9
America	imports	0	-	1	0	2	0

Source: Unpublished Transport Statistics, 1967, 1974, 1976, SCB, Stockholm.

Footnote 2 from p. 246.

[2] The relative traffic loss or deficit (gain or surplus) express the difference between actual and estimated cargo turnover in a port. The estimation was based on the assumption that ports located in a region handle all its imports and exports. A loss shows that ports outside the region successfully compete for its trade. A gain indicates that the ports' hinterlands extend beyond the regional boundary.

The volume of the regional export of a commodity group is assumed to equal the region's share of production. A region generating 10 % of the national production should have the same share of the export. The volume of the regional import of each commodity group is derived from data on population and production.

Figure 3:11. Cargo Turnover by Ports in thousand tons

The negative traffic development meant a decrease by half in the exports through Stockholm between 1962 and 1975 (Figure 3:11). Västerås and Södertälje showed a rapid growth while Norrköping stagnated.

The decrease in Stockholm and the increase in Södertälje resulted from a gradual removal of the industrial centre of the region from the city after 1950. Other factors were the improved roads which increased the accessibility of ports and the Stockholm archipelago, which extend seatime for ships. Location of the port in the centre of the city region is disadvantageous for traffic. Accessibility to road haulage from the periphery is difficult as a consequence of traffic jams and severe traffic regulations.

Gothenburg's position as a leading export port for machinery was slightly strengthened between 1962 and 1975 (Figure 3:11). Its share rose from 57 to 61 %. The structure was modified through a more rapid growth of car export than of other machinery. Its share rose from 48 to 55 % in spite of the opening of the nearby car terminal of Wallhamn. A comparison of the region's engineering production and seaborne machinery export shows that the hinterland of the West Coast ports stretches far into the surrounding regions. The relative traffic surplus of the ports was estimated at 15 % of the traffic, or 120-140 thousand tons in 1975.

Ports along the South Coast participate on a limited scale in the seaborne machinery export (Figure 3:11). Their share remained constant 1962-1975. A major redistribution took place between the ports in the region. Malmö stagnated while Helsingborg increased tenfold. Both Trelleborg and Landskrona increased noticeably.

The import of machinery is often organized in two steps, the first of which leads to a central import warehouse. The geographic pattern of the demand for imported machinery is influenced by three factors: (1) consumption, i.e. the distribution of the population, (2) the distribution of central import warehouses, (3) the distribution of industry demanding direct transports for investment goods, components and parts.

Eastern Middle Sweden and Kalmar *län* have 45-50 % of the country's population. The share in the demand for investment goods should be lower, as the industrial production of the region showed a decrease from 42 to 38.7 % between 1968 and 1974. Provided the industrial production of the East Coast region continues to increase at a slower rate than that of the nation, its share of imported investment goods should decline to about 35-38 %.

The demand for consumer durables in the region is higher than its population share because several firms have placed import warehouses here. As about one sixth of the imports of engineering products was used for private consumption (Table 3:8), the share of the region in the total imports of these products, in the next ten-year period, may be estimated at 40-44 %.

Table 3:8. Imports of Engineering Products 1969, by Main Industrial Origin and Use

Origin	Use by industry											
	Mining	Iron & Steel	Metal manufacturing	Other engineering industry	Electric, electronic industry	Construction	Total	Investments	Consumption priv.	Consumption publ.	Total imports	Total imports 000 000
	%	%	%	%	%	%	%	%	%	%	%	Skr
Metal manufactures	0	14	50	14	7	6	95	0	0	0	100	1 446
Other engineering industry	0	1	0	25	1	5	39	38	16	1	100	8 347
Electric, electronic industry	0	1	0	11	24	8	49	18	19	4	100	2 150

Source: Statistiska Meddelanden, N 1977:5.

The ports of the region accounted for 32 % of the seaborne and 12 % of the total imports of machinery. The import deficit of the East Coast ports in 1975 equalled 80 000 tons. The total deficit on account of competition from alternative ports and modes of transport was some 25 percentage units of the import of machinery or 370 000 tons in 1975. This was twice the actual imports of the East Coast ports (Figure 3:11).

The West Coast *län* accounted for 24 % of the demand for durable consumer goods in 1975, for 30-32 % of investment goods and parts. The region's share in the total demand for imported machinery thus was 28-31 %. The West Coast ports handled 45 % of the seaborne imports of machinery, or 15 percentage units more than the region's share. The relative surplus was 40 % of the actual traffic in 1975.

The North Swedish *län* accounted for 13 % of Sweden's manufacturing production in 1975, an increase of 1.6 units from 1968. The share of mining was 66 % in 1974. The region's share in the demand for imported investment machinery can be estimated at 15-20 % and for parts at 12-15 %. The region's population, i.e. its share in the demand for imported durable consumer goods was small, only 12-14 %. Its share in the demand for imported machinery can thus be estimated at 13-17 %. Ports along the North Coast only handled 3 % of the seaborne machinery import. Some 50-60 thousand tons destinated for this region were handled in other ports, primarily on the West Coast. Land transports accounted for 100 000 tons.

Demand for machinery and parts can be estimated at 15-19 % for the *län* of Southern Sweden, and for durable consumer goods at 17 %. This corresponds to the actual imports through the ports of the region (Figure 3:11). The ferry terminals along the South Coast accounted for 55-60 % of the machinery imports by rail and road.

Malmö was able to retain its leading position in imports among the South Coast ports. The volume of imported cars increased fourfold, while other machinery remained constant between 1962 and 1975 (Figure 3:11). Helsingborg increased conspicuously, while Landskrona declined and Trelleborg stagnated. These changes were due to altered competitive positions between Malmö and Landskrona on the one side and Helsingborg on the other. Competition was marked by large price differences for handling services between these ports.[1]

The decline of imports through the East Coast ports was primarily a result of Stockholm's decreasing attraction for imports of machinery which was halved between

---

[1] See Chapter 4.

1962 and 1975. Cars accounted for half of the decline (Figure 3:11). The imports of machinery through Södertälje trebled in the same period. Traditionally, cars and parts account for 85 % of this import. Norrtälje and Oxelösund expanded rapidly while Norrköping's imports stagnated (Figure 3:11).

In 1962 Stockholm and Gothenburg received 83 000 and 81 000 tons of machinery respectively. The figures for 1975 were 43 000 and 176 000 tons (Figure 3:11). Gothenburg maintained its competitive power and its share in the seaborne machinery imports of Sweden rose from 31 to 35 %. It is considerably below that for exports, due to a larger geographic distribution of destinations, primarily car importers.

The future development of machinery export and import are difficult to estimate. The official long-term projection gives a growth rate for export of 8.7-10 % a year to 1980, and 6.8-7.9 % for import (Table 3:9). The value/weight relation for machinery export was stable in the latest ten-year period. Providing this holds also for the future, the volume of the machinery export (LU) might be estimated at 2.0-2.1 million tons for 1980 and at 3.0-3.4 million tons for 1985. The growth of the machinery export in tons was 9.3 % a year in 1962-1975 (Figure 3:10). The trend extrapolation method and the sector method give an identical prognostic for the 1980's.

The import of machinery showed a shift to high-value goods (Table 3:7). However, the average ton value 1975 remained lower than that for export. A further increase can be expected, since the technical difference between the engineering industries in Sweden and abroad will probably diminish. This should lead to a closer balance between import and export as regards the value of manufactured products. Thus, the growth rate of machinery import in tons (LU) would be 6.3-7.4 % (Figure 3:10).

In a projection by Godlund (G) the seaborne machinery import was estimated at 0.3-0.4 million tons for 1985, i.e. below the 1975 level, and the export at 1.0-1.1 million tons,[1] (Figure 3:10). A comparison between these estimates and the ones made above based on official long-term projection indicates a decreasing role for sea transport in the

---

[1] Godlund & Godlund, 1974, pp. 101-120.

Table 3:9. Supply and Demand for Machinery and Transport Equipment in Sweden 1975-1980. Yearly Rates of Growth.

	Alternatives I	II	III
Demand			
Machinery investments	3.7	3.3	3.1
Consumption	5.3	3.5	3.5
Exports	10.0	8.8	8.7
Supply			
Production	6.5	5.6	5.4
Imports	7.9	6.9	6.8

Source: SOU 1975:89

machinery trade, from the present 50 to 35 % in 1985 for export and from 39 to 14 % for import. Historically, the share of shipping was rather constant in exports, as the British market increased in importance, and the share of the transocean trade did not change. No reason has been shown why this proportions should change in the next ten years. In import, on the other hand, the role of shipping declined continuously but this should be slower in the coming years, as the share of overseas trade tends to increase. On the other hand the share of seaborne imports may be lowered further by a shift of the Swedish trade to foreign transit ports connected with Sweden by land transports, or to air freight. The rapid growth of land transports, which went through an expansion period in the 1960's and 1970's, should cease in the 1980's for machinery and transport equipment.

The geographic distribution of seaborne machinery flows will probably show a continued concentration to the West Coast ports, assuming the present structure of shipping services is available also in the future. This means a further decrease of traffic through the East Coast ports. The tendency should be strengthened by the economies of scale in modern liner shipping which may be achieved through concentration of flows to few ports. Two other alternatives are: increased feeder traffic between Sweden and continental ports or an increased role of Soviet and Polish liner shipping in the supply of transports for Sweden's foreign trade. Both alternatives may lead to a renaissance of general cargo traffic through East and South Coast ports and a slower growth in the West Coast ports.

FOOD

Foreign trade in food is characterized by a strong dominance of imports (Figure 3:12). According to the definition of general cargo,[1] grains (CTSE 1) are excluded. Food imports increased by 6-7 % annually in the 1960's and somewhat less 1970-1975 (Figure 3:12). Food production increased by 2.5 % annually in the second half of the 1960's and 1.9 % in the period 1970-1975. The investments of the industry declined from 700 to 600 million Skr between 1970 and 1975. This and a weak increase in demand in the home market may lead to future stagnation or decline in production. The demand for products from the protected food industry, which accounted for two-thirds of the production, increased by only 1 % per annum between 1960 and 1975 (Table 3:10). Production in the sector exposed to competition had a higher but diminishing increase.

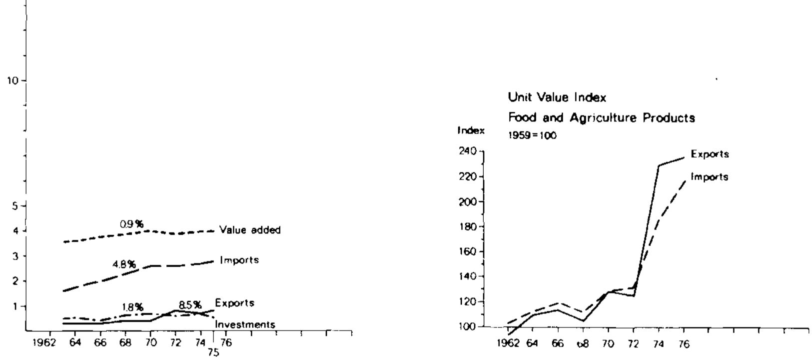


Figure 3:12. Food Industry

[1] See pp. 192 and 239-241.

Table 3:10. Demand for Products of the Food Industry of Sweden

Branch	Annual growth rates %		
	1960-1965	1965-1970	1970-1975
Agriculture	1.5	1.3	1.6
Protected food industry	1.4	0.9	1.1
Competitive food industry	4.8	5.8	3.1
Beverages and tobacco	5.0	3.7	2.1
Total private consumption	4.1	3.2	2.3

Source: SOU 1975:89

Food export increased by 3 % a year in the 1960's. In the 1970's growth was even higher, primarily for commodities produced by the competition-exposed sector and by the beverage and tobacco industries. These branches accounted for half the 1975 export but for only 25 % of the production. However, export and import, which increased more rapidly than production, covered only marginal parts of demand and supply. The share of import in the supply of the Swedish food market was 11 % in 1963 and 15 % in 1975 (Figure 3:12). The share of export in production increased from 3 to 4 % between those two years.

In 1975 the ton-value in current import prices was 3 000 Skr and for export 4 000 Skr (Table 3:11). The ton-value of import remained almost unchanged in fixed prices between 1962 and 1975 - 1 300 and 1 560 indicates a stable goods structure. The export value doubled in the same period from 1 600 to 3 000 Skr, i.e. the expansion was within the high value commodities.

The price index for export was below that for import until 1972 when they reversed their positions (Figure 3:11). Further price increase after 1972 probably contributed to the more gradual increase in export.

The structural stability of import and the concentration of export to high-value goods was confirmed by a detailed analysis of the flows in 1962-1975 (Table 3:12). Fruit and vegetables both years accounted for some 40 % of the import. Alcoholic beverages had a higher growth rate than other food import, resulting in an increase of some 200 Skr of the ton-value. Food export registered growth primarily for high-value products, i.e. fresh and frozen meat, meat products, sugar and tobacco products.

Table 3:11. Value per Ton (VT) and Index (I) for the Swedish Trade with Food and Agricultural Products. (Value in Skr)

	Exports						Imports					
	1967		1970		1975		1967		1970		1975	
	VT	I	VT	I	VT	I	VT	I	VT	I	VT	I
(a) Fresh Fruit and Vegetables (CTSE 2)												
Sea	1 666	97	1 384	76	1 909	97	1 340	97	1 274	97	1 813	95
Rail	1 800	105	2 400	133	2 333	105	1 388	99	1 148	88	1 944	101
Road	2 000	117	2 000	111	2 157	117	1 469	105	1 511	116	2 006	105
Average	1 761	100	1 800	100	2 090	100	1 397	100	1 307	100	1 914	100
(b) Other food products (CTSE 3)												
Sea	2 172	80	1 720	66	3 078	73	1 583	90	1 916	88	3 022	85
Rail	2 763	102	3 392	131	5 552	133	2 161	123	2 754	127	4 280	121
Road	3 454	128	3 638	140	5 309	127	2 432	138	2 637	121	4 460	126
Average	2 705	100	2 597	100	4 185	100	1 760	100	2 171	100	3 536	100

Table 3:12. Commodity Structure of the Swedish Foreign Trade with Food and Agricultural Products. (Percentage)

SITC	Main commodities	Imports				Exports			
		1962		1975		1962		1975	
		weight	value	weight	value	weight	value	weight	value
01	Meat - Total	1.8	4.4	2.2	7.4	22.1	29.3	15.4	22.9
011	Fresh, chilled and frozen meat	1.5	3.2	1.8	6.1	16.6	19.6	12.3	19.1
02	Dairy products	1.0	2.0	1.0	2.1	16.0	26.0	9.6	9.3
03	Fish - Total	4.9	8.2	4.5	10.9	20.4	12.0	10.4	10.7
031	Fresh, chilled, frozen, salted, and dried fish	3.2	5.5	3.1	7.4	18.2	8.6	8.1	5.4
05	Fruit, vegetables	40.3	34.3	37.3	26.9	11.6	9.4	13.3	9.5
051	Fresh fruit	21.4	20.2	18.8	11.8	2.2	2.0	5.0	3.3
06	Sugar	8.5	2.6	7.6	7.7	3.3	1.8	3.5	5.0
07	Coffee, Tea, Cocoa	8.2	23.3	7.6	18.4	1.7	3.3	2.2	11.3
071	Coffee	6.9	19.1	6.3	13.9	0	0	1.5	3.2
1	Beverages	3.6	6.2	7.9	7.6	1.1	1.0	2.3	1.0
112	Alcoholic	3.6	6.2	7.3	7.4	1.0	1.0	0.7	0.4
2	Tobacco	0.9	6.2	0.8	4.2	0	0	1.1	5.4
	Total	100	100	100	100	100	100	100	100
	Total[a]	1 216	1 801	1 789	5 473	181	392	259	1 015

a Total weight in '000 tons
Total value in '000 000 Skr

Source: SOS Utrikeshandel, Del 2, 1962, 1975; SCB, Stockholm.

In spite of a stable goods structure, import saw a redistribution between competing modes of transport (Figure 3:13). Road haulage had the largest increase, 8 % annually 1967-1975. Its share increased from 16 to 29 %.

Also export increasingly moved by road. Its market share increased from 21 to 40 % (Figure 3:13), but the ton value index was unchanged, i.e. the market segment of trucks was the same. As total export of food expanded mainly within the high-value sector, it further favored the growth of road transports.

The share of rail export declined (Figure 3:13), while import was stable, 12 %, as well as the index (Figure 3:13 and Table 3:11). The market profile of the import was un-

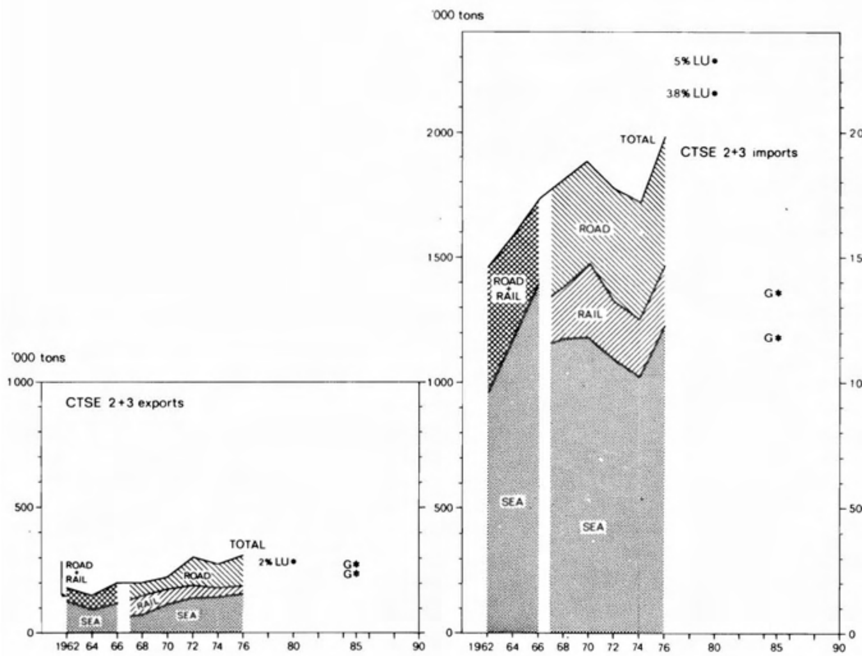


Figure 3:13. CTSE 2+ 3, Exports, Imports

changed, for rail as well as for road. The competition between rail and road in food import is likely to sharpen in the future.

The rapid expansion of road transport led to a relative decline in the volume of seaborne import. In 1967 shipping accounted for some 72 % of the import, but in 1975 for only 58 % (Figure 3:13). The decline was conspicuous for fruit and vegetables, from 72 to 40 % between 1962 and 1975. For other food products the decline was slower. A certain shift to low-value cargo can be seen in both sea import and export (Table 3:11). The inbalance in this trade used to be strong, particularly in frozen food in which only 10-15 % of the capacity could be utilized on return trips. Reefers coming to Swedish ports must be equipped to handle other cargo to avoid return trips in ballast.

Over one third of imported foods were inputs in the food industry. Private consumption took half, while the rest was used by the hotel and transportation industries and agriculture (Table 3:13).

Table 3:13. Imports of Food and Agricultural Products, 1969, by Industrial Origin and Use

Origin	Industry						Consumption		Total imports	
	Agriculture %	Protected food ind. %	Competitive food ind. %	Beverages, Tobacco %	Hotel Rest., Trsp. %	Total %	Publ. %	Priv. %	%	'000 000 Skr
Agriculture	5	7	32	6	12	63	1	36	100	1 682
Protected food industry	0	14	3	0	22	50	1	44	100	684
Competitive food industry	3	9	31	1	8	56	2	42	100	1 223
Beverages and tobacco	0	0	0	5	20	25	0	73	100	325

Source: Statistiska Meddelanden, N 1977:5

The geographic pattern of food import was fairly constant 1967-1976 (Table 3:14). More than half came from Europe. The three other important regions of origin were Latin America, Asia/Oceania and North America. The importance of the two latter trading areas increased in 1976, which was probably a fluctuation rather than a change in the trend. The modal and port redistribution of food imports in the late 1960's must thus be explained in terms of changing competition and by the geographic relocation of the demand, i.e. the population (consumers), the food industry and the import warehouses.

Table 3:14. Geography of the Swedish Food Trade (CTSE 2 + 3)

Trading Areas		1967 '000 tons	%	1974 '000 tons	%	1976 '000 tons	%
Total	exports	184	100	284	100	313	100
	imports	1 628	100	1 726	100	1 964	100
Europe Total	exports	155	84.0	195	68.6	180	57.5
	imports	949	58.2	1 044	60.4	1 113	56.7
Nordic	exports	42	22.8	98	34.5	97	31.0
	imports	380	23.3	480	27.8	450	22.9
U.K. and Ireland	exports	37	20.1	29	10.2	18	5.7
	imports	46	2.8	62	3.5	54	2.7
West Europe	exports	33	17.9	24	8.4	35	11.1
	imports	188	11.5	214	12.3	329	16.8
South Europe	exports	35	19.0	40	14.1	28	8.9
	imports	240	14.7	240	13.4	232	11.8
East Europe	exports	8	4.3	4	1.4	2	0.6
	imports	95	58	48	2.8	48	2.4
U.S. and Canada	exports	5	2.7	20	7.0	10	3.2
	imports	88	5.4	100	5.6	158	8.0
Asia and Oceania	exports	13	7.1	18	6.3	62	19.8
	imports	99	6.0	110	6.4	181	9.2
Japan	exports	1	0.5	12	4.2	12	3.8
	imports	-	0	1	0	4	0
Africa	exports	2	1.0	32	11.3	21	6.7
	imports	73	4.4	96	6.3	64	3.2
Latin America	exports	4	2.1	5	1.7	28	8.9
	imports	319	19.6	325	18.8	365	18.5

Source: Unpublished Transport Statistics, 1967, 1974, 1976, SCB, Stockholm.

