Yrjö Kaukiainen

Sailing into Twilight

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Finnish Shipping in an Age of Transport Revolution, 1860—1914

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Preface

This study is the result of a long-held interest in the history of Finnish shipping and, in particular, the great transformation which took place within it during the latter half of the 19th century. It is also partly a result of an equally long frustration with pre-1918 Finnish shipping statistics. Their inadequacy caused many problems in investigating the history of shipping, which could only be solved by going rather deeply into primary source material — if such existed.

For a number of years, I had been aware that the register-books of the old Finnish mutual marine insurance association contained detailed data on the voyages of several hundred Finnish ships, data which might considerably compensate the shortcomings of the official statistics. I also knew that there were a number of shipping accounts from the late 19th century still in existence — as was demonstrated in the dissertation of Jan-Erik Börman (1979) which I had the pleasure of supervising — but whether they were representative enough of all national shipping was uncertain. It was only in spring 1986 that I had the opportunity to devote some time to these sources, when the Finnish Academy granted money for a pilot study on Finnish shipping and seamen (1870—1930). My first contacts with the registers of the Finnish marine insurance association were so encouraging — fascinating might be a better description — that I immediately started to plan a system for collecting this data, and then used the summer and early autumn of 1986 to do the work. When the Finnish Academy granted me a scholarship for the academic year 1987—88, I was able to continue by going to the provincial archives and collecting data from shipping accounts.

It was clear from the beginning that the time I could afford for

the work would be limited. This meant that the ratio of results to total effort had to be kept reasonably high. Thus, I had to concentrate on the main trends of national development and leave all the interesting details and local specialities unstudied. I also had to rely mainly on periodical samples instead of complete year-to-year observations. This, of course, means that the picture I am able to paint is in some respects summary, it may be even sketchy, and there is no doubt that other studies will be able to add many details.

Now that the work is complete — at least technically, for no serious scientific work is ever "complete" — I have the pleasant duty of thanking people and institutions who have helped me to do it. Not infrequently, scholars regard their studies as examples of original and innovative thinking. More often than not, however, they depend heavily on ideas drawn from previous studies and discussions with other colleagues, even though the author himself is no longer able to trace all such influences. Of fellow maritime historians, Professor Lewis R. (Skip) Fischer not only provoked many ideas and much inspiration with his numerous articles and through many private discussions, but he also read parts of the manuscript and gave valuable comments and suggestions. I am also in debt to several other members of the so-called Maritime Economic History Group for comments and inspiring discussion when I presented part of this study at a conference in Bergen in August, 1989.

The Finnish Academy furnished me with the necessary financial help without which I would probably still be in the planning stages. While I was collecting the material, I was greatly aided by the staff of many archives, and John Hackman and Kim Montin from *Åbo Akademi* deserve special thanks. I would like to thank the Finnish Historical Society for accepting my study in their series, and Professors Viljo Rasila and Markku Kuisma, who read the manuscript, for suggesting that the Society do so. Last but not least, I wish to thank Joan Nordlund M.A. for a considerate, skillful and thorough language revision.

Helsinki, October 1990
Yrjö Kaukiainen

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The growth of international maritime transport

During the latter half of the 19th century and the decade before the first world war, international trade grew at an impressive pace. According to recent estimates, the volume of world exports quadrupled between 1840 and 1870, and again between 1870 and 1913.[1] As exports of cheap and bulky raw materials, such as grain, coal and wood, grew at the same rate or probaly even a little faster,[2] this must have implied similar growth in the physical volume of goods exchange. Since the bulk of these commodities was transported over narrower or wider stretches of water, expanding maritime transport must have been a precondition for this growth in international trade.

Global merchant tonnage, however, did not increase quite as quickly as trade: from 1850 until the First World War it seems to have grown four-fold.[3] Yet, the actual carrying capacity increased

1 Maddison, *Phases of Capitalist Development*, p 254.

2 At least the volume of trade in primary products grew about as fast as total world exports. See e.g. Lewis, *Growth and Fluctuations 1870—1913*, p. 282—283.

3 Cf. e.g. Palmer, "The British shipping industry", p. 90; Gjölberg, *ökonomi, teknologi og historie*, appendix table 1; Fischer — Nordvik, "Maritime transport and the integration of the North Atlantic economy", table III.

much more as steamships superseded sailing vessels. Because the former were able to maintain almost constant speed irrespective of wind conditions, they could in practice carry much more tonnage in a given time than the famed clippers, and as their fuel economy improved — thanks to compound and triple expansion engines and better boilers — this advantage was exploited over longer and longer routes. In the late 19th century, the carrying capacity of a steamship was generally calculated to be three times as much as that of a sailing vessel; one "steam-ton" was thus thought to equal three "sail-tons". In practice, the ratio seems to have varied depending on the state of steam technology and actual trade, but 1:3 is, in any case, a good rough approximation.[4] Using this ratio, it may be claimed that the transport capacity of the world merchant fleet increased more than ten-fold between 1870 and 1913. This suggests an average growth of almost 4% per annum, a little higher than the volume growth in world exports between 1870 and 1913.

As cargo carrying capacity increased much faster than merchant tonnage, it became possible — at least in theory — to carry goods more cheaply by sea. Even in reality, the market situation was such that ocean freight in general decreased.[5] Although freight development was very uneven and depended in the short term more on business cycles than technical innovations, the net result was that distance became less and less of a constraint on the international exchange of goods. The question whether this was an autonomous factor favouring the growth of overseas trade falls outside the scope of this work, however. One thing does seem fairly certain: what happened in this period was the continuation of a general trend of sinking freight rates.[6]

Paradoxically enough, this important development in sea transport has not attracted much interest in economic history during the last two or three decades. Although text-books invariably stress the importance of the so-called transport revolution, it is only seldom that the discussion goes beyond the

4 E.g. official Finnish statistics often used the ratio 1:3. For examples of actual ratios of performance see e.g. Gjölberg, *Ökonomi* ... , appendix table 1.

5 E.g. Fischer and Nordvik, "Maritime transport", p. 537—538.

6 North, "Sources of productivity change in ocean shipping". See also note 8.

traditional topics, canals and railways.[7] This obvious bias in favour of land transport of course reflects the actual state of research: in the era of "New Economic History", shipping has not been one of the favourite subjects. There may be many reasons for this, but one of the most important, I think, is the difficulty of collecting the quantitative data which is needed in modern economic history. Not only has shipping the reputation of being a very special industry, all aspects of which are not easily grasped by a "landlubber", but it is also, and above all, a very international business.As early as by the middle of the 19th century, many national authorities managed to collect rather comprehensive statistics of, say, manufacturing industry or railways, which have proved quite satisfactory in calculating the kind of production statistics which the modern system of national accounting requires. As for shipping, however, the authorities failed to register much more than just the quantitative development of tonnage, while data on what was done with the ships and what income they generated was almost impossible to collect for anything but domestic traffic. Thus, most national shipping statistics cannot furnish an economic historian with the ready-made data to enable him to construct proper production statistics: for example, continuous data on freight income was produced only in Sweden and Norway. The lack of data limits the knowledge of late 19th-century shipping to such an extent that it is hardly possible to embark upon an exhaustive discussion about its role in the "transport revolution".

Perhaps it is natural that the working methods of modern economic history have been applied to the history of shipping only during the last decade or so.[8] As far as the latter part of the 19th century is concerned, examples of this new approach can be found in many North Atlantic countries, most notably perhaps Norway and Canada. Norway is immensely favoured by its excellent

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7 A good example is Philip S. Bagwell's fine book *The Transport Revolution*, which, apart from land transport, only deals with inland navigation and coastal shipping.

8 One notable exception must, however, be noted: Douglass C. North published some important articles on maritime transports in the 1950s. Cf. i.a. "Ocean freight rates and economic development." Journal of Economic History, XVIII (1958).

shipping statistics,[9] while Canadian historians have been furnished with a labourious collection of primary material from ships' registers, crew-lists and other primary material. The work done by the Atlantic Canada Shipping Project has, however, clearly demonstrated that such sources yield a rich return — at least if one is prepared to invest a lot of labour in extracting and processing the data.[10]

The state of affairs described above inevitably means that the accumulation of knowledge about the "transport revolution" in shipping cannot be a rapid process. Although there are a few aspects, such as the development of freight rates or the diffusion of conferences and fixed tariffs in line services, where sweeping overall assessments and truly international studies seem possible, most of the data must obviously be collected from national sources concerning national fleets. That is the only way to produce results which are empirically sound. Whether these jigsaw pieces can also make up a reliable overall picture of international shipping in general depends, of course, a lot on how comparable and how well-interlocking the national pieces are. Obviously, some general agreement about the basic variables and parameters will be needed but, fortunately, there is already a well-tried and universally applied frame of analysis in the form of the system of national accounting. Experiences from international studies of economic growth are encouraging: comparisons of multinational data have not produced insurmountable problems.

Finnish shipping in an international setting

The objective of this study is to create a piece of the jigsaw puzzle which may, some time in the future, form part of something more universal. At first sight, this piece may seem very small and unimportant. Although the Finnish merchant marine had

9 Good examples of how these statistics can be used are Gjölberg, *Ökonomi* ... and Fischer — Nordvik, "Maritime transport" (see especially the freight index computed from Norwegian freight income data, p. 537).

10 A good and rather detailed description of this data base can be found in Fischer and Sager, "An approach to the quantitative analysis of British shipping records".

experienced unusually rapid and almost continuous growth since the 1830s — its tonnage had actually trebled in four decades[11]— around 1870, it was, at best, only about two per cent of world tonnage, and just before the first world war this dropped to below one per cent. What is more, since the country is situated at the far end of a sea lane, a good thousand nautical miles from the coasts of England and the main arteries of world trade, its shipping does not seem too international either.

Yet, Finnish shipping was not quite as "parochial" as its background would suggest. True, in actual figures, the merchant fleet was rather modest, but compared with the requirements of foreign trade, or the size of the country, it became relatively large during the last "golden era" of sail. The following comparison shows this quite clearly (table 1:1).

TABLE 1:1. Tonnage per population in certain countries, 1870.

Country	Merchant fleet, 1,000 net tons	Net tons per 1,000 inhabitants
United Kingdom	5,691	182
United States[1]	1,520	69
France	1,072	28
Italy	1,012	38
Norway	974	561
Germany[2]	939	23
Atlantic Canada (1869)[3]	807	222
Spain (1874)	625	65
Netherlands	447	124
Sweden	347	83
Finland	265	150
Greece (1873)	233	160
Denmark	182	102

1 Inland lake and canal fleets not included.
2 The same area as the subsequent German Empire.
3 Tonnage refers to the Maritime Provinces and Quebec.

Source: Mitchell, *European historical statistics; Historical statistics of the United States*; Palmer, "The British shipping industry 1850—1914," table 1; Matthews, "The shipping industry of Atlantic Canada," app. table I.

11 Kaukiainen, "Merenkulku", p. 462, 465.

Population is, of course, not a perfect parameter to measure the size of an economy, and a maritime economy in particular; neither are the tonnage figures of different countries always fully comparable (all those presented in table 1:1 refer to official registration and therefore must contain lots of errors; see chapter II). The figures should not be understood as anything more than just a very rough comparison, but even as such they indicate certain interesting things. Above all, it can be seen that the Finnish merchant marine was, relatively speaking, not so small — in terms of tons per head of population only Norway, Canada, the United Kingdom and Greece could present higher figures.

Neither was Finnish shipping confined to the nearest coastal or Baltic waters. Quite on the contrary, a very large proportion was engaged on international tramp trade between Britain and the Mediterranean, on the North Atlantic and the Gulf of Mexico, to South America and the Far East, sometimes even to Australia, New Zealand and the west coast of America.[12] Even though the official shipping statistics cannot tell how common such long distance trading was, a rough indication of the frequency can be found in the annual reports, which were sent from the coastal towns to the central government. They were made at the end of the year, when the sailing season in Finnish waters was practically over; nevertheless, a good majority — in the 1860s often around 80% of all coastal town tonnage — was reported as still being away on voyages.[13] Many shipowners did not send their vessels on a single haul out and back home, but on a series of voyages: they usually took an export cargo to Britain, Spain or Italy and, after unloading it, spent two, three or even more years carrying cargoes thousands of miles away from home. Thus, much of the Finnish merchant marine was actually employed in the great staple trades of world shipping, and it quite obviously fared well in freight competition, since the rapid growth of tonnage continued up to the 1870s.

In the heyday of sail, Finnish shipping was a thriving industry and a fully fledged member of the international (or rather, North Atlantic) maritime community. What happened once steam began its breakthrough into maritime transport, was, however, a very

12 See e.g. Hautala, "From the Black Sea to the Atlantic".
13 See e.g. Hautala, "Merimiesten karkaaminen suomalaisilta laivoilta", p. 105.

different story, and made Finland a clear exception from the norm. The vigorous growth came to an end in the late 1870s, and did not resume to the same extent before World War I. The Finnish merchant marine was thus not able to follow the general growth in shipping, and even in technical development it fell behind. While most maritime nations adopted the new technology with such speed that, by the late 1870s, many great West European ports registered more arrivals and departures for steam than for sailing ships,[14] in Finland it was very slow to start. At the turn of the century, most European countries had more tonnage in steam than in sail, but Finland was just beginning to build an ocean-going steam-fleet (see table 1:2).

Even though the figures in table 1:2 are again based on official registration figures and cannot be trusted too much, they do paint a rather dramatic picture. By about 1890, Finland, although clearly behind the average among maritime nations, was in company with three other laggards, Norway, USA and Canada. In 1913, she was quite alone, so far behind all the other North Atlantic and Mediterranean countries that her merchant marine could simply be called backward. Even Russia and Greece, which in many respects were less developed countries than Finland, had — both relatively and in actual numbers — far larger steam-fleets.

This remarkable technical stagnation inevitably also denoted unsatisfactory growth in the shipping industry. The greater transport potential of steamships meant that, at the end of the century, most of the increase in shipping was due to the increase in steam-tonnage and this gain naturally fell to the countries which had built the largest steam-fleets. Between 1875 and 1913, the average rate of growth in world tonnage computed in "sail-tons" (1 steam-ton = 3 sail-tons) was around 3.5 per cent a year. This was also the rate which was achieved in most important national fleets, but in Finland the corresponding figure was only 1.9.[15]

From being a rather typical maritime nation of the 1860s and 1870s, Finland thus stagnated into a very atypical one. This does not, however, mean that the case becomes less interesting in terms of international shipping, rather on the contrary. A comparison of

14 See e.g. Kiaer, *Tabeller vedkommende Skibsfartsbevægelsen 1872—1894.*

15 The rates computed from tonnage figures in the sources mentioned in table 1, above.

TABLE 1:2. Steam-tonnage[1] percentage share of total merchant tonnage, 1892 and 1913.

Nation	1892	1913
United Kingdom	59.7	93.0
Germany	48.1	85.3
France	55.1	61.9
Denmark	38.0	83.4
Sweden	31.3	82.6
Norway	14.4	65.7
Netherlands	57.9	94.2
Belgium	98.6	94.5
Spain	69.8	97.3
Italy	24.8	71.1
Greece	24.6	76.0
Russia	38.9	67.2
USA (1890, 1910)	12.9	40.0
Atlantic Canada (1892, 1910)	13.7	51.2
Finland	10.1	18.2

1 Including motor-vessels.

Source: See table 1:1.

typical and exceptional cases may reveal quite important developmental features, such as what was the role of the different factors of production, and how did their relative prices affect the choice of optimal technology. From the beginning, Finland was a peripheral country with an abundance of certain natural resources, very similar to Canada on the one hand and in sharp contrast to Britain on the other. Irrespective of whether Finland can be linked with any general models of development, however, she was the last western maritime nation to stick to sail. In order to understand the transition from sail to steam, it is quite important to understand why she remained such an "old faithful".

It may certainly be questioned whether data drawn from a single national fleet can be applied to the international shipping industry in general. It would be against common sense to claim that the Finnish merchant marine could be used as a representative sample of world sailing-ship or other maritime trades. However, since Finnish ships normally carried freight under similar conditions to

vessels of other nationalities, it is equally obvious that, within individual trades, they must have performed in much the same way as the great mass. Consequently, it is to be expected that certain parts of the Finnish merchant marine were typical of fleets with roughly similar occupation or production profiles. This certainly applies to the big sailing vessels engaged in world trade. Thus, the fascination of the case lies not only in the unique aspects, but equally in the features typical of the trade worldwide.

Shipping and the Finnish economy

Finnish shipping was, of course, not only part of international shipping but also part of the Finnish economy. In the latter role it contributed to the national income and, as a carrier of a larger or smaller share of the foreign trade of the country, to the balance of payments. Conversely, other sectors of the economy affected shipping. First, the structure and development of foreign trade had a bearing on how much traffic there was to and from the Finnish ports, and how many domestic ships could be employed. Second, the development and profitability of other industries offered alternative possibilities for investment, and the attraction of such "landward opportunities" could significantly affect the interest in shipbuilding and other shipping investments.

The development of Finnish foreign trade undoubtedly favoured shipping. The volume of exports, in particular, grew during the latter part of the 19th century at an impressive pace. Since these, in an increasing degree, consisted of bulky timber products, cargo space requirements grew about 18-fold in six decades, or on average 5 % a year (see table 1:3).

There was, still, one inherent weakness in the structure of Finnish foreign trade. The physical volume of exports was always much higher than that of imports, because a high proportion of the latter consisted of manufactured and other valuable goods. According to the shipping statistics, in the 1870s, about two and a half times as much loaded tonnage left Finnish ports as arrived, and this ratio remained remarkably consistent throughout the whole period.[16] For a shipowner, this meant unbalanced demand

16 These figures did not, however, include trade with Russia: because much

TABLE 1:3. Cargo space required by the most important Finnish export items. 1,000 register tons.

	1850/52	1870/72	1890/92	1910/12
Sawn wood	68	255	444	827
Other timber	24	41	84	916
Tar, pitch	19	26	15	3
Other (incl. pulp, paper)	2	18	46	255
Total	113	320	589	2,001

Source: *Finnish official statistics, ser. I and IA* (shipping and foreign trade, foreign trade). Conversions to register tons made by the author according to the maximum amounts which in practice could be stowed per net reg. ton. It has been assumed that the average "stowage factor" for wood cargo increased from 1870/72 to 1910/12 by about 40 %. This was due to the increasing number of steamships which could carry much more deck cargo than sailing ships.

for cargo space, and that many vessels had to return home in ballast or, at best, only partly loaded.[17]

The volume of imports, however, increased quite at the same rate as that of exports. Therefore, it may be said that the growth of foreign trade — in spite of the skewed demand for maritime transport — gave very good support to the development of Finnish shipping. To transport Finnish timber was not, however, the privilege of Finnish ship-owners. On the contrary, real competition developed after the 1860s on Finnish as well as on other Baltic wood freight markets. This was at first the result of a change in economic policy: liberalistic trends were gaining momentum both in Russia and Finland. In the 18th century, Sweden had restricted competition in export and import transport by a navigation act (*produktplakatet*, which was much like the corresponding British act) and by collecting extra high customs

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grain was imported from St. Petersburg and Estonia, the excess volume of exports over imports was much lower in this case, at best c. 30 %.

17 Kaukiainen, "The Transition from Sail to Steam ... ", p. 173—174.

dues from foreign ships, especially those exporting iron or timber.[18] The Grand Duchy of Finland still used this protective legislation after its cession from Sweden to Russia, but the system was gradually undermined. Russia had been making trade agreements with several countries since the 1840s (e.g. in 1843 with Great Britain, 1845 with Sardinia and Naples, 1846 with France and the Netherlands, and special treaties with Sweden, Denmark and the USA had already existed) which reciprocally gave the same rights to foreign and domestic ships.[19] These treaties actually anticipated the abolition of navigation acts (e.g. by Britain in 1849, by the Netherlands 1850, by France 1866) and the coming of the free trade era. Still, in the Finnish customs tariffs of 1859, 1869 and 1886 (the last of which was valid until World War I), the dues for foreign ships were in principle increased by 50 %.[20] However, since existing trade agreements were already making exceptions for the ships of all the important European maritime nations before the 1860s, the stipulations of the *produktplakatet* and extra high customs only applied in some rare cases.

Certain liberalistic reforms also increased competition between domestic shipowners. According to the old Swedish mercantile system, only burghers in the specially privileged seaports could send their ships on foreign trade missions or import goods from foreign countries. This privileged group gradually grew and after 1830, all towns on the coast were allowed fully to engage in foreign shipping and trade.[21] The trading rights of peasants[22] living on the coast were also increased in much the same way. Originally these people were only entitled to engage in domestic shipping and trade with their own produce, but after the 1830s, export shipping

18 Hecscher, *Sveriges ekonomiska historia från Gustav Vasa II:1* p. 111.

19 Harmaja, *Suomen tullipolitiikka*, p. 731—831, Cf. Pollard, *European Economic Integration 1815—1970* (London 1974), p. 115—117.

20 Special regulations, 1 §, customs tariffs 30.4.1859, 29.7.1869, 22.12.1886 *(Finlands Författnings Samling).*

21 Möller," Merkantilismin aikakausi", p. 102—103, 109.

22 This restricted shipping by peasants is called *bondeseglation* in Swedish (Fi. *talonpoikaispurjehdus),* that is: peasant shipping. In practice, the same restrictions also applied to other non-urban people, including the nobility. I will use the expressions "peasant" or "rural" shipping only as a contrast with shipping by shipowners (or companies) home from towns, but with no reference to their actual social or industrial status.

to all ports in the Baltic was allowed. After the Crimean war they were also permitted to carry freight to all North Sea ports, and this interim privilege was continued until 1868.[23] In that year, all the traditional privileges of different towns were abandoned, and all shipowners irrespective of home port were given full and equal rights for shipping trade. As these new rights were also made use of by many "peasant" seafarers, the liberalistic reforms in practice widened the geographic background of shipping and drastically increased the number of entrepreneurs. Such an increase in the domestic supply of maritime transport might have narrowed the profit-margins of the previously privileged shipowners.

The structure of Finnish export trade also enabled foreign ships easily to exploit the new "free trade" situation. Since wood was a relatively cheap mass product, there were no particularly stringent transport requirements, and thus a producer usually had no need to exert any control over shipments by using his own ships or those of a well-known business associate. Thus he normally sold sawn goods f.o.b.,[24] that is, he left all the transport arrangements to the foreign buyer, or his agent. As the latter had no special preferences for Finnish vessels, this meant, of course, that competition between them and foreign ships became an everyday reality.

The competitive position of shipping also seemed to change a lot compared with other domestic industries. This happened simply because other industries, not only manufacturing and forestry, but even agriculture and domestic trade, experienced unprecedented growth from the 1870s on. Just to mention a couple of examples, the production volume of manufacturing industry (handicrafts included) grew ten-fold between 1870 and 1913, and investments in machinery five-fold.[25] Earlier, there were not so many lucrative alternatives to shipping and foreign trade: the sawmill industry, for example, was strictly controlled and its production limited. After 1860, however, it was allowed to grow

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23 Kaukiainen, *Suomen talonpoikaispurjehdus 1800-luvun alkupuoliskolla*, p. 50—56; Börman, Åboländsk bygdeseglation, p. 30—34.

24 See e.g. Ahvenainen, *Suomen sahateollisuuden historia*, p. 294.

25 Heikkinen — Hjerppe, *Suomen teollisuus ja teollinen käsityö 1860—1913*, app. table 8; Hjerppe — Peltonen — Pihkala, "Investoinnit ja niiden rahoitus Suomessa 1860—1979", p. 2.

freely, and as the demand for sawn goods increased in West Europe, there was a real boom.[26] Whether investment in sawmills gave a better return on capital than shipping still remains to be seen, but in any case it can be said that, after the 1860s, it represented an increasingly attractive alternative. Accordingly, the opportunity costs of shipping (that is, the "price" of choosing shipping instead of any other good business alternative) did increase.

The problem of backwardness

The sluggish development of the Finnish merchant marine since the 1870s seems all the more remarkable against the background of the huge growth in export cargo from Finland. Never before had domestic production created such an increase in demand for shipping services, but for one reason or another, Finnish shipowners failed to grasp this opportunity. This inevitably implies that there must have been a fundamental change in the economics of shipping at the time when most countries were experiencing transition from sail to steam. A history of Finnish shipping between 1860 and 1913 cannot be written without some explanation of this change being given.

In principle, there are two different possible reasons. The decline could have simply resulted from the fact that Finnish ships became uncompetitive after the 1870s, that they could no longer find their share of international transport (including transport from Finland). If this was true, the change quite naturally seems to have been connected with the technical transition from sail to steam and from wooden hulls to iron and steel. However, if sail lost out to the competition and the future was destined to belong to steam, the obvious question is why Finnish shipowners did not acquire modern technology; even if big steamships were not built in the country, they could be bought from abroad. This question leads to the second possible reason: the technical change probably coincided with a decline in the relative profitability of shipping. If "landward opportunities" seemed to give a better return on

26 Ahvenainen op.cit., p. 157—160, 209—211, 283—285.

investment, it may be supposed that lots of shipowners made a rational decision and ceased to invest in shipping. This situation might, of course, have resulted from the first alternative: if Finnish ships could no longer successfully compete in standard freight trade, the profitability of shipping could have sunk so low that this alone was enough to make it an unattractive proposition. However, at least in theory — and some recent studies seem to point in the same direction — it is equally possible that profitability did not decline too much, that even sailing ships could still have produced a fair return on investment after the 1870s. Since the general trend in Finland was that "landward opportunities" developed very quickly, it was possibly the resultant profitability which showed the greatest change.

There is no systematic overall analysis of Finnish shipping during this period. However, the decline is so important and obvious that it has been touched upon in many general text books and popular writing. There is also a wealth of studies with a narrower scope: histories of coastal towns, parishes and shipping companies, and even some of these contain more or less general explanations for the decline of shipping. As early as in 1883, the official shipping statistics noted that the Finnish merchant marine had significantly declined, and attributed this decline quite simply to the growth of steam;[27] the logic obviously was that steam was so superior that domestic sailing vessels were bound to suffer. Technical transformation was inevitably a central point in later interpretations as well, although different authors have explained its actual effects in different ways. In 1910, Ernst Krogius, then director of Finland's greatest steamship company, voiced his opinion that the unfavourable development had resulted from the traditional and all too cautious attitudes of the shipowners. He thought that if the capital earned by sailing vessels had at the time been shrewdly and wisely invested in steam, the situation would have been much better.[28]

The rivalry between shipping and alternative opportunities was already apparent in the 1920s. In his history of the shipping of Turku (Åbo) 1856—1926, Oscar Nikula pointed out that

27 *Bidrag till Finlands Officiella Statistik I:5*, p. 2.
28 Krogius, "Sjöfart", p. 1—2.

shipowners in this town started in the 1870s to invest more and more in manufacturing industry.[29] He thought that both the depression in the freight market and the rapid technical developments made shipping less profitable than before. The same general opinion was later shared by Jorma Pohjanpalo, who studied the development of regular line services in Finnish shipping. He also stressed the importance of capital, or rather the lack of it, by pointing out that steamships were much more expensive than sailing vessels, and thus a direct lack of capital hampered the technical transition.[30] The problem of capital is also stressed by Bruno Suviranta in his history of the Finnish Steamship Company *(Finska Ångfartygs Aktiebolaget)* 1883—1958. Furthermore, he drew attention to the importance of shipbuilding and the shipping companies. According to him the competitiveness of Finnish shipping depended on domestic shipbuilding and was not geared to the new situation. Neither were traditional single-ship companies capable of raising the capital needed to buy steamships.[31]

All the views presented above — and they are just a selection — seem to be based on the assumption that sailing ships, at least wood-hulled ones, became unprofitable some time between the 1870s and the turn of the century. None of the authors could, however, present any solid and representative data on the actual levels of profitability; indeed, studies on this important aspect are very few. The only one in which there is an attempt to tackle the problem in a systematic way is Jan-Erik Börmans investigation of shipping in the Turku archipelago (1850—1920). His figures suggest that profitability really did sink substantially from the 1870s,[32] but his source material was not very large, and the question is whether the study area was representative of the whole country. A slightly different picture can be found in the history of Åland sailing shipping by Georg Kåhre, who — although not really analyzing profitability — presents many examples of quite profitable sailing ships.[33] Apart from these two works, there are

29 Nikula, *Åbo sjöfarts historia*, p. 18—19.
30 Pohjanpalo, *Suomen kauppamerenkulku*, p. 57.
31 Suviranta, *Suomen höyrylaiva osakeyhtiö*, p. 11—14.
32 Börman, *Åboländsk bygdeseglation*, p. 214 seg.
33 Kåhre, *Den åländska segelsjöfartens historia*, p. 446—447.

just two case-studies of one owner with two ships and a single brig.[34] The question, therefore, seems still to be far from answered.

The Finnish experience had certain similarities with what was happening in Norway and Canada. The importance of "landward opportunities" in explaining the decline of shipping has been amply demonstrated in the studies of the "Atlantic Canada Shipping Project".[35] In a paper published in 1982, Lewis R. Fischer, Eric W. Sager and Rosemary E. Omner estimated that Canadian sailing ships may still have been fairly profitable in the 1880s and 1890s: according to them, gross profits (that is, with no deduction for depreciation) ranged between fourteen and twenty per cent of the depreciated value of the ships.[36] Even though these results were not unreservedly accepted by all scholars,[37] they at least present a serious challenge to the belief that sailing ships had become totally unprofitable after the 1870s. As far as Norway was concerned, Ole Gjölberg actually had already reached a similar conclusion in his doctoral dissertation (1979): according to him, Norwegian shipowners were slow to adopt steam-technology simply because their sailing ships still gave a better return on invested capital than steamships in the 1880s (and later around 1900—1905).[38] Even this study may give rise to some doubt, as it was executed on a macro level by exploiting general figures of costs and production, without empirical data on actual profitability. Subsequently, however, Lewis R. Fisher and Helge W. Nordvik found detailed accounting data in the archives of a Norwegian shipowner, Peter Jebsen, and this also suggests that sailing ships could have been profitable during "the twilight of sail".[39] Thus it seems that, in these cases, technical backwardness

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34 Saarinen, "Rosenlew-yhtymän purjelaivanvarustuksesta"; Norrvik, *Briggen Carl Gustaf*.

35 See espec. Sager — Fischer — Omner. "Landward and seaward opportunities in Canada's age of sail" and Sager — Panting, "Staple economies and the rise and decline of the shipping industry".

36 Fischer — Sager — Omner, "The shipping industry and regional economic development ... ", p. 44—45.

37 See the commentary by Peter N. Davies and discussion in *Merchant Shipping and Economic Development* ... , p. 55—63.

38 A good summary of his findings is Gjölberg, "The substitution of steam for sail in Norwegian ocean shipping."

39 Fischer — Nordvik, "From Broager to Bergen", espec. p. 51, 58.

was not simply a result of ignorance and conservatism, but could have had something to do with actual economic realities.

The organization of this study

The question of profitability, especially that of sailing ships, seems to have a key role in any explanation of Finnish technical backwardness in shipping. Yet, if this study is also going to fulfil its aims as a case study of international shipping, lots of other questions must be answered, as well. Above all, a wealth of solid data must be collected so that all the explanations can be based on sufficient empirical evidence. Altogether they should form a systematic total analysis of Finnish shipping, or rather foreign shipping, around 1860—1913. To leave domestic waterborne transport outside this study seems fully justified because it had very little relevance to the problem areas described above.[40]

"Total analysis" may sound a rather dangerous expression, as there can be so many different kinds of "total", depending on different theoretical and other considerations. As this is a study of economic history, the theoretical framework as well as the analytical tools are, quite naturally, derived from contemporary macro economics. Accordingly, the "total", at a theoretical level, comprises factors and activities which are summed up under the umbrella of "total production" and, at an empirical level, it means the systematic descriptive framework known as the system of national accounting. Its various elements make it possible not only to gauge the total production of an industry, and its relative importance in a national economy, but also to estimate how effectively the existing factors of production were exploited in the actual historical situation. Different macro-level parameters of productivity are, indeed, very valuable when the competitiveness of an industry is being considered. The system also has the huge practical benefit that it — as was pointed out before — offers a

40 This choice is also motivated by the hard realities of available data. Finnish shipping statistics, as those of most other countries, contain very little data on domestic shipping. Moreover, "shipping" normally implies foreign shipping.

widely accepted statistical convention, and should thus produce comparable results.

Notwithstanding its merits, macro-level analysis also has obvious limitations. Above all, it is a descripitive method, which tells rather little about the reasoning and motives of those who in reality made the investment and deployment decisions. Therefore, in order to understand and explain economic development, something should also be known about the behaviour of those who were involved; in other words, things must be examined at the business or entrepreneurial level. This, quite naturally, again emphasises the question of profitability, which in most cases was the first consideration of the shipowner when he made his day-to-day business decisions. Whether or not a ship (or a shipping company) was profitable can easily be determined from contemporary accounting material, but it is good to remember that maximum profit was not always the sole consideration. Even if one believes that the majority of entrepreneurs did react in an economically rational way, the possibility that the general conditions of rationality varied a lot cannot be excluded. The choice between alternatives, whether "seaward", "landward" or other, did not only depend on the potential profitability of each, but equally on which were actually known and thought possible. Giving up shipping in favour of a manufacturing investment was much easier for an owner who already had interests in various industries than for one who was only experienced in shipping. To be realistic, it is not always possible, or reasonable, to penetrate the mental and material environment of individual shipowners in such detail. In any case, if one is prepared to face the labour of analysing profitability, one must also be able to put it into a proper chronological and spatial context, if the analysis is to be of any real value.

The empirical part of this study is divided in three main sections: 1) *The factors of production* (the development of tonnage, its value, capital costs and cycles of investment plus labour), 2) *Production* (the actual deployment of tonnage in different trades and transport produced) and 3) *Economic returns* (freight income and value-added, main items of expense, net income and its variations). As is quite obvious, the macro-level analysis will have some precedence in the first two sections, while the business-level will be more important in the third. Throughout, however, both

levels will be intermingled in some degree, and thus the study bears more resemblance to a traditional historical work than to an exercise in macro economics.

In one respect the division may seem illogical: the value of production will not be dealt with in section 2 but in the following one, together with the business economic aspects of productivity. This is simply for practical reasons: the three sections also correspond to the three main types of source: data on tonnage, which in principle covers the whole merchant marine; data on voyages, which covers a large though not random part of the tonnage; and accounting data on the economic results of shipping, which forms a still smaller, and obviously also less representative, sample. In a work like this, where the scantiness and unreliability of the source material is a very real constraint, the evaluation of material is essential. It is therefore practical to structure the study according to the different types of material. Thus, all the sections begin with a descipition of the sources and the problems in using them, and all the criticisms are, if possible, presented there. This has a practical merit: if a reader is not interested in such matters, he may easily skip over this part and move on to the results. The empirical findings are summarized in the concluding chapter and the questions posed above answered, if possible. The overall aim is to place Finnish shipping in the wider contexts of national economy and international sea transport.

II. Factors of production

1. The development of tonnage

In the late nineteenth century, there was virtually no other industry in which fixed capital had as central a position as in shipping. Not only was shipping more capital-intensive than the average manufacturing industry, but the production equipment, the ships, were usually, to the professionals in the trade, not just valuable assets but also sources of pride and images of perfection. To put it more prosaically, the type and quality of ships more or less reflected the nature of the trade in which they were used, and the amount of investment involved also bore some relation to expectations of economic returns. Of course there were also major restraints, which meant that not all owners actually built or bought the optimal tonnage, at least not in the technical sense; apart from customs, conventions and other psychological factors, the amount of capital which was available rather effectively limited the choice of investment.

Thus, changes in tonnage reveal many essential features in the development of shipping. The tonnage figures are also a natural starting point for more penetrating studies and more subtle analyses. Even in a purely technical sense, there is a need for a reliable picture of tonnage development: to be meaningful, most data concerning the actual use of ships and the production of shipping must be related to the tonnage of the vessels involved. In order to extrapolate data covering only one section or a sample of the merchant marine and apply it to the entire national fleet or a major part of it, the total tonnages must be known.

Problems with the data

Data on the tonnage of the Finnish merchant fleet which fulfils the basic needs mentioned above cannot be found in available, published statistics. True, there is an official shipping series dating from 1856,[1] but it leaves much to be desired. Above all, it contains a lot of inconsistencies, which means that the figures are not always comparable over time.

The most obvious problem — and also the most important one in a quantitative sense — is that what was meant by a "ship" or "shipping" depended more on convention than on any systematic definition. From the beginning of the period in question, and up to 1879, the statistics included all sailing vessels larger than 10 *lästs* (which equals about 19 register tons) from towns, while vessels from coastal parishes were included if they were at least five *lästs* (or 9 reg.tons). Practically all steam-propelled vessels, even boats, were also counted.[2] From 1879 onwards, when ship-measurement was changed to tons, the statistics also included urban sailing ships smaller than 19 tons.[3] This practice continued until 1890, when it was decreed that no ship below 19 net tons needed to be registered[4] and, accordingly, they were dropped from the statistics. Apart from these changes in the lower limit, there were also, not unexpectedly, changes in the size-classes into which the fleet was divided.

Even in a qualitative sense, the definition of "ship" was vague and not in accordance with any systematic definition of "shipping". In the early 1860s, all sailing vessels included in the statistics seem to have been real merchantmen, but later even sailing barges and lighters with no rig whatsoever were regarded as

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1 Finnish official statistics, ser. I, foreign trade and shipping 1856—1902, ser. IB, shipping 1903—.

2 The size-limits were recorded in the published tables. That there was no such limit for steam vessels can easily be seen from the extremely low *läst*-figures of certain towns. Very small steamboats were also frequently listed in published ship lists *(Finlands skeppskalender)* of the time.

3 E.g. in the tonnage statistics of 1882 there was a size-category "under 20 tons" and later, in the 1880s, the class was "from 10 to 20 tons". In all cases, such small vessels were recorded from certain towns.

4 Amendment to the navigation law 11.11.1889 §4, the act of ship registers 11.11.1889 *(Finlands Författnings Samling)*.

sailing vessels. This was because even lighters had to be registered from 1873, but in practice such vessels were intended for transporting goods down rivers or in harbours, for example, when loading ships lying in the roads, and thus they do not represent proper "shipping" but rather "auxiliary activities to shipping". Quite the same applies to tugs, which were systematically included in the number of steamships, as were, later, a few salvation vessels and icebreakers. Since the amount and tonnage of lighters in particular increased a great deal after the 1890s,[5] these additions make the picture of the real merchant tonnage quite distorted.

The implicit concept of "shipping" in Finnish statistics also differs from established international conventions in another respect. It included two large fleets from the inland waters of Lakes Ladoga and Saimaa. This was because both lakes were connected with the sea, the former by the River Neva and the latter by a canal, and the vessels could, at least in theory, sail the oceans. In practice, however, it was extremely unusual for any vessel from Ladoga to sail further than St.Petersburg. Ships of the Saimaa fleet were more often seen in the Gulf of Finland, but even then such vessels formed a small minority, and, moreover, most of them only went to St.Petersburg.

The change in ship measument from traditional *lästs* to register tons in 1877[6] accounts for one additional inconsistency. The two measuments were very different in priciple: the old system measured a ship's ability to carry heavy cargo, while the new one directly measured the volume of its holds. In practice, however, the change was not that sudden; until 1866, ships were, indeed, measured by loading them down with (usually) iron (according to a 1778 Act with a few practical amendments), but after that, the *läst*-measurement became in essence a measurement of volume (of the increase in displacement when a ship was loaded),[7] and so the subsequent change to register tons was not very drastic. For average sailing ships, the new tonnage could be estimated quite

5 The total amount and tonnage of lighters has been recorded in the text tables of shipping statistics since 1895.

6 *Finlands Författnings Samling* 4.10.1876.

7 Ibid, 25.7.1866.

accurately by multiplying the *läst*-figure by 1.85.[8] For steamships, however, this straightforward procedure produced highly erroneous tonnages. The weight of machines, boilers and bunkers made them poor carriers of heavy freight and, moreover, according to the 1866 Act, they were measured as if they were not loaded as far down as sailing vessels.[9] This resulted in *läst*-figures which were much lower than those of sailing vessels with the same volume of cargo-space. A study of 25 steamships over 19 register tons measured according to both methods showed that the relationship of tonnage and *läst*-figures was, on average, no less than 2.8.[10] This means that great care must be taken when comparing steamer tonnage at different times. Only since the late 1880s, when old ships were properly remeasured, can the tonnage be taken at face value.

Apart from all these incongruencies, there are also lots of errors in the published statistics. Before late 1870s, the data was derived from ship lists compiled by the so-called "seamen's houses" (*sjömanshus*, authorities which controlled the employment of seamen, collected certain navigation dues and also provided a primitive social security system for seafarers) in every seaport, and by *länsmän* (baillifs) in the coastal districts.[11] Even though these lists may sometimes have missed a ship, or contained some other errors, they gave a realistic general picture of the merchant fleet.

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8 This was the official conversion rate according to the act of 4.10.1876, which applied to ships which still had the old *läst*-figures.

9 Ships were measured unloaded and the load waterline was determined by measuring a certain distance down from the gunwale. The distance was a percentage of the depth of the hold, and this percentage was highest for paddle-wheel steamships, second highest for propeller steamers and lowest for sailing vessels.

10 This sample was collected from the published ship lists *(Finlands Skeppskalender)* of the 1870s and 1880s.

11 "Seamen's houses" were already making ship lists in the 18th century. After 1809 they were regularly collected by the governors of provinces *(län)* and sent to the Finnish Senate. Corresponding lists of rural vessels have been made by baillifs since 1841, and were also sent to the Senate. Both can be found among the letter-acts of either the Economic Department *(Ekonomidepartementet)* or the Office of Finance *(Finansexpeditionen)*. After 1860 they were collected in special series *(Fartygsförteckningar*, ser. Ef) in the latter. They can also be found in the archives of provincial governments *(länstyrelse)* and/or the archives of local officials *(kronofogde, länsman)*.

During the last quarter of the century, however, a new system of collecting the data gradually developed. In 1873, a new law stipulated that every vessel over 10 *lästs* should be enrolled on an official ship-list in the care of the town magistrates before it could have a certificate and be used in merchant shipping. Ships over the same minimum size from rural districts also had to register in the nearest town.[12] The following year, a new act extended the authority of the *sjömanshus* to the rural districts as well: rural skippers and sailors either became members of the one in the nearest town or, if ship-owners preferred, the district could have a "house" of its own.[13] This reform also brought the rural ships into the ship-listing system of the "seamen's houses" (and as these lists were used when making *Finlands Skeppskalender,* the published list of the merchant fleet, the rural ships appeared in this publication too). Quite logically, most of the local *länsmän* ceased to compile their own lists, but the new registration system in the care of magistrates was not "watertight" for many years, and the *sjömanshus* had problems at first in listing ships from rural districts.[14] For some reason or other, neither of these sources of information was developed into a comprehensive system of data collection, and this was fatal as far as the quality of the statistics was concerned. The existence of parallel but neither totally overlapping nor reliable data soon created an almost chaotic situation. As early as 1881, there was an official warning that the tonnage data (concerning the figures for 1876—78) was very defective, and for 1881, 1883—84 and 1887—91 no official tonnage statistics were published at all.[15]

In 1889, the ship-lists of the magistrates were reorganized into a

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12 The navigation law 9.6.1873 §4 *(Finlands Författnings Samling).*

13 Act 30.4.1874 *(Finlands Författn. Samling).*

14 Series *fartygsförteckningar* (Ef), *finansexpeditionen.* Ship-lists from magistrates can be found from c. 1875 onwards, but not for all towns. Lists from a couple of Bothnian *sjömanshus* contain data on "rural" ships from around 1875, but in most cases this happened only at the end of the decade, especially after rural districts had "houses" of their own. Most of the *länsmän's* lists from 1874 and 1875 observe only vessels over 25 or 50 *lästs,* and later such lists were compiled only in Ostrobothnian districts, obviously because there were lots of small vessels which were not under the authority of a local *sjömanshus.*

15 Finnish Official Statistics, ser. I, 1876—1892.

network of ship registers covering the whole country.[16] This was soon followed by a reorganization of the statistical system. As before, data on registered ships was published in *Finlands Skeppskalender*, but it now became an official publication and, beginning in 1892, the official tonnage-statistics (as at 31.12. each year) were computed from it.[17] However, this did not improve the reliability of the statistics, almost the contrary. The ship-lists of the 1870s may have missed some vessels, but the new registers soon contained too many. This is, of course, a typical feature of any system of registration which is made an absolute precondition for carrying on a trade. While no owner (that is, of a vessel over 19 tons) could fail to register his ship, it was much less important to keep the details up to date and to delete ships which no longer existed. Moreover, in some cases a deletion could not be made before certain juridical formalities had been carried out.[18] Sometimes even the owners did not receive reliable information about their ships for months or years. Perhaps the most ambiguous situation arose when a ship was laid up: this may have been done just to wait for better freight, but if the laying-up became final, there was no one who could tell when the ship ceased to be a ship. Naturally, just in case a buyer might be found, the owner liked to keep the ship registered as long as it was still afloat. In most cases, missing entries in ships' registers were completed later, and even laid-up vessels were eventually deleted, but this did not help the ship-lists or statistics, which were compiled according to the current state of knowledge at the end of each year. Thus they

16 Act 11.11.1889, in force from 1.3.1890. It gave much more detailed rules than the 1873 act about the contents of the registers and how and when the owner should inform about e.g. the selling or wrecking of a ship. It also stipulated that the whole country should be divided into register districts which were the same as customs-house districts.

17 Preface to section II, Finnish Official Statistics ser, I, 1892—. After 1892 *Finlands Skeppskalender* was published only every three years, and the intervening years were covered by a supplement which only contained data on changes in the merchant marine. In practice, the work was done by the statistical office of the Board of Customs *(Tullstyrelsen)*, the archives of which still contain one volume called "Skeppsreigister" for the years 1895—1905 (Bg 1).

18 E.g. if there was a mortgage on a ship, it could not be removed from the register before the claim was settled.

lacked data on many changes which had already taken place.

There are cases of ships not being deleted from the registers until ten years or more after their sinking, condemnation or final laying-up.[19] How common this was is much more difficult to say. To get some idea of the magnitude of the inflated figures which crept into the statistics, I made a comparison between the excellent list of Åland ships (c. 1850—1915) compiled by Georg Kåhre,[20] and the official published ship-list *(Finlands skeppskalender).* Ships which, according to Kåhre, were sold, wrecked or condemned on a known date between 1901—11, were examined more closely in ships' calendars. Of 55 such ships, 29 were deleted from the register the year after the actual end of their career in Åland, which is as good as can be expected. In fact, not a single deletion was effected during the year in question; 13 were deleted two years later, and in five cases the delay was at least four years. Of course, it is possible that there are some errors in Kåhre's data, but since he used not only literary sources but also information from still (then) living ships' masters, such cases cannot be many. All these delays imply a cumulative error of 5—6 per cent over ten years, but as Kåhre's list obviously lacks reliable data on most of the laid-up ships, the excess which crept into the official statistics of the Åland merchant fleet must have been greater still.

There is no way of computing corrected figures starting with any estimated percentages of exessive tonnage. Neither is it necessary, fortunately, since there exists a series of primary sources which is more reliable and almost as comprehensive as the shipping statistics and published ship-lists. As was mentioned earlier, the *sjömanshus* also made ship-lists for their respective districts and sent them at the end of every year to higher authorities.[21] Every ship which was engaged in foreign trade had to pay a small navigation-due, and this, as well as the recruiting of crews, was

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19 See e.g. Hoppu, "Suomen merenkulkutilaston uudistaminen"; Kaukiainen, *Koiviston merenkulun historia,* p. 267; Börman, *Åboländsk bygdeseglation,* p. 21.

20 Kåhre, *Den åländska segelsjöfartens historia,* appendix.

21 Up to and incl. 1887 they form the series Ef in the archives of the *finansexpeditionen,* 1888—1891 they are in the letter-acts of the office of trade and industry *(handels- och industriexpeditionen)* of the senate, and after 1892 in the archives of the inspector of navigation *(sjöfartsinspektör),* ser. Eb.

controlled by the local "seamen's house". This was thus a storehouse of knowledge about which ships were actually sailing, and the lists show that track could even be kept of ships (and their crew) which were far from their home-waters. Of course the information was not fully comprehensive — obviously in most cases inquiries were made of the owners — but any errors caused by delayed messages about wrecking are of no real importance. Only once was a significant defect found in a ship-list: five big ships were missing from the 1913 Vårdö (eastern Åland) data.[22] This was probably because their owner actually lived in Mariehamn, and the curator of the "seamen's house" may have thought that they were registered there.

These lists have one substantial drawback, however. Neither the navigtion-dues nor crew-control applied to ships which only sailed in domestic coastal waters. True, most "houses" had information about such vessels as well, but it may not have been as up-to-date as it should have been. Bothnian coastal vessels were not included in the lists at all, but the fleet in question was small. Fortunately, the far larger fleets of small vessels from Åland (which mainly sailed to Stockholm), the Turku Archipelago, the Nyland coast and the Carelian Isthmus (which sailed to St. Petersburg) were all on the books of their respective "seamen's houses". One other problematic area is Saimaa, where not all towns had a "seamen's house" and magistrates took care of their functions. In general, it may be said that the extent of the problems and uncertainties with this source material can be narrowed down to ships of less than 100 tons, and the whole inland fleet. Data can, of course, be checked and completed by the judicious use of shipping statistics and published ship-lists. In a study mainly concerning foreign shipping proper, these problems are, anyway, of secondary importance.

22 The archives of *sjöfartsinspektören,* ser Eb (Vårdö); Kåhre op.cit., ship-list. A couple of years later the error was, however, corrected.

The calculation of tonnage — methods and definitions

In principle, the use of the ship lists from the "seamen's houses" is quite straightforward. They usually contain details of each ship — name, type or rig, tonnage, year of building, owner, number of crew — enabling them to be classified by type and size, and respective total numbers and tonnage can be calculated by simple addition. As the material is fairly extensive and requires a lot of checking for coverage and consistency, as well as additions from other sources, it was, however, deemed not reasonable to do this for every single year during the period in question. Six sample years were chosen instead, 1865, 1875, 1885, 1895, 1905 and 1913. This gives two boom years at the beginning, but as the time in between was generally good for shipping, this is by no means a drawback. According to what the published statistics reveal about the development of Finnish merchant tonnage, 1865 falls in the middle of a steady rise and 1875 represents the culmination of growth. Again, 1885 and 1895 represent years of depression in freight markets, and shipping statistics suggest that 1895 was quite close to the transition from a long decline to a new rise. This new rise, however, ended around 1900 and was followed by an unstable period. There were some really bad years around 1905, and only after 1910 did better times with higher freight and some increase in tonnage follow.[23] The year 1913 is a logical end to the series as the last year before World War I; it was also typical of the pre-war boom. However, 1905 is not ideal because it was definitely worse than the top of the preceding boom, about 1900, on the one hand, but slighly better than 1902—04 and 1908—09, on the other. An attractive alternative would have been to break out from the symmetrical ten-year periods and take 1900 and 1908 instead of 1905, but, unfortunately, there are some serious gaps between 1897 and 1904 in the source-material, and, in practice, there was not much to choose between them. To be realistic, it is not a big problem if only one sample year out of six happens to be less than ideal.

The merchant fleet was defined to include only proper cargo-

23 For business cycles in shipping, see table 4:5 (freight rate indices) and Nikula, *Åbo sjöfarts historia,* p. 6—19; Rinman — Brodefors, *Sjöfartens historia,* p. 60—61, 74, 79.

carrying vessels with their own source of motive power, sails or engine, and intended for and capable of other than river, inlake or harbour services. Therefore, lighters, barges, tugs, salvage vessels and icebreakers were not regarded as merchant vessels. All this is quite well in accordance with current Scandinavian statistical convention. Neither were vessels under 19 register tons observed. This may sound rather a low limit nowadays, but it must be remembered that, at the end of the 19th century, small vessels were still viable in certain trades.

In practice, these limits are not always so easy to observe. All vessels from Lake Ladoga were, with good reason, regarded as inland water vessels, but those from the lake system of Saimaa were more difficult to categorize. The "seamen's house" of Joensuu usually put ships intended for use outside the Saimaa canal under a special heading, but the magistrates of other towns did not pay any attention to the use to which the ships would be put.[24] In the case of passenger ships, however, it was often known if they went beyond Wiborg,[25] but if no such data was available, a formal division was made. Only steamships of 100 tons and over and similar-sized sailing vessels which were not barges were regarded as seagoing ships and included in the merchant tonnage proper.

Tugs were called tugs on many ship-lists, otherwise small vessels with high-powered engines were excluded. A complicating factor is that no less than three different horse-power measurements were used simultaneously,[26] therefore information about ownership was often needed. If the owner was a sawmill or a stevedor, the vessel in question was classified as a tug.

One further problem was the conversion of *lästs* to tons, as has been mentioned. A proper tonnage figure was sought for every steamship observed in 1865 and 1875, but if this was not found,

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24 See sources in note 21.

25 Such data can be found in e.g. Karttunen, *Saimaan vesistön höyrylaivaliikenteen 100-vuotishistoria;* Ahonen, *Joensuun kaupunki 1848—1920:* Vehviläinen, *Savonlinnan kaupungin historia III.*

26 Up to the 1880s, nominal ("Watt's") horsepower was used almost exclusively, but subsequently, indicated horsepower became the most common. Even brake horsepower was sometimes used. The problem is that most sources do not specify which horsepower was in question — e.g. *Finlands Skeppskalender* could give data in different types of horsepower in the same volume.

the *läst*-figure was multiplied by 2.8 (in the case of paddle-wheelers even this may have been too low, but a further elaboration in such a small population would have been meaningless). For sailing-ships, the *läst*-figures were simply multiplied by 1.85. Even though this may have produced slightly erroneous tonnage in a few individual cases, the relationship holds very well on average, and that is what counts on the macro-level.[27]

Before the development of tonnage is more closely examined, it may be of interest to compare the results of the calculations done for this study with the figures from the official shipping statistics. Analysis of the differences may provide additional information about the reliability or otherwise of both series. Comparable figures must be used, however, for if the differences arise from both errors and discrepancies in classification, the result is an equation with two unknowns. The inland water fleets were handled totally differently in this study than in the statistics and must be excluded; even coastal tonnage can only be analyzed for the years for which the tonnage of barges and lighters is known, or when it was negligible. In practice, this means that comparisons can be made for 1865, 1875, 1905 and 1913 (table 2:1).

It is clear that the 1865 and 1875 data agree quite well. True, there are differences for coastal parishes in 1865, but this is because the statistics also included vessels of between 5 and 10 *lästs*. The figures for steamships differ a lot for the simple reason that the "official" *läst*-figures were all too low under the old system of measurement.

The differences are much greater for the years 1905 and 1913, especially as far as sailing-ships are concerned: the 1905 statistics show an excess of 16 % compared with the tonnage computed for this study, and the difference grows to no less than 23% for 1913. The figures for steamships are much closer, and the differences occurred mainly because tugs and other special vessels were included in the statistics but not in the merchant tonnage as defined in this study.

The inconsistencies in the figures for the sailing fleet are so dramatic that they require closer scrutiny. First, it can be

27 This was actually controlled for in the data which was collected from the record-books of The Finnish Maritime Insurance Association (see chapter III).

TABLE 2:1. Merchant tonnage of the Finnish sea-coasts from different sources. Net reg.tons. "Statistics" = official shipping statistics.

Year	Sailing-ships (excl. barges)		Steamships	
	Statistics	This study	Statistics	This study
1865 (towns only)	123,840	124,663	1,598	2,669
1865 (coastal parishes)	63,999	60,364	—	—
1875 (towns only)	115,316	114,400	6,621	7,756
1905	214,707	182,260	46,056	44,614
1913	221,497	179,142	61,843	56,545

NB: Vessels which transported sawn goods on the lake system of Saimaa have been excluded from the Wiborg figures. There are big gaps for coastal parishes in the 1875 statistics.

Source: Finnish Official Statistics, ser. I and IB and appendix I. Data on the tonnage of barges can be found only for after 1904 in the text of the shipping statistics.

mentioned that the statistics for the towns Rauma and Uusikaupunki, which, apart from Åland, had the greatest sailing fleets (and practically no barges) in 1905 and 1913, agree very well with the figures computed from the ship lists of "seamen's houses". The Åland figures are quite close for 1905, but the statistics show an "excess" of about 10% for 1913. On the other hand, the differences were very large in some coastal parishes in South-west Finland.

One more comparison can be made for the total tonnages in the larger size-classes of sailing-ships (there were few barges larger than 500 tons). The figures (table 2:2) show that, even for 1913, the data on such vessels agree quite well, and there are no real differences in the two largest classes (the tonnage of a ship might vary a little according to the source).

It seems that the problem narrows down both geographically and in size-classes. Geographically, the statistics seem to be exaggerated for areas where shipping was in decline. The same applies to the size-classes between 500 and 1000 tons (and very probably also 300 to 500 tons), and once again, this is connected with decline, because these classes mostly consisted of wood-

Table 2:2. Sailing ships in the larger size-classes, 1913.

Size-class net tons	Statistics		This study	
	Ships	Net tons	Ships	Net tons
500>700	23	13,043	18	10,413
700>1000	22	18,571	15	12,859
1000>1500	13	17,184	13	17,090
1500—	32	59,078	32	59,114

Source: As table 2:1.

hulled ships built in the 1870s (in either Finland or North America), which were reaching the end of their natural life. Larger ships, on the other hand, were of iron or steel, and they were bought in localities where shipping was still holding its own. Accordingly, the differences between the official statistics and the figures computed in this study can probably be accounted for by the old laid-up ships which still remained on the register and therefore crept into the statistics, although they contributed nothing to the shipping services or shipping income of the country, nor to the accounts of the "seamen's houses". Of course, it is possible that some ships which were still in business were missed by "seamen's houses" other than Wårdö, but, compared with the total difference, or error, this is not significant.

Whether laid-up ships which were still able to sail should be included in the merchant navy is a point worth considering. It may be logical to do so in principle, but it is impossible to follow in practice, since the actual condition of these vessels is not known. Moreover, for a study in which the focus is on the performance and income of the merchant navy, the tonnage which matters is the tonnage which actually sailed. This principle has been followed consistently in this study and even ships which are listed by a "seamen's house" but which are known not to have sailed during the year in question are excluded. Thus, all tonnage figures for the six sample years refer only to vessels which, as far as can be ascertained, were in existence at the end of the respective year, and had made at least one commercial voyage during the previous 12 months.

The development of total tonnage

The results of a long and complicated search for reliable data are presented in detail in tables I:1—6 in the appendix. The core of this information, the total development of the Finnish merchant marine, can, however, be summarised in a rather simple and short set of data. Table 2:3 presents the tonnages according to two different definitions. First, all ships of at least 19 net tons are recorded (table 2:3A). However, according to certain modern statistical conventions, only sailing vessels of 100 net tons and over, and steamships of 100 gross tons and over, are included in the merchant fleet, so this alternative was also calculated (table 2:3B).[28] Since the data consists of observations at ten-year periods, it can, of course, show only a general trend. Some idea of short-term fluctuations can be found in the "raw" (or uncorrected) tonnage-series of shipping statistics, and in figure 2:1 both sets of data have been superimposed.

It has already been mentioned that the earlier part of the period was the culmination of a "golden era" in Finnish shipping. Indeed, the merchant fleet of the most important seaports had increased steadily since the 1830s, and although the Crimean war caused a steep decline — mostly because owners sold ships in order to avoid the seemingly inevitable material losses — the pre-war level was regained at the end of the 1850s, and soon surpassed.[29] In 1865, the total fleet seems to have been some 50% larger than it was in 1853, just before the Crimean war. This rise continued up to the middle of the 1870s, but some signs of a change could already be detected at the end of the preceding decade: according to the official statistics, the growth in total tonnage halted in 1870—72 (see figure 2:1). Growth from 1865 to 1875 was still in the order of 30 %, or on average almost three per cent per annum.

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28 It must be pointed out that, as gross tonnages are not regularly found in the sources, the classification of many steamships is based on estimated gross tonnages. The relationship between gross and net tonnages was, however, calculated by decades, as the volume of engines and bunkers sunk with the advent of more efficient machinery. Moreover, this is a problem which only affects a rather limited amount of small ships.

29 E.g. Kaukiainen, "Merenkulku", p. 461—465.

Figure 2:1. The Development of Finnish Merchant Tonnage, 1860—1914.

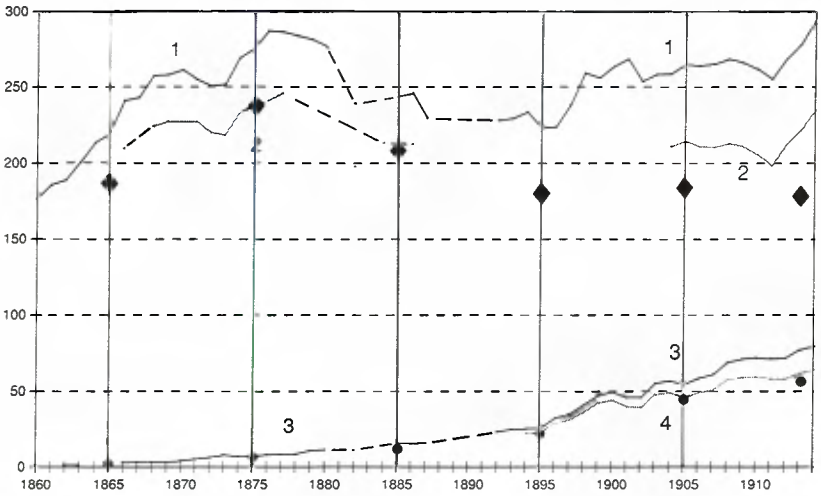

Fig. 2.1. The Development of the Finnish Merchant Tonnage, 1860— 1914.

1 = total sailing-vessel tonnage according to official statistics
2 = sailing-vessels tonnage according to official statistics, excluding lighters, barges and inland fleets
3 = total steamship tonnage according to official statistics
4 = steamship tonnage according to official statistics, excluding tugs and inland fleet
♦ = sailing-vessel tonnage according to this study
• = steamship tonnage according to this study

Source: Table 2:1; Finnish Official Statistics, ser. I and IB.

TABLE 2:3. Finnish merchant marine, 1865—1913.

A. Ships 19 net tons and over.

	Tonnage, net register tons					
	1865	1875	1885	1895	1905	1913
Sailing vessels	185,030	237,670	208,070	181,360	182,260	179,140
Steamships	2,670	8,200	12,120	21,950	44,610	56,550
Total	187,700	245,870	220,190	203,310	226,870	235,690

B. Sailing ships 100 net tons and over, steamships 100 gross tons and over.

	Tonnage, net register tons					
	1865	1875	1885	1895	1905	1913
Sailing vessels	151,590	208,640	181,560	151,630	145,490	138,560
Steamships	2,220	7,740	11,540	20,510	43,030	53,750
Total	153,810	216,380	193,100	172,140	188,520	192,310

NB: Lighters, barges and non-cargo-carrying special vessels are not recorded. Of inland lake fleets, only vessels which are known to have sailed regularly at least to the Gulf of Finland are included.
Source: Appendix I.

After the late 1870s, there was a definite change of trend: if the official statistics are to be believed, the actual drop began in 1877 (figure 2:1). This coincides with the beginning of the so-called "long depression", which was clearly felt in shipping.[30] From 1875 to 1885, the Finnish merchant fleet was reduced by about 10%, and a further 10% reduction was experienced during the following decade. Then the tide turned again, but this period of growth was interrupted by a new slump which lasted most of the first decade of this century. It was only around 1910 that the tonnage began to

30 The well-known Isserlis' freight index ("Tramp shipping cargoes and freights", chart 2, p. 76) shows a decline after 1873. The Norwegian freight rate index calculated by Fischer and Nordvik ("Maritime transport and the integration of the North Atlantic economy", p. 537) peaks in 1873—74 and presents a more modest decline than the former.

grow again, but World War I ended this boom, and, after the autumn of 1914, the best part of the Finnish merchant marine was confined to the Baltic.

This new and corrected series shows that in 1913, the total merchant tonnage of the country was actually smaller than it had been in the middle of the 1870s. Thus, developments after the 1870s were still worse than the official statistics suggest. Of course, the counting of nominal register tons does not tell the whole story. As the proportion of steamships which were able to transport in a given time more goods per ton than sailing vessels increased, the actual carrying capacity of the Finnish merchant fleet did grow a little. Expressed in conventional "sail-tons" (1 steam-ton = 3 sail-tons) the growth was as follows (all vessels 19 net tons and over):

Year	"Sail-tons"
1865	193,040
1875	259,630
1885	244,430
1895	247,210
1905	316,090
1913	348,790

According to these figures, the carrying-capacity of the Finnish merchant fleet was one third higher in 1913 than in 1875. As the maritime carrying-capacity for the whole world had probably grown six-fold during the same period,[31] this was rather a poor performance.

Structural changes in the fleet

The total tonnage figures can only give a very rough idea of what really happened. Even though the Finnish merchant navy was not very large in actual numbers, it was far from uniform and may be described as not one fleet but rather as a score of different fleets which also developed differently. First, as in any country, there were different fleets for coastal and long trades. Second, sail and steam fleets, of course, were very different at the time when steam

31 See chapter I, note 3.

was still experiencing rapid technical development and was gradually beginning to establish itself in ocean trades. A third feature, which was peculiar to Finland, was the traditional difference between urban and rural shipowning, the latter being unusually important. Rural shipowners had somewhat restricted shipping rights before 1868 (see p. 27) and, at first, their fleets were different from those of the urban owners. Subsequently, these differences diminished, although in certain respects they never totally vanished.

Because of this inherent heterogeneity, there is a need for careful consideration of the structural changes in the merchant fleet. The most important features can be satisfactorily described if the fleet is classified by means of propulsion, size-group and home port (or rather by provinces and urban/rural classification). This kind of statistical examination, combined with a description of the most important novelties or technical innovations, will give a rough idea of how the actual environment — economic as well as technical — affected the decision-making of the owners. As the structural features mentioned above overlap, it seems most practical to present the development chronologically, by observing what kind of changes actually took place between subsequent decadic sample years.

The period of growth (the 1860s and 1870s)

Up to and far beyond the end of the 1870s, the domination of sail was not far from total. Steam only had a 1.3 % share of tonnage in 1865, about 3 % in 1875 and just exeeded 5 % during the first half of the 1880s (see table 2:3A). Most steamships were intended for passenger traffic on the coast or on the Baltic, and, accordingly, (counting vessels of at least 19 tons) their average size in 1865 was a little less than 100 net tons. In 1875, however, the average tonnage had increased to about 160. As total steam-tonnage had trebled, interest in modern shipping technology was obviously increasing. The transition from paddle wheels to propellors took place during the latter part of the 1860s: the first propellor steamer which could be called a ship was commissioned in 1864 and the last large paddle-wheeler started its working life in 1867.[32]

32 Lindberg, *Ångbåtssjöfart i Åbo*, p. 178, 179; *Finlands skeppskalender* 1860—70.

Unfortunately, the contemporary ship lists and calendars give very few particulars about engines. However, according to a contemporary description, a ship which was delivered from a Swedish yard in 1864 had "double cylinders", which must mean a compound engine.[33] Since 1870 at least, all newly built ships seem to have been furnished with such engines.[34]

Steamships were ordered from British, Swedish and St. Petersburg yards, and so it was relatively easy to learn about new innovations. Even one Finnish yard in Turku began building iron steamers and engines.[35] Yet, in 1875 there were still only a few steamers which were big enough to be used in long trade, and most of these were not proper steamships but wooden sailing ships with auxiliary steam-engines. This combination of traditional shipbuilding and new machine technology seemed quite attractive at first. The first three auxiliaries were built in 1865—66 in the lake-system of Saimaa, but this innovation had also spread to the sea-coast before the turn of the decade. At least 18 auxiliaries altogether — barques and barquentines — were built in Finland between 1865 and 1874, and they amounted to no less than about 60 % of all new steam tonnage during that time.[36] Almost all of them were engaged in foreign trade beyond the Baltic, but, by and large, they were not very successful. Indeed, the engines were removed from at least two of them, and at least one projected auxiliary was launched as an ordinary sailing vessel.[37] In 1875, there were only seven or eight[38] such ships in Finland with a total tonnage of about 2,000.

In the 1860s, the urban and rural fleets were still very different, almost mirror images of each other. The former included all the big vessels sailing on the oceans: excluding steamers, ships over 300 tons comprised almost 80 % of their total tonnage, and the average was 312 tons. The coastal parish fleets, again, consisted mostly of

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33 Lindberg, *Ångbåtsjöfart*, p. 178.

34 Lindberg, *Ångbåtsjöfart*, p. 198; *The Ships of our First Century*, p. 15—21. Compound engine was also called "Wolff engine". Cf. Persson, *Stimbåt*.

35 Lindberg, *Ångbåtsjöfart*, p. 198.

36 *Finlands Skeppskalender* 1865—73.

37 Nikula, *Åbo sjöfarts historia*, appendix ship-list; Building-accounts of *Regina*, archives of August Eklöf.

38 In a few cases, it is difficult to say whether a vessel should be classed as a steamship or an auxiliary.

relatively small vessels: half of the total tonnage belonged to the class of coastal vessels (19—100 tons), there was just a single ship over 500 tons and the average was a rather modest 67 tons.

There is no doubt that urban shipowners were the leading and really innovative group in Finnish shipping and carried on the true international shipping business. They also adopted new techniques, and in 1865 there were still no steamships in rural districts. This applies especially to the Ostrobothnian towns, which built the biggest ships and also had the largest fleets. The following table (2:4) shows the structure of urban shipping in different parts of Finland, as well as how it developed. The table shows that the period of expansion had already come to an end in the towns before 1875. From the official shipping statistics, it seems that the turning point was the short depression which began around 1867. Even though this was followed by a new shipbuilding boom, earlier levels were not attained. The decline in tonnage was rather universal.

During this same period, however, the fleets were also being modernized. Domestic shipbuilding was still very strong, and when old vessels were sold or scrapped, the replacements were usually larger. This increase in size was especially conspicuous in the Ostrobothnian towns, where earlier long traders of 300—500 tons were replaced by ships of over 600—700,[39] sometimes even over 1,000 tons. Thus the proportion of ships of 500 tons or more rose from 47 % of the total urban tonnage in 1865 to 60% in 1875, and that of ships of at least 700 tons from 10 % to 22 %. In 1865 there was only one ship over 1,000 tons in the whole country (the fullrigged ship *Martin Luther* from Wiborg); by 1875 there were five. Still more were built and in 1879 the ship *Ägir* (1,383 net tons) was launched in Turku.[40] This, however, marked the end of an era: no sailing ship of over 1,000 tons was built in Finland after that date.

Quite obviously, increases in size were dictated by economic considerations. The size of vessels in international traffic was also on the increase. The average of all British sailing vessels, for

39 A special type were the large brigs of over 600 tons which were built in Raahe. They were economical to build as the rig was simpler than that of a barque, and they seem to have been practical bulk-carriers.

40 Nikula, *Åbo sjöfarts historia*, p. 66.

TABLE 2:4. Merchant sailing fleets of towns in different parts of Finland, 1865 and 1875.

Area	1865		1875	
	Total sail tonnage	Average size	Total sail tonnage	Average size
Ostrobothnia	66,870	372	60,280	507
South-west Finland	41,220	312	38,600	336
Gulf of Finland coast	15,830	188	15,080	256
Inland towns	750	188	440	147
All towns	124,660	312	114,400	386

Source: Appendix I.

example, rose from 136 tons to 197 tons between 1850 and 1870 and American and Canadian yards produced softwood vessels of up to 2,000 tons.[41] With their lower running costs per ton, the new, bigger ships could take over the best routes from older, small full-riggers and barques. At the same time, requirements concerning the construction and equipping of ships were increased as it became common practice in many long trades that only classified ships were chartered (otherwise the cargo could not be insured). Building ships of over, say, 6—700 tons from traditional Finnish softwood presented certain problems, and plenty of iron and even imported oak had to be used for main structural members; diagonal strapping (iron bands inside the planking), for example, became common in vessels of over 500 tons in the early 1870s. Wire was often used as standing rigging — the *Ägir* even had iron masts and yards — and copper, zinc or yellow metal sheathing and copper fastening became standard in ships intended for ocean trades. Drawings were ordered from Danish and Swedish, and sometimes even American, naval architects, and many major shipowners obviously tried to follow the latest trends in wooden shipbuilding. One owner even considered building a clipper, but since this kind of vessel was not very practical for transporting wood cargo, the idea was soon abandoned. Yet, many

41 Mitchell, *European Historical Statistics*, p. 651; McGregor, *Merchant Sailing Ships*, p. 174—175.

big ships could be called "medium clippers", that is, they were sharper than was normal in the 1840s or 1850s.[42] That no ship over 1,500 tons was built was probably because a softwood ship of such capacity must have been much deeper than Finnish shipowners were willing to accept (on the Bothnian coast in particular, the shallowness of the sea lanes was a problem). Indeed, the largest ships built in Finland were no less in length and beam than American and Canadian ships of over 1,500 tons (e.g. the *Ägir* was clearly longer and broader than the Canadian *Marco Polo*, 1,625 tons), but never had more than two decks, unlike North American big ships which regularly had three.[43]

The rising standard of building specifications and of rigging and equipment inevitably incurred more costs, and some contemporary writers actually thought that the biggest ships were too expensive to be profitable.[44] Whether the actual capital costs per ton did rise, will, however, be examined later.

The fleet of the coastal parishes was, as indicated previously, quite different, and it also developed differently. Table 2:5 shows the geographical distribution. By far the most important "peasant" fleets were those of the southwestern coast and archipelago and Åland, traditionally oriented towards Stockholm, and of the easternmost coast of the Gulf of Finland, which carried on extensive coastal trade to St. Petersburg.[45] Coastal trade was still very important in 1865: about half of the "peasant" tonnage consisted of vessels smaller than 100 tons (and quite a lot of the smallest are not included in the figures). On the other hand, shipping on the Baltic and to Britain was increasing. Yet, vessels over 300 tons were still rare — they were found mostly in Åland — and rather than fullrigged ships and barques, brigs and schooners were typical long-traders.

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42 E.g. Nikula, *Åbo sjöfarts historia*, p. 66—67; Norrvik, *Briggen Carl Gustaf*, p. 46—47, 50; Nikula, *Malmska handelshuset*, p. 277—299; Kopisto, "Laiva Toivo, Oulu". Collection of drawings of ships in the provincial archives of Oulu (mainly from the archives of the houses of Bergbohm, Snellman and Sovio).

43 Cf. McGregor, *Fast Sailing Ships*, p. 186—187.

44 Norrvik, *Briggen Carl Gustaf*, p. 25.

45 See Kaukiainen, *Suomen talonpoikaispurjehdus*.

TABLE 2:5. The merchant fleet of the coastal parishes in 1865 and 1875.

Area	1865		1875	
	Total sail tonnage	Average size	Total sail tonnage	Average size
Ostrobothnia	2,870	45	7,080	93
Southwest Finland[1]	15,750	81	40,410	157
Åland islands[2]	18,520	141	45,600	215
South coast[3]	4,580	49	6,410	61
Southeast coast[4]	18,650	45	23,540	62
Inland	—	.	230	115
Total	60,370	67	123,270	120

1 The province of Turku and Pori excl. Åland
2 There was a town, Mariehamn (founded 1861), on the Åland islands, but at this time it had few ships.
3 The province of Nyland.
4 The coast of the province of Wiborg.

Source: Appendix I.

It can be seen from the table that the period 1865—75 was a time of impressive growth for this part of the Finnish merchant fleet. The total tonnage doubled and the increase was particularly big in areas where shipping was important before — the Åland islands in particular experienced a real shipping boom.

The size structure changed, too. Coastal tonnage even decreased in actual numbers, comprising only a good fifth in 1875, while the tonnage of ships of 300 tons and over had grown to around 30%. Quite obviously, the shipowners of the coastal parishes still regarded investment in ships as profitable, and so scores of barques were built for them, although many city burghers were no longer increasing their fleets. Whether the different developments in urban and rural areas were a result of the competion between them remains to be seen, but in any case, the success of the rural fleet was enough to offset the small decline in the urban fleet and to result in a substantial increase in the total tonnage of the country.

Yet, the "peasant" ships of 1875 were still of rather modest size

TABLE 2:6. Some structural features of selected merchant fleets, 1875.

	Proportion of steamships %	Average size of sailing ships tons
Finland	2.4	162
Sweden	19.6	118
Denmark	19.0	123
Norway	3.2	172
United Kingdom	46.3	198
Germany	17.5	195
France	24.9	55
Italy	5.8	91
Greece	10.6	50
Atlantic Canada (1874)	7.8	169

Source: Mitchell, *European historical statistics*; Matthews, "The shipping industry of Atlantic Canada."

compared with their urban sisters, being only half the size in average tonnage and with only one ship of over 700 tons. Neither were they generally very well built or equipped: they usually had no metal sheathing on the bottom but rather relied on the old-fashioned "sacrificial" wood lining, which of course gave some protection against *teredo navalis*, but meant that the bottoms were soon fouled up. Thus they were not great ocean traders. On the other hand, they were well suited to the humble trade in wood products from Finland to the North Sea ports.

To put developments in Finland into perspective, the fleets of some important maritime nations are compared in table 2:6. The figures, again, refer to the "raw" statistics of registered ships and cannot, therefore, be taken as absolutely accurate.[46] In any case, they should suffice to indicate the most significant differences.

It is clear that the proportion of steamships in Finland was far

46 Official Finnish statistics, for example, show that the proportion of steam tonnage was 2.4 %, while the figures in table 2:3 show 3.3 %. The difference arises because, among other things, steamship tonnage has been adjusted upwards in this study.

lower than most of the other countries, and only Norway was at roughly the same level. There were even other resemblances between the Finnish and Norwegian fleets. The average size of the Norwegian sailing vessels was a little higher, but the proportion of big ships of 500 tons and over was about the same (around 30 %).[47] This was higher than the average in other Scandinavian fleets, about the same as in Canada and far higher than in France or the Mediterranian countries. Finland had no famous clippers and did not build such huge wooden ships as were launched at the yards of the United States and Canada, nor had she begun to use iron for ships as English and Scottish shipbuilders did. Nevertheless, the sailing merchant fleet of the country was in general quite up to date and up to good, North Atlantic standards.

The period of stagnation (the 1880s and early 1890s)

During the period of stagnation and tonnage decrease, there was only one exception: the steam-propelled fleet grew all the time. Tonnage trebled in the two decades between 1875 and 1895 although, being very modest to start with, it just exceeded 10% of the whole merchant tonnage in 1895.

As table 2:7 shows, most of the steam fleet was based in three towns, Vaasa, Turku and Helsinki. Of these, only Helsinki really increased its tonnage during the depression and accounted for no less than 90% of the total growth. Thus, steam tonnage in the capital rose to 53% of the total. This increase was largely brought about by the development of a single enterprise, The Finnish Steamship Company *(Finska Ånfartygs Aktiebolaget*, usually abbreviated to *FÅA)*. It started in 1883 with two 700 net ton (1,100 dwt) steamers operating regular services to the English East coast, and in 1895 it already owned ten ships of similar size.[48] Apart from *FÅA*, there was just another company carrying regular traffic to the North Sea ports, the *Wasa-Nordsjö Ångbåts Ab.* (which was set up in 1873 with a 250-ton steamer), but in 1895 it had only two North Sea steamers and three smaller ones.[49]

In 1895 the Finnish steam fleet could be divided into three main

47 Finnish Official Statistics I:6, p. 10.
48 Suviranta, *Suomen höyrylaiva osakeyhtiö*, p. 22—39.
49 *Wasa-Norsjö ångbåts a.b.*, p. 19—43.

TABLE 2:7. Steamships in different parts of Finland in 1885 and 1895.

Area	1885		1895	
	Total tonnage	Average size	Total tonnage	Average size
Ostrobothnia	4,830	254	4,220	281
— Vaasa	3,020	275	3,020	302
Southwest Finland	2,440	136	3,610	124
— Turku	1,940	139	2,090	110
Åland	—		200	67
Gulf of Finland coast	4,230	128	13,270	204
— Helsinki	3,000	215	11,570	351
Interior	620	103	650	108
Total	12,120	159	21,950	186

Source: Appendix I.

categories. First, there were rather modern cargo steamers of over 500 tons, such as the *FÅA* boats, which occasionally even carried passengers. They were all newly built and ordered from British or German yards, and, after the late 1880s they were fitted with triple expansion engines.[50] This top group accounted for no more than about 8,500 net tons, but it was still almost 40 % of total steam tonnage. The next group consisted of ships which either ran long coastal routes (e.g. North-Ostrobothnia — St.Petersburg or St.Petersburg — Stockholm) or sailed on the Baltic. They were usually 300—400 net tons and carried cargo as well as passengers. Most of these ships were newly built and ordered from Sweden in the 1870s or early 1880s, and thus they usually had compound engines.[51] This category should include all steamers of over 200 and under 500 tons, thus adding up to about 8,000 tons altogether. Finally, there were the coastal steamers which included some fairly old vessels and which accounted for more than 5,000 tons in all.

Among the smallest steamers were a few wooden vessels, but iron and steel dominated the other groups totally. The popularity

50 *The Ships of our First Century*, p. 10—14.
51 See note 34.

of wood-hulled auxiliaries declined rapidly, and by 1895 they were non-existant. In 1895, all the larger ships were town-based and only some coastal steamers belonged to rural parishes.

The sailing fleet developed in a totally different way, or rather, at first it did not develop at all. No big ships were built after 1879, and up to the end of the 1880s, long-trading tonnage mainly consisted of what was left from the preceding decade. Without any new construction the fleet slowly diminished as old vessels decayed and were removed from service. Some tolerably good ships were even sold abroad, to Norway in particular.

Table 2:8 shows that the stagnant trend continued until the mid-1890s, when the total sail-tonnage was only 76% of what it was two decades earlier, and was also below the level of the mid-1860s. The laying-up of old vessels was not the only change; indeed, closer examination of the fleet reveals two interesting trends. First, coastal shipping tonnage grew, and was actually higher in 1895 than it had been in 1875. This suggests that some small ships had been built, particularly on the easternmost coast, where trade to St.Petersburg increased at almost the same rate as the city grew. There were even some Baltic and North Sea vessels of 200—300 tons built around 1890, mostly on the southwestern coast, but these were not enough to counteract the continuous decline in the ranks of old vessels.

The second point of interest is that the tonnage of ships over 1,000 tons more than doubled since 1885 and quadrupled since 1875. The trend towards greater ships thus continued. However, it was no longer manifest in new, domestic building, but in buying second-hand vessels from abroad. As the demand for sailing tonnage had dramatically reduced since the mid-1870s, prices dropped in proportion, and it was soon possible to acquire a ten-year-old and perfectly sound, hardwood vessel for much less than it cost to built a new one from domestic softwood. Naturally, foreign ships had occasionally been bought before (for example, in 1881 two hardwood ships, of 1,200 and 760 tons, were added to the fleet of the Ostrobothnian town of Oulu);[52] however, it became really common after 1889, when ocean freight at last increased

52 Snellman, *Oulun laivoja ja laivureita*, p. 140—141 (ship *Gustaf Adolf* and barque *Karl*).

TABLE 2:8. Merchant sailing fleets in different parts of Finland in 1885 and 1895.

Area	1885 Total sail tonnage	1885 Average size	1895 Total sail tonnage	1895 Average size
Ostrobothia				
a) towns	44,510	495	22,760	517
b) rural parishes	3,070	70	710	39
South-west Finland				
a) towns	39,220	360	40,780[2]	340
b) rural parishes	40,410	180	35,480	167
Åland	43,850	244	50,390	260
Gulf of Finland coast				
a) towns	11,660	253	9,130[3]	152
b) rural parishes	24,470	53	21,570	49
Interior				
a) towns	810	161	540	135
b) rural parishes	170	58	—	.
All towns	97,220	386	75,210	330
All rural parishes[1]	111,970	122	108,150	125
Total	208,070	179	181,360	166

1 All Åland included.
2 The combined figure for Uusikaupunki and its surroundings is distributed according to the same percentages as in the official shipping statistics, according to which, 59% of tonnage was from the town.
3 Six cases with a combined figure for a town and its surroundings are similarly divided into urban and rural.

Source: Appendix I.

somewhat. There were 19 sailing-ships of over 1,000 tons in the Finnish fleet in 1895 (see appendix I:4A), of which no less than 16 were bought from abroad.[53] Many second-hand vessels were also to be found in smaller size-classes, and between 1889 and 1895 the town of Turku, for example, acquired nine, with a combined

53 *Finlands Skeppskalender* records where most of these were built. Only three were domestic-built ships from the 1870s.

tonnage of over 8,100 tons[54] (in 1895, the town's total sailing tonnage amounted to 11,660 tons). Most of the second-hand vessels were European-built hardwood ships of 700—1,100 tons, but a few larger North American softwood vessels, the biggest being over 1,700 tons, were also found. As some indication of what was to come, there were also two iron or steel ships in the fleet. The first one had been bought just one year before, and the second, a four-masted barque of 2,150 tons, and only three years old, was purchased in June 1895; both were owned by the same company from the small town of Rauma.[55]

Metal-hulled windjammers were being built in great numbers as early as in the late 1850s in Britain, and they had been able to compete successfully on the long ocean trades. Their hulls were strong and they retained their classification longer than wooden vessels.[56] Nor did they need any expensive metal sheathing as protection against *teredo navalis* — new antifouling paints were being developed instead. Thus, it is no wonder that iron and steel sailing ships were still being built in great numbers decades after the last big wooden windjammers had been launched (France was a major customer for these in the 1890s), but as the demand for sail did not grow, second-hand prices began to fall. Iron and steel sailing vessels soon became common in the Finnish merchant fleet.

Different local fleets also developed differently. A comparison of 1895 and 1875 tonnages appears below:

54 Nikula, *Åbo sjöfarts historia*, appendix ship-list.

55 Finnish official statistics I:14, p. 13; Ship lists of Rauma *sjömanshus* 1894—95; *The ships of our First Century*, p. 198 (the *Fennia)*. As early as in 1892, according to *Finlands skeppskalender*, there was one iron-hulled barque *(Pallas*, 1. 251 nt.) in Vaasa. It was, however, still a kind of composite ship: the iron shell was covered by timber so that a traditional copper sheathing could be used without the risk of excessive corrosion.

56 See e.g. Harley, "The Persistence of Old Techniques", p. 374; McGregor, *Fast Sailing Ships*, p. 130—135; McGregor, *Merchant Sailing Ships*, p. 16—17, 113—.

Area	Tonnage in 1895 as a percentage of tonnage in 1875
Ostrobothnia	
a) towns	37
b) coastal parishes	13
South-west Finland	
a) towns	111
b) coastal parishes	83
Åland	111
Gulf of Finland coast	
a) towns	61
b) coastal parishes	72
Inland	
a) towns	123
b) coastal parishes	—
All towns	66
All coastal parishes[1]	86
Total	76

1 Including all Åland.

Coastal parishes generally fared a little better than towns. There were, however, great differences among the towns, and those in Ostrobothnia, which once comprised the major shipping district, experienced a really steep decline. On the other hand, tonnage increased in the Southwest, but this was mainly due to just one small town, Rauma, where tonnage inreased almost threefold from 1875, mostly due to the purchase of second-hand vessels. One other town which also had a relatively large second-hand fleet and a little tonnage increase on 1875 was Vaasa. This was a big exception among the Bothnian towns, and if it is excluded, total tonnage of the province was three quarters less than two decades earlier.

A third town which fared better than the average, although there was no increase in sail tonnage, was Turku. As was mentioned before, foreign, second-hand vessels were common here too. Among the non-urban districts, again, only Åland was able to increase its fleet a little. Even here, a few foreign ships had been bought, but the Åland shipowners had also purchased many from the Bothnian towns.

Of all Finnish urban and rural districts, only two really advanced in shipping during these years of stagnation: the capital Helsinki built the first Finnish steamship fleet of any size for foreign trade, and the tiny Rauma experienced a rather surprising sailing ship boom. In general, Finnish shipping did not fare too well, neither compared with its previous performance nor with other maritime nations. True, there were a couple of regions where steam shipping increased almost as little, such as Norway (the proportion of steam tonnage was 20 % in 1895) and the North American seaboards (in Atlantic Canada steam represented 17 % of tonnage in 1895). In most countries, however, both quantitative and technical developments were far better than in Finland, and thus it was definitely lagging behind in international competition.

The period of fluctuation (the mid-1890s to World War I)

Steamship tonnage grew very rapidly during the boom years of the late 1890s: it doubled between 1895 and 1905, and the best part of the increase was actually recorded before 1901. After the turn of the century, developments were rather unstable and fluctuating, and between 1905 and 1913, the average increase was actually slower than during the preceding two decades. In 1905, steamships represented almost 20 % of total tonnage, and no more than 24 % at the end of 1913.

Tonnage in different size-categories developed quite differently, as the figures below show:

Size-class	1895	1905	1913
20>200 net tons	5,500	6,830	8,480
200>500 net tons	7,930	8,580	8,870
500 — net tons	8,520	29,230	39,050

It is clear that the growth of ocean-going steam-tonnage (for ships larger than 500 net tons) was massive between 1895 and 1905, but then diminished. Technically the ships did not change so much. Indeed, the most revolutionary development since the turn of the century seems to have been a two-fold increase on the earlier optimum size of cargo-carrier, about 1100 dwt, on some of the busiest routes. The demands of increasing emigrant traffic were

TABLE 2:9. Steamships in different parts of Finland in 1905 and 1913.

Area	1905		1913	
	Total tonnage	Average size	Total tonnage	Average size
Ostrobothnia	6,480	381	6,100	244
— Vaasa	4,400	400	5,640	376
Southwest Finland	5,990	200	8,210	164
— Turku	3,510	153	7,320	198
Åland	70	34	170	87
Gulf of Finland coast	31,510	303	41,340	350
— Helsinki	28,440	605	38,580	654
Interior	570	113	730	122
Total	44,610	282	56,550	281

Source: Appendix I.

taken care of by building combined cargo and passenger steamers which could carry 300 *(Arcturus* and *Polaris*, 1899), and later more than 700 *(Titania*, 1908) passengers.[57]

Medium-sized tonnage growth was slower, almost zero during the last decade of the period. Many of the older coastal liners were sold abroad, and, since trains were now a faster means of transport between South-Finland and St.Petersburg or North-Ostrobothnia, no new ships were built to replace them. Short coastal routes, especially in the Turku Archipelago, expanded, however, and coastal tonnage grew at a steady pace.

Geographically, the pattern remained almost unaltered (see table 2:9); indeed, the domination of the three most important towns increased further. At the end of 1913, the steam fleets of Helsinki, Turku and Vaasa constituted no less than 92 % of the Finnish total. Helsinki was constantly in a class of its own, and its share rose from 61 % in 1895 to 68 % in 1913; accordingly, the development of the country's steam shipping was largely dictated by what happened in the capital. Helsinki was also dominated by the Finnish Steamship Company *(FÅA)*; in 1895, 85 % of the local steam-tonnage belonged to it, but this figure dropped to about one half (or a third of the whole country's steam-tonnage) when a

57 *The Ships of our First Century*, p. 30—31, 40.

couple of new steamship companies were established.

Steam shipping also remained an urban business. In 1913 there were barely a dozen, small steam vessels in the coastal parishes[58] and they totalled about one per cent of the national tonnage.

The boom of the late 1890s brought to a halt the downward trend in sail, and the total tonnage began to grow for the first time in twenty years. Even though this boom was followed by a further period of decline, sailing tonnage was still about as big in 1905 as it had been in 1865. It did peak, however, at the turn of the century, and during the lean years which lasted until 1909—10, many old ships were laid up. Although a new boom began after 1910, total sailing tonnage was somewhat less in 1913 than it had been at the lowest period of decline in 1895.

The decline was not universal. Indeed, the trend which was already visible in the 1890s, growth at both ends of the scale and decline in the middle, still continued. The following figures for the different size-classes show this polarization very clearly:

Size-class	1895	1905	1913
20>100	29,720	37,960	40,470
100>700	108,700	75,020	49,800
700>1500	39,060	57,500	29,950
1500—	3,880	13,800	59,110

The size of long-trade sailing ships increased substantially after the 1890s. All the ships in this category were bought from abroad, but they were increasingly of iron or steel, and by 1913, practically all which were larger than 1,000 tons had metal hulls. Both in the late 1890s and early 1910s, when freights were quite good, these ships were brought to Finland in great numbers. In the 1910s boom, even towns such as Helsinki and Turku, which had relatively large steamship fleets, were affected. At the same time, most of the earlier hardwood ships and "Novascotiamen" were sold or laid up.

The small town of Rauma was at the forefront of the second-hand windjammer business until around 1905. It was closely followed by Åland, whose long-trade fleet still included more

58 The official statistics claim that there were about 60, excluding inland districts, but in reality most of them were tugs owned by sawmills and other industrial companies.

TABLE 2:10. Sailing ships in different parts of Finland in 1905 and 1913.

Area	1905 Total tonnage	1905 Average size	1913 Total tonnage	1913 Average size
Ostrobothnia	5,360	109	4,120	111
South-west Finland	79,840	222	66,740	243
Åland	59,350	280	61,510	303
Gulf of Finland coast	37,710	68	46,770	73
Interior	—	.	—	.
Total	182,260	155	179,140	155

Source: Appendix I.

wooden than metal-hulled vessels in the first decade of this century (they continued to buy wooden ships from Finnish towns, where shipowners had begun to go over to iron and steel).[59] Here, the real transition to the "second generation" of second-hand vessels took place only after 1910, but it was rapid. In 1913, over 40 % of the country's big iron or steel sailing-ships were based in Åland. The small town of Uusikaupunki also experienced a similar boom, and in 1913, no less than 80% of all Finnish ships over 700 tons were found in Åland, Uusikaupunki and Rauma (table 2:11). These were also the places in which some medium-sized Baltic and North Sea sailing ships were still to be found: they even accounted for 80% of the tonnage in the medium size-classes (200—700 tons).

Coastal tonnage (see table 2:12), on the other hand, was centred mainly in the neighbourhood of Wiborg, and, as mentioned earlier, was employed in trade to St.Petersburg. Both firewood and stone and sand (for building purposes) were transported there in growing quantities, thus the local coaster fleet prospered and grew.[60] On a minor scale, similar developments were taking place on the coast of Nyland, near Helsinki. The traditional trade to Stockholm seems also to have expanded up to the turn of the century, but the coastal fleets of Åland and the Turku archipelago stopped growing after 1905.

59 See the ship list in Kåhre, *Den åländska segelsjöfartens historia.*

60 E.g. Kaukiainen, *Koiviston merenkulun historia,* p. 221—229.

TABLE 2:11. The geographic distribution of larger (700 tons and over) sailing ships, 1895—1913. Net tons.

Area		1895	1905	1913
Ostrobothnian towns:	Vaasa	7,366	1,446	1,446
	Others	9,085	1,789	751
Åland		6,001	31,103	39,837
South-west Finland:	Rauma	8,107	14,483	7,310
	Uusikaupunki	2,412	11,373	23,940
	Turku	6,710	2,949	5,839
	Other towns	968	—	—
	Coastal parishes	780	3,147	709
South coast:	Helsinki	717	1,618	6,811
	Other towns	792	3,393	2,420
Total		42,938	71,301	89,063

Source: Appendix I.

TABLE 2:12. The geographic distribution of the coastal sailing fleet (vessels under 100 net tons), 1895—1913. Net tons.

Area	1895	1905	1913
Ostrobothnia	1,540	1,870	1,620
South-west Finland	4,520	7,630	6,570
Åland	2,550	4,040	4,090
South coast: Nyland	5,130	6,080	7,140
South coast: county of Wiborg	15,980	18,340	21,060
Total	29,720	36,960	40,470

Source: Appendix I.

The period from 1895 until the first world war was thus, as far as sailing ships were concerned, a period of both decline and growth. Growth, however, was confined to rather narrow geographical areas in the south-west and south-east, and it was in contrast to an almost universal decline elsewhere. In total tonnage, it was a period of slow decline, but for many parts of the country it was nothing less than the final act in the long history of merchant sailing vessels.

TABLE 2:13. Average size of steamships in selected merchant fleets, 1913. Net tons.

Finland (excl. tugs etc.)	283
Sweden	549
Denmark	656
Norway	563
United Kingdom	895
Germany	1,305
France	517
Italy	942
Greece	1,116
Russia	477
Atlantic Canada (1910)	217

NB: In all cases, except Denmark and Norway, the figures also include motor-vessels. As these were at this time mostly quite small, often auxiliary sailers, this tends to deflate the rates somewhat.
Source: See table I.

Almost everywhere in Europe and around the North Atlantic, this final act had already been played by the turn of the century. In 1913, steam tonnage was overwhelmingly dominant in all maritime countries except Finland, the USA and in the Atlantic provinces of Canada. Although the revised figures presented above give Finland a slighly bigger share of steam tonnage than the official statistics — 23.9 % at the end of 1913 rather than 18.2 % — this difference does not really count. Even compared with the USA and Atlantic Canada, Finland was very far behind. In actual figures, the Finnish steam-fleet was almost negligible. It was only 10% of the Swedish, 3% of the German and less than one per cent of British steam tonnage.[61]

Even structurally, the Finnish steam-fleet was relatively weak. Table 2:13 presents the average size of steamships in some typical merchant fleets at the end of the period. The Finnish and Canadian

61 Irrespective of its exceptionally high percentage share, Finnish sailing tonnage was not unusually large in actual figures. True, it was somewhat larger than e.g. the Swedish or the Greek, but only 20—35 % of the German, French, Norwegian and British fleets, and even compared with the population it was easily second to Norway.

figures were clearly below average for that time. This, at least in Finland, was because of the large proportion of coastal vessels in the tonnage. The ocean-going vessels were also of moderate size. Ship sizes had increased considerably after the beginning of the 20th century, and bulk-carriers of around 5,000 gross tons became common in long trades.[62] Even in liner services between Britain and the most important Scandinavian ports, the average size had increased to over 2,000 tons gross by 1914.[63] It could be said, of course, that the "handy size" for Finnish timber ports was smaller than that, but even in the Baltic timber trade the Finnish ships were on the small side. The average size of British steamers visiting Finnish ports in 1913 was 1,260 net tons (or about 2,100—2,200 tons gross). At that time there were only five steamships over 1,500 net tons in Finland, and Finnish steamers which took cargoes beyond the Baltic were on average only about 880 net tons.[64] To put it in a nutshell, the crucial question seems to be why the transition to *big* steamships was so slow in Finland.

62 See e.g. Graigh, *The Ship.*

63 Pearsall. "Steam enters the North Sea", p. 213.

64 Finnish official statistics IB:33. The number and tonnage of British ships can be found directly in table 5, but the figures for Finnish ships sailing beyond the Baltic must be computed from table 9, which specifies clearings by customs house, nationality and destination.

2. Investment cycles and capital formation

The development of the Finnish merchant fleet was clearly not without some quite abrupt changes in new building and other investment activities. Even though these cycles were not identical in all regions, the highest peaks were found in the 1860s, early 1870s and the 1890s, and troughs in the 1880s and between 1900 and 1907. Coastal and Baltic fleets, however, developed more evenly and fluctuated somewhat differently.

In order to compare the different cycles of investment it is necessary to establish how much tonnage was built in Finland and bought from abroad. It is also necessary to know the prices of these ships in order to calculate how much money was "sunk" in shipping at different times. Because there was always some "outflow" of ships (sold, wrecked, worn out), the amount of gross investment may not have developed in line with total tonnage. Conventional tonnage, however, is not an adequate measurement of capital accumulation either, at least not in a period when sailing vessels and steamships represented very different capital values. It is therefore essential to ascertain the actual monetary value of the fleet at different times in order to see whether and how much the capital stock grew or decreased. Last but not least, a very important aspect is the difference between these two series, gross investments and net capital formation, a difference which, in the macro economic sense, represents depreciation of capital stock and which, in an industry such as shipping, could be considerable. Needless to say, all these data are much more difficult to collect than tonnage figures, but at least reasonable estimations are possible.

Prices of new ships

Data on building costs are not difficult to collect. There is not an abundance of information, but many examples are to be found in both owners' and shipbuilding-companies' archives. There is just one notable "blank spot": the prices of small coastal vessels are practically unknown. True, there are a few cases in which building-costs are mentioned, but the vessels in question were

mostly built by owners using timber from their own forest and even labour from their own family (although a special shipwright, at least, was normally hired), and only costs paid in money were usually recorded.[1]

Even for larger sailing vessels, the prices mentioned in the source material are not necessarily unambigious. Normally, new ships built in Finland were sent on their first voyage far from fully equipped. The outfit was then completed in a British harbour and items such as anchors, chain, windlass, instruments etc. bought; usually the ship was then also fitted with copper or zinc sheathing. These were no small expenses: additional fitting out might have cost up to £1 (25 Finnish marks) per ton, and coppering in a dry dock totalled from £1.8 to £2 (35—50 marks) per ton (big ships with less wetted area per ton cost less).[2] Only one major Finnish yard, Turku shipyard, seems to have regularly delivered ships with copper or zinc sheathing; however, their charge for metal seems to have been about 20% higher than in British yards.[3] Finally, it must also be borne in mind that building costs varied a lot depending on local labour costs, on whether the ship was iron- or copper-fastened and how many iron structural members were used.

Examples of building costs for sailing-ships are given in table 2:14. They apply to the 1860s and 1870s, when domestic shipbuilding was still actively going on. Most of the data is derived from owners' accounts, and if all expenses for outfit, coppering etc. were found in the accounts of the first voyage, they were included in the initial building costs. Unfortunately, in most cases it is not clear exactly what was included in the price.

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1 E.g. Börman, *Åboländsk byggdeseglation*, p. 222—223.

2 Ships' accounts (see appendix IV:1). Data which clearly specify coppering-costs have been found for the following vessels: *Martin Luther* (1864—65), *Vesta* (1866), *Freden* (1857), *Toivo* (1871), *Matts August* (1874), *Amur* (1869). See also Norrvik, *Briggen Carl Gustaf*, p. 66—69. Most of the accounts mentioned above also contain different fitting-out items. British yards seem to have charged an additional price of close to £1 per ton for copper-sheathing of new vessels (which, of course, includes no charge for dry-docking), and the total cost of a long-trader's outfit (so-called East India outfit) amounted to about £2 per ton (MacGregor, *Fast Sailing Ships*, p. 143).

3 Engström, *Åbo sjöfarts historia*, p. 42—45; the accounts of *Amur* (1869).

TABLE 2:14. Costs of building new sailing-ships in the 1860s and 1870s, Finnish marks (pounds and decimals).

Size-class net tons	Cases	Aver. net tons	Building-prices per net ton Lowest	Highest	Average
A. 1860s					
>300	1	246	.	.	111 (£4.2)
300>500	3	427	163 (£6.2)	349 (£13.3)	238 (£9.1)
500>700	13	604	132 (£5.0)	291 (£11.1)	182 (£6.9)
700—	3	970	149 (£5.7)	293 (£11.2)	216 (£8.2)
B. 1870s					
>300	5	264	146 (£5.6)	195 (£ 7.4)	162 (£6.2)
300>500	5	357	174 (£6.6)	240 (£ 9.2)	192 (£7.3)
500>700	5	592	145 (£5.5)	311 (£11.9)	230 (£8.8)
700—	3	941	166 (£6.3)	326 (£12.4)	242 (£9.2)

NB: Although the actual exchange rates varied a little, the average value of one pound sterling, 26.2 Finnish marks, is used here.

Source: Shipowners' accounts (see appendix IV:1); Nikula, *Åbo sjöfarts historia* p.60—62; Börman, *Åboländsk bygdeseglation* p. 224, Kaukiainen, *Koiviston merenkulun historia* p.250.

The price variations seem bewildering at first sight. They usually occurred, however, because of differences in outfit and building specifications. The maximum prices recorded above refer to fully-fitted ships with copper sheathing, while the minumum figures obviously apply to cases where the price included only the hull, the rigging and the basic sails. There were also notable local variations. For one thing, it seems that ships were cheaper on the Bothnian coast, and in particular the northern part, than on the southern coast, in Turku, Helsinki and Wiborg. The huge brigs of Raahe were a special case: most of them, measuring around 600 net tons, were fitted out for their first voyage at a total cost of only 140—150 marks (£5.3—5.7) per ton. Obviously they were not built to a very high standard, but even copper-fastened barks and ships from Raahe and the neighbouring Oulu were built, fitted out for ocean voyages and even coppered, for a total of 230—250 marks (£8.8—9.5) per ton. In Turku and other southern ports, as the

maximum figures show, the corresponding price was around 300 marks (£11.5). Prices also, of course, varied a lot with the business cycles: ships built during the booms of the mid-1860s or early 1870s seem to have been more expensive than those launched in the late 1860s.

If a ship was sheathed with zinc rather than copper, the total price tag could have been about 5 % lower, and if it had no sheathing or just wood-lining, and was fitted for Baltic voyages, the price may well have dropped to 200 marks or below. This was the case with schooners, brigs and barks built in the rural coastal ditricts. Humble coastal traders, despite their small size, which in theory should have meant rather high prices per ton, were cheaper still. The few available building accounts suggest that two-masted *galeases* were built for less than 100 marks (£4) per ton, but as similar second-hand vessels were sold for 120 marks or even more per ton,[4] the actual building costs must have been at least 150 marks per ton. On the other hand, smaller, undecked vessels may have been much cheaper.[5]

After the 1870s, the building of larger sailing vessels practically ceased, and only coastal and Baltic fleets were subsequently replenished with domestically built new ships. Information about prices also becomes more scanty, but no fundamental changes in price level seem to have taken place before the first world war.

Finnish prices were very low compared with those paid in Western Europe. During the 1860s and early 1870s, £15—19 per ton was a perfectly normal price charged by a British yard for an iron or composite windjammer of about 1,000 register tons.[6] Thus, even the most expensive Finnish sailing ships cost only 2/3 of the price of British vessels, and the simple "peasant" barques sailing to the North Sea could be built for less than half of that. The differences in price, of course, also reflected differences in quality. An iron ship could be given an initial 15-year classification by Lloyd's or Veritas in their highest class, but for no Finnish softwood ship did they ever go beyond 8 years.[7] Moreover, compared with the big, North American softwood ships, the

4 Börman, *Åboländsk bygdeseglation*, p. 227.
5 See Börman, *Åboländsk bygdeseglation*, p. 226.
6 Harley, "On the Persistence of Old Techniques", p. 377; McGregor, *Merchant Sailing ships*, p. 60—63, 113, 136.
7 Classification was recorded in *Finland skeppskalender*.

Finnish first-class windjammers were not so cheap; £10 per ton seems to be the traditional estimate of Canadian prices for newly built ships, and even lower averages have been suggested.[8] In the United States, on the other hand, shipbuilding-prices rose substantially after the civil war, and quotations of £14—15 per ton seem to have been normal.[9]

The relatively cheap prices gave a substantial advantage to the Finnish ships. However, this only affected traditional sailing vessels; as soon as the new steam technology was applied to shipping, there was an abrupt rise in costs. This was already clearly visible when wood-hulled auxiliaries were being built in the late 1860s and early 1870s. Steam engines, boilers and propellers could increase total costs by about 25 %, and as they and the coal bunkers also decreased cargo space by at least a quarter, the resulting price per net ton, as far as can be seen from the insurance values of these auxialiaries, rose to no less than 450—550 marks (£17—21).[10]

Full-powered iron steamships were still more expensive. The prices of the first two iron propeller steamers in Turku (1864 and 1873) were about 790 and 880 marks (£30 and £34) per net ton.[11] Even more expensive was the first real ocean-going steamer, which the *Wasa—Nordsjö* company built in Port Glasgow 1873—74: the total cost of this vessel (which was only 251 net tons) was 9,850 pounds sterling, or almost 39 pounds (990 marks) per net ton.[12]

Later on, the prices of standard bulk-carriers seem to have fallen. This happened not only because engines and iron hulls became cheaper, especially as the vessels grew bigger, but also because machinery and bunkers required less room and thus there was a definite gain in net tons. The Finnish Steamship Company *(FÅA)* paid about 680 marks (£27) per net ton for their first two ships (built in Germany, 1883). Later they had two ships built in Britain, in 1889, for 546, and again in 1895, two ships for no more

8 Fischer — Sager — Omner, "The shipping industry and regional economic development", p. 37. Unfortunately, the authors do not state whether the ships in question were coppered and fully fitted out.

9 Harley, "On the Persistence, of old Techniques" p. 379 (subnote 9); McGregor, *Merchant Sailing Ships*, p. 176, fig. 229.

10 Record-books of *Sjöassuransföreningen i Finland.*

11 Lindberg, *Ångbåtssjöfart i Åbo*, p. 178, 198.

12 *Wasa-Nordjö Ångbåts Ab.*, p. 23.

than 500 marks (about £20) per net ton (the last order was, indeed, a bargain).[13] Special winter-boats with shells reinforced against ice, and powerful engines were, however, more expensive. *FÅA* paid 885 marks per net ton for two such vessels in 1891, and in 1902 another company paid about 930 marks per net ton for three vessels.[14] All these ships could also carry passengers, but special passenger ships commanded still higher prices: at the turn of the century, they ranged from 1,240 to 1,560 marks (£49—62) per net ton.[15] Small coastal passenger boats were equally expensive; although they were more modestly fitted out, their small size led to relatively high prices per ton.[16]

It is clear that even the prices of steamships varied a lot. What is important, however, is that they were much higher than for Finnish-built sailing vessels. In the 1870s, an ocean-going steamer was up to three or four times more expensive than a first-class barque, and in the 1890s the difference between the few domestic-built barques or barquentines and the cheapest steam-propelled bulk-carriers was still large. For the period after the early 1880s, however, price comparisons of newly built sail and steam ships have little relevance as Finland obtained most of its sailing ships, apart from coastal vessels, on second-hand markets.

Second-hand prices

Finnish shipowners, of course, were buying second-hand ships in the 1860s and 1870s, very few of which were foreign. Thus, second-hand markets were quite an insignificant source of tonnage on a national scale. As already mentioned, in the 1880s the trend was totally reversed, and practically all sailing vessels over 500 net tons entered in the Finnish register were bought from abroad. Second-hand prices then became an important determinant of shipping investments.

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13 *Suomen Höyrylaiva Osakeyhtiö 1883—1933,* p. 15, 19, 34.

14 *Suomen Höyrylaiva Osakeyhtiö 1883—1933,* p. 27; Lindberg, *Ångbåtssjöfart i Åbo,* p. 268.

15 The ledgers of *Finska Ånfartygs Ab.* 1899 (new steamers *Arcturus* and *Polaris)*; Lindberg, *Ångbåtssjöfart,* p. 244, 253.

16 Lindberg, *Ångbåtssjöfart,* p. 305, 321—322, 331—332.

TABLE 2:15. Purchase prices of second-hand sailing vessels, 500 net tons and over, 1880—1913. Finnish marks (pounds and decimals).

Period	Number of cases	Purchase prices per net ton Lowest	Highest	Average
A: Wood vessels				
1880—90	9	43 (£1.7)	119 (£4.7)	69 (£2.7)
1891—1900	7	26 (£1.0)	48 (£1.9)	37 (£1.5)
1901—13	13	21 (£0.8)	104 (£4.1)	53 (£2.1)
B: Iron and steel vessels				
1895—1900	5	88 (£3.5)	171 (£6.8)	110 (£4.3)
1901—10	4	60 (£2.4)	126 (£5.0)	95 (£3.7)
1911—13	6	43 (£1.7)	100 (£3.9)	75 (£3.0)

NB: Marks converted to pounds at the average exchange rate (Bank of Finland, avista) of each period.

Source: Shipowners' accounts (appendix IV:1); Kåhre, *Den åländska segelsjöfartens historia*, p. 359—361, 446—447; Börman, *Åboländsk bygdeseglation*, p. 229—230.

Second-hand prices, however, are difficult to describe systematically. The vessels differed not only according to building specification (e.g. hardwood vessels were much more expensive than softwood ones), they were also of widely varying ages, and age was probably the most important single determinant of a ship's current value. As actual prices are known only for less than 50 large (500 net tons or over) sailing vessels bought after 1880 (table 2:15), there is not enough data to cover such a variance. Fortunately, values and tonnages of ships imported after 1895 are to be found in the foreign trade statistics. Even though these values are not necessarily in all cases true purchase prices, but rather the normal values of comparative vessels, they should suffice to give a rough idea of what was paid for second-hand vessels imported to Finland.[17]

17 Finnish official statistics, ser.I and IA. The values of different commodities were not verified from invoices or other trading documents but they were determined by the Board of Customs after hearing a group of experts. See Pihkala, *Suomen ulkomaankauppa*, p. 17.

TABLE 2:16. Values of sailing vessels imported to Finland 1895—1913. Finnish marks (pounds and decimals).

1=number of cases 2=average tonnage 3=value per net ton

Period	Wooden vessels			Iron and steel vessels		
	1	2	3	1	2	3
1895—1900	53	633	59 (£2.3)	27	1,207	115 (£4.5)
1901—05	40	538	56 (£2.2)	5	1,357	84 (£3.3)
1906—10	33	542	34 (£1.3)	15	1,692	72 (£2.8)
1911—13	41	249	59 (£2.3)	30	1,573	68 (£2.7)

NB: The pre-1912 figures do not include imports from Russia. Conversions as in table 2:15.

Source: Finnish official statistics I and IA (foreign trade), table 2a.

Data on individual purchases and import statistics correlate so well that the values registered by the latter must have been realistic. The only serious defect in the material is that hardwood and softwood vessels were not separated. In general, fluctuations from one year to another were fairly large. This was partly because of variations in the quality of imported tonnage,[18] but mostly because prices fluctuated with freight cycles. The trend, however, was clearly downwards, although wooden vessels seemed to experience a reverse development at the end of the period. The reason for this was probably that the data for 1911—13 includes smaller and probably newer ships than before.[19]

Norwegian import tonnage statistics present a similar picture. Average prices per net ton (in pounds and decimals) developed as follows:[20]

18 E.g. in 1895, the only three-year old four masted barque *Goodrich* (renamed *Fennia)* was bought to Finland for an exeptionally high price of over 170 marks per ton. Of this purchase see Senate, *Finansexpeditionen,* KD 9/21 1897 (the buyers received a loan from the state).

19 This is mainly because imports from Russia, which were not observed earlier, cannot be separated for 1912—13. They consisted mainly of small, Estonian-built vessels.

20 Gjöberg, *ökonomi, teknologi og historie,* table 12.

	wood vessels	iron and steel vessels
1892/95	£2.5	£5.3
1896/1900	£2.6	£3.3
1901/05	£2.4	£3.5
1906/10	£2.3	£2.9
1911/13	£2.1	£2.3

Differences from Finnish import prices are not great. Perhaps the most pronounced one is that wooden vessels imported to Norway were slightly more expensive than those in the Finnish statistics (the difference was especially conspicious in 1906—10), but this was probably because the former were on average relatively small and possibly included more hardwood vessels. As the Norwegian data is more extensive than the Finnish (between 1895 and 1910, the Norwegians seem to have been the leading buyers of second-hand sailing vessels of iron or steel), the development is more steady, but basically both data describe the same worldwide, second-hand markets. This relative uniformity is understandable bearing in mind that the great majority of large, wooden vessels still afloat were built in the late 1860s and 1870s. Even most iron and steel windjammers were built before the mid-1890s. Thus, the age-structure of those sold after that date seems to have changed primarily with the passing of time. The figures presented above support this by showing a general downward trend of 2.5—3 % a year in prices.

Prices of both hardwood and iron sailing ships clearly fell in the 1890s, in spite of the boom in the freight market. Obviously, the supply of second-hand vessels increased when the transition from sail to steam gained momentum, and as the best quality wooden, not to mention iron, hulls from the 1860s and 1870s were very durable, this good supply continued for years. By the mid-1890s, a good hardwood vessel could be bought for an eighth of what it would have cost to build a good ocean-going barque in Finland; at the turn of the century, a good iron fullrigger (such as the famous clipper *Mermerus* which was bought by Turku in 1898 and three years later sold to Åland),[21] cost only half as much per ton as a

21 Nikula, *Åbo sjöfarts historia,* appendix ship-list.

TABLE 2:17. Average prices of steamships imported to Finland and Norway, 1896—1913. Finnish marks (pounds and decimals).

Period	Price per net ton			
	Finland		Norway	
1896/1900	654	(£25.8)	343	(£13.5)
1901/05	655	(£25.8)	401	(£15.8)
1906/10	526	(£20.7)[1]	369	(£14.5)
1911/13	340	(£13.4)	327	(£12.9)

1 1906/09; data for 1910 is obviously faulty.

NB: 1 No. crown = 1.4 Fi. mark.
Source: Finnish official statistics ser.I and IA; Gjölberg, *Ökonomi, teknologi og historie*, table 12.

new, domestically built, softwood barquentine. Around 1910, prices were still lower, although building costs had not dropped at all.

The question of second-hand prices for steamships is in one respect more difficult but, at the same time, less important. This is simply because most steamships acquired in Finland before the turn of the century were new. This can be seen clearly from a comparison of ton-prices for steamships in the Finnish and Norwegian import statistics. As table 2:17 shows, they were quite different.

Up until 1905, the Finnish figures are very close to the prices of new ships and second-hand steamers more than, say, five years old must have been quite rare. The opposite was the case in Norway: prices seem to be only a shade higher than the average second-hand prices of the same period. It is known from the Finnish data that older steamers could be bought for around 300 marks per ton in the 1890s,[22] and this was roughly the level in the early 1910s, too, when only second-hand steamers were imported. Compared

22 A good example is s/s *Sicilia*, 1,210 net tons, which was bought in 1898, then nine years old, and cost 310 marks per net ton. Senate, economy department AD 1521/398 1898.

with the corresponding prices of new ships, second-hand prices for steamers were by no means unduly high. Indeed, if a ten-year old ship could be bought for 50—60 % of the original price, as the figures suggest, its value had fallen by an (arithmetical) average of 4—5 % a year. In any case, they were still more expensive than new, domestically built "second-class" (uncoppered, iron-fastened) barques, and far more expensive than iron-hulled, second-hand sailing-ships.

Investment cycles

Supplementing the price data presented above with tolerably reliable quantity data of new and second-hand tonnage produces the total amounts of investment. This presents no problems from 1895 onwards, when shipping statistics began to include data on tonnage additions, and reliable figures of tonnage bought from abroad are obtainable from the import statistics. Sources are much less reliable, however, for the earlier years. Data on new ships can be found in published statistics from 1866 to 1880,[23] although this material is far from complete; however, no such figures for the whole country seem to be available for after 1880. Thus there is a total blank for the period 1881—1894, which is unfortunate, since these years cover what was supposedly the very trough of the depression which began after 1875.

Moreover, the 1866—1880 data on new building has many obvious gaps. Figures are either not available for all geographic areas, or they just give an estimate of the number of ships with no reference to tonnage. Of course some short chronological gaps can be easily bridged, and even geographical ones can be filled by relating the new building activity to the level of existing tonnage. However, the best means of controlling and completing this data is by referring to the tables concerning the age-structure of the merchant fleet: these were first published for the end of 1875 and

23 Finnish official statistics, ser. I:2—5 (shipping and foreign trade). This data was collected by local *länsmän* for their 5-year reports, which were subsequently summed up in the reports of the governors, and published in the Finnish official statistics, ser. II (the economic conditions of Finland).

later for 1882 and 1885.[24] Since only steamships were normally bought from abroad, these data at least give the absolute minimum number of sailing vessels built at different times.[25] By comparing the age data for different years and the tonnage data, it is also possible to estimate the average amount of the annual "outflow" (whether caused by wrecking, selling or laying up) of tonnage. Both in the 1870s, and between 1875 and 1885, this seems to have been at around 6 per cent a year, which means that one age-class of ships was decimated to half of its original strength in about twelve years.[26] This percentage ratio may be used to reconstruct the "cohorts" of new building after 1860 and up to 1885. The resulting figures must naturally be regarded only as an estimate with a substantial margin of error, but since ships with no age-data (almost 20 % of all in 1875) have been excluded, there should still be a satisfactory safety-margin.

With all their errors, the figures suffice to stress two things. First, the peak of new building activity was reached during the decade between 1865 and 1875. In 1874, which was probably the turning-point, no less than 33,000 tons of sailing vessels were built, but this record was followed by quite a dramatic drop. In the

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24 Finnish official statistics I:3, p. 9, I:6, p. 14 (only ships belonging to urban owners), I:7, p. 15.

25 The data also shows that the official new building statistics were very defective. According to them, 86 sailing vessels were built in Finland 1866—70, but in 1875 there were still no less than 307 sailing vessels built during those years in the Finnish merchant marine. Many of those built 1866—70 had already been sold or wrecked and, moreover, the date of building was known only for a good 80 % of ships. As sailing vessels were only seldom imported, practically all of the difference results from faults in the shipping statistics.

26 In 1870, there were 658 sailing vessels altogether in all Finnish towns; in 1875 the number of urban ships built in 1870 or before was 399. It was assumed that the proportion of ships with no age data was constant at 19 %., and so the average outflow in 1871—75 was 6.0 %. A similar comparison was made between 1875 tonnage and ships built in 1875 or before and in use in 1885 (now a reduction was made in the former because in 1885, only vessels of 50 tons and over were included in the age-statistics), and the result was an average reduction of 5.9 % a year. In 1882, there were 60 ships over 50 tons built 1871—75 in Finnish towns; in 1875, the corresponding figure (with a 20 % reduction for vessels under 20 *lästs)* was 95: the average reduction was almost 7 %.

TABLE 2:18. Estimate of new sailing tonnage in Finland 1861—1880. Net tons.[27]

Period	1861—65	1866—70	1871—75	1876—80	1881—85
Total built	82,000	110,000	120,000	55,000	28,000
Average per year	16,400	22,000	24,000	11,000	5,600
Of this built for towns	12,700	12,800	8,400	1,900	800
— for rural shipowners	3,700	9,200	15,600	9,100	4,800

Source: See note 23.

1880s, only Baltic and coastal sailing ships were still being built, and at the bottom of the depression, in 1885, only 18 vessels over 50 tons were launched; their estimated net tonnage was only about 3,000, and not a single new ship was over 400 tons.

The other obvious change was that the proportion of ships built for rural owners rose and accordingly, investments by urban shipowners dropped by more than the average. Indeed, shipbuilding activities of the latter peaked in the 1860s, and this level was not reached again during the next boom period in the 1870s. At the beginning of the 1880s, new building for urban owners was almost non-existent. As the best ocean-going ships had always come from coastal towns, this structural change had a substantial bearing on the total value of new vessels. It may be

27 The figures were computed as follows: 1861—75 are based on the 1875 age-data, which also records tonnages *(lästs)*, by assuming that each "cohort" diminished on average 6 % a year. Thus the tonnages for each "cohort" were multiplied by 1.06^t, where t = 1875 — (the middle year of the age-class in question). The ratio towns/rural areas is the same as that in the actual age-classes remaining in 1875, but as urban tonnage also included steamships, steam-tonnage was first subtracted from urban tonnage. The 1876—85 figures are based on 1885 age-data by assuming the same outflow (6 %) as before. As the later data only record the number of ships in different size-categories, the tonnages were computed assuming that the average tonnage in each size-class equalled the class median. As the data makes no distinction between urban and rural vessels, the ratio towns/rural areas was computed for 1876—80 using 1882 age-data, which only contains urban vessels. For 1881—85, it was assumed that the proportion of urban vessels was 15 % of total new building (in 1876—80 it was 17 %). In 1875, age was known for 81 % of *tonnage*, in 1885 for 96 % of *ships*.

TABLE 2:19. Estimate of urban and rural investments in sailing tonnage, 1861—1885. Million marks per year.

	urban	rural	total
1861/65	3.3	0.7	4.0
1866/70	3.3	1.8	5.1
1871/75	2.2	3.0	5.2
1876/80	0.5	1.7	2.2
1881/85	0.15	0.75	0.9

Source: Table 2:18. Estimated average values of new building per net ton were: 1861—80 urban 260 marks, rural 190 marks; 1881—85 urban 200 marks, rural 160 marks.

supposed that 60 % of new urban ships were copper or zinc sheathed (this at least was the percentage for 1865—75 urban tonnage),[28] and that the average value of new tonnage was thus about 260 marks (£10) per net ton. After 1880, this value probably dropped as no large ships were built. The value of new rural ships, supposing that no more than 25% of them were coastal tonnage, can be estimated at an average of about 190 marks per ton, although even here, the average value must have fallen after 1880. According to these figures, the value of new building was as follows (table 2:19).

These figures do not include second-hand acquisitions from abroad, but these were very few and this defect is of no real importance. It is more than probable that an underestimation of new building, which cannot be avoided in the calculations, accounts for more tonnage.

The figures do not include steamships either. These were expensive and, despite low tonnages, incurred total investments well worth estimating. It is not difficult to obtain reliable enough figures for steamship acquisitions, irrespective of whether they were built in Finland or bought from abroad. Since practically all ships imported from abroad were newly built, the year of building (found in published ship-lists), usually also indicates when the

28 *Finlands skeppskalender*, 1865, 1975—76. In 1875—76 only 3 % of rural ships, by tonnage, were copper- or zinc-sheathed.

TABLE 2:20. Estimated Finnish steamship investments, 1861—1885.

Period	1861—65	1866—70	1871—75	1876—80	1881—85
New steamships, built and imported, net ton	1,200	2,400	4,400	2,800	3,550
Do, average per year	240	480	880	560	710
Thereof auxiliaries	80	330	490	—	—
Est. av. price per ton, Fi. marks —auxiliaries	500	500	500	.	.
—others	800	800	800	750	600
Total investment per year, million marks	0.15	0.3	0.6	0.4	0.4

Source: *Finlands skeppskalender* and sources for table 2:18 above.

investment in question was made. The age-statistics mentioned above can also be used for the same purpose. The only problem is with the tonnage figures: since the old *läst*-numbers of steamships are not fully comparable with later register tonnage, the relationship between prices and tonnage is also far from systematic, at least up to the mid-1870s. Therefore the estimate (table 2:20), particularly the first part, should be used with caution.

In spite of the margin of error, it is possible to state safely that the figures were quite modest, especially since the proportion of auxiliaries (that is, of cheaper tonnage) was quite high before 1875. Thus, the figures do not basically change the general picture. If investments in sail and steam are summed up, the following averages for different five-year periods are obtained:

1861/65	4.2 mill. marks a year
1866/70	5.4 mill. marks a year
1871/75	5.8 mill. marks a year
1876/80	2.6 mill. marks a year
1881/85	1.4 mill. marks a year

The almost catastrophic decline in investments after 1875 remains beyond any doubt.

After the late 1880s, as imports of second-hand tonnage increased, age-data can no longer be used to determine investment

cycles. This leaves a gap in the data of almost 10 years. However, there are fairly clear indications that the depression in investments continued to the latter half of the 1880s. From 1887 onwards, there is proper data on tonnage imports, and they indicate that, just before the turn of the decade, a small boom was experienced. The average annual value of imported tonnage was still very modest in 1887 and 1888, less than 0.3 million marks (of which only a tenth consisted of sailing vessels). However, during the next two years, 1889—90, it grew to 4.4 million marks a year (sail 1.25 and steam 3.2 millions), and was still over two millions in 1891.[29] Domestic building of wooden sailing vessels was also temporarily revived in those years.[30] During the three or four years after 1891, when freights again declined, imports also decreased.

As mentioned earlier, official data for new tonnage acquisitions began in 1895: since that date, both domestic new building and imports have been fully recorded. However, data on new building contain some tonnage which has not been included in the merchant marine for this study. First, new barges were classified as sailing vessels and tugs were included in the figures for steamships. The statistics also comprise new building for the inland fleet, but the proportion is not specified. To compensate for these "excesses", the following reductions have been made:

— the *increase* in the total tonnage of barges (which can be found in shipping statistics) has been deducted from new sail tonnage

— as compensation for tugs, an arbitrary 25 % has been deducted from domestic new building of steam tonnage

— the proportion of inland tonnage of total sail and steam tonnage has been deducted (in the case of sail this was quite a steady 20%, in steam it fluctuated between 13 and 19 per cent)

The resulting figures for tonnage acquisitions are presented in table 2:21. The simplest way to translate the tonnages to monetary values is to use the values of imports found in the trade statistics. For domestic new building, however, such real values cannot be found, and arbitrary ton-prices have therefore been used, as before.

29 Finnish official statistics, ser. I; import statistics.

30 This is clearly seen in the published ship-lists *(Finlands skeppskalender)* which register many ships built around 1890.

TABLE 2:21. Tonnage acquisitions from different sources, 1895—1913. Averages per year, 1,000 net tons.

	1895/1900	1901/05	1906/10	1911/13
Sailing ships				
— domestic new building	5.1	5.2	3.45	4.3
— imports	11.0	5.7	8.65	19.1
Total, sail	16.1	10.9	12.1	23.4
Steamships				
— domestic new building	0.7	0.6	0.6	0.8
— imports	4.6	2.1	3.2	2.7
Total, steam	5.3	2.7	3.8	3.5
Grand total	21.4	13.6	15.9	26.9

NB: For imports, the first period is 1895/1900, for new building 1896/1900.

Source: Finnish official statistics, ser I, IA and IB (shipping and trade, foreign trade).

The new building-price for sailing ships has been set at 150 marks (about £6) per ton (most of these were simple coastal vessels), and for steamships at 1,000 marks (about £40) per ton (as they were usually small passenger vessels, the ton-price must have been much higher than that of standard bulk-carriers). This produces the following estimates of total shipping investments (table 2:22).

It is clear that investments in steam were always the dominating element, and any variations thus significantly affected the total. As the level was quite low in 1911/13, the total investments do not show the kind of "peak" that the increase in tonnage figures suggest.

All prices quoted here and previously were, of course, current prices. This presents no great problems of comparison, for, as is well known, prices were quite stable during the whole period. It can of course be said that, as prices in general (as for example the well-used Rousseaux index shows) were some 65—70 % higher in the 1860s than in the 1890s, the investment boom of the late 1890s represents a somewhat higher real value than the last boom of the sailing-ship era. Such a comparison, however, fails to take account

TABLE 2:22. Finnish shipping investments 1896—1913. Million marks per year.

	1896/1900	1901/05	1906/10	1911/13
Sailing ships				
— domestic new building	0.8	0.8	0.5	0.65
— imports	1.0	0.4	0.5	1.25
Total, sail	1.8	1.2	1.0	1.9
Steamships				
— domestic new building	0.7	0.6	0.6	0.8
— imports	3.0	1.3	1.7	0.9
Total, steam	3.7	1.9	2.3	1.7
Grand total	5.5	3.1	3.3	3.6

Source: See table 2:21.

of the fact that, during the later period, Finnish tonnage acquisitions were purchased mostly at international prices, whereas before the 1880s, most new tonnage was built clearly more cheaply. On the other hand, the investments could be evaluated by relating them to the carrying capacity of the tonnage — for example by multiplying steam-tonnage by three — but this comparison, again, fails in that the tonnages involved in international shipping were quite different in the 1910s and in the 1860s. Indeed, the only sensible way to rate the actual monetary values of investments during different periods is to show how high were the opportunity costs involved, that is, what other opprtunities were lost by "sinking" these amounts of money in shipping. This can be done by using the Finnish general wholesale price index as a deflator. As Finnish domestic (as well as export) prices were much lower in the 1860s and 1870s than in the 1910s, compared with the international (or Finnish import) prices, this estimation also gives more weight to earlier sailing-ship investments than would the Rousseaux' index, for example.[31] At 1913 prices, the following series emerges (yearly averages of total shipping investments in millions of marks):

31 The indices in question can be found in *Suomen taloushistoria 3* (Historical statistics), table 13.5a.

1861/65	4.3
1866/70	6.6
1871/76	6.3
1876/80	2.9
1881/85	1.6
1896/1900	6.9
1901/05	3.7
1906/10	3.6
1911/13	3.6

Thus, in terms of domestic opportunity costs, shipping investments ranked somewhat higher in 1896/1900 than in 1866/70 or 1871/75; the earlier boom, however, lasted much longer. It actually began after the Crimean war, when tonnage losses were compensated by massive new building. On the other hand, the "high" which was observed in tonnage growth in 1911/13 totally melted away.

Compared with investment volume in general, the pre-1875 boom stands out even more. According to a preliminary estimation, total Finnish investments, excluding residential building and the clearing of new fields, was less than 20 million marks in 1860, and about 30 million in 1870, but rose to over 100 million at the beginning of this century.[32] Thus, in the 1860s and early 1870s, shipping investments had quite a prominent position, but from the turn of the century they began to sink to a rather trivial level.

Capital "outflows"

A large proportion, and sometimes the entire amount, of invested capital was used to replace worn out, lost or sold tonnage. In the "golden days" of the 1860s and 1870s, annual new building amounted to no less than 10 % of existing tonnage and, according to the estimations presented above, this amounted to almost 240,000 net tons between 1865 and 1875. As the merchant marine grew by some 57,000 tons during the same period, a good three

32 Hjerppe — Peltonen — Pihkala, *Investoinnit ja niiden rahoitus Suomessa*, p. 2—5.

quarters of the new building was needed just to compensate for the continuous "outflow" of tonnage.[33]

As mentioned earlier, in a macro economic sense, the entire difference between gross and net investments can be called depreciation. Part of this "outflow", however, consisted of sold ships, which were not direct losses, and should not be regarded as part of depreciation. Selling ships abroad, however, was not very common in Finland, which differed from countries such as British North America in this respect.[34] According to Finnish foreign trade statistics, the export of ships to countries other than Russia was quite rare (and exports to Russia mostly consisted of new tonnage which never was registed in the Finnish merchant marine and was not included in the new building figures presented above).[35]

This impression is further confirmed by the ship-lists of two important local fleets, those of Oulu and Turku. The data consists of about 100 ships which were registered in these towns between 1855 and 1880, and whose fate is known well enough. Of these, half ended their career as shipwrecks, while 23 were sold abroad (16 before 1880 and 7 after that date). Almost as many, 22, were sold to other Finnish towns, and they did not represent "outflow" on a national scale.[36] Typically, ships were sold having been rather well-used (in some cases after being damaged) and thus the former owners also had to accept a good deal of depreciation in their

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33 Earlier it was estimated that the "cohorts" of new ships diminished on average by 6 % a year, while according to figures presented above, the amount of "outflow" (new building minus tonnage increase) amounts to 7.5 % of existing tonnage. The difference arises simply because cohort-specific and average tonnage-related percentages are not the same things in a situation of increasing tonnage. The latter case conserns new building during a period when the amount of tonnage was partly a result of much lower new building earlier. Therefore the percentage must be higher than in the former case.

34 See e.g. Rice, "Measuring British dominance of shipbuilding in the 'Maritimes' ". In the 18th century, large amounts of tonnage were still being built in Ostrobothnia for Stockholm shipowners, but this tradition declined after Finland was ceded to Russia. See Toivanen, "Suomalainen laivakauppa Tukholmaan".

35 Pihkala, *Suomen ulkomaankauppa 1860—1917*, table 2. Of course not all sales of second-hand ships were necessarily noticed by customs officers.

36 Nikula, *Åbo sjöfarts historia*, appendix ship-list; Snellman, *Oulun laivoja ja laivureita*, p. 95—139.

prices. Such a high rate of direct loss by wrecking and indirect loss by depreciation made shipping rather an expensive business: a lot of capital was needed all the time just to maintain the existing level of tonnage (in other words, the difference between gross investments and net capital formation was very high). Between 1865 and 1875, no less than 180,000 tons of new building was needed to compensate for the "outflow". If no ships had been sold abroad at that time — always supposing that the Oulu and Turku data are representative — at least 150,000 tons of new building, or on average over six per cent of the existing tonnage per year, would still have been necessary.

How many ships were sold depended mostly on business cycles, and owners could sometimes earn more by well-timed selling than by normal freight business.[37] Selling old tonnage could, on the other hand, also be motivated by a need to build new ships, but in all cases the figures fluctuated very much. In contrast, the amount of worn out or lost tonnage represents a more stable element, which basically depended not on business cycles but on the average life expectation of ships. This average life was dictated on the one hand by the inevitable wear, which set a limit on how long a vessel could be used without excessive maintenance costs, and on the other hand by the equally inevitable risks involved in shipping, which brought a premature end to the career of some fraction of the existing tonnage every year. This second element may seem quite unsystematic and unpredictable, but in the long run and in large fleets the variations are not too drastic, and seem to be systematically connected with the technical quality of tonnage.

Normally, only the value losses caused by wear and tear are considered under the heading "depreciation". This is more a practical convention than a theoretical distinction. Of course, "risks" were connected with the active use of a ship, while depreciation, not least because of ageing, took place even when a

37 E.g. A. Ahlström from Pori (Björneborg) bought a ship of 773 net tons for 57,300 marks in June 1871 and sold it in May 1873 for £4,400 (if an agents provision of 1/2 % is subtracted it amounted then to 109,200 marks). Normal net income in those days for a large ship like this was around 20,000 marks a year. General ledgers, the Archives of A. Ahlström.

ship was snugly laid up in a cove.[38] However, no one built a ship without the intention of using it in maritime transport, and in this sense the expenses caused by "risk" were an unavoidable item of capital "outflow". On the practical level, the difference is relevant, however, because many owners catered for "risk" by insuring their ships, and premiums paid were, and still are, understood as operational costs (although in principle they were merely redistributed risks). Therefore, it is useful to estimate these elements of capital loss separately. In the following, they will still be called "risk" and "depreciation".

How high were the risks of shipping in the late 19th century? A rough indication of how contemporaries saw it is that normal insurance premiums were around six per cent of insurance value a year.[39] This percentage, however, contained a safety margin; the first Finnish Mutual Maritime Insurance Association *(Sjöassuransföreningen i Finland)*, for example, could return around 20% of paid premiums to its members in 1850—1889 (and this period even included the Crimean war). The actual bill for sea-damage in the 1860s, when practically no steamships were insured, amounted on average to slightly less than 5 % of the total value of the fleet. This figure, of course, includes total losses as well as minor damage through rigging failure, grounding or collision; total losses, again, amounted to 3—4 % of tonnage.[40] As a rather large share of Finnish merchant tonnage belonged to the Association (see table 3:1), there is no reason to believe that the risks of other vessels were much different.

The risks for steamships might appear to be lower. As far as total losses were concerned, this actually seems to have been the case: according to the Finnish shipping statistics, the average amount of tonnage lost in shipwrecks between 1893 and 1913 was around

38 On the other hand, most of the actual wear which caused value losses also resulted from the active use of the ship.

39 Record-books of *Sjöassuransföreningen i Finland;* Hoving, *Finska sjöförsäkrings aktiebolaget*, p. 28—32.

40 Huldén, *Suomen merivakuutusyhdistys*, p. 12; Annual reports of the Association *(Protokoll fördt vid allmän bolagsstämma ...)*. The statistics published in the reports only accounted for the number of lost ships, which probably represented a slightly higher proportion of ship numbers than of total tonnage.

2.5 % a year for sailing vessels and only 0.6 % for steamships.[41] Yet, the difference in overall risk seems to have been smaller. Steamships visiting more harbours and narrow passages in a year than windjammers obviously had more than their share of collisions and groundings and so were most often charged the general 6 % premium. Finnish Maritime Insurance Association statistics for 1907—1913 (when they gave different accounts for steam and sailing-ships) show, however, that the total bill for steamers amounted to 2.2 % and for sailing vessels to 3.7 % of the respective insurance values.[42] Unfortunately, the statistics do not indicate whether iron-hulled windjammers fared better than wooden ones, but it seems that the general "risk" level of sailing ships decreased a little after the 1860s.

In real life, the costs were a little higher, perhaps one percentage point, because owners who had insured their ships paid more: their premiums had to cover the costs of underwriters as well. It may be said, however, that the difference consisted of money paid for services (and perhaps even for a feeling of security), and not a capital cost caused by "risk".

The rate of depreciation "proper" cannot be determined at a similar aggregated level. The whole idea of assessing the value losses of capital due to ageing and wear was strange to most shipowners. Assessments of depreciation can only be found in some accounts after the 1870s, and with one exception these were steamship companies. Thus, the only way to compute depreciation is to look at the new building or purchasing and selling prices of the ships for which all that data can be found. Even ships which were laid up or scrapped can be included (their end value is, of course, taken as nil), as can wrecked ships which were insured for their full value and for which the claim paid by the underwriters (which represented their end value) is known.

From shipowners' accounts (see chapter IV) and other possible

41 Finnish official statistics, ser. I and IB (shipping and trade, shipping).

42 *Ömsesidiga Sjöförsäkringsanstalten Sjöassuransföreningen i Finland*, reports for 1907/1910 and 1911/1913. The accounts of two Finnish maritime insurance companies (which even used to charge premiums of around 6 %) show such a difference between premium income and settled claims that a general "realized" level of "risk" at the beginning of the 20th century seems to have been around 3 %. *Finnish official statistics*, ser. XXII (insurance).

sources, reasonable data for almost 40 sailing ships were found (table 2:23). The modern convention is to calculate the depreciation as a percentage fraction of the remaining or depreciated value (that is, the value of the ship diminishes as a geometrical series). In historical material, however, this system may result in some odd situations. If a vessel was laid up, its end value should be taken as zero, which means that its original value divided by its end value is infinity. An arbitrary very small end value would, of course, produce a rational result, but it would be very sensitive to how low this end value was set. A much simpler way, therefore, is to compute an arithmetic mean by dividing the total value loss by the number of years of operation and expressing it as a percentage of the new building (or purchasing) value. This method produces much lower percentages compared with exponential depreciation, but these are by no means less realistic. Indeed, the actual price data conform rather well to it. Obviously the shipowners of the time were used to adjusting the value of their vessels (e.g. when the insurance value was determined or the selling price negotiated) downwards by equal annual amounts, "flat rate depreciation".[43] This method also has the advantage that undepreciated new building values (which, if not readily found, can be determined within reasonable margins of error) can be used in computing the actual value of depreciation — either for a whole fleet or a single ship — while the exponential method uses depreciated rest values, which are usually more difficult to determine.

The results are presented for four different categories of ships, depending on the one hand on whether they were domestically built or second-hand, and on the other on when they were sold, lost or laid up. It was assumed that the prices of sailing ships dropped faster after the "long depression" began. Differences between Finnish-built ships were, however, quite small and those sold before 1875 depreciated by the same amount as those sold after that date. Nor was there any significant difference between sold and wrecked (insured) vessels, which seems to give some reliability to the insurance values. In general, it seems that ships

43 Record-books of *Sjöassuransföreningen i Finland*. Norwegian shipowners also followed this custom, see Fischer and Nordvik, "From Broager to Bergen", p. 51—52.

TABLE 2:23. Rates of depreciation, sailing ships, 1860—1913. Per cent of new building-value.

Number of cases	Average tonnage	Depreciation, % per year Max.	Min.	Aver.
A. Ships built in Finland 1860—1875, sold etc. before 1876				
5	496	6.0	2.1	3.7
B. Ships built in Finland before 1880, sold etc. 1876—1900				
14	548	5.2	2.0	4.0
C. Ships built in Finland, sold etc. after 1900				
5	312	4.0	2.4	3.1
D. Second-hand ships				
15	1124	10.1	4.0	6.7

NB: "Sold etc." also denotes laid up vessels and total losses for which full compensation, the value of which was known, was received from underwriters.

Source: Accounting data, appendix IV:1.

which were used for a long time had lower rates of depreciation than average (see group C in the table). This was probably because they had undergone a massive rebuilding at some time. It seems that a realistic rate of depreciation for domestically built sailing ships was about 4 %; in other words, their typical "life-expectation" discounting wrecking was about 25 years.

Second-hand vessels clearly deviated from this relative uniformity. Their high percentages may at least partly result from the simple fact that depreciation here was compared with rather low purchase-prices (while contemporaries typically depreciated with equal decrements, these were not necessarily high compared with the new building prices). Another reason may be that many of them were bought during a boom period and sold when depression prevailed. There were also cases when an uninsured ship was sold after suffering serious damage, or a partly (or under-) insured one compensated by a rather small payment from underwriters. In any case, it seems that the balance of capital costs was slightly more unfavourable for sailing-ship owners during the last two decades of the period than it had been before.