The share of the East Coast *län* in the imports of food for immediate consumption amounted to 44 % in 1975. It should grow since the region's population share increases. The region's demand for imported food used as industrial inputs was lower, 34 %, but some firms have located import warehouses here. Therefore, the region's share in the total demand for imported food can be estimated at 42-48 %. The share of the East Coast ports in seaborne import of fresh food declined from 35 to 8 % between 1962 and 1975. The decline was less conspicuous for other food, from 38 to 31 % (Figure 3:14). The loss of the ports amounted to 12-16 percentage units or 150 000 tons in 1975, which was half the actual traffic. The weight of food imported to the East Coast region by rail and road can be estimated at some 400 000 tons for 1975, i.e. 60 % of the region's food import.

The decline in food import via the East Coast ports was primarily a result of the fall in the import of fresh food via Stockholm. Also the import of other food via Stockholm went down between 1962 and 1975 (Figure 3:14), a result of the unfavorable location of the port for liner shipping. The seaborne import of fresh food to the Stockholm region was relocated to competing ports in other regions, *pro primo* the South Coast (Helsingborg), but also Gothenburg (Figure 3:14). The two remaining ports on the East Coast were Norrköping and Kalmar. Traffic here stagnated and was concentrated to local hinterlands and low-value cargo.

The South Coast ports were the only ones showing increase in food import between 1962 and 1975, mainly fresh fruit and vegetables. They accounted for 31 % in 1975, while the region's share in the consumption of food import was estimated at 14 %. The share of food production was 33 % in 1974, an increase with 3 units compared to 1968. The region's share in the total demand for imported food can be estimated at 20-24 %. Consequently, the South Coast ports showed a significant traffic surplus, i.e. they were very competitive, particularly Helsingborg. Its share in fresh fruit and vegetables import increased from 6 % to 20 % between 1962 and 1975 (Figure 3:14). The increase for other food was considerably lower. Malmö, South Sweden's largest receiving port for food, had a stagnating import of fresh food while other kinds of food increased slowly. Remaining ports in the region handled small volumes.

The West Coast ports accounted for the largest share of Sweden's food import (Figure 3:14). Their share of the fresh fruit and vegetables traffic increased from 52 to 62 % between 1962 and 1975. It was almost constant for other food products (Figure 3:14). The region's share in the demand for food imports can be estimated at 20-23 %, i.e. some 15 percentage units less than its share of the seaborne trade. Thus more than a third of the handled quantities was for destinations outside the West Coast region. This share

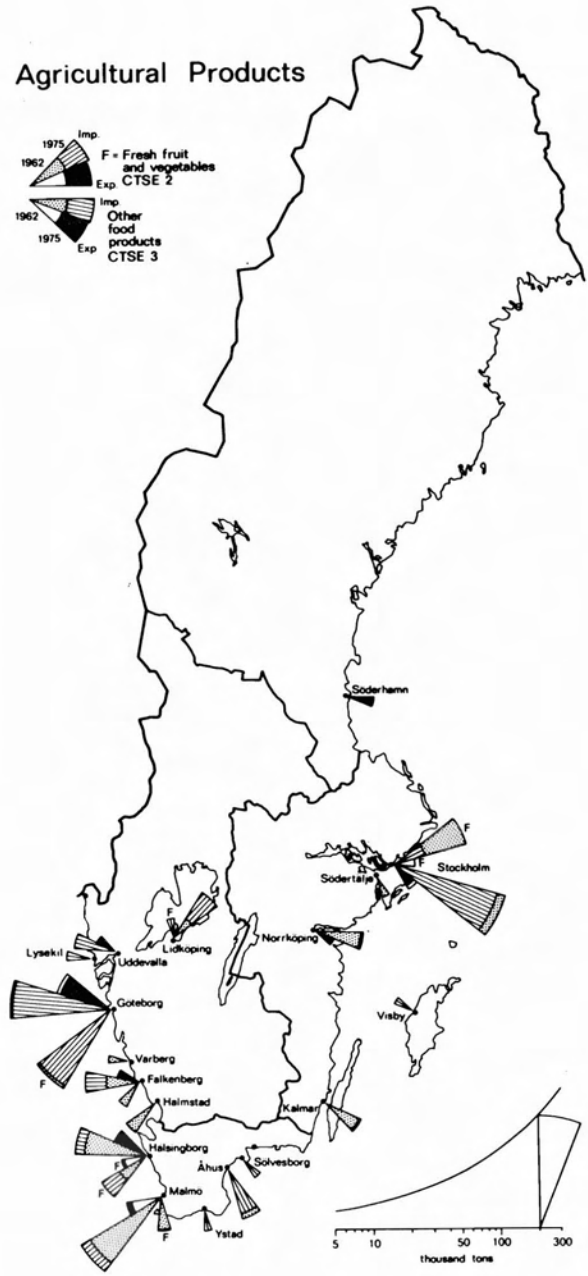


Figure 3:14. Agricultural Products, Turnover by Ports

was even higher for fresh fruit and vegetables. Gothenburg, which alone accounted for 56 % of the seaborne import of fruit and vegetables, increased its share noticeably after 1962 and took over flows via Stockholm. The period 1962-1975 saw also a geographic redistribution of food import to several small ports on the West Coast (Figure 3:14). Particularly Falkenberg and Uddevalla showed a rapid growth in the short-sea trade. The growth at Lidköping can also be explained by the increased attraction of small ports for low-value feed.

The seaborne food export showed an even growth rate and some concentration to low-value goods (Figure 3:6 and Table 3:3). The share of Europe significantly decreased, (Table 3:14), with the growing aid shipments to Asia and Africa. However, the geographic patterns of these shipments vary from year to year. Geographically, the export was strongly focused on the West Coast ports which in 1975 accounted for half. The share of the South Coast ports amounted to 30 %, while the East Coast ports handled the remaining 20 % (Figure 3:14). Small export volumes cause a strong inbalance for all ports, especially for fresh and frozen food, which decreases the competitiveness of shipping.

Future changes in food import will depend on structural changes in private consumption, influenced by price elasticities and consumer preferences. The extremely low population growth means a slow increase or stagnation in food consumption. According to the official long-term projections a structural change in food consumption should be expected with a more rapid growth in the demand for products from food industry exposed to competition (Table 3:15). This should increase the need for import. The export growth will be low and will not influence the import needs as the share of reexports is expected to remain small.

Table 3:15. Demand and Supply of Food and Agricultural Products 1975-1980, Yearly Rates of Growth, fixed prices

	Agriculture	Protected food industry	Competitive food industry	Beverages and tobacco industry
Private consumption	+0.9 - +1.5	+0.4 - +1.0	+2.0 - +3.2	+1.3 - +2.3
Exports	-6.2	+3.3	+1.9	+1.4
Imports	-0.4 - +0.7	+3.9 - +4.3	+4.8 - +5.9	+2.1 - +3.5
Production	+0.3 - +0.8	-0.6 - +1.1	+1.6 - +2.6	+2.4 - +3.3

Source: SOU 1975:89

As previously mentioned, structural changes in the export caused a doubling of ton-values, while import had unchanged values. A stable import structure means an annual weight increase of 3.5-5.0 %. The growth of export tonnages are more difficult to apprise. They will probably have lower rates than in the 1960's and early 1970's, and draw near the increase in fixed prices, i.e. 1.5-2.0 % per annum.[1]

Road transports are likely to increase their share of food export at the expense of rail, since both compete within the same sector of the market. The competition between road and sea should also increase, provided food exports also in the future will be concentrated to Europe. A stabilization of the modal distribution can be expected for import. Sea transports should keep their position since the share of overseas cargo is high. However, import through continental transit ports might prove more competitive and cause traffic decline in Swedish ports.

A continued concentration to South Coast and West Coast ports is likely. Such concentration provides economies of scale in warehousing, transport, and port operations. This means that Gothenburg, Helsingborg, and possibly Malmö will retain their high shares. The port distribution of low-value agricultural imports will be strongly influenced by price differences between large and small ports for handling and for port-hinterland transports.

OTHER GENERAL CARGO

Other general cargo includes crude materials (CTSE 10, excl. 10.18) and manufactured articles (CTSE 19, excl. 19.40 and 19.41). Demand for transports in this heterogeneous group must be seen against changes in the production of several industries. Other general cargo accounted for roughly 19 % of the total general cargo trade of Sweden. Import dominated export as a consequence of a substantial share of crude material. Their weight remained constant between 1962 and 1975 (Figure 3:15).

Textile products, i.e. fibers, yarns and clothes, were the largest group both in import and export (Table 3:16). Their share of import decreased from 44 to 35 % between 1962 and 1975, mainly as a result of reduced demand for fiber caused by the decline and restructuring in the textile industry (Table 3:17). The import of apparel and shoes (high-value goods in comparison with fiber) expanded.

Similar structural changes occurred in export. The share of textiles declined from 38 to 27 % between 1962 and 1975, a result of the decrease in fiber export. The volume of high-value products increased.

---

[1] SOU 1975:89, p 133.

Table 3:16. Commodity Structure of the Swedish Foreign Trade with Commodities Classified here as Other General Cargo (Percentage)

SITC	Commodity	Imports 1962 weight	Imports 1962 value	Imports 1975 weight	Imports 1975 value	Exports 1962 weight	Exports 1962 value	Exports 1975 weight	Exports 1975 value
	Raw Materials								
21	Hides, skins	5.8	3.2	2.9	1.2	6.6	12.5	4.4	2.6
23	Rubber	12.3	4.2	9.9	1.7	2.3	0.7	3.8	0.6
26	Textile fibers	16.2	7.4	5.4	1.4	19.0	6.0	7.0	1.6
263	Cotton	7.2	2.7	2.1	0.5	1.0	0	0	0
266	Synthetic fibers	1.6	1.2	1.2	0.5	9.5	4.0	4.2	1.2
291	Crude animal materials	13.0	10.7	6.2	0.5	1.9	1.2	5.9	0.6
292	Crude vegetable materials	6.0	4.0	6.5	3.1	1.4	0.5	0.5	0.5
	Manufactured goods								
61	Leather and manufact.	0.9	2.6	0.8	1.6	1.0	3.5	2.1	3.2
62	Rubber manufactures	4.7	4.4	12.2	7.3	9.0	9.1	13.4	8.2
65	Textile yarn, etc.	18.1	31.5	19.0	21.0	8.1	17.2	10.6	16.3
81	Sanitary, plumbing etc., fixtures and fittings	1.1	0.7	1.6	1.4	9.5	7.8	7.8	5.9
82	Furniture	1.4	1.1	9.8	4.4	4.2	5.0	20.1	13.7
84	Clothing	2.0	11.6	5.3	20.4	1.0	10.0	1.7	13.0
85	Footwear	1.2	3.1	1.9	3.9	0.5	1.4	0.9	2.5
86	Scientific instruments etc.	1.9	12.0	2.3	13.0	1.0	8.5	1.9	12.4
892	Printed matters	1.8	1.7	3.4	2.4	2.9	3.2	5.7	4.6
893	Articles of plastic	1.0	1.4	5.8	4.0	1.0	2.0	6.1	5.8
	Subtotal raw materials	53.0	29.5	31.1	8.0	31.2	19.9	21.7	6.0
	Subtotal manufactured goods	47.0	70.5	68.9	92.0	69	80.1	78.3	94.0
	Total (th. tons, mill. Skr)	430	3 259	795	13 120	210	1 175	424	6 225

Source: SOS, Utrikeshandel, Del 2, 1962, 1975, SCB, Stockholm.

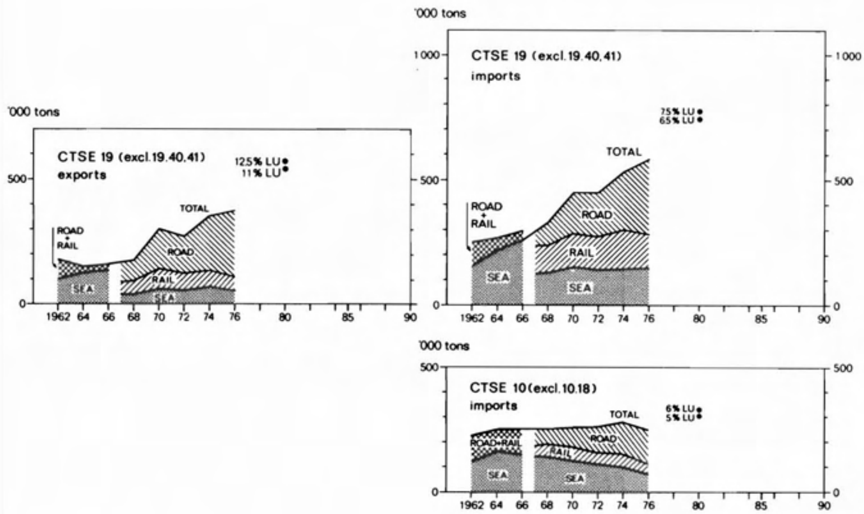


Figure 3:15. CTSE 19 Exports and Imports

Table 3:17. Development and Structure of the Swedish Textile, Wearing Apparel and Leather Industries

ISIC	Industry	Production	
		Share %	Index 1968=100
321	Manufacturing of textiles	54	105
3211	Spinning, weaving	23	92
3213	Knitting	12	144
322	Wearing apparel	35	82
323	Leather and products	6	85
324	Footwear	6	73
32	Total	100	93
	Million Skr	6 959	

Source: SOS Industry 1975, SCB, Stockholm.

The demand for imported fibers and yarns was geographically concentrated to Älvsborg's *län* (Borås *kommun)*, which accounted for 40 % of the production of the textile and apparel industry. Älvsborg's *län* and other West Coast *län* accounted for two-thirds of the production. The geography of demand for finished textile products depends on the location of the population and of central warehouses, i.e. is more evenly distributed.

A continued decrease in fiber import should be expected. The total import will be close to constant in the next ten-year period, measured by weight. A changing import structure will be reflected in the modal distribution. Shipping accounted for 57 % in 1967 and was dominating for fibers, 82 %. The corresponding numbers for 1975 were 35 and 50 %, i.e. the share of shipping declined. This depended foremost on competition from road haulage which increased its share from 23 to 44 % between 1967 and 1975. Road filled out the loss for sea.

The shift of textile exports towards high-value goods did not influence noticably its modal distribution. The share of shipping remained constant. Road increased slightly its share in the traffic at the expense of rail.

The West Coast ports, especially Gothenburg, accounted for 70 % of the seaborne import of textiles in 1975, Helsingborg had 13 %. The traditionally important traffic via Stockholm and Gothenburg of finished textile products decreased substantially, from 19 000 and 12 000 tons in 1962 to 4 000 and 1 000 tons in 1975, as a result of the closedown of production in the Stockholm and Norrköping regions.

The future seaborne textile import is likely to see an increased share of finished products, especially from overseas. The import of textile fibers will decrease, but more slowly than in recent years. Further decline in the seaborne textile import is not likely. The distribution between Helsingborg and Gothenburg will be determined by the general competition for deep-sea lines. Gothenburg should be favored by the shorter distance to the central region of demand (Borås). The development of the seaborne export will be influenced by the competitiveness of the Swedish industry in the overseas markets. Transport to Europe will be handled by road.

Beside textile products, rubber and rubber products, furniture and plastic articles are most important in the group of other general cargo (Table 3:16).

Import of rubber showed a more rapid growth for finished articles than for raw materials (Table 3:18). The Swedish market was characterized by growing import. Export from domestic rubber industry developed slowly, causing stagnation in the import of raw materials and semimanufactures for rubber production. The structural changes in the rubber import caused a decrease in the volume of "other general cargo" handled in Malmö and Trelleborg. In the longer perspective it might also influence Gothenburg, the gateway of Swedish seaborne rubber import.

Table 3:18. Demand and Supply of Rubber Manufactures

	1968		1974		1975		Index 1975
	Mkr[a]	'000 t[b]	Mkr	'000 t	Mkr	'000 t	1968=100
Production	943		1 722		1 734		118
Exports							
Rubber	16	8	31	10	39	15	
Rubber manufactures	226	41	542	67	511	52	126
Imports							
Rubber	154	86	304	101	225	78	
Rubber manufactures	270	45	773	85	963	96	213
Consumption	987		1 953		2 185		

a Million Skr
b Tons

Sources: SOS Industristatistik 1968, 1975; SOS Utrikeshandelsstatistik 1968, 1975, Statistiska Centralbyrån, Stockholm.

Gothenburg also plays an important part in the handling of other commodities classified here as "other general cargo" (Figure 3:16). The dominance of the port in this traffic was strengthened from 60 to 70 % between 1962 and 1975. Its share in export increased from 27 to 59 %. The East Coast ports decreased their share in incoming traffic from 22 to 8 %. The share of outgoing cargo remained unchanged and low. The decrease in Malmö was a result of competition from road transport in European traffic and from Helsingborg in overseas liner shipping.

The future trade with "other general cargo" will be characterized by an increasing share of high-value goods. This should lead to further expansion of road haulage in the European trade and of air transport in overseas traffic. A concentration to Gothenburg and Helsingborg can be foreseen provided they can maintain deep-sea liner shipping in competition with continental ports.

CONCLUSIONS

Development tendencies in the general cargo transports to and from Sweden in 1962-1976 can be summed up as follows: (1) considerable inbalance exists between the volume of incoming and outgoing cargo, but it decreased during the examined period; (2) redistribution of flows took place from rail to road and from sea to road, which resulted in an increased concentration of shipping and rail to the

Figure 3:16. Other General Cargo

market segment of low-value general cargo, particularly in the machinery trade; (3) seaborne general cargo trade moved from East Coast to West Coast ports, but the previously expected concentration of seaborne trade to Gothenburg[1] was not confirmed by the actual development, mainly because of the rapid development of Helsingborg for deep-sea services and of a number of small regional ports in short-sea shipping.

The declining technical gap between Sweden and some other developed and several rapidly developing countries will probably result in a more rapid increase of imports of the "medium-technology" products. Thus, the great rate of general cargo imports by weight in the late 1970's and early 1980's should be higher than in the 1960's and early 1970's, i.e. reach 6-8 % per annum. The imports and exports in the early 1980's will grow at the same rates, and show a higher structural similarity than in the 1960's or early 1970's. Western Europe, particularly the Nordic countries and West Germany will continue to dominate the trade. The role of the Far East countries will increase, mainly in the "medium-technology" imports. Consequently, the modal distribution of general cargo flows in the early 1980's should show a further increase as regards the role of trucks. Market share of shipping should remain constant, while that of railways should decline unless a radical change of transport policy in Sweden and in the rest of Europe will not limit the competitiveness of road transports.

DEMAND FOR BREAK-BULK CARGO TRANSPORT

According to the definition, break bulk cargo includes commodities which form an intermediate group between general cargo and bulk cargo as regards transport needs.[2] Break bulk cargo used to be supplementary goods for liner services from Sweden, because the general cargo trade showed a permanent surplus for imports. This was particularly important for the short-sea traffic with its limited possibilities of finding additional *en route* cargo. The development of special ships and transport systems for break bulk cargo lifted large parts of these flows off the liner market.[3] On the other hand, the share of road transports increased in the break bulk cargo movements, i.e. these commodities became an important element of the demand for ferry and roll-on-roll-off shipping, the new forms of liner services on short-sea routes.

---

[1] Nordtrans, 1969, pp. 104-116.

[2] For definition see pp. 191-193.

[3] See pp. 139-142.

The Swedish break bulk cargo includes three main commodity groups: wood and wood products (CTSE 5, 10.18, 19.40 and 19.41), metals (CTSE 16) and chemicals (CTSE 14). Two other commodity groups might be included in the break bulk category: seeds, oil-nuts, etc. (CTSE 4) and lime, cement, etc. (CTSE 15). Swedish trade in the former category is rather limited, while lime and cement shipments are mostly organized as bulk transports. Therefore, these commodities are of little importance as regards demand for liner services to and from Sweden.

WOOD AND WOOD PRODUCTS

Wood and wood products, the leading commodity group in Sweden's break bulk exports, is second only to iron ore in total exports by tonnage. This group includes three main subgroups: wood (CTSE 5), pulp (CTSE 10.18) and paper (CTSE 19.41). Remaining wood products are lumped into one group (CTSE 19.40) and are of minor importance.

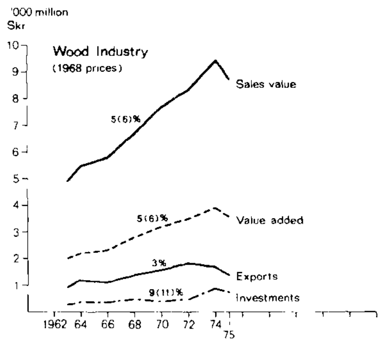
The development of the Swedish wood, pulp and paper industries in the 1960's and early 1970's, their future perspectives, export potentials and import needs have been analyzed in several studies.[1] The following analysis is a short review of the tendencies in the exports and imports of these commodities. The role of sea transports in competition with other modes will be emphasized as well as changes in the port distribution of the flows.

The Swedish wood exports in the 1960's grew at the same rate as production (Figure 3:17). The early and particularly the mid 1970's saw a significant fall in the exports while production decreased much less. As a result, the export share of production went down from about 20 % by value as an average for the 1960's to 15 % in 1975. On the other hand, the exports of pulp and paper developed more rapidly, particularly in the early 1970's, than production (Figure 3:17), as a result of the rapid and even growth of the paper export (Figure 3:18). Paper increased its share of the exports of wood and wood products from 23 % in 1962 to 31 % in 1976, measured in tons (Table 3:19). The wood and pulp exports had a rather constant structure during the 1960's and early 1970's. The ton-value in 1968 prices remained about 300 Skr for wood and about 600 Skr for pulp during the whole period (Figures 3:17, 3:18 and 3:19). Also the structure of the paper export was fairly constant during the 1960's, the average ton-value being 800 Skr. However, in the early 1970's it increased to about 1 100 Skr, indicating a shift towards more valuable grades.