No compatible data on actual transactions can be found for Finnish steamships. There are, of course, occasional notices of

prices paid for old vessels, but they are far from representative. The account-books of the Finnish Steamship Company *(FÅA)* contain complete data on capital values and annual depreciation for all their ships, but as the rates were arbitrary, they do not necessarily give a reliable picture of the development of current values. Indeed, when business was good, as around 1895, they depreciated no less than 6 % of the value of their fleet, while ten years later, when times were worse, they had to go down to 2—3 % (all percentages here are of depreciated rest values). For a longer run, ups and downs balanced each other and produced individual ship depreciation fluctuating around 2.5% of new building value.

This rate seems to be quite near what was regarded as realistic by contemporaries. This can be confirmed by looking at how steamship insurance values developed. For 10 ships which were insured by the Maritime Insurance Association for at least 15 years, and which did not experience substantial rebuilding, the insurance values dropped an average 2.4 % a year (max. 3.0 %, min. 1.7 %).[44] This suggests that the normal "life expectancy" of a steamship (if built of iron or steel, as were all ships referred to above, and not accounting for wreckage) was about 40 years.

It is quite obvious that steamship tonnage "outflow" was smaller than that of a fleet of sailing vessels. A difference in risks which was especially pronounced in regard to total losses has already been demonstrated, and the value of a steamship also depreciated more slowly than the value of a windjammer. It is not easy to combine the different items of capital "outflow" in a single parameter, not least because it is partly a question of imaginary expenses. In any case, if the "life-expectancy" of an iron- or steel-hulled steamer was over 60 % longer than that of a softwood sailing vessel, and if the difference in terms of total losses was greater still, the average "outflow" in the former case must have been only half of what it was in the latter. Earlier, it was estimated that regular new building of over six per cent of existing tonnage was needed in the 1860s and 1870s just to compensate for the tonnage "outflow" (selling excluded). In steamship tonnage, the corresponding rate would have been in the neighbourhood of three

44 Registers of *Sjöassuransföreningen i Finland*. The steamships in question were picked up from the sample which was collected in order to study the use of the tonnage (see next chapter).

per cent. Thus, the difference between gross investments and net capital formation was, in general, reduced because of the technical transition. This development, however, did not affect the Finnish merchant marine much because the proportion of steamships was so low until the end of this period.

The real value of the fleet and capital accumulation

As anyone who is familiar with national accounting knows, the real (or current) value of a capital stock is a rather ambiguous quantity. Ships, however, are not the worst possible item. They are continuously being bought and sold, which offers at least some reference data. During the period in question, both second-hand prices — although fluctuating from boom to depression — as well as the rates of depreciation showed such relative consistency that it seems meaningful to compute a series of the value of the capital stock in question.

In theory, this could be done by starting with the prices of new ships and applying to them the rates of depreciation computed before. Fortunately, there is another much simpler and far more representative method: insurance values can be found for all ships insured by the Maritime Insurance Association of Finland. These data were collected for the same sample years, 1865, 1875, 1885, 1895, 1905 and 1913, as the tonnage data, and it comprises values of over 700 vessels altogether.[45] This material is very representative of the larger size-classes (300 tons and over, see next chapter) and of ships which belonged to urban owners. Insurance values seemed to correlate quite well with actual prices, as was seen with steamships before. They probably did not follow the short-term fluctuations in every detail, but this is not necessarily a drawback in a description of long-term development.

Average insurance values per ton were computed separately for each sample year and size-class. As it seemed very likely that ships included in this data were in general of higher quality and more valuable than those which were not insured, the figures were modified in two ways. For 1865, 1875 and 1885, a separate set of values, 10 % lower than the average, was calculated for rural-

45 Registers of *Sjöassuransföreningen i Finland.*

owned vessels, and those below 100 tons were given an arbitrary value per ton of 100 marks (about £4). After 1895, non-urban vessels were not taken as a separate group, but all ton-values for sailing-ships in classes below 700 tons were lowered by 5 %, and all vessels under 100 tons were rated at 100 marks per ton. Furthermore, for 1905 and 1913, the insurance material was supplemented with the accounting-values of ships belonging to the Finnish Steamship Company (which were no longer insured by the Association), and the ton-values were counted separately for passenger-ships and ordinary bulk-carriers. Using these values per ton, the value of tonnage in each size-class and for the whole merchant fleet was easily calculated (table 2:24; values per ton can be found in appendix II).

These figures are, again, a rather dramatic expression of the extent of the stagnation in shipping after 1875, and of the modest recovery after the mid-1890s. Even in 1913, the nominal value of steam tonnage was lower than the 1875 figure for sailing ships. It is not surprising that the value of windjammers was decreasing all the time as the average age of the fleet, with the sole exception of small coastal vessels, was steadily increasing. It is more startling that the rising curve of the capital value of steam-tonnage apparently crossed the falling curve for sail only just before the turn of the century.

It is also significant that the nominal total value (as well as the real value if computed by domestic wholesale prices) was lower in 1913 than it had been in 1875. Although this kind of comparison contains elements which cannot be directly compared (for example, no account is taken of the fact that the increasing sizes of ships decreased building-costs per ton so that higher tonnage could be produced for less money), the figures prove at least that there was no positive capital accumulation between the mid-1870s and the 1890s. When the new but short investment boom of the 1890s came to an end, there followed a period when investments hardly exceeded the natural tonnage outflow and depreciation. Between 1905 and 1913, wholesale prices in Finland and abroad increased by around 20 %. The increase in the current value of steam tonnage was actually slightly below this rate, and for the whole fleet it was less than 6 %. Thus there was hardly any net capital formation in shipping after the turn of the century.

It is remarkable, although not unexpected, that gross

TABLE 2:24. Estimated current value of Finnish merchant tonnage, 1865—1913. Mill. Finnish marks.

Year	Sailing ships size-classes			Total	Steamships size-classes		Total	Grand total
	20>100	100>500	500—		20>500	500—		
1865	2.9	16.7	11.9	31.5	2.4	—	2.4	33.9
1875	2.7	23.3	13.2	39.2	6.6	0.9	7.5	46.7
1885	2.5	14.3	8.7	25.5	6.6	1.5	8.1	33.6
1895	3.0	9.5	5.8	18.3	7.0	4.3	11.3	29.6
1905	3.8	4.8	8.6	17.2	8.3	15.1	23.4	40.6
1913	4.0	3.2	8.2	15.4	8.6	18.9	27.5	42.9

Source: Appendices I and II.

investments for a greater part of the period were smaller than tonnage outflow. One reason might be that shipping generated too little income to enable the existing capital stock to be maintained. On the other hand, it is equally probable that the lack of investment resulted not from inadequate income but from failure to reinvest, that capital flowed out to other industries. Which explanation is more plausible will be seen once a clear picture of the economic returns of shipping begins to emerge.

3. Labour

As shipping was not labour-intensive, its quantitative requirements in this respect were not great. Demand for certain skills was, however, quite high. In Finland, as in many European countries, there were already formal qualifications for masters and mates in foreign trades at the beginning of the period. These were specified by a law which presupposed both formal examinations and years of practice. The diffusion of steam added its own skilled labour requirements, and in Finland the qualifications of engineers on passenger vessels were stipulated by law in the 1850s, and their education and training was arranged in the technical schools.[1]

In Finland, only a Finnish citizen could act as master or mate on a Finnish vessel and it was only in exceptional cases, such as if a ship lost one of its officers in a foreign port, that a foreigner could be hired.[2] At least in theory, similar limitations also applied to ordinary seamen, because in Finland they had to be shipped through the local *sjömanshus*. In practice, however, ocean-going ships, especially those which made long voyages, had international crews. Cheap Finnish labour rather than the law kept the labour market for Finnish shipping relatively restricted. The price of labour, of course, also had some bearing on how demand developed in terms of man per ton.

Sources of labour and wage information

No comprehensive and reliable statistics on the quantitative development of labour in shipping exist for Finland before 1918. Only in 1863—70 did shipping statistics include data on the number of seamen,[3] but these figures were inaccurate. They were collected from the ship-lists by the *sjömanshus* (towns) and *länsmän* (rural districts), which also gave the numbers of masters and seamen, the former in the form of a special roll of sailors.[4] It is

1 *Finlands Författnings Samling* 18.4.1859, 19.2.1879, 27.3.1890.
2 *Finlands Författnings Samling* 21.8.1851, 31.1.1863, 15.4.1874.
3 Finnish Official Statistics I:1—2.
4 See chapter II:1, note 11.

possible that the figures collected by the *länsmän* missed a sailor or two, but the town rolls certainly contained too many sailors, because they included all members of the *sjömanshus* in question, including those who were too old to sail.

It is not, however, too difficult to find more relevant data for seamen on urban vessels. Many of the ship-lists gave the number of sailors aboard along with other ship-specific data. Sometimes they only included their "own" men (that is, the members of the *sjömanshus* in question) but more often, fortunately, the total number of crew. This is enough to create a representative sample,[5] or rather a series of samples, which, like the ship-lists, cover the whole period. Moreover, for after the late 1870s, when "seamen's houses" were also established outside the towns, the material covers the whole country; before that it can, of course, be supplemented with the ship-lists of the *länsmän*. Many of the ships' accounts (see chapter III) also contain detailed data about the seamen aboard.

Data on wages are to be found both in the archives of *sjömanshus* and in ships' accounts. The former very often contain special series of crew agreements *(mönstringsrullor)* and data on wages were noted on the rolls *(matrikel)*. The ships' accounts, again, were often supplemented by special crews' accounts *(folkbok)*, which divulge not only the initial monthly wages but also any increases and total earnings. Crew agreements provide very extensive and representative material, while the crews' accounts show more precisely what the actual labour costs were.[6] As the development of monthly wages is not of primary importance to this study, exhaustive data collection in the archives of various *sjömanshus* was not regarded necessary and accounting material was mostly used instead. The data for steamship crews was, however, very limited. Since the Finnish Steamship Company (FÅA) accounts, which are by far the most important data on steamships used in this study, only supply the total wage

5 That lists of certain "seamen's houses" do not contain full details of the number of seamen seems to have no systematic connection with any relevant features of shipping.

6 Ships, and sailing ships in particular, were not fully manned all the time. After coming to a foreign port, men often jumped ship or left legally, and replacements normally only joined the ship just before it sailed.

bill and not individual wages, it was considered necessary to supplement them by collecting information about steamship wages from the archives of the Helsinki *sjömanshus* (as mentioned before, the town had a relatively large steam fleet from the beginning). Existing studies dealing with seamen's wages were, of course, examined.[7]

Crew size

The data on the number of seamen is a large sample of individual ships rather than a summary. It would therefore be logical first to determine typical manning levels, and only after that, and using these ratios, to estimate the total number of seamen. Average crew sizes are useful figures for other purposes, too: they provide a rather good parameter of labour productivity.

Crew size is normally gauged by comparing the number of officers and crew with ship tonnage (typically expressed as men per 100 net tons). This is very convenient, but it does produce a few complications. First, as is widely known, man-ton ratios diminished substantially when ships grew larger, and a 1,000-ton ship or barque, for example, needed only 60 per cent more men than a 300-ton brig. The rates were also different for steamships and sailing vessels; apart from very obvious differences in jobs, this was also related to differences in tonnage: compared with length and beam, steamships always had lower net tonnage than windjammers. Thus, man-ton ratios must be expressed separately for different size-classes and for sail and steam.[8] The man-ton ratios of sailing vessels are also often computed for different rigs, but the correlation of size and rig was, at least within one period,

7 See sources for tables 2:27 and 2:28.

8 Of course, an alternative would be to express the man-ton ratios as curvilinear regressions, separately for sail and steam. Apart from involving relatively complicated formulae, an additional draw-back is that the extrapolation of the data in order to estimate the total number of seamen would require the input of the individual tonnages of all ships, which is not feasible.

so high that it does not produce much new information.[9] Moreover, it should be remembered that seamen had many other tasks aboard than just trimming the sails, and the total amount of work depended mainly on the size of the ship.

There is a group of steamship personnel which presents special difficulties: those who took care of restaurant services on passenger vessels. Before the turn of the century, these restaurants were not usually kept by shipping companies but by independent entrepreneurs, who also hired their own people (the *FÅA*, for example, took over the restaurants aboard their ships in 1905). Therefore ships' accounts do not usually include them, neither did the "seamen's houses" mention them in their lists (however, they should be found in *påmönstringsrullor*, if the ship was sailing abroad).[10] It is obvious that their number had no logical relationship with the size of the ship; it depended rather on the size and quality of its restaurant. For this reason, these people were not included in the crew when computing man-ton ratios.

The development of manning levels is summed up in table 2:25. As the number of observations was relatively limited, the figures for steamships show some casual fluctuations. Therefore, the data are also presented in a more accurate form as curves of man-ton ratios by net tons (figure 2:2).

The data shows that, in size-classes below 500 tons, steamships required 60—80 per cent larger crews per net ton than sailing vessels, but in larger classes the difference clearly diminished.[11] In general, the ratios were remarkably stable; for steamships, especially, there was only a weak trend towards smaller crews.

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9 Eric W. Sager *(Seafaring Labour*, p. 208) presents a table which shows that there was no less than a 25—30 % difference in man-ton ratios between ships and barques. All the observations for the period 1863—1914, however, are summarized in this table which fails to indicate the gradual change from ships to barques which took place simultaneously with the general decline in man-ton ratios. Thus, the table somewhat exaggerates the actual differences between the two rigs.

10 Sundqvist, "Kvinnor ombord," p. 499—503. Although, by law, the *påmönstringrullor* of *sjömanshus*, also listed restaurant personnel aboard ships sailing abroad, their wages were not recorded.

11 As steamships normally had a net tonnage of about 60—65 % of gross tonnage, their manning ratios per gross ton were smaller than those for sailing vessels.

TABLE 2:25. Man-ton ratios in the Finnish merchant marine, 1865—1913. Men per 100 net tons, masters included.

Year	Size-class 19<100	100<200	200<300	300<500	500<700	700<1000	1000—
A. Sailing vessels							
1865	7.1	4.8	5.1	3.7	2.8	2.4	..
1875	7.4	5.0	4.0	3.2	2.6	2.1	..
1885	7.4	4.6	3.8	2.9	2.3	2.0	1.8
1895	7.8	4.7	3.7	2.8	2.1	1.7	1.5
1905	7.5	4.7	3.7	2.9	2.2	1.8	1.4
1913	7.8	5.3	3.8	2.9	2.1	1.7	1.3
B. Steamships (excl. restaurant personnel on passenger ships)							
1865	..	8.2	7.0	—	—	—	—
1875	(13.5)[1]	8.6	6.1	4.6	—	—	—
1885	12.9	8.5	6.1	4.9	2.7	—	—
1895	13.3	6.8	6.9	4.4	2.8	..	—
1905	11.3	6.5	6.0	4.3	2.8	2.0	1.9
1913	12.3	7.2	5.7	4.5	2.9	2.5	1.8

1 Only three observations.

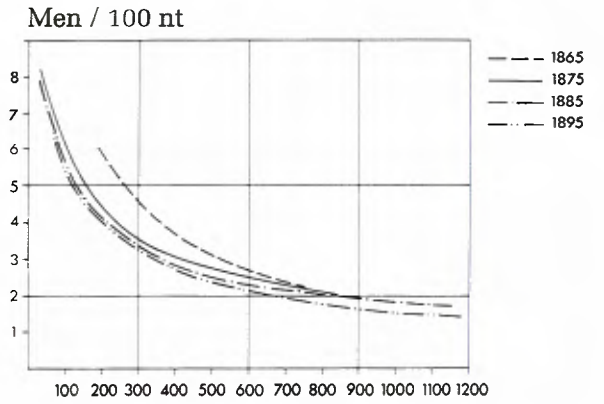
Source: Ship-lists of *sjömanshus* and *länsmän*.

Sailing vessels, on the other hand, seem to have experienced a trend towards more rational labour use in the 1860s and 1870s. With the exception of the two smallest size-classes, men per ton ratios dropped from 1865 to 1885 by 20—25 per cent. Most of this rationalization took place in the 1860s, and seems to have been connected with the general growth in ocean-going ships (see p. 55). A contributing factor may have been a direct shortage of experienced sailors at a time when tonnage was increasing rapidly.[12] The man-ton ratios still fell a little in the highest size-classes — but only in them — from 1885 to 1895, and after that there were hardly any changes.

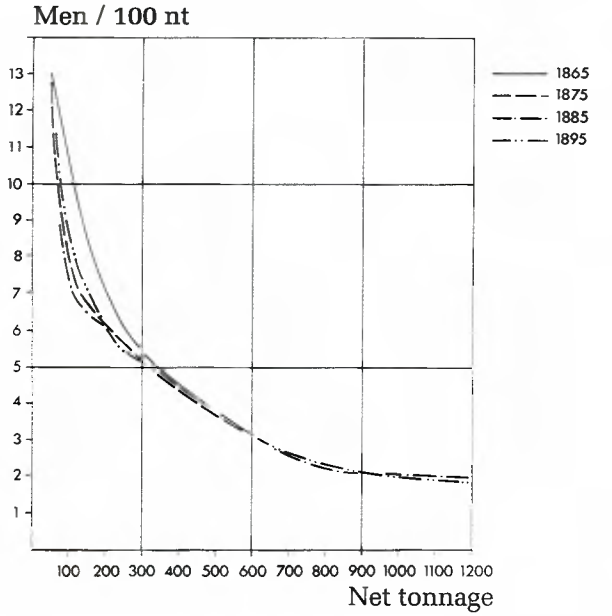
12 At least in Turku (Åbo), complaints about a shortage of seamen were voiced. Nikula, *Åbo sjöfarts historia*, p. 166.

Fig. 2:2. Man-ton Ratios in the Finnish Merchant Marine.

A. Sailing vessels



B. Steamships



Source: Appendix II:2.

In 1862, the board of the Finnish Marine Insurance Association expressed its opinion that Finnish ships had much larger crews than similar-sized foreign vessels.[13] Unfortunately, there are little data on man-ton ratios in different countries, but at least compared with North American levels, the Finnish ratios were quite generous. According to some Canadian studies, in the 1860s, normal man-ton ratios were 2.6—2.7 in size-class 250—499 tons, and 2.0—2.4 in the 500—999-ton class. In Finland in 1865, there were still 3.6 men per 100 tons in the 300—499-ton size-class, and 2.5 men in the 500—999-ton class, which means that there was a real difference of 10—30 per cent. This difference did not vanish when the Finnish crews diminished: quite on the contrary, the Canadian ratios fell equally fast and, what is more remarkable, continued to fall even after the 1880s. At the turn of the century, a Canadian ship of 500—999 tons had on average a 20—25 % smaller crew than a Finnish one of similar size.[14]

Because of high labour costs, the North American man-ton ratios were probably the lowest in the world, and therefore the Finnish figures may not have been excessively high compared with some other nations. At least British man-ton ratios were systematically 15—25 % higher: in the 1890s, for example, Finnish ships of 500—999 tons had on average 1.9 men per 100 tons while the corresponding British figure was 2.2.[15] This difference may partly have depended on the fact that British ships often carried boy apprentices, who were practically nonexistent in the Finnish fleet. On the other hand, Finnish owners had no strong motives to approach the American "under-manning" levels: ships engaged on ocean trades had to be prepared for long series of voyages, and as desertion was commonplace,[16] it was prudent to carry more than minimum crews. As long as Finnish labour was cheaper than foreign labour, this was also profitable.

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13 Nikula, *Åbo sjöfarts historia*, p. 164.

14 Sager, "Sources in productivity change in the Halifax ocean fleet", p. 104; Fischer, "The great mud hole fleet", p. 145; Sager, "Labour productivity in the shipping fleets of Halifax and Yarmouth", p. 162; Sager, *Seafaring Labour*, p. 202—204.

15 Sager, *Seafaring labour*, p. 215. See also Williams, "Crew size in Trans-Atlantic trades", p. 111.

16 Hautala, *Merimiesten karkaaminen suomalaisilta laivoilta*.

Total labour development

Once man-ton ratios have been computed, it is relatively straighforward to estimate the total number of seamen. If the extrapolation is done separately for sail and steam and for each size-class (and each sample year, of course) the resulting totals should reasonably accurately represent the total demand for labour. Because of a lack of data, the steamship figures for 1865 and 1875 are not very reliable, but as they were relatively few in number, the totals are not affected much.

Table 2:26 presents the development of the total number of seamen as well as of the different subgroups, even incorporating a rough estimation of restaurant personnel on passenger steamers. The figures show that the middle of the 1870s, not surprisingly, marked a turning-point in the growth of labour, exactly as it did in the growth of tonnage. The total figure of almost 10,000 men was never reached again; indeed, after the early 1880s, the level dropped below that of the mid-1860s for good. Even if there was a slight increase to well over 8,000 by the turn of the century, this was again followed by a slow decline.[17]

The total demand for labour fell somewhat faster than total tonnage. This was a result of two conflicting trends. The average ship size increased considerably and this meant, of course, that the demand for labour per ton declined. At the same time, however, the proportion of steamships rose, and as they required more men per net ton than sailing vessels, this change partly counteracted the effects of the increase in ship size.

Traditional coastal shipping by small and simple sailing vessels represented a constant and very conservative element; man-ton ratios remained practically unchanged. These were high on small ships and the vessels therefore employed quite a substantial number of men, 2,300—2,900. If they are disregarded, the decline in the demand for labour was still more dramatic: from 1875 to the 1910s it had fallen by no less than a third.

The demand for formally competent masters and officers dropped even more. Excluding coastal sailers, whose masters were

17 Kaukiainen, "Från jungman Jansson till Kalle Aaltonen", p. 354. In table 2:26, these figures are slightly modified as far as passenger steamers are concerned.

TABLE 2:26. Estimated numbers of crew and officers in the Finnish merchant marine, 1865—1913.

	1865	1875	1895	1913
A. Coastal sailing vessels				
Masters	814	666	694	912
Other crew	1,830	1,590	1,630	2,000
Total	2,650	2,250	2,300	2,900
B. Other sailing vessels				
Masters	481	655	398	248
Mates (incl. *konstaplar)*	780	1070	540	360
Crew	4,320	5,230	3,130	2,270
Total	5,600	6,950	4,050	2,900
C. Steamships				
Masters	26	46	117	203
Mates	30	50	140	260
Machine officers	35	75	160	280
Crew	140	360	760	1,410
Total	230	530	1,180	2,150
D. Restaurant personnel on passenger steamers				
Total	40	80	140	250
Grand total	8,500	9,800	7,700	8,200

Source: The figures are based on Kaukiainen, "Från jungman Jansson till Kalle Aaltonen" (HTF 3/1988), table 3 and *bilaga* 3. The number of restaurant personnel has been estimated on the basis of *påmönstringsrullor* of Helsinki *sjömanshus* and the data of steamships officers and crews, 1914—15, in the archives of *sjöfartsinspektören* (Ba:1, Ec:1).

not required to take an examination, the number of masters fell by 36 per cent from 1875 to 1913 and of mates (including second mates and so-called *konstaplar*, that is unqualified acting watch officers) by no less than 45 per cent. Again, the decrease was

mainly due to the rise in average ship size, but it was also helped by the fact that the requirements for the number of deck officers were quite liberal in Finland.[18] A decline in the number of the most expensive men, compared with the tonnage in business, was of course a boon to the owners, but it affected only those who had sailing vessels. Steamships also needed engineering officers, and this new category of qualified and well-paid personnel made up for most of the decrease in the number of deck officers.[19]

The price of labour

A typical feature of maritime labour was that the crew of a ship formed a hierarchical structure, where differences in position were also reflected in wages. Table 2:27 below shows that the highest wages were sometimes five to ten times more than the lowest ones. These figures do not include masters, whose earnings exceeded those of mates by even more, nor cabin boys, whose pay was perhaps a half of a *jungman*'s wage.

The table also shows one unsatisfactory feature of maritime wages. Although, in principle, a man's pay depended on how he was rated aboard, ranks of ordinary sailors such as *matros* (able-bodied seaman), *lättmatros* (ordinary seaman) or *jungman* (boy, or junior ordinary seaman) were not in any way universally defined. Neither were they based on examinations or ability testing, but rather depended on the owner's or master's subjective ideas about how skillful a man was and to what extent these skills should be paid for. Thus it is no wonder that there was no uniform wage

18 According to the act of 1874, which was effective until the end of the period in question, ships sailing on the Baltic or the North Sea required only one second mate *(understyrman)*, while on the Atlantic they had to have one mate, and only if they sailed beyond the line from Cape Horn to the Cape of Good Hope should they have both first and second mates. Steamships carrying passengers had slightly higher requirements on the number and quality of officers. Kaukiainen, "Från jungman Jansson," p. 359.

19 According to the regulations, a coastal steamer was required to have at least one qualified engineer and a "sea-going" ship, that is, one sailing day and night, at least two. In addition, ships often had engineering apprentices, who mostly acted as firemen but were paid somewhat more. *Finlands författnigns samling* 21.8.1851, 31.1.1863, 15.4.1874. The largest steamships usually had three engineers.

TABLE 2:27. Typical monthly wages for officers and sailors on foreign-going ships in Finland 1860s—1913. Finn. marks.

	1860s	1870s	1880s	1890s	1900—10	1910—13
A: Foreign-going sailing vessels						
(First) mate	+—100	110—120	100—125	95—125	90—115	110—150
Carpenter	40—65	50—70	45—70	50—75	35—60	65—85
AB *(matros)*	35—60	50—70	45—60	40—65	35—60	+—60
OS *(lättmatros)*	30—50	40—50	30—50	30—45	30—40	45—55
Boy *(jungman)*	15—30	20—30	15—30	15—35	22—30	25—45
B: Steamships						
First mate	100—140	120—175	150—200	200—250	175—200	175—225
First engineer	150—200	130—200	150—200	200—225	200—225	225—250
Carpenter	..	60—65	50—60	50—60	55—70	75—80
AB *(matros)*	45—55	40—65	45—60	40—50	45—60	45—70
Boy *(jungman)*	25—35	18—45	25—40	25—40	25—35	25—45
Fireman	40—52	35—60	40—50	40—50	40—55	40—60

Source: Ships' accounts (see appendix IV:1); Helsinki *sjömanshus, namnrullor, afmönstringsrullor*; Lybeck, "Sjöfolket i Raumo", p.550; Nikula, *Åbo sjöfarts historia*, p.166—167; Papp,"Sjöfolk i Vårdö", p.587—588; Börman, *Åboländsk byggdeseglation*, p.249—250.

scale. The various wage brackets (which may have been fewer than the three mentioned above) very often overlapped and a boy aboard one ship may well have had higher pay than an ordinary seaman on another.

There were, however, certain systematic differences in wages, mainly depending on the nature of the trade in question. The most distinctive of these differences was that men on board sailing vessels in coastal and Baltic trades (whose wages were not recorded in table 2:27) were paid clearly less than sailors in long trades.[20] Another systematic difference was found in the wages of

20 This can be clearly seen e.g. in Börman's figures from Kimito; the averages were clearly lower than those presented in table 28, because a large proportion of the sailors in this case were recruited for coastal or Baltic vessels (Börman, *Åboländsk byggdeseglation*, p. 249—250). See also Ahlström, "Sjöman i Helsingfors," p. 524.

mates: they were paid a good deal more on steamships than on sailing vessels. This may have been because of the high wages of first engineers (which obviously reflected the limited supply of the necessary skills); "first officers" (who were responsible for the cargo) would not have earned very much less. Surprisingly, the less experienced deckhands *(jungmän)* also had better than average pay on steamships. This may have been affected by the wages of firemen: their work was so hard that pay equal to or better than that of an OS on a windjammer was well justified. *Jungmän* had to do similar heavy work quite often — especially when the ship was coaling — and experience of traditional seamanship counted for very little.[21]

It is quite obvious that wages rose during the boom periods, both in the early 1870s and from 1911 to 1913. In both cases the increases were larger than the general increase in prices; thus, there was some real growth too. However, real growth was still better in the 1880s when prices fell and wages followed them only marginally. There was a special steamship boom, however, in the 1890s, when tonnage increased at a faster rate than ever before. This undoubtedly resulted in a great demand for officers, and their wages rose distinctively (and as prices then were quite stable, this also meant real growth). When the prospects of shipping worsened after the turn of the century, mates' wages were frequently lowered, and other pay levels also dropped slightly. At the same time, prices were increasing and the first years of the 20th century brought a substantial decrease in real wages.

Finally, a few words must be said about the man whose influence over the labour bill was decisive: the master. He was by

21 Wages were probably also affected by the fact that there were more married men past their twenties on steamships than on sailing vessels. According to an unwritten but well-followed rule, such men were paid more than young, unmarried men, irrespective of actual working ability. It has been claimed that only in the era of steamships, could being a seaman become a career. It is possible, however, that differentiation between temporary and very young sailing-vessel seamen and more or less permanent steamship men developed only after, say, the 1860s. Obviously, life aboard steamers which regularly visited domestic ports was more "civilized" and therefore suited older, married men. It was perfectly normal that 2/3 to 3/4 of all men on sailing vessels were under 30 years of age. See e.g. Ahlström, "Sjöman i Helsingfors," p. 521.

far the best paid individual aboard, and even though it is open to question whether he was a manager or an entrepreneur (many, indeed, had shares in the ships they sailed), and whether he represented business know-how rather than labour, his earnings were a cost to be met by the owner. In Finland, most masters, like their colleagues in Western Europe, received their pay partly as a monthly wage, and partly as a percentage of freight income, so-called *kaplake* (dutch *kapplake).*[22] The former, typically, was the same or somewhat lower than the mate's wage, up to 100 marks (£4) a month.[23] *Kaplake*, again, was almost invariably five per cent of gross freight until the end of the 1880s,[24] and this, of course, was much more money than the monthly wage. Later, when shipping profitability declined, many sailing ship owners dropped the percentage to four, and in some cases (usually when a new and inexperienced master was hired) even down to three. Some others tried to fix the commission to net income or profit.[25] In steamships, however, the trend was quite the opposite. A steamship master was required to pass a short examination in the principles of steam engines, and this obviously also brought them higher wages. A fixed wage became the norm during the boom of the 1890s, and the wages were good: depending on the size of the ship, they fluctuated between 3,000 and 10,000 marks per year. This development resulted in a clear differentiation of masters' wages in steam and sail. A slight levelling off took place at the end of the period. The increase in sailing ship size resulted in higher incomes for their masters, while the wages of steamship masters, on the other hand, were lowered somewhat during the depression of 1906—08; in fact, the trend followed that already found in the wages of steamship officers (see table 2:27).

The development of wages in the different categories does not,

22 Many shippers and shipping agents even used to pay master a small gratuity, but in Finland it was usually agreed between the master and the owner that this gratuity was wholly or largely paid to the owner.

23 Included in the master's wage are certain supplements (e.g. so-called "cabin provisioning money") which were paid on a monthly basis, but not money which was paid as compensation for expenses (e.g. so-called "land-going money").

24 On rural ships, however, a greater variety of percentages was used. See Börman, *Åboländsk bygdeseglation*, p. 256.

25 Ships' accounts (see appendix IV:1).

however, give an adequate view of the development of manning costs. The actual wage bill of a ship depended just as much on the structure of the crew and the combination of high and low skills as on the general level of wages. In sailing ships, in particular, the substitution of *jungmän* for some of the AB:s or OS:s made quite a difference to the total labour costs, and in this respect, crew composition varied a lot. Steamships, on the other hand, were always obliged to carry both deck and engineering officers, which substantially increased the payroll and made the wages of deckhands a lower proportion. Therefore, a better idea of the actual level of labour costs may be formed by looking at the average monthly wages of all crew members, including mates and cabinboys. This figure measures both the general level of maritime wages and the average levels of different ranks and skills among the crews at the same time. In principle, an even more simple method would be directly to calculate labour costs per net ton, but this figure should be obtained separately not only by decade but also by size-class (it would be affected, of course, by man-ton ratios). However, the wage data is drawn mainly from the accounting material, which is far too restricted to allow such a split. Moreover, an important element of the total labour bill, the wage of the master, was only remotely connected with tonnage.

The average wages of crewmen and masters are presented in table 2:28. Since the source material mainly covers relatively large vessels, the figures are not fully applicable to all kinds of ships. As the table shows, the average tonnages in the sample are always clearly above the national average: it may be said that the data represents sailing ships which sailed mainly outside the Baltic, and steam ships which ran on long coastal routes to Sweden, Estonia and Russia or further afield. It is also obvious that the average tonnages were somewhat different at different times, but fortunately, they developed in much the same way as the averages for the whole merchant marine (coastal vessels excluded). Moreover, the differences in tonnage affected average wages surprisingly little: there was practically no correlation between these variables for sailing vessels, and for steam, the averages began to fall noticeably only when the size exceeded 600—700 tons. Thus, in both groups, labour costs per ton developed in roughly the same way as man-ton ratios.

Table 2:28 shows that the average wages for crew members

TABLE 2:28. Averages of monthly wages of crew members (masters excluded, officers included) and of total earnings per month of masters in samples of Finnish foreign-going ships 1860—1913. Finn. marks and pounds and decimals.

		1860s	1870s	1880s	1890s	1900—10	1910—13
A: Medium-sized and large sailing vessels							
Av. tonnage, net tons		446	547	608	704	737	1,181
Crew	Marks	39.3	45.7	45.4	45.3	45.7	60.8
	Pounds	1.5	1.8	1.8	1.8	1.8	2.4
Masters	Marks	363	353	299	275	273	398
	Pounds	13.6	13.4	11.8	10.9	10.8	15.7
B: Medium-sized and large steamships (excl. auxiliaries)							
Av. tonnage, net tons		238	251	293	317	630	620
Crew	Marks	60.5	71.9	68.1	77.6	74.3	78.6
	Pounds	2.3	2.7	2.7	3.1	2.9	3.1
Masters	Marks	..	c.350	..	..	560	490
	Pounds	..	c.13.3	..	..	22.0	19.3

NB: Marks converted to pounds according to the average exchange rates of the four middle years of a decade.

Source: Ships' accounts (see appendix IV:1); Helsinki *sjömanshus, namnrullor, afmönstringsrullor.*

were, as expected, very different in sail and steam: with the exception of the last ten years or so, the former fell within the wage brackets of ordinary seamen *(lättmatroser)*, while the latter could be compared with the wages of carpenters or bosuns. Since steamships also required more men per net ton than sailing vessels, they were relatively expensive to man. Using the man-ton ratios computed before, the total wage bill (master included) of a normal (250 tons) steamer in the 1870s turns out to be about 5.4 Finnish marks per month and ton, while the corresponding cost figure for a normal (500 tons) sailing vessel hardly exceeded two marks. In the 1910s, again, the average, foreign-going steamer (around 550 tons) could be manned for about 3.4 marks, but the average sailing vessel trading outside the Baltic (around 750 tons) required only 1.6 marks per month and ton. If steam and sailing

ships of similar net tonnage are compared, the wage bill of the former was typically 50 % higher than that of the latter.

Indirect labour costs: food provisions

In addition to monetary wages, practically all sailors were fed and lodged aboard their ships.[26] With the exception of officers, lodging at the beginning of the 20th century was still of such a modest quality that it is very difficult to attach a cash value of any importance to it. Since it was also unthinkable to sail a deep-water vessel without having the crew permanently aboard, it seems impossible, even in principle, to make a distinction between costs of lodging and fixed costs in general. Food provisions, on the other hand, were a special item of running expenses, and even though the quality of food was often, and on long-traders especially, quite poor, it was in any case a typical natural benefit paid by the employer.[27]

The costs of food provisions are normally identifiable in the ships' accounts, if they are detailed enough. Unfortunately, many masters did not trouble to specify all cost items according to their final use but rather presented a ships chandler's bill containing both food and bosun's stores as a single lump sum. The value of provisions which were loaded at home before sailing abroad were not always specified either. All this means that sufficient data on food costs can be found only in a minority of accounts. Fortunately, the variation in figures seems to be moderate,[28] and

26 On a few passenger steamers, men were not fed by the ship but they could have their meals in the restaurant. In such cases, the men were paid about 20—30 marks more per month.

27 According to the modern system of national accounting, "wages and salaries" include all the remuneration an employee receives for his work, either in cash or in kind, including e.g. net costs for housing and food which the employer offers. As sailors usually paid nothing for these, total food costs must be included.

28 Food costs were computed from 44 sailing vessels' accounts (1858—1914) and for 34 FÅA steamships in 1905 and 1913. In the former group, the overall standard deviation was 4.8 (average = 32.8), in the latter 11.4 (aver = 65.2). The deviation in the latter case was larger probably because on some (but not all) ships which occasionally carried passengers, the food costs of passengers were included in the normal food bill.

TABLE 2:29. The average value of food provisions per man and month in the Finnish merchant marine, 1860—1913. Finn. marks, pounds and fractions.

Period	Sailing vessels		Steamships	
	FIM	£	FIM	£
1860s	33.5	1.25	..	..
1870s	34.5	1.31	..	..
1880s	32.2	1.27	..	..
1890s	27.3	1.08	..	..
1900—13	36.2	1.43	65.2	2.57

NB: Conversions as in table 2:28.
Source: Ships' accounts (see appendix IV:1).

therefore reasonable representativeness can be achieved from relatively few observations.

Table 2:29 shows that, at least on sailing ships, the food bill per man was quite stable; variations in it reflect price fluctuations rather than any real changes.

Even in this respect, steamships seem to have been more expensive. The data is, of course, quite limited and represents only one company, the *FÅA*, at the very end of the period. It is, however, quite possible that the quality of food was somewhat better on steamships. One reason is that, before the 1880s, most of them (auxiliaries excluded) carried passengers, and there was usually a restaurant aboard for them; the restaurant kitchen was also used to prepare food for the crew. It must also be remembered that the personnel on steamships included a lot of officers who normally dined better than common seamen (in a few cases even some passengers' consumption may not have been itemized separately from the crew's bill). Finally, a fraction of the difference arose because the value of food provisions aboard sailing vessels did not always include cabin provisions: the master often had to buy at least some of his food and drink himself, and he was paid a special allowance for this.[29]

29 This practice was common on e.g. ships from Turku (Åbo). The allowance *(kajutfourneringspengar)* typically amounted to 20 marks a month. See note 23.

TABLE 2:30. Average wages for able-bodied seamen *(matroser)* in Finland and some other countries. Pounds sterling per month.

	1860s	1870s	1880s	1890s	1900—10	1911—13
Finland	1.7	2.3	2.2	2.2	1.9	2.4
Norway[1]	1.8	1.9	2.3	2.8	3.0	3.4
England	3.1	3.2	2.9	3.0	3.0	3.1
British N-America	6.0	5.4	5.2	4.7	..	..
Europe, average	2.8	3.1	2.9	3.0	..	..

1 Averages of one-year (1860, 1870, 1880 etc.) values.

Source: Fischer — Nordvik, "From Namsos to Halden", table 1; Fischer, *International Maritime Labour, 1863—1900*, tables 2—3; Fischer, "A Dereliction of Duty," p. 66.

Despite the low quality of food, which was so often vividly described in memoires and other narrative sources,[30] its value was obviously not so trifling. Indeed, in the 1860s, the average value of provisions on sailing vessels almost equalled the average wages, and even later it represented some two thirds of them.

Finnish labour costs compared

It has been a common belief that the wages of Finnish sailors were quite low by international standards. This study has not produced anything to challenge this: all the monthly wages presented above were low compared with those on British and North American ships. The following comparison (table 2:30), which only takes into account one group of seamen, the AB:s or *matroser*, shows this very clearly.

Because the differences between the different ranks of common seamen were rather fluid, the comparison cannot be totally accurate. Neither can it be used to indicate differences in overall manning costs, because AB wages did not necessarily represent

30 See e.g. Kaukiainen, "Laiva Toivo, Oulu," esp. notes 32—35.

average crew wages. Both on British and Canadian vessels, the majority of ordinary sailors were rated as ABs, while they represented the elite of the forecastle on Finnish windjammers. Accordingly, average actual crew wages (master excluded, officers included) for Canadian vessels were slightly higher than AB wages[31] but in Finland they were 10—15 % lower (see table 2:28). The rates on British ships, with their boy apprentices, probably fell between these two. On the other hand, Canadian vessels were often able to hire crew abroad for lower wages than those paid in their home ports; according to Eric W. Sager, the average crew wages in the Windsor fleet fluctuated around £4 in 1863—1905.[32]

By observing the differences in both man-ton ratios and wage levels, it is possible to present a very rough estimation of relative wage costs in these three fleets. If Finnish average crew costs (master excluded, officers included) on a long-trading, 500—999-ton sailing vessel are given the value 100, comparative British and Canadian costs are rated as follows:[33]

about 1865, British 240, Canadian 205
about 1875, British 200, Canadian 160
about 1885, British 180, Canadian 145
about 1895, British 185, Canadian 150

It must be admitted that the data on the average wages of crew members, or wages per ton, is far from precise; moreover, indirect labour costs (the value of food provisions) should also be taken into account. The estimation, however, shows very wide national variations which must mainly represent real differences in manning costs. In the 1860s, in particular, Finnish shipowners were enjoying a massive comparative advantage; it certainly diminished after that, but it was still of importance at the turn of the century. It is a real pity that fully comparable data for Germany and France was not available; however, the average European wage

31 Sager, *Seafaring labour*, p. 217 (graph 14).

32 Ibid.

33 Man-ton ratios for sailing vessels of 500—999 tons according to table 2:25 (Finland) and Sager, *Seafaring labour*, p. 215 (Canada and Britain); average wages according to tables 2:28 and 2:30 (Finland and England, in the latter case AB wages reduced in all cases by £0.1) and Sager, *Seafaring labour*, p. 217 (graph 14, Windsor fleet representing Atlantic Canada).

was very close to the English level. It seems probable that Norwegian manning standards were roughly equal to the Finnish, and that the differences in labour costs between the two countries were fairly small. It was only after the turn of the century that Norwegian wages clearly rose above Finnish levels.

Many Finnish owners and masters found out that foreign sailors were used to better wages when they were obliged to recruit new men in big international ports. As indicated previously, it is quite possible that this wage differential also kept Finnish crews slighly larger than the lowest levels in Atlantic merchant marines: having an ample crew when sailing from a home port could postpone the day when the master had to take on an expensive foreign sailor.

Basically, the low wages of Finnish sailors reflect the general level of workers' wages in the country, as well as the standard of living. In Finland, able-bodied seamen were paid comparable wages to railway and urban consruction workers, and although AB:s represented the higher end of the maritime wage scale, it must be remembered that the other wages mentioned included no food. Ordinary farm-hands who were fed by their employer, on the other hand, earned about the same as, or slightly less than a *jungman*.[34]

At the beginning of the period covered by this study, in fact, Finnish maritime wages were quite good compared with those on land. There were two major reasons for this. First, as long as shipping was expanding, the demand for labour was high; and second, the high level of foreign wages compelled owners to pay better wages for ocean-going seamen than was necessary for domestic labour, so as to keep desertion rates tolerable. Later, however, the development of maritime wages was less favourable. The following figures (table 2:31) present indices of real wages for seamen and some typical land-based jobs.[35]

Over the whole period, both agricultural and industrial wages increased more than maritime wages. Since the demand for maritime labour had decreased during the shipping depression,

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34 Wage data on non-maritime professions from: Heikkinen — Kortteinen — Soikkanen — Soininen, *Palkat, toimeentulo ja sosiaalinen rakenne Suomessa*, appendix tables 4,9.

35 Heikkinen et al., *Palkat ...* , appendix tables 6, 10. All wages deflated by cost of living index (op. cit., app.table I).

TABLE 2:31. Finnish real wages, 1865—1913. Indices, 1913 = 100.

Time	Real wage index			
	Matros, average wage	Aver. crew wage on a sailing ship	Wage of a farm-hand	Aver. wage in manuf. industry
C. 1865	86	73	..	52
C. 1875	106	78	64	63
C. 1885	120	99	69	91
C. 1895	124	98	72	100
C. 1905	93	88	87	97
C. 1913	100	100	100	100

especially in the 1880s and 1901—08, this is not surprising. It is also a fact that desertion rates in the Finnish merchant marine diminished after the 1880s.[36] Accordingly, the factors which had earlier caused the raising of maritime wages to a somewhat higher level than that demanded by the situation on the domestic labour market were removed. It seems that the labour costs in Finnish shipping actually fell after the turn of the century, both compared with other industries at home and, as the case of Norway seems to indicate, with certain other merchant marines.

36 Hautala, "Suomalaisten merimiesten karkaaminen".

4. Capital, labour and know-how

During the last "golden" era of sail, Finland enjoyed comparative advantages in terms of both capital and labour costs. Because international data on building prices and seamen's wages is still rather limited, it is not possible to measure these advantages on a one-dimensional scale. It is, however, indicative that the building of sailing ships was roughly as cheap in Finland as in North America, and that the manning costs on long traders were roughly at the same level as in Scandinavia up to the turn of the century. Thus, it is appropriate to say that Finnish shipping represented a low-cost mode of production.

In the 1860s and early 1870s, wages were already rising, largely because there was a high demand for labour. The prices of the best tonnage also rose steadily. This was a result both of the technical difficulties of building large wooden hulls and of the growing proportion of imported material and equipment (sailcloth, paint, wire, metal structures, steering-gear etc.). The final blow for cheap ships came with the transition from sail to steam. Practically all Finnish steamships plying the Baltic and beyond were bought from abroad, and for prices of no comparative advantage.

During the depression which began in the late 1870s, the demand for labour declined, but as nominal wages fell less than prices (probably because of the undeveloped labour market), real labour costs rose. Accordingly, the advantage of cheap labour also seems to have diminished a little.

A new investment boom in the 1890s did not produce quite as rapid an increase in tonnage as that of the 1860s and early 1870s. It was, however, dominated by steamship acquisitions, and as most of them were new, and even included special winter and passenger ships, total expenditure was high. From a later perspective, it may seem odd that a low-cost country mainly bought new and expensive tonnage, but it must be remembered, that there were still relatively few steamships. Well-used (and by now mostly second-hand) sailing vessels had a clear tonnage majority, and thus low-cost shipping was still very prevalent.

In any event, the boom seemed to indicate that, even in Finland, the final transition from sail to steam was in evidence. However, just at this point, for some reason or other, developments deviated

from the path which led to the rapid substitution of steam for sail in Norway 1900—13, for example. It seems that the years of depression in the first decade of the 20th century were crucial in this respect. They also seem to have produced a change in the development of capital and labour costs. Wages were lowered in relation to domestic wages in general and to foreign maritime wages. At the same time, there was also a transition in steamship investment from new ships to second-hand tonnage. It seems, therefore, that Finnish shipping took one step back on the ladder of production costs. This may have improved competitiveness (if that was the problem) but it unfortunately made little difference during the great pre-war boom, and little fruit could be gathered before the World War brought normal development to an end.

Finally, a few words must be said about a factor which has so far been totally neglected: know-how and entrepreneurship. According to Joseph Schumpeter, these were the decisive ingredients in economic development, and today a kind of neo-schumpeterianism is well in evidence.[1] These views stress a very important point; even modern econometric analyses seem to indicate that economic growth depends at least as much, if not more, on certain qualitative characteristics (often dubbed "total productivity") of the factors of production as on quantitative increments of capital or labour.[2] Unfortunately, features such as know-how, or entrepreneurship, are very difficult to measure.

To say that the skill and know-how of shipowners and masters were important to the success of shipping is pure common sense. That some were better than others is self-evident, and thus also uninteresting, and only accounts for the inevitable unsystematic variations evident in the profit-and-loss accounts. What is interesting for an historian is whether there were any systematic, such as geographic, differences or changes over the period. Such variations can sometimes explain differences in the productivity of capital and labour.

Low-cost production is not uncommonly associated with a

1 A well-known advocate of this line of thought in Scandinavia is Erik Dahmén; see e.g. "Kan den företagshistoriska forskningen bidra till den ekonomiska teoriens utveckling?"

2 For one Finnish example see Hirvonen — Hjerppe, "Taloudellinen kasvu Suomessa 1880—1980" p. 172.

relatively low share of highly skilled labour, or a lower-than-average level of skills in general. What is known of the formal education of masters and mates[3] in Finland, however, does not indicate that the level was exceptionally low. The first three navigation schools (in Turku, Helsinki and Vaasa) were founded in 1812, almost four decades before formal examinations for masters and mates were required in Britain, and there were six of them by 1870.[4] The quality of these schools seems to have reached the normal Scandinavian level, and there was a steady improvement. At least in one critical area, knowledge of foreign languages, the standard was not very good in the middle of the 19th century: according to the 1851 act, the navigation schools only taught rudimentary German, French and English.[5] After 1863, only English was taught, but this was done more thoroughly: future masters were even trained in English correspondence. Better training was also given in economic geography and the general know-how of business conditions. Inclusion in the master's examination of great circle navigation after 1863 and the basics of climate, winds and currents after 1874 also brought about improvements in the ability to navigate the shortest and fastest routes.[6] Even though the board of the Maritime Insurance Association sometimes criticized the standard of Finnish ships'

3 Since 1765, Swedish (and Finnish) masters sailing in long trades were required to pass an examination. During the period it was possible to pass three different examinations in the Finnish navigation-schools; in hierarchical order they were: *östersjöskeppare* or *coopevardie (kofferdi) skeppare*, mate *(styrman)* and master *(sjökapten)* examinations. Before 1863, the mate's examination was the lowest one. *Östersjöskeppare* could act as master on the Baltic and the North Seas, but not further. On coastal sailing vessels, and also on the Baltic before 1863, no formal qualifications were required of masters.

4 *Finlands författnings samling*, 3.4.1812; Olin, *Åbo sjöfarts historia I*, p. 206; Sager, *Seafaring labour*, p. 94—96; *Bidrag till Finlands officiela statistik II:2* (1866—70), p. 33—34.

5 Finlands författnings samling 21.8.1851. See also Nikula, *Åbo sjöfarts historia*, p. 147; Ahlström, "Sjöman in Helsingfors", p. 529.

6 *Finlands författnings samling* 21.1.1863, 15.4.1874. An interesting point is that even Finnish masters contributed to the fundamental oceanographic work of M. F. Maury by sending him their observations of winds and currents. Accordingly, Maury's *Sailing Directions* soon became known in Finland. Nikula, *Åbo sjöfarts historia*, p. 146.

masters, it was quite high, at least after the improvements mentioned above. In fact, they and other Nordic masters received praise from abroad.[7]

An especially interesting feature of the know-how of that time was, of course, the competence of engineering officers. This was an area in which Finland almost totally lacked traditions, but in her semi-modern society of the middle of the 19th century, it was not difficult to organize the education of engineers, in particular since the common use of the Swedish language on the coasts made it very easy to find relatively up-to-date literature. There is nothing to prove that Finnish steamships experienced any troubles because of incompetent machine-room personnel, not at least from the 1860s onwards. On the contrary, Finnish engineers and steamship masters were found in some numbers on the river-boats of St Petersburg and even on the Caspian Sea.[8]

The case of entrepreneurs (shipowners) is more complex. Their abilities cannot, of course, be measured by any formal examinations. Obviously the owners present a very wide assortment of people, from the peasant who could just read and write to a trading-house owner who had served his years of apprenticeship in large continental firms, knew several languages and had wide foreign business contacts. Needless to say, the latter was immensely better equipped to deploy his ships in international freight markets. On the other hand, the former usually had the advantage in coastal trade and local markets, which required knowledge of local conditions above all else.

No comprehensive analysis of shipowners for the period in question exists[9] and therefore only some general observations can be made. Around the middle of the 19th century, the unquestionable top class of shipowners consisted of urban trading

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7 See e.g. Nikula, *Åbo sjöfarts historia*, p. 147—148; Norrvik, *Briggen Carl Gustaf*, p. 20 (subnote).

8 See e.g. Engman, "Sjöman från Finland i Ryssland."

9 Most sources used in this study, such as published and manuscript ship-lists, only mention the managing owner *(correspondent redare)* and the existence of other shareholders usually remains unknown. The insurance registers (see chapter III) record the precise shares of shareholders who insured their holdings in the ship. Only the ships' accounts (see chapter IV) record all owners and their respective shares, but this data exists only for a small minority of vessels.

houses, which also represented the highest level of business know-how in Finland. In 1859, twenty such firms or merchants owned roughly a third of Finnish tonnage, and much more of the biggest, ocean-going ships.[10] However, when the freight markets stagnated, the biggest trading houses were among the first to give up shipping. This trend was already evident in Wiborg and Helsinki in the 1860s,[11] and in the Bothnian towns after the early 1880s (see appendix I). Many of these firms began to concentrate their business on the sawmill and other industries, and reduced their foreign activities. They often also bought shares in new steamship companies, most of which only carried coastal traffic. The net result was a distinct change in the structure of shipowners: the proportion of owners, especially of sailing vessels, with limited or nil experience in foreign trading and with insignificant business contacts abroad, obviously rose. Of course, many "self-made" businessmen were just as smart as well-established members of the urban bourgeoisie. It does seem probable, however, that a negative development was taking place even in the imaginary stock of know-how.

Whether such potential impoverishment had any significant implications is difficult to say. In everyday business it was probably not felt much, because masters, with the exception of regular lines services, still had a remarkable role in decision making, and their qualifications, as well as the availability and standard of the services of shipping agents, were improving. The effects were probably felt above all in long-term decision-making, in investments and the choice of future strategies. This may be one explanation of the traditional attitudes (e.g. adherance to sail).

All this does not imply that shipping totally lacked innovative elements or high-level business management at the end of the 19th century. The few big steamship companies were undoubtedly examples of up-to-date organization, but they were small in number and concentrated in a few towns, mostly in the capital. It is interesting that members or descendants of former important trading house families were quite well represented among their

10 Mauranen, "Kauppa ja liikenne," p. 437; Finnish published ship-lists.

11 Tigerstedt, *Kauppahuone Hackman II*, p. 133—148; Kovero, "Helsinki liikennekeskuksena," p. 302.

shareholders.[12] In general, joint-stock companies did not became popular in shipping, and at the end of the period, the overwhelming majority of sailing vessels were still owned by individual owners or traditional one-ship companies. At a time when technical modernization required more capital than before, this kind of organization was not an efficient tool: the traditional companies could neither collect investment funds nor attract much capital outside the established core of shareholders. The slow acceptance of new company forms is just one aspect of long-term decision-making, which, as noted above, probably suffered from a lack of up-to-date know-how.

The change in the structure of ship owning could, of course, be just a reflection of the declining opportunities offered by shipping and of the fact that those with a better-than-average understanding of business economics were the first to draw such conclusions. There is, however, at least a shadow of doubt that the change in entrepreneurship was also the cause of or, at least a contributing factor to, the worsening fortunes of shipping. However, it is impossible to provide a definite answer without more information about the actual behaviour of Finnish shipowners.

12 See e.g. Suviranta, *Suomen Höyrylaiva Osakeyhtiö*, p. 20—23; *Wasa-Nordsjö Ångbåts Ab.*, p. 16—17.

III. Production

1. General problems of data and methods

The size and type of a ship always has some connection with the trade in which it is used and, therefore, the structural changes which were observed in the Finnish merchant marine give some indication of the structural changes in the deployment of the fleet. This connection is particularly logical in the case of small sailing vessels: most of them were so basic that they could only be used in coastal trade which, for geographical reasons, meant nothing more than trade to Sweden, Russia and domestic ports. As far as larger ships are concerned (which, in the middle of the 19th century, covered anything from a 200-ton schooner upwards) the picture is, however, much more complicated. This was especially true in the days when most sailing vessels were general-purpose bulk-carriers, which might sail almost anywhere. Accordingly, no meaningful picture of what shipping really was and how it developed can be painted without the background of a reasonable overview of the actual trades in which it was engaged.

The data

Finnish shipping statistics are not very helpful for collecting data on how and in which trades the ships were used. True, after 1856, they registered the traffic in Finnish ports (that is, the total tonnage of entered and cleared vessels), but the tables were published in a rather summary manner. Only from 1883 is it possible to find figures which specifically give the number and tonnage of Finnish

sailing and steam ships entered from or cleared for different countries.[1] Even then, the data is practically unusable as far as steamships are concerned; very many of them were engaged in regular line traffic which involved visiting a number of Finnish ports before sailing abroad, or after returning to home waters. Since they were included in the statistics of each port of call (and the tonnage was always register tonnage, not the tonnage of cargo loaded or unloaded), the figures were inflated far above the actual volume of traffic.[2] Only from 1892 onwards was distinction made in the shipping statistics between "direct" foreign shipping and "combined" domestic and foreign shipping, which meant that a passenger liner, for example, was registered only once per voyage (or twice per turnround) in the former category. Thus, it is only after that date that comprehensive and reliable data on all shipping by Finnish tonnage between Finland and foreign countries became available.[3]

Most sailing vessel traffic was "direct" shipping. Accordingly, it was normally registered only once each voyage,[4] and the export and import cargo figures are realistic even before 1892. For

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1 Finnish Official Statistics, ser. I. The original tables which the customs-houses compiled contained a good many details, especially after 1867, when a special form was used for them (see Finnish Official Statistics I:2, p. 1—2). Unfortunately, such basic material could not be found in the archives of the Statistical Office or the Board of Customs or the Senate. The search yielded only one useful piece of data; a working table for the year 1872, which specified the arrivals and departures of Finnish ships by country of departure and destination. The special archives of the Central Statistical Office of Finland XXIV:1.

2 See e.g. Finnish Official Statistics I:15 (1895), p. 15.

3 Finnish Official statistics, series I. Unfortunately, the published statistics do not specify "direct" traffic by nationality *and* motive power (sail/steam) *and* loaded condition (loaded / in ballast) *and* the port of departure / destination, all of which are required for the extraction of figures for the export and import cargoes of Finnish steamships and sailing vessels. The original working tables, however, have been preserved and they provide detailed data. *Tullstyrelsen* (The Board of Customs), ser. Hh *(merenkulkutilasto 1894—1916)*.

4 In 1895, e.g. only about 4 % of all entered and cleared loaded sailing vessels (irrespective of nationality) were registered in combined foreign and domestic shipping (and the bulk of these were in domestic traffic — the corresponding proportion of foreign traffic was only about 1 %), while the corresponding rate for steamships was 56 %.

"peasant" vessels, voyage data can be found even for the 1860s and 1870s: the ship-lists of the *länsmän* (see p. 39) contain information about their voyages.[5] However, three wide gaps in the data still remain: there is no information for urban ships before 1883, nor for all steamships before 1892. Most importantly, with the exception of some sporadic data from the late 1860s,[6] there are no real statistics on cargoes transported by Finnish ships between foreign countries. As this kind of "cross-trading" was a very important part of the shipping industry in those times, the deficiency is rather critical.

Fortunately, there are private archives which contain abundant information on the voyages of Finnish ships. By far the best are those of the Finnish Mutual Marine Insurance Association *(Sjöassuransföreningen i Finland).* This association was established in 1850,[7] and it grew so popular that the overwhelming majority of major urban shipowners were members in the 1860s and 1870s.[8] Thus, it also represented a rather large proportion of Finnish merchant tonnage. Most significantly, its register-books were carefully kept, and contained basic data of the hull, outfit and

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5 See chapter II, note 14. Unfortunately, after 1876—77, the lists were made only in Ostbothnia. For the best part of the 1860s there are only summary tables. Lists have, however, been found in the archives of the *länsmän* — see e.g. Börman, *Åboländsk bygdeseglation,* p. 8—9 — and copies of those of the Province of Wiborg, 1853—1864, are still in Wiborg *(Leningradskogo oblastnogo gosudarstvennogo arhiv, Vyborgskoje gubernskoje pravlenie, opis* no. 2).

6 As early as in the 1860s, the shortcomings of the statistics were recognized by the Finnish Statistical Bureau, as it began to collect data on how much freight Finnish ships carried between foreign ports. This effort, which mainly relied on information received from a number of shipowners in different towns, produced rather extensive statistics for 1868, but subsequently the material thinned out and became unrepresentative; after 1877 it was no longer collected. No consistent statistics can be reconstructed using these data. Finnish official Statistics I:2—3. Original material can be found in the Special archives of the Central Statistical Office of Finland, ser XXIV.

7 Activities began formally in 1850 as two distinct associations, West Finnish and South Finnish, but these were merged in 1859. Huldén, *Suomen merivakuutusyhdistys,* p. 8.

8 Only one really big shipowner, C. G. Wolff from Vaasa, did not join the association, but neither did he insure his ships with any other company.

classification, plus the voyages, sometimes even the cargoes of each single vessel.[9]

The manager of the Association (in Turku) received information from the company's own agents (who were in the biggest Finnish seaports), directly from owners and from published ship-lists such as the *Lloyd's List.*[10] All this resulted in very complete and reliable data on voyages; in typical cases, exact dates of arrival and departure are noted. A significant amount of this data can also be cross-checked as detailed account-books (see chapter IV) were found for a good number of the ships. When the information in the register-books was compared with the masters' accounts of voyages (and in some cases with log-books), which are primary and very reliable sources, no single substantial difference was found. There were a few instances when the register-books omitted a port call, but this was virtually never a port of loading or discharge. Thus, the Association's register-books seem very reliable. Moreover, they are very easy to use because all the data for each ship covering three consecutive years is to be found in one or two places in a single volume.

These register-books were examined for the same sample years (1865, 1875, 1885, 1895, 1905, 1913) as those for which total tonnage was checked. Data was collected not only on the voyages but also on insurance values (which were used in chapter II to determine the actual value of the merchant fleet) and some other characteristics of the vessels. In order to improve the representativeness of the data and to smooth out the effect of exceptional fluctuations, the samples were stretched beyond single calendar years. Each ship was followed for a minimum amount of time or number of voyages: in most cases, which concerned vessels used in long trading all the year round, this was either two years or eight voyages (cargo or ballast), whichever limit was reached first. If the voyages were unusually long, the time-

9 *Sjöassuransföreningen i Finland*, register-books. The charter ("octroi") of the association was originally for three years, and subsequently it was always renewed for similar periods. The register-books also cover similar three-year periods, beginning August 1.

10 Great numbers of agents' and owners' letters can be found in the archives of the association. In a few cases, the register specifically mentions that information has been drawn from a published ship-list.

limit was exceeded, but there were also instances (e.g. wrecked and sold ships) when it was not reached.[11] Ships which returned home for the winter were normally observed over one year (most often spring to spring, thus including laying-up time), but if two consecutive sailing seasons were very different, both were used. In practice, all this resulted in an average observation period of one-and-a-half years per ship. When the sailings of individual ships were summed up the figures were, of course, divided by the time in question so as to represent performance over one year (see appendix III:2).

In some respects, however, the register-books are not entirely satisfactory. For instance, they often lack detailed data about the voyages of steamships which sailed on regular coastal or Baltic lines and only indicate the line in question. Information on cargoes — and this refers to all ships — is also rather unsystematic and defective: in the majority of cases, there was no record of whether the voyage was made loaded or in ballast. Of course, with some knowledge of the general conditions of maritime trade, it is often possible to make an informed guess. Fortunately, there is also a parallel source. The Association did not underwrite cargo risks, but as there was demand for such activity, a subsidiary company, the Second Marine Insurance Association, was formed in 1860 (later, in 1907, they were merged).[12] In practice, it was run by the same people as the "First" Association and thus also has excellent register-books. They contain cargo data on all ships having at least one insured cargo (in addition, the Second Association also underwrote *casco* (hull) risks which exceeded the maximum limit set by the First Association).[13] Practically all ships which were insured with the Second Association had their primary *casco* insurance with the "First", and thus the parallel use of both register-books substantially supplements the cargo data. The

11 If a wrecked or sold ship was followed for less than a year, the time was always recorded as a full year. This is because such ships were included in the tonnage figures, and their lower-than-average production must be accounted for, otherwise the totals would be inflated.

12 Huldén, *Suomen merivakuutusyhdistys*, p. 22; Hoving, *Finska sjöförsäkrings aktiebolaget*, p. 11.

13 Archives of *Sjöassuransföreningen i Finland*, record-books of *Andra sjöassuransföreningen i Finland*.

account-books of individual ships (see appendix IV:1) also often yield similar information.[14]

Another, much smaller problem is that the orthography of the names of distant ports is sometimes so faulty that it is very difficult to identify the precise location. However, if the preceeding and subsequent ports, and the times required for passages were considered, it was usually possible to guess the port of call with reasonable accuracy.[15]

The representativeness of the data is a complex problem. It is obvious that the Association insured a large share of the Finnish merchant marine, more than half of all urban tonnage in the middle of the 1860s and, ten years later, almost three quarters. Different types, sizes and local fleets, however, were quite differently represented in its books. From the very beginning, the rules of the Association stated that only sailing vessels over 40 *lästs* (about 75 reg.tons), fitted out for trading outside the Baltic and owned by burghers in the Finnish staple towns, could be insured. This ruled out the coastal and Baltic fleets as well as vessels belonging to rural owners, and also steamships — obviously steam was still regarded as an unknown quantity. It was only in 1872 that the rules were amended so as to allow steamship insurance.[16] Southwest Finnish "peasant" shipowners, on the other hand, formed an insurance association of their own, *Åbo läns privata sjöförsäkringsförening* (The Private Marine Insurance

14 The percentages of ships with precise cargo information were as follows for the different sample years (N = percentage according to numbers, NTO = percentage according to net tonnage):

	N	NTO
1865	4	4
1875	36	36
1885	43	41
1895	32	35
1905	17	16
1913	16	20

15 Another difficulty is that many ports, especially in colonies which later became independent, have changed their name. A good source for finding old names was *Philips' Mercantile Marine Atlas* (1905). *Reed's Tables of Distances* was also useful.

16 Huldén, *Suomen merivakuutusyhdistys*, p. 8, 16.

Association of Turku Province), in 1865, and in 1874, a separate association was also set up in Åland.[17]

The representativeness of the register-books also depended on business cycles and the development of the insurance business in particular. During the depression of the 1880s, the number of vessels belonging to the Association dropped much faster than actual tonnage (see table 3:1), and in the 1890s, there was practically no recovery, thanks to the appearance of new competitors in marine insurance. In 1889, a company called *Triton* was established in Turku, and the Finnish Marine Insurance Company Ltd. *(Finska Sjöförsäkrings Aktiebolaget)* began its activities in 1898; it was after this date that the biggest steamship company in the country *(Finska Ångfartygs Aktiebolaget)*, left the Association.[18] On the other hand, the small associations which had insured peasant-owned vessels fared still worse, and their members began to join the "First" Association.

In order to arrive at a more balanced sample, it was therefore deemed necessary to supplement the register-books with some additional source material. The voyage data of rural ship-lists was, of course, exploited as long as it was available;[19] unfortunately these lists were no longer compiled in the 1880s, and "peasant" vessels were seldom insured by the Association. Although the archives of the "Private" Association of Åbo Province have also been preserved, their register-books contain little or no data on voyages. However, for the mid-1880s they do record voyages which were made after October and before May (they charged extra high premiums).[20] This material may seem rather scanty, but at least it indicates how common it was to keep ships sailing all the year round.

Additional data on ships sailing mainly on the Baltic were

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17 Hoving, *Finska sjöförsäkrings aktiebolaget*, p. 11.

18 Register-books of *Sjöassuransföreningen i Finland*, Hoving, *Finska sjöförsäkrings aktiebolaget*, p. 11—14. The director of the FÅA was very active in the founding of *Finska sjöförsäkrings aktiebolaget*, and therefore it was natural that his company left the Association.

19 Since this data was of a rather different nature, it was not included in the voyage sample. Anyway, there is almost 100 per cent coverage for 1875, and even for 1865, voyage data for almost half of the peasant tonnage can be found.

20 The archives of *Åbo läns privata sjöförsäkringsförening*, register-books.

TABLE 3:1. The representativeness of the sample collected from the register-books of the Finnish Marine Insurance Association (incl. some additional material) by size class.

A. Sailing vessels.

1 = Sample tonnage (net tons) percentage of total urban tonnage
2 = Sample tonnage (net tons) percentage of total Finnish tonnage

Size-class	1865	1875	1885		1895		1905	1913
(net tons)	1	1	1	2	1	2	2	2
20>100	11	10	11	1	1	0	0	0
100>200	39	16	14	5	9	5	2	2
200>300	67	61	44	9	32	9	4	9
300>500	60	76	58	24	32	12	12	11
500>700	56	95	68	51	68	35	19	39
700>1000	58	89	91	82	108	85	45	48
1000>1500	100[1]	40	87	87	82	71	75	69
1500>3000	.	.	.	.	100	100	100	69
Total	56	78	66	30	59	28	30	37
N of sample	179	172	119		74		59	54
Of these								
— peasant vessels (excl. Åland)	0	2	1		3		8	0
— Åland vessels	0	0	0		1		18	19

1 N = 1.

extracted from log-books, of which there are large collections in the archives of most "seamen's houses" as well as in the Maritime Archives of *Åbo Akademi*. The systematic collection of data from such comprehensive material was not possible, however, and therefore an arbitrary sample was taken from the ships of two West Finnish towns, Uusikaupunki and Rauma, where Baltic sailing was very common (as mentioned earlier, after the turn of the century, they had the only important Baltic sailing fleets apart from Åland). The *sjömanshus* archives contained hundreds of volumes of log-books, and the ones chosen were of sixteen

B. Steamships and auxiliaries.

Sample percentage of total Finnish steam tonnage
1 = Including all steamships in the sample
2 = Including only steamships with detailed voyage data

Size-class	1875[1]		1885		1895		1905		1913	
(net tons)	1	2	1	2	1	2	1	2	1	2
20>100	0	0	0	0	0	0	0	0	0	0
100>200	36	0	44	0	11	4	4	0	13	0
200>500	93	51	68	11	64	7	83	29	74	0
500>1000	.	.	100	100	84	84	79	52	80	50
1000>3000	.	.	.	.	.	.	39	39	50	43
Total	63	29	59	25	57	36	54	35	56	32
N of sample	20	9	21	6	28	14	42	22	50	20

1 Excluding an auxiliary from which the engine was removed in 1875.

Source: Appendix I and III:1.

schooners, brigs and barquentines, many of which covered long periods of time.[21]

Finally, the steamship data was augmented with material from the archives of the *FÅA*. These contain series of special accounts and positon lists, and it is possible to follow the voyages of the company's steamers even after they had left the Insurance Association.[22] In addition, the accounting material (see appendix IV:1) yielded new data on a few steamships and sailing vessels which were not found in the register-books of the Association.

These additions help to correct the worst anomalies in the sample, but it still remains skewed. As table 3:1 shows, the larger size-classes were always very well covered, while the data on the smallest vessels, sail and steam alike, was scanty at the outset and gradually thinned out to nothing. Although more "peasant" ships,

21 Archives of the *sjömanshus* of Uusikaupunki and Rauma. One log-book from the *sjömanshus* of Kustavi was also used.

22 The archives of *Finska Ångfartygs Aktiebolag,* special voyage accounts of ships (usually in two volumes called "Oceanbåtar" and "Östersjöbåtar").

particularly from Åland, were insured with the "First" Association after the turn of the century, coverage remains modest.

Thus, for the entire period in question, the sample offers a somewhat top-heavy collection of the best tonnage.[23] The skewness in tonnage also affects the voyage patterns: it is clear that the proportion of long trades (which involved large ships) is much higher in the sample than it was in reality. A good illustration of this is that, although the sample figures for around 1885 (see appendix III:2) are about 31,000 net tons of clearances a year from Finland for Southern Europe (the Iberian Peninsula and the Mediterranian) and only about 11,000 for the North Sea ports (including the whole of Britain), the shipping statistics record about 40,000 tons for the former and about 77,000 tons for the latter.[24] This means that coverage for tonnage sailing for Southern Europe was almost 80 per cent, but it was only around 15 per cent for North Sea trade. No such problems exist with the largest size-classes, however; it may be safely assumed that most sailing vessels over 700 tons were fitted out for and used in ocean trades. It was only at the very end of the period that many older wooden vessels in this size-class became unusable in anything other than North Sea trade. However, it can said that the sample gives a relatively good picture of freight business between foreign ports, and since there are statistics on traffic to and from Finland from 1883 onwards, its weaknesses in the latter respect (as far as sailing tonnage is concerned) are not an insurmountable problem.

There is a similar skewness in the sample regarding steamships. An additional difficulty arises because the number of observations, especially containing detailed voyage data, is usually rather small. In general, steam tonnage venturing outside the Sound (or later the Kiel Canal) was sufficiently documented, although there is one poorly covered area: there are only a few examples of ships which were occupied on irregular tramp freight business. The scantiness of voyage data for ships sailing within the Baltic before 1891 is also

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23 For example, in size-classes 300 to 700 tons, sailing ships with copper or zinc sheathing and fitted out for ocean-voyages were in a clear majority, while in the actual Finnish merchant tonnage (rural tonnage included) they probably amounted to a third or less.

24 Finnish Official Statistics I:7, table 7a, I:8, table 14.

a problem, because it cannot be supplemented with shipping statistics (see p. 130, above). Fortunately, there are good statistics of liner services for 1894 (and for that year only) which give, among other things, the number of voyages actually sailed on different regular routes.[25] With due care and in combination with the time-tables of different lines,[26] this information can be used as "bench mark" data to indicate normal traffic frequency on these routes. Indirectly, it also indicates how many steamships were engaged in other kinds of traffic, in other words, tramping. Finally, in autumn 1914, when war broke out, detailed data on all Finnish foreign-going steamships was collected, including information on the kind of traffic they were used for. This material also makes it possible to give an overview of the proportion of tramp freight traffic.[27]

How to measure sailing and production

An industry in which production consists of a great number of very different kinds of transport using very different vessels inevitably is difficult to represent with a simple and straightforward set of figures. Irrespective of whether the goal is to summarize total production or to describe the percentages of different trades, there is no perfect and all-encompassing unit of measurement. The structure and distribution of sea-transport is often studied by counting the number of entrances and/or clearances in different ports, either by simple frequencies or by using shipping tonnage as a unit of measurement.[28] From the perspective of the port, it would be logical to count the volume of cargo (usually measured in tons), and this does, indeed, describe an important and tangible aspect of shipping. Its value to the

25 Finnish Official Statistics I:14, table 10.

26 Timetables can be found in the daily papers and also e.g. between the leaves of the account-books of the FÅA.

27 Lists of steamships 1914, Archives of *Sjöfartsinspektören* (inspector of navigation), Ba 1, Ec 1.

28 See e.g. Alexander, "Output and productivity in Yarmouth ocean fleet"; Sager, "Sources of productivity change in Halifax ocean fleet"; Fischer, "The great mud hole fleet".

economy as a whole was relative to the amount of goods it was able to move from one place to another.

From the perspective of the ship, however, the essence of maritime transport is in the voyages, of which the ton is not a perfect measure. The time and effort a ship commits to transporting cargo was also a function of the distance covered, which could be anything from a short coastal trip to a haul to the other side of the globe. The ton, or any measurement of weight or volume which does not take distance into account, actually puts disproportionate weight on short transport. Therefore, it has become customary to gauge transport using measuments which combine both the amount of goods transported and the length of distance covered, such as ton-miles or ton-kilometers. This method produces a better comparison of transport on different routes.

However, even a sophisticated unit such as the ton-mile fails to measure correctly all the important elements in the production of seaborne transport. Moving a cargo from point A to point B is just one part of the total effort; the cargo must also be stowed in a ship and then unloaded. If the costs, time and labour involved are calculated, these harbour activities take up a substantial proportion of total production.[29] Moreover, they were not related to the length of the voyage but to the volume of the cargo.

In the big European and North American ports, however, loading and unloading were performed by specialized stevedores, and were not therefore produced by the ship and its crew (their job was to clean the holds and prepare the ship for its cargo). In coastal trade, in small Baltic harbours and in many Southern European and Far East ports, on the other hand, it was common practice for seamen to do the loading and unloading, possibly aided by a few local casual labourers. This whole problem, of course, could be avoided by considering loading and unloading apart from shipping production proper and categorizing them as "auxiliary activities of shipping". However, since the costs of these activities were incorporated into the freight, and either paid for by the ship or carried out by the crew, this is not the perfect solution. It would, however, be too complicated to try more sophisticated physical measurements. Moreover, the shortcomings of physical

29 Harley, "Issues on the Demand for Shipping Services", p. 68.

measurements are at least partly compensated by a third, very common measurement of production: monetary income and expenses (which will be introduced in chapter IV). However, money also has obvious limitations as a unit of measurement, and physical measurements should not be discarded altogether. It is obvious that a balanced picture of maritime transport requires the use of both.

On a practical level, there are some difficulties in measuring the physical volume of transport. Above all, the precise weight or cubic volume of goods carried in a ship are only seldom known. This information can sometimes be found in accounting material, but the data is far too scanty to enable total figures to be computed. On the other hand, a ship's measured tonnage can always be found. Although, in principle, it indicates the volume of available cargo space rather than of actual cargo, in practice, it is a good substitute for the latter. Practically all Finnish ships left domestic ports fully loaded and, in foreign tramping, the carrying capacity of most ships was utilized to the full. There were undoubtedly great differences in the stowage rates of individual ships, for example depending on whether they were loaded with light, high volume, or heavy goods, but in general the cargo weight or volume correlate with ships' tonnage well enough to enable the latter to be used as a measure of actual cargo carried. As far as passenger ships are concerned, this is a particularly attractive solution since it avoids all the problems of converting the number of passengers into some physical measurement.[30] For comparative purposes, register tons may also be converted to dead weight tons with reasonable accuracy.[31] Net ton, moreover, has the advantage of being the same unit used in Finnish shipping statistics to measure traffic to and from Finland.

In certain circumstances, however, tonnage is not accurately related to the volume of cargo. Sailing ships, for example, sometimes carried small, paying cargo instead of ballast, but were

30 Harley, "Issues on the Demand," p. 82.

31 In general, the ratio between gross ton and dw-ton was a rather steady 1:1.5—1.6, irrespective of whether it was a steamship or not, but since only net ton was normally used in the 19th century, this does not help much. For sailing vessels, the ratio of net tons to dw-tons was normally around 1:1.85, and for steamships 1:2.3—1:2.6, but as the latter dw-tonnage also includes bunkers, the ratio of net tons to cargo tons may have been 1:2—1:2.3.

nowhere near fully loaded. Steamships on regular lines also often had to count on much less than a full cargo — or a full complement of passengers — on certain legs of their routes. In both cases, there is no way of knowing the actual amount of cargo. A small error in the total figures therefore has to be accepted.

Establishing the distance between different ports is not too complicated. The idea is not to record how many miles a vessel sailed through the water, but rather to observe normal waterborne distance between any two points on the globe,[32] and standard tables of distances and similar sources are perfectly adequate.[33] Of course, sailing vessel routes in the 19th century were sometimes different from modern sea lanes,[34] and there were also some significant changes during the period in question. This happened because of the opening of new canals, such as the Suez Canal (1869), the North Sea Canal (Ijmuiden—Amsterdam, 1876) and the Kiel (Kaiser Wilhelm) Canal (1895). The Suez Canal had no direct bearing on Finnish shipping since very few steamships sailed to the Far East and sailing vessels regularly doubled the Cape. The other two, however, were frequently used (the Kiel Canal mainly by steamships) and must therefore be taken into account in establishing distances.[35]

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32 Attention is drawn to what the well-known master mariner J. C. B. ("Bracewinch") Jarvis said about sailing ship trade: "It wasn't the miles that counted in deep-water voyages: it was making best use of the ocean winds." (Cited in Villiers, *The War with Cape Horn*, p. 237.)

33 For this work I used *Reed's Tables of Distances* (10th ed., 1920), a modern *Brown's Nautical Almanac* and *Philips' Mercantile Marine Atlas* (1905). In very few cases, distances had to be measured on a modern geographic atlas.

34 E.g. the lane round South America nowadays passes through the Straits of Magellan instead of doubling the Horn, which was the standard passage for windjammers. On a voyage from California or Chile to Europe, this means difference of around 400 nautical miles, and from Australia to Europe, the difference is around 200 naut. miles. Needless to say, the actual mileage through the water was on average longer going westwards, against the prevailing winds, than eastwards.

35 It was assumed that from 1876 onwards, all vessels went to Amsterdam by the North Sea Canal instead of the Zuidersee. For sailing vessels, all distances were measured round Skagen, even after 1895, except in a few cases, when it is specifically mentioned in the sources that a port (always at the mouth of the Elbe) was reached by the Canal. The route of *FÅA* steamships was usually known. If this information was not available, it was assumed that steamships passed through the Canal. The Panama Canal was opened in August 1914 and therefore had no bearing on this study.

Accurate distances can only be determined from the data collected from the register-books of the Insurance Association or similar sources (the insurance sample). Shipping statistics merely give a breakdown of shipping by country of departure or destination and, similarly, the ship-lists of "peasant" vessels from the 1860s and 1870s usually mention the country to or from which the voyages were made. In these cases, the insurance sample data was consulted as far as possible, to find out the actual destinations and average distances covered by ships sailing to, for example, Germany or Spain. Failing this, the distance to the nearest, well-frequented port of the country in question was measured.[36]

As was mentioned above, many ships cited in the insurance records were followed for up to two years, and the period was extended on either side of the sample year in question. Thus, when cumulated transport performance is then divided by time so as to arrive at the figure for one year, the result does not, strictly speaking, represent the calendar year in question. This difference, however, is of no practical significance.

By far, the most complicated issue is how to compute the ton and ton-mile totals. Since only traffic from and to Finland around 1895, 1905 and 1913, plus corresponding sailing ship traffic around 1885, plus the voyages of rural vessels around 1875, can be scanned with practically 100 per cent coverage, a substantial part of the total must be derived by extrapolation from the insurance sample. The "unknowns" consist partly of certain shipping categories (steamships) and partly of certain trades (foreign tramping), and the only logical method is to perform the extrapolation using the same categories. Accordingly, the production of sailing vessels and steamships was computed separately, and both totals were estimated from the totals of their different trades. For 1865 and 1875 (and, to double-check, 1885, too) the former were divided into two groups, urban and rural tonnage.

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36 E.g. for peasant vessels sailing to England the distance was computed to Hull, which was probably their most important export destination. Incidentally, the distance from any Finnish port to Hull differs only slightly from the distance to many other English or Scottish East coast ports.

Sailing vessels represented a far wider variety of different trades than steamships and, therefore, are more complex to deal with. As already mentioned, the insurance sample had an obvious bias towards longer trades and traffic to the North Sea ports, for example, was not well covered. It is quite clear that there was a division of labour between different vessels, and the choice of trade was related primarily to size, but also to quality (e.g. copper-sheathing was required in ocean trades). Quality is difficult to assess but, fortunately, there was a rather strong correlation between size and quality, at least after the late 1860s, when small, ocean-going schooners disappeared. Thus, the basic assumption may be made that the representativeness of the figures for different trades depended on the average size of ships engaged, just as the representativeness of the whole sample varied according to size. This principle was directly followed for long, Atlantic and World, trades: for each year, the average vessel size was computed and the sample coverage was assumed to be the same as that for the size-class within which this average tonnage fell.

For shorter trading, a few amendments were necessary, however. Baltic trades were so thinly represented in the insurance sample that, before the mid-1880s, as far as urban vessels were concerned (for rural vessels there was data in the ship lists), the traffic could only be estimated on the basis of potential Baltic tonnage. As suggested previously (see p.138), there was also a huge difference between the coverage rates of North Sea and South European trades. It is quite clear that mainly urban vessels with copper sheathing sailed to Spain and the Mediterranean, and they were better represented in the sample than their average size would suggest. This presents no problem for the years after 1883, as the total figures for the respective export and import trades can be obtained directly from the statistics (the sample should also reveal, in roughly the right proportions, the occurrence of tramping compared with export and import transport in those waters). For the 1860s and 1870s, again, only urban tonnage is affected, as the voyages of rural vessels are covered relatively well by the respective ship-lists. A comparison of the sample and the statistics for 1885 indicated that coverage for South European and Mediterranean trades was just as good as for Atlantic business, while coverage for urban vessels carrying goods to North Sea ports was about as poor as the sample percentage of ships in the size-

class 300—500 tons.[37] These guidelines, then, were followed in estimating the traffic to the North Sea and Southern Europe by urban vessels in 1865 and 1875.

For steamships, the procedure was more simple. Since both the total extent of line services in 1894 and the tonnages engaged in different lines and tramping trades in 1914 were known, the extrapolation of the sample data between those dates was not complicated. Starting from these "bench mark" years, statistics of steamship traffic from and to Finland can also be used to show fluctuations in individual traffic routes and areas, in spite of the multiple recording mentioned above. For earlier years, again, the numbers are low enough to make it practicable to follow the few boats sailing to the Southern Baltic and to the North Sea individually.

Coastal trade to Russia and Sweden in the 1880s and earlier presents a similar problem to that encountered with sailing ship cross-trade; this was also solved by analogy, supposing that the insurance sample represented the same proportion of traffic as of tonnage in the relevant size-classes. The estimate was, furthermore, cross-checked by ascertaining that it developed in a roughly similar manner to the "gross" figures (including multiple registration) found in the shipping statistics.[38]

Finally, a practical definition of "different trades" needs to be arrived at. For a master or ships' agent, "trades" were quite specific things, transport of certain goods from a port (or a group of ports) of origin to a common destination; so they could speak of the Baltic wood trade (often divided into the Gulf of Finland and the Gulf of Bothnia sectors), or the Black Sea grain trade, or pitch-pine trade, or Far East rice and teak trades. In a statistical description, such detailed identification, apart from often being impossible because of lack of detail in the data, is, however, quite unreasonable. If the analysis is to go any way towards presenting an overall view, the perplexing variety of ports and trades must be condensed into a manageable number of classes.

A substantial part of the data, shipping statistics, already

37 The total coverage for North Sea trade in 1885 was as low as 15 %, largely because the insurance sample for that year only includes one rural vessel, while the majority of the traffic in question was carried by these ships.

38 The extrapolation procedure is reported more fully in appendix III:2.

presents figures for entered and cleared tonnage according to countries of departure and destination. The principle of a pure geographical classification is quite acceptable, provided a distinction is made between export, import (in relation to Finland) and cross-trade cargoes. It is not necessary to identify all the different countries, however; it is more practical to define the natural areas of navigation. The competence requirements for masters and mates, the "trade" categories in the classification system of *Bureau Veritas* and, accordingly, the voyages made by a vessel — before 1868 even the "lawful" revires of "peasant" ships — were defined according to similar natural boundaries.

These principles, applied to the realities of late 19th-century shipping, resulted in six natural areas of navigation. Starting from the "core", Finland's own coasts, they were:

1. Coastal waters, or the Gulfs of Finland and Bothnia and the Northern Baltic. As domestic transport is not included, in practice, this means trade with Russia and Sweden.
2. The Baltic, in practice trade to Denmark and the Baltic coast of Germany.
3. The North Sea, including all British and Irish ports, the South of Norway and the French Channel ports.
4. Other European waters, north of Stavanger and south of Ouessant, including the Mediterranean and the Black Sea.
5. The Atlantic, down to the line from Cape Horn to the Cape of Good Hope (and, of course, excluding the European coasts).
6. The rest of the World ("World trades").

According to this system, each voyage was classified by the most distant port of loading or discharge, even when most of the sailing took place nearer to home. The division is not very different from that applied in the shipping statistics: although the boundaries sometimes do not coincide with national ones, the deviations are not significant.[39] Only in one case, the French ports, was there conflict between different sources, since Finnish shipping statistics do not make any distinction between the Channel and

39 From 1892, Finnish shipping statistics distinguish between the Baltic and the west coasts of Sweden, as well as between the Baltic and the North Sea coasts of Germany.

Biscayan ports.[40] It might also have been useful to distinguish between North and South Atlantic trades, but there were usually so few cases of the latter in the periodic samples that separating them would have involved a significant risk in extrapolation.

Simply measuring ton-miles, however, does not produce the full picture of the trends and structures of shipping. Although it is possible to present a breakdown of total figures by different trades, the tons and ton-miles do not give answers to all the relevant questions. The overall development of the freight market, and factors affecting it, dictated the real options for steamships and sailing vessels. At different times, there were different combinations of outward and home cargoes which experience had shown to be profitable, and there were also different optimal cargoes for different types and sizes of vessel. All these are things which can only partly be expressed within quantitative dimensions. Different combinations of voyages may, of course, be picked up from the data but, because of the great number of different ports of loading and discharge involved, a statistical analysis is bound to be very complicated. Needless to say, the same applies to connections between the economic environment and the behaviour of Finnish shipowners and masters. Obviously, a traditional, historical narrative will be a necessary and useful additional tool.

40 Since 1892 there has been a distinction between Mediterranean and other French ports. A good number of small sailing vessels usually visited French Channel ports, while steamship lines more often touched Bordeaux. By consulting other sources, a fair estimation of the relative importance of Channel and Biscayan ports can be made.

2. The development of trade

In principle, a Finnish ship engaged in foreign trade either sailed between Finland and other countries carrying export and import cargo, or "tramped" between foreign ports in so-called "cross-trade". In the first half of the 19th century, these activities differed in one respect: practically all shipping to and from Finland was protected by *produktplakatet* and special customs dues for foreign ships, while in international trade, Finnish ships were naturally not similarly favoured. However, by the end of the 18th century, Finnish "blue-water" shipping had already stepped outside the protected circles of the country's own export and import business: in addition to the normal "shuttle" trade to Spanish and other salt-loading ports *(spaniefart)*, ocean-going ships began to carry freight on the Mediterranean and other southern waters during the winter.[1] This cross-trade increased substantially in the second quarter of the 19th century and, as mentioned earlier (see p. 22), by the 1860s, the great majority of ships belonging to urban owners passed the winter outside the Baltic. The increasing popularity of freight-carrying in foreign waters at that time was quite understandable. Not only was it possible to carry on sailing when the Northern waters were ice-bound, but foreign tramp freight also helped to compensate for the permanent lack of import cargo. At least before the 1870s, international trade in general increased faster than Finnish foreign trade; moreover, the volume of goods carried on west European or Mediterranean routes, for example, was so large compared with what was exported from Finland, that there seemed to be room for an almost limitless growth in trade for the small northern fleet. Accordingly, carrying foreign goods was not limited to when the northern Baltic was covered with ice, and even became the full-time business of some ships.

The growth of tramp-freight, of course, meant that an increasing proportion of Finnish shipping was subjected to free international competition. This trend was further strengthened by the *de facto* abolition of *produktplakatet* and other special rights of domestic

1 See e.g. Olin, *Åbo sjöfarts historia I*, p. 176—177, 185—186; Alanen, *Der Aussenhandel und die Schiffahrt Finnlands*, p. 379—382 (and sources mentioned in loc.cit.).

ships (see p. 27). As tonnage still continued to grow after the liberalization of navigation legislation, Finnish shipping was clearly competitive and had succeeded in taking a tolerable market share of international maritime transport. Of course, in an expanding market this was not too difficult for a relatively small fleet, which was also favoured by the comparative advantages of cheap tonnage and cheap labour. The situation changed after the 1870s, however, at least in one fundamental respect. There was always some division of labour between the transport of valuable, light goods and cheap bulk products,[2] but with the advent of steam the distinction grew sharper than ever. In many of the best trades, steamships became market-leaders; this actually created a market division in which the "second-class" freight was left for sailing vessels. Soon the demand for sailing tonnage stopped growing, and gradually began to shrink.

Because of this development, it seems practical to examine the freight markets of sailing vessels and steamships separately. However, there was also a third category of shipping in Finland: traditional coastal trade by sail was a special, non-competitive sector, at least in the sense that it was tied to local resources and other factors of production which were not accessible to foreigners.[3] Many of the coastal passenger steamers should, in fact, be counted in the same category, although, in that their traffic was confined to domestic waters, they fall mainly outside the scope of this study. Humble sailing trade to Sweden and Russia is also peripheral in this respect, but there is one aspect which should be noted here. For certain owners of foreign-going sailing vessels, in rural districts in particular, coastal trade always counted as an alternative opportunity, especially if international freight declined. Rather than giving up the business altogether, affected owners could return to traditional small-scale shipping.

2 See e.g. Unger, *The Ship in the Mediaval Economy*, p. 28, 34—35.

3 Apart from requiring lots of local knowledge, engaging in coastal trade (so-called *cabotage)* was difficult for foreigners because they were not allowed to carry freight between Finnish ports.

Sailing ship trades

Different ships for different trades

During the latter half of the 19th century, there were practically no legal requirements in Finland covering the seaworthiness of sailing ships. In theory, any vessel could sail as far as the competence of its master permitted. In practice, however, not only common sense but also the activities of classification societies, such as Lloyd's Register and Bureau Veritas, created a division of labour based on the quality and outfit of ships. In the "golden decades", the 1860s and 1870s, it was becoming increasingly difficult to charter an unclassified vessel in Atlantic or longer trades.[4]

Economies of scale also meant that longer trade required larger ships. Table 3:2 below shows that ship size correlated strongly with the trade for which it was used. Coastal vessels were very modest in size and the bulk of Baltic traders were under 200 net tons. The strong correlation, however, does not mean that ships within one size-bracket always sailed in one and the same trade. With the exception of small coastal sailers, most ships normally carried goods on pure "tramping" principles where (within the confines of what their classification or the quality of outfit permitted) it seemed to be most profitable. Thus, different ships usually had rather wide "bands" of sailing waters and a vessel normally trading within the Baltic, for example, now and then carried a cargo to the North Sea ports, and many long-traders carried wood cargo either to British ports or to Spain as the first leg of their cross-trading adventure.

In a few cases, the economics of shipping disturbed the correlation pattern between long trade and big ships. Surprisingly, ships crossing the Atlantic were, on average, slightly smaller than those sailing in the Mediterranean and other European waters.

4 See e.g. Norrvik, *Briggen carl Gustaf*, p. 47. Bureau Veritas, which was more popular in Finland than Lloyds, made a distiction between ships which were allowed to sail on the Atlantic (class "A") and on "long trades" (class "L"), depending i.a. on how high they were sheathed with metal. Ships with no metal sheathing could be classified for "great coasting trade", including the Mediterranean. See "Regulations for the Classification of Wooden Vessels", art. 3, *Veritas. Registre International de Classification des Navires.*

TABLE 3:2. Average sizes of Finnish sailing vessels in different trades, 1865 and 1875. Net tons.

Trade	1865	1875
Coastal trade to Russian ports[1]	29	25
Coastal trade to Swedish ports[2]	53	66
Exports to other ports on the Baltic	125	150
Exports to the North Sea ports	c.350[3]	325
Exports to other European ports	347	390
Exports to other continents[4]	189	340
Cross-trade in European waters (excl. the North Sea and the Baltic)	415	419
Atlantic cross-trade	385	586
World cross-trade	646	775

1 Average size of vessels cleared in the coastal customs check-points in the Province of Wiborg (excl. Ladoga coast).
2 Average size of vessels cleared in the Åland customs-houses of Eckerö and Degerby.
3 Estimation based on the insurance sample and the preserved ship-lists of coastal parishes.
4 Only three cases in each year.

Source: The register-books of the Finnish Marine Insurance Association; ships-lists of coastal parishes; data on clearances in Finnish customs-houses, *Finnish Official Statistics* I:2, the special archives of the Central Statistical office of Finland XXIV:1.

This was simply because in certain Trans-Atlantic trades, such as carrying sugar or rum from the West Indies or coffee from Brazil, the "handy size" was still quite modest. Indeed, the low average of export trade from Finland to other continents mostly reflected the fact that coffee was imported in small schooners, which often first took a cargo of sawn goods to Brazil.

Later, such small-scale traders gradually disappeared and the general increase in ship size further strengthened the correlation between tonnage and trade. As table 3:3 shows, average tonnage grew on practically all the major routes. Only in a couple of traditional areas, coastal trade to Sweden and Mediterranean trade (including cross-trade to and from these waters), was the opposite

TABLE 3:3. Average sizes of Finnish sailing vessels in different trades 1884/86, 1894/96, 1904/06 and 1912/13. Net tons.

Trade	1884/86	1894/96	1904/06	1912/13
Coastal to Russian ports	36	46	51	61
Coastal to Swedish ports	63	69	58	57
Exports to ports on the Baltic	204	233	285	290
Exports to the North Sea ports	328	358	410	462
Exports to other European ports	446	526	442	452
European cross-trade (excl. the North Sea and the Baltic)	499	626	608	..
Atlantic cross-trade	685	854	949	1,031
World cross-trade	947	1,142	1,432	1,795

Source: The register-books of the Finnish Marine Insurance Association; data on clearances in Finnish customs-houses, *Finnish Official Statistics* ser. I.

the case, but both were losing importance in relation to other alternatives. Since small schooners and brigs had also practically disappeared, the correlation between size and trade grew all the stronger. The difference between ocean-going vessels and those sailing on the North Sea and other European coastal waters grew substantially, and at the end of the period, the former mostly consisted of iron and steel ships of over 1,000 tons.

The most interesting dividing line between different trades is that which separates cross-traders from vessels which only transported goods to and from Finland. In practice, this division was the same as that between ships sailing only on the Baltic and the North Sea and those going further afield; it also separated ships sailing only seasonally from those which were employed throughout the year. However, like all other dividing lines between different trades, this one was frequently crossed by individual ships: ships engaged in any cross-trading activity varied from those which only occasionally carried a cargo on the Mediterranean to the equally extreme case of a ship which left Finland in ballast and returned home for a hasty refit after five years or more, also unloaded; and among ships which kept sailing

during the northern winter were always some which only went to Spain with wood from Finland and returned home next spring with a cargo of salt, thus carrying on the traditions of old *spaniefart* in its simplest forms (see p. 177). So, by all definitions, there was a rather large "grey area".

Although the distinction between long trade and "full-time" sailing on the one hand and summer-time North Sea and Baltic trade on the other was quite diffuse, it is still tempting to try to measure, however roughly, the proportion of tonnage normally engaged in either one. For statistical purposes, the most practical distinction is whether ships were laid up for the winter or not; for analytical purposes, it is more relevant to know which ships sailed "full-time" than to ascertain which carried, say, at least one cargo between any two foreign ports. The insurance registers also furnish reliable data about the actual sailing period: since *ristorno* (refunding of insurance premiums) was granted for the laying-up period, it was also carefully noted.

The source material for the 1870s is full enough for very reliable exrapolation to be made; not only does the 1875 insurance sample cover almost 80 per cent of all urban tonnage, but there is also an almost complete series of rural ship-lists. This material quite convincingly shows that very few urban vessels under 200 tons sailed on long trades or during the winter, but that in the size-class 300 to 500 tons, they were in the clear majority and among larger vessels, any winter lay-up was highly unusual. The material is not quite as comprehensive for the preceding decade, but it is very clear that, as with ocean-trading schooners, there were more long-traders in the small size-classes, and in the 300- to 500- ton class, only five percent of insured tonnage returned home for the winter.[5]

The above only refers to urban tonnage. As already noted, "peasant" ships were in general more modestly equipped: for example, they normally lacked any kind of metal sheathing. This quite effectively ruled them out of long trading in southern waters, and they were mainly engaged in seasonal North Sea or Baltic trades. They also carried freight between foreign ports, but only seldom extended their voyages to waters which were navigable during the northern winter. Indeed, around 1875, less than ten of

5 The register-books of *Finska sjöassuransföreningen.*

all the thousand or so peasant vessels were engaged in long trades during the winter, and in the middle of the 1880s, the number was probably even smaller.[6] In the middle of the 1860s, there must have been very few "peasant" long traders indeed.

Later the insurance sample gradually became less representative for small and medium-sized vessels, and thus it is more difficult to estimate how many might have been engaged in long trade. At the same time, however, the minimum size of ships sailing in cross-trades also increased, as was indicated above. This development was further strengthened by the ageing of wooden ships built in the 1870s: during their later years, many of them could no longer be used for ocean trades and were deployed in the North Sea instead. Moreover, since the medium size-classes were also thinning out, cross-trading more than ever before became the business of really big windjammers, and the difference between them and other sailing tonnage became less diffuse than in the 1870s. This development, fortunately, makes extrapolations from the insurance sample much easier; in practice, no vessels under 300 tons can be expected to have sailed during the winter. It is, therefore, possible to present realistic estimates of total Finnish cross-trading[7] sailing tonnage (table 3:4).[8]

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6 Rural ship-lists, 1875; the register-books of *Åbo läns privata sjöförsäkringsförening*, 1884—85.

7 Although the figures in table 35 explicitly refer to ships which did not come home for the winter, similar tonnages are arrived at by counting the vessels which carried at least one cargo between West European and Mediterranean ports or futher afield. This can be estimated at around 93,000 net tons in 1875 and around 100,000 tons in 1865.

8 The number of ships which were not laid up for any significant period was first extracted from the insurance samples (for 1885, additional data for "peasant" ships was collected from the register-book of *Åbo läns privata sjöförsäkringsförening* and for 1875 from the rural ship-list). The insurance data was extrapolated in the following way: in size-classes below 300 tons, only vessels which were found in the sample and did not return home for the winter were included; in size-classes 300>500 and 500>700 tons, the percentage of tonnage not laid-up was applied to all tonnage; in size-classes from 700 tons upward, all tonnage except vessels which the sample showed to have been laid up were included. After 1895, however, size-class 300>500 tons was extrapolated in the same way as ships below 300 tons before, and size-class 700>1000 tons as size-classes 300>500 and 500>700 tons before. In addition, it was assumed that only 50 % of "peasant" vessels in size-class 500>700 tons was not laid up for winter.

TABLE 3:4. Estimated tonnage in year-round occupation, 1865—1913. Sailing vessels.

Time	Thereof urban, net tons	% of total urban tonnage	Urban and rural, net tons	% of total Finnish tonnage
1865	102,600	82	103,000	56
1875	92,300	81	95,900	40
1885	60,400	63	64,300	31
1895	62,100	72	74,700	41
1905	..	..	78,100	42
1913	..	..	91,100	51

Source: Register-books of the Finnish Marine Insurance Association and of the Marine Insurance Association for the Turku Province (1884—85); ship-lists of rural parishes 1865 and 1875. For methods of estimation see note 8.

The figures clearly suggest that long-trading tonnage was already diminishing somewhat during the depression at the end of the 1860s. Since total urban tonnage was also dropping and never fully regained its earlier level, this coincidence emphasises the importance of cross-trade for urban tonnage. It is perhaps not so surprising that tonnage decreased still more before the mid-1880s, as the new depression which grasped international freight markets during the late 1870s intensified. In the next decade, when prospects were brighter, a distinct upswing is noticeable, and at the end of the period, Finland's fleet of cross-trading windjammers was almost as big as it was in the 1870s. At that time, about half of her entire sailing tonnage was mainly engaged in long trading outside the Baltic and the North Sea.

The changing structure of transport

However interesting tonnage figures for different trades may be, they are nevertheless a poor measure of the different types of cargo carried and of how effectively the ships were run. A more accurate picture may be obtained by calculating the voyages in tons and ton-miles.

TABLE 3:5. Estimated transport by Finnish sailing vessels in different trades. Loaded voyages, net tons (nt) and (net)ton-(nautical)miles (ntm), annual averages, 1865—1913.

Trade	c. 1865		c. 1875		1884/86	
	1000 nt	Mill. ntm	1000 nt	Mill. ntm	1000 nt	Mill. ntm
Coastal trade, exp. and imp.	215	19	238	21	285	26
Other exp. and imp. trades	225	364	224	313	222	329
Cross-trade	255	847	277	978	208	632
Total	695	1,230	739	1,312	715	987

Trade	1894/96		1904/06		1912/13	
	1000 nt	Mill. ntm	1000 nt	Mill. ntm	1000 nt	Mill. ntm
Coastal trade, exp. and imp.	280	24	263	22	316	30
Other exp. and imp. trades	210	266	163	175	148	142
Cross-trade	188	589	158	967	202	1,475
Total	678	879	584	1,164	666	1,647

NB: Beginning 1884/86, the figures for all export and import trades are three-year averages; before that they are based on either one-year figures drawn from the ship-lists of rural parishes, or the insurance sample, which on average covered 1.5 years; all figures for cross-trades as well as for export and import before 1884 are based on the insurance sample, in which the larger ships were observed on average for two years.
Source: Appendix III:2.

Table 3:5 presents the broad outlines of development. As far as the two first sample periods are concerned, the figures are not very accurate, because coastal trade data is rather poor; long trading, on the other hand, can be estimated fairly well. The table shows a dramatic difference between tons and ton-miles. Coastal sailers always carried quite large amounts of goods, from a third to almost

TABLE 3:6. Percentages of different trades of the estimated total of ton-miles produced by Finnish sailing vessels, 1865—1913.

	c.1865	c.1875	1884/86	1894/96	1905/06	1912/13
Coastal trade, exp. and imp.	1.5	1.6	2.6	2.7	1.9	1.8
Other exp. and imp. trades	30	24	33	30	15	8.6
Cross-trade	69	75	64	67	83	90

Source: See table 3:5.

half of the total, but the distances covered were so low that the resulting ton-miles only made up a small fraction of total transport production. Cross-trading, in contrast, only accounted for larger quantities of cargo than coastal trade in the 1860s and 1870s, but because of the long distances involved they always represented a clear majority (from 63 to 90 per cent, see table 3:6) of all sail-based transport expressed in ton-miles.

Coastal trade and other export and import shipping was rather stable up to the 1890s: fluctuations in percentages mainly reflected changes in the volume of cross-trade. In general, transport production fluctuated in a similar way to the development of sailing tonnage. Structural changes, however, meant that there was quite a difference in magnitude. The following set of indices shows this quite well:

Year	Sailing tonnage	Transport production	
		nt	ntm
1865	100	100	100
1875	128	106	107
1885	112	103	80
1895	98	98	71
1905	100	84	95
1913	97	96	134

The index of ton-miles shows by far the greatest fluctuations. This, of course, mainly reflects the changing cycles of cross-trade. It is interesting to note that there was a relatively steep rise from the

low point at the beginning of the 1890s, and just before the world war, the record of the previous "golden era" was clearly surpassed. Transport in tons, on the other hand, never repeated the maximum achieved in the 1870s. It also developed more steadily, which obviously reflects the great impact of coastal and other short transport on these figures. Thus, the fluctuations in ton-miles resulted from fluctuations in the average length of voyage (that is, mainly of long-trade voyages). In this respect, the period clearly falls into three stages: from the relatively stable situation of "the golden decades", the average fell to roughly three quarters, and rose again in the last two decades, finally surpassing the level of the 1870s.

The indices also show that, on both scales, production in the 1860s, compared with tonnage, reached its highest ever levels, with the exception of 1913. This means nothing less than a subsequent reduction in the productivity of the merchant marine. This is rather surprising, since the ships seem to have been developing rapidly, at least in pure technical terms, at that time (see p. 55—56). The voyage data, however, offer a straightforward explanation for the decline: ballasted voyages increased radically after the late 1860s. In the insurance sample, their percentage share of total mileage developed as follows (since data was often lacking, the percentages are given in round figures):[9]

1865	9—10 %
1875	23—26 %
1885	23—25 %
1895	32—37 %
1905	24—26 %
1913	c. 25 %

9 See appendix III:2. The exact percentages were as follows ("A" = percentage of ships for which complete cargo data was found; "All" = the whole sample):

Sample	"A"	All
1865	8.5	10.2
1875	26.1	22.4
1885	23.3	24.7
1895	36.9	32.2
1905	25.5	23.6
1913	25.0	24.0

There was a further increase in the prevalence of ballasted voyages in the 1890s, after which time, and probably as early as the latter half of the decade, the levels stabilized again at around 25 per cent. These figures, once more, have a very strong bias towards long trades. Finnish shipping statistics reveal that the share of ballasted voyages did not change much in coastal or Baltic trades,[10] and, moreover, they represented a modest share of total ton-miles. It may be said, then, that production was clearly affected by the availability of cross-trade, paying cargoes.

These changes resulted, of course, from the general development of the international freight market, from the changing balance between the demand for and the availability of tonnage, and from the changing division of labour between sail and steam. As already mentioned, these factors may have had quite different influences on different trades, which therefore should be examined separately.

The development of cross-trade

Cross-trade, or long trade, was not only the largest category of Finnish sailing vessel activity, but also the first to be affected by ups and downs in freight business cycles. It is thus a logical starting point for a closer analysis of development. Table 3:7 shows how the contribution of Finnish sailing vessels to international cross-trading changed over the period. It does not exclusively cover true long trade. There was also cross-trading within the Baltic (e.g. wood cargo from Northern Sweden to Germany, which "peasant" vessels, in particular, used to carry), and coal freight from Britain to Denmark, Sweden and St. Petersburg were equally common. This kind of cross-freight was mostly carried by vessels which never ventured to the oceans nor sailed during the winter. Compared with the grand total, however, they were a minor element. They will be dealt with in connection with other Baltic and North Sea trade, further on.

In the middle of the 1860s, cross-trading mainly consisted of three roughly equal elements, at least in terms of ton-miles. The first, trade between West and South Europe and in the

10 Finnish Official Statistics, ser. I and IA (tables of shipping by destination and origin).

TABLE 3:7. Estimated transport by Finnish sailing vessels in foreign cross-trade. Loaded voyages, net tons (nt) and (net)ton-(nautical)miles (ntm), annual averages, 1865—1913.

Cross-trade	c. 1865		c. 1875		1884/86	
	1000 nt	Mill. ntm	1000 nt	Mill. ntm	1000 nt	Mill. ntm
Baltic	6	4	11	7	7	5
North Sea	32	36	95	105	83	87
Mediterranean and other European	127	310	32	80	12	27
Atlantic	58	248	108	422	92	375
World	31	249	33	361	14	139
Total	255	847	277	978	208	632

Cross-trade	1894/96		1904/06		1912/13	
	1000 nt	Mill. ntm	1000 nt	Mill. ntm	1000 nt	Mill. ntm
Baltic	7	5	7	5	6	4
North Sea	77	80	51	51	32	32
Mediterranean and other European	5	12	1	3	2	3
Atlantic	85	354	35	201	35	189
World	13	138	64	707	126	1,248
Total	188	589	158	967	202	1,475

Source: See table 3:5.

Mediterranean, which also recorded by far the greatest number of voyages and tonnage, was dominated by grain trade from the Black Sea. There was usually a consistent triangular voyage pattern: first, after delivering a Finnish wood cargo, a ship might load coal in a Bristol Channel port (Cardiff, Newport, Swansea) or in Newcastle (Shields), and take it to Alexandria or some other Mediterranean port. Sometimes a new cargo for Constantinople or the Black Sea was found, but very often the next leg was sailed in ballast. In Russian (Odessa, Nicolayev, Taganrog) and Roumanian[11] (Sulina,

11 Roumania was an autonomous principality under the Ottoman Empire from 1861, an independent kingdom after 1881.

Kustendje/Constanza) ports, ships loaded mostly wheat, and sometimes tallow, for Britain or France (mostly Marseille). From Britain the triangle could be commenced anew; from Marseille, again, some vessels took cargo to a British coal port while others returned in ballast to the Black Sea. In addition, there was other business to be found when the season was not favourable for grain, such as carrying ore and esparto from South Spain to Britain, or marble from Leghorn. After a few years' continuous sailing between West Europe and the Black Sea, the regular final leg consisted of salt cargo from Cadiz, Cagliari or some other Peninsular or West Mediterranean port to the Baltic, usually to the ship's home port.[12]

For Finnish ships, the Black Sea trade was a business with traditions. It began in the late 1830s, and up to the middle of the century, in other words, before new trade agreements put most foreign ships on a par with domestic ones, the Finns obviously enjoyed some advantage of flying the Russian tricolor. More significant, however, was that the export of grain from the Black Sea to England and certain other parts of West Europe grew steadily and there was a brisk demand for shipping.[13] There was the additional advantage that, according to the standards of Bureau Veritas, metal sheathing was not required of vessels trading in the Mediterranean.[14] This, of course, saved a lot of expense for owners who did not worry about fouled bottoms and who were not interested in sailing the Atlantic.

The second category, Atlantic trade, was far more heterogenous. In the middle of the 1860s its mainstay, as far as Finnish vessels were concerned, seems to have been the "shuttle" trade between Britain or continental ports and British possessions in the West Indies and Central America: of all Trans-Atlantic return (eastward) cargoes recorded in the sample, two thirds came from this area (including Bermuda). Shipping was required first and foremost to

12 Unless otherwise stated, the descripitions of trades and cargoes are based on the voyage data in the "insurance sample".

13 See e.g. Nikula, *Malmska handelshuset,* p. 123—124; Engström, *Åbo sjöfarts historia II:1,* p. 118; Hautala, "From the Black Sea to the Atlantic, p. 13—16; Ahlström, "Hamnen i Odessa"; Attman, "The Russian Market in the World Trade"; Siegelbaum, "The Odessa Grain Trade"; Harlaftis, "The Role of the Greeks in the Black Sea Trade".

14 See note 4.

import raw sugar, logwood and mahogany while the export of coal usually gave enough outward cargo. Many Finnish ships also sailed to Brazil (Rio, Bahia) for coffee, or to the Argentine to load hides and other cattle produce. Some of them brought wood cargo from Finland, but the outward cargo more often consisted of coal from Britain or salt from the Mediterranean. Imports were also brought directly to Finland from the West Indies and Brazil. A third trade of some importance was grain, cotton or petroleum from the United States to West Europe and the Baltic. The civil war, of course, limited U.S. exports to some degree.

The last main category, "world trade", consisted mainly of imports from the East Indies to Europe: coffee and spices from the Dutch colonies or rice and teak from Burma. A few ships even sailed to Australia, New Zealand and the Philippines, or loaded nitrate or guano in Chile. Some also engaged in local coastal trade if the season was not right, for example, loading rice. Outward cargoes, again, consisted almost exclusively of coal.

In most long trading, ships sailed in both directions with paying cargo. In Black Sea, Mediterranean and Atlantic trade, outward cargoes comprised about 45 per cent of the total (measured in net tons). In East Indian and other world trades the figure was clearly lower, but this was partly because a few voyages began with a paying cargo to Capetown or South America. In all cases there was one common denominator: as has already been mentioned more than once, the standard outward cargo was British coal.[15]

* * * * * *

By the middle of the 1870s the general cross-trade picture had changed substantially. Given that North Sea tramping had trebled (mainly as a result of the growth in "peasant" shipping), the total increase in long trade was, however, modest at some 7 per cent in terms of ton-miles — net tonnage had actually diminished by a fifth. More important, however, was the structural change, "from the Black Sea to the Atlantic", as Kustaa Hautala expressed it. Indeed, the former mainstay of Finnish cross-trading, grain cargo from the Black Sea, had almost disappeared: in the entire mid-1870s sample there were only three cases. Other kinds of cargo

15 For a good description of the coal trade see Palmer, "The British Coal Export Trade".

were still being carried in the Mediterranean, however, but Atlantic voyages had gained in importance, and also in "world trades", production in ton-miles reached a higher level than before.

There were two reasons for the almost total disappearance of cargo from the Black Sea. First, within a short time after the opening of the Suez Canal, steamships gained supremacy in the best Mediterranean and related trades. By 1875, no less than 80 per cent of all tonnage cleared in Odessa was steam tonnage, and most sailing vessels still in business seem to have been rather small Greek or Turkish coasters.[16] At the same time, grain imports from the United States increased (although they did not yet surpass Black Sea grain), thus offering an alternative opportunity for sailing ships displaced from Black Sea trade.

The Atlantic trade, however, had also changed a great deal. The West Indies became less important for Finnish sailing ships — obviously because of an abrupt drop in sugar freight[17] — and accounted for just 10 per cent of all return cargoes in the sample. No less than 80 per cent now came from the United States (including the Mexican Gulf ports) and even Canada recorded some 7 per cent. This left only one per cent for the South Atlantic ports,[18] and it can be said that North America totally dominated the scene. As the economy of the United States was growing at a fast rate,[19] this was not surprising.

Finnish ships found their North American cargoes mainly in three different trades. First, they transported grain (wheat and indian corn) from New York, Philadelphia and Baltimore to Ireland and West British ports, sometimes also to the Continent. Probably equally important, although the lack of data about goods carried prevents the computation of any precise quantities, were cargoes of petroleum from the same area to all of West Europe and even to the Baltic. A third important cargo was wood, which fell

16 The report of the Finnish trading agent in Odessa, the archives of the State Secretary, VSV 291:1876.

17 Between 1865 and 1868 there was a fall of over 40 % in the freights of sugar and molasses from the West Indies to the US. Sager, *Seafaring labour*, p. 69.

18 On the other hand, South American ports recorded a much higher percentage in outward cargo, but a substantial proportion of this was (as in the 1860s) carried by "world" traders destined for the East Indies.

19 See e.g. Hacker, *The Course of American Economic Growth*, p. 172—175.

into two categories: pitch-pine from the Gulf ports (mainly Pensacola) and softwood from Canada. In the 1870s, the former was far more important. Some Finnish ships also took part in the phosphate trade from the Bull River area (South-Carolina).[20]

The great drawback with Atlantic trade was that outward cargoes were difficult to find. Most American exports were bulk goods while imports mainly consisted of industrial products which required much less space; British coal, for example, was only in very limited demand in the United States. According to an estimate by C. Knick Harley, eastbound demand for cargo-space in the late 1870s was more than double westbound demand.[21] Indeed, the sample shows that Finnish ships performed accordingly: the number of outward cargoes was only a third of all return (eastward) cargoes. Since no less than a third of outward cargo went to South America and other South Atlantic ports (being mainly carried by ships destined for the East Indies), no less than four fifths of the regular Atlantic traders arrived at Transatlantic ports in ballast.[22] This development, indeed, was mainly responsible for the notable increase in ballasted voyages after the 1860s. Moreover, excessive demand in one direction meant excessive supply in the other and freights were, accordingly, very low.

As high ballast mileage and low outward freights inevitably lowered shipping profitability, one may wonder why so many Finnish ships were engaged in Atlantic trade. The simple answer seems to be that it offered the best opportunity to all "blue-water" vessels which were not suitable for "world" trade. Traditional West Indies trade did not grow at the same pace as that with North America, nor did it match the growth of deepwater tonnage in Atlantic countries. It must also be remembered that their most valuable product, raw sugar, did not require much cargo space.

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20 See also Nikula, *Åbo sjöfarts historia*, p. 108—109.

21 Harley, "Issues on the Demand for Shipping Services", p. 82—85.

22 Hautala ("From the Black Sea," p. 21) cites U.S. statistics which reveal that 42% of Russian (of which the majority were Finnish) ships arrived with cargo. The difference between this figure and the proportion found in the sample may be explained by there being, in reality, more paying ballast cargo than the insurance records registered. It is also possible that there was some direct exporting by Russian vessels from Russia to the U.S.

"World" trade, of course, involved far fewer entries and much less tonnage than Atlantic trade, as far as Finnish ships were concerned, but, since distances were great, the resulting total of ton-miles was only 15 per cent lower. Although, with the opening of the Suez Canal, regular steamship traffic had affected Far East trades, and virtually brought to an end the story of tea clippers, traditional East Indian cargo was still to be found. This accounted for the bulk of Finnish "world" trader business and comprised about 80 per cent of all cargo to Europe in the sample. The rest consisted of occasional coastal trading in China and the Pacific (mainly coal from Newcastle, NSW), and even voyages from San Francisco to Britain.

Thus, the general picture of "world" trade was very similar to what it was ten years earlier. There is one interesting difference, however: the proportion of outward cargo had increased to over 60 per cent of return cargo (and cargo to South Atlantic ports is not included in this figure). As coal still dominated the former, this was probably a result of the increase in steamship traffic in the Far East, which needed coal of course. Paradoxically, sailing vessels had an important role in supplying the coaling stations.

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During the next two decades, cross-trading was in continuous decline, although the chronology of decline differed in different trades. During the first phase of the "long depression", long trade suffered most: both by tons and ton-miles, the output of Finnish ships dropped clearly below the level of the 1860s. From 1885 to 1895, the decrease was not as dramatic and "world" trading remained roughly at the same level as in the mid-1880s. Shipping in Mediterranean and West European waters, however, followed yet a different pattern, steep and continuous decline. In the mid-1890s, the volume was only a fifth of 1870s levels. This trade developed in conjunction with respective export and import shipping: indeed, most of what is here classified as cross-trading was nothing more than cargoes of wood from Sweden and salt to Baltic ports. Both the export of wood from Scandinavia to South Europe and the import of salt diminished markedly during this period, and it seems that steamships were already dominating Mediterranean trade to such an extent that there was little business to be found for sailing vessels.

Atlantic trade fared better than average during the depression. Both by tons and ton-miles, the decrease in the decade 1875—85 was 10—15 per cent, and this new level was retained up to the mid-1890s. The structure of the trade also remained much as it was in the 1870s. In the samples from both the 1880s and the 1890s, over 90 per cent of eastward cargo carried by Finnish ships was loaded in the United States or Canada. Of the other ports of origin, the West Indies fared worse and South America better, but, on the whole, these changes were marginal.

There was, however, one systematic trend in the American trade of the Finnish windjammers: wood cargo gradually increased until it was totally dominant. By around 1885, southern pitchpine and Canadian softwood accounted for two thirds of all return cargo registered in the sample, and close on 90 per cent by around 1895. This, of course, meant that other kinds of cargo, grain, petroleum and so on, diminished. At first sight, it might appear that this is an example of specialization: Finns, if anyone, must have been accustomed to carrying wood. This hypothesis, however, falls short of the truth: in reality, specialization was not voluntary. Steamships took over the best Atlantic bulk freight one by one, beginning with grain.[23] In the 1880s sample, there were still a few clear entries concerning grain cargo from the United States, but ten years later there were none (the only exception being one instance of wheat shipped from Bahia, Brazil). Petroleum in barrels was still substantial business for Finnish ships in the mid-1880s, and taking back empty barrels also provided some outward cargo. However, by the mid-1890s, specially-built tankers had taken over most of the business, and the sample contains only four or five cases of petroleum cargo.[24] Thus, pitchpine and softwood business became so popular simply because they were still available for windjammers. Returns were not very good and the ships were usually loaded in relatively primitive ports or on open roads, which meant that port-times were longer than steamships were willing to accept. Timber cargoes did not require first-class ships either, but could be carried tolerably safely even in old and "soft" wooden vessels.

As the choice of return cargoes became more limited, outward

23 See e.g. Harley, "The Shift from Sailing Ships to Steamships," p. 221—224.
24 See also Hautala, "From the Black Sea", p. 19.

cargo also diminshed. In the 1885 sample, there were still three outgoing to every ten return cargoes (although these also included cargo to South America and South Africa carried by long-traders destined for the East Indies), but ten years later, outward cargo represented only 20 per cent of the latter. The increase in ballasted voyages was a direct result of the imbalance in Atlantic cargo. Paradoxically, this happened at the same time as the increase in emigrant traffic was turning the scales to make demand for westbound tonnage surpass that for eastbound.[25] This, again, well illustrates the dual freight market: emigrant traffic belonged mainly to the domain of steamships. (Even before, when emigrants sailed in windjammers across the Atlantic, Finnish ships practically never carried westbound passengers, probably because the emigrant trade from British ports was quite tightly controlled.)

Compared with the relative stability in Atlantic trade, "world" trade seems to have experienced a dramatic depression: there was already more than a 50 per-cent fall in cargo carried by Finnish sailing vessels during the late 1870s and early 1880s. Such a decline obviously resulted from market developments. Steamships gained definite supremacy in Indian trades, which both directly and indirectly affected the traditional East Indian freight markets. The demand for sailing tonnage in general dropped, and this marred the prospects of all but first class ships. By the early 1880s, there were already quite imposing fleets of iron or composite sailing vessels, not only in Britain but also in Germany and the Netherlands,[26] and compared with them, Finnish wooden vessels were no great match. Moreover, during this decade, many of the latter reached the age at which they could no longer retain the highest class without extensive repairs; normally, a copper-fastened ship might be expected to stay in the Veritas top class (3/3) for 12—13 years.[27] Indeed, many long-traders were sold before they were due to be reclassed, and some others reduced their outfit and copper sheathing so as to rate down from the "L" (long trade) to the "A" (Atlantic) category.[28] Very few Finnish vessels were able

25 Harley, "Issues on the Demand," p. 82—83.
26 See e.g. Palmer, "The British Shipping Industry", table 4.
27 Veritas, "Regulations for the Classification of Wooden Vessels", art. 11—13.
28 *Finlands Skeppskalender* registered the classification of vessels (if any) after 1892.

to continue making Far East voyages, and the whole tradition of "world" trading seemed to be fading away.

Second-hand vessels which were bought in the 1890s did, however, revive the business beyond the two great capes. At the same time, they also manifested a definite change in trade, a change from the East Indies to Australia. In the 1880s sample, all Finnish "world" traders but one still loaded in the East Indies (including India and Hong-Kong) but by the next decade, only two East Indian cargoes were found and Australian and East African ports now dominated transport. The structure of the trade had changed in another sense too: the primacy of colonial return cargo was substituted for outward cargoes of wood, mainly Scandinavian and Canadian softwood. Even return cargoes quite often consisted of timber, kauri or yarrah from Tasmania and South-west Australia (it must be remembered that Australian grain exports were still in their prime in the 1890s), but one cargo of timber from Portland, Oregon was also recorded. All this meant that there was freight in both directions, which remarkably lowered the mileage of ballasted voyages. At around 1885, outward cargo destined beyond the Atlantic was only about 60 per cent of respective return cargo, but these figures evened out a decade later.

In summary, it may be said that both the 1880s and 1890s represented a low point in Finnish sailing vessel trading beyond the Atlantic. The seeds of new development did, however, begin to sprout before the turn of the century.

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The omens of the 1890s were well realized during the decade before the war. The structure of tramp-trading, and particularly of long-trading, was totally transformed. The Atlantic lost most of its former importance to really long, "world" trade, which accounted for two-thirds of all Finnish loaded net tons in cross-trade and over four-fifths of all ton-miles in 1912—13. This development also meant such an increase in long voyages that the total number of ton-miles probably exceeded the level of the 1860s by the turn of the century, and the level of the 1870s was surpassed by a good margin before the War. Another side of story is, however, that the number of voyages was quite low, and in net tons, transport did not even exceed the level of the mid-1880s.

The decline in Atlantic trade ended the "Pensacola era" in

Finnish deepwater shipping. Although almost a third of all return cargoes from America to Europe still came from pitch-pine in 1904/06, the amount was only a fifth of what it had been ten years earlier, and there were just a couple of cases in the 1912—13 sample. On the other hand, Finnish ships transported increasing amounts of pitch-pine to South America, often returning with freight from South America to Europe. This type of trade was already fairly common in the 1890s, and in 1904/06 almost two-thirds of Finnish windjammer Atlantic freight was either destined to, or originated from, South Atlantic ports. At that time, however, the actual volume of Atlantic freight was only about a half of what it had been around 1885 and 1895, and subsequently even pitch-pine cargo to Brazil and Argentine decreased. In the 1910s, the Southern Atlantic still accounted for about two-thirds of all Atlantic freight by Finnish sail, but about 60 % of it consisted of outward cargo (often carried by ships destined for "world" trade). Amazingly, West Indies trade gained importance again at the end of the period, but the total number of voyages in the sample is so low that it is very difficult to say whether this was anything more than just accidential fluctuation. In any case, there seemed to be one systematic change: the proportion of outward cargo rose a little and, accordingly, that of ballasted voyages fell.

In "world" trade, the East Indies had totally lost its former importance: not a single Finnish vessel loaded or unloaded there. Apparently, Australia was the centre of this business, as she was in the 1890s. In the 1904—06 sample, no less than three-quarters of return cargo was loaded there. Much outward cargo, mainly timber from Scandinavia, however, went to South Africa. Later, South American guano and nitrate were more frequently loaded by Finnish ships and, in the 1912—13 sample, double the number of cargoes to Europe were loaded in Chile or Peru than in Australia. In addition to simple "shuttle" trade to Australia and South America, a third voyage pattern became common. After a shipload of (usually) timber hed been taken to Australia, coal was loaded in Newcastle, NSW, bound for the West coast of South America and the circle was completed with a cargo of nitrates or guano to Europe. Occasional timber freight from the North West coast of the United States was also recorded.

The amount of outward and return cargo was consistently equal. Not only was there a need for timber from Scandinavia in Africa

and Australia, but coal from Europe was also in demand on the West coast of South America. Thus, few ships had to sail long passages in ballast, or carrying cheap (ballast) cargo. On the other hand, all this freight traffic to and from the Pacific was not the kind to attract steamer business: it consisted of relatively cheap and bulky goods loaded mainly in primitive ports, or in natural harbours, and transported over long ocean routes with few or no coaling stations. The demand for this kind of transport kept big sailing ships viable, while steam had made windjammers obsolete in medium-range shipping.

Finnish exports and imports: North Sea and Baltic trades

Practically all Finnish shipping to the Baltic, the North Sea ports and to South Europe, had one thing in common: the Baltic wood trade. This refers not only to export goods loaded in Finnish ports, but also to most cross-trade cargo carried on these waters. All the countries on the Northern seaboards of the Baltic experienced a boom in timber exports some time in the latter half of the 19th century, and sawn goods and other wood products filled most of the cargo-space of the ships leaving Finnish (see p. 25) as well as Northern Swedish ports, and St.Petersburg.[29] In Finland, especially, tar was also an important export item, but production was already in decline in the 1860s.[30]

The export of tar and wood, of course, went back a long way in Finland. In the late 18th century, tar from Ostrobothnia and sawn goods from South Finland (from the surroundings of Wiborg, in particular) were being exported in great quantities to West Europe and certain Mediterranean ports.[31] Timber exports to Northern Germany, west of the Oder, and Denmark (which were the only timber deficit areas within the Baltic) were also traditional. The production of sawn goods increased slowly during the earlier part of the 19th century, but a real breakthrough was made in the 1860s, when British customs-dues for non-empire wood products were lowered and steam technology was adopted in the Finnish sawmill

29 Kaukiainen, "British Timber Imports and Finnish Shipping", p. 163.
30 Se espec. Hautala, *Suomen tervakauppa 1856—1913.*
31 Alanen, *Der Aussenhandel,* p. 109—129, 167—203; Åström, *From Tar to Timber,* ch. I—II.

industry.[32] From 1860 to 1913, exports of sawn goods from Finland grew roughly ten-fold.[33]

The most important import item, at least in terms of volume, was traditionally salt.[34] In the latter half of the 19th century its role was definitely reduced as new, bulky imported goods such as coal gained ground. The import of grain also grew to impressive dimensions, but since it was mainly bought from Russia, this affected coastal shipping and railways more than anything else. In any case, as already noted (see p. 25), a permanent feature of Finnish foreign trade was that imports required much less cargo-space than exports.

These basic facts are relevant in the context of the development of export and import transportation by Finnish sailing ships (table 3:8). The imbalance in the physical volume of trade is clearly reflected in the volumes of outward and return cargo: both in the 1860s and 1910s, the latter amounted to only a third of the former (in net tons), but at other times it was lower still. The total amount of cargo was quite stable up to the 1890s, but a steady decline set in after the turn of the century.

For the entire period, the bulk of export and import shipping could be classified as Baltic and North Sea trade. Apart from that, there was actually only one other of importance: the wood and salt trade to the Iberian peninsula and the Western Mediterranean. These trades, together with small-scale cross-trading in the same waters, developed quite differently and thus should be investigated separately.

* * * * * *

Baltic trade was surprisingly stable right through the period. During the first three decades, exports to Denmark and North Germany (mainly Schleswig-Holstein) required 50,000 net tons, or a little more, of shipping each year. In the 1890s, however, the figure rose to about 70,000 net tons and remained at that level until the War. The increase obviously resulted from an increase in the demand for timber products in Germany, where industrial growth was accelerating. As there were already several steamship lines

32 Åström, *From Tar to Timber*, esp. appendix tables; Hoffman, *Suomen sahateollisuuden kasvu*, p. 39—57.

33 Ahvenainen, *Suomen sahateollisuuden historia*, p. 285.

34 Alanen, *Der Aussenhandel*, p. 244—276.

TABLE 3:8. Estimated Finnish export and import transport by Finnish sailing vessels (other than coastal traffic). Loaded voyages, net tons (nt) and (net)ton-(nautical)miles (ntm), annual averages, 1865—1913.

Trade	c. 1865		c. 1875		1884/86	
	1000 nt	Mill. ntm	1000 nt	Mill. ntm	1000 nt	Mill. ntm
Exports:						
Baltic	57	36	52	32	50	30
North Sea	71	94	113	148	74	92
Other	40	114	16	45	40	104
Total	169	245	181	225	164	226
Imports:						
Baltic	16	11	9	6	9	5
North Sea	11	14	12	14	22	26
Other	29	94	22	67	26	72
Total	56	119	43	88	58	104
Grand total	225	364	224	313	222	329

Trade	1894/96		1904/06		1912/13	
	1000 nt	Mill. ntm	1000 nt	Mill. ntm	1000 nt	Mill. ntm
Exports:						
Baltic	70	42	69	42	72	44
North Sea	73	91	55	69	36	43
Other	21	56	7	17	5	14
Total	164	186	131	127	113	102
Imports:						
Baltic	5	3	6	3	13	8
North Sea	22	26	18	22	17	20
Other	19	53	9	23	5	12
Total	46	82	32	48	35	40
Grand total	210	268	163	175	148	142

NB: Sums computed from unrounded figures.
Source: See table 3:5.

across the Baltic, at that time, it seems odd that Finnish sailing vessels were still able to increase their wood cargo. The explanation seems to be two-fold. On the one hand, timber was

still mostly unloaded in rather primitive, small ports (such as Lübeck inner port and Eckernförde) which did not attract steamers. On the other hand, a substantial amount of this wood consisted of pit-props, baulks and other timber which was not produced at large sawmills, but rather loaded in natural coastal harbours or roadsteads.[35] Small and medium-sized sailing vessels with low day-costs were still suitable for this kind of business.

There was, however, a shortage of return cargo, and the trend was distinctly downwards at the beginning of the period: import cargo in the mid-1860s was estimated at almost 30 per cent of export cargo (by tonnage), but at well below 20 per cent around 1875. As this was a period of expansion in steamship lines across the Baltic, it seems very probable that such vessels managed to establish themselves as carriers of more valuable import goods. In the 1890s, the proportion of import cargo dropped further, to below 10 per cent of export cargo, and this also coincided with expansion into Baltic lines by Finnish steamships. At the very end of the period, however, sailing vessels were returning with more cargo, most of which consisted of cement, bricks and other construction materials for which there was an increasing demand in Finland. Accordingly, the proportion of return cargo again rose to almost 20 per cent, but it must be remembered that this was quite often only ballast cargo.[36]

It was mentioned earlier that Finnish sailing vessels also transported wood from Swedish sawmills to Germany and Denmark in addition to normal export cargo. This kind of trade began in the 1830s, and was practised by Åland and Southwest Finnish "peasant" shipowners in particular.[37] Around 1875, for which period there is the best data, this was not, however, extensive and amounted to about a fifth of what was exported from Finland to Germany and Denmark. There is no comparative data for the latter part of the period, but Swedish shipping statistics

35 This was typical, at least according to the logs of the Baltic traders from Rauma and Uusikaupunki. They also state very clearly how long loading and unloading could take.

36 Examples of ballast cargo were found in the log-books of Baltic sailing vessels (Rauma and Uusikaupunki *sjömanshus).*

37 Kaukiainen, *Suomen talonpoikaispurjehdus,* p. 122—124; Börman, *Åboländsk bygdeseglation,* p. 191 (figure 34); Papp. *Åländsk allmogeseglation,* p. 180—185.

clearly suggest that trade declined slowly. Just before the War, only about 60 % of the tonnage levels of the 1870s was recorded.[38] (See table 3:7.)

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North sea trade was in many ways just an upgrading of Baltic trade, but it developed differently. At first, sailing vessels fully exploited the rapid growth of timber exports to Britain: by around 1865, North Sea exports accounted for more cargo space than Baltic exports, and the volume almost doubled in the next ten years. It seems that, at that time, wood freights beyond the Sound compared quite favourably with those within the Baltic, and many rural shipowners seemed to abandon the latter and to make North Sea trade their major business. Indeed, this became a dominant element in Finnish "peasant" shipping, and by about 1875, almost 60 per cent of wood cargo on Finnish keels to North sea ports was carried by tonnage from rural parishes. In addition, many ships from Åland and Southwest Finland also carried wood from Swedish sawmills (precisely as they took their products to Germany or Denmark): in 1875, this kind of trade involved no less than 50,000 net tons of shipping, which, compared with the 110,000 plus net tons of direct exports, was no small figure.

Between 1865 and 1875, North Sea trade was the most rapidly expanding sector of Finnish shipping. While the estimated total cargo of sailing vessels during that time increased by some 66,000 net tons, the respective increase in wood cargo to the North Sea, including that from Sweden, was 75,000 net tons. This was obviously to the detriment of other trade. Indeed, there seems to have been some movement from Mediterranean to North Sea

38 *Bidrag till Sveriges Officiella Statistik: Utrikes handel och sjöfart: Sjöfart.* Only for the 1910s do the statistics record the tonnage of entered and cleared Finnish vessels by origin of departure and destination, so that vessels sailing on the Baltic can be separated from those going to the North Sea. Before that, the statistics record only the total tonnage of entered and cleared Finnish vessels in different customs districts. A rough picture of the combined development of Baltic and North Sea trade from Sweden can be formed by comparing the tonnage of Finnish vessels cleared from Swedish Bothnian ports. From the working tables of the shipping statistics of the *Tullstyrelsen*, the development of wood trade from Sweden can be followed roughly from the number of ships which were cleared empty for Northern Sweden. This tonnage decreased quite drastically from the mid-1890s until 1912/13. See also appendix III:2.

timber shipment but, since practically all of the increase was in rural tonnage, the changes simply reflect the fact that shipping by "peasant" owners was still expanding while urban shipping began to stagnate.

One advantage of North Sea trading for rural shipowners was that it was easier to find return cargo in England than in Germany or Denmark. Coal was already in some demand in Copenhagen, Stockholm and St. Petersburg, and it could be loaded in the East coast ports, Hull and Newcastle, where most timber was unloaded. Although Newcastle coal was not comparable with the hard Welsh "steam-coal", and obviously did not pay very high freights, it suited the low-cost, rural vessels quite well. Accordingly, around 1875, nearly 40 per cent of all Finnish "peasant" vessels taking wood from Finland, Sweden or Russia to the North Sea obtained some kind of return cargo. It is true that this figure was not very high, but it was clearly better than Baltic trading could offer. Urban ships, on the other hand, carried relatively little return cargo from North Sea ports, only a tenth of similar outward cargoes. However, many of them did return home (or to other Baltic ports) with salt from South Europe.

The attraction of North Sea freight for Finnish sailing vessels seems to have declined quite suddenly during the first decade of the "long depression": there was a reduction of about a third between 1875 and 1885. During the following decade, however, the figures remained virtually constant. The decline was not universal either: North Sea cargo on urban ships dropped by almost two thirds, while rural vessels continued trading almost unaffected up to the 1890s. By the turn of the century, a new and universal decline did set in. Even "peasant" sailers began to suffer, and before the world war, North Sea exports by Finnish windjammers were down to less than a third of 1870s levels. On the other hand, import cargo did not diminish at all at first; on the contrary, its tonnage increased in the 1880s and the 1890s, and declined only slowly after that. The reason for this surprising development was that Finnish imports of coal grew considerably during the period. It was not, however, enough to reverse the general downward trend in North Sea trading by Finnish windjammers.

Wood cargo from Sweden also seems to have followed a downward trend. Unfortunately, only a very crude estimation is

possible, but all the data suggest that the decline was slow at first and gathered momentum only after the 1890s. Just before the War, the figure was only a third of what it was in the 1870s (including return cargo; see table 3:7).[39]

The general decline in North Sea trades was accentuated by the fact that sailing vessels were gradually demoted to transporting second-class timber products, such as splitwood or firewood, plank-ends (which were still used to pave streets) and raw timber. The decline seems to have been first and foremost the consequence of steamships taking over the transportation of sawn goods. In the 1890s, steamships enjoyed an above-average share of export transport (excluding shipments to Sweden and Russia) in six major timber ports (about 71 % of all loaded tonnage in 1894/95, for example, while the figure for the whole country was about 66 %). The proportion of sailing tonnage in these ports also dropped quite dramatically from 1895 until the War, from almost 30 per cent to less than a tenth.[40]

The overwhelming popularity of steamships for transporting bulky and cheap timber products is not exactly what could be expected. Of course, the engines made a great difference in the variable summer and autumn winds of the Baltic, and the cranes were a distinct advantage when loading at the roadstead, as happened in most timber ports. The biggest advantage, however, was probably that the steamer's capacity to carry wood cargo had gradually increased ton for ton beyond that of a sailing vessel. Since wood is relatively light, a full load also implies deck cargo, which was restricted on sailing vessels for reasons of stability and rigging. Early steamers with large open decks, on the other hand, could carry more than a third of their cargo on deck and, net ton for net ton, could accommodate close to 50 per cent more than a typical wooden sailing vessel.[41] This substantially increased the

39 See note 38.

40 Finnish Official Statistics, ser. I and IB.

41 The difference was clearly verified by the Finnish ship-list *(Suomen kauppalaivasto)* of 1930, which in many cases record a vessel's capacity to carry wood cargo (in standards). For steamships built before 1914, the average was 0.85 standards per net ton, for sailing vessels 0.5—0.6 standards. The difference arose not only because of differences in deck-cargoes; iron vessels (as all steamers were) had fewer structural members (pillars, orlop beams) in their holds and could therefore utilize the space better when loading bulky wood products.

steamer's edge over a sailing vessel in transport performance.

* * * * * *

Mediterranean trade, which was in fact the start of deepwater shipping in Finland (see p. 148), was a third important category of export and import shipping. As already metioned, outward voyages taking timber to South Europe and return trips with salt were often only the beginning and end of a long-trader's voyage pattern. There were, however, quite a few vessels which really specialized in this trade, carrying on what almost amounted to liner traffic between Finland and certain Mediterranean ports. This was especially typical of the South coast towns of Helsinki, Porvoo (Borgå) and Loviisa (Lovisa).

The stable element in this trade was the import of salt, for which there were not many alternatives; for the export of wood products, on the other hand, Spanish, Portuguese and other Mediterranean ports were some of many possible destinations. This basic difference can be seen quite well in table 3:8. Fluctuations in export cargo, whether expressed in tons or ton-miles, were far greater than in imports.

According to the figures, there was a big drop in export tonnage destined for Southern Europe in the beginning of the period, from the mid-1860s to the mid-1870s. As this was a decade during which timber exports from Finland to Britain expanded rapidly, it seems that market development disfavoured South European ports. In the following decade, when depression affected prices in England, and Atlantic freight rates had declined, timber exports to the Mediterranean again reached the level of the 1860s. In the 1890s, increasing economic activity in Western Europe made North Sea (including French) markets attractive again, and exports to the Iberian Peninsula and beyond, declined.

Salt imports from Southern Europe remained relatively stable during all these fluctuations. There was only a 20 per cent drop in the 1870s — which probably meant that there was more salt coming from Liverpool — but former levels were subsequently almost regained. It was only in the 1890s that a systematic fall began and just before the War, salt-importing sailing tonnage was less than a fifth of what it was half a century earlier. This final decline was probably a natural consequence of the development of sailing tonnage. Old, medium-sized wooden vessels were being

replaced by big iron and steel ships which were not economical in traditional small-scale Mediterranean trade. One significant contributing factor was that the Finnish Steamship Company opened a line to the Mediterranean in 1889, and these ships could now import salt to Finland. Thus, even this traditional trade seemed to reflect the displacement of sail by steam on increasingly long transport routes.

Coastal trade

Although coastal trade is not the subject of this study, it sometimes offered an alternative opportunity to certain other types of shipping. A "peasant" shipowner, in particular, who had taken firewood to Stockholm or St. Petersburg before building a North Sea -going brig or barque, might well return to his former business if wood and coal transport between Britain and Scandinavia became less profitable. Therefore it seems reasonable to look at the general development of coastal trade in order to see whether fluctuations occurred in the opposite direction to those in the Baltic and North Sea business.

The problem with coastal trade is that the data is far from perfect, particularly for the early part of the period. It is true that local ship-lists are reliable on the number of coastal vessels, but they often give only a summary record of the number of voyages. Neither do pre-1883 shipping statistics present figures for all ships sailing to Sweden or Russia.[42] This means, of course, that the estimates in table 3:9, particularly as far as the 1860s and 1870s are concerned, must be used with greater caution than the earlier estimates of longer-range shipping.

Table 3:9 contains at least one example of coastal shipping development as the antithesis of North Sea and longer trades. After

42 The best proxy for such figures before 1883, after which time destination / origin-specific figures for Finnish ships are available, is the number and tonnage of ships cleared from Degerby and Koivisto (Björkö, for which figures can be found only from 1867 onwards). They were by far the most important customs stations for coastal vessels sailing to Stockholm and St.Petersburg, but the figures also comprised vessels sailing further afield. On the other hand, their traffic was just a part, albeit a major part, of the total trades in question. Accordingly, the figures can only be used, together with statistics on the export of firewood, as indicators of general trends.