The geography of the wood, pulp and paper export showed a stable pattern between 1967 and 1976 (Table 3:20). Only small amounts of wood were destinated outside Europe,

---

[1] Svensk Skogsindustri i omvandling, 1973; SOU 1973:14; Ds Jo 1975:1; SOU 1975:89; SIND 1976:7; SOU 1976:22; Lundin, O., 1977.



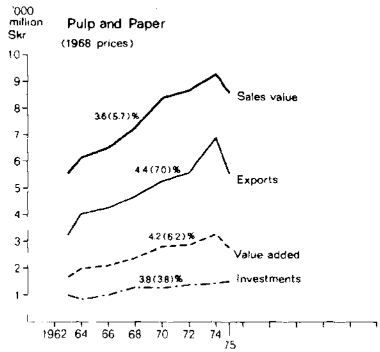


Figure 3:17. Wood, Pulp and Paper Industries

Table 3:19. The Structure of Sweden's Trade in Wood and Wood Products (Percentage)

SITC	Commodity	Imports				Exports			
		1962		1976		1962		1976	
		weight	value	weight	value	weight	value	weight	value
24	Wood	84	48	86	35	38	25	38	22
25	Pulp	1	1	2	3	35	38	28	32
63	Wood manufactures	10	20	4	22	3	3	3	5
64	Paper	4	30	7	40	23	34	31	40
	Total	100	100	100	100	100	100	100	100
	'000 tons; million Skr, current prices	873	318	3 286	2 158	8 336	4 384	12 323	17 084

primarily to the Middle East and North Africa. Pulp exports were slightly less concentrated to Europe and the share declined. One-fifth of the paper export was destinated outside Europe, Asia and Africa being the main trans-ocean markets. The concentration to Europe made wood and wood products an attractive market for the land modes. Their share was as high as 40 % for wood and it had not changed since the mid 1960's (Figure 3:19). There was a strong competition between rail and road in this market. Road increased its share from 17 % in 1967 to 26 % in 1976, while rail dropped from 23 to 16 %. The average ton-value of wood export by trucks was lower than for other modes

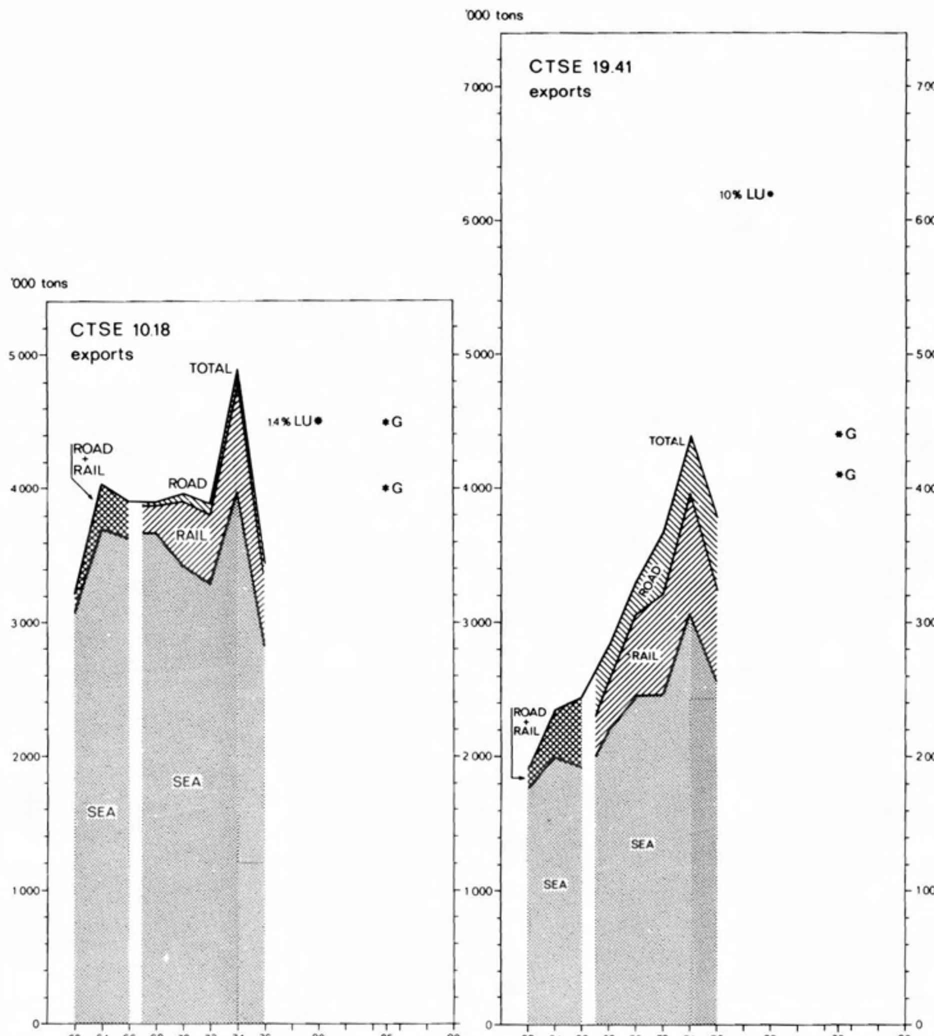


Figure 3:18. CTSE 10.18 and 19.41, Exports

(Table 3:21). Short distance movements of round wood across the Norwegian border strongly influenced this relation. In 1976 they accounted for 60 % of total wood exports by road.[1]

---

[1] Statistiska Meddelanden, T 1978:5.

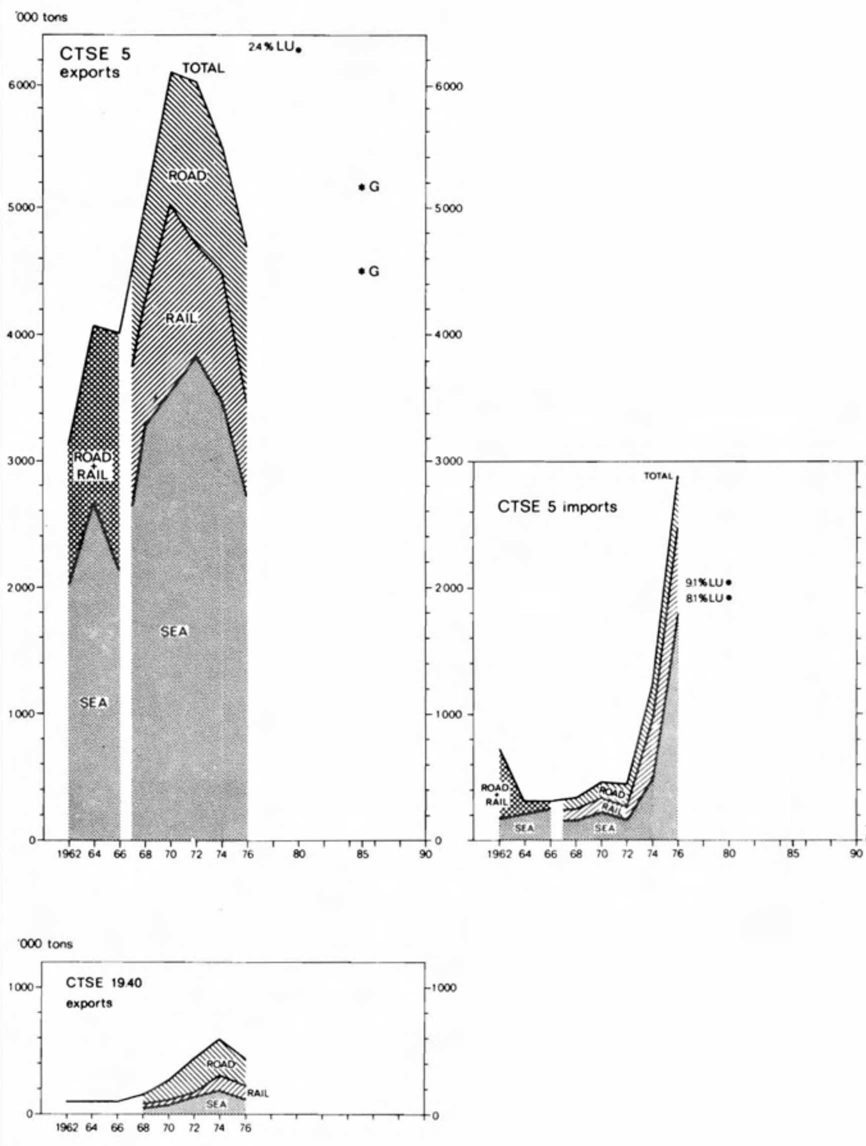


Figure 3:19. CTSE 5 Exports and Imports

Table 3:20. The Geography of Sweden's Trade in Wood and Wood Products

Trading Area		Wood				Pulp				Paper			
		1967		1976		1967		1976		1967		1976	
		'000 tons	%	'000 tons	%	'000 tons	%	'000 tons	%	'000 tons	%	'000 tons	%
Total	exports	4 476		4 690		3 917		3 436		2 473		3 780	
	imports	362		2 893		13		82		89		226	
Europe Total	exports	4 391	98.1	4 446	94.8	3 552	90.7	3 029	88.2	2 036	82.3	3 155	83.5
	imports	306	84.5	2 834	98.0	8	61.5	76	92.7	76	85.4	210	92.9
Nordic	exports	1 835	41.0	1 889	40.3	179	4.6	151	4.4	241	9.8	471	12.5
	imports	272	75.1	778	26.9	6	46.2	63	76.8	41	46.1	143	63.3
U.K. and Ireland	exports	981	21.9	924	19.7	1 128	28.8	680	19.8	575	23.3	912	24.1
	imports	0	0	48	1.7	0	0	1	1.2	4	4.5	11	4.9
West Europe	exports	1 276	28.5	1 316	28.1	1 373	35.1	1 709	49.7	1 029	41.6	1 574	41.6
	imports	4	1.1	1 072	37.1	0	0	15	18.3	27	30.3	152	23.0
East Europe	exports	55	1.2	4	0.1	125	3.2	0	0	51	2.1	0	0
	imports	17	4.7	933	32.3	0	0	0	0	1	1.1	2	0.9
South Europe	exports	244	5.5	313	6.7	747	18.3	489	14.2	140	5.7	199	5.3
	imports	13	3.6	3	0.1	2	15.4	0	0	3	3.4	2	0.9
U.S. and Canada	exports	0	0	0	0	130	3.3	35	1.0	98	4.0	65	1.7
	imports	4	1.1	19	0.7	1	7.7	1	1.2	6	6.7	12	5.3
Latin America	exports	0	0	0	0	74	1.9	23	0.7	95	3.8	76	2.0
	imports	1	0.3	0	0	0	0	0	0	0	0	0	0
Asia and Oceania	exports	20	0.5	137	2.9	102	2.6	103	3.0	140	5.7	151	4.0
	imports	22	6.1	8	0.3	0	0	0	0	0	0	0	0
Japan	exports	0	0	0	0	9	0.2	6	0.2	0	0	1	0.0
	imports	0	0	2	0.1	0	0	0	0	0	0	0	0
Africa	exports	38	0.9	91	1.9	44	1.1	32	0.9	78	3.2	156	4.1
	imports	16	4.4	14	0.5	0	0	0	0	0	0	0	0

Source: Unpublished transport statistics, 1967, 1976, SCB, Statistiska Centralbyrån, Stockholm

Table 3:21. Value per Ton (VT) and Index (I) for Sweden's Trade in Wood and Wood Products

	Exports						Imports					
	1967		1970		1976		1967		1970		1976	
	VT	I	VT	I	VT	I	VT	I	VT	I	VT	I
WOOL (CTSE 5)												
Sea	380	112	369	108	905	108	440	124	376	108	239	90
Rail	315	93	332	98	1 088	131	571	161	640	184	298	112
Road	235	68	243	72	517	62	226	64	275	79	361	136
Total	337	100	340	100	832	100	353	100	347	100	266	100
PULP (CTSE 10.18)												
Sea	583	100	752	100	1 598	100						
Rail	515	89	714	96	1 607	100						
Road	514	89	567	75	1 258	79						
Total	579	100	754	100	1 593	100						
PAPER (CTSE 19.41)												
Sea	808	94	824	91	1 616	89						
Rail	1 013	118	1 014	111	1 940	106						
Road	1 214	141	1 375	151	2 655	145						
Total	862	100	910	100	1 825	100						

The pulp export was strongly dominated by sea transports, but the rail share increased from 6 % in 1967 to 16 % in 1976, while that of trucks remained low, 1 % (Figure 3:18). The increase for railways should be seen against the decreasing role of Northern Sweden in pulp production. There was also a striking modal shift in paper export. Sea transports lost 14 percentage units between 1967 and 1976, while rail increased from 11 to 18 % and road from 8 to 14 % (Figure 3:18). A strong market segmentation in the movement of paper was reflected in the average ton-values, which were nearly 50 % higher for trucks than for ships (Table 3:21). The proportion was constant between 1967 and 1976, i.e. road transports expanded within the same market segment. As shown above, the average ton value for paper export increased during the early 1970's. This probably strengthened the competitiveness of trucks in the paper export.

The modal shift of wood and wood products was accompanied by a significant change in the port distribution of seaborne flows. The share of the northern ports decreased from 51 % in 1962 to 33 % in 1975 (Figure 3:20). The share of the inland ports on the Lake Vänern remained constant while the ports of the South and East Coasts showed the largest gains. The traffic losses of the northern ports were concentrated to wood and pulp, while their share in the seaborne export of paper remained constant between 1962 and 1975. The decrease in pulp export should be seen against the declining share of the northern region in pulp production, 52 % in 1962 and 47 % in 1975. The region's share of paper production increased from 19 to 35 % in the same period. But this was not reflected by a corresponding increase in the port traffic. It shows that the northern ports have difficulties in competing for the paper traffic of their traditional hinterlands.

Parallel with these interregional relocations of flows went significant changes in the position of individual ports in the North. Sundsvall in the late 1960's became the leading terminal of the region for wood and wood products, particularly paper and board (Figure 3:20). It was a result of a new distribution system introduced by the SCA, leader in the Swedish pulp and paper industry. Sundsvall and Umeå were made the main export terminals of this company. Gävle, the traditional leader among the northern wood ports, showed a strong traffic decrease, as a result of competition from road and rail as well as ports in other regions. Shipments were discontinued in many small wood ports of the northern region during the 1960's and early 1970's (Figure 3:20), because of the introduction of special transport systems by the wood industries. These systems are based on the concentration of flows to few terminals which allows for mechanization of cargo handling and the introduction of special ships.

The growing share of the East Coast ports was mainly the result of the rapid increase of wood exports through Norrköping and Oskarshamn (specialized transport systems), which became the leading wood terminals of the region. Traffic through other ports stagnated and it decreased at Stockholm and Jättersön, the latter reflecting the recession in the local pulp industry.

The South Coast ports traditionally had a low share in the seaborne trade of wood and wood products. However, the increasing production of the wood industries in southeastern Sweden led to a significant traffic growth among the ports in the eastern part of the South Coast (Figure 3:20).

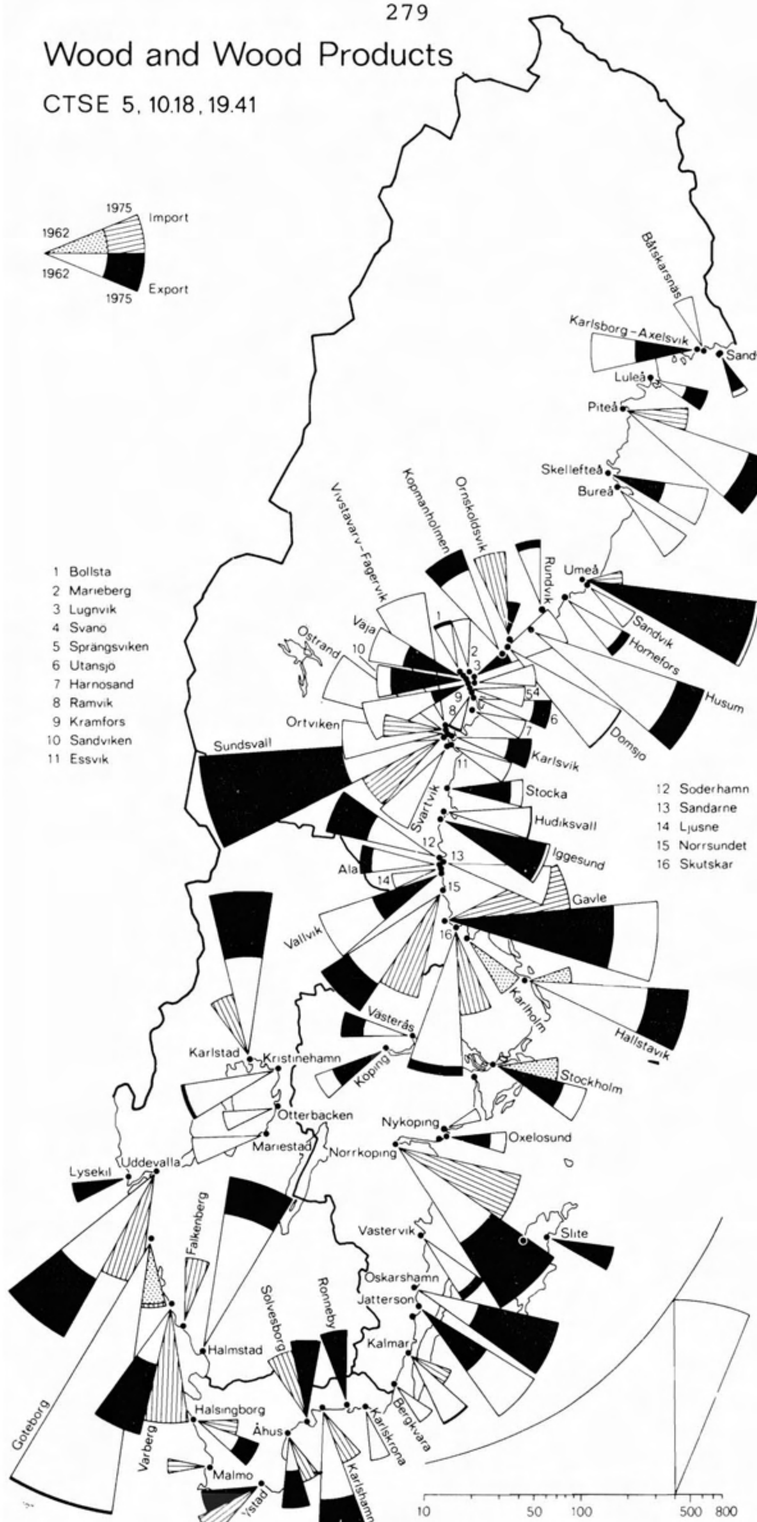


Figure 3:20. Wood and Wood Products, Turnover by Ports

Among the West Coast ports, Halmstad, Varberg and Uddevalla, showed a rapid traffic increase between 1962 and 1975, a result of new industrial location and of Uddevalla's growing competitiveness for traffic which prevously had been handled by the inland ports on the Vänern. The leading position of Gothenburg was reduced during the 1960's and early 1970's. Its market share decreased from 28 % in 1962 to 19 % in 1975 because of increasing competition from other West Coast ports.

The seaborne imports of wood was comparatively small during the 1960's. After 1972 it started to grow rapidly (Figure 3:19). The main commodity was low-value round wood from West Germany, Denmark and Finland. The import from Germany was temporary storm-felld trunks from the 1974 storm. The balance between exports and imports of wood and wood products shows a strong surplus of outgoing cargo, which creates a significant surplus of transport capacity in the return trips to Sweden. It can be utilized for movements either of other break bulk cargo, mainly chemicals, or general cargo, which has a significant import surplus.[1] However, this balancing of flows requires flexible modes for the movement of various types of cargo and the location of exports and imports to the same harbors or to ports along the same route. The imbalance in general and break bulk cargo traffic is particularly strong at the northern ports. Exports were twice the imports in 1976. The East Coast ports also show a surplus for exports, about 1 million tons. These imbalances mean that 30-40 % of the tonnage used for general and break bulk cargo exports from ports along the North and East Coasts of Sweden cannot find return cargo.

The future volume and structure of the Swedish exports of wood and wood products are difficult to predict. They strongly depend on the competition from the North American wood industry and on the development of the wood, pulp and paper industries in Western Europe. According to government forcasts made in the mid 1970's, the exports of wood will increase by 2.4 % per annum during the late 1970's, the pulp exports by 1.4 % per year, and exports of paper by 10 % per annum, measured in fixed prices.[2] The demand for paper in the European markets is supposed to grow quicker than domestic production. The tonnage growth should be lower, considering the tendency of the early 1970's towards higher ton-values. During those years the tonnage growth was 1.5 per cent units lower than the value growth (fixed prices). Assuming this proportion holds in the future, the tonnage growth of paper exports will be about 8.5 % per annum.

---

[1] See pp. 287-294.

[2] SOU 1975:89, pp. 138.

The modal distribution of wood exports in the late 1970's and early 1980's will be strongly influenced by the faster growth of production in the South than in the North of Sweden, which should strengthen the competitiveness of trucks in the movement of paper and wood products and of railways in the pulp export. The port distribution of seaborne exports will probably remain stable as the shift towards specialized transport systems was finished in the Swedish wood industry by the mid 1970's.

METALS

The cargo group "metals" (CTSE 16) includes pig iron and steel ingots as well as bars, rods, plates, sheets, wire and tubes of steel and non-ferrous metals and products thereof. The development of the metal industries and their export perspectives have been analyzed in several studies in recent years.[1] Only the main tendencies will be described here to provide a background for the analysis of the modal and port distribution of the metal trade.

The share of metals in the tonnage export of break bulk cargo increased from 8.7 % in 1962 to 13.3 % in 1976. In imports it decreased from 40 to 33 % (Figure 3:21). The growth rate for exports (fixed prices) was higher than for production between 1962 and 1976, which meant an increasing dependence on foreign markets (Figure 3:21). In 1962 about 20 % of the production was destinated abroad, in 1975 the corresponding number was 30 %. Also imports grew at a higher rate than production: the share of imports in the total consumption increased from 16 % in 1962 to 25 % in 1975.