TABLE 3:9. Estimated coastal transport by Finnish sailing vessels. Loaded voyages, net tons (nt) and (net)ton-(nautical) miles (ntm), annual averages, 1865—1913.

Trade	c. 1865		c. 1875		1884/86	
	1000 nt	Mill. ntm	1000 nt	Mill. ntm	1000 nt	Mill. ntm
Exports:						
Sweden	24	4	27	4	37	6
Russia	102	7	113	8	126	9
Total	126	11	140	12	163	15
Imports:						
Sweden	12	2	14	3	24	5
Russia	77	6	85	6	99	7
Total	89	8	98	9	122	12
Grand total	215	19	238	21	285	26

Trade	1894/96		1904/06		1912/13	
	1000 nt	Mill. ntm	1000 nt	Mill. ntm	1000 nt	Mill. ntm
Exports:						
Sweden	29	5	30	5	31	5
Russia	136	10	127	8	206	14
Total	165	14	157	13	237	19
Imports:						
Sweden	14	3	13	3	16	3
Russia	102	7	93	7	63	8
Total	115	10	106	9	79	11
Grand total	280	24	263	22	316	30

NB: Excluding coastal transport within Finland and transport over the Ladoga. Sums computed from unrounded figures.
Source: See table 3:5 and note 42.

a rather stable phase of slow increase, there was rapid growth between 1875 and 1885, when long trading became less attractive. As far as Russian exports were concerned, this trend continued to the 1890s. Trade to Stockholm, on the other hand, declined after the mid-1880s, but at the same time, Baltic shipping increased considerably. This seems to be a case of contrary development, of

coastal trade suffering from the growth of another freight business.

It would, however, be unrealistic to suggest that changes in coastal trade were mainly a result of tonnage supply, that shipowners could have transferred their activities at will. They could have done so only if demand for coastal transport was much larger than supply, or if it was continuously increasing. As mentioned earlier, coastal trade consisted mainly of firewood transport to Stockholm, Reval (Tallinn) and St. Petersburg. St.Petersburg was, at least in quantitative terms, by far the most important, and exports to Stockholm normally exceeded those to Reval. There was, in addition, substantial business in fish to both Sweden and Russia. Small boats were normally used for this, however, all of which were not included in the shipping statistics, and the impact on ton-figures was small. Table 3:9 indicates that import cargo was also important, particularly with Russian trade. The overwhelming bulk of imports consisted of grain, for which there was an increasing demand in Finland.

Factors of demand explain why costal trade to Sweden did not expand any more after the 1890s. Although the city of Stockholm doubled in population during the period, the demand for firewood was adversely affected by the increasing use of coal (from 1861 to 1907, coal imports to Sweden grew 14-fold).[43] The same phenomenon also affected the demand for firewood in St.Petersburg;[44] it is worth noting that tonnage sailing from Finland to Russia had decreased by the turn of the century. There were, however, a couple of other export products in increasing demand in the Russian capital: stones and sand to construct ports, quays, houses and fortifications. In the 1910s in particular, the fortification works in and around Chronstadt created a real boom in East Finnish coastal trade.[45] On the other hand, import transport from Russia stopped growing in the mid-1880s. It is probable that more and more grain was being imported by rail. Moreover, at the end of the period, Russia was losing ground to Germany in grain exports to Finland.[46]

Demand from St.Peterburg was substantial and growing more

43 *Historisk statistik för Sverige* 3, table 3.1.
44 Pihkala, *Suomen Venäjän-kauppa* p. 70.
45 Ibid., p.102—103; Kaukiainen, *Koiviston merenkulun historia*, p. 224—228.
46 Pihkala, *Suomen Venäjän-kauppa*, p. 148—149.

than demand from Stockholm. Coastal trade, therefore, seemed to offer better long-term opportunities along the Southeast coast of Finland than in the Southwestern archipelago. This is in accordance with observations concerning the development of tonnage: big ships almost disappeared from coastal parishes close to Wiborg during the early 1880s, and North Sea trade was never resumed again. At the same time, many Southwestern or Åland "peasant" owners stuck to their big ships, almost as long as they were still afloat. It is true that, even in these regions, there was some increase in the total tonnage of coastal vessels around the turn of the century,[47] but this was probably more to do with domestic coastal transport than the rather stagnant trade to Sweden.

Coastal shipping offered urban shipowners no real alternative to their traditional long trading. Resources such as forest for fire-wood, which were important as far as Stockholm and St.Petersburg were concerned, were lacking, as was the necessary know-how. It was also impossible for owners of large vessels to switch straight from foreign cross-trading to coasting, for which their existing tonnage was unsuitable. Transition could, therefore, only be a long-term objective, as large, old vessels were replaced with new, much smaller ones. This rarely happened with urban owners, at least as far as sailing tonnage was concerned. However, there was some transition to coastal trading in another sense. Many urban owners invested money in small steamships, which sailed on domestic coastal routes.

Steamer trade

From coastal passenger/cargo vessels to specialized steamships

As tonnage development indicates, the growth of steam in Finland followed a well-trodden path. At first, it was dependent on coastal line services between Finnish towns and to Sweden and Russia. Thus, at the outset, there was no real competition with sailing vessels; steam created a market for a new type of service, namely regular and reliable transport for passengers.[48] It was only during

47 See appendix table I and Börman, *Åboländsk bygdeseglation* p. 120—123.

48 See e.g. Palmer, "The British Shipping Industry 1850—1914", p. 94.

the early 1870s that steamships began to make headway with traditional bulk cargo, but even then, it mainly involved wood-hulled auxiliaries. As far as Finnish merchant tonnage was concerned, steam really entered the common bulk-carrying market and began to compete with sailing vessels only in the late 1880s.

The development of steam tonnage was covered in some detail in chapter II and it is not necessary to repeat it here. Steamship quality was directly related to the traffic in which it was engaged: up to the 1890s, only a small minority of Finnish steamers ever sailed beyond the Sound. During the two or three first decades of the period covered by this study, when the number of cargo steamships was extremely low, there was hardly any demand for passenger traffic to Western Europe. There was hardly any local supply of suitable tonnage, either. While it was perfectly safe to cross the Baltic on vessels similar to those which sailed to Sweden, it was not thought advisable to expose them to the conditions of the North Sea. North Sea trade not only required stronger vessels (longer waves mean that more longidutinal rigidity is needed) but the "handy size" was also larger. In the middle of the 1880s, there was hardly any difference in the average tonnage of steamers sailing to Sweden, Russia and Germany. On the other hand, apart from wooden auxiliaries, hardly any Finnish steamer under 500 net tons ever sailed beyond the Baltic.[49] All this also meant that, before the 1890s, few steamers were able to sail all the year round. They simply were not able to reach ice-free waters in winter.

Both the technical limitations of the early Finnish steamers and the small amount of steam tonnage make it relatively easy to assess the birth and growth of steamer traffic beyond the Sound (table 3:10).[50] Even in the mid-1880s, no less than three quarters of all Finnish steam-propelled tonnage was sailing within the Baltic and, accordingly, laid up for four to six months every year. There was quite a sudden "take-off", however, between 1895 and 1905

49 Finnish Official Statistics I, IB: entered and cleared shipping.

50 The tonnage in question was estimated as follows: all ships over 500 net tons were included unless they sailed a regular line within the Baltic (only one case, s/s *Wellamo,* 613 nt, was actually found). Of smaller vessels, those which are known to have sailed to the North Sea were included. Data on their sailings was drawn from the insurance registers, ship-lists of local *sjömanshus* and from the lists of Finnish steamships in 1914 (archives of *sjöfartsinspektören,* Ba1, Ec1).

TABLE 3:10. Estimated tonnage sailing outside the Baltic, 1865—1913. Steamships, incl. auxiliaries.

Time	Net tons	% of Finnish steam tonnage
1865	—	0
1875	2210	27
1885	2820	23
1895	8520	39
1905	28570	64
1913	38860	69

Source: See note **50.**

(or, rather, at the turn of the century) when the proportion of "ocean-going" steamers increased by 25 percentage points. This new level did not change much before the World War.

Up to the early 1890s, it was only North Sea tonnage which sailed all the year round. However, winter-traffic between Hangö and Stockholm (or Oxelösund) by small steamer started in 1878, and after the Finnish government acquired its first icebreaker, the *Murtaja*, in 1890, a slowly increasing number of reinforced passenger vessels also sailed during the winter-months.[51]

The slow escalation from coastal services to longer trading stands out equally clearly from estimations of the extent of shipping services provided by Finnish steamships in different trades (table 3:11). These estimates, however, are not very precise due to the previously mentioned, inherent weaknesses in the data. For one thing, steamers sailing on regular routes — that is, most Finnish steamers at that time — were assumed to be fully loaded on all legs of their normal services, irrespective of how few goods there actually were in their holds (see p. 142). One possible consequence of this is that the statistics may exaggerate steamer transport production. It is also possible that they present too balanced a picture of outward and inward cargo; as mentioned earlier, Finnish exports required much more shipping space than her imports. Yet, there are strong reasons to believe that steamers

51 See e.g. Ramsay, *I kamp med östersjöns isar;* Pohjanpalo, *100 vuotta Suomen talvimerenkulkua.*

carried return cargo to Finland more often than sailing vessels; many steamers' accounts reveal that freight income was quite evenly distributed between outward and inward voyages; this was typical within the Baltic in particular.[52] Fortuitously, this also means that the suspected excess in the figures for total production cannot have been very large. There was, however, one important exception, namely the emigrant business, which was predominantly one-way traffic. Although returning emigrants were estimated to total one fourth of those leaving, they could not fill the third-class bunks on return voyages, especially since there was a notable time-lag between leaving and returning. For this reason, it seemed reasonable to introduce a small correction into the estimates by subtracting 15% (representing an average 30% unused capacity on return voyages) from the total tons and tonmiles of emigrant vessels.[53]

It has been mentioned already that pre-1883 data concerning traffic on coastal lines to Sweden and Russia is very scanty, as is also data on ships mainly engaged in irregular foreign "tramping" (see p. 138). Thus, the figures for coastal trade should be used with some caution as far as the two earliest sample years are concerned. The latter problem only applies after the 1890s (before that, practically all steamers sailed in regular service), and even then, because of the rather small volume of cross-trading, its bearing on the total figures is not substantial.

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52 The ledgers of the *FÅA* and other steamship companies used in this study. E.g. the accounts of the s/s *Lloyd* from Wiborg show that the ship normally earned more on inward cargo from Lübeck than on export cargo. Such data cannot be found for the *FÅA* ships, but a rough idea can be formed by looking at the loading expenses, which were recorded in the special voyage accounts. It must also be remembered that less than full cargo was also common on outward legs, e.g. when a steamer collected sawn goods at various Finnish South Coast ports.

53 Only in one case, the *Titania* (1997 nt) was the reduction increased to 20 %. All these percentages may sound low, but emigrant ships also carried cargo, and after the turn of the century, their income from cargo fluctuated between 40 and 25 per cent of total income. They carried a relatively high number of emigrants, when full, one passenger per 2.5—2.7 net tons (the corresponding rate in Atlantic traffic was about five; see Harley, "Issues on the Demand for Shipping Services", p. 82). Obviously, the third-class accommodation was very modest and the emigrant decks were probably used for general cargo on the return voyage.

TABLE 3:11. Estimation of transport by Finnish steamships in different trades. Loaded voyages, net tons (nt) and (net)ton-(nautical)miles (ntm), annual averages, 1865—1913.

Trade	c. 1865		c. 1875		1884/86	
	1000 nt	Mill. ntm	1000 nt	Mill. ntm	1000 nt	Mill. ntm
Coastal trade, exp. and imp.	35	15	120	38	160	60
Other exp. and imp. trades	15	9	28	21	60	57
Cross-trade	—	—	8	15	11	16
Total	50	24	156	74	231	133

Trade	1894/96		1904/06		1912/13	
	1000 nt	Mill. ntm	1000 nt	Mill. ntm	1000 nt	Mill. ntm
Coastal trade, exp. and imp.	319	117	465	137	729	164
Other exp. and imp. trades	214	258	488	540	709	774
Cross-trade	24	47	52	133	47	178
Total	558	424	1,006	810	1,485	1,117

NB: Totals were computed from unrounded figures. Beginning with 1884, the figures for all export and import trade are three-year averages; for earlier years they are based on one-year figures drawn from the shipping statistics or the insurance sample.
Source: Appendix III:2.

That the overwhelming majority of steamship transport in the 1860s was coastal traffic is no surprise. Table 3:11 does not include any domestic coastal services which, however, did employ a notable number of steamers of 200 net tons and less. On the other hand, ships sailing beyond the Sound, which were used most of the year, were more productive per ton than those confined to the Baltic, and thus the proportion of long trade transport was somewhat higher than the corresponding proportion of tonnage.

Measured in ton-miles, the percentage of traffic sailing beyond the Baltic grew as follows:

c.1865	0 %
c.1875	30 %
1884/86	38 %
1894/96	58 %
1904/06	70 %
1912/13	72 %

These figures illustrate an earlier and less pronouced transition than the tonnage figures in table 3:10: the change seems to have been most rapid between the mid-1880s and mid-1890s. The difference may have arisen partly because of the element of error in the estimates. On the other hand, tonnage sailing beyond the Sound in the 1870s consisted almost solely of auxiliaries. They sailed long distances without using their small engines, and therefore their transport capacity was not much greater than that of pure sailing vessels. By comparison, the new cargo steamers of the *FÅA* and *Wasa—Nordsjö* company were a great improvement, and it is therefore logical that, between 1875 and 1885, steamer transport in long-trading grew in excess of long-trading steam tonnage. On the other hand, after the 1890s, transport to the North Sea and beyond developed quite well in line with tonnage development. During the last decade of the period, the structural change in Finnish steam shipping was by all standards quite slow. This deceleration was not totally unexpected, since European and North Atlantic freight markets experienced a series of depressions in 1903—04 and 1907—08. The Russo-Japanese war in 1904 caused additional difficulties for Finnish shipping.

The slowing down of the transition did not, of course, mean that the growth of steamship transport had stopped. As table 3:11 shows, up to the War, the quantitative increase was quite impressive ton for ton and ton-mile for ton-mile: transportation grew about 40-fold in half a century. Yet, as the following indices indicate, even in total production, the most rapid increase (excluding the 1860s) took place in the late 1880s and the 1890s (table 3:12; in order not to overemphasize the importance of the very small steam tonnage of the 1860s, the figures for 1912/13 have been given the value of 100).

TABLE 3:12. Finnish steamship transport indices (1912/13 = 100).

	nt	ntm
c. 1865	3	2
c. 1875	11	7
1884/86	16	12
1894/96	37	38
1904/06	68	73
1912/13	100	100

Source: Table 3:11.

To sum up, steamship transport data, like tonnage data earlier, tells of a slow and incomplete transition. During the first half of the period, up to the mid-1880s or early 1890s, steamships were still mainly being used in a rather narrow sector, basically in the same way as during the introduction of the new technology in the 1830s and the 1840s. The breakthrough of cargo steamers started a new, dynamic development, but this slowed down at the beginning of the 20th century. Neither in tonnage nor traffic figures, nor in comparison with what happened abroad, did this breakthrough in Finland ever really fulfil its potential during the period in question.

Coastal trade

Since steam shipping began by carrying coastal passenger traffic, it seems logical to begin a closer look at the trades with them. Compared with the coastal trade of sailing vessels, however, this was a different business. Not only did most coastal steamers represent far larger capital, and sail on much longer routes than the small galeasses carrying fire-wood to Stockholm or St.Petersburg, but many of them could equally well travel to the southern Baltic. Thus there was no clear-cut difference between coastal and Baltic trade in steam shipping.

Coastal trade was totally dominated by lines to Stockholm and St.Petersburg. For example, in 1894 (a year for which there is complete data on all regular lines to and from Finland),[54] Finnish

54 Finnish Official Statistics I:14, p II:86—87.

steamers sailed a total of 493 two-way trips engaged in coastal trade. Of these, 216 were between Finnish ports and the Russian capital (112 to and from the *Saimaa* area), 115 between St.Petersburg and Stockholm and 76 between Stockholm and Finland, which adds up to over 80 % of the tours in question. In addition, 58 trips were made between Finland and Reval (Tallin) and 28 between Kaskö and Sundsvall.

As well as regular liner services, there was also some "tramp" cargo shipping between Sweden and Finland and Russia and Finland. This was, however, quite modest in comparison, only 13 per cent of all traffic to and from Sweden in 1894. In Russian trade, the corresponding figure was larger, about 35 per cent, but "tramping" was still of minor importance.[55]

Table 3:14 shows the estimated development of coastal trade. Although, as already pointed out, the first third of the time series is less than totally reliable, there is no doubt of a remarkable increase. The number of tours and the tonnage of ships engaged increased to such an extent that, in terms of net tons, the traffic grew 20-fold. Measured in ton-miles, however, the ratio was more modest at about 1,000 %. This indicates some qualitative changes in trade apart from pure growth. Above all, the average length of route decreased by over 50 per cent from 400—500 to 225 nautical miles. At the same time, there were fundamental changes in lines. At least from the 1870s, and up to the 1890s, St.Petersburg was a far more popular destination than Stockholm. Of special importance were long routes from the upper Gulf of Bothnia which, at the same time, made connections between Finnish coastal towns. Such lines were in special demand in Bothnian shipping towns, regularly carrying Russian hemp and canvas for sailing vessels.[56] Since the early 1870s, however, the steamer-lines from South-Finland to the imperial capital had been in competition with the railway from Helsinki to St.Petersburg, and when the Bothnian railway reached Oulu in the middle of the 1880s, the long coastal lines also began to suffer. After the 1890s,

55 The volume of "tramping" was estimated by subtracting the traffic on regular lines (according to FOS I:14, p. II:86—87) from total traffic volumes (Finnish steamships cleared for and entered from Russia and Sweden).

56 This is evidenced both by the accounts of s/s *Oulu* and many building accounts. See also Norrvik, *Briggen Carl Gustaf*, p. 43.

TABLE 3:13. Estimated coastal transport by Finnish steamships. Loaded voyages (cargo and/or passengers), net tons (nt) and (net)ton-(nautical) miles (ntm), annual averages, 1865—1913.

Trade	c. 1865		c. 1875		1884/86	
	1000 nt	Mill. ntm	1000 nt	Mill. ntm	1000 nt	Mill. ntm
Exports:						
Sweden	8	3	23	7	28	10
Russia	9	5	37	12	52	20
Total	18	8	60	19	80	30
Imports:						
Sweden	8	3	23	7	28	10
Russia	9	5	37	12	52	20
Total	18	8	60	19	80	30
Grand total	35	15	120	38	160	60

Trade	1894/96		1904/06		1912/13	
	1000 nt	Mill. ntm	1000 nt	Mill. ntm	1000 nt	Mill. ntm
Exports:						
Sweden	60	18	120	30	248	60
Russia	100	41	88	31	124	25
Total	160	59	208	61	372	84
Imports:						
Sweden	61	18	139	35	245	59
Russia	98	40	118	41	106	21
Total	159	59	256	76	357	80
Grand total	319	117	465	137	729	164

NB: Excluding coastal transport within Finland and transport over Ladoga. Sums computed from unrounded figures.
Source: See table 3:11.

total ton-miles sailed between Finland and Russia decreased systematically.[57]

This trend was further reinforced by the fact that the exchange of goods between Russia and Finland grew quite slowly after the mid-1880s, and actually declined from 40—50 % to about 30 % of Finland's foreign trade. It is obvious, however, that the decline in shipping was not only caused by market factors: Russia was building its own steam fleet and, therefore, wanted to restrict the competition from Finnish lines (see p. 299). The constitutional crisis between Russia and Finland (the so-called Russian oppression) also made Russian connections less popular.

At the same time, traffic between Sweden and Finland increased rapidly. Since the volume of trade between the countries was not enough to sustain more than modest cargo shipping, this may have been simply a result of the general increase in travelling (including emigration).[58] While the increasing numbers of visitors to St.Petersburg were effectively catered for by the railways,[59] travellers going over to Stockholm (including those from northwest Russia) had no alternative but to sail. The expansion in winter traffic meant substantial increases in the yearly number of tours to Sweden, but sailing east of Hangö (or in mild winters, Helsinki) was not possible in midwinter. There was only one factor which was contrary to this trend: in the 1890s, after the *FÅA* had bought their first passenger vessels, emigrants began, in increasing

57 There was only one minor development which was contrary to this trend: shipping by small (c. 100 nt) tramp steamers, mostly wood-hulled and carrying firewood, increased. They used to load at different small ports on Lake Saimaa and their size was dictated by the size of the locks of the Saimaa Canal. Thus they represented the beginning of the transition to steam in traditional coastal trade.

58 Unfortunately, there are no precise figures on the volume of liner services after 1894, but the shipping statistics (FOS, ser. I and IB) show that, e.g. in 1913, no les than c. 213,500 net tons of Finnish steamshipping to Sweden was cleared at the customs house of Degerby, Åland, which was then a checkpoint for most regular lines. This tonnage was about 82 % of all Finnish steamshipping to Sweden. In addition, there were Finnish lines which, at least in wintertime, sailed directly from Helsinki or Hangö to Sandhamn (at the mouth of the south-eastern passage to Stockholm).

59 That the number of passengers on the Helsinki — St.Petersburg railway increased substantially is clearly shown in contemporary railway statistics. *Finska statsjärnvägarne 1862—1912*, p. 333.

numbers, to use direct lines to England instead of first going over to Sweden. After the turn of the century, however, when competition on the Finland — Stockholm lines increased and ticket-prices fell, the trend was reversed for a few years.[60] During the last decade before the War, the capital of Sweden clearly surpassed St.Petersburg as a destination for coastal liners.

It is interesting that traffic both to Russia and Sweden was firmly in the hands of Finnish companies; Russian and Swedish ships were found only on a few secondary routes. This is a rather typical example of the adage that contacts with large centres are usually established by those living in smaller centres or "outports"; but this, of course, does not offer a real causal explanation. Winter-traffic probably gave an additional boost to Finnish companies by allowing the most modern Baltic tonnage to be used all the year round. There was massive wear and tear on ships in the ice, however, and business was profitable only because the state subsidized wintertime traffic.[61]

In any case, coastal traffic seemed to offer Finnish steamship owners a nice niche, in which international competition was hardly felt at all. However, it was a niche with limited opportunities for growth. This message was brought home the hard way during the first decade of this century when two Finnish companies, *FÅA* and *Bore* from Turku, engaged in tough competition on their Stockholm lines; tariff wars (which lowered the income of both) were fought from 1903 to 1905 and again from 1909 to 1911, until the companies agreed on a division of traffic.[62] Undoubtedly, the competition was intensified by the fact that, at that time, there was a good supply of tonnage since traffic on Ostrobothnian coastal lines had decreased because of the new railway. Railway development was, indeed, one more factor which limited growth opportunities, and thus it is no wonder that the proportion of coastal traffic in the total transport output of Finnish steamships constantly declined.

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60 Suviranta, *Suomen Höyrylaiva Osakeyhtiö,* p. 35; Kero, *Migration from Finland to North America,* p. 36.

61 See note 54; also Kaukiainen, "The Transition from Sail to Steam," p. 180—181.

62 Suviranta, op. cit., p. 45—46; Törngren, *Ångfartygs Aktiebolag Bore,* p. 62—65.

Steamers in North Sea and Baltic trade

As was mentioned before, steamships trafficking on the Baltic were very similar to those sailing from Finland to Sweden and Russia. Thus, Baltic steamer trade was in many respects just a logical extension of coastal trade. Indeed, many vessels combined both, or sailed occasional voyages on the Southern Baltic in late autumn, when normal services on more northern routes were difficult to maintain.[63]

Passing the Sound was a technical threshold for steamships, but it did not prevent vessels built for the North Sea from carrying goods within the Baltic. For example, the first real cargo steamer in Finland, the *Fennia* from Vaasa, sailed a route between Finland and the East coast of England, but in practice it carried more cargo within the Baltic than beyond.[64] Many ships sailing the North Sea later must also have had some involvement in Baltic freight business. Although Finnish exports to Great Britain were constantly on the increase (in the middle of the 1890s they exceeded exports to Russia and took over the number one position), import volumes were much smaller and lagged far behind those from Germany.[65]

The clear dominance of regular liner services in early Finnish steamer business was also clearly visible in the Baltic and North Sea trades. In 1894, only 22 % of Baltic cargo and 9 % of all North Sea cargo loaded onto Finnish steamers represented irregular "tramp" trading.[66] On the other hand, passengers were of much less importance compared with coastal trade. True, most steamers sailing on the Baltic regularly carried passengers, but, before the

63 In the registers of *Sjöassuransföreningen i Finland* a frequent entry for such vessels was that they made *östersjöturer* (Baltic voyages) in November-December. Unfortunately, these entries do not normally specify the voyages in more detail, neither do they prove that they were actually made, but at least the owners wanted the insurance policy of their vessels to allow this kind of Baltic voyage.

64 The registers of *Sjöassuransföreningen i Finland* 1874—76.

65 Pihkala, *Suomen ulkomaankauppa 1860—1917*, p. 53—54. At that time, the statistics specified the geographical distribution of foreign trade according to the origin and destination of transport. Thus, British export means goods loaded for a British port and German import, goods loaded in a German port.

66 The volume of cargo on regular lines was computed from FOS I: 14, p. II:86—87.

TABLE 3:14. Estimated Finnish export and import transport by Finnish steamships (other than coastal traffic). Loaded voyages (cargo and/or passengers), net tons (nt) and (net)ton-(nautical) miles (ntm), annual averages, 1865—1913.

Trade	c. 1865		c. 1875		1884/86	
	1000 nt	Mill. ntm	1000 nt	Mill. ntm	1000 nt	Mill. ntm
Exports:						
Baltic	8	5	12	7	17	11
North Sea	—	—	3	4	11	14
Other	—	—	0	1	1	2
Total	8	5	15	12	29	27
Imports:						
Baltic	8	5	12	7	18	11
North Sea	—	—	1	1	13	15
Other	—	—	0	1	1	4
Total	8	5	13	9	31	31
Grand total	15	9	28	21	60	57

Trade	1894/96		1904/06		1912/13	
	1000 nt	Mill. ntm	1000 nt	Mill. ntm	1000 nt	Mill. ntm
Exports:						
Baltic	37	28	78	51	106	69
North Sea	66	78	166	195	236	278
Other	8	23	15	41	17	45
Total	112	129	259	287	359	392
Imports:						
Baltic	39	29	79	51	113	73
North Sea	51	60	136	161	220	264
Other	13	40	15	41	17	45
Total	103	129	229	253	350	382
Grand total	214	258	488	540	709	774

NB: Sums computed from unrounded figures.
Source: See table 3:11.

FÅA steamers *Urania* and *Astraea* were built in 1891, North Sea vessels had accommodation for just a few.[67] It was only when emigration grew to large proportions that passenger traffic became an important part of North Sea trade. Beginning in 1891, the *FÅA* built several ships which could carry large numbers of third-class (emigrant) passengers.

Table 3:14 shows that export and import transportation by Finnish steamers increased substantially after the 1880s. By far the most significant feature in the table is the growth of North Sea trade. In the middle of the 1880s, it was still a minor element, on a par with Baltic traffic, accounting for much less in tons and ton-miles than coastal transport; at the end of the period, just before the First World War, it was worth no less than about a half of all Finnish steamship transport. Regular lines to the east coast of England accounted for most of this growth, but the *FÅA* deep sea fleet also visited the big continental ports, from Hamburg to Bordeaux, and Copenhagen on the Baltic. From 1891, the line Helsinki (or Hangö) — Copenhagen — Hull was also open through the winter.

Finnish lines were not equally successful on the Baltic. Even though there was continuous growth, the volume of traffic (in ton-miles) in the 1910s was only a quarter of Finnish North Sea steamer transport. One of the reasons must have been that a greater volume of Finnish exports, especially wood products which required a lot of cargo space, went beyond the Sound than to Germany or Denmark. On the other hand, Finnish liners sailing to England and other North Sea ports could easily carry many imports from Germany on their homeward voyages; an increasing number of them were coming from Bremen and Hamburg rather than Lübeck.[68] Another, even more important reason was that German and Danish shipping companies also operated liner services to Finland — in 1894, they had more tonnage and made a greater number of voyages than Finnish-owned Baltic lines.[69]

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67 *The Ships of our First Century*, p. 9—45; the ledgers of the *FÅA* (the ships had distinct passenger and freight accounts, which makes it possible to ascertain how much income they earned from passenger traffic).

68 See e.g. *Suomen Höyrylaiva Osakeyhtiö 1883—1933*, p. 46—47.

69 Finnish Official Statistics I:14, p. II:86—87.

Accordingly, the Finns faced great difficulties in expanding their market share.

From the very beginning, *FÅA* ships carried freight between West European and Mediterranean ports during the winter. Thus it was not totally unexpected (although a grant and cheap loan from the state seem to have been the decisive factors) that the company started a Mediterranean line as early as 1889.[70] At first, ships sailed between Barcelona and St.Petersburg, via South Finland, and they accounted for practically all Finnish steamer traffic beyond the North Sea. However, it never developed into very good business,[71] and, as table 3:14 clearly shows, cargo volume remained modest. This was not surprising: regular liner services always needed a firm background of export and import business and, with the dwindling role of salt imports, Finland's trade with the Mediterranean area was losing its former importance. Neither were the expectations of carrying imports to St.Petersburg fulfilled, as Russia began to develop her own steam shipping. Indeed, it seems that the most important achievement of the *FÅA* Mediterranean line was to deal a final blow to sailing vessels' traditional *spaniefart*.

Even the indirect effects of North Sea steam trade were far more significant. The coincidence of rapid growth and the decline of sailing vessel cargo to British and Northern French ports, together with the general fall in medium-sized sailing tonnage, implies very strongly that windjammers were pushed out of this trade by the expanding steamer services. On the other hand, the situation on the Baltic was quite the opposite. It seems obvious that the modest development of Finnish lines there left more room for less up-to-date means of transport and provides some explanation for the tenacity of sail east of the Sound.

In general, the growth opportunities of steamer trade between Finland and the big West European ports were relatively good. Not only were Finnish exports and imports expanding rapidly, but, as sailing vessels were being pushed aside, the growth of steam was potentially even more rapid. As far as regular lines were concerned, the services could never aim to cover the majority of exports, however. Since imports required less than a half of the

70 *Suomen Höyrylaiva Osakeyhtiö*, p. 19—20.
71 Ibid., p. 34, 46.

cargo space of exports, a realistic target would have been at a much lower level, if cargo on homeward legs was to be secured as well.

Until the turn of the century, services to West Europe grew quite freely. This was mainly because, after the 1880s, big British shipping companies were not interested in establishing lines to Finland; in 1894, for example, there were none to be found.[72] The *FÅA* and *Wasa—Nordsjö* had already agreed upon co-operation and the division of traffic in 1884, and, in 1888, *FÅA* made an agreement on traffic between Finland and Copenhagen with the Danish *Det Forenede Dampskibs-Selskab.*[73] Thus, the situation on these routes was much the same as on many great sea-lanes where the traffic was regulated by shipping conferences (agreements on tariffs and traffic). In this case, the two Finnish companies had, in practice, a divided monopoly on regular services between Finland and Britain (this was further aided by the state subsidies to the *FÅA* granted to maintain the traffic in wintertime). Only at the beginning of the 20th century was the peace disturbed. In 1902, a new shipping company called *Nord* was formed in Helsinki (although at least half of the major shareholders were from Turku). The aim was to open a regular, year-round service between South Finland and the East coast of England. By superseding the *FÅA*, it also succeeded in obtaining state subsidies for maintaining winter traffic on this route. Since the route was vital to the *FÅA*, they did not give up willingly, and after a violent, two-year tariff war, the new company had to surrender. The *FÅA* bought the three *Nord* steamers, but, having no use for them, soon sold them abroad at a substantial loss. In addition to this, both companies suffered big losses because the tariffs had been too low to cover costs; total losses were estimated at three million Finnish marks at the time.[74]

Although the *FÅA* had succesfully defended its supremacy in North Sea liner trade, competition between domestic companies had come to stay. In 1905, a new company, *Ångfartygsaktiebolaget Transito*, was established in Turku. Its first route was to Lübeck, but in 1909 it also started shipments to England.[75] The tariff war on

72 Finnish Official Statistics I:14, p. II:86.
73 *Suomen Höyrylaiva Osakeyhtiö*, p. 16, 18—19.
74 Kaukiainen, "The Transition," p. 181—182; *Suomen Höyrylaiva Osakeyhtiö*, p. 43—45; Lindberg, *Ångbåtssjöfart i Åbo*, p. 265—276.
75 Lindberg, *Ångbåtssjöfart*, p. 342—346.

the Stockholm route had also disturbed the lucrative emigrant business of the *FÅA* as low prices induced emigrants to travel via Sweden. Thus, the last decade of the period was a time of uncertainty, at least for the leading steamship company in the country. In principle, of course, so-called healthy competition within an industry should not be harmful. In this case, however, it did disturb the normal development of income and may also have led to a decline in investments and retarded the growth of liner services. It is also possible that foreign trampers were competing more and more with liners in the transport of export goods such as wood and pulp.

Cross-trade

It has already been shown that cargo from one foreign port to another played a very modest role in the Finnish steamship business. Although the auxiliaries of the 1870s and *FÅA* steamers used to sail on the Mediterranian and other ice-free waters during the winter, there were hardly any steamers which were mainly engaged in tramp-trading at large before the 1890s. Only by the turn of the century did it become more common to invest in big (and usually old) ships which were then deployed in so-called "wild trade".[76] In 1913, there were still only nine or ten of these tramp steamers, with a total net tonnage of about 14,000.[77]

Table 3:15 presents the estimated development of steamer cross-trade. As has been mentioned, the data must be used with caution, and this specifically applies to the two last sample years. Up to the

76 The first big tramp-steamer in Finland was *Heros*, 894 nt, bought from England in 1893 by a company in Kristinestad. In 1899 they changed over to a larger, new ship, and subsequently bought two more steamers. In 1913 the company moved its office to Helsinki. (Norrvik, *Briggen Carl Gustaf*, p. 287—289.) A Helsinki businessman, Viktor Ek, who was director of a liner-company *(Helsingfors Ångfartygs AB)*, started tramping-business in the 1890s, and owned two tramp-steamers in 1913. The son of the founder of *FÅA*, Ernst Krogius (or rather the firm Lars Krogius & co) founded *Finska Lloyd* in 1896, a company which also built new ships (in 1913 they owned five vessels) and deployed them in various tramp-trades. Two ships were sold to *FÅA* in early 1914.

77 The archives of *sjöfartsinspektören*, Ba:1 and Ec:1 (the lists of Finnish foreign-going steamers, made in autumn 1914, which also register the trade in which they were used).

TABLE 3:15. Estimated transport by Finnish steamships in foreign cross-trade. Loaded voyages (cargo and/or passengers), net tons (nt) and (net)ton(nautical)-miles (ntm), annual averages, 1875—1905.

Cross-trade	c. 1875		1884/86	
	1000 nt	Mill. ntm	1000 nt	Mill. ntm
Baltic	1	1	1	1
North Sea	2	1	7	7
Mediterranean and other European	4	8	3	5
Atlantic	1	5	1	4
Total	8	15	11	16

Cross-trade	1894/96		1904/06		1912/13	
	1000 nt	Mill. ntm	1000 nt	Mill. ntm	1000 nt	Mill. ntm
Baltic	—	—	(—)	(—)	(—)	(—)
North Sea	1	0	(9)	(11)	(18)	(14)
Mediterranean and other European	22	44	(35)	(91)	(12)	(18)
Atlantic	1	3	(7)	(31)	(17)	(116)
Total	24	47	52	133	47	178

NB: Sums computed from unrounded figures.
Source: See table 3:11.

mid-1890s, voyage data covered all the ships which, in practice, could carry freight on more distant waters, and therefore gave an almost complete picture of cross-trading. After that, however, the information was much more scanty: for both 1904/06 and 1912/13, only about 45 per cent of ocean-going tonnage is included, and the percentage of "full-time" tramp-steamers is lower still. Although the percentages do not seem small, the actual number of ships and voyages was very low. Therefore, extrapolation involves rather a large margin of error. The geographical distribution of cross-trading, in particular, may be far different in the sample than it was in reality (therefore the figures for the two last sample years are given in parenthesis).

Because of the error involved, the estimates are very conservative. Indeed, there is one further "unknown" which might increase the figures. Liners sailing between Finland and Western Europe could, at least in theory, carry substantial amounts of cargo between their foreign ports-of-call, but no records of this type of transaction have been found. However, since most regular shipping in European waters after the late 1880s was governed by shipping conferences involving the big continental and British companies, it is not likely that Finnish liners were able to exploit West European freight markets to any great degree. This, indeed, also somewhat limited the growth of tramp trading.

Both the errors in the data and the relative unimportance of the trade make closer analysis unnecessary. One trend is worth pointing out, however: the volume and share of more distant transport increased systematically. On the other hand, after the turn of the century, total growth was modest. This is understandable with regard to the development of the tonnage in question. As mentioned, up to the late 1890s, the bulk of cross-trading was a winter occupation of North Sea liners. These ships of about 600 net tons were quite handy in the Mediterranean, and they may occasionally also have been used in trade with West Africa and the Atlantic islands. The growth of Baltic winter-traffic meant that an increasing number of liner-steamers no longer needed to find other employment during the coldest months; accordingly, the frequency of cross-trading declined in the *FÅA* fleet. Nor did "full-time" tramp-trader tonnage grow much after the turn of the century. There were, however, a few big ships, 1,500—2,000 net tons, which were optimal on more distant voyages. Accordingly, South American trade became a common occupation for Finnish tramp steamers, although they hardly ever sailed the North Atlantic routes.

The development of cross-trading may also have been hampered by the low level of tramp freights from 1902 to 1908. Finnish ships, in particular, faced difficulties in finding freight during the Russo-Japanese war.[78] In the 1910s, on the other hand, big sailing vessels

78 Even the *FÅA* tried to exploit the tramp freight market by buying two ships of almost 1,300 nt each in 1902. Since tramp freights were still sinking, however, they were mostly used on regular services.

obviously attracted the interest of speculation-minded shipowners far more than tramp steamships.

Although the volume of steamship traffic still increased during the last decade before the War, it is tempting to say that, in a qualitative sense, the expansion had almost stopped. For some reason or other, Finnish shipowners were not able to deploy steamships successfully in the truly international shipping sector, foreign tramp trade. This is in sharp contrast to what happened in Norway during the same decade; Norwegian owners made massive purchases of second-hand steamships, tramp-steamers, thus effectively bringing about the transition from sail to steam in that country. In Sweden too, the transition must have been largely the result of a massive exploitation of the international tramp freight market.[79]

79 This can be deduced, above all, from the fact that the average freight income of Swedish steamers (as will be seen later) was much lower than was typical in liner traffic.

3. Total production and productivity

Total production of shipping services: growth and change

Sail tonnage and steam tonnage underwent very different patterns of development. Although the growth of sailing-ship business had already culminated around 1875, it never fell into as steep a decline as in many other countries. There was even a modest renaissance after 1895 and, measured in ton-miles, 1912/13 output clearly exceeded the peak levels of the 1870s. Steam shipping, on the other hand, increased continuously and relatively rapidly, but, up to the late 1880s, the volume was so small that the total transport output of Finnish shipping closely followed the cycles of windjammers. Only by the late 1890s did steam gain a position to reverse trends in Finnish shipping production, pushing it past earlier peaks and doubling it during the next 15 years or so (see figure 3:1 and table 3:16). Just before the First World War, Finnish vessels carried almost three times as much cargo (in net tons) as in the mid-1860s, and produced over twice as many ton-miles.

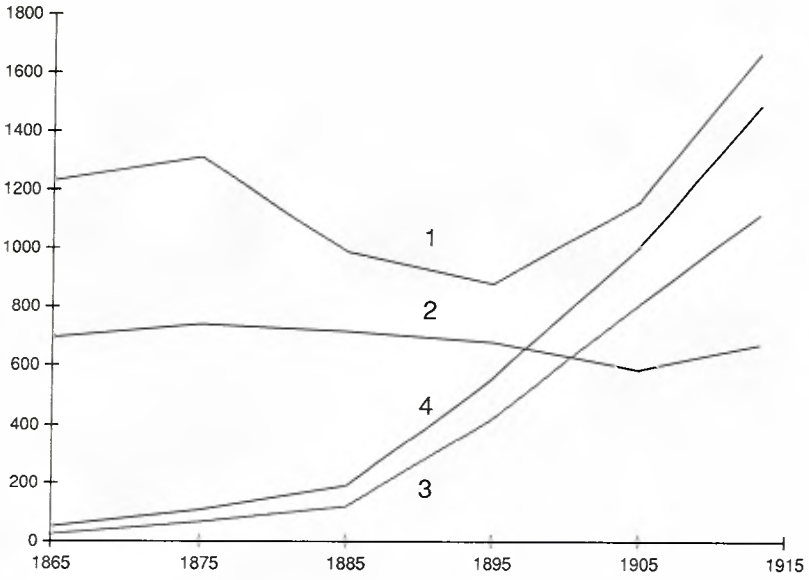
This kind of increase may seem impressive and, indeed, looked at in isolation, there was significant growth in the two last decades, averaging over four per cent per annum in terms of ton-miles. Over the whole period, however, the picture is far less rosy. Most other seafaring nations managed to achieve far greater growth in output since the carrying capacity of their merchant navies, if computed in "sail tons",[1] grew four-fold, or even more. Thus, what was said about the rather stagnant development of Finnish merchant tonnage also holds good in the light of the production estimates.

The crucial and most interesting feature was, of course, the transition from sail to steam. Transport estimations are particularly effective in showing how slow the transition actually was, and how it proceeded. Although sailing vessel and steamship

1 Steam tonnage is usually multiplied by 3 and added to sail tonnage. The sail-ton was commonly used in the late 19th century to evaluate the actual carrying capacity of a merchant navy containing both sail and steam, and the ratio 1:3 was believed to represent the difference in efficiency between sailing vessels and steamships.

Fig. 3:1. Sailing Vessel and Steamship Transport, 1865—1913.

1 = sailing vessels, net-ton-nautical miles
2 = sailing vessels, net tons
3 = steamships, net-ton-nautical miles
4 = steamships, net-tons



Source: Tables 3:5, 3:11

trade was analysed separately, some important interactions are already in evidence. Table 3:17 sums up the change by presenting the proportion of steamship transportation in various trade categories as well as in the total output.

The table shows once more very clearly how the success story of steam shipping began on coastal lines and rather slowly moved up to longer trades. Steamers on routes to Sweden and Russia already accounted for more ton-miles than coastal sailing-vessels in the 1870s (although in terms of net tons, they gained superiority only during the early 1890s). In longer export and import transportation, steam passed sail only two decades later, in the middle of the 1890s.

TABLE 3:16. Estimated total production of Finnish shipping (transport by Finnish steamships and sailing vessels) in different trades. Loaded voyages, net tons (nt) and (net)ton-(nautical)miles (ntm), annual averages, 1865—1913.

Trade	c. 1865		c. 1875		1884/86	
	1000 nt	Mill. ntm	1000 nt	Mill. ntm	1000 nt	Mill. ntm
Coastal trade, exp. and imp.	250	34	354	59	445	86
Other exp. and imp. trades	240	373	252	334	282	386
Cross-trade	255	847	285	993	219	648
Total	745	1,254	891	1,386	946	1,120

Trade	1894/96		1904/06		1912/13	
	1000 nt	Mill. ntm	1000 nt	Mill. ntm	1000 nt	Mill. ntm
Coastal trade, exp. and imp.	599	141	728	159	1,045	194
Other exp. and imp. trades	424	524	651	715	857	916
Cross-trade	212	636	210	1,100	249	1,653
Total	1,236	1,302	1,590	1,974	2,151	2,764

NB: Totals have been computed from unrounded figures. As in all previous calculations, they do not take into account shipping between domestic ports, whether on the interior lakes or along the coasts, unless it was a part of a line going abroad.

Source: Tables 3:5 and 3:11.

Steam gave rise to services which did not exist before (coastal passenger lines) and with which sailing ships did not compete; thus, traffic could grow irrespective of sail. Real competition in economic terms began when steamships entered the bulk-carrying market, although, even then, freight rates were not the only important consideration. For steamers, regular services were one asset which could not be measured directly in money. In Finnish

TABLE 3:17. The proportion of steamships in the total production of Finnish shipping in different trades. Per cent.

Trade	c. 1865		c. 1875		1884/86	
	nt	ntm	nt	ntm	nt	ntm
Coastal trade,	14	44	34	64	36	70
Other exp. and imp. trades	6	2	11	6	21	15
Cross-trade	0	0	3	2	5	2
All trade	7	2	13	5	21	11
	1894/96		1904/06		1912/13	
	nt	ntm	nt	ntm	nt	ntm
Coastal trade	53	83	64	86	70	85
Other exp. and imp. trades	50	49	75	76	83	84
Cross-trade	11	7	25	12	19	11
All trade	45	33	63	41	69	40

Source: Tables 3:5 and 3:11.

shipping, this second phase began around the middle of the 1880s, since which time windjammers were constantly in retreat.[2] It may be said that the transition had already proceeded quite far by 1913, when steamers had a 70-per cent share of all cargo in Finnish ships (in net tons). Of course, competition was not restricted to Finnish steamers and Finnish sailing vessels; however, it seems appropriate to conclude that, as far as import and export transport

2 This retreat is demonstrated by the following percentages which exclude coastal trade. The percentage of steamships in all other transport was:

	of total nt	of total ntm
c. 1865	3 %	1 %
c. 1875	7 %	3 %
1884 / 86	14 %	7 %
1894 / 96	38 %	27 %
1904 / 06	65 %	39 %
1912 / 13	70 %	38 %

was concerned, the success of Finnish steamers was a major factor in pushing Finnish windjammers out of business.

However, in one category, long cross-trade, Finnish steamers hardly affected the development of Finnish sail at all. It was, above all, British and other Western European steamships, which made things difficult for them as well as for any sailing vessels. The changes observed in the long-trading patterns of Finnish sailing ships provided a perfect illustration of how sail was displaced from an increasing amount of business. This happened first in the Black Sea grain trade, and the Atlantic grain trade followed suit in the late 1870s. Gradually petrol cargoes were also taken over by steamers, and in the 1890s, big North American ports offered very few opportunities for sailing vessels. After the turn of the century, even traditional wood cargo from the Gulf area to Europe declined, and Finnish vessels, at least, moved one more step towards the shipping periphery, transporting pitchpine to South America. It was only in the longest ocean bulk transport, in which price mattered more than time, that competition between sail and steam had hardly begun. The effect in this one sector was rather drastic: in the 1910s, Finnish sailing vessels still accounted for more ton-miles than Finnish steamers.[3]

The transition from sail to steam also brought about other structural changes. If sea transport is divided into two sectors, one serving the country's foreign trade (and communications) and the other consisting of international cross-trading, it can be seen that the former grew systematically after the 1870s while the latter fluctuated in the same way as sailing vessel output. Expressed in indices (ton-miles in 1865 = 100) the picture is as follows:

	exp/imp.	cross-tr.
c. 1865	100	100
c. 1875	97	117
1884/86	116	77
1894/96	163	75
1904/06	215	130
1912/13	272	195

3 E.g. in the Norwegian merchant marine, according to Gjölberg's estimates, steamships passed sailing vessels in output of tonmiles around the middle of the 1890s. Gjölberg, "The Substitution of Steam for Sail in Norwegian Ocean Shipping," diagram 1.

This development is not surprising considering the division of labour between sail and steam: big sailing ships traditionally specialized in international tramp trade and steamers operated on regular liner services between Finland and its most important trading partners. Increases in both steam shipping and foreign trade thus inevitably supported the development of export and import shipping. Yet, with the high percentage of sail, cross trade still accounted for over half of the total output of ton-miles by Finnish shipping in the 1910s (see table 3:16).

Technical transition and productivity

Needless to say, productivity changes are very central to the development of any industry. They merit special interest when a technical transition is taking place, such as the substitution of steam for sail.

Productivity, if understood as the relationship between actual output and existing factors of production (labour and capital), does not, however, directly measure the technical efficiency of ships or any other production system. The amount produced in a given year depends largely on market factors, fluctuations of demand and business cycles in general. Moreover, the correct measurement of production factors and output is not always easy, especially where an industry producing intangibles, like transport, is concerned.

For shipping, the most meaningful parameter of productivity is the ratio of tonnage to transport production. This ratio is usually produced simply by dividing the number of loaded ton-miles sailed by the tonnage in question.[4] The figures computed for the Finnish merchant marine are presented in table 3:18. They do not include coastal sailing tonnage, because it still included vessels which were not occupied for the full summer season.

The figures seem to indicate a significant increase in productivity. Steamship production per ton more than doubled and, moreover, growth was continuous. Even sailing vessel productivity seems to have increased at the end of the period,

4 See e.g. Gjölberg, "The Substitution of Steam for Sail," p. 140 (Diagram 2).

TABLE 3:18. Production and productivity indices for Finnish shipping 1865—1913 (1912/13 = 100).
S/V = sailing vessels, excl. coastal transport,
S/S = steamships.

Time	Index of ntm			Index of tonnage			Index of productivity		
	S/V	S/S	Total	S/V	S/S	Total	S/V	S/S	Total
c. 1865	75	2	45	109	5	79	69	42	57
c. 1875	80	7	50	150	15	111	53	46	45
1885/86	60	12	40	131	21	99	46	57	40
1894/96	53	38	47	109	39	89	59	97	53
1904/06	71	73	71	105	79	98	68	93	72
1912/13	100	100	100	100	100	100	100	100	100

NB: Sailing vessels of 100 net ton or less were regarded as coastal vessels.
Source: Tables 2:3, 3:5 and 3:11.

although it declined at first, obviously as a response to the depression in the 1880s.

On the other hand, the productivity indices do not substantiate the empirical data on performance which was collected from the insurance registers. Table 3:19 presents actual mileages sailed in one year by sailing vessels and steamships in the size-classes which were not laid up for the winter. In order to eliminate the effect of business cycles, all the years represent boom periods (exept 1885 for steamships, which was chosen simply because it was the first year with any number of steamers sailing beyond the Sound). It is apparent that there was hardly any increase in annual mileage. Indeed, the only systematic trend was that sailing vessel mileage grew in line with the increase in size.[5] Thus, only the

5 This is, of course, to be expected, since the speed potential (hull speed) of a vessel increases by the square root of its waterline length. This effect is, however, not very strong. E.g. a 1,000-ton ship is only c. 20 % longer than a 500-ton ship and the difference in hull speed is only c. 10 %. In reality, the speed of a sailing vessel depended on sail area and wetted area as much as on length. During the last quarter of the 19th century, economies were made in rigs by abolishing sky-sails, studding-sails and other "flying kites", and by razing frigates to barques and barques to barquentines, which must have negatively affected their speed in light weather.

TABLE 3:19. Average annual total mileages (with cargo and in ballast) of sailing vessels and steamships in boom periods.

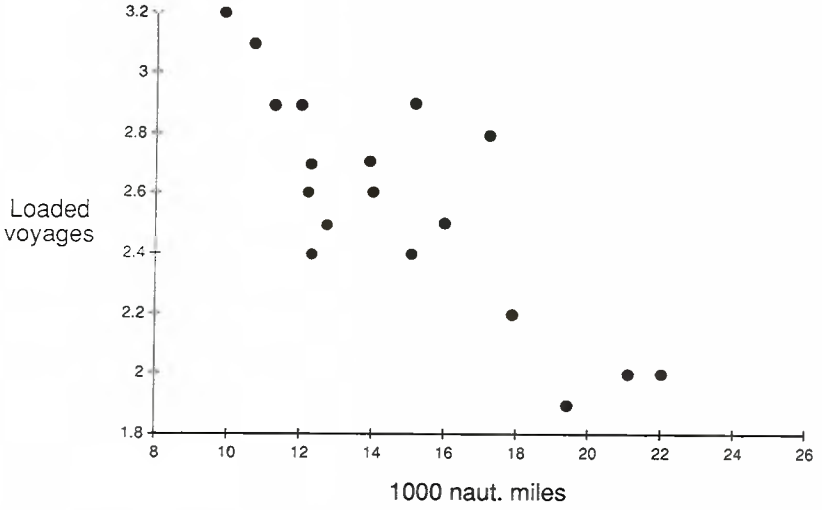
Time	Size-class (net tons) 500>700	700>1000	1000>1500	1500—
A: Sailing vessels				
c. 1875	13800	17880	21090	.
c. 1895	12250	17160	15020	19380
c. 1913	11220	15090	19390	22040
B. Steamships				
c. 1885	21310	.	.	.
c. 1895	26710	23210	.	.
c. 1913	22330	18190	21130	31830

Source: Data collected from the insurance records of *Sjöassuransföreningen i Finland.*

transition to larger ships could have produced some increase in technical efficiency.

The discrepancy between the empirical data and the productivity indices arose simply because the changes in the latter were brought about mostly for reasons other than technical development. Not only were the actual ton-mileages affected by business cycles (e.g. increases in ballasted voyages lowered the total of loaded ton-miles) but they also reflected how effectively the tonnage was deployed, above all how large a share of it was not laid up for the winter. Finally, as has already been noted, the ton-mile is not a perfect gauge of shipping output, since no account is taken of the time in port and port activities (see p. 140). Two similar ships could produce widely different results, depending on the length of their voyages. This is quite dramatically illustrated in figure 3:2, which shows how the average annual mileage sailed by Finnish sailing vessels compared with the number of cargoes carried. It also contains an implicit comparison of mileage and ship size, since a low number of cargoes per year was typical of large vessels engaged in long trade (these vessels also sailed on more favourable winds than vessels on the Northern Atlantic or

Fig. 3:2. The Relationship of Loaded Voyages and Total Mileage Sailed in a Year.



Source: Data file of vessels insured with Sjöassuransföreningen i Finland.

the Mediterranean, for example). There was a logical (obviously curvilinear) difference in favour of long trade, and an increase of one cargo (or rather, a corresponding shortening of the average voyage) could decrease mileage by 4,000 to 5,000. Unfortunately, the material on steamships is not varied enough for comparison: most of the ones for which there is good voyage data sailed similar routes.

The importance of time in port was also reflected in the freight rates. Examination of the rates and the distances involved shows that more was paid per mile on a short haul than on a long haul; the rate seemed to consist on the one hand of a fixed price per ton (depending largely on the stevedoring costs of the goods involved), and on the other of a fare set according to transport length. In the 1860s and 1870s, according to freights paid to Finnish sailing vessels, the "fixed part" corresponded to a distance of about 2,100 and 1,400 nautical miles respectively. In the following decade, the

figure was over 6,000 miles and in the 1890s about 1,700 miles.[6] International freight rates from 1909—13 indicate that port activities could be compared with 1,300 miles of plain sailing in the grain trade and about 2,800 miles in the coal trade.[7] Obviously the changes had very little to do with the development of port efficiency, they rather reflected market changes: the prices of long hauls may have increased more than short ones (and vice versa).

In order to assess whether technological development affected productivity at all, some of the above parameters need to be revised. First, to eliminate the effect of the changing number of ships limited to summer sailing, tonnage should be expressed in terms of "year-round-occupied tonnage". In other words, tonnage laid up for the winter is multiplied by a figure of less than one; in this case a realistic multiplier seemed to be 0.6.[8] Second, to eliminate the effect of changes in the average length of voyage and time in port, ton-mile figures need to be manipulated by adding something to represent port activities. The addition of 2,000 nautical miles to each loaded voyage[9] seemed realistic for all ships except coastal steamers; because they mainly transported passengers, which are quick to "load" or "unload", only 1,000 miles was added. However, it must be pointed out that any mileage figure is arbitrary and does not account for the possibility that the

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6 The data was collected from the ships' accounts (see appendix 4:1). In each case, a regression line was plotted comparing the length of the haul with freight per ton (and the relationship was often remarkably linear). The regression lines were as follows:

1864 / 66	y = 20.9 + 0.01x
1874 / 76	y = 13.4 + 0.01x
1884 / 86	y = 21.2 + 0.0033x
1894 / 96	y = 9.4 + 0.0054x
1904 / 06	y = 11.6 + 0.0027x
1912 / 14	y = 20.9 + 0.0027x

7 The estimates were based on freight data published in Harley, "Issues on the Demand for Shipping Services, 1870—1913", p. 72.

8 Typical laying-up times were four to six months, or 0.3—0.5 years. Tonnage occupied for 12 months a year according to tables 3:4 and 3:10.

9 This was done using the classified data in tables 3:5 and 3:11; the average length in each trade category was first computed by dividing the ntm by nt, this was then increased by 2,000 and the result multiplied by the nt in question.

TABLE 3:20. Revised production and productivity indices for Finnish shipping 1865—1913 (1912/13 = 100). S/V = sailing vessels, excl. coastal transport, S/S = steamships, a = productivity based on the index of actual ntm, b = productivity based on the index of revised ntm (rntm).

Time	Index of rntm			Index of tonnage use			Index of productivity					
	S/V	S/S	Total	S/V	S/S	Total	S/V		S/S		Total	
							a	b	a	b	a	b
c. 1865	94	3	39	110	3	78	68	85	62	82	58	51
c. 1875	99	8	45	137	11	99	61	81	60	71	50	45
1885/86	79	13	40	112	17	84	54	76	66	76	48	48
1894/96	71	36	51	101	34	81	54	78	112	107	58	62
1904/06	77	71	73	99	77	92	71	82	95	91	78	79
1912/13	100	100	100	100	100	100	100	100	100	100	100	100

NB: Index of tonnage use results from: (tonnage in year-round occupation) + 0.6 × (tonnage laid up for the winter). Index of r(evised)ntm results from: nt x (nm + 2000), for coastal steamers nt x (nm + 1000), computed from classified data and unrounded figures.
Source: Tables 2:3, 3:5 and 3:11.

actual time in port depended a great deal on the cargo in question and, moreover, that the average length of time probably decreased.[10]

The revised productivity indices, while still requiring due caution, show quite clearly that changes were brought about more as a result of inconsistency in efficient tonnage use and the prevalence of long trading than by technical development. There was hardly any improvement for sailing vessels, apart from the very end of the period; on the other hand, the decline in the 1880s and 1890s seems to have been caused by trade structure and other market-induced factors (such as increase in ballasted voyages) rather than, for example, by the deterioration of tonnage with age.

10 An additional problem was that port times differed between chartered vessels and liners, because the latter often only handled minor amounts of cargo in intermediary ports. On the other hand, if there were many such ports, the total time spent could be quite high.

Real technical improvements in steamers seem to have taken place between the 1870s and 1890s (although the paucity of the material, especially for the 1860s, may cause some distortion in the results). For the last two decades, however, there is no indication of any change which could have been measured by an increase in ton-miles.

According to revised and unrevised figures, however, there was a total productivity growth in the order of 50 per cent. This simply resulted from the increase in steam tonnage. Since steamers greatly outperformed sailing vessels, this was enough to improve overall productivity even if steam and sail, on their own, maintained the same level all the time. As was mentioned before, it was felt at the time that steamships could carry three times as much cargo as sailing vessels within a given period. The empirical material used in table 3:19 suggests a much smaller difference, and a similar result is obtained if sailing vessel and steamship actual ton-miles are divided by respective total tonnages. Once again, however, it must be remembered that the trades in question were so different that comparison is rather misleading. On the other hand, if the revised ton-miles (as computed above) are divided by the revised (year-round-occupied) tonnage, clearly higher ratios are obtained (three boom periods):

c. 1875	3.5 : 1
1894/96	5.4 : 1
1912/13	3.7 : 1

The wide variety in the results is a good illustration of how difficult "pure" comparison of technical performance is in reality.

* * * * * *

Finally, a few thoughts must be given to labour productivity. Since man-ton ratios declined significantly during the entire period (see p. 106), labour productivity must have improved more than production per ton. The calculations which are presented in table 3:21 show that growth was quite impressive; labour productivity on sailing vessels at least doubled and on steamships it grew four-fold. For sailing vessels the real gains originated in the last decade of the period, and for steamships mainly after the 1880s.

Productivity development was thus quite good because it

TABLE 3:21. Labour productivity in the Finnish merchant marine, 1865—1913.
S/V = sailing vessels, excl. coastal transport, S/S = steamships, excluding restaurant personnel
a = productivity based on the index of actual ntm,
b = productivity based on the index of revised ntm (rntm).

Time	Index of total labour			Index of labour productivity[1]					
	S/V	S/S	Total	S/V		S/S		Total	
				a	b	a	b	a	b
c. 1865	193	11	115	39	49	18	24	39	34
c. 1875	240	26	149	33	41	23	24	34	30
1894/96	140	55	104	38	51	69	65	45	49
1912/13	100	100	100	100	100	100	100	100	100

1 Index of ntm or rntm divided by the index of total labour.

Source: Tables 2:26 and 3:20.

improved compared with both capital[11] and labour. This was by no means the rule during a period of technical transition. For example, the Finnish sawmill industry experienced substantial growth in labour productivity in the period 1860—1900, when the use of steam power became common, but the productivity of capital declined at the same time.[12] Thus, Finnish shipping was not as badly off in all respects as its slow total growth might suggest.

11 The productivity of capital did not improve only as a ratio of production to net tons. Since the current value of the tonnage, or the average value per ton, did not rise in the long run (see p. 100), production also grew compared with the capital value of the fleet.

12 Hoffman, *Suomen sahateollisuuden kasvu*, p. 100—101.

Finnish shipping and the transport demands of Finnish foreign trade

When the performance of a national fleet has to be put into a wider context, one traditional method is to compare it with all the maritime transportation of the country in question. For the 1860s and 1870s, after the abolition of various national navigation acts, when competition on the international freight market was very free and ship-owners usually earned a similar amount irrespective of the origin of goods transported, this kind of comparison would not be fully relevant. Later, however, after the introduction of the conference system[13] in international liner services and the rebirth of shipping subsidies in many countries, "the freedom of the seas" was markedly reduced. Accordingly, the transportation of the country's foreign trade again became a natural source of employment for the national merchant fleet.

The growth in Finnish foreign trade during the period 1860—1913 was much greater than the increase in sea transport by Finnish vessels. As was shown previously (see p. 26), the demand for cargo-space for Finnish exports grew about six-fold in four decades (1870/72—1910/12), and official shipping statistics registered a five-fold increase in loaded arrivals and departures during the same period.[14] Both ratios indicate that foreign trade outgrew Finnish shipping by a wide margin.

The same development is also to be seen in the traditional statistical variable, the proportion of domestic vessels in maritime traffic. According to Finnish official statistics, this was in continuous decline in from 1860 to 1913. In the late 1860s, Finnish vessels still accounted for about 70 per cent of all loaded entries and departures, but this dropped as low as 44—48 per cent during the last decade of the period.[15]

Unfortunately, the pre-1892 statistics contain some serious

13 A useful overview of the development of the conference system can be found in Cameron and Faradon, *Lloyd's List* (Development of the Liner System and Shipping Conferences), p. 169—177.

14 Finnish official statistics, ser. I and IB.

15 Kaukiainen, "Merenkulku", p. 474 (figure 18); Kaukiainen, "The Transition from Sail to Steam," p. 173.

errors, mainly because of double registering (see p. 130).[16] Therefore, it is not possible to follow the decline in domestic tonnage over the whole period. Nor would it be as useful as it might appear; one single percentage series can disguise some very significant variations. Above all, the percentage of Finnish tonnage differed largely in different kinds of transportation. As mentioned before, most ships operating regular services between Finland and Sweden and Finland and Russia were Finnish, as were the coastal sailing vessels. Accordingly, domestic ships had the lion's share of maritime business to and from these countries. However, this also implies that, in the Baltic and the North Sea, the performance of Finnish ships was well below the overall figure. Moreover, there were significant differences between export and import shipping.

Table 3:22 presents some recalculated figures for the last three sample periods of this study. It is very clear that, with the exception of trade with Sweden and Russia, Finnish shipping had a very small slice of the maritime transport cake, especially in exports (clearances). Since, at the end of the period, a great deal, probably half, of the shipping activity between Finland and her neighbouring countries was passenger traffic, the residual group, other countries, actually represents the real bulk of Finland's foreign trade, at least as far as cargo space is concerned.

The reasons why Finnish vessels had such a small share of business to the Southern Baltic and beyond are two-fold. First, it is obvious that there was a plentiful supply of tonnage in these waters during the decades in question. A national share of about 50 per cent in such market conditions is, according to more recent experiences, not low at all,[17] and Finnish tonnage was indeed able to sustain such a level in import trade. The huge surplus volume of exports over imports, however, made it difficult to attain similar success with exports. This would have required a high proportion of ships to return to Finland in ballast, and this was not an attractive alternative for steamers, which had fuel costs

16 Double registering mainly concerned Finnish steamship traffic (before 1892, domestic traffic was also included in shipping statistics), and therefore resulted in an inflated figure for domestic vessels, which, moreover, grew with the growth of steam shipping. Only for the early 1860s, when steam shipping was still modest, must the figures have been quite realistic.

17 E.g. the proportion of domestic tonnage in Norwegian maritime transport was a little more than 40 % in the 1970s.

TABLE 3:22. The percentage of domestic vessels in different sectors of Finland's maritime transport (net tonnage registered in loaded entrances and clearances), 1894—1913.

		Sweden, Russia	Other countries	All foreign shipping
1894/96	Entrances	77.3	47.0	62.6
	Clearances	93.2	25.0	41.6
	Total	85.1	30.2	48.4
1904/06	Entrances	75.7	54.6	64.7
	Clearances	88.0	22.6	35.3
	Total	81.4	30.0	44.7
1912/13	Entrances	74.4	42.8	54.7
	Clearances	91.4	22.3	38.8
	Total	83.5	28.6	44.4

Source: Finnish Official Statistics, ser. I and IB (recalculated from figures on shipping in Finnish ports).

irrespective of their loaded condition. It seems, therefore, that the big increase in regular steamer services in Finnish foreign shipping almost automatically led to a decline in the share of domestic vessels in export shipping.

This conclusion, however, is only acceptable with reservations. First, it seems that the high proportion of foreign vessels in Finland's export transportation was not a new phenomenon. Although early shipping statistics do not directly yield such information, it is possible to estimate that, as early as at the end of the 1860s, Finnish vessels were below the 50-per-cent level in loaded departures to countries other than Russia and Sweden; by the middle of 1870s the figure had further declined to below 40 per cent.[18] Developments can be gauged more precisely by looking at export shipping from the biggest timber ports (Kemi, Oulu/Uleåborg, Pori/Björneborg, Kotka, Hamina/Fredrikshamn and Viipuri/Wiborg), which handled 60—70 % of Finland's exports of

18 Cf. Kaukiainen, "British Timber Imports and Finnish Shipping", p. 165. The estimates were calculated by subtracting the tonnage of vessels sailing to Finnish and Russian ports from the tonnage of all cleared Finnish tonnage and the total of cleared tonnage, and by comparing the Finnish residue tonnage with the total residue tonnage.

sawn goods.[19] Since very few goods were shipped to Sweden and Russia from these ports, the figures in practice represent shipping to "other countries". The percentage share of Finnish ships in these ports was even lower than in all export shipping:[20]

1866/67	35 %
1874/75	29 %
1894/95	16 %
1904/05	13 %

Although the percentages chart a definite decline, it is just as evident that, even in the "golden" days of windjammers, Finnish shipowners were not very eager to carry domestic wood products. In the light of what was said about the development of sailing ship trade, an obvious conclusion is that owners of large ships, at least, regarded foreign cross-trade as a much better proposition than shipping wood from Finland. Whether this was true during the whole period in question remains to be seen, but it can be said that wood was not a favourite cargo for line steamers. It was rather carried by cheap tramp ships, of which there was no great abundance in the pre-war Finnish merchant marine.

In one respect, however, the situation had changed fundamentally. In the 1860s and 1870s, Finland had more tonnage than she needed to transport her own export and import cargo. After that, the growth of foreign trade surpassed the development of shipping to such a degree that, at the beginning of the 20th century, the tonnage was not sufficient even in theory to carry all the goods involved in Finnish foreign trade. This is clearly visible from a comparison of the transport output of the Finnish merchant marine with the demand for cargo space for export and import goods.

Since traffic to Sweden and Russia mostly involved passengers and goods transported by coastal sailing vessels, and since some of the trade with Russia was carried out by rail,[21] it seems best to

19 From the beginning, Finnish shipping statistics specify traffic by port. The figures cannot be calculated for before 1866, since it was only then that statistics began to separate loaded and ballasted departures.

20 Kaukiainen, "British Timber Imports," p. 166.

21 Moreover, data on coastal traffic to Russia is incomplete for the 1860s.

TABLE 3:23. The demand for shipping in Finnish foreign trade (excl. Russia and Sweden) and the transport output of Finnish vessels (excl. coastal traffic), 1865—1913.

Time	Demand for shipping		Transport output			
	A. 1000 nt	B. Mill. ntm	C. 1000 nt	D. Mill. ntm	C/A	D/B
c. 1865[1]	198	300	495	1220	2.5	4.1
c. 1875[2]	400	520	538	1327	1.3	2.6
1884/86	988	1300	500	1034	0.5	0.8
1894/95	1417	1750	637	1161	0.4	0.7
1904/06	2241	2450	862	1815	0.4	0.7
1912/13	3079	3300	1106	2570	0.4	0.8

1 Demand for shipping 1867/68.
2 Demand for shipping 1874/76.

NB: The demand for shipping in ton-miles was estimated by multiplying tonnage by the average transport mileage of Finnish vessels in export and import trades (excl. coastal traffic).
Source: Finnish Official Statistics, ser. I and IB; table 3:16.

leave them out of the calculations and focus the comparison on trade with other countries. The results are shown in table 3:23, in which the actual tonnage, entered and cleared (to and from countries other than Sweden and Russia), is used as a proxy for tonnage demand. The figures agree quite well with earlier estimations of the demand for cargo space for the most important export items (table 1:3).

The table shows that, in the 1860s and 1870s, both by net tons and ton-miles, Finland had (as expected) clearly more tonnage than she needed to carry her foreign trade; after that there is an equally systematic deficiency. However, caution must be used in comparing these ratios. As was pointed out before (p. 139—140), neither tons nor ton-miles are perfect indicators of transport performance, or of the transport potential of a merchant fleet. Thus, the ratios (C/A and D/B) computed in table 3:22 can only present minimum and maximum levels of surplus and deficit. A more accurate calculation of the transport potential would require

some allowance in ton-miles to be made for time in port. The productivity calculations incorporated a 2,000-nautical-mile allowance for each cargo. Incidentally, this revision of ton-miles produces ratios which fall close to the average of C/A and D/B:

c. 1865	3.2
c. 1875	1.8
1884/86	0.6
1894/96	0.55
1904/06	0.5
1912/13	0.5

To sum up, the comparison suggests that, in the 1860s, Finland had three times more tonnage (other than coastal) than was necessary to transport her normal export and import cargo to the other side of the Baltic and beyond. In the mid-1870s, there was still an excess of almost 100 per cent (or slightly less, because the tonnage could not be used for a full 12 months a year on export and import transport). Thus, it was no wonder that international cross-trading represented such a large share of the total occupation of ships. Rapid growth in foreign trade and a simultaneous decline in tonnage in the 1880s, however, meant that Finnish shipping could, in theory, only carry about 60 per cent of export and import cargo. During the last two decades of the period, domestic tonnage represented a rather constant 50 per cent of the total shipping capacity needed in the country's foreign trade. It must be remembered, however, that this is a totally theoretical comparison; in reality, Finland was left with an increasing amount of tonnage, large sailing vessels, which could not be used economically in Baltic or North Sea transport. Irrespective of the rates of return enjoyed by their owners, the ships offered no opportunity to those who wanted to carry goods to or from Finland.

IV. Income and profitability

1. Problems of data

It is a well-known fact that, during the last quarter of the 19th century, the general trend in maritime freights was downwards. Anyone in the business could see for themselves by reading *Lloyd's List*, for example, and the development was also depicted in statistical publications long before L. Isserlis brought out his often-cited study of tramp freights from 1869 to 1935.[1] Although the representativeness of traditional freight indices has been questioned lately,[2] it cannot be denied that the shipping industry was facing quite dramatic economic challenges during the period of technical transition.

The decline of freight rates could, of course, have had very different implications in different sections of the economy. For manufacturers and merchants it meant a welcome decrease in transport costs, but for a ship-owner it could have signified a decline in income, unless he was able to increase the efficiency of his ships enough to compensate. The existence of such a trend also suggests that the current value of maritime transport was possibly developing along more diverse lines than the ton-mile ratings would imply. It is even less likely that output volume was directly related to shipping profitability.

1 See e.g. Sundbärg, *Aperçue statistiques internationaux*, table 264; Isserlis, "Tramp Shipping Cargoes, and Freights".

2 Fischer and Nordvik, "Maritime Transport and the Integration of the North Atlantic Economy, 1850—1914"; Harley, "North Atlantic Shipping in the Late Nineteenth Century".

Historical studies on shipping, however, contain relatively little on the economic returns of the trade. This is not altogether surprising, since there is one overwhelming problem which makes progress rather slow in this field: the lack of data. Unlike technical details about new vessels and their speed records, the economic returns of shipping normally remained the private knowledge of the owners, and early shipping statistics only seldom touched on income or profits.[3] Thus, there is not a wealth of data on the actual economic basis of shipping. This shortage has forced a number of maritime historians to employ different surrogates or "proxies" in place of hard evidence. For example, gross freight has been estimated by using some well-known indices of freight rates, and the value added by shipping calculated assuming that it amounted to some round percentage of gross freight. Even the best of the indirect methodologies, inevitably, depend on certain presumptions, which have not been established empirically, such as estimates of the average number of voyages per year, the amount of cargo that could be stowed per register ton and the frequency of ballasted voyages.[4]

Shipping acounts

The simplest and at the same time the most reliable way to study shipping income and profitability is to exploit the original profit-and-loss accounts of the shipowners. The only drawback of this strategy is that such accounts have not been preserved in any great quantity — just the opposite. This means that problems of representativeness are always present, and this may impose certain limitations on the validity of the results.

In Finland, lots of late 19th-century archives from private enterprises have been preserved both in public and private collections.[5] Shipping, however, is rather poorly represented;

3 Only Swedish and Norwegian shipping statistics present a continuous series of freight income from the late 1860s.

4 See, for example, the use of such assumptions in Lewis R. Fischer, Eric W. Sager and Rosemary E. Ommer, "The Shipping Industry and Regional Economic Development in Atlantic Canada," p. 33—53.

5 There is an extremely good general directory of Finnish business archives, *Suomen yritysarkistot I—II.*

obviously, manufacturing and other industries with permanent buildings were in a better position to preserve their papers than owners of perishable wooden ships, especially since shipping companies were often dissolved when the ship was sold or wrecked. The number of existing shipping archives is limited and almost all of them which contained any real ships' accounts from the period in question were used for this study. Thus, the material is not a sample. Its extent and distribution — geographic and other — were determined simply by what had been preserved and not by any considerations of representativeness.

The backbone of the material comes from nine archives of trading-houses and ship-owners, which are both extensive and very well preserved. All these contained accounts of ships covering rather long periods. In addition, the "Maritime Archives" of *Åbo Akademi* contain a large number of detached ships' accounts, which have been collected from different private sources. Finally, data from a few existing studies were also appended to the material.[6]

These archives and collections yielded data for about 180 different ships,[7] of which 60 were steamers. The material was in the form of annual accounts or voyage accounts which usually spanned several years; all told they covered more than 1600 vessel working years.[8] Although there were a few accounts which yielded ambiguous data on income or profit, the total amount of material is sufficient to give at least an idea of normal income and profit expectations. Unfortunately, the material is not equally representative of all kinds of vessels. The total number of working years falls into the following main categories:[9]

Sailing vessels, long trading	810 years (48.4 %)
Sailing vessels, sailing on the North Sea and the Baltic	249 years (14.9 %)
Steamships	615 years (36.7 %)

6 See appendix IV:1.

7 Five of these appeared in two different archives, as they were sold to other Finnish owners.

8 See appendix IV:1.

9 Data files collected from accounts presented in appendix IV:1. Unless otherwise stated, all the following numerical descriptions are based on the same data file.

There is plenty of data on long-trading sailing vessels, at least compared with what is available on the smaller windjammers sailing on the Baltic and the North Sea (the number of long-traders over the entire period 1860—1913 was previously estimated at slightly less than 50 per cent of total sailing tonnage), and there are just a couple of examples of coastal sailers. The number of steamship accounts clearly exceeds their total share of tonnage during the period (at the beginning of the 1890s they had a 10% share of total merchant tonnage), but an overwhelming majority of them date from the latter half of the period. The number of observations from before the 1880s is, indeed, so low that random variations may excessively affect the results. Moreover, the material from after 1885 is not quite as good as the number of ships and working years might suggest. Data from the ships of the biggest steamship-company, *Finska Ångfartygs Aktiebolaget* (FÅA) was not processed with equal thoroughness for each year. The company ledgers contained a large number of different accounts — there were normally eight to ten for each ship — and the system became more complex with the growth of the business. Moreover, although the company did compute depreciation, the accounts did not separate balance and profit-and-loss statements systematically (for example, the accounts for coal and oil open with the value of existing coal and oil stocks). Many individual accounts also contained transfers from other accounts and certain expenses were accounted differently at different times.[10] It was therefore necessary to make minor corrections to the different ships' accounts. In addition, company overhead costs had to be distributed between the ships in order to arrive at realistic results.[11] It would have been too time-consuming to do all this for each single year, so a sample was collected instead: corrected

10 E.g. wages which sailors were due to receive but which were not paid were not included in expenses before the turn of the century. Insurance costs were first included in the ships' accounts (although when the company took part of the risk and set up an insurance fund, sums paid to it were not deducted from ships' profit-and-loss accounts) but at the end of the period they were excluded.

11 This was done by tonnage, which may slightly underestimate the overhead costs of big passenger (emigrant) vessels. The company overheads, however, were very small and did not greatly affect the profitability of individual vessels.

TABLE 4:1. The distribution of ships in the accounting material, by province.

Province	Number of cases sail	steam
North Ostrobothnia	21	1
South Ostrobothnia	8	4
West coast of Turku and Pori province	10	—
Åland	30	—
Turku	17	10
Turku archipelago ("peasant" ships)	26	—
Helsinki and Porvoo	5	44
Viipuri	5	1
Viipuri province ("peasant" ships)	2	—
Total	124	60

NB: Ships which were sold from one province to another were counted in both.

Source: Data file collected from the accounting material described above.

figures for individual ships were computed only for every tenth year (1885, 1895, 1905 and 1913). However, "raw" data on gross revenue (totals from the credit sides of the ships' freight and passenger accounts) and traffic result (the balance of the ships' profit-and-loss accounts, excluding overhead costs) were collected for each year. As far as gross revenue is concerned the error is negligible; traffic results, on the other hand, sometimes exceeded real net result by a considerable margin. Although this difference must be accounted for when profitability is estimated, the figures in general are accurate enough to give a true picture of profit fluctuations across the whole fleet.

As table 4:1 shows, the most important shipping provinces are quite well represented in the material. With the exception of South Ostrobothnia, which is underrepresented compared with the northern part of the province, the geographic skewness of these distributions is roughly in line with the shipping activity in different provinces and towns.

Chronologically, the material is not very evenly distributed. As far as sailing vessels are concerned, there are far more accounts for

TABLE 4:2. The chronological distribution of accounting material (Sailing time).

Period	Total number of accounts	Total coverage in years	Average ship-size, net tons	Average total tonnage in the sample[1]
A: All sailing vessels				
1860—69	81	175	442	7,740
1870—79	142	249	471	11,730
1880—89	120	230	479	11,020
1890—99	95	151	522	7,880
1900—09	89	144	870	12,530
1910—14	43	67	1253	16,790
Total	570	1,016	600	.
B: Cross-trading sailing vessels				
1860—69	71	164	455	7,460
1870—79	102	207	557	11,530
1880—89	74	163	603	9,830
1890—99	55	102	681	6,950
1900—09	58	114	1076	12,270
1910—14	37	59	1352	15,950
Total	397	809	714	.
C: Steamships				
1860—69	4	4	195	78
1870—79	13	15	213	320
1880—89	31	40	493	1,972
1890—99	189	189	578	10,924
1900—09	254	254	651	16,535
1910—13	113	113	676	19,097
Total	604	615	612	.

1 Average size multiplied by coverage in years divided by ten (1910—14 divided by five, steamships 1910—13 by four).

NB: Ships which mainly carried other than Finnish export or import cargoes, and normally did not return home for the winter are included in the "cross-traders" category. Individual accounts were included in the period within which their middle years fell. Each annual account for an *FÅA* vessel has been regarded as an individual account.

Source: Data file collected from the accounting material described above.

the earlier half of the period than for the latter half (table 4:2): over 60 per cent of them cover the first three decades. This imbalance, however, is somewhat illusionary. As the average size of vessels grew, their numbers decreased and, therefore, there is no reason to expect an equal number of accounts for each decade. Indeed, the tonnage covered by the accounts did not decline at the same rate; on the contrary, the highest figures occur after the turn of the century. The tonnages are also high enough to represent a significant share of total tonnage, at least in the larger size-classes. The long traders (cross-traders) in the accounting material can be estimated as percentages of all Finnish long-trading tonnage as follows:

1860—69	7.1 %
1870—79	11.8 %
1880—89	15.2 %
1890—99	9.5 %
1900—09	16.0 %
1910—14	17.6 %

If the small flaws in the *FÅA* data are overlooked, the representativeness of steamship accounts is even better: from 5 per cent (of ships over 100 tons) in the 1870s, the figure rose to about 50 per cent in the mid-1890s and remained at about 35 per cent after that. The great drawback is that the steamship accounts do not represent all shipping categories: the data does not include a single tramp steamer. Neither does it cover small tonnage to any reasonable degree. Percentages, of course, do not indicate the true representativeness of material; this depends not only on the number of observations but also on the amount of variance found in different variables.

* * * * * *

In one respect, shipping accounts are a rather difficult source material: they are quite frequently incomplete. This problem results from the nature of the trade in the days of sail: economic transactions and decisions normally occurred in at least two different localities. The owner, of course, made the most important decisions and also paid the expenses of the ship and its crew as long as they were in the home port or nearby. However, when the ship had sailed, communications which were then available did

not allow the owner much participation in day-to-day business aboard and he had to leave most of it in the hands of the master. The latter, then, paid practically all running expenses, signed the charter-parties and collected freight revenues, only now and then sending surplus money home (or sometimes drawing a bill of exchange on the owner). This bifurcation of responsibilities also meant that each single ship normally had two different sets of accounts, those of the master, which recorded the ship's running expenses and income, and those of the owner. In addition, there was normally a third account, that of the crew (usually an appendix to the master's account); since wages were paid both by the owner and the master, the men's total earnings had to be calculated when they were paid out.[12]

Not surprisingly, it frequently happens that only one of these accounts is preserved, and this inevitably means that some part of the ship's economy remains unknown. The quality of individual accounts also varies and some yield much more information than others. For example, different masters specified various cost items in foreign ports very differently. In some cases it is easy to distinguish between food expenses and bosun's stores, while in others, different ships chandlers' bills are merely recorded as lump sums.

A general feature of the material is that the owners' accounts, which show the net result ("profit and loss"), are much better preserved than the masters' accounts. To illustrate the differences in data availability, the frequencies of four important variables are tabulated in table 4:3.

The differences in the numbers of usable observations may seem disturbing. The pattern, however, is very fortunate as it corresponds with the quantitative needs for different kinds of data. The variables presented above differ widely in terms of variance: in the material concerning sailing vessels, the standard deviation for profit (expressed per year and net ton) was about 110 per cent of its arithmetic average, while the corresponding figures for the three others ranged between 30 and 39 per cent; for steamships the

12 See Yrjö Kaukiainen, "From Days and Knots to Pounds and Dollars", p. 62—63.

TABLE 4:3. The frequency of selected economic variables in the accounting data.
1= number of accounts, 2= coverage in years, 3= average tonnage

	Sailing vessels			Steamships		
	1	2	3	1	2	3
Owners' accounts with data on net result	356	734	699	102	113	538
Masters' accounts with data on gross income	191	385	683	103	114	524
Crew accounts with data on crew wages	154	313	625	54	53	641
Owners' and masters' accounts with data on food expenses[1]	82	195	702	48	48	695

1 This item also requires the owner's accounts for the initial provisioning costs.

Source: Data file of accounts specified in appendix IV:1.

deviations varied in a similar manner.[13] It is quite clear that, in the first case, many observations are needed in order to avoid excessive error in the estimate. On the other hand, for gross income, wages and food expenses, a much smaller number of cases still produces a rather low standard error.[14]

In general, the accounting material is abundant enough to enable reasonably trustworthy conclusions to be drawn about the entire Finnish deepwater fleet, whether sail or steam. With an

13 Because the levels of income and profit were quite different, the data for steamships and sailing vessels should not be merged.

14 For example, for the previously-mentioned variables, the standard errors of estimate compared with the arithmetic averages in the cross-trading sailing fleet were as follows:

net result per year and net ton	6.4 %
gross income per year and net ton	2.5 %
wages per year and net ton	2.6 %
food expenses per year and net ton	3.2 %

The figures are based on the standard deviation for the whole period and do not take account of possible systematic changes within it.

average of over fifteen observations a year on profit and nine on gross income, it is possible to produce a realistic analysis of general trends. The main drawback is that data on smaller vessels is scanty, and this inevitably introduces an element of error into all estimations covering the whole merchant fleet.

Methods of calculation

In this study, the ships' accounts were used in two ways. They helped to illuminate changes which were important on the business-level, such as fluctuations in income or profit and general cost development. They were also exploited in producing macro-level parameters of economic performance, the gross income of the whole merchant fleet, as well as the net result, or profit, and the contribution of shipping to the gross national product. This means that the calculations were made in two logical stages; first, the data had to be converted into time-series of income and profit, which were then extrapolated to produce macro-level variables for all Finnish shipping.

As data on both gross income and net result were drawn directly from empirical source material, it was not necessary to make complicated calculations at the first stage. Only two simple amendments to the actual monetary values found in the accounts were needed for the purpose of commensurability. First, since the accounts cover very different periods, the figures had to be expressed as annual averages and, secondly, as the ships were of different sizes — which directly affected gross income — they had to be divided by the net tonnage of the vessel in question.[15] Thus, both income and profit are always expressed as average figures per year[16] and ton.

15 For a discussion of net ton as a scaling device see Kaukiainen, "From Days and Knots," p. 70—71.

16 The basic calculations of gross income and net result did include various periods of inactivity (total accounting period). For long-traders, effective sailing time, in other words, time at sea and in port excluding lay-up for repairs and fitting out, was also computed (it was assumed that, because this occurred at irregular intervals, it would have increased the standard deviation). It turned out that sailing periods were, on average, only 4 % shorter than the total accounting periods and the difference in deviation was hardly noticeable.

A few things must be borne in mind, however, in using the old shipping accounts. First, although the master's accounts invariably present calculations of the ship's income, they do not always record a sum identical to gross freight. The master may have deducted agents' fees or freight advances, thus presenting only what he actually received at the port of discharge. In such cases, the accounts must be adjusted and the missing elements of gross freight added; only compensation for damaged or late cargo can be counted as "legal" deduction. On the other hand, all other income, such as net profit from sold cargo owned by the ship (for example when salt was imported to Finland),[17] as well as minor items such as demurrage, dock dues paid by the shipper and income from sold stowage material, also need to be added.

It must be said, too, that the "profit" shown in the owner's accounts is not identical to what is now understood as net result, or operating surplus (which is the item used in national accounting); the accounting conventions of the late 19th century differed from today's in several respects. First, no real distinction was made between investments or capital costs and running expenses. It was common practice to regard the price of a new ship — just like the price of stock in a shop — as a cost which opened the debit side of the account. Income and expenses were noted normally, but only when the net profits accumulated to a sum exceeding the initial value of the ship did the account show "profit".[18] Moreover, capital repairs and additional investments such as copper sheathing or the basic fitting out of the ship were also recorded as ordinary running costs. Normally, depreciation was not accounted for but, on the other hand, interest of 6 % on the owner's capital (that is, on the balance of the account) was usually debited as a cost. It was only in the 1880s that a few steamship companies began to separate investments and costs and to

17 Net rather than gross income is used here because the issue is transport, not income from import trade. The difference between the purchase price and the selling price of salt, for example (the former also including customs dues and possible provisions), can be seen in terms of value added through transportation to consumers.

18 However, if a ship was owned by a company, the shareholders paid for it at the beginning and its value was no longer accounted for, but separate accounts were made for each voyage or series of voyages.

depreciate the value of their assets, and sailing ship owners were still slower to adopt the new system.[19]

All this means that several corrections to the owners' accounts need to be made in order to arrive at the equivalent of today's operating surplus. The initial value of the ship has to be removed from the opening debit, and expenses which either involved investments or capital repairs disregarded. Finally, only rents actually paid, but not interest on capital, can be included as costs. This only involves some straightforward subtractions and practically all owners' accounts yield the data needed to make them.

Operating surplus is the income which not only gave the owner his final profit, or return on investment, but also paid for depreciation and, if the ship was uninsured, even for the risks of shipping. During the period in question, most big ships were already insured so that risks were, in fact, converted to operating costs in the form of insurance premiums. Depreciation, on the other hand, can be determined directly from the accounts only in a few cases. The data on prices and insurance values, which was used to determine capital costs (see p. 96—97), should, however, suffice to show what were realistic levels of depreciation.

The corrected figures for gross income and net result were converted to time series separately for sailing vessels and steamships. The data was not divided according to size-classes, because this would have created too small clusters of observations; moreover, since freight income was paid typically per ton, no substantial differences can be expected between big and small vessels (apart from differences in trade). Thus, sailing vessels were divided into two classes only, ships engaged in international long-distance trade and those sailing mainly in the Baltic and the North Sea, and laid up for the winter. The time-series were not presented on an annual basis either, because this too had resulted in unreasonably small numbers of observations.[20] Instead, the figures found in the accounts were projected as moving averages: for each

19 Kaukiainen, "From Days and Knots," p. 65.

20 It may have proved difficult in some cases to split a voyage account covering several years. There were many expenses paid and much income received which covered rather long periods, or which were settled much later than they were incurred.

decade, four observations were computed so that neighbouring periods always overlapped by two years. Each single account was given a chronological fix according to its middle year and was, accordingly, classified in period(s) within the time-brackets of which this middle year fell. As accounts were of different duration, a weighted average (the chronological span of the accounts acting as the weight) was chosen as the primary parameter.

In practice, this procedure produced so many observations within each period that standard errors of estimates could be kept tolerably low. Like any system of moving averages, of course, it also has a levelling effect: short-term fluctuations are moderated and trends stand out more clearly. On the other hand, the method is more sensitive than those based on linear or simple curvilinear regressions and, therefore, gives a better description of an industry such as shipping, with rather strong fluctuations spanning several years.

As previously mentioned, steamship data was much more scanty. Moreover, it consisted of two rather different files. Data from diverse accounts found in various archives and in literature spanned a random choice of years, just as for sailing vessels, but there were only three examples from after the end of the 1880s. Accordingly, less sophisticated methods had to be employed here: common arithmetical averages, either spanning one decade or a half (depending on the number of observations) were computed as the main parameter. On the other hand, the ledgers of the Finnish Steamship Company *(FÅA)* produced rich data which could be processed in the same manner as the data on sailing vessels. However, because the "crude" annual series included certain minor distortions, they could only be used in combination with the more detailed data from the four sample years.

Steamships were difficult to study in other respects, too. First, there was a purely technical problem: the change in measurement, which meant that the *läst*-figures of the 1870s — even though converted to net tons by an empirically derived multiplier — were not a very good parameter of steamship carrying capacity. Secondly, there were different types of steamship. While practically all sailing vessels were intended to carry bulk cargo, a significant number of steamships carried passengers, and such ships differed markedly from bulk-carriers: instead of upper holds

they had cabins and saloons and carried only limited amounts of general cargo. Compared with their net tonnage, passenger ships, or passerger/cargo ships, and bulk-carriers could generate very different gross income as well as net profit. For example, in 1895, the gross revenue of the two "emigrant" ships (which sailed to Hull and also carried some cargo) of the Finnish Steamship Company *(FÅA)* earned three times as much as similar-sized cargo-ships; and the difference in net result was greater still.[21] Accordingly, to make comparisons meaningful, different profit series need to be calculated for cargo and passenger (or passenger/cargo) vessels.

The next step involved a similar process of extrapolation as used for the estimation of total traffic volumes in different trades. The most obvious, and also the simplest way of doing this was to start with the time series of average income and net result in different shipping categories and multiply the figures by the tonnage in question. As far as sailing vessels were concerned, this presented no major problem, since it was possible to present tolerable estimations of the tonnage categories according to which the data on income and profit were classified (long-traders, North Sea and Baltic tonnage, coastal vessels);[22] the only difficulty was the scantiness of data on coastal vessels.

In the case of steamships, the distinction between cargo and passenger ships was not always easy; although passenger ships were required to undergo a special safety survey,[23] neither published nor manuscript ship-lists registered which steamers had been approved and registered as passenger-carriers. Before the 1880s, however, and not counting auxiliaries, there were relatively few special cargo-steamers in the Finnish merchant fleet; moreover, the differentiation was still so weak that all steamers could be called passenger/cargo ships. Subsequently, at least in larger size-classes (or ships sailing to the North Sea), this specialization led to distinct cargo and passenger ship types, which were usually easy to identify. Only smaller vessels, below 300 net tons or so, may still pose some problems simply because

21 Ledgers of the FÅA, 1895.

22 Estimations of tonnage sailing all the year round (= long traders) were presented in table 3:4. All vessels of less than 100 net tons were regarded as coastal sailers, and the residue represented Baltic and North Sea tonnage.

23 *Finlands Författnings Samling* 14.10.1874, 18.4.1859, no. 6/1879, 27.3.1890.

they often lacked technical data. On the other hand, from the late 1890s, the cargo ships should be divided into two classes: liners and tramps. Unfortunately, data on tramp tonnage is limited.

Apart from leaving some blank or dubious areas (costal vessels, tramp steamers), the estimation method has one additional weak point: it permits only a very rough division of shipping income into different trades. Fortunately, income can also be estimated independently by computing how much on average was paid for typical hauls in different carrying trades.[24] Such data is readily found in ships' accounts; the only difficulty is that these sources contain information on a very great variety of freights. It would be pointless, for example, to look up how much was paid per ton for grain from Baltimore to Cork; such detailed data could not be related in a meaningful way to the macro-level estimates of tonnage or traffic output. A far better method is to relate income per ton to the length of haul and to compute a regression showing how income grew, on average, with distance (see p. 210). Of course, there were notable deviations from the average, such as outward (westward) cargoes over the Atlantic, but this kind of difference was normal in most trades, and the low-paying freights affected the regression according to frequency. Only in a few cases, when the focus was on trades consisting of one-way hauls such as Finnish import shipping, was it considered relevant to compute averages for a special group of freights.[25] Accordingly, this material could be used to produce satisfactory estimations of the amount of income generated by the different trades. This second estimate can be used not only to cross-check the first, but also to fill in some of

24 Similar data was also available from another source, the freight insurance registers of *Sjöassuransföreningen i Finland*. The latter material must be used with some caution, because all ship-owners did not insure their freight in full: it was very common that the freight advance (which could amount to a third of the estimated total) was, as required by the shipping agent, insured with a British company. Freight earnings recorded in the accounts are, therefore, a safer choice.

25 The average freight for e.g. salt importation from South Europe was computed from the insurance freight registers of *Sjöassuransföreningen i Finland* (see note 22), since this data is more plentiful and, accordingly, produces better estimations. The resulting figures were corrected by comparing them with the freights in the accounting material in order to compensate for the fact that cargo was not always insured in full.

the blank areas mentioned above. Unfortunately, it does not throw any additional light on coastal trade, and reveals little even for Baltic freights. It has no relevance to regular liner services, either.

By analogy the net result for all Finnish shipping can be extrapolated from the time series of profit per year and ton. In this case, only one method is possible: the average profit for each shipping category was multiplied by the total tonnage in question. The sum of wages paid (including masters' "kaplake") and food expenses must still be added to the total net result in order to arrive at the contribution of shipping to the gross national product. The basic data for these items was already presented in the chapter on labour.

2. The development of gross income

Average gross income per year was affected by factors which, at any given time, were relatively uniform. These were, above all, market factors such as freight rates and the balance between outward and homeward cargoes, which had a great bearing on the frequency of ballasted voyages. Even the length of inactive periods may have been influenced by market fluctuations: the accounting material shows, not unexpectedly, that laying up for reparations was far less common during a boom than during a depression.[1] On the other hand, the efficiency with which ships were used (e.g. whether laid up for the winter or not) as well as how effectively they were deployed in the existing freight market differed very much from one case to another. Accordingly, there was always some variance around the averages but, as mentioned before, it was moderate rather than large. Quite interestingly, the variation tended to be larger than average during boom periods. This probably indicates that up-to-date information on freight market changes did not reach all masters (or owners) to the same degree.

Sailing vessels

The average total earnings of Finnish sailing vessels are presented in figure 4:1 (detailed data can be found in appendix IV) and the development is summed up in table 4:4 in the form of indices. Since most short-term fluctuations have been eliminated, the figures show rather logical development in three or four different phases.

As far as long-traders were concerned, the 1860s represent a real "golden era". In the middle of the decade, the average annual net ton earnings clearly exceeded £5 (140 Finnish marks). On the other hand, as indicated by the standard deviation values (partly a result of the low number of observations; see appendix IV:2), there were

1 Cf. appendix IV. Average long-trader income was computed both with regard to the total accounting period (incl. laying up) and to the sailing period (excl. laying up and reparations). In e.g. 1863—67 and 1871—74 there was a difference of only 4 % between these times, but in 1866—69 and 1876—79 it was around 8 %.

TABLE 4:4. The development of the average gross income of Finnish sailing vessels, per year (total accounting time) and net ton, 1858—1914. Indices based on income in Finnish marks; the average for long-trading vessels, 1868—72 = 100.

A = Long-trading vessels over 400 net tons
B = Vessels laid up for the winter
C = 100 x B:A

Time	A	B	C	Time	A	B	C
1858—62	103	..	..	1888—92	70	46	66
1861—64	120	..	..	1891—94	61	47	77
1863—67	126	90	71	1893—97	62	40	65
1866—69	93	81	87	1896—99	70	38	54
1868—72	100	(96)[1]	(96)	1898—1902	68	38	56
1871—74	101	86	85	1901—04	54	37	69
1873—77	95	81	85	1903—07	51	35	69
1876—79	84	73	87	1906—09	52	33	63
1878—82	80	61	76	1908—12	61	45	74
1881—84	77	59	77	1911—14	71	61	86
1883—87	69	49	71	1913—14	98	(61)[1]	(62)
1886—89	71	41	58				

1 Only two observations.

Source: Appendix IV:2.

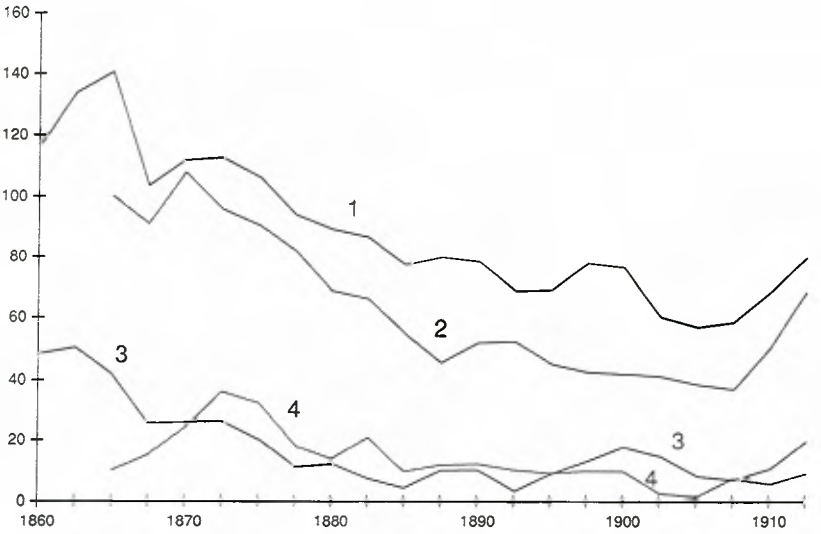
significant differences between individual ships; in the middle of the decade, the standard deviation was about 30 per cent of the average.

It seems quite clear that such a high level of income was, both directly and indirectly, a consequence of the war in America; not only did it mean that a lot of tonnage normally sailing on the Atlantic was now out of action, but it also hindered grain imports from the U.S. to Europe and thus increased grain trade from the Black Sea, as well as freight rates.[2] In addition, coal exports from

2 It is interesting that a freight index constructed by Keith Matthews (as quoted in Sager, *Seafaring Labour*, p. 165), which only covered a selection of North Atlantic freight rates, presented a rapid growth culminating in 1862, and after that an equally rapid decline. It seems obvious that the decline was mainly a result of the decline in U.S. exports. Black Sea grain freights, which were more important for Finnish vessels, reached top values later.

Fig. 4:1. Gross Income and Net Result, Sailing Vessels.

1 = Long traders, gross income
2 = Baltic and North Sea traders, gross income
3 = Long traders, net result
4 = Baltic and North Sea traders, net result



Source: Appendix IV2.

England to the Mediterranian gave a good number of outward cargoes, even though the price per ton was only about half that of grain freight.[3]

The boom ended quite abruptly in 1867—68, giving way to a short but deep depression. This was clearly reflected in income. Although freight rates rose again during the earlier part of the 1870s, the annual earnings of Finnish deepwater merchantmen no longer exceeded £5 per ton. The mid-1870s marked the beginning

3 Normal freight for grain from the Black Sea to West Europe was around £2.3 (FIM 60) per ton while coal from Wales to e.g. Alexandria fetched about £1.2 (FIM 30) per ton.

of the well-known "long depression" and, indeed, the downward trend continued, with just one break (1885—1890), until the middle of the 1890s. By the end, average annual earnings had already declined to below £3 per ton. This decline was universal, as evidenced by the fact that differences between individual ships levelled out after the 1860s; by the 1870s, the standard deviation had already fallen below 20 per cent of the average, and remained at or below that level until the middle of the 1890s.

Around the middle of the 1890s, a modest rise began, and the average income level recovered to that of the early 1880s. The boom was, however, rather short-lived, and a new decline set in after the turn of the century. This bottomed out around 1907—08, with average annual earnings falling down to less than £2.5 per ton. After that, deepwater sailing vessels again experienced slightly better times, and average income rose steadily until the War. 1913 was a particularly good year when an annual income of close to £4.5 per ton — the level of the mid-1870s — was perfectly normal.

It must be remembered, of course, that the ships in the sample were very different at different times. In the 1860s and 1870s they were, typically, newly built softwood vessels of 400—900 net tons, while at the end of the period they consisted almost exclusively of second-hand iron and steel ships of over 1,000 net tons (see table 4:2). On the other hand, there never seem to have been any systematic differences in income level by ship size;[4] the only notable exception was in the 1860s, when small vessels sailing to South America and the West Indies clearly earned more than larger bulk-carriers, but this is understandable in view of their valuable colonial cargoes (since they were under 400 tons, they were not included in the indices in table 4:4). That different sized ships earned about the same per ton is exactly what can be expected, as ships were paid freight by cargo weight or volume. As no real differences by size were apparent, it could be said that, as far as income levels were concerned, the ships represented a rather typical bunch of cargo-carriers, whose owners tried to optimize

4 This was tested by comparing the income levels of ships over 700 tons (after the turn of the century over 1,000 tons), with the average. No substantial deviation could be discerned for any decade.

their business according to the changing opportunities of the times.

The income development of vessels sailing mainly on the Baltic and the North Sea followed roughly the same trends as that for long-traders. Comparison is rather difficult for the 1860s and the beginning of the next decade, however, since income data is either non-existent or very scanty. In fact, masters' accounts for these smaller vessels are not plentiful for the whole period[5] and therefore, at certain times, the margin of error in these figures may be considerable.

There are also some interesting differences between the two income series. It seems possible that the depression of the late 1860s was relatively mild for North Sea and Baltic vessels; on the other hand, the average income fell far more steeply from the mid-1870s to the late 1880s (about 50 %) than that of long-traders (about 25 %). There was then a temporary rise, but this was followed in the mid-1890s by a new period of stagnation, as long-traders again began to earn more. Smaller sailing tonnage income fell systematically up to the 1910s, when even it caught up with the pre-war boom.

The average income of the Baltic and North Sea fleets was considerably lower than that of long-traders. At best, in the 1860s and the 1870s, the annual average was close to £4 (100 Finnish marks) per ton and fell to no less than £1.5 (less than 40 Finnish marks) during the first decade of the 20th century. This difference is not at all surprising, since the vessels in question were regularly laid up for the winter. The actual duration of lay-up varied a lot depending on the latitude of the home port but, since the bulk of the tonnage in question came from the Southwestern coast and Åland, the average sailing season amounted to 7.5 or 8 months. Thus, it might be expected that, if such vessels earned the same per ton of freight, they would bring in (per net ton) 63—67 per cent of what a ship sailing all the year round was able to accumulate. Column C in table 4:4 indicates that the average income of Baltic

5 This may have been because, as vessels frequently returned home at the end of the sailing season, the need for elaborate master's accounts was not very great. It is also possible that, since many Baltic and North Sea windjammers had peasant-born masters (often without formal education at navigation schools), and were owned by peasants, accounting skills were rather limited.

and North Sea tonnage actually exceeded this percentage in certain periods. In the late 1860s and for most of the following decade, the percentage was 85 or more, and up to the late 1880s it was constantly higher than two thirds of the long-traders' average income. This very strongly suggests that freights from the Baltic to Central and Western Europe were at a rather high level during the last "golden" days of windjammers. This is quite logical: since it was also a period of very rapid growth in the sawmill industries of both Sweden and Finland, the demand for shipping increased rapidly too. On the other hand, it must be remembered that the voyages in question were shorter and involved more port work than those of long-traders. Accordingly, freight income must have been slightly higher per ton than for ocean hauls.

The rapid decline in average income per ton of Baltic and North Sea tonnage obviously resulted from the increase in tonnage supply, which coincided with the breakthrough of steamshipping in the Baltic. Thus the level of Baltic freights sank and, around the turn of the century, they even seem to have fallen below the normal level of many other trades. Since the average income of Finnish Baltic and North Sea tonnage dropped to about 55 per cent of the average earnings of long-traders, they earned less per month of active sailing season. During the last decade before the War, the percentage rose a little again, and exceeded two-thirds in the early 1910s.

The income level of coastal vessels cannot be similarly estimated since there is very little data; obviously most of them never had any real accounts. A few scattered sources produced the following examples:[6]

— 1860—63: a vessel of 74 nt earned on average FIM 7,461 a year, or FIM 101 per ton

— 1864—66: the same vessel earned FIM 7,769 a year, or FIM 105 per ton

— 1867—69: the same vessel earned FIM 8,376 a year, or FIM 113 per ton

— 1875: a vessel *(jakt)* of 41 nt earned FIM 1,214, or FIM 30 per ton

6 Börman, *Åboländsk bygdeseglation,* p. 130, 132; id., *Under västnyländska segel,* p. 299—300; Kaukiainen, *Koiviston merenkulun historia,* p. 252; Krogius, "Sjöfart", p. 39:13.

— 1885: a vessel *(jaala)* of 45 nt was estimated to earn FIM 2,100—2,700 a year, or FIM 47—60 per ton

— 1908: a coastal sailer was estimated to earn FIM 0.25 per day per net ton on average, or FIM 45—50 a year

— 1911: a vessel *(galeas)* of 75 nt earned FIM 3,761, or FIM 50 per ton

The first vessel on the list (accounting from 1860 to 1869) belonged to an iron mill and is not perhaps fully representative. In any case, the scanty income data shows some consistency with the income levels of Baltic and North Sea tonnage. However, the coastal fleet also included vessels which did not trade very intensively, but which were employed for a couple of voyages a year to transport farm produce or fish for sale; the *jakt* of which there was data for 1875 may be an example of this kind of occasional shipping. Therefore, it is probable that, at least by the 1860s and 1870s, the average income across the whole coastal fleet was lower than the above examples would suggest. On the other hand, it is also probable that occasional shipping of farm produce gradually declined, with the result that an overwhelming majority of coastal tonnage was "professionally" employed at the end of the period. This should have produced smaller changes in the average income level in coastal trade than in other shipping categories.

Sailing ship income and freight rates

With the exception of the last five years or so, the period presented an almost constant decline in the average gross revenue of Finnish sailing vessels. The picture has, of course, much in common with some well-known freight rate indices, although no traditional index can ever present a complete picture of actual shipping income, since changes in the efficiency of ship use, or the productivity of shipping, could greatly modify the effects of freight fluctuations.

A comparison of the development of the gross income of Finnish deepwater merchantmen with two freight rate indices, the well-known Isserlis and another which presents the earnings of Norwegian vessels in Atlantic trades, is presented in table 4:5. The Isserlis incorporates an increasing amount of typical steamship freight and therefore does not, in principle, describe the same trade

TABLE 4:5. Comparison of average gross income, freight rates and prices. Indices, 1868/72 = 100.

Period	Isserlis tramp freight index	Norwegian Atlantic[1] freight index	British wholes. price index	Baltic wood freight index[2]	Gross income of Finn. Long-trad. 400 nt and over	Gross income of Finn. Baltic & North Sea traders
1858—62	..	..	98	..	94	..
1861—64	..	..	103	..	111	..
1863—67	..	..	104	(114)	122	107
1866—69	..	91	101	97	96	97
1868—72	100	100	100	100	100	100
1871—74	106	121	107	107	101	103
1873—77	102	112	106	106	95	97
1876—79	92	96	99	106	85	88
1878—82	85	89	95	100	83	74
1881—84	75	84	92	87	78	71
1883—87	64	72	81	75	70	59
1886—89	68	73	75	68	70	49
1888—92	65	76	77	61	70	55
1891—94	58	66	74	52	62	56
1893—97	56	65	68	51	64	48
1896—99	60	..	67	49	74	46
1898—1902	62	..	71	48	73	45
1901—04	50	..	72	54	57	44
1903—07	50	..	74	61	52	41
1906—09	48	..	77	65	51	40
1908—12	54	..	80	..	62	54
1911—14	67	..	85	..	68	73
1913—14	68	..	87	..	95	..

1 Average U.S. East Coast and Gulf of Mexico freight indices.

2 Average Gefle — England and Luleå — England; 1863—67 Riga — England.

Source: Isserlis, "Tramp Shipping Cargoes and Freights", p.122; Fischer and Nordvik, "Maritime Transport and the Interaction of the North Atlantic Economy", p.537; Fischer and Nordvik, "Shipping and the Baltic Wood Trade to Britain 1863—1908, p. 176; Mitchell, *European Historical Statistics* (1980), p. 773—4.

as the gross income series. The Norwegian index, on the other hand, was computed from actual earnings and covers trade relatively long dominated by sailing ships; this makes comparison more relevant. In addition, the income development of Finnish Baltic and North Sea tonnage is compared with typical wood freights from the Northern Baltic to England.

Not surprisingly, the income series for Finnish deepwater windjammers had more in common with the Norwegian than with the Isserlis index. The latter shows much lower values than the Finnish income index for the years after the early 1880s; the only exception is the depression of 1903—08, when both are at the same low level. The Norwegian index, on the other hand, is fairly close to the Finnish series, although it usually gives a more "optimistic" picture, especially for the mid-1870s.

This last difference is probably largely due to differences in income for the base period (1868—72) and the fact that the Norwegian index, as used here, was narrower in scope (Atlantic freights, excluding Black Sea trade) than the Finnish income series. Accordingly, it may not have been affected by the structural change — including an increase in the proportion of ballasted voyages — which took place in Finnish deepwater trade.

Baltic wood freights developed slightly differently. They remained relatively stable up to the beginning of the 1880s but then, right until the turn of the century, declined more steeply than Atlantic freights or tramp freights in general. The average income of Finnish Baltic and North Sea traders shows the same characteristics, although the decline began earlier than the freight index suggests. From the 1870s to the turn of the century, both indices tell a similar story and income development seems to have depended very much on the trend in freights. It is also obvious that Baltic freights in the 1870s (and probably also in the preceding decade) were at a relatively high level, which contradicts some well-established opinions.[7] The above comparisons revealed that it was only in the 1890s that the income level of Finnish sailing vessels engaged in Baltic wood trade was really poor.

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7 See e.g Fischer and Nordvik, "Shipping and Baltic Wood Trade to Britain", p. 171.

TABLE 4:6 Average real gross income of Finnish sailing tonnage, 1858—1914. Fixed price index (British wholesale prices), 1868/72 = 100.
1=long-traders, 2=Baltic and North Sea traders

	1	2		1	2
1858—62	96	..	1888—92	91	71
1861—64	108	..	1891—94	84	76
1863—67	117	107	1893—97	94	71
1866—69	95	96	1896—99	110	69
1868—72	100	100	1898—1902	103	63
1871—74	94	96	1901—04	79	61
1873—77	90	92	1903—07	69	55
1876—79	86	89	1906—09	66	52
1878—82	87	78	1908—12	78	68
1881—84	85	77	1911—14	80	86
1883—87	86	72	1913—14	109	..
1886—89	93	65			

Source: Table 4:5.

What did the general fall in average income mean — was it real or did it partly result from monetary fluctuations? Table 4:6 presents a comparison of freight earnings and British wholesale prices. Since the pound sterling was by far the most common currency for settling freight bills, and since most of the expenses of Finnish deepwater sailers were also paid in pounds, most of the effects of currency fluctuations should thus be eliminated. The indices show that the development of gross income clearly deviated from that of wholesale prices in the 1860s, at least as far as long-traders were concerned. At first, average income increased much faster than prices, but from the mid-1860s to the mid-1870s, the real value declined by no less than one quarter. Then followed an amazingly stable period up to the late 1880s. There was a modest rise at the turn of the decade, a modest fall in the early 1890s and a boom in the latter part of the decade, with the real income level almost as high as in the middle of the 1860s. However, if the rise was remarkable, so was the slump following it, and between 1900 and 1910 the real annual value of gross income per ton reached an all-time low. The short pre-war boom, again, boosted the average

income level roughly to the same heights as during the two earlier peaks (the mid-1860s and the late 1890s).

Baltic and North Sea fleets were even different in this respect. The decline in income between the late 1870s and the 1890s was constantly faster than the general fall in prices, and this trend only decreased, rather than stopped, during the boom of the 1890s. Even in this case, the real value of average income bottomed out in the middle of the first decade of the 20th century.

The relative inflexibility in the real value of long-trade shipping income is somewhat surprising, given the general belief that sea transport became cheaper and more efficient during the period in question. This assumption implies, of course, that if ship income level were retained, it should have been possible for them either to transport more goods, or to sail more miles a year, or both. However, the productivity estimations showed that the Finnish windjammer fleet produced virtually no improvement in productivity before the turn of the century, in other words, before big metal-hulled ships became common. That long-trading sailing vessels were able to generate a fairly constant level of real income without a rise in average output may at first sight seem surprising, but it must be remembered that, from the 1880s, this trade only represented the periphery of maritime transport. Peripheral activities are not usually among the first to show increased efficiency.

Steamships

Although the accounting data for Finnish steamers is rather scanty for the earlier half of the period, one fact stands out very clearly. The normal annual gross income per net ton was far higher than for sailing vessels. In the middle of the 1860s, when Finnish cross-trading windjammers earned an average of over 140 marks (over £5) per net ton, the few passenger/cargo steamers travelling along the coasts of the Northern Baltic (and sailing only about 7 months a year) recorded an annual average of no less than about 700 marks (£28) per net ton. Of course, the net ton is not a perfect gauge for comparing such different vessels; not only were there problems in the measuring method itself but, since a good proportion of coastal steamer income consisted of passenger fees, there was not the same

tonnage ratio as with bulk-cargoes. Yet, even later the cargo liners which carried hardly any passengers recorded an annual income per ton four to five times higher than sailing long-traders (see table 4:7, columns B and D).

It seems, however, that there was a declining trend in steamship income which continued to the middle of the 1880s: from the 1860s to the end of the 1880s, the decrease amounted to over 50 %. Since the data for the 1860s, in particular, was very limited and the error of the estimate fairly high, the result is not conclusive. On the other hand, the trend is very similar to the development of sailing-vessel income.

The data for after 1885 is plentiful and does not present similar problems of representativeness. It is true that most of it deals with one single company, the *FÅA*, but on the other hand, the figures for the cargo liners in particular show such small variation (see appendix IV:2B) that they must be typical of the trade. The company had such a large market share of Baltic passenger/cargo and "emigrant" shipping (in emigrant trade to England practically 100 %) that these figures, too, cannot be very different from Finnish averages

From 1885 to 1913, the average income of cargo liners fluctuated in roughly the same way as that of sailing long-traders (see figure 4:2). There was some improvement in the latter half of the 1880s, a slow and relatively consistent fall until about 1910, and a conspicuous rise thereafter. However, there was no boom in liner freight at the turn of the century, when big windjammers were doing fairly well; on the other hand, 1905 was a better-than-average year for cargo liners while the two preceding years, when a tariff war was being fought between *FÅA* and *Nord* for the Hull-route, were not as bad as might have been expected. Fluctuations were, however, quite modest; for example, from 1898/1902 to 1906/09 the decline was only a quarter (that is, 5 %) compared with the fall in sailing long-trader income, and in the 1910s the increase was about a half of what big sailing vessels achieved. This kind of stability is exactly what could have been expected; carriage fees on regular lines always fluctuate less than tramp freights.

The income development of Baltic passenger/cargo liners presents a different picture: from a low point at the beginning of the 1890s, there was a remarkable and continuous increase, which was particularly rapid around the middle of the 1890s and the

TABLE 4:7. The development of the average gross income of Finnish steamships, per year (total accounting time) and net ton, 1865—1913. Indices, based on income in Finnish marks; average, 1871—75 (FIM 419.8) = 100.
A = Passenger/cargo ships sailing within the Baltic
B = Cargo ships sailing regular lines outside the Baltic and occupied all the year round
C = Passenger ships sailing outside the Baltic ("emigrant ships")
D = Annual income per net ton for long-trading sailing vessels over 400 net tons

Time	A	B	C	D	B/A	C/A	B/D
1865/68	171	—	—	33	.	.	.
1871/75	100	—	—	27	.	.	.
1876/80	85	—[1]	—	22	.	.	.
1881/85	92	—	—	21	.	.	.
1886/89	77	86	—	19	1.12	.	4.53
1891/94	68	91	250	16	1.34	3.68	5.69
1896/99	110	82	373	19	0.75	3.39	4.32
1901/04	108	73	397	14	0.68	3.68	5.21
1906/09	127	75	525	14	0.59	4.13	5.36
1911/13	172	99	367	19	0.58	2.13	5.21
(1912/13	181	102	411	26	0.56	2.27	3.92)

1 Although the first Finnish regular line to England was started in 1874, the ships in question did not sail all the year round. *FÅA* was the first company to engage its ships in foreign cross-trading for the winter.

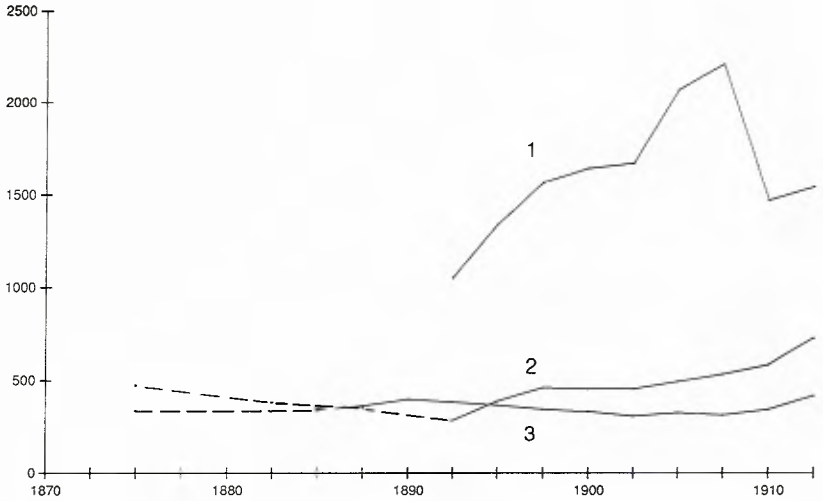
Source: Appendix IV:2B.

early 1910s. This is understandable, since passenger volumes, especially to Sweden, grew at that time, and it is obvious from the accounts that passenger income was a relatively high proportion of total revenue precisely during these two periods of growth (see appendix IV:2B). On the other hand, the development was far from smooth: average income fluctuated according to the intensity of the competition on the routes to Stockholm.

Still more impressive was the growth in emigrant traffic to

Fig. 4:2. Steamship Gross Income.

1 = North Sea passenger (emigrant) ships
2 = Baltic passenger ships
3 = cargo ships over 500 net tons



Source: Appendix IV:2.

England, which began on Finnish keels only in 1891. The upsurge of emigration[8] meant a rapid increase in volume and in income per ton for the *FÅA* emigrant ships; in 1907 they recorded the huge gross income of over 2,800 Finnish marks (over £110) per net ton. It was by far the the most lucrative trade in the entire Finnish shipping business. This growth, however, was not continuous: around 1900, and in 1903 and 1904, income declined temporarily, after 1907 it fell steeply and only partly recovered in 1913 (see figure 4:2). Some of this fluctuation occurred only because tonnage was increased in 1899 (two ships totalling 2,267 net tons) and 1908 (one ship of 1,997 net tons). Such sudden increases in carrying

8 Reino Kero, *Migration from Finland to North America*, p. 36.

Fig. 4:3. Emigrant Ship Income and Finnish Emigration, 1892—1913.

1 = Passenger income, 1,000 FIM
2 = Cargo income, 1,000 FIM
3 = Total Finnish emigration (number of persons/10)

Source: Ledgers of the FÅA; Kero, Migration from Finland, p. 28, 36.

capacity naturally exceeded the growth in emigration, and income per ton was bound to fall. Total passenger income, on the other hand, showed a rising trend, although it fluctuated far more than income from cargo on emigrant vessels (see figure 4:3). These fluctuations follow those in the number of emigrants: 1908 and 1911 were also very low points in Finnish emigration. It was only in 1904 that the market situation (the tariff war) made income fall more than the number of emigrants.

Of special interest is, of course, the comparison of sailing vessel and steamship income, because it supplements the productivity estimations in the preceding chapter. For obvious reasons — sailing vessels never carried regular passengers — only year-round cargo-carrying trade is relevant here. Table 4:7 (column B/C) shows that Finnish cargo liners usually accumulated four to five times more income per net ton than long trading sailing vessels. At

least, as far as the middle of the 1890s and 1912/13 are concerned, the ratios are fairly close (slightly higher) to those which were computed from the revised ton-mileages of sailing vessels and steamships (see p. 212). In general, they clearly exceed the traditional 3:1 ratio. This was obviously because the steamers in question exclusively consisted of liners: not only did they command somewhat higher freight rates, at least during periods of depression, but, above all, they trafficked on shorter routes with more frequent port calls than big windjammers. Thus these ton-miles were more expensive. A comparison with tramp steamers would probably have produced lower rates.

Unfortunately, income data on tramp steamers is practically nonexistent. Since an overwhelming majority of Finnish steamers consisted of regular liners up to the 1890s, this lack is felt only for the end of the period. Fortunately, there is some scattered information which makes it possible to form at least a rough idea of the income which tramp steamers were able to generate.

Since the insurance records contain voyage data on a few tramp steamers, it is possible to estimate their income if it is assumed that they earned a similar return per ton-mile (with due regard to the type of trade) as sailing vessels. This results in a consistently and substantially lower annual income per ton (between one and two thirds) than was recorded for liner steamers.[9] It also illustrates that, after 1902, the two largest cargo ships of the *FÅA*, which were engaged in semi-regular trade to the Mediterranean and were in construction typical "tramp-steamers", consistently generated an income per ton of 70 per cent of the average for the company's cargo steamers. Moreover, in 1913, when the *FÅA* cargo-carriers recorded an average income of 468 Finnish marks (£18.5) per net ton, a Finnish tramp steamer was time-chartered to the coal trade at an annual freight of about 180 marks (£7) per net ton.[10]

The relatively low income generated by tramp steamers is also evident from Norwegian shipping statistics. They record an average annual steamer income around 1895 equivalent to about

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9 According to the typical grain or coal freights of the time, these earnings had been smaller still. Since both loading and unloading of grain and coal were already quite well mechanized, the ton-mileages in these cases would probably have been substantially higher.

10 Lindberg, *Ångbåtssjöfart i Åbo*, p. 348.

400 Finnish marks (£16), in other words, close to the average for the *FÅA* fleet. This was just at the beginning of a massive import boom of second-hand steamships, which was soon to transform the Norwegian shipping-business. This large fleet of second-hand steamers was mainly used in tramp-trading and, perfectly reflecting the change, the average annual steamship income in Norway declined to the equivalent of 200 Finnish marks (£8), or less than two-thirds of the average income of Finnish cargo liners, during the next ten years.[11] This kind of figure would bring the income ratio of steam and sail down to, say, 2.8—3.5, which conforms fairly well with the old steam-ton to sail-ton ratio.

Another category for which there was hardly any accounting data at all was that containing the small, under 300-ton steamers. This group consisted on the one hand of passenger ships which sailed mainly on domestic coastal routes (but even sometimes visited St.Petersburg, Reval and other Baltic ports) and of relatively modest cargo-carriers (many of them built of wood and, by the end of the period, quite often equipped with a combustion engine) which sailed on the Northern Baltic. From the few scattered pieces of data it is possible to conclude that, in the 1890s and at the beginning of the 20th century, an annual gross income of 400-600 Finnish marks per net ton was perfectly normal for passenger craft.[12] This was also what the *FÅA*-owned 190- net ton steamer normally earned, although she was unusual in often sailing 12 months a year.[13] Small cargo ships, again, probably charged similar unit freights to Baltic sailing vessels. Given their higher transport capacity, their annual income could thus be 3.5—4 times as high, and amount to 160—180 Finnish marks in the middle of the 1890s, and 130—150 marks during the depression of the next decade. This agrees tolerably well with the estimates given by the director of the *FÅA* in 1908: according to him, small coastal steamers earned 0.55—0.6 marks per net ton per day, which in a normal sailing season would add up to about 120 marks.[14] The company's own motor coasters (116 and 160 net

11 Gjölberg, *Ökonomi, teknologi og historie*, table 8,2.
12 Lindberg, *Ångbåtssjöfart*, p. 308—315, 323, 332.
13 The ledgers of *FÅA:* s/s Tor (1904—1913). The vessel occasionally carried passengers.
14 Krogius, "Sjöfart", p. 39:13.

tons), however, earned about double that at the end of the period, but they may not have been typical in this respect.[15]

Steamships and general freight development

It was obvious that the average income of Finnish steamers fluctuated less than the income of sailing vessels. This also indicates that general freight development — international charter or tramp freight — had less impact on steam than on sail. There were at least four different, but intertwined, factors which contributed to this. First, the steamers only sailed on the Baltic at first, which was a minor sector of the international freight market. Second, most of them initially transported passengers, and the fares were determined by the local rather than the international market. Moreover, up until the turn of the century, the majority of steamers sailed on regular lines and freights always seemed to fluctuate less than tramp freights. Finally, steamship productivity developed positively in the 1870s—1890s, which probably counteracted the effects of the general decline in freight rates.

These special features, however, were not unique in early steam shipping. Quite on the contrary, regular passenger/cargo services on coastal lines were typical, both in the Baltic and beyond the Sound. This is quite well demonstrated by the fact that Finnish steamship income was, at first, surprisingly similar to that in Sweden and Norway (table 4:8). Both in the mid-1870s and the mid-1880s, actual gross income was roughly at the same level in all three countries, and this trend continued in Finland and Norway until the 1890s. It is also interesting to note that average income fell substantially in the early 1890s in Sweden and, as has already been mentioned, during the latter part of the same decade in Norway. In both cases, it is tempting to see this change as the result of a "take-off" in steam shipping. This would have triggered an increase in international and, above all, in bulk cargo traffic and was also bound to cause a decline in average income per ton. It is clear that Finnish cargo-liners did not fare as well as passenger ships, and that tramp-steamers earned still less (but as ship-size

15 The ledgers of *FÅA*, m/s Ursus (1906—1913) and m/s Taurus (1911—1913).

TABLE 4:8. Average steamship gross income per net ton in Finland, Sweden and Norway, 1875—1913. Finnish marks.

Time	Finland	Sweden	Norway
1875	416	397	483
1885	338	360	321
1895	378	287	405
1905	338	225	200
1913	418	280[1]	..

1 1912.

NB: The Finnish income rate is the average of column A and B in table 4:7. A fixed exchange rate, 1 Sw. crown = 1.4 Finnish marks, has been used.

Source: Table 4:7; Krantz, *Historiska nationalräkenskaper för Sverige: transporter och kommunikationer 1800—1980,* tables T1 and T8b; Gjölberg, *Ökonomi, teknologi og historie,* table 8.2.

TABLE 4:9. The real value of Finnish steamer gross income (per year and net ton), 1865-1913. Indices, 1871/75 = 100.

A = Passenger/cargo ships sailing within the Baltic
B = Cargo ships sailing regular lines beyond the Baltic and occupied all the year round
C = Passenger ships sailing beyond the Baltic ("emigrant ships")
a = deflated by British, b = by Finnish wholesale prices

	A		B		C	
	a	b	a	b	a	b
1865/68	178	184	.	.	.	.
1871/75	100	100	.	.	.	.
1876/80	92	86	.	.	.	.
1881/85	108	100	.	.	.	.
1886/89	110	98	123	110	.	.
1891/94	99	79	132	106	362	291
1896/99	175	129	130	96	592	439
1901/04	160	119	108	80	588	436
1906/09	175	128	103	76	724	530
1911/13	215	174	124	100	459	371

Source: Table 4:7.

increased, there was not an inevitable negative effect on profitability). That Finnish steamship income remained high was simply a result of low tonnage; liner steamships remained in an undisputable majority until the War and the proportion of passenger vessels was also high. The difference would have been larger still had the "emigrant" ships of the *FÅA* been included in the average income in table 4:8. Since emigration culminated (reached its maximum intensity) in Norway in 1881—85, and in Sweden in 1885—90, the take-off in steam shipping did not benefit from it there as it did in Finland. In 1913, according to the official statistics, passenger income amounted to a trifling 0.8 per cent of the total in Swedish foreign shipping, and the first Swedish passenger liner in foreign service beyond the Baltic was launched only during the War, in 1915.[16]

The real value of sailing vessel income was previously estimated by using British wholesale prices as a deflator. This would not be as meaningful for Finnish steamships since, before the 1890s in particular, not much of their income was either generated or spent in pounds sterling. Therefore it seems reasonable to compare income development with Finnish wholesale prices as well (table 4:9). The main difference between Finnish and British price trends was that the former rose more at the end of the period. As far as Baltic passenger/cargo ships, for which the longest time-series exist, are concerned, both series indicate that real income per net ton declined in the late 1860s and the 1870s, but they also suggest that there was some improvement in the following decade, and after a temporary fall, a substantial rise in the late 1890s. Finally, from 1900 to 1913, real income rose by 35—50 per cent.

"Emigrant" ship income fluctuated so much that the picture remains the same irrespective of whether it is expressed in current or fixed prices. For cargo-liners sailing beyond the Sound, developments from the early 1890s until the First World War were not uniformally good: compared with both British and Finnish prices, average real income declined between 1891/94 and 1906/09 by about a quarter. Although gross revenue improved

16 Krantz, *Historiska nationalräkenskaper för Sverige: transport och kommunikationer 1800—1980,* p. 20, 30 (note 34); De Geer, *Migration och influensfält,* p. 36—48.

substantially after that, its real value was still lower before the War than in the early 1890s. Cargo-liners, indeed, faced far tougher competition than other classes of steamers, and thus it is no wonder that the tonnage did not grow fast. With the exception of the very last years before the War, their average income development, however, compared favourably with that of sailing vessels.

3. The development of net result and profitability

Net result, or operating surplus, is a far more complex concept than gross income. A co-product of a number of different economic variables which may fluctuate differently, it inherently involves large variation both over time and between different ships. As appendix IV:2 illustrates, despite a good number of observations, the standard deviation and error are often relatively large. Since there may be substantial national differences in some of the factors affecting the net result, such as wages, there are obvious limitations to how well the figures for one country's fleet represent international shipping in general. Yet, the total wage bill (master included) for Finnish deepwater sailing ships, for example, normally amounted to no more than roughly a quarter of all expenses,[1] and for steamships it was less than a tenth. The overwhelming majority of other expenses were for stevedoring, ships chandlers and agents, and dock dues and other bills incurred in international ports. Thus, the net result of Finnish cross-traders, at least, was greatly affected by the general constraints of shipping.

Sailing vessels

Appendix IV:2 and figure 4:1 reveal that the operating surplus of Finnish deepwater sailing ships developed along much the same lines as gross income. Again, the worst periods were in the middle of the 1880s, the early part of the 1890s and 1906—09. However, it is interesting to note that the lowest point of this curve had already been reached in the 1890s; in contrast to general price trends, the ships in this sample produced better annual profits per ton in 1906—09 than during the two earlier slump periods. Obviously some improvement in profitability (or rather, cost efficiency) had taken place since the turn of the century.

1 In this material, the overall average was just below 24 %. Variations over time and across different sized ships were surprisingly small. Indeed, the standard deviation was only 4 percentage points.

The material is far too limited to allow a detailed analysis of how profitability correlated with ship size. It is possible, however, to make some very general observations. First, it seems clear that the smallest vessels, say under 400 net tons, regularly fared worse than others (cf. appendices IV:2A). Their crew/tonnage ratio was obviously so much larger that it disproportionately increased total costs. There is also a small, although irregular, correlation between net result and size for larger vessels. Ships over 700 tons were clearly more profitable from the mid-1860s (although there were few of them at first) until the early 1880s, and again around the turn of the century. During the worst years of depression, on the other hand, they yielded somewhat lower results. The reason may have been because, when there was a surplus in the supply of tonnage, larger ships were more difficult to "place", and accordingly had to wait for freight. Although it is possible that the material is not fully representative of size-classes, the correlation between size and profitability is smaller than might have been expected.

Gross revenue and operating surplus did not always correlate very well. While some of these discrepancies obviously arose because the figures were produced from rather different samples of ships (there were always more vessels with owners' accounts than with masters' accounts), there were also systematic variations due to the differerent development of income and costs.

The most important features of cost development are summarized in table 4:10 (note that decimals are used only to avoid distorting the relationships between different variables; with regard to the error of the estimate, decimals would be inappropriate). It gives the impression of a rather rigid cost structure: both wages and other costs remained stable at first and fell much less than gross income during the 1880s and 1890s. Obviously it was difficult to reduce sailors' wages from the levels to which they were accustomed, and the same obviously applied to stevedoring and dock charges. Only food costs roughly followed the trend of falling prices from the end of the 1870s to the turn of the century. Although average tonnage rose, clearly no real improvement in cost-efficiency was achieved.

Such cost inflexibility was fatal during a period of falling prices. As the last column of table 4:10 shows, the real value of other costs (that is costs which were mainly incurred abroad) actually rose in

TABLE 4:10. Comparison of average gross income, net result and costs in the Finnish deepwater sailing fleet, ships over 400 net tons. Finnish marks (and fractions) per year and net ton.

Period	Gross income	Net result	Total costs	Wages[1] (ex food)	Other costs	Other costs[2] real value
1861/67	137.2	46.1	91.1	21.0	70.1	£2.19
1871/77	109.4	23.4	86.0	19.8	66.2	£2.04
1881/87	81.8	5.8	76.0	19.0	57.0	£2.26
1891/97	68.9	6.0	62.9	15.7	47.2	£2.26
1896/1902	77.1	15.6	61.5	16.0	45.5	£2.18
1903/09	57.7	7.5	50.2	13.0	37.2	£1.66
1911/14	79.8	19.8	60.0	15.6	44.4	£1.77

1 Wages represented an average of 23 % of total costs during the first four periods, 25 % during the following two and 26 % during the final period.

2 Deflated by the British wholesale price index (1913 = 100). NB: Conversions from Finnish marks to pounds were made according to exchange rates recorded in ships' accounts until 1876, and from 1877 according to the Bank of Finland *avista* exchange rates, published in *Suomen Pankki 1926* (Bank of Finland Yearbook 1926).

Source: Accounts specified in appendix IV:1 (data file).

the 1880s and remained at that level up to the turn of the century. It was only during the subsequent depression that owners and masters managed to reduce them; indeed, a no-less-than fundamental change occurred around the turn of the century. This was very probably connected with the transition from wooden to metal-hulled vessels which took place in the Finnish fleet at that time. Not only were the latter somewhat cheaper in upkeep per ton; they were also employed on longer routes with fewer port visits per year (and as every master knew, port was a costly place). It is, however, possible that the source material exaggerates the change; vessels in this sample substituted iron and steel for wood more abruptly than in the actual merchant marine.

After the early 1870s, sailing vessels which trafficked on the Baltic and the North Sea produced somewhat higher net results than deepwater windjammers. This is not unexpected, since it was

TABLE 4:11. Comparison of average gross income, net result and costs in the Finnish Baltic and North Sea sailing fleet (ships laid up for the winter). Finnish marks (and fractions) per year and net ton.

Period	Gross income	Net result	Total costs	Wages (ex food)	Other costs	Other costs[1] real value
1871/77	93.1	34.3	58.8	19.1	39.7	£1.44
1881/87	60.5	15.3	45.2	13.7	31.5	£1.44
1891/97	48.7	9.6	39.1	11.6	27.5	£1.52
1901/07	39.9	2.0	37.9	10.7	27.2	£1.42
1911/14	68.4	9.2	59.2	13.2	46.0	£2.12

1 Deflated by the British wholesale price index (1868/72 = 100) and expressed in pounds (1913 values).

NB: Conversions from Finnish marks to pounds were made according to exchange rates recorded in ships' accounts until 1876, and from 1877 according to the Bank of Finland *avista* exchange rates, published in *Suomen Pankki 1926* (Bank of Finland Yearbook 1926).
Source: Appendix 4:1 and the data file of ships' accounts.

seen that their gross revenue was also relatively high, taking into account the fact that they sailed for only seven to eight months a year. The tide turned only after the mid-1890s; while long-traders (now mostly consisting of second-hand steel and iron windjammers) turned in improved profits per ton, Baltic and North Sea sailing vessels went through very meagre years. This was an inevitable outcome of the decrease in gross freights which they experienced at that time.

Since the accounting material is rather limited, and the variations caused by differences in the length of the actual sailing season were great, the cost development of Baltic and North Sea tonnage can be sketched only in a rather summary manner (table 4:11; again, the decimals have nothing to do with the margin of error of the estimate). However, there seem to have been certain logical differences in costs compared with long-traders. It is obvious that the wage bill was relatively high for the Baltic and North Sea tonnage, simply because man/ton ratios were bound to be high in smaller vessels. However, a higher-than-average

reduction was brought about during the depression, mainly by reducing the master's pay. On the other hand, other costs were quite low and, before the turn of the century, represented 54—60 per cent of the comparative amount for long-traders. This obviously was because these vessels mostly loaded in small, cheap Finnish or North Swedish ports and the crews did a good deal of the actual loading. Only during the last decade of the period did the scales turn in this respect. Apart from the general rise in prices, this change was mostly relative: big iron and steel long-trader costs were cut much more effectively.

For coastal vessels, the data is again very limited. Complete accounts are rare, but Jan-Erik Börman was able to collect a substantial amount of material for coastal sailers from the Southern Turku archipelago. According to him, the average profit in Finnish marks per net ton was as follows:[2]

	jakts	*galeases* [3]
1860s	12.2	21.9
1870—75	16.6	15.8
1876—89	9.2	8.0
1890s	22.0	18.2
1900—13	27.9	..

These averages are in line with the few proper accounts which are available.[4] Nor do they differ very much from the net income series for Baltic and North Sea tonnage, which did, however, seem to fare better in the earlier half of the period; after the 1890s the scales seemed to turn. These differences in economic performance are not unexpected in the light of tonnage development; as was seen before, coastal sailing tonnage diminished in the 1870s but began to grow again at the end of the century.

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2 Börman, *Åboländsk bygdeseglation*, p. 137 (bilaga 12).

3 *Jakt* was a single-masted and *galeas* a two-masted coastal vessel. In the late 19th century both were fore-and-aft rigged.

4 See Börman, *Åboländsk bygdeseglation*, p. 128—136; Kåhre, *Den åländska segelsjöfartens historia*, p. 373; Kaukiainen, *Koiviston merenkulun historia*, p. 251—252.

Steamships

Steam tonnage was heterogeneous and an equally incoherent picture of profits emerges (see figure 4:4 and appendix IV:2B). The differences were not too pronounced in the earlier data: in the 1870s and 1880s, both cargo vessels and combined passenger and goods carriers earned, on average, an annual net profit of 90—100 Finnish marks (£3.5 to £4) per ton. It also seems that the decline in freight rates which took place from 1875 diminished results by 10—15 per cent.

Although the *FÅA* "raw" data for individual ships' profits present a reliable general overview of the fluctuations, it must be remembered that overhead costs are excluded and the picture is slightly too optimistic. Moreover, because of substantial changes in insurance accounting, the material contains two distortions in particular; compared with the level of about 1905, it gives about six marks per net ton more profit in the mid-1890s, and about 15 marks per ton in the 1910s.[5] By using both the "raw" data and the detailed (1885,1895,1905 and 1913) profit analyses, a realistic profit estimate is, however, possible.

It seems that the normal net returns of cargo ships sailing to the North Sea and beyond (as the bigger ships of the company exclusively did) was about 50—55 marks per net ton in the middle of the 1880s. After a few very good years in the late 1880s, this declined slowly to slightly less than 40 marks (£1.5) per ton. There was a temporary improvement at the turn of the century, followed by a rapid decline which brought down the average profit level for the best part of the decade to only 27—28 marks (£1.1). Only after 1908 did the figures improve markedly, reaching about 70 marks (£2.75) in 1913.

The "emigrant" steamers of the *FÅA* generated not only huge gross income but also such a good net result — peaking to over 350

5 First, around 1895, the company was building up an insurance fund and transferred an average 7 marks per net ton to it (which resulted in a decrease in insurance costs, while payments to the fund were included in ships' profits). Later, when the fund was considered big enough, the annual payment diminished to a tenth of what it had been. Finally, in the 1910s, all insurance costs were drawn from the individual ships' accounts to a company overhead account.

Fig. 4:4. Steamship Net Result.

1 = North Sea passenger (emigrant) ships
2 = Baltic passenger ships
3 = cargo ships over 500 net tons

Source: Appendix IV:2.

Finnish marks (£13.8) per ton in 1896—98 and 1906-07 — that the investment can be termed very profitable. However, the development was quite unstable with really deep drops in 1899—1900, 1903—04 and 1910—12. The first of these drops was somewhat artificial; as with gross income, it resulted mainly from the trebling of the tonnage in question. The second decline was produced by the tariff war with the *Nord*-company (see p. 196) and the third reflected the temporary drop in the number of emigrants. Most of the time, passenger ships were about five times as profitable per ton as ordinary cargo ships. It must, however, be borne in mind that they were also far more expensive.

The Baltic passenger/cargo vessels of the *FÅA* fleet usually generated only about the same net income per ton as the bulk-carriers of the company. On the other hand, much better results were produced at the end of the 1890s, in 1906 and in the 1910s,

that is, when there was no strong competition and traffic agreements with the *Bore*-company were in existence. The brand-new *Bore* ships turned in profits of about 50 and 110 marks (£2 and £4) per ton in 1898-99, in other words, they fluctuated within the same range as the *FÅA*. After the turn of the century, the *FÅA*-Baltic fleet also included a couple of newly built ships, but their profitability depended only on how hard the competition was; technical modernity seems to have been of marginal importance.

Unfortunately, with the exception of one auxiliary and one steamship of 159 net tons, there are no detailed accounts from the 1860s or 1870s. Steamship cost structure and development can be assessed in general terms only after the mid-1880s.