The increased dependency on foreign suppliers did not cause any significant change in the commodity structure of the metal imports (Table 3:22). The average ton-value in 1968 prices was about 1 100 Skr in 1962 as well as in 1975 (Figure 3:21). In exports the share of commercial steel increased, while that of ingots decreased (Table 3:22), but it did not influence the average ton-value which both years was about 1 500 Skr. Exports thus included more valuable goods than imports.

The geography of the Swedish metal trade in the late 1960's and early 1970's showed an increasing concentration of exports to Europe, while the prior dominance of this continent decreased in imports as a result of the rapidly growing share of Japan and other Asia (Table 3:23). Europe's increased role in exports strengthened the competitiveness of road transports which grew continuously from 8 % in 1967 to 21 % in 1976. The share of railways remained con-

---

[1] Jernkontoret 1971; SOU 1974:11, SOU 1975:89; SIND 1976:7; SOU 1976:22, SOU 1977:15 g, 16; Lundin, O., 1977.

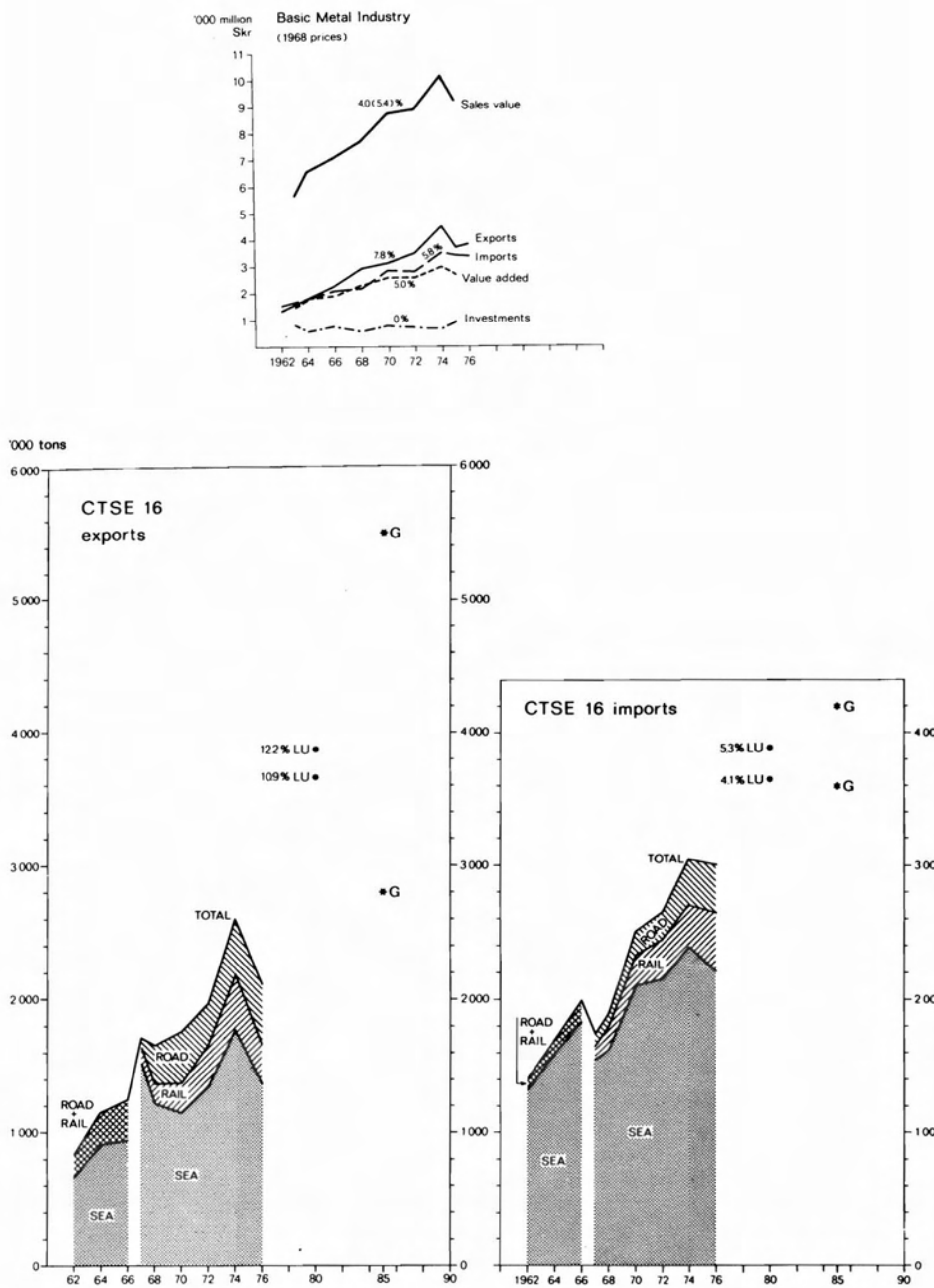


Figure 3:21. Basic Metal Industry

Table 3:22. Structure of the Swedish Trade with Iron and Metals

SITC	Commodity	Imports				Exports			
		1962		1975		1962		1975	
		weight %	value %	weight %	value %	weight %	value %	weight %	value %
67	Iron and Steel	86.2	58.1	90.5	68.9	91.6	81.8	93.3	83.7
671	Pig iron, Spiegel-eisen, ferro-allays etc.	14.8	5.7	15.5	12.9	11.2	10.5	16.0	7.0
672	Ingots etc.	0.8	1.4	8.5	3.7	13.9	4.2	6.2	2.1
673	Iron and steel bars etc.	15.6	9.0	20.6	12.5	23.4	17.8	20.9	16.1
674	Plates, sheets etc.	40.4	28.1	38.7	22.3	19.2	16.9	33.8	25.8
675	Hoop and strip	2.6	2.1	3.5	2.5	3.8	9.3	3.2	7.9
678	Tubes, pipes etc.	10.4	10.2	9.8	12.8	13.2	19.0	9.2	17.7
68	Non-ferrous metals	13.7	41.9	9.5	30.1	8.4	18.2	6.7	16.3
682	Copper	6.0	20.0	3.5	10.6	5.5	12.8	3.1	7.2
684	Aluminium	3.2	10.0	3.0	7.3	1.0	2.2	1.8	3.9
	Metals	100	100	100	100	100	100	100	100
		1 408[a]	1 469[b]	2 969[a]	6 664[b]	854[a]	1 376[b]	2 177[a]	6 670[b]

a '000 tons
b 1 000 000 Skr.

Source: SOS, Utrikeshandelsstatistik, Part 2, 1962, 1975, Statistiska Centralbyrån, Stockholm.

stant while that of shipping went down. The ton-value index for both road transports and shipping decreased between 1967 and 1975 (Table 3:24). Shipping lost the commodities with the highest ton-value to trucks. However, large differences in average ton-value continued to exist between the modes.

Also in imports shipping lost market shares, from 88 % in 1967 to 73 % in 1976 (Figure 3:21). The share of rail increased from 7 to 14 %, which resulted in a decreasing ton-value index. In 1975 it equalled the sea index. In other words, railways were increasingly competing with shipping in the same market segments. Also the share of road transports increased considerably, from 4 % in 1967 to 12 % in 1976 and the ton-value index decreased. However, it is still more than twice those of sea or railway.

Table 3:23. Geography of the Swedish Metal Trade (CTSE 16)

Trading Areas		1967 '000 tons	%	1974 '000 tons	%	1976 '000 tons	%
Total	exports	1 595	100	2 606	100	2 117	100
	imports	1 726	100	3 040	100	3 013	100
Europe Total	exports	1 103	69.2	2 145	82.3	1 854	87.6
	imports	1 615	93.6	2 740	90.1	2 362	78.4
Nordic	exports	296	18.6	744	28.6	599	28.3
	imports	420	24.3	727	23.9	682	22.6
U.K. and Ireland	exports	257	16.1	291	11.2	336	15.9
	imports	264	15.3	200	6.6	230	7.6
West Europe	exports	367	23.0	717	27.5	638	30.1
	imports	685	39.7	1 537	50.6	1 165	38.7
South Europe	exports	98	6.1	223	8.6	118	5.6
	imports	17	1.0	77	2.5	0	0
East Europe	exports	85	5.3	170	6.5	163	7.7
	imports	229	13.3	199	6.5	285	9.5
U.S. and Canada	exports	126	7.9	188	7.2	134	6.3
	imports	28	1.6	59	1.9	50	1.7
Asia and Oceania	exports	146	9.2	115	4.4	69	3.3
	imports	7	0.4	161	5.3	373	12.4
Japan	exports	85	5.3	32	1.2	11	0.5
	imports	5	0.3	145	4.8	337	11.2
Africa	exports	10	0.6	48	1.8	12	0.6
	imports	34	2.0	34	1.1	49	1.6
Latin America	exports	19	1.2	76	2.9	35	1.7
	imports	39	2.3	28	0.9	47	1.6

Source: Unpublished Transport Statistics, 1967, 1974, 1976, Statistiska Centralbyrån, Stockholm.

Table 3:24. Value per Ton (VT) and Index (I) in the Swedish Trade with Iron and Metals

	Exports						Imports					
	1967		1970		1975		1967		1970		1975	
	VT	I	VT	I	VT	I	VT	I	VT	I	VT	I
Sea	1 430	86	1 786	78	2 318	76	1 085	87	1 394	87	1 953	87
Rail	1 916	115	2 520	109	3 506	114	1 656	132	1 817	113	2 016	89
Road	3 356	201	4 335	188	5 744	187	3 148	252	4 087	255	4 568	203
Total	1 666	100	2 303	100	3 064	100	1 248	100	1 605	100	2 254	100

During the 1960's and early 1970's imports dominated exports, measured in tons (Figure 3:21). Thus, there was a continuous surplus of transport capacity from Sweden. This was particularly important for sea transports where the capacity surplus was as high as 20-50 % in the 1960's and early 1970's.

Only-one third of the import of the early 1970's was used as input in the metal industry, about 50 % were inputs in the engineering industry and the rest was used by the building and shipyard industries.[1] Its port distribution is thus a function of the location of the import warehouses for semi-manufactures and of the engineering industry. The port distribution of the export, on the other hand, is a function of the location of the iron and metal industry. The products are sensitive to transport costs, production is concentrated at a few places and the shipments are organized through nearby ports, i.e. an optimal transport system for iron and metals is based on short-land and long-sea transports.

Seaborne iron and metal export in 1962 was highly concentrated to the northern ports, 46 % and the East Coast ports, 27 % (Figure 3:22). The corresponding numbers for 1975 were 33 and 40 %. The increase in the East Coast ports was a result of the rapid traffic growth through Oxelösund with its new steel plant and through Västerås which became the major export terminal for shipments from Bergslagen, the traditional heart of the Swedish steel industry.

No port on the South Coast handled export of this category during the 1960's and 1970's. The West Coast ports had a constant share during the period, in spite of a rapid growth for Halmstad which reported a 50 % capacity increase for the local steel plant. Exports through Gothenburg increased at a slower than average rate and experienced competition from the smaller West Coast ports, particularly Uddevalla and Vänersborg. Cargo handling charges were much lower in these ports than in Gothenburg.

The port distribution for imports differs very much from that of exports (Figure 3:22). The East Coast and West Coast ports each accounted for about one-third of the total traffic in 1962 and 1975. The decline of Stockholm stands in a sharp contrast to the increases at Gävle, Västerås and Köping. High handling costs, declining manufacturing in the metropolitan area and the location of new warehouses outside Stockholm were the main reasons for the deconcentration of imports from Stockholm to smaller terminals. The share of the South Coast ports

---

[1] Statistiska meddelanden N:1977:5.

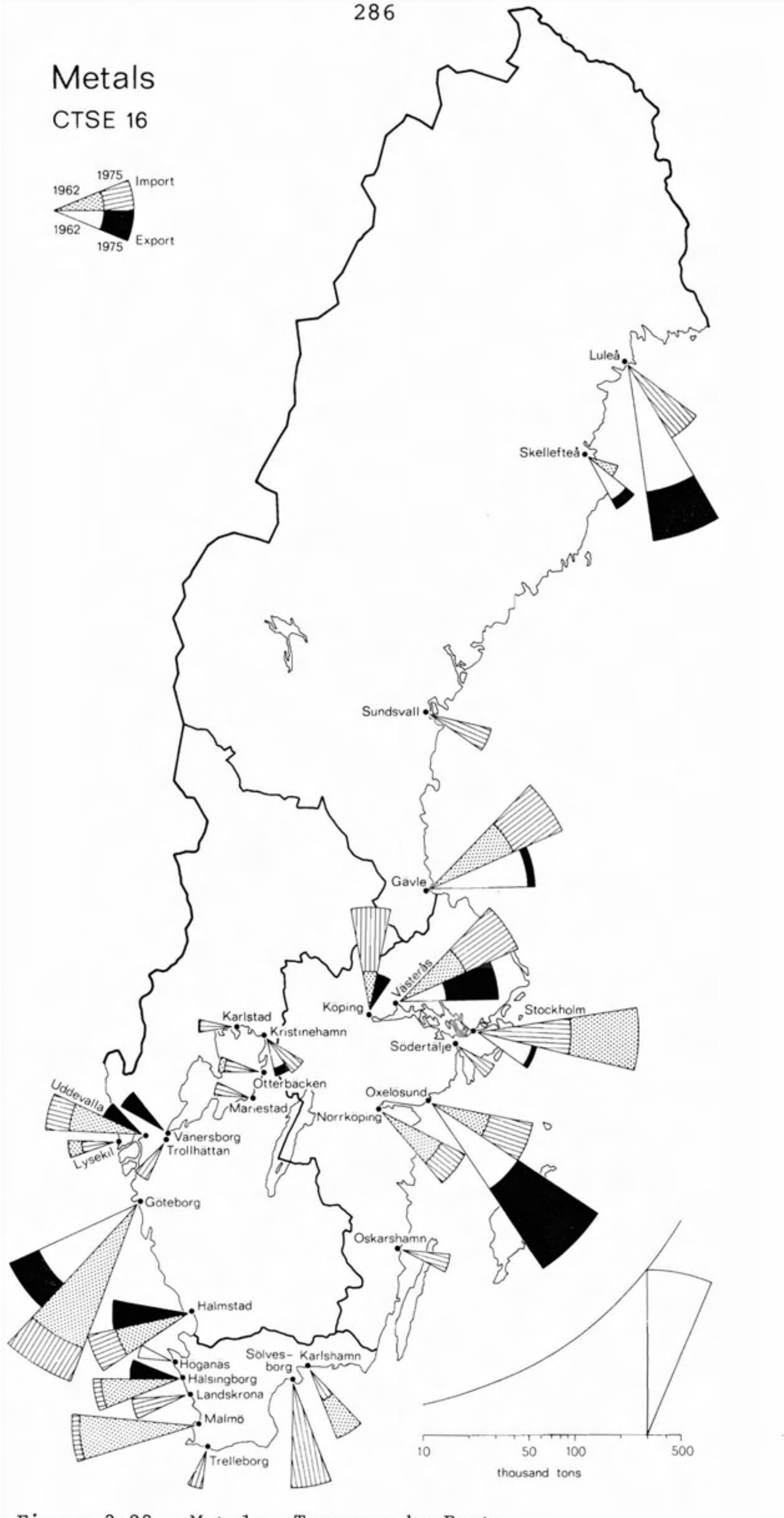


Figure 3:22. Metals, Turnover by Ports

was also rather constant in the 1962-1976 period, about 20 %. Malmö was in the early 1960's the central import terminal of the region. The expansion of the car component industry in the eastern part of the hinterland (the Volvo subcontractor at Olofström) provided a rapid traffic growth through Sölvesborg, which was adopted as a specialized terminal in the transport system of the company.

As mentioned above, the West Coast ports handled about one-third of the iron and metal imports. The leading position of Gothenburg was slightly weakened during the 1960's and early 1970's, a result of increasing competition from smaller ports of the region which offered cheaper cargo handling.

Imports and exports showed strong regional imbalances. The export surplus of the northern ports was about 100 000 tons in 1975, while the East Coast ports had an import surplus of 400 000, i.e. a significant surplus of outgoing tonnage which had to search for other break bulk or general cargo.

The future demand for transports by this group is difficult to estimate and so is the outcome of the structural changes that started in the mid 1970's in the steel industry of the world including Sweden. The increased use of substitutes in the engineering and building industries make the forcasts even more difficult. The cancellation of advanced plans for a major iron and steel complex in the North (Luleå) made all prognoses of the early and mid 1970's useless. It will probably result in larger imports and a slower growth of exports.[1] A partial restructuring of imports can also be foreseen. The share of low-value commodities used as inputs in iron and metal manufacturing will probably decrease, leading to stagnating demand for sea transports and larger shares for road and rail. The changing structure of the flows and of their modal split should result in a redistribution of the seaborne trade. Traffic through terminals handling cargo for central warehouses will probably grow, while flows through terminals handling imports and exports of iron and metal plants may stagnate or even decrease.

CHEMICALS

Chemicals (CTSE 14) are a very heterogeneous cargo group as regards transport needs. It includes both semimanufactures and final products. Some of them can be defined as general cargo, but most should be classified as break bulk cargo. Chemicals to a higher degree than other break bulk cargo are used as supplementary or return cargo in liner shipping.

---

[1] SOU 1976:22, p. 71.

During the 1960's and early 1970's both exports and imports of chemicals grew at higher rates than the output of the chemical industry, oil refineries excluded (Figure 3:23). Hence, the industry became more dependent on foreign markets. For chemicals imports were traditionally larger than exports. The annual growth of imports in fixed prices was about 11 % in the 1960's, but slowed down to 8 % in the early 1970's (Figure 3:23). The tonnage growth of the imports was considerably slower, particularly in the 1970's, a result of two sharp declines in the 1970-1972 and 1974-1976 periods. The differences in growth rates by fixed prices and by tonnage indicate changes in the commodity structure. The average ton-value, in 1968 prices, increased from 1 000 Skr in 1962 to 1 400 Skr in 1976 (Figure 3:23).

Also exports showed a concentration towards more valuable goods. The average ton-value, in 1968 prices, increased from 1 500 Skr in 1962 to 2 200 Skr in 1976. The increase happened in the early 1970's. The annual growth rate of exports in those years was 12 % in value and only 6 % in tons. The corresponding numbers for the 1960's were 13 and 18 %, i.e. the share of low-value commodities increased in that period. The increased ton-values of imports and exports to a high extent was the result of growing trade in drugs and plastic materials (Table 3:25).

The geography of the chemical trade showed an increase for Europe in both imports and exports. Less than 9 % of the exports were destinated outside Europe in 1976 and only 5 % of imports came from these areas (Table 3:26). The share of the Nordic countries increased both in imports and exports and made them the main export market in 1976. Western Europe kept its place as the main import area.

The increased ton value and a concentration of trade to the Nordic countries and Western Europe influenced the modal split of chemical cargo. Truck exports increased from 25 % in 1967 to 40 % in 1976 and reached the proportion characteristic for general cargo. In imports the share of trucked chemicals increased from 12 to 30 % between 1967 and 1976, i.e. slightly below the average for general cargo. The rail share was relatively low, 12-16 % and remained constant during the period. In the mid 1960's shipping had two-thirds of the chemical imports and exports, but in 1976 it had decreased to about 50 %, a result of truck competition. Structural and geographic changes in flows strengthened this competition.

The large modal differences in the structure of carried chemicals remained nearly unchanged between 1967 and 1976. The average ton-value for seaborne exports was less than half of the trucked flows (Table 3:27) and for imports only-one fourth. The ton-value index for seaborne trade decreased continuously, i.e. shipping became increasingly concentrated to low-value chemicals.

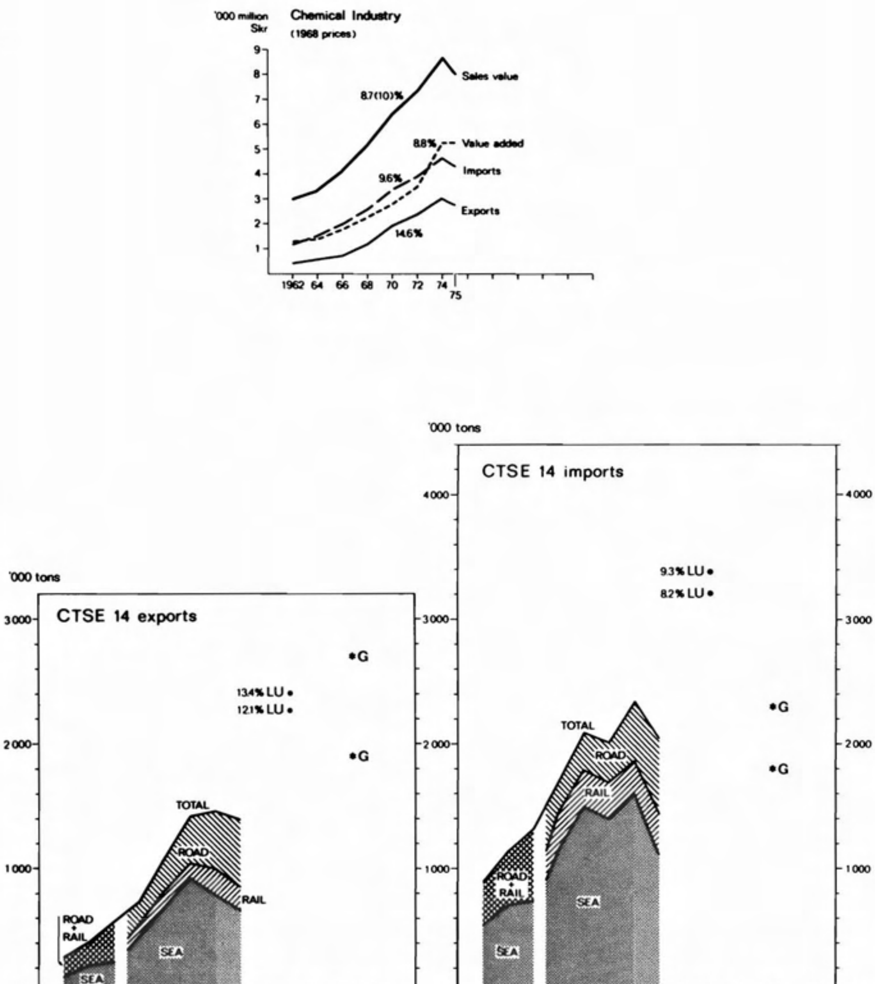


Figure 3:23. Chemical Industry

Table 3:25. Sweden's Foreign Trade in Chemicals

SITC	Commodity	Imports				Exports			
		1962		1975		1962		1975	
		weight %	value %	weight %	value %	weight %	value %	weight %	value %
51	Chemical elements	72	40	63	30	45	31	46	26
52	Minerals	5	1	1	0	4	0.4	1	0
53	Colouring materials etc.	3	9	3	7	2	4	3	5
54	Drugs etc.	0.03	11	0.5	14	0.03	9.4	1	14
55	Oils, perfumes etc.	2	5.5	3	6	2	4	3	5
57	Pyrotechnics etc.	0	1	0	0	1	4.3	1	3
58	Plastic materials	9	22	17	29	16	30	19	31
59	Other chemicals	9	12	13	12	29	16	26	15
	Chemicals	100	100	100	100	100	100	100	100
	Manufactured fertilizers	899[a]	1 131[b]	2 202[a]	5 700[b]	296[a]	457[b]	1 301[a]	3 249[b]

a '000 tons
b 1 000 000 Skr.