The accounts of the steamship *Lloyd* from Wiborg (1875—77), reveal a cost structure which is atypical in several respects. Wages (master included) represented an unusually high (57.5 %) proportion of all expenses, or 96 Finnish marks per net ton, while fuel and oil only accounted for 18%, or 30.2 Finnish marks per net ton. On the other hand, total expenses were only 167 marks (around £6.5) per ton, which was actually much lower than the corresponding figure for the auxiliary. It is probable that the *Lloyd* did not pay any port dues in either Wiborg or Lubeck and, moreover, she sailed only six months a year. On the other hand, she was heavily manned with a well-paid crew (obviously the men had extra high wages because they had to pay for their food in the ship's restaurant).[6] The auxiliary, again (the *Expressen* from Turku/Åbo, 1871—73) recorded much lower wages (48 marks/nt) but higher fuel costs (sic.!: 36 marks/nt; but she was in business practically 12 months a year), and her total costs amounted to 228 Finnish marks (around £9) per net ton.[7] Oddly enough, these figures seem to be more representative than those of the *Lloyd*; according to a Swedish estimate from 1871, wages (excluding food) could amount to 24 % and fuel expenses to 14 % of total running costs.[8]

The cost structure of the *FÅA* fleet was estimated for the same

6 The accounts of s/s *Lloyd* (see appendix IV:1). The ship sailed between Wiborg and Lübeck.

7 The accounts of the *Expressen* (see appendix IV:1). The ship was engaged in tramp trading to Western Europe.

8 Krantz, *Historiska nationalräkenskaper för Sverige*, p. 23.

years (1885, 1895, 1905 and 1913) for which detailed data was collected from the ledgers. These figures agree relatively well with the ratios presented above, as far as fuel costs are concerned: 16—17 % of total costs was typical in all *FÅA* vessels. Wages, on the other hand never exceeded the coal bill, in fact, they usually came to less than half of it. The explanation is the relatively high average tonnage, which naturally meant that man/ton ratios were low. The company had also been able to economize on earlier steamship manning standards (table 4:12).

Differences in other costs were surprisingly large. Before the turn of the century, bulk-carriers managed with 200—250 Finnish marks (£8—10) per net ton, and Baltic passenger/cargo ships had only a slighly higher average bill. Big passenger ships ("emigrant" ships), on the other hand, recorded costs four to five times higher, mainly a result of feeding a high number of passengers; in 1905 the *FÅA* itself began to run the restaurants aboard the passenger ships.[9] Moreover, these costs were on the increase and this clearly affected profits during the last decade before the War. Baltic steamer costs also rose steeply at the end of the period, mainly as a result of the introduction of new modern ships burning much more coal. However, the investment was not bad as net result in this group increased more than costs.

At the end of the period, costs in general increased relatively quickly, more quickly than British wholesale prices, for example. However, for all groups of *FÅA* vessels except the big passenger ships, the increase was roughly the same as or less than the increase in net result.

Again, the data does not apply to tramp steamers. Generating less gross income than liners, they probably also recorded a lower and less stable net result. On the other hand, data on the largest cargo-ships of the *FÅA* (their "tramp steamers", 1902—) clearly shows that total costs for such vessels were fairly moderate, substantially less per ton than for all other vessels belonging to the company. It must be remembered that chartered ships visited far fewer ports than liners, and port dues made up a very large proportion of total costs. In general, the net result of the company's

9 Exerpts from the directory's minutes in so-called "historical material", the archives of the *FÅA*.

TABLE 4:12. Comparison of average gross income, net result and costs of *FÅA* vessels, 1885, 1895, 1905 and 1913. Finnish marks (and fractions) per year and net ton.

Period	Gross income	Net result	Total costs	Wages, ex. food	Coal, oil	Other costs	Other costs[1] real value
A. Cargo steamers							
1885	349.5	52.7	296.8	(22.7)	48.1	226.0	£9.67
1895	359.6	40.1	319.5	(22.7)	49.7	247.1	£12.54
1905	336.9	47.6	289.3	22.7	52.5	214.1	£10.05
1913	499.7	69.7	430.0	27.2	74.3	328.5	£12.99
b. Thereof ships over 1,000 nt							
1905	262.1	56.9	205.2	15.4	33.6	156.2	£7.33
1913	361.0	70.3	290.7	17.5	45.8	227.4	£8.96
B. Passenger ships over 500 nt ("emigrant ships")							
1895	1,243.5	202.0	1,041.5	(29.6)	161.9	850.0	£43.12
1905	1,834.1	303.1	1,531.0	30.4	116.6	1,384.0	£64.94
1913	2,244.2	229.7	2,014.5	32.1	155.0	1,827.4	£71.97
C. Baltic passenger/cargo ships							
1895	375.0	36.4	338.6	(32.9)	58.9	246.8	£12.52
1905	417.3	37.9	379.4	31.2	86.1	262.1	£12.30
1913	768.2	104.7	663.5	46.6	173.8	443.1	£17.52

1 Deflated by the British wholesale price index (1868/72 = 100) and expressed in 1913 pounds (and fractions).

NB: Figures in brackets denote wages estimated using the known man/ton ratios and average monthly wages. Conversions from Finnish marks to pounds were made according to exchange rates recorded in ships' accounts, until 1876, and from 1877 according to the Bank of Finland *avista* exchange rates, published in *Suomen Pankki 1926* (Bank of Finland Yearbook 1926).

Source: Accounts as in appendix IV:1 (data file).

cargo fleet fluctuated around 15 % of gross revenue (e.g. 15.6 % in 1905, 14.2 % in 1913), which was also regarded as a normal ratio in Sweden.[10] There is no reason to believe that tramp steamers, with their lower average costs, fared worse. If the typical annual gross revenue of a tramp steamer amounted to 180—250 Finnish marks per ton (see p. 251), the corresponding profit would fall to about 27—38 marks (£1.1—1.5). Even so, it almost matched the profits of sailing vessels in the "golden" 1860s.

As far as coastal cargo tonnage is concerned, proper accounting data exists (as mentioned before) only in the archives of the *FÅA* and covers just one steam and two motor vessels. Although a reasonably good gross income was accumulated, the accounts mostly show negative net results.[11] It is possible that the wage rates paid by the company were too high for such small vessels. In any case, as long as simple sailing vessels dominated the transport of cheap bulk cargo, the hard fact in coastal trade was that freight levels were low. Apart from passenger traffic, this trade could not offer real prospects for anything other than the most basic and cheap steam and motor vessels, such as the wooden "tar-steamers" which carried fire-wood from the Saimaa area to St. Petersburg.

Return on capital

One of the key problems dealt with in this study is the development of profitability, both over time and across different tonnage categories. Needless to say, a comparison between sail and steam is of special interest.

It is obvious that there are certain technical difficulties in comparing steamships and sailing vessels. Since there are also considerable problems with data, great caution is required in drawing conclusions. That the net result for steamships was, in general, much higher than for sailing vessels was, however, established beyond any doubt, but this observation does not mean that steamships were more profitable by an equal margin. They were also much more expensive, and therefore they had to bring

10 Krantz, *Historiska nationalräkenskaper för Sverige*, p. 24—25.

11 The ledgers of the *FÅA*, s/s Tor (1896—1913), m/s Ursus (1906—1913), m/s Taurus (1911—1913).

more income to the owner if he was to have a reasonable return on his investment.

Of course, the best way to measure profitability is to compare operating surplus with the current value of the capital stock. Ideally, the capital stock should include not only ships but also circulating capital, such as stores and cash. In practice, the latter items are very often disregarded,[12] and this can be done with the good excuse that they always played a minor role in shipping. From the 1860s to the end of the 1880s, a typical value for bosun's stores, food provisions and cash aboard Finnish long-trading windjammers seems to have been between 13 and 15 Finnish marks (£0.5—£0.6) per net ton (the lower value refers to the 1880s when prices were lower too), or much less than 10 % of the value of the vessel herself. At the end of the period, their actual value was probably a little lower, as ships were larger and more economical to run.[13] On the other hand, as they were also much cheaper, the proportion was higher than before. It may be estimated that, at the beginning of the period, return on total capital may have been about one percentage point lower than that computed on fixed capital only, and at the end the difference was probably close to 1.5. For steamships, the value of circulating capital per net ton was probably higher (especially for passenger ships), but since the ships themselves were much more expensive, the proportion of total capital must have been smaller still than for sailing vessels. In any case, these are only rough estimates because data on circulating capital is very fragmentary.[14] This is the main reason why return on fixed capital represents the principal parameter of profitability in this case.

12 See e.g. Fischer and Nordvik, "From Broager to Bergen".

13 Accounts specified in appendix IV:1.

14 A reliable overview of the value of food provisions etc. can be formed only if both the master's and owner's accounts have been preserved and are fairly detailed. The number of such cases is practically the same as those with complete data on food expenses (excluding *FÅA* steamers, for which no data on cash and bosun's stores exists).

TABLE 4:13. Average current value per net ton of Finnish sailing vessels and steamships, 1875—1913. Finnish marks (pounds and fractions).

Year	Sailing vessels 200>500 nt		500— nt		Steamships[1] 200>500 nt		500— nt	
1865	201	(£7.9)	205	(£8.1)	..	..	.	.
1875	214	(£8.2)	177	(£6.8)	813	(£31.3)	.	.
1885	141	(£5.6)	135	(£5.3)	647	(£25.5)	632	(£24.9)
1895	114	(£4.5)	92	(£3.6)	468	(£18.5)	510	(£20.2)
1905	99	(£3.9)	111	(£4.4)	640	(£24.3)	546	(£21.5)
1913	84	(£3.3)	83	(£3.3)	515	(£20.3)	471	(£18.6)

1 Excluding auxiliaries.

Source: Registers of *Sjöassuransföreningen i Finland;* Ledgers of *Finska Ångfartygs Aktiebolaget* (Åbo Akademi, Maritime archives).

Table 4:13 presents the development of the average ton-value of Finnish sailing vessels and steamships (see p. 99—100). Although current values declined in all categories, steamers remained, net ton for net ton, much more expensive than sailing vessels. On the other hand, there were significant differences in the ton prices for different types of steamship. The average book-values of *FÅA* ships were as follows (Finnish marks):[15]

Year	Cargo ships over 500 nt	North Sea pass. ships	Baltic pass. ships
1885	681	.	.
1895	524	1,003	727
1905	438	917	710
1913	362	857	694

Before going further it must, however, be pointed out that operating result is a balance in which no account is taken of capital costs of any kind. Even if it could be supposed that the majority of steamships and deepwater sailing ships were insured and

15 Ledgers of *Finska Ångfartygs Aktiebolaget.*

therefore "risk" was deducted from the result in the form of insurance costs, realistic depreciation should, at least, be accounted for. In reality, many North Sea and Baltic sailing vessels as well as the whole coastal fleet sailed uninsured and thus, in the long run (although accidents occurred at very different rates to individual owners), capital losses through wreckage and minor misfortunes were incurred on a fairly regular basis.

In the chapter on capital formation, it was estimated that Finnish-built wooden vessels which were either sold or wrecked before the turn of the century normally lost about four per cent of their original building cost per annum, while later second-hand windjammers lost about seven per cent of their purchase price. Compatible rates for steamships were appreciably lower, on average 2.5 % a year. These rates were computed according to the 19th-century practice of equal ("flat rate") depreciation on the newbuilding or purchase value, and percentage depreciation on the actual value may be very different depending, above all, on the average age of the fleet and on how long ships belonged to the same owners. Of course, it may be said that a sensible depreciation is not necessarily one which conforms with the ideas of the time in question; it should rather take into account the technical "ageing" of ships as well as the actual selling prices or insurance values. Ageing, however, is impossible to gauge other than subjectively. Moreover, in the late 19th century, shipping business (at least as far as bulk cargo was concerned), there was still a reasonable market for "second"- or even "third"-best technology and technical obsolescence was not a risk of primary concern. Therefore, in all the following estimations, depreciation has been computed starting with the above-mentioned percentages of building costs and purchase prices, which are then expressed as percentages of actual (depreciated) tonnage value. To be on the safe side, sailing vessel depreciation was never allowed to fall below six per cent (for the 1860s, five per cent would have been the actual estimation).

The big question mark in table 4:14 is the additional depreciation which was computed for the Baltic and North Sea fleet to compensate for the uninsured risk. Since even these net results include reparation costs, only total losses were accounted for in this deduction. While total losses normally fluctuated around 2.5—3.5 % of total sailing tonnage (see p. 94), it has been

TABLE 4:14. Estimated profitability of the Finnish sailing fleet. Average operating result, depreciation and return on capital in per cent of current ship value.
a = operating result
b = depreciation
c = additional depreciation to compensate for uninsured "risk" (Baltic and North sea fleets)
d = return on capital

Time	Deepwater vessels over 400 tons			Vessels sailing on the Baltic and the North Sea				
	a	b	d	a	b	a-b	c	d
1861/67	22.5	6	16.5	..	..			
1873/77	13	6	7	16	6	10	1.5	8.5
1878/82	8	6.5	1.5	8	6	2	1.5	0.5
1883/87	3	7	–4	7	6	1	2	–1
1888/92	9	7.5	1.5	9.5	6	3.5	2	1.5
1893/97	9.5	8	1.5	8	6	2	2	0
1898/1902	16	8	8	9	6.5	2.5	2	0.5
1903/07	7	8	–1	1.5	7	–5.5	2	–7.5
1911/14	24	8	16	11	7	4	2	2
(1913/14	38.5	8	30.5	16.5	7	9.5	2	7.5)

Source: Appendix IV:2 and table 4:13.

assumed that the figure was slighly lower for this tonnage which sailed mostly in moderate weather conditions and was laid up for four to five months; moreover, in the 1870s, many vessels were insured, although the numbers decreased substantially during the following decade.[16] In any case, although the deduction may seem arbitrary, it is clear that accounting only a normal depreciation would produce an unrealistically high return on capital.

Had it been possible to include circulating capital in the estimation, the returns would not be quite as high as merely

16 Registers of *Åbo läns enskilda sjöassuransförening,* Provincial Archives of Turku. E.g. in the middle of the 1880s about 50, "peasant"-owned ships were insured by the association, while ten years earlier the number had been around 150. Even this figure was less than a third of all Finnish sailing vessels in Baltic and North Sea trades.

compared with fixed capital. In any case, the figures show that, at the beginning of the period, shipping undoubtedly gave a very reasonable return. Long-traders, especially, accumulated respectable interest on investment. By the middle of the next decade, however, the rewards were no longer so attractive; it was possible to achieve similar results simply by lending money (interest rates were quite high at that time). During the "long depression", returns diminished still further; by the middle of the 1880s, net result was no longer enough to allow any decent depreciation. Although interest rates were also quite low at that time, sailing ships were obviously not a good investment.

As indicated by the net result, Baltic and North Sea vessels were more profitable in the 1870s than long-traders. If depreciation proper had only been accounted for (see column a—b), they would have remained so until the mid-1890s. This good result, however, was achieved by letting the majority of vessels sail uninsured, and therefore the inevitable total losses lowered the actual average return on capital. Indeed, it seems that only in the mid-1870s and by the middle of the next decade, when the depression in the international freight market was deepest, was there a substantial difference in favour of the smaller tonnage, but even then it was a difference between smaller and larger losses. Since total losses of uninsured ships fell on relatively few owners, it is very likely that the majority of them (in particular "peasant" owners who often were not able to calculate the actual return on their investments) thought Baltic and North Sea tonnage more profitable than it was. If normal insurance costs (4.5—6 %) had been added to average expenses, the balance would have been decidedly negative after the end of the 1870s.[17]

After the mid-1890s, Baltic and North Sea tonnage regularly produced a much less favourable return on capital than larger vessels. Not only did profitability in this area decline, but that of long-traders also slowly began to improve (mainly because the prices of second-hand ships fell further). By the turn of the century, big second-hand windjammers were bringing a moderately good return and, just before the War, booming sailing ship freight meant that old and cheap vessels earned over 20-per

17 On the other hand, if all vessels had been insured, some proportion of accounted reparation costs would have been paid by the underwriters.

cent return on capital, in other words more than the average in the "golden" 1860s. It is, however, possible that the estimations for the 1880s and 1890s are slightly too optimistic; many long-traders (old, wood-hulled ones, in particular) also sailed uninsured, or only partly insured. Although the profitability was very good in the 1910s there were, on the other side of coin, the very meagre years around 1905—08, and an owner who was in the business, for example, from 1903 to 1913, could barely average more than about six per cent per annum. That was, of course, quite enough to make business meaningful, but on the other hand it was six per cent on rather cheap assets. A big iron or steel barque could not earn such an impressive amount pound for pound, and to accumulate enough to buy a steamship must have seemed quite difficult for the average windjammer owner.

It is not possible to compute similar estimations for coastal sailing vessels. Not only is the data all too scanty, but the coastal trade itself was so labour-intensive that return on capital was not a central measure of success. The ships normally represented pure family enterprises and were built with relatively small inputs of money. They were not regarded as investments but rather as tools which gave the crew the opportunity of a decently-paid job. If a coastal *galeas* or *jakt* was built using timber from the owner's forest and farm labour (see p. 74), it would cost no more than 80—100 Finnish marks per net ton. Compared with a net result of 15—20 marks per ton this was not bad business. However, if a price had been put on timber and farm labour (as anyone planning to invest in a coastal sailer would have done), the cost would have leapt to 150—200 marks per ton. The proposition no longer seems so attractive, especially as such small vessels normally had a very short life. Returns probably only corresponded with depreciation, in other words, during its lifetime a vessel earned just enough money to build the next one.

For steamships, the picture of return on capital is again drawn from the ledgers of the *FÅA* company. The data is presented in table 4:15. The estimations are based on the rather simplistic assumption that 4 % of current value represents a realistic level of depreciation for all the decades in question. This value may be rather low for tramp steamers and second-hand craft but, as was mentioned before, it was derived from existing Finnish price data. The data on steamships from the 1870s and 1880s is much more

TABLE 4:15. Operating result and return on capital in the Finnish Steamship Co (FÅA) fleet. Per cent of the recorded book-value of ships.
a = operating result
b = return on capital = operating result minus 4 % depreciation

Year	North Sea cargo ships		North Sea pass. ships		Baltic pass/ cargo ships	
	a	b	a	b	a	b
1885/86	8.5	4.5	.	.	.	.
1893/97	7.2	3.2	23.0	19.0	6.5	2.5
1898/1902	9.6	5.6	23.2	19.2	3.8	–0.2
1903/07	6.3	2.3	24.4	20.4	4.8	0.8
1912/13	17.3	13.3	20.6	16.6	20.3	16.3

NB: Moving averages of "crude" traffic results (appendix IV:2B:c) were reduced by the ratio of real net result to "crude" result for 1885, 1895, 1905 and 1913, and for 1898/1902 by the average of the 1895 and 1905 ratios.

Source: Appendix IV:2; ledgers of *Finska Ångfartygs Aktiebolaget* (Åbo Akademi, Maritime archives).

superficial. Compared with ton values for all steamships of over 200 tons, typical net results amounted to about 12 per cent of capital value during the 1870s and about 14 per cent during the following decade.[18] If 4 per cent of current value is still regarded as a realistic depreciation, this would indicate returns on capital in the order of 8 and 10 per cent respectively. It may seem surprising that profitability improved during a time when freights in general fell, but if this really were the case, it may have been simply because steamers became cheaper. These figures are higher than the first *FÅA* new-built cargo vessels could produce, which is really no wonder since the actual value of the latter was rather high. It is also possible that the international depression in freight markets, which certainly affected steamships sailing to the North Sea and beyond, was not as serious for those carrying goods and passengers on the coastal and Baltic lines.

18 Appendix IV:2Ba.

Since the earlier data on steamships is not totally reliable, comparisons must be made with due caution. In any case, it seems clear that in the 1860s, deepwater sailing vessels earned on average better returns than steamships ever did before the 1910s. Equivalent averages were recorded by steamships only in 1913, but at that time long-trading windjammers again surpassed them. On the other hand, it is equally clear that, in the 1880s, steamers were clearly more profitable than any kind of sailing vessel.

Table 4:15 demonstrates that different steamships also produced very different returns on capital. The emigrant passenger ships of the *FÅA* were still in a class of their own and, in spite of great fluctuations in business, earned on average close to 20 per cent of their current value.[19] Baltic passenger/cargo steamers of the *FÅA* were far less successful. In certain periods they hardly earned enough to account for depreciation, and over two decades (1893—1913) they produced a somewhat worse return on capital than cargo steamers.

Differences between the cargo ships in the *FÅA* fleet and deepwater sailing vessels fluctuated in both directions. During the booms, from 1895 to around 1900 and in the early 1910s, windjammers seem to have been more profitable; cargo steamers, again, performed better during the other periods. Comparison with Baltic and North Sea sailing craft, on the other hand, shows that these could never match the economic performance of steamers. In general, the *FÅA* cargo steamers gave a steadier economic performance than deepwater sailing vessels; this was, naturally, because they were mainly engaged in regular services. Yet, from the early 1890s to the First World War, the average overall performance in both groups was remarkably similar: if the depreciation rates used here are realistic, a return on capital in the order of 5 per cent was accumulated.

If depreciation had not been accounted for, however, the comparison would have been vastly different. Except in the 1880s, deepwater sailing vessels produced a higher net income as a

19 This was on average slightly better than the results of the German Hapag's New York line, 1905—1913. On the other hand, during the same years, Hapag's Brazil and LaPlata line generated about the same return as the *FÅA's* cargo liners. Kresse, "The Shipping Industry in Germany, 1850—1914," p. 160—161.

percentage of their value than cargo steamers, and even medium-sized sailing vessels compared favourably in the early 1890s. This is worth pointing out since there must have been many sailing-vessel owners who did not compute depreciation on their assets. The opportunities offered by big windjammers may thus have seemed more attractive than they actually turned out to be.

Although there is very little reliable data on tramp steamers, it is possible to estimate the approximate margins of profitability for them. By the turn of the century, normal ton-prices of decent second-hand cargo-steamers seem to have fluctuated around £14—16 (350—400 Finnish marks, see p. 82). A comparison of this with the assumed average profit of 27—38 marks per net ton (see p. 267) suggests a gross return on capital of 7—11 per cent. Since realistic depreciation for a second-hand steamer would be close to 5—6 %, this would result in net returns which were hardly better than those accumulated by the cargo ships of the *FÅA* in the 1890s. In the following decade, at least during the depression when tramp freights were low, their prospects must have been worse. The declining interest in tramp steamers at that time is certainly a hint at such a trend.

The varying fluctuations in the profitability of different ships make it difficult to give an overall estimation of which ones actually fared best during the latter part of the period. Depending on the actual time period, similar ships often produced results which deviated substantially from each other. The most decisive factor in "life-time" profitability — at least in the case of sailing vessels — was probably not the annual net result, but the price for which the vessel was bought and sold. The existence of an international, and obviously very competitive, market for second-hand ships, however, makes it reasonable to expect that ton-prices developed in accordance with profit expectations. Unfortunately, too little light is thrown upon this side of shipping by the accounting material.

One thing stands out quite clearly. With the exception of the "emigrant" ships of the *FÅA*, the differences in economic behaviour between sailing vessels and steamships were by no means clear-cut. Indeed, overall assessment depends all too much on how high the elusive cost items of depreciation and uninsured risk are estimated. This is at least proof that sailing vessels were still potentially viable, which is in accordance with certain

explanations of the developments in Norway which have been cited before.[20] That reasonable economic results could be obtained in Finland with second-class shipping technology is perhaps not so surprising. It must be remembered that the country was then decidedly peripheral, with good supplies of cheap labour. In such conditions, the relative price of capital compared with the price of labour was inevitably higher than in the industrialized "core"-countries of Western Europe.

20 For a general discussion on the profitability of shipping in Norway see Nordvik, "The Shipping Industries of the Scandinavian Countries," p. 144—145.

4. The macro view

The extrapolation of income and profit data into national totals may, at first sight, seem merely a technical routine. It is true that, since the average economic performance of Finnish merchant vessels has already been established, the total figures cannot provide any drastically new insights into the development of gross income or profitability. However, it must be remembered that if the average net return of shipping changed by, say, a quarter, the total income effect of the change would depend on the total volume of affected business. Therefore, series of total income and profit do have a certain analytical value of their own. Moreover, the fluctuations in total profit provide a very interesting comparison with the series of total investments presented earlier. It can be used to find out whether there was any remarkable capital "emigration" from shipping.

National shipping income and value-added are also useful in providing fairly reliable details, or data for cross-checking, for the estimates of the total gross domestic product. However, since this study deals mainly with structural changes, annual series were not computed, as interesting as they might have been in studying business cycles. Instead, estimates for shipping income and value-added will be presented as averages for five years or so.[1] This should be sufficient to reveal the main trends and big cycles which covered several years.

1 This is because the basic series of gross income and net result were computed as five-year moving averages. Strictly speaking, all data did not cover similar periods: for example, sailing-vessel income was mainly based on estimates of transport output, which were derived from voyage data normally covering a couple of years, or from four-year averages computed from shipping statistics, and from freight data which could cover significantly longer periods. Thus, the periods shown in the tables should not be taken too literally; the averages always weight the middle years slightly more than the marginal years.

Total gross revenue

Strictly speaking, only gross revenue earned in foreign traffic is relevant here. All estimations of transport output presented earlier excluded traffic between Finnish ports unless it belonged to a line going abroad. On the other hand, tonnage figures referred to all ships above certain minimum sizes and, particularly at the low end of the scale, sometimes included vessels which never crossed Finnish boundaries. Certain earlier estimations of shipping income, as well as current statistics, also include domestic shipping. For this reason, it was deemed useful to present an estimation of domestic coastal traffic. This will, however, be very crude and, moreover, only include steamship traffic.[2] Since this figure is not very reliable (see appendix IV:3), the gross revenue of *foreign* shipping will be always used as the primary series.

The results of the estimations are presented in tables 4:14—16. As mentioned before, it was possible to calculate the gross income for sailing vessels using two alternative methods. These yielded slightly different results in most cases. However, the variations were systematic: they arose mainly because of disparities in the chronological spread of the estimations. The first one was based on three-year freight averages (or, rather, the regression lines of three-year freight observations) and the estimation of ton-miles from a sample covering almost two years on average. The second estimation, again, was drawn from average income series covering no less than five years. This difference implies that the first estimation, being more prone to short-term fluctuations, should suggest higher values for boom periods and lower ones for depressions, while in the second, fluctuations are partly smoothed out. Moreover, the second estimation was based on scantier and slightly less representative material; as previously mentioned, the accounts represent larger-than-average vessels, and in all probability, they could have been better run. Thus, for many purposes, the first estimation is to be preferred. The first observation of the series, for about 1864/66, should be used with some caution, since the data for Baltic and North Sea freight are very limited.

2 There was also domestic traffic by sailing vessels; e.g. firewood was transported to Helsinki and burned lime to all the bigger towns by small coastal sailers.

TABLE 4:16. Estimated total gross revenue of Finnish sailing vessels. Million Finnish marks (mill. pounds sterling)

A. Estimation by ton-miles produced in different trades

	1864/66	1874/76	1884/86	1894/96	1904/06	1912/13
Cross-trade	13.8	13.2	6.4	4.9	4.4	8.0
Export	6.1	5.5	3.0	2.5	1.85	2.45
Import	1.2	1.0	0.7	0.55	0.25	0.45
Coastal trade	2.0	1.75	1.3	1.3	1.7	2.0
Total	23.1	21.5	11.4	9.3	8.2	12.9
	(£0.91)	(£0.81)	(£0.45)	(£0.36)	(£0.32)	(£0.51)

B. Estimation by tonnage

	1863/67	1873/77	1883/87	1893/97	1903/07	1911/13
Long-traders	14.5	10.2	5.0	5.15	4.4	7.25
Baltic and North Sea	4.8	10.2	6.4	3.45	2.6	3.25
Coastal	2.0	1.7	1.3	1.3	1.7	2.0
Total	21.3	22.1	12.7	9.9	8.7	12.5
	(£0.84)	(£0.84)	(£0.50)	(£0.39)	(£0.34)	(£0.49)

Source: Appendix IV:3.

Table 4:16 shows that, in the 1860s and 1870s, foreign cross-trade generated no less than about 60 % of all income earned by sailing vessels. During the "long depression", this figure dropped to 53—54 %, but it reached the 60 % level again in the early 1910s. The high level of freight in the "golden" 1860s is also very evident; although sailing vessel tonnage increased from 1865 to 1875 by more than 25 %, gross income hardly exceeded 1864/66 levels (although in 1871/74 it was probably close to 23 million marks). During the short depression at the end of the 1860s, total gross freight had already fallen to about 18 million marks,[3] although the real decline began in the late 1870s. By 1885, total gross revenue was only a half of its former boom-period level, and two decades later it had dropped further by a quarter. The picture brightened in the late 1890s, and income probably exceeded 11 million just

3 This estimation is based on the development of freights and income and it is supposed that long-trading sailing tonnage declined by some 5 %.

TABLE 4:17. Estimated total gross revenue of Finnish steamships. Million Finnish marks (mill. pounds sterling). Estimation by tonnage

	1863/67	1873/77	1883/87	1893/97	1903/07	1911/13
Emigrant ships	—	—	—	1.7	7.4	7.5
Long-tr. cargo-ships						
— regular liners	—	0.08	0.7	2.1	3.4	8.1
— tramps	—	0.5[2]	0.07[2]	0.4	2.3	2.75
Baltic passenger[1]	1.15	1.95	2.2	2.8	3.7	4.35
Baltic cargo[3]						1.1
Total excl. domestic shipping	1.15 (£0.04)	2.5 (£0.09)	3.0 (£0.12)	7.0 (£0.28)	16.8 (£0.66)	23.7 (£0.93)
Domestic traffic	0.2	0.4	0.7	0.7	0.8	1.6
Total incl. domestic shipping	1.35	2.9	3.7	7.7	17.6	25.3

1 Including passenger/cargo vessels.
2 Only auxiliaries.
3 Special cargo vessels only after around 1900, before 1912/14 included in the preceding group.

Source: Appendix IV:3.

before the turn of the century. The pre-war boom brought it back to about the same level as at the beginning of the 1880s. If the war had not begun, the gross revenue of Finnish sailing vessels might well have been about 14 million marks in 1914.

The estimation of steamship income is, in certain respects, cruder than that for sailing vessels. It suffers, above all, from a lack of data in certain tonnage categories, such as tramp steamers, passenger ships below 300 tons and small cargo vessels sailing to Russia and Sweden (which, however, became common only after the turn of the century). For all these cases there is insufficient infromation about both total tonnage and average income, nor was it possible to make a precise distinction between domestic and small-scale foreign-going shipping. Fortunately, all these unknowns concern rather small, low-income groups. On the other hand, there is a wealth of information about the shipping

categories which became important, such as liner services beyond the Sound: in 1913, for example, no less than 64 % of the estimated steamship gross income was generated by *FÅA* ships, and 58 % of this sum was brought in by their emigrant steamers. This was fortunate, because these were also trades with great fluctuations in income, as indicated previously. In 1913, the new boom in emigrant steamers and cargo liners brought total steamship income, domestic traffic included, close to 30 million Finnish marks, while the average for 1911—13 was only about 25 million.

Table 4:17 shows that steamship income grew almost 20-fold in five decades. It also indicates that the importance of shipping beyond the Baltic grew rapidly at the end of the 19th century, generating over three quarters of gross freight by 1905. On the other hand, most of this income originated from transport to or from Finland; cross-trade was negligible at first, and it was only by the turn of the century that it probably exceeded 10 % of all steamship income for a few years.[4] As might be expected from all the earlier data, the growth in income was fairly continuous. It was, however, most rapid in the 1890s, while the first five or six years of this century witnessed a distinct stagnation.

The development of total shipping income (table 4:16) does not produce any real surprises. It reveals the same decline after the late 1870s and growth after the 1890s shown by both total tonnage and transport output. Across the whole period, however, growth was fairly modest. Depending on whether the total is gauged by British or Finnish fixed prices, the volume of gross income in the 1860s and 1870s was between 55 and 70 per cent of what it was in 1911/13. This was much less than the growth of total production either in net tons or ton-miles and, once more, presents proof of how sea transport became cheaper. On the other hand, the proportions of steamship and sailing vessel income correlated rather well with transport share in net tons. Thus, gauged by both gross freight and loaded net tons, steamships passed sailing vessels some time during the latter part of the 1890s, while in ton-miles they only exceeded the 40-per-cent level by 1905 and stayed at that up to the

4 Cross-trade was carried on mainly by tramp steamers, which could equally well carry cargo to or from Finland. Of course, many liner steamers also did some cross-trading in the winter. Income generated by tramp steamers probably represented the maximum income from cross trade.

TABLE 4:18. Estimated total gross revenue of Finnish shipping, 1864—1914.
Total I = total of foreign shipping;
Total II= total incl. domestic traffic by steamships.

Time	Gross revenue, mill. Finnish marks				Steamsh. share of	Indices of total I, 1912/14=100		
	S/V	S/S	Total I	Total II	total I, %	Current prices	Fixed Finn.	prices Brit.
1863/67	21.3	1.2	22.5	22.7	5	62	69	53
1873/77	22.1	2.5	24.6	25.0	10	68	66	55
1883/87	12.7	3.0	15.7	16.4	19	43	55	46
1893/97	9.9	7.0	16.9	17.6	41	47	65	60
1903/07	8.7	16.8	25.5	26.3	66	70	83	82
1911/13	12.5	23.7	36.2	37.8	65	100	100	100

NB: For the sake of consistency, the "B" estimate of sailing-vessel gross revenue (covering five-year periods) was used here. Index "Finn." = current price index deflated by Finnish wholesale-prices; index "Brit." = current price index deflated by British wholesale-prices.
Source: Tables 4:16—17.

end of the period. Ton-miles counted so little in income simply because, at the end of the period, windjammers sailed most of their ton-miles engaged in low-paying, long-distance tramp trading.

Another important structural change, which almost automatically followed from the dwindling role of sailing vessels, was the declining importance of foreign cross trade. In the 1860s and 1870s, over 55 % of all shipping income (excluding domestic traffic) originated in transport between foreign ports. This dropped to around 30 % in the middle of the 1890s, and after the turn of the century it fluctuated around 27—29 %.

Only one systematic estimation of Finnish shipping income during this period existed previously. It was published as part of a total assessment of transport and communication in Finland between 1860 and 1913 by Matti Peltonen.[5] Although the author

5 Peltonen, *Liikenne Suomessa 1860—1913*, table 1. There is also an earlier estimate which covers the years 1900—13; Leppänen, *Liikenne Suomessa 1900—1965*, although these figures on shipping before World War I are more loosely based than Peltonen's.

had to be content with rather crude data — i.a. he lacked reliable information on actual freight earnings — his results fell relatively close to those presented above:

	Peltonen	This study (total II)
1863/67	17.8	22.7
1873/77	24.5	25.0
1883/87	16.8	16.4
1893/97	16.7	17.6
1903/07	25.3	26.3
1911/13	43.4	37.8

The greatest single difference occurs for the 1860s. It is obvious that shipping income at that time (which is not covered by any good freight rate index) has been generally underestimated. On the other hand, the decline in the 1880s was somewhat steeper than indicated by any tonnage figures or calculations of ton-miles. Peltonen probably overestimated the last boom of the period because he used the official tonnage figures as a starting point, thus counting more ships than existed in reality. However, it can be said that both sets of estimations generally correlate quite well.

Value-added or net value of production

It is generally understood that gross revenue (as any measurement of the gross value of output) does not present a correct picture of shipping's real contribution to the national economy. A large proportion of the costs involved were paid either abroad or to other branches of the economy and did not contribute to the income of Finnish shipowners or sailors. In modern economic history, the value-added of an industry surpasses the gross value of output as the standard macro-economic gauge.

In manufacturing and other goods-producing industries, value-added is very conveniently calculated by subtracting the purchaser's value of raw-materials, semi-finished goods and other bought-in services (including maintenance and repair) used in the production process from the gross value of output. This is not feasible when dealing with a service-producing industry like

TABLE 4:19. Estimated value-added of Finnish shipping, 1865—1913. Million Finnish marks.
1 = operating surplus
2 = wages of crew, masters' salaries, cost of food provisions[1]
3 = value-added

Time	Sailing vessels (excl. coastal)			Coastal sailing vessels			Steamships (excl. domestic traffic)		
	1	2	3	1	2	3	1	2	3
1863/67	5.03	5.22	10.25	0.45	0.67	1.12	0.21	0.12	0.33
1873/77	5.60	6.25	11.85	0.44	0.67	1.10	0.59	0.39	0.98
1883/87	1.41	4.28	5.69	0.23	0.51	0.74	0.63	0.54	1.17
1893/97	1.36	3.12	4.48	0.46	0.59	1.04	0.99	0.92	1.91
1903/07	0.73	2.76	3.50	0.46	0.71	1.17	1.92	1.90	3.82
1911/13	2.24	3.14	5.38	0.81	0.87	1.68	3.47	2.41	5.88

Time	Total foreign traffic			Domestic traffic by steamships			Sum total (total II)		
	1	2	3	1	2	3	1	2	3
1863/67	5.69	6.02	11.71	0.03	0.07	0.10	5.72	6.09	11.81
1873/77	6.63	7.31	13.93	0.07	0.17	0.24	6.70	7.48	14.17
1883/87	2.26	5.34	7.60	0.08	0.26	0.34	2.34	5.60	7.94
1893/97	2.81	4.63	7.44	0.13	0.51	0.63	2.94	5.14	8.07
1903/07	3.11	5.37	8.48	0.15	0.50	0.64	3.26	5.87	9.12
1911/13	6.52	6.42	12.94	0.27	0.79	1.06	6.79	7.21	14.00

1 No food costs were included for coastal sailing vessels.

Source: Appendix IV:4.

shipping, simply because the residual between gross output and value-added consists of a rather complex collection of different cost items. It is far easier to sum up the "positive" items contributing to value-added, wages and salaries and operating surplus. Since value-added represents an industry's contribution to *gross* national (or domestic) product, it includes the depreciation of production capital. This inclusion is automatic in this study because operating surplus was calculated without taking capital costs into account.

An estimation of the value-added of Finnish shipping is

presented in table 4:19 (for more details, see appendix IV:4). It includes two insufficiently-known sectors, coastal sailing vessels (sailing to Russia and Sweden) and steamers navigating domestic coastal waters, of which the former was, of course, included in the "primary" series concerning foreign traffic.[6] Totals must, therefore, be used with caution.

The figures reveal some interesting trends and fluctuations. First, it can be seen that the value-added of shipping was probably not greater at the end of the period than in the middle of the 1870s (since the level of wholesale prices in Finland was about the same at both times, this also applies to real values). At the same time, gross income grew by about 50 %, which means that the proportion of overhead costs, such as port dues and fuel, had increased. This was, of course, to be expected with the increase in steamship income: overheads featured more prominently in the cost structure of steamships than of sailing vessels. They are often estimated at two-thirds of gross income for steamers and about a half for sailing ships.[7] In practice, the proportions fluctuated a lot; according to this estimation they were as follows:

	Sailing v. (ex. coastal)	Steamships (ex. domestic)	Total
1863/67	51.4 %	71.3 %	52.4 %
1873/77	40.0 %	60.9 %	43.9 %
1883/87	43.7 %	61.0 %	47.6 %
1893/97	44.0 %	72.7 %	57.4 %
1903/07	46.2 %	77.3 %	68.6 %
1911/13	50.6 %	75.2 %	67.5 %

The high percentage for steamships in the 1860s may, at least partly, arise from the fact that the respective gross income was very cautiously estimated; in any case, sailing vessel figures, which are relatively reliable, were also high at that time. At least as far as sailing vessels were concerned, the subsequent decrease resulted from the increase in wood exports on small and medium-sized

6 Since a significant proportion of wages and food were consumed abroad, the value-added of shipping should be understood as a part of national rather than domestic gross product.

7 See e.g. Peltonen, op. cit., p. 26.

vessels; as was mentioned before, these ships incurred lower port expenses than long-trading windjammers. The same probably also applies to coastal passenger steamers. Later, when the proportion of long-traders again grew, the percentages for sailing vessels also increased a little. Steamship overheads also grew at the same rate as the increase in shipping beyond the Sound. These differences account for the interesting fact that sailing ships contributed more to the national income than their gross income would indicate; still, after the turn of the century, steamship value-added (excluding coastal and domestic trade) exceeded that of sailing vessels with fairly modest margins.

It is obvious that fluctuations in value-added closely followed the fluctuations in operating result. In the 1860s and 1870s, as far as sailing vessels were concerned, the latter was roughly equal to the total wages and food bill (which represented income for labour). Later it dropped to a third and only in the 1910s (and probably also during the boom of the late 1890s) did it regain a higher level at about two-thirds. Steamships, however, showed a very different distribution pattern among the main elements of value-added; operating result was constantly higher than the income for labour. This is perfectly understandable: since steamships were expensive, a far larger proportion of their value-added was contributed by capital than in the case of sailing vessels. Irrespective of the actual man-ton ratios, steam represented a capital-intensive mode of production and sail a labour-intensive one.

The value-added of shipping computed here differs significantly from the estimation presented in the previously-mentioned study on the growth of the transport sector in Finland, 1860—1913.[8] In most cases, Peltonen's figures were lower but, for the end of the period, they surpassed the ones in this study:

8 Peltonen, op. cit.

	Peltonen	This study (total II)
1863/67	8.8	11.8
1873/77	12.0	14.2
1883/87	7.2	7.9
1893/97	7.7	8.1
1903/07	11.2	9.1
1911/13	19.1	14.0

The differences probably resulted from the fixed ratios of value-added to gross production which Peltonen used; the differences in estimated gross revenue also increased the disparity both at the beginning and the end of the period. In a few cases the differences are of such a magnitude that they affect the estimation for the whole transport sector.

Shipping income and shipping investments

Of all the items on the shipping balance sheet, the operating result is, in one respect, the most interesting: it was the main source of investment. For everything from old-fashioned one-ship companies to modern, joint-stock companies the assumption was that, if shipping was profitable, a high proportion (which, of course, depended on the standard of everyday consumption of the owner and/or dividends to shareholders) of the operating surplus was reinvested in shipping.

There was also another "insider" source of capital which was quite often used for buying shares in vessels, namely the masters' salaries. Masters of big ships had fairly high earnings, half or even more of the total wage bill for the crew (officers included). This made them potential investors in shipping, and during the "long depression" in particular, they had a keen interest in buying shares in ships: being a shipowner secured their master's income which, in times of low freights, could easily exceed the profit from the ship herself. Of course, a significant amount of this income was taken up by the normal consumption of the master and his family.

It is impossible to estimate how much masters invested in shipping. The cautious approach to this problem would be either to neglect their contribution altogether, or to count only a low

proportion, say 5 % of their total earnings, and thus largely to compare operating surplus with investments. This still leaves one more item which must be taken into account to make the balance realistic: income from sold ships always had some importance in the financing of new acquisitions. As previously observed, the selling of used tonnage was an irregular business which mainly depended on freight cycles and cycles of investment (see p. 92—93). Unfortunately, there are no reliable data on sold ships before 1887, when the foreign trade statistics began to incorporate figures on exported tonnage.[9] This, of course, does not apply to ships sold in Finland, but as the investment estimations used were on a national level and did not include ships bought or sold within Finland, this series is a logical match. Unfortunately, the statistics do not allow for any distiction between second-hand and newly built ships which were exported directly by the shipbuilding industry; caution is therefore called for.[10]

It is possible only to make rough estimations for before 1887. The data on about 100 ships registered in the ports of Turku (Åbo) and Oulu between 1855 and 1880 (see p. 92) indicated that about a quarter of them, or half as many as were lost in shipwrecks, were sold abroad. Since total losses of sailing vessels amounted to 2.5—4 % of tonnage, assuming that Turku and Oulu were representative of the whole country, it seems that in the 1860s and 1870s, the normal export rate for other than coastal ships was between one and two per cent of the tonnage in question. This is, of course, a rough approximation which can only hold good for a period including at least one complete business cycle.

Table 4:20 presents a comparison of entrepreneurial income and investments in shipping. Since no trustworthy estimations of newbuilding could be computed for 1886—1895, there is a gap for that period. The table does not include coastal shipping simply

9 Finnish Official Statistics, ser. I and IA.

10 New vessels (mainly small steamers) were exported above all to Russia. Small coastal sailing vessels were also sold there (usually to Estonia). Since the following comparison does not take coastal vessels into account, all export to Russia was excluded. As far as export to other countries was concerned, all sailing vessels were observed (practically all of them were second-hand craft), but exported steamships were counted only if their value per ton clearly indicated that they were not new.

TABLE 4:20. Entrepreneurs' income and investments in Finnish shipping (excluding coastal vessels), 1860—1914. Annual averages, million Finnish marks.

Time	A. Operat. surplus	B. Income fr. sold tonnage	C. Total investments	D. A+B–C
1861/70	5.0	0.35	4.5	0.85
— thereof urban shipowners	4.25	0.25	3.5	1.0
1871/80	5.6	0.50	3.95	2.15
— thereof urban shipowners	2.45	0.30	1.85	0.9
1881/85	2.8	0.35	1.1	2.05
1896/1900	2.85	0.3	4.0	–0.85
— thereof steam	1.1	—	3.0	–1.9
1901/10	3.60	0.60	2.05	2.15
— thereof steam	2.65	0.45	1.5	1.6
1911/14	6.5	0.95	2.15	5.3
— thereof steam	4.25	0.8	0.9	4.15

Source: Appendix IV:4; estimations of tonnage sold abroad 1860—1885 and statistics of exported tonnage 1887—1914 (Finnish Official Statistics, ser I and IA); tables 2:19—22 (to exclude investments in coastal tonnage the total investments have been reduced by 0.3 million for the 1860s, 0.25 for the 1870s and 0.2 million for 1881/85; from 1896 onwards, only imported tonnage was observed).

because neither income nor investments are accurately known. Certain distinctions have been made, however. Urban and steamship income and investments are separated from the total sum up to 1880 and from 1896 respectively. This kind of classification, however, has one inherent weakness: since there is no reliable data on domestic buying and selling of ships, capital movement between these groups remains unknown.

Strictly speaking, it is impossible to ascertain the proportion of shipping investment which was made up of reinvested shipping income; as a matter of course, capital was frequently both withdrawn from the industry and imported by newcomers. However, the relationship between investment and income is indicative of the interest aroused by the shipping business. The comparison immediately shows one general feature: with the

exception of one single period, which only concerned steamships, income always exceeded investments by a relatively good margin (no estimation of masters' investments was included). Basically, this is not unexpected; the consumption of shipowners, who built large houses and imported foreign luxuries for their private use, was by no means modest. Yet, considering the low housing costs and the low level of wages for domestic servants in Finland, and the fact that, at least before the 1890s, many owners were also involved in other business, it does not seem probable that the entire difference between income and investments was accounted for by private consumption.[11]

In any case, it seems reasonable to suppose that a clear majority of shipping surplus was reinvested, both in the 1860s and 1870s. In the "golden" 1860s, when "peasant" shipping expanded, rural owners actually seem to have invested more in larger vessels than they earned from them. Obviously, they invested income from coastal traffic and from sales of coastal vessels, and, logically, the coastal fleet diminished at that time. In the following decade, the figures suggest that investments by rural owners had declined substantially. As wood exports to the North Sea ports were prospering at that time, this does not seem very probable. Indeed, they bought numerous ships from Finnish towns: at least 15 big vessels, for example, were bought for the southern Turku archipelago.[12] Thus, investments by rural owners must have been much larger than the estimation suggests, while urban owners received more income from sold ships (which they did not reinvest). On the whole, it seems that no less than 35 % of all shipping income (if income from sold tonnage is included) was withdrawn from business during this decade.

During the 1880s, the excess of income over investments rose on average to roughly the same real value as in the preceding decade,

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11 It may be supposed that, in the 1860s and 1870s, there were 30—40 important shipowners whose private comsumption was probably around 10,000 marks a year (the total income of a senator or a governor was, at that time, about 20,000 marks a year), but since many of them had substantial income from other sources, shipping probably contributed less than 0.3 million marks to their living. If the remaining, say 150, more modest owners of other than coastal craft (excluding those who only had some minor shares) consumed on average 2,000 marks a year, the total would end up at 0.6 million marks.

12 Börman, *Åboländsk bygdeseglation*, p. 141.

but since profits had declined, this means that only a third of total income was reinvested. The latter part of the decade, up to 1888, was probably similar to the earlier part in this respect.[13] It may be claimed that, in the whole period from 1871 to 1888 (or rather from the late 1870s to 1888), as much as about 40 million marks of shipping income was not reinvested. This is almost as much as the current value of the fleet by 1875. There is only one reservation: it is possible that masters increased their investment in shipping in the 1880s.

A turnaround in investment activity started as early as 1889 and 1890, but it was only during the latter half of the 1890s that investment outstripped shipping income. As already mentioned, this was due to investments in steam, while investments in sail again show a deficit of about 0.8 million (although part of this was probably invested in coastal vessels). This was a period when the state gave low-interest loans and even subsidies to shipping.[14] Existing steamship companies also increased their joint-stock capital, and new ones were founded. Thus, for the first time, there is an indication of noticeable sums of "outside" money being invested in shipping. By the next decade, however, the situation changed again and a good half of all income "escaped" from steam shipping. Investment in sail, on the other hand, remained surprisingly constant, although it fluctuated at the same rate as the operating surplus. The last few boom years before the war were a logical continuation of this: investments in sail still grew, but steamships produced far more than was reinvested in them. In the period from 1901 to the War, no less than 35—40 million marks of shipping income — most of it from steamships — seems to have been either consumed or (mainly) invested elsewhere. Considering that the current value of the whole Finnish merchant tonnage of 1913 was estimated at less than 43 million marks (see p. 101), this was no small sum.

An obvious conclusion seems to be that, for the best part of the period, shipping was not only self-supporting in terms of investments but also generated money which was invested in other

13 In 1887—88, sailing vessels worth 0.38 million were exported and only 0.06 million imported. During the same years, imports of steamships averaged 0.52 million marks.

14 See e.g. Kaukiainen, "The Transition from Sail to Steam", p. 180—182.

industries. Even in the 1860s, it may be suspected that the excess of income over investments was not consumed entirely, but that some part of it went to the financing of new sawmills, for example. During the decade beginning 1875, money evidently went out of shipping and was invested elsewhere, and the "counter-current" in the 1890s could not nearly compensate for it. The final period is all the more remarkable in that most of the capital movement took place within steam shipping, which was bringing tolerable returns.

This also indicates that the low investment rate after the turn of the century was rather a result of a lack of interest than of inadequate income. For the period 1875—1887, when the tonnage actually declined, the answer may not be equally obvious. The difference between actual investments and operating results, however, was so large — about 1.7 million a year in 1881/85 — that it clearly exceeded reasonable estimations of shipowners' private consumption. Another question is whether income was high enough just to support the existing level of tonnage, that is, to pay for actual losses and wear and tear. At that time, investments equalling about 6 per cent of the tonnage value were needed to retain the current volume (see p. 84). By 1875, 6 per cent of the current fleet value equalled about 2.8 million marks, or roughly the same as the estimated average operating result. It has already been established that, as far as sailing vessels were concerned, the operating result scarcely exceeded capital costs in the middle of the 1880s. All this means that, even if owners had believed in the business (that is: if there had not been better opportunities), shipping income would hardly have provided realistic possibilities of tonnage growth from the late 1870s to the middle of the 1890s.

However, to put these facts into perspective, it must also be stressed that not even the "tolerable returns" of the last two decades would have enabled Finland to build enough steamships to bring her up to average European levels. In 1913, Sweden, for example, had about 130 net tons of steamships per thousand inhabitants. In order to achieve a similar ratio, Finland should have built over 350,000 net tons of steamshipping over two decades, a total investment of something between 150 and 200 million marks. This would have required a massive contribution from outside traditional shipping circles.

V. Summary and conclusions

Structural change and profitability

Although the transition from sail to steam in Finnish shipping was much delayed, and far from complete at the outset of the First World War, there is no doubt that a profound structural change took place in the period 1860—1914. This change can be looked at from various angles and the technical one was not necessarily the most important. As was pointed out at the beginning of this book, the most outstanding feature was that Finnish shipping, with a slower growth rate than the national economy and international shipping in general, changed from being relatively up-to-date and competitive and became a backward or, at best, semi-modern industry.

In the 1860s, the hard core of Finnish shipping consisted of a relatively uniform top stratum of urban shipowners. Geographically, it spanned, above all, the towns on the Bothnian and west coast, from Oulu (Uleåborg) to Turku (Åbo); excluding the small towns of Uusikaupunki and Rauma,[1] most of the tonnage was occupied in international cross-trade, far away from Baltic waters. Around 1865, this "blue-water" shipping occupied about 55 % of the total Finnish merchant navy, accounted for almost 70 % of the total national shipping output in ton-miles and earned over 60 % of all Finnish shipping income and about two-thirds of its value-added (excluding domestic coastal trade).

1 Even in these towns, long-trader tonnage normally slightly exceeded the tonnage of North Sea and Baltic vessels, although the number of big ships was clearly below 50 %.

By 1913, the overall picture was very different. If "hard core" denotes something which was of importance in international shipping and, technically, up to date, the only category fitting into this frame was steamers on regular lines beyond the Sound and tramp steamers of, say, over 700 net tons. In the 1910s, these vessels were found mainly in Helsinki and, on a much smaller scale, in Turku (Åbo) and Vaasa. Although they comprised about 70 % of Finnish steam tonnage (excluding the inland fleets) they represented only around 17 % of the total sea-going tonnage. Yet they accounted for about 30 % of all ton-miles sailed by Finnish ships and earned no less than 55 % of the country's estimated shipping income and about 35 % of the value-added.[2]

At the same time, however, there was a second major category, long-trading sailing vessels, which were going through a kind of renaissance in the 1910s. At that time, they comprised 39 % of total Finnish merchant tonnage and logged no less than half of the total national output of ton-miles. However, they earned less than 20 % of Finnish shipping income and accumulated about a quarter of the value-added.

It is remarkable that neither of these internationally important fleets originated from the same area as the hard-core fleet of the 1860s. The main centre of modern steam shipping, Helsinki, was never[3] the number one base of sailing vessels. True, there was strong continuity from the sailing ship era in the fleets at Turku and Vaasa, and even the original owners of the *FÅA* included members of a few families which had earlier been heavily involved in sailing vessels (for example, Wolff from Vaasa, later Wiborg and Hackman from Wiborg).[4] It is also a well-known fact that most early coastal steamship lines were started by local, well-established shipowners. Later, however, practically all "one-town" steamer companies (with the exception of those carrying strictly local coastal traffic) were either dissolved or incorporated into larger ones. Since big steamship companies attracted capital from

2 No less than a quarter of all shipping income was earned by the four *FÅA* "emigrant" steamers, which clearly shows how unsymmetrical the distribution of income was.

3 Except for a short while in the beginning of the 19th century.

4 Suviranta, *Suomen Höyrylaiva Osakeyhtiö*, p. 22—23. Hackman, however, had sold his long-traders in the 1850s.

various towns, it was convenient to place the office in the capital; accordingly, this was bound to lead to geographical discontinuity although it may have been more apparent than real. However, it is an indisputable fact that most of the earlier maritime centres in Ostrobothnia (including Pori, which still had a large fleet of cross-trading windjammers in the 1860s) lost most of their shipping. In 1913, for example, Oulu and Pori did not have a single sailing vessel left, while Raahe and Kokkola (Gamla Karleby) only had a couple of coasters.

In 1913, no less than 80 % of all sailing vessels over 100 tons, long-traders and Baltic tonnage alike, were found in Åland and the towns of Uusikaupunki and Rauma. These were all localities with maritime traditions, but none of them were real ocean-trading centres in the 1860s; Rauma and Uusikaupunki were primarily known for their strong traditions in Baltic shipping, while Åland was just beginning to evolve from traditional "peasant" shipping to North Sea trade. Discontinuity, thus, also characterized the development of Finnish sailing tonnage.

There was only one sector which did not undergo any major upheaval. The position of the traditional "peasant" shipping in coastal waters remained much as it was in the 1860s and, even at the end of the period, there was some growth in tonnage. No one would claim, however, that this balanced the shortcomings in hard-core shipping.

The overall structural transformation resulted from a series of different changes. These changes were not necessarily inter-connected parts of a single logical trend, although there were frequently apparent links with changes in profitability. This was obvious as early as in the late 1860s, when the decline in cross-trade profitability resulted in a decrease in urban shipping investment. Since previous income levels were not reached again during the next boom, long-trading tonnage volume did not regain the earlier level. Although old tonnage was generally replaced with larger ships, this was more an attempt to solve profitability problems than an expression of further expansion. The total cessation of the building of big sailing vessels after 1879 was an equally rational response to continually declining prospects. Later on, when freight income began to improve, there were (with relatively short time-lags) two booms for big second-hand windjammers.

The rise in North Sea sailing trade was also connected with the rise in freights in the early 1870s. As long as these medium-sized vessels seemed to be more profitable than long-traders, tonnage decreased at a slightly slower rate than that of sailing vessels in general. At this point, however, one reservation must be made: these ships fared better than long-traders only if capital costs were not accounted for, but since they often sailed uninsured they were, on average, subject to fairly high depreciation. Although some new building of medium-sized sailing vessels took place in the late 1880s, most of the fleet was nearing the end of its natural life in the 1890s, when North Sea timber freights fell more than ocean freights. The owners had generally not been able to accumulate funds to replace (or rebuild) the ships and thus it was no wonder that this fleet rapidly diminished.

The fact that all "peasant" owners were not capable of making accurate risk and depreciation estimates does not, of course, prove that there was not rational thought behind their actions; in principle, the evidence points to the contrary. There is also another example with a similar implication. If North Sea wood freights were more profitable in the 1870s than ocean freights, why were long-traders still used in their traditional activities in spite of rapidly worsening prospects? Big-ship owners, however, were facing two problems which made such a change impracticable. First, their vessels were, in many cases, too big to be handy North Sea traders; moreover, they were expensive and, in order to meet capital costs, they had to be employed all the year round, which was not possible with timber from the Northern Baltic. Thus, what may at first sight seem an example of inflexibly traditional attitudes was in reality rational behaviour, which was dictated by earlier investment decisions.

Fluctuations in the development of steam tonnage profitability and investment do not seem as closely connected. This may be partly explained by deficiences in the accounting material, especially as far as the earlier half of the period is concerned. In any case, it was established beyond any doubt that Finnish-owned steamships (then consisting mainly of small and medium- sized Baltic vessels) were more profitable than sailing vessels in the 1880s. Thus, the continuous increase in steam tonnage and the equally continuous decrease in large and medium-sized sailing tonnage were exactly to be expected.

The rapid growth in steam tonnage in the good years of the late 1890s was also compatible with the improvement in profitability of large cargo ships, although this was a time when long-trading sailing vessels did even better. The slow tonnage growth during the last decade before the first World War, which seemed exceptional in international terms, was more understandable in the light of the economic returns. The *FÅA* figures showed that cargo steamer profitability was in decline until about 1908; passenger vessels, on the other hand, developed extremely erratically. All this must have created an atmosphere of uncertainty which normally militates against long-term investment.

This development obviously depended to some degree on certain non-market factors. First, in the mid-1880s, the Finnish state began to grant noticeable sums to shipping, in the form of both low-interest loans and direct subsidies, and both peaked in the late 1890s. From 1897 to 1899 these loans totalled 2.8 million marks, which corresponded to about 5,000 net tons of cargo steamers.[5] Although this sum is only a fraction of all shipping investment during the decade, the availability of cheap public money obviously encouraged investment at the height of the boom.

In the next decade, however, loans to shipping stopped altogether: only a few minor ones were granted in the 1910s. It has been assumed that this sudden decline was a result of worsening prospects, that shipowners did not dare to invest, not even with the additional incentive of public money. It is true that some companies were allowed to defer the amortization of state loans because of "bad times",[6] but this does not tell the whole story. In violation of existing legislation, the Russian government had increased its direct influence in Finland since 1899. This led to a constitutional crisis known as the "first period of oppression", which lasted until the end of 1905. It is possible that some major shipowners, who were mostly very anti-Russian (one member of the *FÅA* board was even exiled in 1903) lost confidence in the

5 Increased loans and subsidies resulted from the recommendations of the state committee on shipping, which published its memorandum in 1884. See Kuusterä, *Valtion sijoitustoiminta*, p. 220—222; Kaukiainen, "The Transition from Sail to Steam", p. 181.

6 Kuusterä, *Valtion sijoitustoiminta*, p. 222.

Senate (the government of Finland which also granted the largest loans), which consisted of politicians who were willing to collaborate with the Russians. These political antipathies may even have been a contributory factor when the *FÅA* lost its former subsidies for maintaining winter traffic to Hull to the *Nord* company in 1902. Russification also caused direct economic losses: both the *FÅA* and the *Bore*-company from Turku lost their subsidies for winter-traffic to Sweden, because they did not accept unlimited control by the gendarmerie aboard their vessels.[7]

Moreover, since Russia was building up its own steam fleet, the government tried to limit traffic by Finnish lines to St. Petersburg. When shipping companies received subventions for foreign traffic, they had to promise not to go to Russian ports.[8] Although the first period of russification came to an end late in 1905, a new one followed four years later. Indeed, the pessimistic first decade of the 20th century in Finland was in sharp contrast to what was happening in Norway: Norway severed her remaining ties with Sweden in 1905, and although this expression of nationalism had virtually no direct influence on economic life, it certainly created an atmosphere of progress.

As economic and non-economic factors were closely intertwined, it is difficult to show the primacy of the latter, but at least their coincidence with the shipping depression of 1903—04 proved fatal. This was also a period when competition between Finnish steamship lines was becoming more intense than before. The fact that a new Finnish company was formed to compete with the *FÅA* on the important Hull line shows that the previous, almost monopolistic market situation was being disturbed. Competition on the Stockholm line is further evidence of this.

Finally, right at the end of the period, a somewhat special instance of competition seems to have retarded the growth of steam shipping. In the 1910s, the profitability of long-trading windjammers increased suddenly and they began to produce a larger return on capital than any other type of vessel, even including emigrant steamers. Although war brought a premature end to this renaissance, within a couple of years it had still made a strong impact on shipping investments. In 1911—13 the net

7 Kaukiainen, "The Transition", p.181—182.
8 Kaukiainen, op. cit., p. 182.

tonnage of imported sailing vessels was seven times as large as that of imported steamships, and even in monetary value the former clearly outstripped the latter. A typical example of this development is that even the *FÅA* invested in windjammers by founding a subsidiary company, *Finska Skolskeppsrederiet* (Finnish Training Ship Company), in 1911.[9] Since the preceding years had been a time of great uncertainty in shipping for many reasons, it is very understandable that even established steamship owners preferred short-term speculation with sailing vessels to strategic long-term investments in first-class technology.

To sum up, it is obvious that, although sometimes affected by non-market factors, profitability offers the primary explanation of the general development of the Finnish steam and sailing fleets. This does not mean that there were not owners who acted irrationally, who, out of affection or ignorance, stuck to unprofitable sailing vessels, but as far as short-term decision-making was concerned, they must have been in the minority. On the other hand, if the average level of know-how among shipping entrepreneurs really declined, as has been supposed (see p. 127), this might have affected long-term planning in two different ways. The inability to estimate realistic depreciation (including risk) may have led to an excessively optimistic view of the business, and the lack of planning skills probably made immediate profit seem better than investment which might bring better returns some time in the future. Of course, the uncertainty which prevailed in the freight market also favoured short-term speculation. However, in spite of certain reservations, the relatively slow transition from sail to steam mainly resulted from the fact that sailing vessels offered a competitive investment opportunity for longer than has generally been believed.

Since developments in Finland differed so much from the general trend of transition, however, this explanation is not totally satisfactory. Whether Finnish-owned sailing vessels were more profitable than sailing vessels in general, or whether Finnish-owned steamships were less profitable than steamships in general, is, at the moment, impossible to say, because there is very little

9 *The Ships of Our First Century*, p. 197—198. In spite of the name, which may have indicated idealistic goals, the company's three ships operated at a good profit.

comparative data available. However, it is possible to show that in certain respects the principal factors of production were differently priced in Finland than in the industrialized "core" countries. It still remains to be seen whether such differences affected profitability to any significant degree.

The question whether the profitability of shipping differed from that of other investment opportunities also remains open. The availability of comparative data imposes certain restrictions here too, but at least it should be possible to estimate whether opportunities in certain other industries were better enough to attract capital from shipping. The answer to this question would explain not only the differences between Finland and other countries but also local differences within the country.

Finnish shipping and the international economy

There is no doubt that, compared with Great Britain, for example, Finnish shipowners were at a comparative advantage because of cheap labour and, as long as wooden ships were being built, low capital costs. It remains to be seen how significant these advantages were and how much bearing they had on the tenacity of sail.

Because of the lack of data, Finnish labour and capital costs can be compared with average North Atlantic levels only in hypothetical terms. Moreover, it is assumed that there were no substantial differences in gross income, or, at least, that Finnish vessels did not earn more than the average. As far as international cross-trade was concerned this is reasonable because, in principle, freights did not vary according to the home port of a ship. It has been claimed that Norwegian sailing-ship masters often agreed on freights which were lower than the market norms[10] and it is not unreasonable to expect that masters from another low-cost country, Finland, did the same. Moreover, since the Russian tricolor was not one of the favourite ensigns in North Atlantic ports, Finns were occasionally at a disadvantage for flying it; for example, in the late 1870s when Russia and Turkey were at war, as

10 See e.g. Hodne, *Norges økonomiske historie*, p. 142.

well as during the Russo-Japanese war, Finnish vessels had difficulties finding cargo.[11]

That the income level of Finnish sailing vessels did not exceed the international average is also confirmed in both Swedish and Norwegian shipping statistics. Indeed, the average income of the Swedish sailing tonnage fell largely in accordance with the figures put forward in this study,[12] while Norwegian statistics indicate that the average gross income for all sailing vessels per net ton was somewhat higher than the Finnish ocean sailers were able to generate.[13] This may have been because there was massive emigration from Norway to America, peaking as early as 1881—85, and this probably gave westbound Norwegian vessels valuable income. However, contrary data also exists. For example, according to David McGregor, eleven fairly large British ships earned an average annual income "before voyage expenses were deducted" of about £3.6 per gross ton during the years 1863—75.[14] Even if allowance is made for the difference in tonnage, this income level is clearly below the corresponding rate in the Finnish sample. Estimates of the gross income of Saint John's (New Brunswick) ocean fleet put forward by Lewis R. Fischer, Eric W. Sager and Rosemary E. Ommer were also systematically much lower in value per ton than indicated in the Nordic statistics.[15] However, in terms of representativeness, the Nordic data is superior.

Table 5:1 represents an attempt to estimate how differences between Finnish, British and Canadian labour and capital costs might have affected net result and return on capital. The comparison is hypothetical in the sense that all other costs were considered equal; in reality, masters' wages, for example, may

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11 See e.g. Nikula, *Åbo sjöfarts historia*, p. 7; Suviranta, *Suomen Höyrylaiva osakeyhtiö*, p. 41—42.

12 This is clearly demonstrated by the fact that Matti Peltonen made his estimation of Finnish shipping income starting with Swedish average income for sailing vessels and steamships (*Liikenne Suomessa*, p. 25). As was seen, in most cases this estimate fell quite close to the one presented in this study.

13 See Gjölberg, "The Substitution of Steam for Sail in Norwegian Ocean Shipping," table 1.

14 McGregor, *Merchant Sailing Ships 1860—1875*, p. 160.

15 Fischer, Sager and Omner, "The Shipping Industry and Regional Economic Development," p. 38—43.

TABLE 5:1. Hypothetical wage and capital cost differentials in Finnish, British and Canadian long-trading sailing vessels. Percent of gross income.
F = Finnish, B = British, C = Canadian.

Period		Crew wages	Net result	Capital costs	Return on capital
1861/67	F	9.3	33.6	9.0	24.6
	B	22.3	20.6	13.2	7.4
	C	19.1	23.8	9.0	14.8
1871/77	F	10.8	21.4	9.7	11.7
	B	21.6	10.6	13.5	–2.9
	C	18.9	13.3	9.7	3.6
1881/87	F	15.4	7.1	11.6	–4.5
	B	27.7	–5.2	15.1	–20.3
	C	21.3	1.2	11.6	–10.6
1891/97	F	15.2	8.7	10.6	–1.9
	B	28.2	–4.3	10.6	–14.9
	C	22.8	1.1	10.6	–9.5
1911/14	F	14.4	24.8	8.3	16.5
	B	26.6	12.6	8.3	4.3
	C	21.6	17.6	8.3	9.3

Source: Tables 2:30, 4:9, 4:12, 4:13, indices of wage costs, p. II:18. It was supposed that all other costs (including masters' salaries) were equal. The estimation for 1911/14 is based on the assumption that wage differentials were the same as in the 1890s. Before the 1880s, capital costs were supposed to be equal in Finnish and Canadian fleets, the differences between British and Finnish capital costs were calculated according to new building costs (p. 76).

have dropped earlier in other countries than in Finland, and bigger, iron-hulled ships which were already common in British tonnage in the 1870s, were obviously more economical to run than smaller wooden vessels. The comparison, however, shows one important thing: wage differentials, as well as the differences in tonnage prices between Finland and Britain, were powerful enough decisively to affect the profitability of shipping. It is possible that, in the 1860s, Finnish sailing vessels, which showed

three times higher profit from assets one third cheaper, gave a return on investment four times as high as British tonnage. It also seems possible that at least small and medium-sized British windjammers experienced difficulties in covering capital costs after the mid-1870s, and in balancing running costs and income during the following decade. Thus, it is no wonder that a definite breakthrough in British steam shipping took place between 1875 and 1885.[16]

With their cheaper ships, Canadians had more in common with Finnish owners, but cheaper labour was still enough to produce substantial differences in profitability. That many Canadian wooden vessels were sold to Finland in the 1890s is direct proof of this. Of course, when more and more Finnish sailing vessels were bought from abroad at international market prices, the differences in capital costs, even compared with Britain, narrowed to practically nothing. It is also reasonable to suppose that owners in high-cost countries not only tried but even succeeded in reducing other costs. Thus British sailing tonnage, for example, declined fairly slowly in the 1890s. In France, the state directly subsidized sailing-ship owners.

Interestingly, at the end of the period, Finnish sailing vessels enjoyed smaller comparative advantages than during the "golden ages of sail". Indirect proof of this is the fact that big fleets of deep-sea sailing vessels, not only from Britain but also from other high-cost countries, were still in business at the beginning of the 1910s. This is quite clearly seen in table 5:2, which only includes metal-hulled and composite vessels (which were usually synonymous with ocean-going crafts at that time). With her 70,000 net tons or so, Finland was far from the top in 1910. Accordingly, it may be claimed that national differences in cost structure were not totally decisive for the viability of sail. Before the World War, there was still a section of the international freight market, the longest ocean routes, on which big sailing vessels of many nations were able to make a living.

Finnish steamships also enjoyed the advantage of cheap labour, but crew wages (excluding master, including officers and engineers) amounted to only 4—5 % of gross income, much less in

16 British steam tonnage amounted to 32 % of total tonnage in 1875, and 53 % in 1885.

TABLE 5:2. Composite, iron and steel sailing-vessels in selected national merchant fleets, 1910. Thousand net register tons.

United Kingdom	684
British possessions	53
United States	134
Germany	358
France	360
Norway	406
Sweden	18
Denmark	17
Italy	206

Source: Palmer, "The British Shipping Industry", table 4 (based on the Lloyd's register)

passenger ships. Thus, the advantage was fairly marginal, even compared with British steamers, in the order of 2 % of total costs. Indeed, more could be saved by well-timed purchases of coal and other stores, but in this respect Finnish shipping companies could not expect similar discounts to those granted to bigger British and Continental lines. On the other hand, Finns were on a virtually equal footing in the purchasing of steamships; since there were no customs dues on large vessels,[17] they paid normal world market prices. Because of higher transaction costs (commissions for bills of exchange, for example), a Finnish buyer probably had to spend marginally more than his British counterpart, but that could not have produced significant differences in shipping profitability. What was more important was the sheer lack of capital; irrespective of whether steamships bought for Finland were the same price as British ones, at the turn of the century, they were seven to eight times more expensive per ton than second-hand sailing vessels of iron or steel. As mentioned previously, shipping investment was typically financed by shipping income; the price difference, however, was so great that, after the 1870s, practically no large sailing vessel earned enough money during its entire

17 *Finlands författnings samling,* customs tariffs of 29.7.1869, 19.5.1886, 30.5.1888.

productive life to buy a medium-sized steamship.