The port distribution of the seaborne imports of chemicals depends primarily on the competitiveness of the supplied transports and on the location of the chemical, textile, wood, pulp and paper industries. About 14 % of the imports were used for private consumption in the early 1970's.[1]

The distribution of exports is strongly influenced by the location of the chemical industry. Exports were mainly concentrated to a few terminals on the North, South and West Coasts, while imports were more evenly distributed (Figure 3:24). The share of the West Coast region in the chemical production increased from 36 to 42 % between 1968 and 1974 and in pulp and paper production remained constant, about 30 %.[2] Considering that the chemical industry uses about 30 % of the chemical imports, the textile industry 11 % and the wood industry 6-8 %, the share of this region in the total demand for chemical imports can be estimated at about 34-38 % in the mid 1970's. The ports of the region,

---

[1] Statistiska Meddelanden N 1977:5.

[2] Statistiska Meddelanden: 1, 1973:15; 1976:6.

Table 3:26. Geography of Sweden's Trade in Chemicals (CTSE 14)

Trading Areas		1967 '000 tons	1967 %	1974 '000 tons	1974 %	1976 '000 tons	1976 %
Total	exports	583	100	1 466	100	1 393	100
	imports	1 308	100	2 343	100	2 044	100
Europe Total	exports	493	85.0	1 192	81.3	1 269	91.1
	imports	1 133	86.0	2 106	89.9	1 937	94.7
Nordic	exports	201	34.5	567	38.7	586	42.1
	imports	227	17.3	449	19.2	400	19.6
U.K. and Ireland	exports	137	23.4	240	16.4	245	17.6
	imports	183	14.0	283	12.1	261	12.8
West Europe	exports	124	21.3	239	16.3	277	19.9
	imports	513	39.2	1 001	42.7	983	48.1
South Europe	exports	16	2.7	40	2.7	36	2.6
	imports	36	2.7	95	4.0	105	5.1
East Europe	exports	15	2.6	106	7.2	125	9.0
	imports	174	13.3	278	11.8	188	9.2
U.S. and Canada	exports	13	2.2	90	6.1	17	1.2
	imports	72	5.5	86	3.6	89	4.3
Asia and Oceania	exports	33	5.7	70	4.8	44	3.1
	imports	10	0.8	24	1.0	8	0.4
Japan	exports	2	0.3	11	0.7	2	0.1
	imports	6	0.4	6	0.2	7	0.3
Africa	exports	9	1.5	39	2.7	25	1.7
	imports	4	0.3	1	0	0	0
Latin America	exports	7	1.2	50	3.4	23	1.7
	imports	96	7.3	144	6.1	4	0.2

Source: Transport statistics 1967, 1974, 1976, Unpublished, SCB, Stockholm.

Table 3:27. Value per Ton (VT) and Index (I) for Sweden's Trade in Chemical Products

	Exports						Imports					
	1967		1970		1975		1967		1970		1975	
	VT	I	VT	I	VT	I	VT	I	VT	I	VT	I
Sea	1 100	74	813	63	1 737	68	1 092	75	902	65	1 503	57
Rail	1 516	102	1 531	119	2 471	97	1 459	100	1 599	116	2 561	98
Road	2 250	151	2 240	174	3 262	129	3 139	219	3 190	231	5 439	208
Total	1 484	100	1 284	100	2 538	100	1 457	100	1 377	100	2 614	100

Figure 3:24. Chemicals, Turnover by Ports

including inland ports on the Lake Vättern, handled about 25 % of the chemical imports in 1975. The difference between the region's share in the demand for imported chemicals and in seaborne trade can be explained by competition from the South Coast ports and by a higher share of land transports.

In exports the share of the West Coast ports in the early 1970's corresponded to the region's share in chemical production. Gothenburg, traditionally the leading port in handling seaborne chemical trade, had a decreased share in exports as a result of the rapid traffic expansion in newly established industrial terminals and of competition from land transports. In imports Gothenburg strengthened its market position between 1962 and 1975 (Figure 3:24).

The development in the sulfuric acid plant at Helsingborg resulted in a substantial traffic growth through this port, which became one of the leading industrial terminals for the chemical trade. Traffic expansion at Helsingborg and through the smaller industrial terminals made the South Coast ports increase from 13 to 30 % between 1962 and 1975 in seaborne imports, while the demand of the region for these commodities was about 22-26 % in the mid 1970's. The traffic surplus was destinated to the West Coast region.

The high share of the northern terminals in imports was unchanged between 1962 and 1975 (Figure 3:24). Kubikenborg was the main port for imports of basic chemicals required for bleaching by the pulp and paper industries. The import of these chemicals was also handled by small ports located at the pulp and paper plants. These flows were the main return cargo for vessels carrying wood and wood products from the northern ports. The rapid expansion of exports through Skellefteå and Helsingborg was the result of the growth of the local sulfuric acid plants.

The East Coast share of chemical imports declined as the heavy chemical industry of the region had a slow increase and the light chemical industry shifted to road transports. This particularly hit Stockholm where the 1975 turnover was only half that of 1962.

According to the official long-term projections, chemical exports were to grow at 12.1 - 13.4 % a year (fixed prices) in the late 1970's.[1] The import growth were to be 8.2 - 9.3 %. These rates are slightly higher than those of the early 1970's but below those of the 1960's. The tonnage growth should be lower as the pulp, paper, textile and basic chemical industries were expected to have a low expansion rate. The annual growth rate of export tonnages were estimated at 5-7 % for the late 1970's and the early

---

[1] SOU 1975:89.

1980's and the corresponding numbers for imports at 2-4 %. The road share should increase, but at a rate slower than in the 1960's and early 1970's. The rapid growth characteristic of the introduction phase should slow down. However, the share of shipping will continue to decrease as a result of the slow growth of the pulp and paper industries.

The imports of base chemicals for the chemical industry will develop at the same rate as the production of this industry. Hence, this traffic growth will be concentrated to the industrial terminals located at the chemical plants. Deep-sea movements of high-value chemicals will be concentrated to Gothenburg and, possibly, Helsingborg assuming these ports can compete in prices and services with the large ports on the Continent.

CONCLUSIONS

Tendencies in the break bulk cargo trade of Sweden, its modal and port distribution can be summarized as follows:

Break bulk cargo traditionally was an important complement to general cargo for liner shipping, particularly on unbalanced short-sea routes. Europe was the leading trading area for these commodities, and this has not changed during the 1960's and early 1970's. However, there was a concentration of this trade to the Nordic market. The commodity structure of break bulk exports changed toward more valuable goods, while that of imports was nearly constant, a development common for highly industrialized countries. It created a strong difference between imports and exports as regards quality and price of demanded transports.

The sea share in the exports of break bulk cargo decreased from 74 % in 1967 to 65 % in 1976 and from 72 to 60 % in imports as a result of growing competition from road transports. The switch to road transport, helped by structural changes in the commodity composition of the flows, had a strong impact on the type and geographic location of required sea transport services and increased a demand for ferry services. As a result, the share of the northern ports in the export of break bulk cargo decreased from 58 % in 1962 to 41 % in 1975. However, this was only partly a result of the described structural changes and partly followed from the more rapid growth of the wood processing industries in the southern parts of the country. Also the expansion of the chemical industry in the southern region helped increase its share of the break bulk exports. The share of the northern region in imports increased as a result of rapidly growing volumes of wood. The share of the East Coast ports decreased, because relatively limited volume of wood and chemicals were destinated to this region. The West Coast ports had a stable share of both imports and exports of break bulk cargo.

The introduction of specialized transport systems for break bulk cargo, particularly by the wood processing and chemical industries, stimulated concentration of flows to a few terminals. This was most pronounced among the northern ports, strongly dominated by the exports of wood and products.

The analysis of the changes in the commodity structure and in the geography of the trading areas and hinterlands cannot provide the whole explanation of modal and port distribution changes for the general cargo and break bulk cargo flows. To understand these changes it is necessary to study in addition differences in prices and qualities of the supplied transport services. Only through a two-step approach will it be possible to explain the patterns and dynamics of the seaborne general cargo.

4. MODAL AND PORT ALLOCATION OF GENERAL CARGO FLOWS: AN OPTIMIZATION APPROACH

One conclusion in the first chapter was that the ro-ro technique had far-reaching consequences on the organization and competition of sea and land transports, both in deep-sea and short-sea markets, resulting in an increased mobility of general cargo flows as regards their allocation on alternative modes and terminals. These reallocation tendencies were described in the third chapter with the general cargo trade of Sweden in focus. The main tendency was the increasing role of road transports and the declining role of small ports. Trade was highly concentrated to Western Europe and several modes and terminals competed for these flows. An analysis of the demand for individual services thus requires an integrated approach including all available transport alternatives and considering their interdependences.

THE BASIC CONCEPT

SPATIAL ORGANIZATION OF FLOWS

A synthesis of the spatial organization of general cargo transports shows a very simple pattern including the following phases: assembling transports in the hinterland, transshipment operations in an export harbor, sea transport, transsshipment operations in an import harbor and distribution transports in the foreland (Figure 4:1a). However, in reality the pattern is much more complex, even when the analysis is limited to the short-term perspective, considering flow allocation problems only within an existing system of modes and terminals (Figure 4:1b).

The optimal use of this system can be studied from several perspectives. One may be how to design an optimal transport system for an individual consignor. Another may include optimization of transports required by individual regions including several general cargo consignors. A third may be the perspective of a supplier of transports or terminal services.

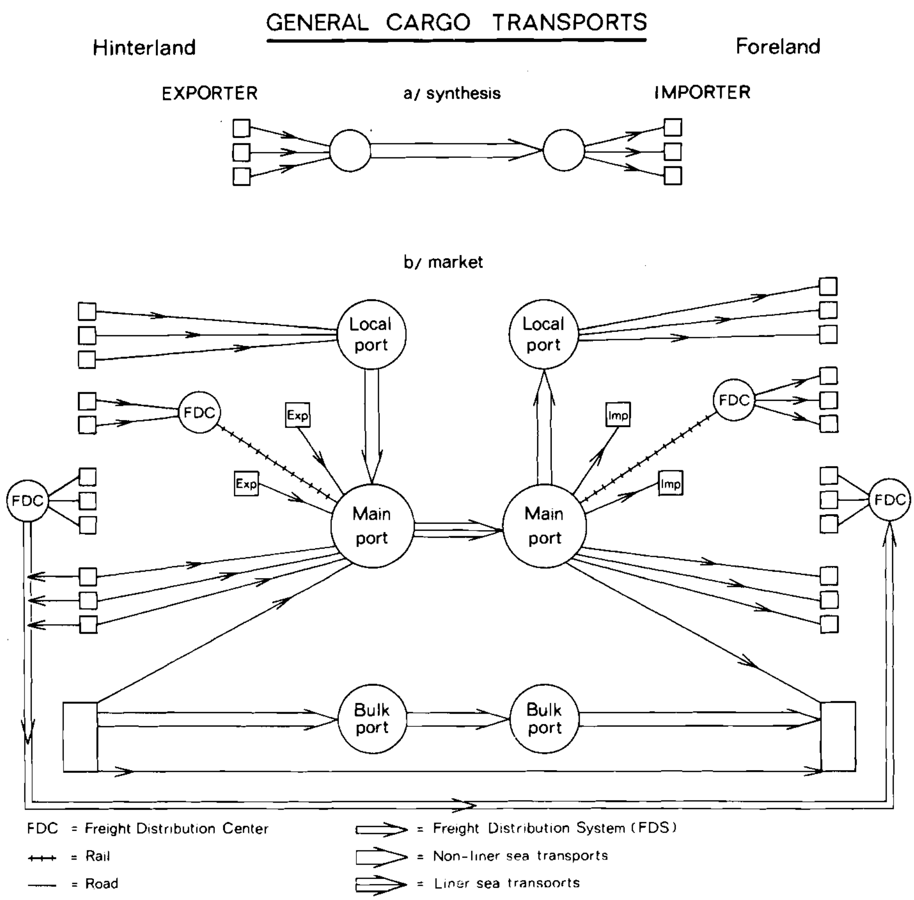


Figure 4:1. Spatial Organization of General Cargo Transports

This study has chosen a fourth focus, the optimal modal and port allocation of general cargo flows seen in the national perspective with a static approach. An optimal port allocation of flows is searched, given actual prices, times and capacities of all in the market available transport alternatives. The study is based on a Flow Distribution Model (FDM) and linear programming techniques are used to solve the problem.

BASIC ASSUMPTIONS

The basic assumption of the FDM is that the lowest total transport costs for general cargo shipments from all regions in the country provide the optimal flow allocation. Transport costs are defined as a function of prices charged by available transport modes and terminals and of transport time. The monetary value of transport time is estimated with the help of data on the frequence of transport services, the value of the cargo, and the consignor's requested rate of return on his capital tied up in the transport process.

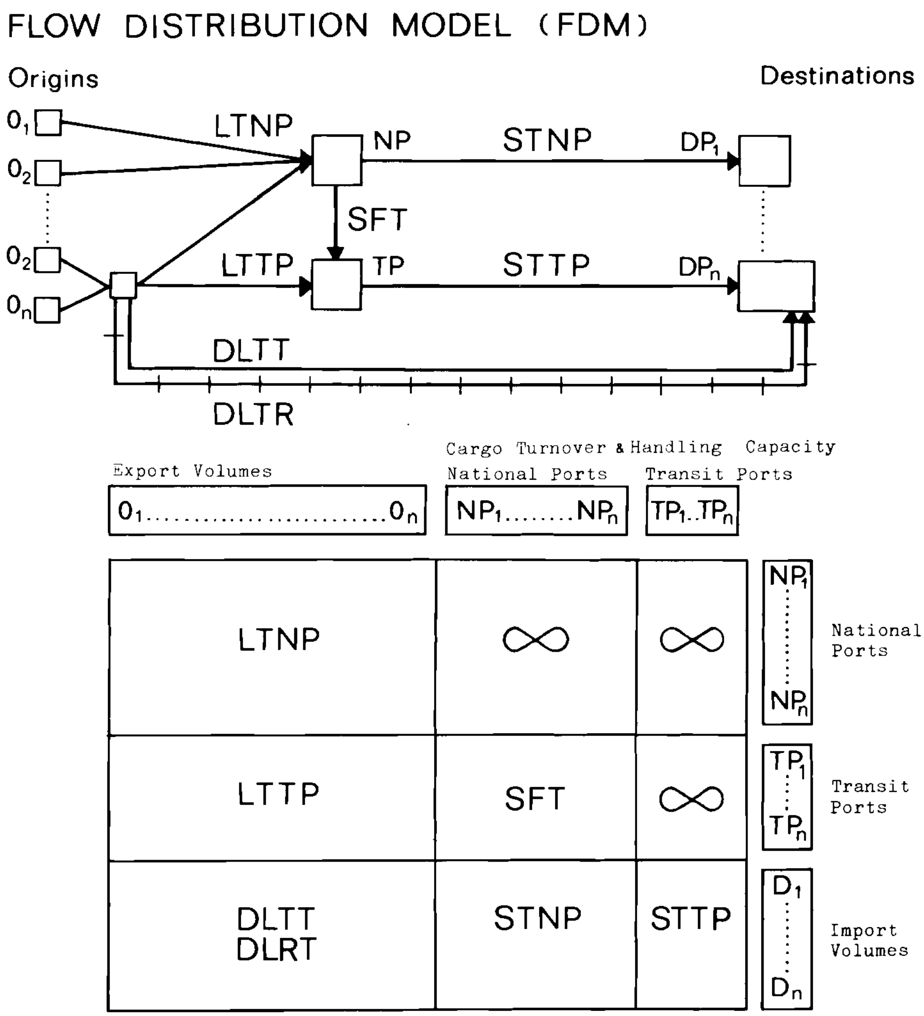
The second assumption is that export flows generated by each region include several consignments sent by individual shippers, i.e. the prices for transports are proportional to the quantity of the shipped cargo. The third assumption is that all consignors have perfect information about prices and times for individual transport alternatives and that these two variables and the capacity of the sea services are the elements that determine modal and port allocation of general cargo flows. The fourth assumption is that export volumes generated by individual regions are proportional to the number of employees in industries producing general cargo. The latter assumption is based on findings of earlier studies which showed a close correlation between employment in manufacturing or total population and cargo volumes generated by individual regions.[1]

The spatial pattern of a transport system operationalized in the FDM is shown in the upper part of Figure 4:2. It includes the following main alternatives: (1) road and rail transports in the hinterland (LTNP) and sea transports (STNP) from national ports (NP) to destination ports (DP), (2) road or rail feeder (LTTP) alternatively sea feeder (SFT) to foreign transit ports (TP) followed by sea transports to destination ports and (3) direct road transports from origin to destination points, including transshipment in inland terminals (DLTT or DLTR). The distribution transports in the foreland are not included in the analysis.

In the lower part of Figure 4:2 these alternatives are operationalized in matrix form. The following three alternatives were excluded by assigning them infinitely

---

[1] See pp. 208-212.



Costs:

LTNP - Land Transport to National Ports

LTTP - Land Transport to Transit Ports

DLTT - Direct Land Truck Transport

DLRT - Direct Land Rail Transport

SFT - Sea Feeder Transport

PST - Port Sea Services

Figure 4:2. The Concept of the Flow Distribution Model high costs: transit transports between national ports, shipments between transit ports, and shipments from transit to national ports for further movement to foreign destination ports. The restriction on the possibilities for transit movements between national ports or between transit ports were introduced to adopt the model to the conditions in the Swedish transport market for general cargo by the mid 1970's. Return transports from transit terminals were counted as illogical and therefore excluded from the analysis. The mathematical formulation of the model is given in Appendix 1.

The model can be used to estimate (1) volumes of general cargo exports generated by individual regions, (2) the shape of hinterlands of national ports considering the network and prices of inland transport, and (3) modal and port distribution of general cargo exports from individual regions to a given destination. Destinations are defined as import harbors, distribution transports in the foreland were not included in the analysis.

THE CASE STUDY OF SWEDEN

In the third chapter was shown that general cargo exports from Sweden in the late 1960's and early 1970's were characterized by increasing competition between modes and ports. These tendencies are summarized in Table 4:1. Three destinations dominated the exports: Norden, The Continent, and United Kingdom including Ireland. Traffic to the Continent was characterized by the continuously growing role of road transports, the rapid decline of the rail share and the fluctuating position of sea transports. Exports to the United Kingdom did not show any stable trend as regards the role of individual modes. Unfortunately, no data are available about the traffic of individual ports by destinations.[1]

The Continent and U.K. markets were chosen to test the FDM because they account for large trade volumes - their size should limit the risk that one firm dominates the trade - and they show different patterns as regards modal allocation of flows.

---

[1] In the official transport statistics shipments from all ports are aggregated into 15 transport districts. Only 12 destinations are used; flows to the Continent are not separated from those to the United Kingdom. SCB, Transport Statistics of Sweden, unpublished List TR 9.

Table 4:1. General Cargo Export of Sweden by Destination and Transport Modes

Destination		Total '000 tons	%	Road %	Rail %	Sea %	Air %
Norden	1967	407	100	56	29	15	0
	1974	818	100	67	17	15	0
	1976	829	100	71	15	11	0
The Continent[a]	1967	214	100	35	44	21	0
	1974	505	100	47	17	36	0
	1976	494	100	64	18	17	0
U.K. and Ireland	1967	139	100	24	6	70	0
	1974	244	100	10	0	90	0
	1976	200	100	20	0	80	0
Southern Europe[b]	1967	79	100	3	15	72	0
	1974	160	100	15	37	47	0
	1976	110	100	30	30	40	0
Eastern Europe[c]	1967	30	100	7	63	30	0
	1974	37	100	38	51	11	0
	1976	72	100	26	36	38	0
North America	1967	116	100	1	2	97	0
	1974	201	100	3	1	96	1
	1976	178	100	3	0	95	2
World	1967	1 136	100	26	27	46	0
	1974	2 400	100	37	14	47	0
	1976	2 267	100	42	12	42	0

a West Germany, Benelux, France, Switzerland, Austria
b North Coast of the Mediterranian, Portugal, Bulgaria and Romania
c East Germany, Poland, the Soviet Union, Czechoslovakia, Hungary

Source: Unpublished Transport Data for Sweden 1967, 1974, 1976, SCB, Stockholm.

EXPORT POTENTIALS OF THE REGIONS

The only export data available in Sweden are on the national level and cannot be used for estimates of modal and port allocation of flows. Therefore, the first step in the FDM was an estimate of exports by regions made with a method common in multiregional transport models.[1] National export data by commodity were assigned to individual industries according to a key in Appendix 2, which allowed the computation of export volume per employee under the assumption that export production was evenly distributed among all

---

[1] See pp. 202-203.

employees. In the next step, the export quotients were multiplied by the number of employees of individual industries by region. The sum of these numbers gave the total volume of general cargo export generated in each region. These data formed the input vector 0_1 - 0_n in the model (Figure 4:2).

As pointed out in the second chapter, the method has several drawbacks, the most important being the assumption about regional equality in export propensity for individual industries. It ignores the location pattern of subcontractors as well as the existence of assembly plants, which in many industries are the dominating export origins. This disadvantage could be counterbalanced by regional coefficients indicating the difference between the national averages and the export orientation of industries in individual regions. The value of such coefficients could be estimated from indirect data about the location of assembly plants or export warehouses. Such data were not available for Sweden's general cargo producing industries in the mid 1970's. On the other hand, subcontractors - large and small - are often large exporters which should work to make the assumption quite realistic.

As employment data were the base of the computation, it was necessary to choose regions used for the employment statistics. The communes were the basic unit as the counties (*län*) represent too aggregated data. Some competing ports are located in the same county, particularly in the South. As only one port in each region can be considered a transport alternative in the model, use of the counties as origin regions would considerably limit the number of examined transport alternatives. To decrease the number of regions included, some communes were joined (Figure 4:3a). The number of regions used in the computation was 126, which allows a detailed picture of the regional distribution of exports (Figure 4:3b). The figure shows a significant concentration of general cargo exports in the southern part of the country where most of the general cargo ports are located. The short distance between ports and hinterland points and the equal distance in several regions to more than one port create a very competitive market.

PORTS AND HINTERLANDS

In the second step of the analysis, the price of assembling transports was estimated for the hinterlands of national general cargo ports. All ports that in the mid 1970's showed a turnover of commodities here classified as general cargo were included in the analysis. Of 30 ports, eight in 1974 had a general cargo turnover below 10 000 tons (Figure 4:4).

The distance between 126 points (regions) and 30 ports were converted to prices in a cost matrix, the LTNP element in the model, with the help of official domestic tariffs of the national railways (SJ) and the two leading

Figure 4:3a. Transport Regions in the Flow Distribution Model

Figure 4:3b. Export Potentials by Regions 1974

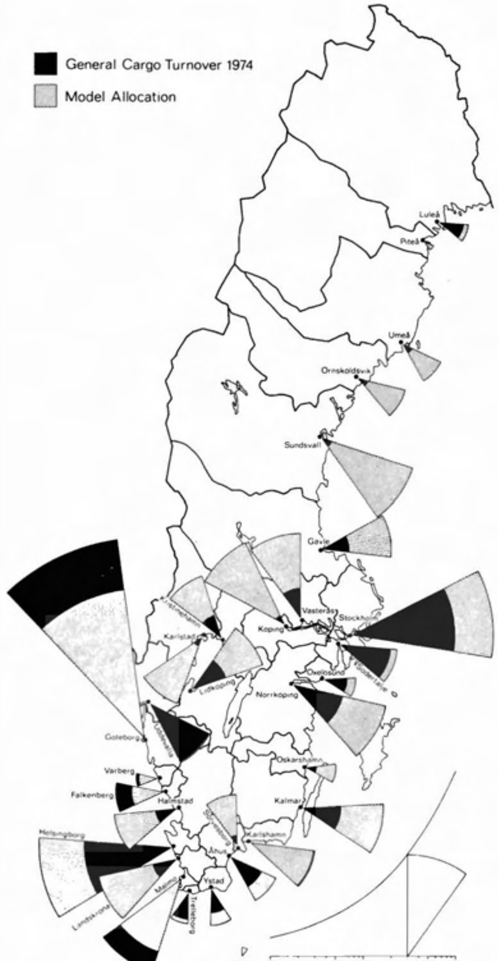


Figure 4:4a. Port Hinterlands by Land Transport Costs

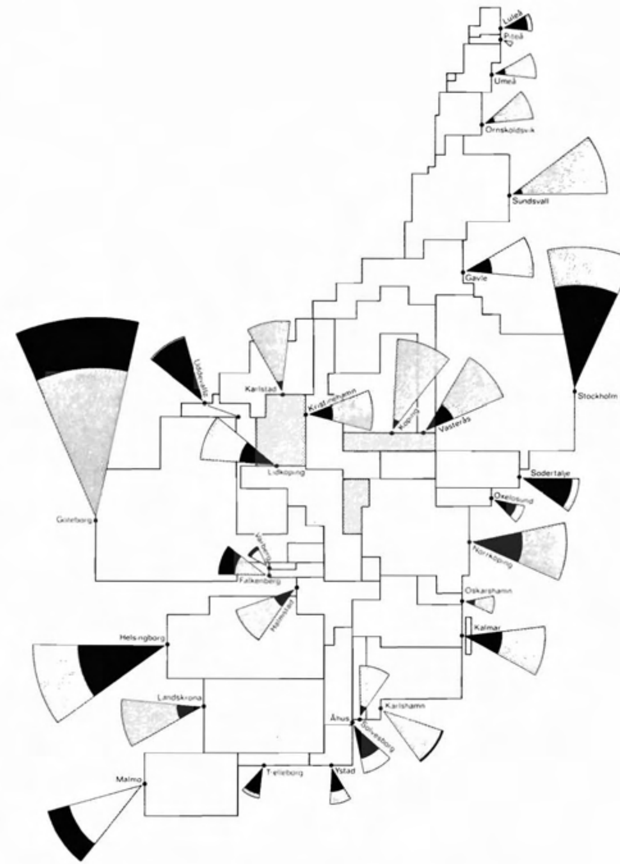


Figure 4:4b. Port Hinterlands by Land Transport Costs

road transport companies (ASG and Bilspedition). The average size of shipment was estimated at 15 tons. Rebates were not included in the calculations, except for the general freight aid for longdistance transports from the Northern regions. Individual rebates are a function of the bargaining skills of the consignor and are not related to the transport distance. They may vary considerably between consignors within the same region. Thus, it would be difficult to establish regional rebate levels in the model.

The results of the computation are presented in Figure 4:4, showing the optimized hinterlands of the national ports. For the optimal allocation of flows, only prices for assembling transports were considered. Total cost minimization in the whole transport system was sought. The assumption was made that all general cargo exports were shipped by sea from national ports. The estimated national volume was 106 % larger than the actual turnover, all transports were assumed to move by sea, while actually 53 % of the general cargo exports in 1974 moved by road or rail. The overestimation of traffic in small ports and the significant difference between the actual and estimated flows indicate that the design of a hinterland system of national ports using the price for assembling transports as single criterion may be very misleading. This type of calculation is useful only as a first step in the analysis. In the following steps, data on prices and capacity for cargo handling in ports and on the geography and frequency of sailings as well as capacity and freight rates. The exports of the country can be divided into five European submarkets: Norden, the Comecon coast in the Baltic, the Continent, The British Isles and the Mediterranian north coast (Table 4:1). Two of these destinations, the Continent and the British Isles, were chosen for further analysis. In the mid 1970's they were second and third in the Swedish general cargo exports. Thirteen of the national ports had regular services to the Continent and 14 to United Kingdom.

FLOWS TO THE CONTINENT

The estimation of the optimal mode and port allocation of general cargo flows to the Continent was made in four steps. In the first, only prices for cargo handling in the ports and freight rates were included in the STNP matrix of the model. In the second step, the transport capacity of individual alternatives was restricted, considering the size and productivity of vessels used on the routes. In both steps the assumption was made that all export to the Continent was seaborne. In the third step, direct road and rail transports (the DLTT and DLTR elements in the model) were introduced as alternatives to sea transports. Finally, in the fourth step the transport time was included.

Data about prices for general cargo handling in the ports, handling capacity and productivity, as well as geography and frequency of supplied sailings was collected from all 30 ports. Data were collected through a direct survey to the port authorities (Appendix 3). Answers were received from all ports.

The price for the general cargo handling in the ports was computed considering the following components: aboard and quayside work, social oncost when charged as a separate item, cranage, trucking and port cargo dues, i.e. the whole chain of transshipment services common in a general cargo port. The prices for aboard and quayside work included all auxiliary services, e.g. cargo weighting, control, and supervision.

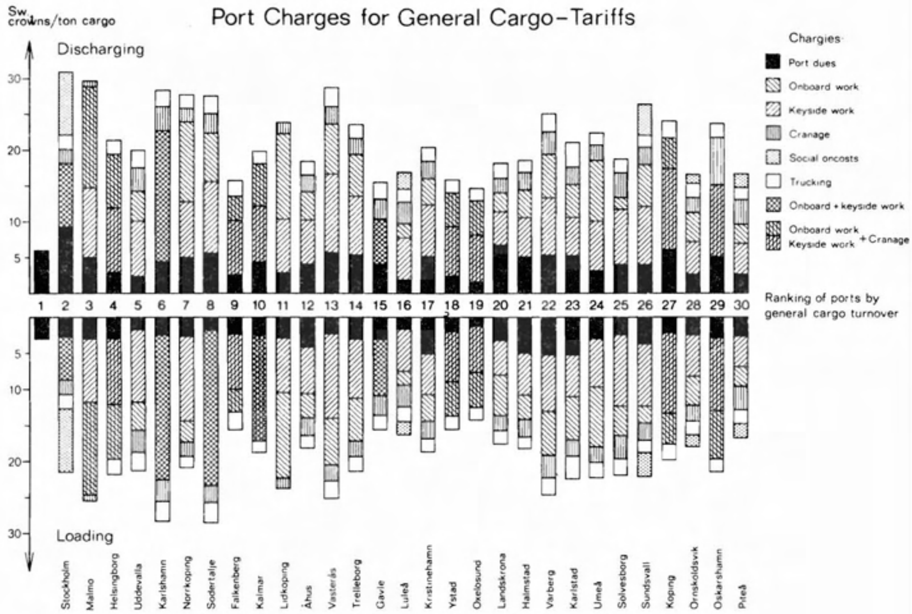
The total prices showed in Figure 4:5a represent averages for most common types of general cargo shipped on standard pallets, according to the price lists for 1974/75. The calculation was based on the following assumptions: a conventional general carrier with five holds was loaded, the holds were empty, i.e. no need for extra stowing work aboard. The following resources were used for loading: a full gang assisted by a conventional 2-5 ton crane and a forklift of 2-5 ton capacity. The cargo was moved directly from a warehouse to the quayside by a forklift. The productivity of the whole process was estimated at 20 tons per hour.[1] Cranage and trucking prices were quoted per hour of service and converted to ton-values using average productivity.

In most lists the prices for aboard and quayside work were quoted according to the "output" method, i.e. per ton commodity. A few ports, e.g. Stockholm, applied "input" pricing, quoting prices per resource input used for loading or discharging regardless of type of commodity. In the latter case, prices were recalculated to a ton base assuming average productivity.

The results indicate that large ports put higher prices in their lists than medium-size ports. The average price per ton for ports with a general cargo turnover above 100 000 tons in 1974 was 27 Skr. The corresponding number for ports handling 50-100 thousand tons was 24 Skr, and for those in the class 10-50 thousand tons 20 Skr. The average for ports with a turnover below 10 000 tons was 22 Skr. These differences may be a function of the higher readiness of large ports to meet the needs for handling various types of general cargo which requires larger invest-

---

[1] According to the proof tender asked for to check the calculation, productivity varied between 15 and 30 tons. According to parallel survey, the average crane productivity in conventional cargo handling in the mid 1970's was 25 tons per hour. Jansson & Rydén, 1978, p. 3-10.



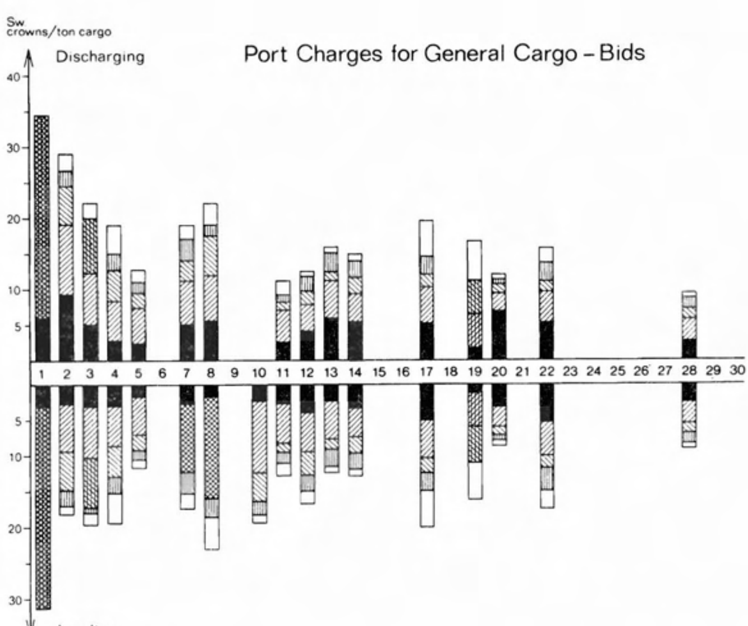


Figure 4:5. Charges for General Cargo Handling in 1974/75.
1 = Gothenburg

ments in infrastructure and cargo handling equipment[1] and a higher proportion of permanently employed labor. They may also result from differences in pricing policy, e.g. cost-based pricing versus market-oriented pricing. The possibility of subsidizing general cargo operations by profits from other activities, e.g. handling of bulk cargo or ferry traffic, may explain substantial deviations from the average group price for some ports.

The port of Gothenburg in the mid 1970's did not publish any price lists for cargo handling operations. Prices were settled in direct negotiations between shipowners and consignors. To include this port into the analysis it was necessary to design a proof tender. A total price for cargo handling services was requested for two types of conventional carriers. A detailed specification was made about the type of loaded cargo and the loading conditions (Appendix 4). This tender was also sent to the authorities and stowing firms in all other ports included in the study. The aim was to check to what extent list prices might differ from actual charging practices. Sixteen ports quoted prices that differed from those calculated from the price lists (Figure 4:5), 10 acknowledged the calculated prices as representative of their actual charges, and three did not make any comments. In some cases, port authorities and stowage companies made separate tenders and quoted substantially different prices.

Differences between calculated and tender prices probably reflect both the difficulty of finding an unequivocal interpretation of an "output-designed" price list and the rebate policy of ports. As rebates result from individual bargaining, they were not included in the model, i.e. list prices for cargo handling were used in the price matrix for the sea transports between national and destination ports, the STNP element in the model (Figure 4:2). The other and dominating part (roughly 3:1) of this element was the freight rate for the sea movement. Data on rates were collected from price lists supplied by the lines and through direct inquiries to the ship agents in all ports supplying sailings to the Continent and the United Kingdom. In the inquiry, the agents were asked to indicate rates for the most common types of general cargo. Average rates for conventional transports of general cargo between each port in Sweden and the ports in the Hamburg-Rotterdam range was computed on that base. In cases when sea freight rates included part or all cargo handling, they were reduced by the corresponding price for port services.

The result of the first optimization step based on prices for both assembling (LTNP) and sea (STNP) transports, are shown in Figure 4:6a. Flows were mainly allocated to

---

[1] French suprastructure.

Figure 4:6a. Port Hinterlands and Turnover Considering Prices for Land and Sea Transports, Trade with the Continent

Figure 4:6b. Port Hinterlands and Turnover Considering Capacity Limits; Trade with the Continent

Figure 4:6c. Port Hinterlands and Turnover Considering Land Transport Alternative, Trade with the Continent

medium-sized ports (Uddevalla, Köping, and Kristinehamn), a result of the low-pricing policy of the shipowners calling and of the ports themselves. This policy should be considered in relation to the supplied transport capacity.

In the next optimization step, capacity restrictions were introduced. They express the maximum cargo volume that could be carried by vessels actually employed on the routes. The total estimated capacity of services to the Continent was twice the carried cargo volume in all steps. The result of the second optimization are shown in Figure 4:6b.

The surplus of allocated traffic in Figure 4:6a was redistributed to large ports with high frequency of sailings. Helsingborg almost reached capacity, indicating a competitive mix of prices and sailings.

In the third step, the alternative of direct land transports from hinterlands in Sweden to the Continent was included. Prices for these transports were centered on Düsseldorf, assumed to represent a mid-location for export destinations on the Continent. Regions in Sweden were divided into traffic areas according to tariffs applied by the national railway and the road transport companies.

The results of the third optimization step are shown in Figure 4:6c. They indicate a strong competitiveness of the land transports. Sea transports through Stockholm, Uddevalla, and some smaller ports remained competitive even in this case, primarily as a result of low-pricing policies adopted by the lines.

In the final optimization, transport time was included. Its value was computed as a function of the sailing frequency and the duration of the sea voyage, assuming evenly distributed cargo arrivals, i.e. the average lay-time for cargo in ports estimated at half the interval between two sailings. Lay-times and sailing-times were added and expressed in monetary terms using the average ton-value of Sweden's general cargo exports to the Continent in 1974 and a 20 % weekly compounded rate of return.

The results of the final optimization are shown in Figure 4:7. The volume of land transports increased even further compared with the third optimization, i.e. the time factor strengthened the position of land transports, particularly by road. The modal distribution of flows estimated with the help of the FDM corresponds well with the actual pattern of 1974 (Table 4:2). As mentioned earlier no data by port were available about exports to the Continent. However, the capacity data indicate an intense traffic from several ports. According to the model, only three ports (Stockholm, Uddevalla, and Köping) could attract cargo. The model may seem unrealistic as regards the port allocation of Sweden's general cargo exports to the Continent. Gothenburg, Helsingborg, and Norrköping had large traffic to the area and the vessels hardly left empty. The map

Figure 4:7a.

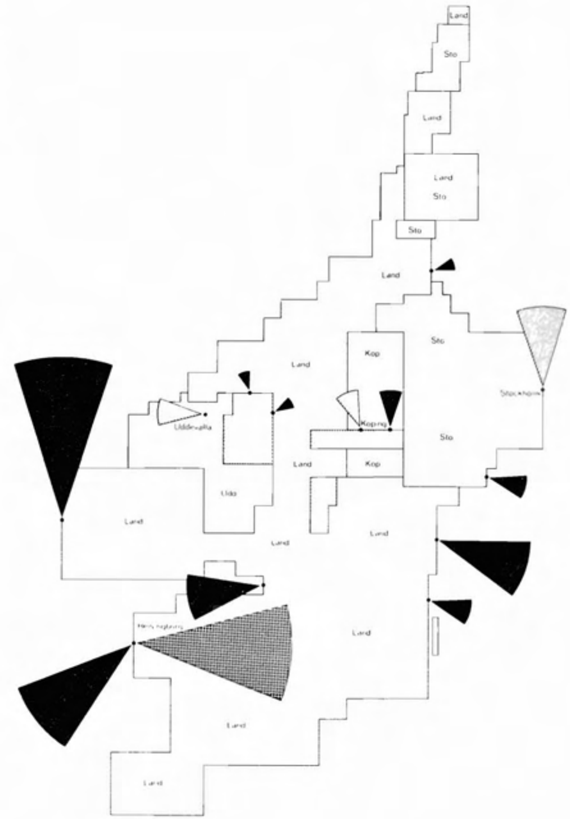


Figure 4:7b.

Modal and Port Distribution of Flows to the Continent
Considering Prices, Capacity Limits and Transport Time

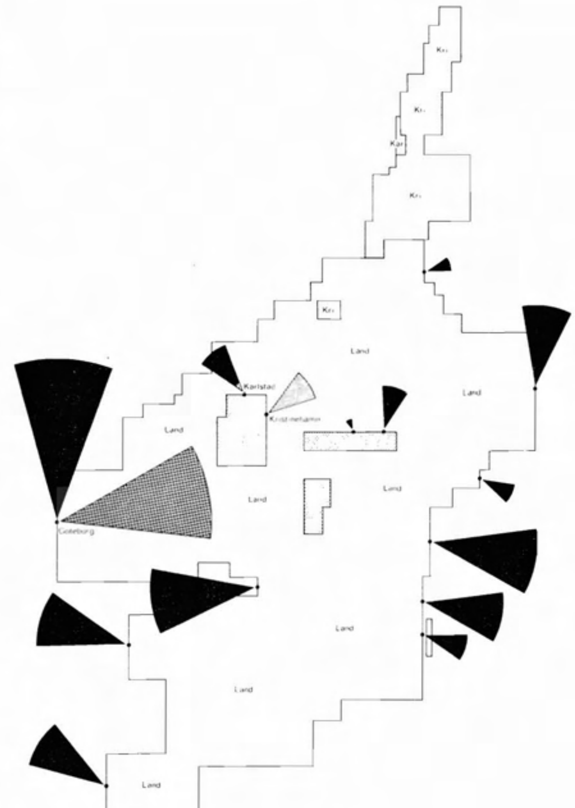


Figure 4:8a. Figure 4:8b.

Modal and Port Distribution of Flows to United Kingdom
Considering Prices, Capacity Limits and Transport Time

Table 4:2. Mode Distribution of Sweden's General Cargo Export 1974 to the Continent and United Kingdom, Actual and by the FDM

	The Continent		United Kingdom	
	Actual %	Model %	Actual %	Model %
Total	100	100	100	100
Road	47	56	10	83
Rail	17	15	0	0
Sea	36	29	90	17

Sources: Unpublished Transport Statistics of Sweden, SCB, Stockholm; Generated by the FDM

should be understood to mean that these three ports and others were facing keen competition from the land transports but were able to retain traffic by factors not considered in the model, e.g. inertia and rebates.

FLOWS TO UNITED KINGDOM

United Kingdom and Ireland in 1974 occupied the third position among the markets for Sweden's general cargo exports. Fourteen Swedish ports in the mid 1970's had regular liner connections with British ports, ferry and ro-ro lines excluded.

Also the road transport alternative was included in the FDM. Results were generated in the same way as for the Continental traffic. The results of the final optimization is shown in Figure 4:8. Land transports appear as the best alternative, considerably differing from the actual pattern which shows a strong dominance for sea transports (Table 4:2).

CONCLUSIONS AND EVALUATION

Few studies on modal and port allocation of general cargo flows in international trade have been based on optimization models. The method has been more common in studies of optimal designs of transport systems for individual consignors[1] or for estimation of an individual line's[2] vessels and capacity.

[1] Näslund, 1969

[2] Toscano, 1959; Datz, 1971; Lundström, 1974.

However, the increasing competition between modes and terminals in general cargo transports, particularly in the short-sea markets between Sweden and the Continent and United Kingdom, requires a system approach in which transport alternatives are treated as complementary and competitive elements of one system. The basic inputs are: (1) export potentials of individual regions in the hinterlands and import needs in the forelands, (2) pattern and prices of transports in the hinterlands, (3) prices and turnover capacity of the ports, (4) geography, frequency, capacity and prices of sea transports supplied at individual ports and (5) prices, frequency and capacity of direct land transports between hinterland and foreland. All those elements are included in the Flow Distribution Model. It aims at finding a distribution pattern giving the lowest total transport costs for general cargo exports at the national level, considering prices, time and capacity restrictions of the available transport system.

The model can be used both for mapping the current pattern and stimulation of its future lay-out, considering planned or expected changes in the demand for general cargo movements. It can be used to estimate deviations between the observed and the optimal pattern, and to analyze the consequences of changes in an individual element on the whole system.

The validity of the FDM and similar approaches[1] must be discussed against their basic assumptions. In the FDM two assumptions are of particular importance. The first states that modal and port allocation of flows is optimal from the national point of view when the total price, seen as the cumulated transport costs of the export industry, is minimized considering time and capacity restrictions of the available transport system. According to the second assumption, price, time and capacity are the main elements determining flow allocation on the transport market. The first assumption means that pricing of transport and cargo handling services is based on marginal costs, i.e. the price change is a function of changes in the required resources, and that the optimal use of cargo handling and transport resources is one of the explicit objectives of the national transport policy which can be reached by state interference in the pricing policy. The second assumption is that the transport market is characterized by a high mobility of flows, i.e. there is no inertia caused by long-term agreements or market contacts, and that price and time data on individual alternatives are well known to all consignors.

The deviations between the actual and optimal allocations which appeared in the model tests were a function of

---

[1] Barr, 1970: Netherlands Economic Institute, 1973; Eriksson, 1975; Crowley, 1975.

inertia in the transport market, rebates and of very approximate data about the capacity of sea transports supplied by the individual ports.

As shown in the first chapter, loyalty agreements including various rebates have a long tradition in the international general cargo transports. In the short-sea traffic they were less formalized than in the deep-sea markets, but their influence on the modal and port distribution of flows in the mid 1970's certainly was significant, considering examined differences between list and bid prices for port services. The corresponding differences also existed in rail, road and sea transports. However, data were not available, neither on their extent nor on the range of long-term transport agreements about general cargo movements between Sweden and the Continent and United Kingdom.

The capacity of transport services supplied at individual ports included in the analysis was considerably above the estimated export volumes as a result of the difficulty of separating loading space for general and break bulk cargo. Both cargo types were carried by general carriers in regular services between Sweden and the Continent and United Kingdom. The volume of seaborne break bulk exported in the mid 1970's to the Continent 26 times the general cargo exports (Table 4:1 and 4:3). For the United Kingdom the proportion was 17 to 1. Wood and wood products in both cases amounted to about 85 %. Several wood processing industries used special transport systems for the movement of their products to the Continent and United Kingdom.[1] But a significant part of these flows was carried by conventional general carriers, i.e. formed an important cargo base for the short-sea liners. The deadweight tonnage was deemed to provide the most reliable measure of the carrying capacity of the general carriers. A division of their capacity into break bulk and general cargo space would be unrealistic.

Table 4:3. Break Bulk Cargo Exports of Sweden by Destination and Modes

Destination		Total '000 tons	%	Road %	Rail %	Sea %
Norden	1967	3 404	100	31	50	19
	1974	4 353	100	43	27	30
	1976	4 222	100	60	20	20
The Continent[a]	1967	4 167	100	3	15	82
	1974	6 726	100	8	23	69
	1976	5 564	100	11	19	70
U.K. and Ireland	1967	3 104	100	1	0	99
	1974	3 811	100	1	1	98
	1976	3 198	100	2	1	97
Southern Europe[b]	1967	1 348	100	0	10	90
	1974	1 767	100	1	22	77
	1976	1 184	100	1	29	70
Eastern Europe[c]	1967	331	100	1	19	80
	1974	628	100	4	43	53
	1976	693	100	4	47	49
North America	1967	366	100	0	0	100
	1974	373	100	0	0	100
	1976	251	100	1	0	99
World	1967	13 561	100	11	14	74
	1974	20 640	100	15	17	68
	1976	16 344	100	20	16	65

a West Germany, Benelux, France, Switzerland, Austria
b North Coast of the Mediterranian, Portugal, Bulgaria and Romania
c East Germany, Poland, the Soviet Union, Czechoslovakia, Hungary

Sources: Unpublished Transport Data for Sweden 1967, 1974, 1976, SCB, Stockholm.

APPENDIX 1

The Flow Distribution Model

The basic model:

$$\text{Min } C_j = \sum_i \quad Vij \cdot Cij \qquad (1)$$

where

C_j - total transport costs for the national exports to destination j

V_{ij} - volume of general cargo shipped from origin i to destination j

C_{ij} - price and time for movement from i to j

Subject to:

$$\sum_{ij}\sum V_{ij} = \sum_i \cdot O_i = \sum_j \quad D_j$$

$$V_{ij} \geqslant CC_{ij}$$

where

O_i - general cargo volume supplied by origin i

D_j - general cargo volume demanded by destination j

CC_{ij} - carrying capacity on the route between i and j

$$O_i = \sum_k \left[\left(\frac{NE_k}{\sum_i E_{ik}} \cdot E_{ik} \right) \cdot ED_{ki} \right] \qquad (2)$$

where

NE_k - national exports from branch

E_k - number of employed in branch k in region i

ED_{ki} - export diffusion indicator for branch k in region i

Transport price and time for movement of one ton of general cargo from i to j

$$C_{ij} = LTNP_{inp} + STNP_{npj} \tag{3}$$

where

$$LTNP_{inp} = D_{inp} \cdot FR_d + TV_k \cdot RR_k \frac{TT_{inp}}{7} \tag{4}$$

D_{inp} - distance from origin-region i to national port np

FR_d - freight rate for inland transports over distance d

TV_k - ton value of commodity k

RR_k - internal rate of return on capital bound in commodities applied on a weekly basis

TT_{inp} - transport time for movements from region i to national port n in days

$$STNP_{npj} = NP_{np} + ST_{npj} + TV_k \cdot RR_k \cdot \frac{SF_{npj} \cdot 0{,}5 + TT_{npj}}{14} \tag{5}$$

NP_{np} - ton-price for cargo handling in port np including aboard work, quayside work, cranage, trucking and saidcorts

ST_{npj} - price for sea transports from national port np to the destination port j

SF_{np} - sailing frequency to destination j from the national port np

Alternatives

- *Sea-feeder*

$$C_{ij} = LTNP_{inp} + SFT_{nptp} + STTP_{ipj}$$

SFT_{nptp} - price and time for sea-feeder transports

$STTP_{tpj}$ - price and time for sea transport from transit to destination port

Computation method equals that for the STNP element.

- *Land-feeder*

$$C_{ij} = LTTP_{itp} + STTP_{tpj}$$

$LTTP_{itp}$ - price and time for land-feeder to transit ports for computation method see LTNP element

- *Direct land transports*

$$C_{ij} = DLTT_{ij}\ (DLTR_{ij})$$

where

$$DLTT_{ij} = D_{ij} \cdot FR_{ot} + TV_k \cdot RR_k \frac{TF_{ij}}{7}$$

$DLTT_{ij}$ - price and time for direct land transport by truck

$DLTR_{ij}$ - price and time for direct land transport by rail

APPENDIX 2

COMMODITY - INDUSTRY KEY

General Cargo Group	Commodities CTSE	SITC	Industries ISIC
Food	02-04, 10.26[a]	0 excl. 041, 1, 22, 29[a], 4	31
Textile	10.14, 10.19, 19.39[a], 19.42[a] 19.51[a]	21, 26, 61, 65, 83-85	32
Light chemical products	10.16, 10.26[a], 14.37, 14.38, 19.39[a], 19.51	23, 29[a], 53-55, 57-59, 62, 893	3513, 352, 355, 356
Metal works	17	69	381
Machinery	18	7	382-384
Other general cargo	15.44, 19.51[a], 20	661.1, 661.8, 662-667, 81, 82, 86, 89 excl. 893, 95	332, 342, 361, 362 385, 390

CTSE - Classification for Transport Statistics for Europe 1961/68, Economic Commission for Europe, Inland Transport Committee

SITC - Standard International Trade Classification, 1960/74

ISIC - International Standard Industrial Classification

 Stockholm den 11 oktober 1974

APPENDIX 3

I samarbete med Transportforskningsdelegationen bedrivs vid Handelshögskolan i Stockholm ett projekt rörande utvecklingstendenser inom linjesjöfarten. Första delen av projektarbetet omfattar en analys av efterfrågan på linjesjöfarten, där utvärdering av alternativa transportvägar utgör en väsentlig del av studien. Eftersom Er hamn utgör en viktig länk i det analyserade transportsystemet vore vi mycket tacksamma för Er medverkan vid insamling av kompletterande uppgifter nödvändiga i analysarbetet.

Hittills har en mängd data rörande de svenska hamnarnas godsomsättning, fartygstrafik och teknisk utrustning insamlats från publikationerna SOS Sjöfart och Port Dues Charges and Accomodation. Den återstående delen eftersökta data består dels av uppgifter rörande hamnens taxor och viss teknisk utrustning samt information beträffande linje- och semilinjesjöfarten på hamnen. Beträffande hamnens taxor ber vi Er sända oss de av Er publicerade informationerna rörande:

1. Hamnlotstaxa. (om sådan finnes:)
2. Fartygshamnavgift och varuhamnavgift.
3. Godshanteringstaxa. (om informationen förfogas av hamnen)
4. Lagringstaxa.
5. Div servicetaxor. (isbrytare, bogserbåt, elström, färskvatten, mottagande av oljerester, sophämtning, hamnspåravgifter etc.)
6. Krantaxa.

Beträffande data rörande linje-och semilinjesjöfart samt teknisk utrustning i hamnen vore vi tacksamma om Ni besvarar den bifogade enkäten. Om de uppgifter vi söker redan finns tillgängliga i publicerad form mottar vi med tacksamhet dessa publikationer i stället för den bifogade enkäten. Data beträffande Er hamn, som ingår i vår analys, kommer att publiceras i bearbetad form i projektrapporter.

Vi är medvetna om att vissa av de av oss begärda uppgifterna kan vara svårtillgängliga för Er I de fall uppgifter utelämnas vore vi tacksamma för en kort förklarande kommentar.

Vi hoppas på Ert samarbete och tackar på förhand för all hjälp.

Högaktningsfullt

Christopher von Schirach - Szmigiel
Projektledare.

Postadress
Box 6501
113 83 STOCKHOLM

Gatuadress
Sveavägen 65

Telefon 08-349560

LINJESJÖFARTEN

(v.g. använd en blankett för varje sjöfartslinje)

1. Linjens namn eller beteckning:

----

2. Linjens anlöpshamnar:

----

3. Antal avseglingar per vecka / månad:

----

4. När startades linjen:

----

5. Om trafiken på linjen är begränsad till en viss årstid ange vilken:

----

6. Är hamnen en bas eller sidohamn för linjen:

----

7. Namn på de fartyg som trafikerar linjen:

----

8. Namn på rederiet / rederierna som bedriver trafiken på linjen:

----

9. Namn på den sjöfartskonferens linjen tillhör:

SEMILINJESJÖFART MED STYCKE- OCH PARTIGODS

(v.g. använd en blankett för varje godstyp, enligt specifikation nedan punkt 1 - 5.)

Semilinjesjöfart omfattar relativt regelbundet återkommande fartygstransport med parti- eller styckegods vilken inte är organiserad i form av sjöfartslinje. Denna trafik kan bedrivas med tonnage av paragraf, eller liknande typ, samt med specialbygda fartyg.

Som partigods definieras:

1. Skogsindustriprodukter dvs. alla trävaror samt papper och pappersmassa.
2. Allt livsmedel och foder utom spannmål.
3. Järn stål och varor därav.
4. Kemikalier utom de som transporteras som massgods.
5. Styckegods är varor som transporteras i smärre enheter mindre än hela fartygslaster.

1. Typ av transporterat gods:

----

2. Avgångs- och destinationshamnar, samt trafikens regelbundenhet:

----

3. Antal avseglingar per månad:

----

4. Vilket år igångsattes trafiken:

----

5. Om trafiken är begränsad till en viss årstid ange vilken:

----

6. Namn på fartyg som bedriver trafiken:

----

7. Namn på rederiet / rederierna som bedriver trafiken:

----

8. Om trafiken bedrivs som en del i en systemtransport ange det transporterande företagets namn:

HAMNENS ANLÄGGNINGAR FÖR GODSHANTERING

RO - RO LÄGEN FÖR FÄRJETRAFIKEN

Ange antalet färjelägen samt längden och djupet vid dessa: ANTAL:________

TOT LÄNGD:________

DJUP :________

CONTAINERTERMINAL (inklusive ro - ro lägen för godsfärjor)

Om hamnen disponerar en containerterminal ange: Antal kajplatser, eventuellt ro - ro lägen, total kajlängd, djup vid kajerna, antal containerkranar, lagerlokaler utom och inomhus, hyra i respektive lokal, typ, antal och kapacitet hos truckar och övrig utrustning för hantering av containers.

ant kaj platser	tot. kaj längd	djup vid kaj	ant. cont. kranar	kapa-citet	lager ute m^2	lager varm inne m^2	hyra resp lokal	cont. truck typ	antal	kapa-citet	övrig utrustn.	kapa-citet

Hamnens omsättning av containers / flak föregående år:

	IN	UT
Container mindre än 20 ft.		
Container 20 ft. och större.		
Flak.		

ANLÄGGNINGAR FÖR UPPSTÄLLNING OCH LAGRING AV STYCKE - OCH PARTIGODS ANNAT ÄN ENHETSGODS

Har hamnen uppställningsspår inom hamnområdet:________.

Finns möjlighet att direkt lasta eller lossa stycke - eller partigods mellan järnvägsvagn och fartyg:_______.

Hamnens uppställningsplatser och lagerlokaler som e j u t g ö r del av containerterminal:

	Antal	Total yta m^2	Hyra per m^2	Temp	Volym
Lagringsutrymmen utomhus:					
Lager under tak :					
Varmlager :					
Kyllager :					
Fryslager :					

Postadress
Box 6501
113 83 STOCKHOLM

Gatuadress
Sveavägen 65

Telefon 08-349560

ANLÄGGNINGAR FÖR TRANSPORT AV GODS I HAMNEN

Antal typ och kapacitet hos de truckar som används i hamnen:

TYP	ANTAL	KAPACITET

SYSSELSATTA HAMN - OCH STUVERIARBETARE

Antal hamn - och stuveriarbetare hamnen anlitar:__________.

APPENDIX 4

PROVOFFERT

Denna provoffert bör ifyllas i den mån stuveribolaget anser att de egna publicerade taxorna inte rättvist återspeglar prisförhållanden i hamnen.

Offerten bör avse den genomsnittliga prisnivån 1974 och illustrera genomsnittspriser för hantering av parti- och styckegods. Avgifter för kran och truck ska ingå i beräkningarna, men ej tally. Samstuvning med annat gods förekommer ej.

Förutsättningar :

Lossning - Fartygets storlek klass I 2000 dwt.
klass II 8000-10000 dwt.
- Hela lasten lossas i hamnen.
- Lasten tages från fartygets rum upplagt magasin/kaj, utan brytning av pallar, med gaffeltruck.

Lastning Fartygets storlek klass I 2000 dwt
klass II 8000 - 10.000 dwt
Fartyget är tomt vid lastningens början.
Lasten tages från magasin eller kaj med gaffeltruck

Lasten består av följande:

Pallat gods, vikt per pall 1000-kg, och totalt minst 100 ton.
" " " " " 4-500 kg " " " " " "
Säckgods, ej pallat, 50 kg säck, " " " " "
Tackjärn, pallat, vikt per pall 1.500 kg, och totalt minst 500 ton.

	LASTNING magasin-fartyg fartygets storlek 2000 dwt	8000-10000 dwt	LOSSNING fartyg-magasin 2000 dwt	8000-10000 dwt
Förutsättningar:				
Pallgods 1000 kg pall.				
1. Antal man i stuverigänget	....	....	....	....
2. Uppskattad produktivitet i ton per gängtimme	....	....	....	....
3. Priser per ton gods:				
Ombordsarbete	....	....	....	....
Landarbete	....	....	....	....
Kranhyra	....	....	....	....
Truckhyra	....	....	....	....
Ev. annan avgift (.................)	....	....	....	....
TOTALT	______	______	______	______

	LASTNING 2000 dwt	8000-10000 dwt	LOSSNING 2000 dwt	8000-10000 dwt
Pallgods på 400 - 500 kg pall.				
1. Antal man i stuverigänget	....	....	....	....
2. Uppskattad produktivitet i ton per gängtimme	....	....	....	....
3. Priser per ton gods:				
Ombordsarbete	....	....	....	....
Landarbete	....	....	....	....
Kranhyra	....	....	....	....
Truckhyra	....	....	....	....
Ev. annan avgift (.................)	....	....	....	....
TOTALT	______	______	______	______

HAMN:......................

	LASTNING magasin - fartyg		LOSSNING fartyg - magasin	
	Fartygets storlek 2000 dwt	8000-10000 dwt	2000 dwt	8000-10000 dw

Förutsättningar:

Säckgods, ej pallat, 50 kg säck.

1. Antal man i stuverigänget	....	....	....	....
2. Uppskattad produktivitet i ton per gängtimme	....	....	....	....
3. Priser per ton gods:				
Ombordsarbete	....	....	....	....
Landarbete	....	....	....	....
Kranhyra	....	....	....	....
Truckhyra	....	....	....	....
Ev. annan avgift (................)	....	....	....	....
TOTALT	________	________	________	________

Tackjärn, pallat, vikt per pall 1500 kg.

1. Antal man i stuverigänget	....	....	....	....
2. Uppskattad produktivitet i ton per gängtimme	....	....	....	....
3. Priser per ton gods:				
Ombordsarbete	....	....	....	....
Landarbete	....	....	....	....
Kranhyra	....	....	....	....
Truckhyra	....	....	....	....
Ev. annan avgift (.................)	....	....	....	....
TOTALT	________	________	________	________

REFERENCES

AAGESEN, A. (1949). Geografiske studier over Jernbanerne i Danmark, *Det Konglige Danske Geografiske Selskab*, Bd 5, København.

ALEXANDERSSON, G. (1967). *Geography of Manufacturing*, Prentice - Hall, Englewood Cliffs, N.J.

ALEXANDERSSON, G. (ed) (1978). Shipping and Ports, *Geo-Journal*, Vol 2, No 2.

ALEXANDERSSON, G. & NORSTRÖM, G. (1963). *World Shipping*, Almqvist & Wiksell, Uppsala.

ALVSTAM, C.G., LUNDIN, O., NORDSTRÖM, L. (1977). Geografiska aspekter på den framtida utrikeshandeln, *Choros Nr 104*, Göteborg.

ANSOFF, H.I. (ed) (1969). *Business Strategy*, Penguin, Harmondsworth.

ASP, K. (1975). Interregionala godstransporter i ett rumsligt system. *Meddelanden från Göteborgs Universitets Geografiska Institutioner*, serie B, nr 43, Göteborg.

ATHAY, R. (1971). *The Economics of Soviet Merchant Shipping Policy*, The University of North Carolina Press, Chapel Hill.

BACKMAN, H. (1968). Der Fährverkehr in Nordeuropa, *Schriften des Geographischen Instituts der Universität Kiel*, Kiel.

BARCZUK, W. (1966). *Krajowe zaplecze portów polskich* (The Domestic Hinterland of Polish Ports). Wyd. Morskie, Gdynia.

BARCZUK, W. (1975). Chosen elements of the theory on the hinterland and foreland of sea ports relating to research on Polish ports. *Geographia Polonica*, nr 31, 41-52.

BARR, B.M. (1970). *The Soviet Wood-Processing Industry*, University of Toronto, Toronto.

BAYLISS, B.T. & EDWARDS, S.L. (1970). *Industrial Demand for Transport.* HMSO, London.

BAYLISS, B.T. (1973). Demand for freight transports. *European Conference of Ministers of Transport - Round Table 20*, Economic Research Centre, Paris.

BENNATHAN, E. & WALTERS, A.A. (1969). *The Economics of Ocean Freight Rates*, Praeger, New York.

BIRD, J. (1968). *Seaport Gateways of Australia*, Oxford University Press, London.

BIRD, J. (1971). *Seaports and Seaport Terminals.* Hutchinson University Library, London.

BLACK, W.R. (1971). The utility of the gravity models and estimates of its parameters in the commodity flow studies. *Proceedings of the Association of American Geographers*, Vol. 3, 28-32.

BONSOR, N.R.P. (1955). *North Atlantic Seaway*, T. Stephenson & Sons Ltd, Prescot, Lancashire.

BRANZINI, M.S., HERENDEEN, J.H., MILLER, H.J. & WOMER, N.K. (1974). A transportation-sensitive model of a regional economy. *Transportation Research*, Vol. 8, 45-59.

BROERS, P. (1974). *Die Strukturwandlungen in der deutschen Seeschiffahrt*, Duncher & Humblot, Berlin.

BROWN, R.T. (1966). *Transport and the Economic Integration of South America*, The Brookings Institution, Washington D.C.

BRUCH, H.W., PUTMAN, S.H. & STEGER, W.A. (1966). Evaluation of alternative transportation proposals: the Northeast Corridor. *Journal of American Institute of Planners*, Vol. 6.

van den BURG, G. (1969). *Containerisation: a Modern Transport System*, Hutchinson, London.

van den BURG, G. (1975). *Containerisation*, Hutchinson Benham, London.

CRISHOLM, M. & O'SULLIVAN, P. (1973). *Freight Flows and Spatial Aspects of the British Economy.* Cambridge University Press, Cambridge.

CHRISTIE, J.D. (1935). *Liner Development During the Past Fifty Years*, North East Coast Institution of Engineers and Shipbuilders, London.

CHRZANOWSKI, J. (1975). *Concentration and Centralization of Capital in Shipping*, Saxon, Prescot.

CLEVENSJÖ T. & WILLIAMSON, M. (1972). Transportsamarbete inom svensk verkstadsindustri, *Choros*, nr 44. Kulturgeografiska institutionen, Göteborgs Universitet, Göteborg.

COMMITTEE OF INQUIRY INTO SHIPPING, (1970). (Rochdale Report), Her Majesty's Stationary Office, London.

COMMON MEASURES OF UNDERSTANDING IN SHIPPING, (1964). *Maritime Transports.*

CROWLEY, J.A. (1975). 'Towards an Integrated Freight Transportation System' in: *Models of National and International Traffic.*

DANSKE STADSBANERS PROGNOSMODELL FOR INTERREGIONALE GODSTRANSPORTER. *Nordisk Komité for Transportekonomisk Forskning*, Publikation nr 20, Oslo.

DATZ, I.M. (1971). *Planning Tools for Ocean Transportation*, Cornell Maritime Press, Inc.

DEAKIN, B.M. (1973). *Shipping Conferences*, Cambridge University Press, Cambridge.

DEVELOPMENT IN MERCHANT SHIPBUILDING, (1972). Symposium 30th May - 2nd June, Delft University of Technology, Delft.

DEVELOPMENT OF PORTS. (1969). *United Nations Conference on Trade and Development, United Nations*, New York.

DEVINE, P.J., JONES, R.M., LEE, N., TYSON, E.J. (1974). *An introduction to industrial economics*, George Allen & Unwin, London.

Ds Jo (1975:1). *Virkesbehov och virkestillgång*, Jordbruksdepartementet, Stockholm.

EIDEM, F. (1974). A simulation model for a multiport system. *Transportøkonomisk institutt*, Report 2457, Oslo.

E S C, (1978). *The European National Shippers' Councils*, The Hague.

FAIR, M.L. & WILLIAMS, E.W. (1975). *Economics of Transportation and Logistics*, Business Publications, Dallas, Texas.

FAIRPLY SHIPPING WEEKLY, 1970 - 1978.

FISSER, M.F. (1957). Trampschiffahrt, Carl Schüneman Verlag, Bremen.

FOREIGN TRADE AND SHIPPING, (1945). American Maritime Council, New York.

FRIHAGEN, A. (1963). Linjekonferanser og kartell-logvining, *Arkiv før Sjørett*, Vol. 6.

THE FUTURE OF LINER SHIPPING, (1976). Institute of Shipping Economics, Bremen.

de GEER, S. & ENEBORG, H. (1927). *Östersjöhamnarna före och efter världskriget.* Oskar Eklunds Boktryckeri, Stockholm.

GETZ, J.R., ERICKSEN, S., HEIRUNG, E. (1968). Design of a Cargo Liner in Light of the Development of General Cargo Transportation, *The Society of Naval Architects and Marine Engineers*, Diamond Jubilee International Meeting, Paper no 6, New York.

GILMAN, S. & WILLIAMS, G.T. (1976). The economics of multi-port itineraries for large container ships. *Journal of Transport Economics and Policy*, Vol X, 137-149.

GLØERSEN, E. (1967). *Skipsfart i India*, Skipsfartsøkonomisk institutt, Norges Handelshøyskole, Bergen.

GODLUND, S. (1969). Det svenska näringslivets struktur- och lägesförändringar samt betydelse härav för hamnverksamhetens och sjöfartens omfattning och lokalisering. *SOU 1969:23*, bilaga 2, 30-187.

GODLUND, S. (1974). *Gods för sjöfart.* Sjöfartsverket, Stockholm.

GRINDHAUG, T. & HANNEVIK, S.A. (1977). *En beskrivelse av av Nord-europeisk småskipsfart*, Skipsfartsøkonomisk Institutt, Bergen.

GULBRANDSEN, O. & EIDEM, F. (1973). Port development planning. *Transportøkonomisk institutt*, Report 83, Oslo.

HARDY, A.C. (1924). *Merchant Ship Types*, Chapman & Hall Ltd, London.

HARDY, A.C. (1928). *Motorshipping*, Chapman & Hall Ltd, London.

HAY, F.E. (1975). *Cunard and the North Atlantic 1840-1973.* The Macmillan Press Ltd, London.

HECKSCHER, E.F. (1907). *Järnvägarnas betydelse för Sveriges ekonomiska utveckling*, Stockholm.

HECKSCHER, E.F. (1940). *Den svenska handelssjöfartens ekonomiska historia sedan Gustaf Vasa*, Sjöhistoriska samfundet, Uppsala.

HEGGIE, J.G. (1969). Are gravity and interactance models a valid technique for planning transport facilities? *Operational Research Quarterly*, Vol. 20, nr 1, 93-110.

HILLING, C. (1977). *Barge Carrier Systems*, Benn Group, London.

HÖGBOM, I. (1934). *Världssjöfarten.* Elanders Boktryckeri, Göteborg.

HÖLCKE, O. (1952). *Varutrafiken över Stockholms hamn.* Företagsekonomiska forskningsinstitutet vid Handelshögskolan i Stockholm, Stockholm.

HÖRNELL, E., VAHLNE, J-E. & WIDERSHEIM - PAUL, F. (1973). *Export och utlandsetablering*, Almquist & Wiksell, Uppsala.

HYDE, F.E. (1967). *Shipping Enterprise and Management 1830-1939*, Liverpool University Press, Liverpool.

IATA, *World Air Transport Statistics* 1966-1977, Geneva.

INITAL ATTEMPTS AT MODELLING ROAD FREIGHT FLOWS. (1971). *Department of Environment, Mathematical Advisory Unit*, note 211, London.

INSTITUT FÜR KONJUNKTURFORSCHUNG. (1940). Der Wettbewerb in der Seaschiffahrt, Jena.

JANSSON, J.O. & RYDÉN, I. (1978). *Swedish Seaports - Economics and Policy*, The Stockholm School of Economics, Stockholm.

JANTSCHER, G.R. (1975). *Bread upon the Waters: Federal Aids to the Maritime Industries*, Brookings Inst., Washington D.C.

JOHNSON, K.M. & GARNETT, H.C. (1971). *The Economics of Containerisation*, Allen & Unwin, London.

KEILHAU, W. (1948). *Skipsfartens betydning for Norge*, Norges Redarforbund, Oslo.

KENYON, J. (1970). Elements in inter-port competition in the United States. *Economic Geography*, nr 46, 1-24.

KILGOUR, J.G. (1975). *The U.S. Merchant Marine*, Praeger Pub, New York.

KRESGE, D.T. & ROBERTS, P.O. (1972). Systems analysis and simulation models. *Techniques of Transport Planning* (ed J.R. Meyer), Vol. 2, The Brookings Institution, Washington D.C.

KRITZ, L. (1976). *Transportpolitiken och lastbilarna*, 1Ul, Stockholm.

KUZMA, L. & SZCZEPANIAK, T. (1971). *Porty Morskie*, Wydawnictwo Morskie, Gdansk.

LAEISZ, W. (1910). *Technik und Wirtschaftslichkeit im Schiffahrtsbetriebe*, Jena.

LAING, T. (1975). *Containers and their Competitors*, Maritime Transport Centre, Liverpool.

LAWRENCE, P. (1973). A computer simulation model for port planning. *The Center for Transportation Studies*, Occasional Paper nr 4, University of British Columbia, Seattle.

LAWRENCE, P. (1973). Demonstration tests of a port planning simulation model, *The Centre of Transportation Studies*, Occasional Paper nr 5, University of British Columbia, Seattle.

LAWRENCE, S.A. (1966). *United States Merchant Shipping Policies and Politics*, The Brookings Institution, Washington D.C.

LINER SHIPPING IN THE U.S. TRADES, (1978). *Maritime Policy and Management*, Vol. 5, No. 3.

LLOYD's REGISTER OF SHIPPING, *Statistical Tables* 1950-1978, London.

LORANGE, P. & NORMAN, V. (ed) (1972). *Shipping Management*, Institute for Shipping Research, Bergen.

LU LÅNGTIDSUTREDNINGEN 1975, see SOU 1975:89.

LU SVERIGES EXPORT 1975-1980, see SOU 1976:22.

LUNDIN, O. (1977). Prognoser över Svensk utrikeshandel år 1990, *Choros*, no. 107.

MAJCZYNO, J. (1970). *Polityka Rozwoju Zeglugi Morskiej*, Wydawnictwo Morskie, Gdansk.

MARCUS, H. (1974). *Planning Ship Replacement in the Containerization Era*, Lexington, Lexington, Mass.

THE MARITIME AIDS OF THE SIX MAJOR MARITIME NATIONS, (1977). U.S. Department of Commerce, Washington D.C.

MARITIME SUBSIDIES, (1971). U.S. Dep. of Commerce, Washington D.C.

MARITIME TRANSPORT, (1955-1977). OECD, Paris.

MARITIME TRANSPORT DATA FOR MARKETING, Research and Development, (1974). Maritime Research Centre, The Hague.

MARRINER, S. & HYDE, E. (1967). *The Senior John Samuel Swire 1825 - 98*, Liverpool University Press, Liverpool.

MARX, D. (1953). *International Shipping Cartels*, Princeton, N. Jersey.

MAYER, H. (1978). The Japanese Ferry System: An Expanding Transportation Mode, *Urbanism Past & Present*, No 6, pp 39-42.

MEEKER, D. (1905). *History of Shipping Subsidies*, New York.

MEYER, J.R. & STRASZHEIM, M.R. (1971). Prising and project evaluation. In *Techniques of Transport Planning* (ed. J.R. Meyer), Vol. 1, The Brookings Institutions, Washington D.C.

MILCHERT, T. (1970). *Färjetrafiken mellan Sverige och utlandet*, Kungliga Tekniska Högskolan, Stockholm.

MODELS OF NATIONAL AND INTERNATIONAL TRAFFIC, (1974). *Proceedings of Seminar S*, Planning and Transport Research and Computation Co. Ltd, London.

MODELS OF NATIONAL AND INTERNATIONAL TRAFFIC, (1975). *Proceedings of Seminar Q*, Planning and Transport Research and Computation Co. Ltd, London.

MOLLE, W.T.M. (1975). Methodological aspects of the analysis of the port trade movements in Western Europa. *Proceedings of Seminar P - Seaports*. University of Warwick, Planning and Transport Research and Computation, London.

MÖNCKE, H. (1975). *Development and Porspects of Barge Carrier Systems*, Institute of Shipping Economics, Bremen.

MORGAN, F.M. (1951). Observations on the study of hinterlands in Europe. *Tijdschrift voor Economische en Sociala Geografie*, nr 12.

MORGAN, F.M. (1958). *Ports and Harbours*. Hutchinson, London.

MORSKI ROCZNIK STATYSTYCZNY, (1960, 1965, 1968). Wydawnictwo Morskie, Gdynia.

MORTENSEN, J.H. (1974). Interregionale godstransporter. *IMSOR*, nr 19, Lyngby.

MOSES, L. (1960). A general equilibrium model of production, interregional trade, and location of industry. *The Review of Economics and Statistics*, Vol. 42, 373-397.

MURAY, J.M. (1960). Merchant Ships 1860-1960, *Quarterly Transactions of the Royal Institution of Naval Architects*, Vol. 102, nr 4, London.

NÄSLUND, B. (1969). Combined Sea and Land Transportation, *Operational Research Quarterly*, Vol. 21, nr 1.

NATIONAL PORTS COUNCIL, (1969). *Port Progress Report*, London.

NETHERLANDS ECONOMIC INSTITUTE, (1973). *Preparatory Report for the Shannon Estuary: An Outline Development Framework*, Limerick.

NEW ZEALAND SHIPPING, (1971). Government Printer, Wellington.

NORDSTRÖM, L. (1971). Rumsliga förändringar och ekonomisk utveckling. *Meddelande från Göteborgs universitets geografiska institutioner*, serie B, nr 23, Göteborg.

NORSTRÖM, G. (1973). *Transportgeografiska studier i svensk utrikeshandel*. Ekonomiska Forskningsinstitutet vid Handelshögskolan i Stockholm, Stockholm.

NORSTRÖM, G. (1977). A gravity model of the regional distribution of Sweden's foreign trade. *Research Paper 6081*, Ekonomiska Forskningsinstitutet vid Handelshögskolan i Stockholm, Stockholm.

NORWEGIAN SHIPPING NEWS, (1960-1979). Oslo.

OI, W. (1961). The Optimal Size of Liner Firms in *The Economic value of the United State Marchant Marine*, by Ferguson, A.R. and others, Evaston, Illinois.

PALANDER, T. (1935). *Beiträge zur Standortstheorie*. Almqvist & Wiksells Boktryckeri, Uppsala.

PENROSE, E. (1959). *The Theory of the Growth of the Firms*, Oxford, Blackwell.

PISKOZUB, A. (ed) (1978). *Zegluga i Porty Morskie na tle przemian w systemie transportowym*, Wydawnictwo Morskie, Gdansk.

PORTBURY. Reasons for the Minister's Decision not to Authorise the construction of a New Dock at Portbury, Bristol. (1966). *Ministry of Transport*, HMSO, London.

PROCEEDINGS OF THE SELECTED COMMITTEE ON MAIL CONTRACTS, (1869). Minutes of Evidence, John Burns, § 1457.

RICCARDO, J.L. (1847). *The Anatomy of the Navigation Laws*, House of Parliment, London.

QUANDT, R.E. & BAUMOL, M.J. (1966). The demand for abstract transport modes: Theory and measurement. *Journal of Regional Science*, Vol. 6, 13-26.

RIMMER, P.J. (1967). The search for spatial regularities in the development of Australian seaports 1861-1961. *Geografiska Annaler*, Vol. 49 B, nr 1, 42-54.

RUIST, E. *Tidserieanalys och prognosmetoder*. Handelshögskolan i Stockholm, (stencil).

SANDERSON, A.E. (1938). Control of Ocean Rates in Foreign Trade, U.S. Department of Commerce, *Trade Promotion Series No 185*.

SARANGAN. T.K. (1967). *Liner Shipping in India's Overseas Trade*, UNCTAD, Geneva - New York.

SCHAFFER, N.M. (1965). The competitive position of the port of Durban. *Northwestern Studies in Geography*, nr 8, Evansto, Illinois.

von SCHIRACH-SZMIGIEL, Ch. (1973). Internationell färjetrafik på Östersjön, *Svensk Geografisk Årsbok* 49.

von SCHIRACH-SZMIGIEL, Ch. (1976). *Foreign Trade in European Ports*, Map, The Stockholm School of Economics, Stockholm.

von SCHIRACH-SZMIGIEL, Ch. (1977). Integrated Transport Systems and the International Movements of General Cargo, *GeoJournal*, Vol. 1:3, Stockholm.

von SCHIRACH-SZMIGIEL, Ch. & WAJSMAN, J. (1977). *Utbuds- och kostnadsstrukturen för färjetrafik*, Institutionen för Trafikplanering, Kungliga Tekniska Högskolan, Stockholm.

SEAPORTS, (1975). *Proceedings of Seminar P*, Planning and Transport Research and Computation Co. Ltd, London.

SELAND, J. (1962). Forståelse för eller misforståelser omkring norsk skipsfart, *Socialøkonomen* No 9-10.

SHIPPING STATISTICS, Yearbooks 1966, 1968, 1973, 1975, 1977 and Monthly Statistics 1958 - 1979, Institute of Shipping Economics, Bremen.

SIND 1976:7, *Industriutveckling i Sverige*, Statens Industriverk, Stockholm.

SLETMO, G.K. & MARSHALL, R.B. (1976). *Market Penetration and Potential for Barge Carrying Vessels*, National Maritime Research Center, Kings Point, New York.

SOS SJÖFART, (1914-1976). National Central Burea of Statistics, Stockholm.

SOFART FØRENINGEN TIL SØFARTENS FREMME, (1975). Vol. 25 Nr 1.

SOS UTRIKESHANDELN, Del 2 (1962-1975). SCB, Stockholm.

SOU 1973:14. *Mål och medel i skogspolitiken*, Liber, Stockholm.

SOU 1974:11, *Svensk industri*, Liber, Stockholm.

SOU 1975:66. *Trafikpolitik - behov och möjligheter*. Betänkande av Trafikpolitiska utredningen, Liber, Stockholm.

SOU 1975:89, *Långtidsutredningen* 1975, Liber, Stockholm.

SOU 1976:22, *Sveriges export 1975-1980*, Liber, Stockholm.

SOU 1976:27, *Den internationella bakgrunden*. Bilaga 1 1975 års långtidsutredning, Liber, Stockholm.

SOU 1976:51. *Modeller för samhällsekonomisk perspektivplanering*. bilaga 7 1975 års långtidsutredning.

STATISTIK DER SCHIFFAHRT, see Shipping Statistics.

STATISTISKA MEDDELANDEN, Serie H, SCB, Stockholm.

STATISTISKA MEDDELANDEN, Serie I, SCB, Stockholm.

STATISTISKA MEDDELANDEN, Serie N, SCB, Stockholm.

STATISTISKA MEDDELANDEN, Serie T, SCB, Stockholm.

STENROTH, E. (1971). *Kompendium i Skeppsbyggnad,* Kungliga Tekniska Högskolan, Stockholm.

SLETMO, G. (1972). *Demand for Air Cargo,* Institute for Shipping Research, Bergen.

STRØMME SVENDSEN, A. (1956-58). *Sjötransport of skipsfartsökonomikk,* Norges Handelshøyskole, Bergen.

STRØMME SVENDSEN, A. (1978). The Comentration of Capital in Shipping and the Optimum Size of Shipping Companies, *GeoJournal,* Vol. 2, nr 2.

STURMEY, S.G. (1962). *British Shipping and World Competition,* The Athlone Press, London.

STURMEY, S.G. (1974). *The UNCTAD Code of Conduct for Liner Conferences,* Institut für Seeverkehrswirtschaft, Vorträge und Beiträge: 7, Bremen.

SVENSK SJÖFARTSTIDNING, 1960-78, Göteborg.

SVENSK SKOGSINDUSTRI I OMVANDLING, (1971). Stockholm.

TAAFFE, E.J., MORRILL, R.L. & GOULD, P.R. (1963). Transport expansion in underdeveloped countries. *Geographical Review,* nr 53, 502-529.

TAJI, Y. (1932). Japanese Shipbuilding and Shipping, *Shipbuilding and Shipping Record,* April 14.

TFD, 1977:2. *Skogsindustrins uttransporter,* Transportforskningsdelegationen, Stockholm.

T G M (Technika i Gospodarka Morska), (1970-1978), Gdansk.

THORBURN, T. (1958). *Sveriges inrikes sjöfart 1818 - 1949,* Uddevalla.

THORBURN, T. (1960). *Supply and Demand of Water Transport.* The Business Research Institute at the Stockholm School of Economics (EFI), Stockholm.

TOSCANO, F.C. (1959). Allocation of Containers in a Trade Route, in: *Research Techniques in Maritime Transportation,* National Academy of Sciences, Publication 720, Washington D.C.

TRANSPORT STATISTICS OF SWEDEN, Unpublished data lists *TR 1 - TR 9,* Central Bureau of Statistics, Stockholm.

TRESSELT, D. (1967). Shipping and Shipping Policy in Latin America, *Norwegian Shipping News.* nr 22.

TRESSELT, D. (1967). *The West African Shipping Range,* UNCTAD, Geneva - New York.

UNCTAD, (1969). *Level and Structure of Freight Rates, Conference Practices and Adequacy of Shipping Services,* New York.

UNCTAD, (1970). *The Liner Conference System,* New York.

UNCTAD, (1972). *The Regulation of Liner Conferences,* New York.

UNCTAD, (1977). *Technological Change in Shipping and Its Effects on Ports,* Geneva.

UNGAR, A. (1973). Market areas for ocean shipping. *International Journal of Physical Distribution,* Vol. 3, 155-160.

U.S. DEPARTMENT OF JUSTICE, (1977). *The Regulated Ocean Shipping Industry,* Washington D.C.

THE U.S. MERCHANT MARINE TODAY, (1970). The Labor Management Maritime Committe, Washington D.C.

USE OF SYSTEMS OF MODELS IN PLANNNING. (1975). *Economic Commission for Europe,* United Nations, New York.

VALG AV TRANSPORTMÅLE, (1965). *Samfärdsel,* nr 3, Oslo.

WÄRNERYD, K-E. (1967). *Ekonomisk psykologi.* Natur och Kultur, Stockholm.

WEIGAND, G.G. (1958). Elements in the study of port geography. *Geographical Review,* nr 2, 185-200.

YOUNGSTON, A.J. (1966). The Opening up of New Territories, in *The Cambridge Economic History of Europe,* Vol. Vl, part 1, University Press, Cambridge.