Thus, capital from outside was needed and, apart from state loans, the practical alternatives were raising joint-stock capital or bank-loans. The latter were more expensive in Finland than in Britain, for example: the difference in interest rates was normally two percentage points or more (even in Sweden the interest rates were marginally lower than in Finland). Since British discount rates fluctuated at about 3—4 per cent, the difference was fairly large.[18] The high interest rate also made it more difficult to collect joint-stock capital.

British capital was not imported into Finland as it was imported to Norway, for example. In the 1880s, certain British shipping agents and other businessmen began investing money in ships which were formally registered in Norway, because they could benefit from the local cheap labour. This British capital was important in Bergen, in particular, and probably accounted for the relatively rapid transition from sail to steam in that city.[19] Finland, on the other hand, despite having even cheaper labour, never attracted any notable number of foreign shipowners before the War; this was probably because the Russian flag was not regarded as very convenient in other respects.

Because of expensive capital, steamships were an attractive opportunity for Finnish owners only in areas such as liner traffic for which profit expectations were higher than for average bulk trades. The development of freight markets, however, made this a sector in which newcomers had difficulties in establishing themselves. Although the "freedom of the seas", or of maritime trade, prevailed in principle after the abolition of most navigation acts, competition in freight markets was far from free after the late 1880s. The growth of steam created surplus tonnage and some governments began to support their national shipping by granting subventions or special reductions in shipping dues. What was probably more important, however, was that big, well-established liner companies agreed on the division of markets by tariff and traffic agreements, so-called conferences, which usually aimed at excluding new competitors from the area in question. Being late-comers, Finnish liner companies had only limited possibilities of

18 Pipping, *I guldmyntfotens hägn*, p. 149—151.
19 Hodne, *Norges økonomiske historie*, p. 147, 154.

establishing themselves in European waters and the Atlantic. That they were relatively successful in shipping between Finland and England and Finland and Sweden was obviously because there was little interest in these routes from British and Swedish companies; they fared worse in the Baltic. Extending regular services beyond the network which existed around 1900 was fairly difficult which, once more, leads to the conclusion that the only real prospects of expanding steam shipping in Finland lay in tramping. With the extremely limited data on tramp-traders, it is not possible to determine how profitable they were. However, because sailing vessels brought about the same return on investment as cargo liners, and growth in tramp tonnage after 1900 was slow, plus the fact that Finnish owners faced higher financing costs, it seems that the prospects were not very good. The choice of a second-hand tramp steamer in preference to a second-hand sailing vessel was certainly far from obvious.

It is clear that most of the comparative advantages which Finnish shipping still enjoyed at the beginning of the 20th century applied only to sailing vessels. This simply means that, in international shipping, Finnish windjammers did much better than Finnish steamers, and that the transition from sail to steam, both on a worldwide scale and within the domestic merchant marine, was probably the key factor undermining the competitiveness of Finnish shipping. However, it must be remembered that there was no way out of this situation: international sailing-vessel trade was a contracting market. It only brought decent returns because sailing tonnage was also diminishing.

Finnish shipping and the Finnish economy

Although sail and steam were very real competing alternatives in shipping, it would be misleading to strech the dichotomy too far. In spite of dual freight markets, it was perfectly reasonable for a shipping boom to inflate the earnings of both, and for a depression to hit sail and steam equally badly. This should be taken into account in any comparison of shipping with landward opportunities; very often the choice was to abandon shipping altogether in favour of some other investment.

It is impossible to produce an overall profitability comparison of different industries in late-19th-century Finland: there is simply no data. What can be done is to document the most common alternatives to shipping chosen by shipowners and to estimate the profitability margins within certain branches of manufacturing industry, for which there exists a proper study of production growth.[20]

Before going further, one important point must be stressed quite strongly. In the 1860s and 1870s, the "hard core" of shipowners, major trading-houses, did not only specialize in shipping. Many of them may at times have obtained the bulk of their income from it, but they also had many other business interests. The export and import trades were regarded as an integral part of their activities, as was the retail trade; what is more, by the 1860s, many houses already owned sawmills or other manufacturing plants, or shares in them.[21] A good number of the firms which later abandoned shipping were not leaping into the unknown but rather restructuring their existing diversified business.

In order to form an idea of how the ship-owning trading houses and firms revised their business strategies, information was collected on those which existed in the 1870s and which were still in business at the turn of the century (either run as private firms by the original owners or their successors, or reorganized as joint-stock companies). The basic data was extracted from commercial calendars which were published at irregular intervals, beginning in 1871; whenever possible, this was supplemented by consulting local historical works and even archival material.[22] The search yielded 35 "biographies" of, mainly larger, firms which were also major shipowners in the 1860s and 1870s, but a few smaller ones

20 Heikkinen and Hjerppe, *Suomen teollisuus ja teollinen käsityö 1860—1913.*

21 See e.g. Mauranen, "Kotimaankauppa," p. 436—441.

22 Forselius, *Finlands handelskalender,* var. editions; Saarinen, *Porin historia III;* Hautala, *Oulun kaupungin historia 1856—1918;* Nikula, *Malmska handelshuset i Jakobstad;* Norrvik, *Briggen Carl Gustaf;* Nikula, *Åbo sjöfarts historia;* Lähteenoja, *Rauma 1809—1917;* Möller, *Gamlakarleby stads historia III;* Cederlöf, *Lovisa stads historia III;* Brick, *Nykarleby stads historia III;* Kaukovalta, *Uudenkaupungin historia IV;* Söderhjelm, *Brahestad 1649—1899;* Ahvenainen, *Kymin osakeyhtiö;* Hoffman, *Suomen sahateollisuuden kasvu, rakenne ja rahoitus,* p. 133—156; the archives of Bergbom, Sovio and Snellman, Oulu Provincial Archives.

were also included. The list may seem rather short, but it must be remembered that firms are set up and disbanded all the time and the average life-span, even excluding any structural changes, may be much shorter than thirty years. Nor can the list be comprehensive or accurate in detail, because in many cases the information in the calendars could not be cross-checked, and shares in joint-stock companies are difficult to trace.[23] The list should, however, be representative enough to give an idea of some typical opportunities.

Locality and firm	Activities around 1900—05 (by original firm or its direct successor)
Viipuri (Wiborg)	
Paul Wahl & C:o	sawmills, iron manufacturing etc.
Loviisa (Lovisa)	
Ars. Terichoff	sawmill, export
Porvoo (Borgå)	
Aug. Eklöf	sawmill, pulp mill, wholesale trade, shipping
L. Simolin	wholesale and retail trade
Turku (Åbo)	
C. M. Dahlström	commerce and manufacturing, shares in a pulp and paper mill
G. A. Lindblom	shipping, manufacturing, shares in a pulp and paper mill
A. B. Nordfors	wine and spirits trade
G. A. Petrelius	manufacturing, retail trade
J. G. Wikeström	agency, coal trade, shipping
Uusikaupunki (Nystad)	
A. E. Blom (Chr. B.)	shipping, export
Aug. Forsström	shipping, export
Leonard Kräki	shipping agency
Gabr. Rivell	shipping, spirits manufacturing
Joh. Rivell	shipping, export
J. P. Seikow	shipping
F. W. Wahlberg	shipping, export, tobacco manufacturing
Rauma (Raumo)	
Gabr. Granlund	shipping, export

23 For example, in many cases, commercial calendars indicated that firms still carried on shipping although it was known that they did not own a single ship. Obviously, the descriptions of activities were not accurate, or the firms wanted to mention shipping in their activities just in case of a revival.

A. W. Grundström	agency, stevedoring
H. J. Ridderstad	shipping, export
J. W. Söderlund	shipping, export, salt trade, printing
Pori (Björneborg)	
A. Ahlström	sawmills, iron manufacturing, export
Rosenlew & C:o	sawmills, iron manufacturing, export
Fr. W. Petrell	drinks manufacturing, wholesale trade
Kristiinankaupunki (Kristinestad)	
G. Hydén	shares in a steamship company, agency, brewery
L. W. Wendelin	export
Vaasa (Vasa, 1855—1917 Nikolaistad)	
C. G. Wolff	pulp and paper manufacturing in South-eastern Finland (two joint-stock companies), shares in the *FÅA*
Uusikaarlepyy (Nykarleby)	
C. Nylund	retail trade
Pietarsaari (Jakobstad)	
Petter Malm	sawmills, shares in tobacco and paper- mills, shares in the *FÅA* (1892—, shipping until 1899)
Ph. U. Strengberg	tobacco manufacturing, export and retail trade
Kokkola (Gamlakarleby)	
G. W. Forsén	retail trade, tar export
Raahe (Brahestad)	
Johan Lang	wholesale and retail trade
J. G. Rein	export and retail trade
F. Sovelius	brick and spirits manufacturing, shares in sawmills (shipping until 1898)
Oulu (Uleåborg)	
G. & C. Bergbom	sawmills, tar export (shipping until 1896), shares in textiles industry
J. W. Snellman	sawmills, tar export, import (shipping until 1888)

The list includes 15 firms which maintained their interests in shipping after 1900. However, no less than ten of these were from Uusikaupunki and Rauma, and if they are excluded, only one fifth of the earlier shipowners or shipping companies were still active in the business. On the other hand, at the turn of the century, 18 firms had manufacturing activities, or at least owned shares in manufacturing companies. The most popular industry was sawmilling (9 cases) but involvment in iron, food and drink manufacturing and having shares in pulp and paper mill companies were also common. With just a couple of exceptions, all

the firms also had interests in foreign or domestic trade. In most cases these activities were not new but stemmed from the 1870s or earlier, the "golden days" of shipping. That firms were still occupied with such activities, and were even expanding them, suggests that they regarded them as more profitable than shipping. The list also includes examples of activities which were started after the 1870s, such as pulp and paper mills and various food and drink manufacturing plants. Perhaps it should also be mentioned that some shipowners participated in the building of local railways to Rauma, Uusikaarlepyy, Pietarsaari and Raahe.[24]

Profitability in different manufacturing industries can be gauged only by comparing the volume of operating result (profit) with the gross value of production: since there are no proper capital stock estimations, return on capital cannot be calculated. The role of fixed capital was relatively large in the textile and iron industries, and also in the paper and pulp industries by the end of the century; in this respect, these industries were much like shipping. On the other hand, fixed capital was much lower for sawmills, but since they always had large stocks of both raw materials and finished products, they needed a lot of circulating capital.[25] This made it a relatively capital-intensive industry, at least compared with the volume of labour.

Table 5:3 sums up the proportions of profit and labour costs of gross production. In total industry, the percentages were remarkably equal, and a natural conclusion would be that, in capital-intensive industries, profit normally outstripped labour

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24 The railway to Rauma was built by the town (—1899), which meant that all local shipowners materially contributed to it, although Söderlund was the *primus motor* in the business (Lähteenoja, *Rauma,* p. 230—231). Uusikaarlepyy and Raahe railways were built by local companies, also at the turn of the century, and Fredrik Sovelius (Sovio) donated 200,000 marks for the latter (Birck, *Nykarleby stads historia,* p. 363—64; Söderhjelm, *Brahestad,* p. 275—76). The railway to Pietarsaari was built by the State (1886—87), but only after Otto Malm had donated 200,000 marks for the purpose (Nikula, *Malmska handelshuset,* p. 437). All these railways were far from good businesses, and therefore money spent on them was public consumption rather than investment.

25 In the 1870s, the building costs of a steam saw-mill amounted to about 10 marks per one produced standard. The costs of raw wood was about 40—50 marks per standard at the same time. Hoffman, *Suomen sahateollisuuden kasvu, rakenne ja rahoitus,* p. 133—160, appendix table 11.

TABLE 5:3. The proportion of operating result and wage and salaries in selected Finnish manufacturing industries and in shipping, 1864—1913. Per cent of the gross value of production.
1 = operating result, 2 = wages and salaries

Industry	1864/66		1874/76		1884/86		1894/96		1904/05		1911/13	
	1	2	1	2	1	2	1	2	1	2	1	2
Total industry	22	22	24	19	19	20	18	19	20	19	19	19
Beverages, tobacco	20	13	16	8	17	11	22	12	30	11	28	12
Textiles	24	15	29	19	29	18	35	17	32	16	26	19
Sawmills	33	14	32	13	15	16	5	19	13	18	14	18
Pulp, paper	23	18	23	17	24	17	28	17	26	19	26	14
Manuf. of machinery	30	26	36	30	43	31	9	29	37	35	35	35
Shipping, ex. coastal	24	25	27	30	16	38	16	27	14	20	16	14

Source: Heikkinen and Hjerppe, Suomen teollisuus ja teollinen käsityö 1860—1913, appendix tables 2—4; tables 4:18 and 4:19.

costs. Shipping, however, at first sight, is an exception, since only at the end of the period did profit exceed labour costs. It must be remembered, however, that, in addition to the relatively high wage level, a high proportion of wages (4—5 per cent of gross production, after the 1890s slightly less) consisted of masters' commissions which, in fact, represented redistributed profit rather than normal labour income.

The most interesting feature is whether the profit percentage did change. In many manufacturing industries such as textiles, tobacco and beverages and pulp and paper, a modest increase took place in the 1890s, which can be interpreted as improved rather than diminished profitability. On the other hand, both shipping and sawmills experienced a very similar decline and, even with sawmills, this seems to have been connected with decreasing profitability.[26] In this light, the decision to abandon shipping in

26 Hoffman, *Suomen sahateollisuuden kasvu*, p. 120—122.

favour of certain manufacturing activities seems to have depended on profitability differences.

Many companies, however, stuck to sawmills although they sold their ships, which may not seem very rational behaviour. As far as can be deduced from the few accounts, shipping brought a better return on investment in the 1860s, while in the following decade the two were more even.[27] Most shipowners who were involved with sawmills had been so for many decades or had invested in steam-driven ones in the 1870s. Since the fixed capital of the business was fairly modest compared with the total turnover, most of these were already "written off" in the 1880s when the sawmill business became less profitable. It is true that many sawmills incurred direct losses after the 1870s, but at that time they were not easy to sell either. Obviously, many owners did not stick to, but rather were stuck with, their sawmills, and it seems perfectly possible that income from shipping, small as it was then, had to be used to keep the sawmills running.

Unfortunately, the most common alternative opportunities for shipowners, the wholesale and retail trades, are the least documented, at least as far as profitability is concerned. Of course, foreign and domestic trade with different articles resulted in widely differing profit, but there are examples of import, export and retail businesses generating income comparable with that of shipping during the "golden days" of sail.[28] Moreover, unlike manufacturing, this was an industry which practically all urban shipowners knew very well.

It is clear that there were local differences in the opportunities available. The sawmill industry is a good example of this: it developed mainly on or around coastal towns which were connected by rivers to the interior forest areas. Thus, it developed relatively early in the trading areas of Oulu, Pori, Wiborg and on the southern coast (Porvoo, Kotka, Hamina). On the other hand, it never achieved real prominence in South Ostrobothnia and, accordingly, many rich ship-owning families later invested in other local industries, or in paper and pulp mills in other parts of the country. Turku shipowners also invested in faraway forest industry enterprises (for example, *Kymmene* pulp and paper

27 Hoffman, op. cit., p. 138—139.

28 Hoffman, op. cit., p. 136, 139, 145.

company was originally controlled by them),[29] obviously because such opportunities did not abound in the vicinity of their town. The lack of viable alternatives is also reflected in the fact that both in Turku and two South Ostrobothnian towns, Vaasa and Kristiinankaupunki, capital was invested in steamships.

In this respect, the last sailing-ship area, the towns of Uusikaupunki and Rauma, and the province of Åland, are of special interest. These were all localities with little or no industry at the beginning of the 20th century. There were not good natural conditions for sawmills or other forest-based industries: only limited small-scale production of timber products, such as hewn planks and baulks, and of fire-wood was to be found. Nor were shipowners engaged in many activies other than import and export trade; this was the case in Uusikaupunki and Rauma both in the 1870s and at the turn of the century.[30] Åland shipowners, again, were usually farmers, although a few major ones were also engaged in retail trade. Against this background, it was not surprising that owners in these areas remained faithful to shipping. They simply had few other opportunities, shipping expansion was their "industrial revolution".[31] Of course, it is remarkable that more distant opportunities were not taken up, at least not on a significant scale.[32]

On the macroeconomic level, it is perfectly understandable that many industries developed more favourably than shipping. Based on local natural resources and cheap labour, and as long as there was demand abroad, they had distinct comparative advantages. Although there was a chronic dearth of capital, cheap labour made it possible to increase production by relatively small investments. Indeed, from 1860 to 1913, Finnish industrial growth was more a

29 Ahvenainen, *Suomen sahateollisuuden historia*, p. 9—10.

30 Forsell, *Finland handelskalender*, var. editions.

31 Only one major shipowner in Uusikaupunki, Zachariassen, also owned a sawmill. The firm, however, was a newcomer to shipping: it started as an organ factory and the sawmill was also built before it became a major shipping company.

32 For Uusikaupunki and Rauma, this may have been a result of the small average size of the firms. In the case of Åland, it was probably also connected with language barriers and local separatism. During the World War, localism was weakened to some degree when two major shipowners, Robert Mattsson and August Troberg, moved to Helsinki.

result of increased labour than capital input.[33] This is also an indication of the optimal combination of the factors of production in an undeveloped country. The major obstacle to the development of these industries had been expensive transport, but this was removed by the development of both land transport[34] and, paradoxically enough, shipping and the decline in freight rates after the 1870s.

Compared with Finland-based manufacturing, the advantages of shipping were slightly diminished early on because long-trade wage levels were, of necessity, clearly higher than those paid in the country. The capital requirements of shipping were also relatively high and, moreover, they were increasing. As mentioned earlier, steamships represented even more capital-intensive shipping than sailing vessels. During the two last decades before the first World War (as the relative decline of labour costs, table 5:3, indirectly shows), the role of capital was further increased. The capital intensity of steam shipping is amply emphasized by the fact that the joint-stock capital of the Finnish Steamship Company *(FÅA)* was five million marks after 1898, while before the turn of the century, a typical joint stock holding in a forestry industry company was worth from 500,000 to 1,000,000 marks.[35]

The problems of raising capital were exacerbated by the ending of domestic shipbuilding and the loss of any comparative advantage in tonnage prices. In fact, the change was greater than indicated by ship prices. In many cases, home-built, wooden ships were not paid for wholly in cash; for example, a merchant may have paid for timber delivered by peasants with iron, salt or other consumer goods, or by writing off debts they owed to him for earlier purchases; peasant shareholders, again, normally delivered most of the timber from their forests. This kind of *in natura* capital formation was out of the question with ships bought from abroad, even second-hand windjammers. Requirements for cash and credit

33 See e.g. Hjerppe, *The Finnish Economy 1860—1985*, p. 108.

34 At this point it is worth stressing that, in Finland, railways were built mainly with state money, loaned from abroad. Thus, railway building did not compete with shipping as an investment opportunity.

35 Cederholm, *Finlands bank och aktiebolag; Suomen höyrylaiva osakeyhtiö 1883—1933*, p. 145. In 1898, *Wasa-Nordsjö* company raised its joint stock from 0.8 to 2 million marks: *Wasa-Nordsjö Angbåts Ab*, p. 51.

thus grew somewhat more rapidly than actual prices and this often created additional transaction costs. The effect of all these changes was that the factors of production for shipping developed into a combination which was less and less optimal for a developing country like Finland.

From golden days to twilight years

The different elements of change combined to produce the same result: the importance of shipping in the Finnish economy declined. In quantitative terms, it never was a big industry. It contributed only about 3.5 % to the gross national product around 1865, but accounted for 8.5 % of all non-primary (non-agrarian) production and about 40 % of the value-added of manufacturing industry. In the 1860s, investments in ships rose to about a third of all investments in production equipment (excluding investments in residential construction and the clearing of new fields, see p. 91), and this is the best proof of the dynamic nature of the industry.

In the "golden days" of sail, Finnish blue-water shipping was unusual in its heavy dependence on foreign cross-trading. It could be said that it was only partially integrated with the national economy and, in fact, its backward linkages were rather tenuous. Most of the expenses were incurred, and a proportion of the wages spent abroad;[36] profits were not always repatriated, and some owners had money permanently invested abroad.[37] Since investments almost equalled profits, it is obvious that shipping income did not benefit other sectors to any great degree.[38] The most

36 How large this proportion was cannot be exactly determined. Normally, 1/3 to 1/2 of married men's wages were paid to their wives and both married and unmarried Finnish sailors received a large proportion of their wages after the voyage at home. Masters spent, relatively speaking, still less of their salaries abroad. Probably half or more of all wages were paid and consumed in Finland.

37 Otto Malm, for example, had large sums of money in the care of Rew, Kington & C:o (London), and he also bought Indian railway bonds and German securities. Nikula, *Malmska handelshuset*, p. 438—452.

38 After the 1870s, the situation, of course, was different. Since investment declined, shipping income could, at times, be used for other purposes.

important linkage to the Finnish economy was through shipbuilding, which considerably boosted the development of the western coastal districts.

In the sawmill industry, the backward-linkages to the national economy, wages and the value of domestic raw materials, probably amounted to three times more than the value-added. In the 1860s, investments in domestic-built ships plus seamen's wages consumed in Finland must have totalled less than 90 % of the value-added of shipping, which is less than in any manufacturing industry with the possible exception of the textiles industry, which used foreign cotton as raw-material.[39] In many ways, Finnish shipping in the 1860s resembled certain "enclave" economies of the time, such as the cotton industry in Egypt. It may seem strange to call worldwide shipping an enclave, but being an exceptionally modern and very international sector in an undeveloped country, it was rather like a runner shooting out from the economy than an integral part of it.

Cross-trading was not vital to the growing industrial sector, and it could easily have been disposed of if it did not bring a decent return on investment. When there was a good international supply of tonnage and freight rates were relatively low, it was more productive, both for entrepreneurs and the whole economy, to invest in industrial development. The interests of exporting industries were only connected with maritime transport to a limited extent, and these interests were promoted with the growth of regular liner services. The decline of shipping was thus a logical outcome. In the early 1910s, it contributed less than one per cent to the gross domestic product, and about 1.5 % to non-primary value-added.

It is obvious that, at least after the 1880s, this was more a result of the development of other opportunities than of the decline in shipping income. As previously shown, big windjammers sailing on long ocean routes were also profitable enough to offer perfectly sound business opportunities, at least for owners in low-cost countries. Even in Finland, however, this kind of trade remained the top choice only in limited, more or less peripheral areas, and thus sailing-ship trade ended up in a side road of economic development. In the early 1870s, a large number of first-rate

39 See e.g. Kaukiainen, *Finnland 1860—1913*, p. 279.

businessmen still had personal interests in sail and even proudly regarded their biggest ships as symbols of economic success. After the turn of the century, in spite of the exceptionally high percentage of sailing tonnage in the Finnish merchant fleet, even the biggest steel windjammers counted for practically nothing in the big-business circles of the country. Although these ships were economically quite successful, the total development of shipping was far from being a success story; it was closer to being a failure. It is true that the Finnish golden days of sail outlasted the corresponding period in Western Europe, but by scarcely more than a decade. What followed was not an Indian summer but an autumn twilight.

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APPENDIX I: 1A. SAILING VESSELS BY SIZE-CLASS, 1865.
(Excluding barges, lighters and inland fleets)

AREA	20 > 100		100 > 200		200 > 300		300 > 500		500 > 700		700> 1000		1000 >1500		SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Tornio	1	24	1	154	1	285	0	0	0	0	0	0	0	0	3	463
Oulu	8	472	3	463	2	503	11	4734	14	8318	2	1434	0	0	40	15924
Raahe	9	398	1	111	2	549	17	7829	17	9639	0	0	0	0	46	18526
Oulu county, towns	18	894	5	728	5	1337	28	12563	31	17957	2	1434	0	0	89	34913
Kemi parish	8	302	1	148	0	0	0	0	0	0	0	0	0	0	9	450
Iijoki	29	1284	0	0	0	0	0	0	0	0	0	0	0	0	29	1284
Kalajoki	2	52	0	0	0	0	0	0	0	0	0	0	0	0	2	52
Oulu c., rural areas	39	1638	1	148	0	0	0	0	0	0	0	0	0	0	40	1786
Oulu county, total	57	2532	6	876	5	1337	28	12563	31	17957	2	1434	0	0	129	36699
Kokkola	8	286	0	0	0	0	6	2496	4	2139	0	0	0	0	18	4921
Pietarsaari	4	200	0	0	1	231	5	1882	4	2298	3	2205	0	0	17	6816
Uusikaarlepyy	3	148	3	353	1	270	2	884	1	520	0	0	0	0	10	2175
Vaasa	3	198	3	355	2	529	7	2882	14	7829	0	0	0	0	29	11793
Kaskinen	0	0	1	143	0	0	0	0	1	672	0	0	0	0	2	815
Kristiinankaupunki	3	207	4	592	1	278	2	753	3	1930	2	1674	0	0	15	5434
Vaasa county, towns	21	1039	11	1443	5	1308	22	8897	27	15388	5	3879	0	0	91	31954

AREA	20 > 100		100 > 200		200 > 300		300 > 500		500 > 700		700> 1000		1000 >1500		SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Lohtaja	4	118	0	0	0	0	0	0	0	0	0	0	0	0	4	118
Kokkola parish	1	20	0	0	0	0	0	0	0	0	0	0	0	0	1	20
Uusikaarlepyy parish	2	43	0	0	0	0	0	0	0	0	0	0	0	0	2	43
Oravainen, Vöyri	3	74	0	0	0	0	0	0	0	0	0	0	0	0	3	74
Koivulahti	1	37	0	0	0	0	0	0	0	0	0	0	0	0	1	37
Närpiö	9	333	0	0	0	0	1	307	0	0	0	0	0	0	10	640
Korsnäs	1	30	0	0	0	0	0	0	0	0	0	0	0	0	1	30
Lapväärti	2	117	0	0	0	0	0	0	0	0	0	0	0	0	2	117
Vaasa c., rural areas	23	772	0	0	0	0	1	307	0	0	0	0	0	0	24	1079
Vaasa county, total	44	1811	11	1443	5	1308	23	9204	27	15388	5	3879	0	0	115	33033
Hammarland, Eckerö	3	96	4	644	2	433	3	1005	0	0	0	0	0	0	12	2178
Finström	3	191	6	993	4	1055	2	801	1	518	0	0	0	0	16	3558
Saltvik	8	315	2	333	0	0	0	0	0	0	0	0	0	0	10	648
Sund, Vårdö	18	1195	8	1045	4	975	0	0	0	0	0	0	0	0	30	3215
Jomala	1	55	4	729	3	757	1	324	0	0	0	0	0	0	9	1865
Marianhamina	0	0	1	133	0	0	0	0	0	0	0	0	0	0	1	133
Lemland, Lumparland	5	359	9	1391	12	2753	3	1014	0	0	0	0	0	0	29	5517
Föglö	9	293	2	276	1	248	1	344	0	0	0	0	0	0	13	1161
Kumlinge	12	379	0	0	0	0	0	0	0	0	0	0	0	0	12	379
Åland, total	59	2883	35	5411	26	6221	10	3488	1	518	0	0	0	0	131	18521

AREA	20 > 100		100 > 200		200 > 300		300 > 500		500 > 700		700> 1000		1000 >1500		SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Pori	0	0	1	137	1	222	5	1918	6	3465	5	3928	0	0	18	9670
Rauma	8	693	14	1950	4	1003	6	2337	2	1119	0	0	0	0	34	7102
Uusikaupunki	1	70	19	3167	13	2877	5	2063	3	1674	1	943	0	0	42	10794
Naantali	0	0	0	0	2	488	0	0	0	0	0	0	0	0	2	488
Turku	1	85	6	1034	10	2538	10	4246	7	3719	2	1539	0	0	36	13161
Turku and Pori county, towns	10	848	40	6288	30	7128	26	10564	18	9977	8	6410	0	0	132	41215
Ulvila, Merikarvia	1	50	1	130	0	0	0	0	0	0	0	0	0	0	2	180
Eurajoki. Luvia	8	479	0	0	0	0	0	0	0	0	0	0	0	0	8	479
Pyhämaa	4	159	0	0	0	0	0	0	0	0	0	0	0	0	4	159
Uusikirkko	12	705	2	279	0	0	0	0	0	0	0	0	0	0	14	984
Vehmaa, Taivassalo	2	105	1	137	0	0	0	0	0	0	0	0	0	0	3	242
Kustavi	9	344	1	128	3	729	0	0	0	0	0	0	0	0	13	1201
Velkua, Iniö	4	218	0	0	0	0	1	396	0	0	0	0	0	0	5	614
Lemu, Kakskerta	3	98	0	0	1	241	0	0	0	0	0	0	0	0	4	339
Parainen	32	951	0	0	0	0	0	0	0	0	0	0	0	0	32	951
Sauvo, Karuna	2	128	1	124	0	0	0	0	0	0	0	0	0	0	3	252
Nauvo	9	252	6	1032	7	1537	0	0	0	0	0	0	0	0	22	2821
Korppoo	18	703	5	709	4	901	0	0	0	0	0	0	0	0	27	2313
Halikko, Uskela	5	365	0	0	1	263	2	647	0	0	0	0	0	0	8	1275
Perniö	12	633	2	287	1	259	0	0	0	0	0	0	0	0	15	1179
Kemiö, Västanfj.	11	707	9	1199	1	215	0	0	0	0	0	0	0	0	21	2121
Hiittinen	13	636	0	0	0	0	0	0	0	0	0	0	0	0	13	636

AREA	20 > 100		100 > 200		200 > 300		300 > 500		500 > 700		700> 1000		1000 >1500		SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Turku and Pori county, rural areas	145	6533	28	4025	18	4145	3	1043	0	0	0	0	0	0	194	15746
Turku and Pori county, total	155	7381	68	10313	48	11273	29	11607	18	9977	8	6410	0	0	326	56961
Helsinki	27	1055	2	283	7	1674	2	740	2	1204	0	0	0	0	40	4956
Porvoo	5	270	4	542	1	222	6	2074	0	0	0	0	0	0	16	3108
Loviisa	1	78	1	167	2	523	4	1623	1	529	0	0	0	0	9	2920
Uusimaa county, towns	33	1403	7	992	10	2419	12	4437	3	1733	0	0	0	0	65	10984
Tenhola, Bromarv	25	1563	4	551	0	0	0	0	0	0	0	0	0	0	29	2114
Pohja, Karjaa	12	553	0	0	0	0	0	0	0	0	0	0	0	0	12	553
Inkoo	6	353	2	235	0	0	0	0	0	0	0	0	0	0	8	588
Siuntio, Kirkkonummi	2	96	0	0	0	0	0	0	0	0	0	0	0	0	2	96
Helsinki parish, Sipoo	8	194	0	0	0	0	0	0	0	0	0	0	0	0	8	194
Porvoo parish	26	755	0	0	0	0	0	0	0	0	0	0	0	0	26	755
Pernaja	9	283	0	0	0	0	0	0	0	0	0	0	0	0	9	283
Uusimaa c., rural areas	88	3797	6	786	0	0	0	0	0	0	0	0	0	0	94	4583

AREA	20	> 100	100 > 200		200 > 300		300 > 500		500 > 700		700> 1000		1000	>1500	SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Uusimaa county, total	121	5200	13	1778	10	2419	12	4437	3	1733	0	0	0	0	159	15567
Hamina	1	96	4	535	1	222	1	318	1	555	0	0	0	0	8	1726
Viipuri	1	99	5	679	2	477	2	842	0	0	0	0	1	1025	11	3122
Viipuri county, towns	2	195	9	1214	3	699	3	1160	1	555	0	0	1	1025	19	4848
Pyhtää, Kymi	4	285	1	111	0	0	0	0	0	0	0	0	0	0	5	396
Vehkalahti, Suursaari	17	390	0	0	0	0	0	0	0	0	0	0	0	0	17	390
Virolahti	38	1186	4	580	1	203	0	0	0	0	0	0	0	0	43	1969
Säkkijärvi	61	3754	4	513	0	0	0	0	0	0	0	0	0	0	65	4267
Koivisto, Johannes	107	2921	25	3343	2	463	0	0	0	0	0	0	0	0	134	6727
Lavansaari, Seiskari	30	1480	0	0	0	0	0	0	0	0	0	0	0	0	30	1480
Uusikirkko	119	3420	0	0	0	0	0	0	0	0	0	0	0	0	119	3420
Viipuri c., rural area	376	13436	34	4547	3	666	0	0	0	0	0	0	0	0	413	18649
Viipuri county, total	378	13631	43	5761	6	1365	3	1160	1	555	0	0	1	1025	432	23497
Lappeenranta	0	0	1	155	0	0	0	0	0	0	0	0	0	0	1	155

AREA	20	> 100	100	> 200	200	> 300	300	> 500	500	> 700	700>	1000	1000	>1500	SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Joensuu	0	0	1	159	0	0	1	324	0	0	0	0	0	0	2	483
Kuopio	0	0	1	111	0	0	0	0	0	0	0	0	0	0	1	111
Inland, towns	0	0	3	425	0	0	1	324	0	0	0	0	0	0	4	749
Whole country, towns	84	4379	75	11090	53	12891	92	37945	80	45610	15	11723	1	1025	400	124663
Whole country, rural areas	730	29059	104	14917	47	11032	14	4838	1	518	0	0	0	0	896	60364
Sum total	814	33438	179	26007	100	23923	106	42783	81	46128	15	11723	1	1025	1296	185027

APPENDIX I: 1B. STEAMSHIPS BY SIZE-CLASS, 1865.

(Inclusive of auxiliaries, excluding tugs and inland fleets)

AREA	20 > 100		100 > 200		200 > 300		SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto
Oulu	1	28	2	300	0	0	3	328
Oulu county, towns	1	28	2	300	0	0	3	328
Pori	1	50	0	0	0	0	1	50
Turku	1	95	1	115	3	757	5	967
Turku and Pori county, towns	0 2	0 145	1	115	3	757	6	1017
Helsinki	1	67	1	197	1	255	3	519
Porvoo	1	25	0	0	0	0	1	25
Uusimaa county, towns	2	92	1	197	1	255	4	544
Viipuri	4	210	0	0	1	266	5	476
Viipuri county, towns	4	210	0	0	1	266	5	476
Joensuu	0	0	1	106	0	0	1	106
Kuopio	1	80	1	118	0	0	2	198
Inland, towns	1	80	2	224	0	0	3	304
Whole country, towns	10	555	6	836	5	1278	21	2669
Total	10	555	6	836	5	1278	21	2669

APPENDIX I: 2A. SAILING VESSELS BY SIZE-CLASS, 1875.
(Excluding barges, lighters and inland fleet)

AREA	20 > 100		100 > 200		200 > 300		300 > 500		500 > 700		700> 1000		1000>1500		SUM TOTAL	
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Oulu	1	96	1	161	0	0	3	1448	8	4735	8	6662	0	0	21	13102
Raahe	7	324	0	0	0	0	7	3213	24	14585	2	1654	0	0	40	19776
Oulu county, towns	8	420	1	161	0	0	10	4661	32	19320	10	8316	0	0	61	32878
Kemi parish	11	425	0	0	0	0	0	0	0	0	0	0	0	0	11	425
Iijoki, Kiiminki	32	1578	0	0	0	0	0	0	0	0	0	0	0	0	32	1578
Oulu parish	2	107	0	0	0	0	0	0	0	0	0	0	0	0	2	107
Kalajoki, Pyhäjoki	2	101	0	0	0	0	0	0	1	690	0	0	0	0	3	791
Oulu county, rural areas	47	2211	0	0	0	0	0	0	1	690	0	0	0	0	48	2901
Oulu county, total	55	2631	1	161	0	0	10	4661	33	20010	10	8316	0	0	109	35779
Kokkola	6	174	1	142	0	0	0	0	3	1631	0	0	0	0	10	1947
Pietarsaari	2	145	0	0	0	0	2	711	5	2924	3	2327	3	3306	15	9413
Uusikaarlepyy	3	78	0	0	0	0	0	0	1	648	0	0	0	0	4	726
Vaasa	1	46	1	131	0	0	4	1736	9	5300	0	0	0	0	15	7213
Kristiinankaupunki	0	0	1	126	2	537	4	1703	3	1859	2	1682	2	2198	14	8105
Vaasa county, towns	12	443	3	399	2	537	10	4150	21	12362	5	4009	5	5504	58	27404

AREA	20 > 100		100 > 200		200 > 300		300 > 500		500 > 700		700> 1000		1000>1500		SUM TOTAL	
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Lohtaja	4	197	0	0	0	0	0	0	0	0	0	0	0	0	4	197
Närpiö	8	244	3	459	0	0	2	696	0	0	0	0	0	0	13	1399
Lapväärti	0	0	5	873	3	670	3	1037	0	0	0	0	0	0	11	2580
Vaasa county, rural areas	12	441	8	1332	3	670	5	1733	0	0	0	0	0	0	28	4176
Vaasa county, total	24	884	11	1731	5	1207	15	5883	21	12362	5	4009	5	5504	86	31580
Hammarland, Eckerö	3	135	9	1437	6	1422	7	2629	0	0	0	0	0	0	25	5623
Finström	8	424	2	276	6	1594	10	3902	2	1164	0	0	0	0	28	7360
Saltvik, Sund, Vårdö	23	1477	15	2133	11	2745	10	3442	4	2300	0	0	0	0	63	12097
Jomala, Marianhamina, Lemland, Lumparland	4	159	25	3944	20	4989	20	6917	0	0	0	0	0	0	69	16009
Föglö	4	134	4	609	9	2140	1	338	0	0	0	0	0	0	18	3221
Kumlinge	2	111	5	623	1	248	1	313	0	0	0	0	0	0	9	1295
Åland, total	44	2440	60	9022	53	13138	49	17541	6	3464	0	0	0	0	212	45605
Pori	1	85	3	471	2	513	2	795	4	2278	0	0	0	0	12	4142
Rauma	0	0	18	2483	3	633	6	2433	2	1143	1	760	0	0	30	7452
Uusikaupunki	0	0	17	2697	13	3362	7	2656	2	1187	6	4789	0	0	45	14691
Naantali	1	91	1	163	0	0	0	0	0	0	0	0	0	0	2	254

AREA	20	> 100	100	> 200	200	> 300	300	> 500	500	> 700	700>	1000	1000>1500		SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Turku	0	0	0	0	4	1003	12	4623	8	4905	2	1531	0	0	26	12062
Turku and Pori county, towns	2	176	39	5814	22	5511	27	10507	16	9513	9	7080	0	0	115	38601
Ulvila, Merikarvia, Eurajoki. Luvia	4	383	2	351	7	1814	0	0	1	616	0	0	0	0	14	3164
Pyhämaa, Uusikirkko, Vehmaa, Taivassalo, Kustavi, Velkua, Iniö	38	2144	13	2080	7	1718	8	2872	1	572	0	0	0	0	67	9386
Lemu, Rymättylä	3	100	0	0	1	209	1	306	0	0	0	0	0	0	5	615
Parainen	37	1097	2	353	2	518	1	408	0	0	0	0	0	0	42	2376
Sauvo, Karuna	0	0	0	0	1	296	1	463	0	0	0	0	0	0	2	759
Nauvo	11	392	4	762	17	3855	6	2173	0	0	0	0	0	0	38	7182
Korppoo	5	217	0	0	14	3376	4	1411	0	0	0	0	0	0	23	5004
Halikko, Uskela	0	0	0	0	1	269	1	439	0	0	0	0	0	0	2	708
Perniö	5	258	1	100	3	711	0	0	0	0	0	0	0	0	9	1069
Kemiö, Västanfjärd	9	527	9	1256	18	4192	8	2615	0	0	0	0	0	0	44	8590
Hiittinen	4	213	4	620	3	723	0	0	0	0	0	0	0	0	11	1556
Turku and Pori county, rural areas	116	5331	35	5522	74	17681	30	10687	2	1188	0	0	0	0	257	40409
Turku and Pori county, total	118	5507	74	11336	96	23192	57	21194	18	10701	9	7080	0	0	372	79010
Tammisaari	1	67	1	163	3	715	2	974	1	590	0	0	0	0	8	2509

AREA	20 > 100		100 > 200		200 > 300		300 > 500		500 > 700		700> 1000		1000>1500		SUM TOTAL	
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Helsinki	14	474	0	0	3	763	5	1780	1	573	0	0	0	0	23	3590
Porvoo	1	95	5	815	3	755	6	2346	3	1884	0	0	0	0	18	5895
Loviisa	2	111	0	0	2	572	5	1935	0	0	0	0	0	0	9	2618
Uusimaa county, towns	18	747	6	978	11	2805	18	7035	5	3047	0	0	0	0	58	14612
Tenhola, Bromarv	19	1251	10	1208	2	469	0	0	0	0	0	0	0	0	31	2928
Pohja, Karjaa	21	1009	1	104	1	211	1	335	0	0	0	0	0	0	24	1659
Inkoo	7	491	0	0	0	0	0	0	0	0	0	0	0	0	7	491
Siuntio, Kirkkonummi	1	30	0	0	0	0	0	0	0	0	0	0	0	0	1	30
Helsinki parish, Sipoo	7	179	0	0	0	0	0	0	0	0	0	0	0	0	7	179
Porvoo parish	25	801	0	0	0	0	0	0	0	0	0	0	0	0	25	801
Pernaja	10	323	0	0	0	0	0	0	0	0	0	0	0	0	10	323
Uusimaa county, rural areas	90	4084	11	1312	3	680	1	335	0	0	0	0	0	0	105	6411
Uusimaa county, total	108	4831	17	2290	14	3485	19	7370	5	3047	0	0	0	0	163	21023
Hamina	0	0	0	0	0	0	1	465	0	0	0	0	0	0	1	465

AREA	20	> 100	100	> 200	200	> 300	300	> 500	500	> 700	700>	1000	1000>	1500	SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Viipuri county, towns	0	0	0	0	0	0	1	465	0	0	0	0	0	0	1	465
Pyhtää, Kymi, Vehkalahti, Suursaari	14	522	4	584	2	470	0	0	0	0	0	0	0	0	20	1576
Virolahti	20	927	3	483	2	513	2	735	0	0	1	715	0	0	28	3373
Säkkijärvi	51	3204	20	2380	2	506	0	0	0	0	0	0	0	0	73	6090
Koivisto, Johannes	115	4735	8	1107	5	1269	4	1424	1	503	0	0	0	0	133	9038
Lavansaari, Seiskari	53	913	1	113	0	0	0	0	0	0	0	0	0	0	54	1026
Uusikirkko	69	2437	0	0	0	0	0	0	0	0	0	0	0	0	69	2437
Viipuri county, rural areas	322	12738	36	4667	11	2758	6	2159	1	503	1	715	0	0	377	23540
Viipuri county, total	322	12738	36	4667	11	2758	7	2624	1	503	1	715	0	0	378	24005
Joensuu	0	0	3	440	0	0	0	0	0	0	0	0	0	0	3	440
Inland, towns	0	0	3	440	0	0	0	0	0	0	0	0	0	0	3	440
Liperi	0	0	2	229	0	0	0	0	0	0	0	0	0	0	2	229
Inland, rural areas	0	0	2	229	0	0	0	0	0	0	0	0	0	0	2	229

AREA	20	> 100	100	> 200	200	> 300	300	> 500	500	> 700	700>	1000	1000>	1500	SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Whole country, towns	40	1786	52	7792	35	8853	66	26818	74	44242	24	19405	5	5504	296	114400
Whole country, rural areas	631	27245	152	22084	144	34927	91	32455	10	5845	1	715	0	0	1029	123271
Sum total	671	29031	204	29876	179	43780	157	59273	84	50087	25	20120	5	5504	1325	237671

APPENDIX I: 2B. STEAMSHIPS BY SIZE-CLASS, 1875.
(Inclusive of auxiliaries, excluding tugs and inland fleets)

AREA	20	> 100	100	> 200	200	> 300	300	> 500	SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto
Tornio	0	0	1	179	0	0	0	0	1	179
Oulu	1	37	1	160	0	0	0	0	2	197
Raahe	0	0	1	132	0	0	0	0	1	132
Oulu county, towns	1	37	3	471	0	0	0	0	4	508
Kokkola	0	0	0	0	1	213	0	0	1	213
Uusikaarlepyy	0	0	0	0	1	246	0	0	1	246
Vaasa	0	0	0	0	3	733	0	0	3	733
Vaasa county, towns	0	0	0	0	5	1192	0	0	5	1192

AREA	20	> 100	100	> 200	200	> 300	300	> 500	SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto
Pori	2	93	1	138	1	216	2	639	6	1086
Turku	5	279	1	162	4	1046	0	0	10	1487
Turku and Pori county, towns	7	372	2	300	5	1262	2	639	16	2573
Parainen	1	39	0	0	0	0	0	0	1	39
Halikko	2	69	2	340	0	0	0	0	4	409
Turku and Pori county, rural areas	3	108	2	340	0	0	0	0	5	448
Turku and Pori county, total	10	480	4	640	5	1262	2	639	21	3021
Tammisaari	0	0	1	176	0	0	1	374	2	550
Helsinki	1	25	2	361	1	255	2	705	6	1346
Porvoo	1	53	1	137	0	0	0	0	2	190
Uusimaa county, towns	2	78	4	674	1	255	3	1079	10	2086
Viipuri	3	144	0	0	1	241	0	0	4	385
Viipuri county, towns	3	144	0	0	1	241	0	0	4	385
Savonlinna	0	0	1	114	0	0	0	0	1	114
Kuopio	3	253	0	0	0	0	0	0	3	253
Joensuu	2	197	0	0	0	0	0	0	2	197

AREA	20 no	> 100 nto	100 no	> 200 nto	200 no	> 300 nto	300 no	> 500 nto	SUM no	TOTAL nto
Inland, towns	5	450	1	114	0	0	0	0	6	564
Whole country, towns	18	1189	10	1899	12	2950	5	1718	45	7756
Whole country, rural areas	3	108	2	340	0	0	0	0	5	448
Sum total	21	1297	12	2239	12	2950	5	1718	50	8204

APPENDIX I: 3A. SAILING VESSELS BY SIZE-CLASS, 1885.
(Excluding barges, lighters and inland fleets)

AREA	20 no	> 100 nto	100 no	> 200 nto	200 no	> 300 nto	300 no	> 500 nto	500 no	> 700 nto	700> no	1000 nto	1000> no	1500 nto	SUM no	TOTAL nto
Oulu	2	172	2	302	0	0	0	0	4	2280	8	6474	1	1193	17	10421
Raahe	8	359	0	0	0	0	2	946	19	11479	2	1581	0	0	31	14365
Oulu county, towns	10	531	2	302	0	0	2	946	23	13759	10	8055	1	1193	48	24786
Kemi parish	8	329	0	0	0	0	0	0	0	0	0	0	0	0	8	329
Iijoki, Kiiminki	22	863	0	0	0	0	0	0	0	0	0	0	0	0	22	863
Oulu parish	1	20	0	0	0	0	0	0	0	0	0	0	0	0	1	20
Kalajoki, Pyhäjoki	3	152	0	0	0	0	0	0	0	0	1	718	0	0	4	870

AREA	20	> 100	100	> 200	200	> 300	300	> 500	500	> 700	700>	1000	1000>	1500	SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Oulu c., rural areas	34	1364	0	0	0	0	0	0	0	0	1	718	0	0	35	2082
Oulu county, total	44	1895	2	302	0	0	2	946	23	13759	11	8773	1	1193	83	26868
Kokkola	6	245	0	0	0	0	0	0	1	504	0	0	0	0	7	749
Pietarsaari	0	0	0	0	0	0	2	780	4	2567	1	973	2	2036	9	6356
Uusikaarlepyy	2	104	0	0	0	0	0	0	0	0	0	0	0	0	2	104
Vaasa	1	64	2	227	0	0	4	1801	2	1172	1	745	0	0	10	4009
Kaskinen	0	0	0	0	0	0	1	470	0	0	0	0	0	0	1	470
Kristiinankaupunki	1	22	1	175	1	273	2	877	1	569	5	4059	2	2063	13	8038
Vaasa county, towns	10	435	3	402	1	273	9	3928	8	4812	7	5777	4	4099	42	19726
Lohtaja	2	58	0	0	0	0	0	0	0	0	0	0	0	0	2	58
Nrpiö	3	71	1	146	0	0	1	340	0	0	0	0	0	0	5	557
Lapväärti, Siipyy	0	0	2	373	0	0	0	0	0	0	0	0	0	0	2	373
Vaasa county, rural areas	5	129	3	519	0	0	1	340	0	0	0	0	0	0	9	988
Vaasa county, total	15	564	6	921	1	273	10	4268	8	4812	7	5777	4	4099	51	20714
Mariehamn seamans house distr.	21	1166	24	3710	39	9713	39	14505	7	3828	2	1517	0	0	132	34439
Vårdö s.h. district	16	913	16	2349	5	1308	7	2399	4	2437	0	0	0	0	48	9406
Åland, total	37	2079	40	6059	44	11021	46	16904	11	6265	2	1517	0	0	180	43845

AREA	20	> 100	100	> 200	200	> 300	300	> 500	500	> 700	700>	1000	1000>	1500	SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Pori	1	72	2	266	1	277	4	1487	3	1715	1	968	0	0	12	4785
Rauma	0	0	20	3256	10	2338	7	2840	2	1103	1	793	1	1021	41	11351
Uusikaupunki	1	76	5	852	11	2730	5	1874	1	563	3	2444	0	0	26	8539
Turku	1	28	1	182	5	1254	13	5212	5	2966	3	2382	2	2427	30	14451
Turku and Pori county, towns	3	176	28	4556	27	6599	29	11413	11	6347	8	6587	3	3448	109	39126
Ulvila, Merikarvia, Eurajoki, Luvia, Pyhämaa	7	500	6	1000	8	2210	3	1020	0	0	0	0	0	0	24	4730
Uusikirkko	3	172	1	132	8	1933	4	1509	2	1160	0	0	0	0	18	4906
Vehmaa, Taivassalo	3	142	1	184	0	0	1	375	0	0	0	0	0	0	5	701
Kustavi	6	227	5	664	4	912	3	1263	0	0	0	0	0	0	18	3066
Velkua, Iniö, Lemu, Rymättylä	0	0	0	0	0	0	1	322	0	0	0	0	0	0	1	322
Parainen	35	1032	1	144	1	252	0	0	1	687	0	0	0	0	38	2115
Nauvo	11	410	3	559	14	3315	5	1833	1	519	0	0	0	0	34	6636
Korppoo	2	43	0	0	11	2669	6	2042	1	522	0	0	0	0	20	5276
Halikko, Uskela, Perniö	4	130	0	0	3	738	2	628	0	0	0	0	0	0	9	1496
Kemiö, Västanfj.	6	200	7	1066	25	6193	9	3022	0	0	0	0	0	0	47	10481
Hiittinen	8	272	1	142	1	265	0	0	0	0	0	0	0	0	10	679
Turku and Pori county, rural areas	85	3128	25	3891	75	18487	34	12014	5	2888	0	0	0	0	224	40408

AREA	20	> 100	100	> 200	200	> 300	300	> 500	500	> 700	700>	1000	1000>	1500	SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Turku and Pori county, total	88	3304	53	8447	102	25086	63	23427	16	9235	8	6587	3	3448	333	79534
Tammisaari, Hanko	0	0	2	320	0	0	0	0	0	0	0	0	0	0	2	320
Helsinki	9	265	1	108	1	283	5	1955	0	0	0	0	0	0	16	2611
Porvoo	0	0	1	131	1	218	2	786	5	2877	0	0	0	0	9	4012
Loviisa	0	0	0	0	0	0	7	2413	0	0	0	0	0	0	7	2413
Uusimaa county, towns	9	265	4	559	2	501	14	5154	5	2877	0	0	0	0	34	9356
Tenhola, Bromarv	12	770	8	961	4	981	1	353	0	0	0	0	0	0	25	3065
Pohja, Karjaa	3	146	0	0	1	237	0	0	0	0	0	0	0	0	4	383
Inkoo	7	269	0	0	0	0	0	0	0	0	0	0	0	0	7	269
Helsinki parish, Sipoo	26	671	0	0	0	0	0	0	0	0	0	0	0	0	26	671
Porvoo parish	27	1050	0	0	0	0	0	0	0	0	0	0	0	0	27	1050
Pernaja	19	656	0	0	0	0	0	0	0	0	0	0	0	0	19	656
Uusimaa county, rural areas	94	3562	8	961	5	1218	1	353	0	0	0	0	0	0	108	6094
Uusimaa, total	103	3827	12	1520	7	1719	15	5507	5	2877	0	0	0	0	142	15450
Kotka	2	67	1	161	3	709	1	412	0	0	0	0	0	0	7	1349
Hamina	0	0	0	0	1	285	0	0	0	0	0	0	0	0	1	285

AREA	20	> 100	100	> 200	200	> 300	300	> 500	500	> 700	700>	1000	1000>	1500	SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Viipuri	2	143	1	164	0	0	1	361	0	0	0	0	0	0	4	668
Viipuri county, towns	4	210	2	325	4	994	2	773	0	0	0	0	0	0	12	2302
Pyhtää, Kymi, Vehkalahti, Suursaari	34	976	0	0	0	0	1	439	0	0	0	0	0	0	35	1415
Virolahti	15	658	0	0	0	0	1	426	0	0	0	0	0	0	16	1084
Säkkijärvi	49	2813	6	707	1	224	0	0	0	0	0	0	0	0	56	3744
Koivisto, Johannes	128	5421	2	246	1	256	4	1620	0	0	0	0	0	0	135	7543
Lavansaari, Seiskari	64	2651	0	0	0	0	0	0	0	0	0	0	0	0	64	2651
Uusikirkko	50	1940	0	0	0	0	0	0	0	0	0	0	0	0	50	1940
Viipuri county, rural areas	340	14459	8	953	2	480	6	2485	0	0	0	0	0	0	356	18377
Viipuri county, total	344	14669	10	1278	6	1474	8	3258	0	0	0	0	0	0	368	20679
Joensuu	0	0	5	805	0	0	0	0	0	0	0	0	0	0	5	805
Inland, towns	0	0	5	805	0	0	0	0	0	0	0	0	0	0	5	805
Rantasalmi	3	173	0	0	0	0	0	0	0	0	0	0	0	0	3	173

AREA	20	> 100	100	> 200	200	> 300	300	> 500	500	> 700	700>	1000	1000>	1500	SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Inland, rural areas	3	173	0	0	0	0	0	0	0	0	0	0	0	0	3	173
Inland, total	3	173	5	805	0	0	0	0	0	0	0	0	0	0	8	978
Whole country, towns	36	1617	44	6949	34	8367	56	22214	47	27795	25	20419	8	8740	250	96101
Whole country, rural areas	598	24894	84	12383	126	31206	88	32096	16	9153	3	2235	0	0	915	111967
Sum total	634	26511	128	19332	160	39573	144	54310	63	36948	28	22654	8	8740	1165	208068

APPENDIX I: 3B STEAMSHIPS BY SIZE-CLASS, 1885

(Inclusive of auxiliaries, excluding tugs and inland fleets)

AREA	20	> 100	100	> 200	200	> 300	300	> 500	500	> 700	SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Tornio	0	0	1	179	0	0	2	771	0	0	3	950
Oulu	1	37	0	0	0	0	1	347	0	0	2	384
Oulu county, towns	1	37	1	179	0	0	3	1118			5	1334
Pietarsaari	1	20	0	0	0	0	1	384	0	0	2	404
Vaasa	3	165	0	0	4	994	2	757	2	1100	11	3016
Vaasa county, towns	4	185	0	0	4	994	3	1141	2	1100	13	3420

AREA	20 >		100 >		200>		300 >		500 >		SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Närpiö	1	74	0	0	0	0	0	0	0	0	1	74
Vaasa c. rural areas	1	74	0	0	0	0	0	0	0	0	1	74
Vaasa county, total	5	259	0	0	4	994	3	1141	2	1100	14	3494
											0	0
Pori	1	39	2	309	0	0	0	0	0	0	3	348
Turku	9	669	1	101	2	494	2	680	0	0	14	1944
Turku and Pori county, towns	10	708	3	410	2	494	2	680	0	0	17	2292
Uskela	0	0	1	148	0	0	0	0	0	0	1	148
Turku and Pori county, rural areas	0	0	1	148	0	0	0	0	0	0	1	148
Turku and Pori county, total	10	708	4	558	2	494	2	680	0	0	18	2440
Hanko	0	0	0	0	1	298	0	0	0	0	1	298
Tammisaari	0	0	1	176	0	0	0	0	0	0	1	176
Helsinki	6	180	3	508	1	255	2	704	2	1356	14	3003
Porvoo	2	83	0	0	0	0	0	0	0	0	2	83
Uusimaa county, towns	8	263	4	684	2	553	2	704	2	1356	18	3560

AREA	20 >		100 >		200>		300 >		500 >		SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Viipuri	14	523	1	146	0	0	0	0	0	0	15	669
Viipuri county, towns	14	523	1	146	0	0	0	0	0	0	15	669
Savonlinna	0	0	1	114	0	0	0	0	0	0	1	114
Joensuu	0	0	2	214	0	0	0	0	0	0	2	214
Kuopio	2	195	0	0	0	0	0	0	0	0	2	195
Inland, towns	2	195	3	328	0	0	0	0	0	0	5	523
Leppävirta	1	95	0	0	0	0	0	0	0	0	1	95
Inland, rural areas	1	95	0	0	0	0	0	0	0	0	1	95
Inland, total	3	290	3	328	0	0	0	0	0	0	6	618
Whole country, towns	39	1911	12	1747	8	2041	10	3643	4	2456	73	11798
Whole country, rural areas	2	169	1	148	0	0	0	0	0	0	3	317
Sum total	41	2080	13	1895	8	2041	10	3643	4	2456	76	12115

APPENDIX I: 4A. SAILING VESSELS BY SIZE-CLASS, 1895.

(Excluding barges, lighters and inland fleets)

AREA	20> 100		100 > 200		200 > 300		300 > 500		500 > 700		700>1000		1000>1500		1500>3000		SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Oulu	0	0	0	0	0	0	0	0	0	0	0	0	1	1115	0	0	1	1115
Raahe	7	349	0	0	0	0	0	0	4	2576	0	0	1	1037	0	0	12	3962
Kemi parish	8	313	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	313
Iijoki	4	184	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	184
Oulu county, total	19	846	0	0	0	0	0	0	4	2576	0	0	2	2152			25	5574
Kokkola	3	126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	126
Pietarsaari	0	0	0	0	0	0	1	442	1	673	0	0	2	2036	0	0	4	3151
Uusikaarlepyy	1	78	0	0	0	0	0	0	0	0	1	931	0	0	0	0	2	1009
Vaasa	6	256	0	0	0	0	1	496	1	554	3	2614	4	4752	0	0	15	8672
Kaskinen	0	0	0	0	0	0	0	0	0	0	1	757	0	0	0	0	1	757
Kristiinan-kaupunki	1	22	0	0	1	273	1	460	0	0	2	1487	0	0	1	1722	6	3964
Var. coastal parishes	6	211	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	211
Vaasa county, total	17	693	0	0	1	273	3	1398	2	1227	7	5789	6	6788	1	1722	37	17890
Mariehamn seamans house district	37	1560	12	1831	36	9268	40	15763	13	7248	4	3491	2	2510	0	0	144	41671

AREA	20>	100	100 >	200	200 >	300	300 >	500	500 >	700	700>1000		1000>1500		1500>3000		SUM TOTAL	
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Vårdö s.h. district	20	992	15	2024	5	1193	6	2179	4	2332	0	0	0	0	0	0	50	8720
Åland, total	57	2552	27	3855	41	10461	46	17942	17	9580	4	3491	2	2510	0	0	194	50391
Pori	2	170	2	266	0	0	1	306	1	611	1	968	0	0	0	0	7	2321
Rauma	0	0	13	2129	17	4109	11	4314	3	1893	2	1488	4	4465	1	2154	51	20552
Uusikaupunki (& surr.)	26	753	5	864	14	3506	12	4655	4	2491	3	2412	0	0	0	0	64	14681
Turku	7	267	2	277	1	205	8	2955	2	1243	4	3459	3	3251	0	0	27	11657
Eurajoki, Luvia	7	298	2	316	9	2213	2	697	0	0	0	0	0	0	0	0	20	3524
Rauma parish	2	68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	68
Kustavi, Taivassalo	10	294	2	275	1	252	5	2032	0	0	0	0	0	0	0	0	18	2853
Rymättylä	1	28	0	0	0	0	2	700	0	0	0	0	0	0	0	0	3	728
Parainen	33	1103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	1103
Nauvo, Korppoo	26	701	1	193	13	3288	11	3930	1	522	1	780	0	0	0	0	53	9414
Perniö, Kemiö, Västanfj., Hiittinen	22	839	3	333	19	4700	10	3488	0	0	0	0	0	0	0	0	54	9360
Turku and Pori county, total	136	4521	30	4653	74	18273	62	23077	11	6760	11	9107	7	7716	1	2154	332	76261
Hanko (& surr.)	13	558	6	660	2	468	1	353	0	0	0	0	0	0	0	0	22	2039

AREA	20	> 100	100 > 200		200 > 300		300 > 500		500 > 700		700>1000		1000>1500		1500>3000		SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Tammisaari (& surr.)	14	477	1	108	1	226	1	481	0	0	0	0	0	0	0	0	17	1292
Helsinki (& surr.)	53	1610	0	0	0	0	0	0	0	0	1	717	0	0	0	0	54	2327
Porvoo	1	31	1	162	0	0	0	0	2	1099	0	0	0	0	0	0	4	1292
Loviisa (& surr.)	18	739	0	0	0	0	3	995	0	0	0	0	0	0	0	0	21	1734
Porvoo parish	43	1718	1	110	0	0	0	0	0	0	0	0	0	0	0	0	44	1828
Uusimaa county, total	142	5133	9	1040	3	694	5	1829	2	1099	1	717	0	0	0	0	162	10512
Kotka (& surr.)	24	926	2	254	0	0	0	0	0	0	0	0	0	0	0	0	26	1180
Hamina (& surr.)	24	1537	0	0	0	0	1	449	0	0	0	0	0	0	0	0	25	1986
Viipuri	3	164	1	147	0	0	2	803	0	0	1	792	0	0	0	0	7	1906
Säkkijärvi	28	1380	1	101	0	0	0	0	0	0	0	0	0	0	0	0	29	1481
Koivisto, Johannes	145	7427	1	129	0	0	2	677	1	506	0	0	0	0	0	0	149	8739
Lavansaari, Seiskari	55	2757	3	348	0	0	0	0	0	0	0	0	0	0	0	0	58	3105
Uusikirkko	44	1786	0	0	0	0	0	0	0	0	0	0	0	0	0	0	44	1786
Viipuri county, total	323	15977	8	979	0	0	5	1929	1	506	1	792	0	0	0	0	338	20183

AREA	20 > 100		100 > 200		200 > 300		300 > 500		500 > 700		700 >1000		1000 >1500		1500>3000		SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Joensuu	0	0	3	428	0	0	0	0	0	0	0	0	0	0	0	0	3	428
Savonlinna	0	0	1	117	0	0	0	0	0	0	0	0	0	0	0	0	1	117
Inland, total	0	0	4	545	0	0	0	0	0	0	0	0	0	0	0	0	4	545
Sum total	694	29722	78	11072	119	29701	121	46175	37	21748	24	19896	17	19166	2	3876	1092	181356

APPENDIX I: 4B. STEAMSHIPS BY SIZE-CLASS, 1895

(Inclusive of auxiliaries, excluding tugs and inland fleets)

AREA	20 > 100		100 > 200		200 > 300		300 > 500		500 > 700		700> 1000		SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Tornio	1	47	0	0	0	0	0	0	0	0	0	0	1	47
Oulu	1	37	1	115	0	0	0	0	0	0	0	0	2	152
Oulu county	2	84	1	115	0	0	0	0	0	0	0	0	3	199
Vaasa	1	67	1	176	4	915	2	761	2	1098	0	0	10	3017
Kaskinen	0	0	1	108	0	0	0	0	0	0	0	0	1	108
Kristiinankaupunki	0	0	0	0	0	0	0	0	0	0	1	894	1	894
Vaasa county	1	67	2	284	4	915	2	761	2	1098	1	894	12	4019

AREA	20 > 100		100 > 200		200 > 300		300 > 500		500 > 700		700> 1000		SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Åland	2	67	1	132	0	0	0	0	0	0	0	0	3	199
Pori	0	0	2	239	2	419	1	440	0	0	0	0	5	1098
Uusikaupunki	1	29	2	319	0	0	0	0	0	0	0	0	3	348
Turku	13	794	3	392	1	244	2	662	0	0	0	0	19	2092
Parainen, Salo	2	71	0	0	0	0	0	0	0	0	0	0	2	71
Turku and Pori county	16	894	7	950	3	663	3	1102	0	0	0	0	29	3609
Hanko	1	20	0	0	0	0	0	0	0	0	0	0	1	20
Helsinki	8	335	3	450	2	503	10	3762	10	6523	0	0	33	11573
Porvoo	2	90	1	171	0	0	0	0	0	0	0	0	3	261
Uusimaa county	11	445	4	621	2	503	10	3762	10	6523	0	0	37	11854
Kotka	6	210	0	0	0	0	0	0	0	0	0	0	6	210
Hamina	2	48	0	0	0	0	0	0	0	0	0	0	2	48
Viipuri	17	784	0	0	1	228	0	0	0	0	0	0	18	1012
Säkkijärvi	2	149	0	0	0	0	0	0	0	0	0	0	2	149
Viipuri county	27	1191	0	0	1	228	0	0	0	0	0	0	28	1419
Savonlinna	0	0	1	114	0	0	0	0	0	0	0	0	1	114
Joensuu	1	66	3	369	0	0	0	0	0	0	0	0	4	435

AREA	20 > 100		100 > 200		200 > 300		300 > 500		500 > 700		700> 1000		SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Kuopio	0	0	1	103	0	0	0	0	0	0	0	0	1	103
Inland	1	66	5	586	0	0	0	0	0	0	0	0	6	652
Sum total	60	2814	20	2688	10	2309	15	5625	12	7621	1	894	118	21951

APPENDIX I: 5A. SAILING VESSELS BY SIZE-CLASS, 1905

(Excluding barges, lighters and inland fleets)

AREA	20 > 100		100 > 200		200 > 300		300 > 500		500 > 700		700>1000		1000>1500		1500>3000		SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Tornio	2	43	0	0	0	0	0	0	0	0	1	858	0	0	0	0	3	901
Raahe	5	271	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	271
Kemi parish,																		
Simo	5	197	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	197
Iijoki	2	51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	51
Kalajoki,																		
Pyhäjoki	6	290	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	290
Oulu county,																		
total	20	852	0	0	0	0	0	0	0	0	1	858	0	0	0	0	21	1710

AREA	20 > 100		100 > 200		200 > 300		300 > 500		500 > 700		700 >1000		1000>1500		1500>3000		SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Kokkola (& surr.)	7	333	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	333
Pietarsaari	2	166	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	166
Uusikaarlepyy	2	52	0	0	0	0	0	0	0	0	1	931	0	0	0	0	3	983
Vaasa	9	353	0	0	0	0	0	0	0	0	0	0	1	1446	0	0	10	1799
Kristiinan-kaupunki	0	0	0	0	1	257	0	0	0	0	0	0	0	0	0	0	1	257
Var. coastal parishes	5	114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	114
Vaasa county, total	25	1018	0	0	1	257	0	0	0	0	1	931	1	1446	0	0	28	3652
Mariehamn seamans house district	77	2710	8	1135	16	4147	29	11236	5	2773	11	9681	6	7502	0	0	152	39184
Vårdö s.h. district	28	1330	11	1489	2	504	3	1276	3	1648	7	6108	4	4489	2	3323	60	20167
Åland, total	105	4040	19	2624	18	4651	32	12512	8	4421	18	15789	10	11991	2	3323	212	59351
Pori (& surr.)	8	437	2	288	0	0	1	306	0	0	0	0	0	0	0	0	11	1031
Raum (& surr.)	22	845	2	343	25	6336	19	6915	4	2360	2	1720	4	5524	4	7239	82	31282
Uusikaupunki (&. surr.)	36	1174	2	338	13	3302	10	3625	5	3040	5	4245	4	5458	1	1670	76	22852

AREA	20 > 100		100 > 200		200 > 300		300 > 500		500 > 700		700>1000		1000 >1500		1500 >3000		SUM TOTAL	
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Naantali	1	23	0	0	0	0	0	0	1	653	0	0	0	0	0	0	2	676
Turku	7	181	0	0	0	0	0	0	2	1241	0	0	1	1384	1	1565	11	4371
Kustavi, Taivassalo	13	335	3	471	1	252	4	1657	1	551	0	0	0	0	0	0	22	3266
Rymättylä	4	118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	118
Parainen	36	1319	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	1319
Nauvo, Korppoo	33	957	0	0	2	554	5	1912	3	1695	3	2438	0	0	0	0	46	7556
Perniö, Särkisalo	19	905	1	101	0	0	0	0	0	0	0	0	0	0	0	0	20	1006
Kemiö, Västanfj.	23	935	3	468	6	1560	4	1411	1	529	1	709	0	0	0	0	38	5612
Hiittinen	11	396	0	0	0	0	1	353	0	0	0	0	0	0	0	0	12	749
Turku and Pori county, total	213	7625	13	2009	47	12004	44	16179	17	10069	11	9112	9	12366	6	10474	360	79838
Hanko (& surr.)	10	599	3	323	0	0	1	362	0	0	0	0	0	0	0	0	14	1284
Tammisaari (& surr.)	11	364	0	0	0	0	1	303	0	0	0	0	0	0	0	0	12	667
Helsinki (& surr.)	71	2152	0	0	1	228	1	410	0	0	2	1618	0	0	0	0	75	4408
Porvoo (& surr.)	53	1901	0	0	0	0	0	0	1	571	0	0	0	0	0	0	54	2472

AREA	20	> 100	100	> 200	200	> 300	300	> 500	500	>700	700	>1000	1000	>1500	1500	>3000	SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Loviisa (& surr.)	26	1067	0	0	0	0	0	0	0	0	2	1912	0	0	0	0	28	2979
Uusimaa county, total	171	6083	3	323	1	228	3	1075	1	571	4	3530	0	0	0	0	183	11810
Kotka (& surr.)	10	563	4	583	0	0	0	0	0	0	0	0	0	0	0	0	14	1146
Hamina (& surr.)	29	1880	2	266	0	0	0	0	0	0	0	0	0	0	0	0	31	2146
Viipuri	4	289	3	388	3	646	1	407	0	0	0	0	1	1481	0	0	12	3211
Säkkijärvi	18	945	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	945
Johannes	8	374	1	165	1	288	0	0	0	0	0	0	0	0	0	0	10	827
Koivisto	163	9131	19	2389	1	262	0	0	2	1014	0	0	0	0	0	0	185	12796
Lavansaari, Seiskari	63	2972	12	1453	0	0	0	0	0	0	0	0	0	0	0	0	75	4425
Uusikirkko, Kuolemaj.	52	2190	2	234	0	0	0	0	0	0	0	0	0	0	0	0	54	2424
Viipuri county, total	347	18344	43	5478	5	1196	1	407	2	1014	0	0	1	1481	0	0	399	27920
Sum total	881	37962	78	10434	72	18336	80	30173	28	16075	35	30220	21	27284	8	13797	1203	184281

APPENDIX I: 5B. STEAMSHIPS BY SIZE-CLASS, 1905.

(Inclusive of auxiliaries, excluding tugs and inland fleets)

AREA	20 > 100		100 > 200		200 > 300		300 > 500		500 > 700		700> 1000		1000> 1500		1500> 3000		SUM TOTAL	
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Oulu	0	0	2	259	0	0	0	0	0	0	0	0	0	0	0	0	2	259
Oulu county	0	0	2	259	0	0	0	0	0	0	0	0	0	0	0	0	2	259
Kokkola	1	67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	67
Uusikaarlepyy	1	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	22
Vaasa	1	28	0	0	4	935	2	844	2	1098	2	1490	0	0	0	0	11	4395
Kaskinen	0	0	1	151	0	0	0	0	0	0	0	0	0	0	0	0	1	151
Kristiinan-kaupunki	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1587	1	1587
Vaasa county	3	117	1	151	4	935	2	844	2	1098	2	1490	0	0	1	1587	15	6222
Åland	2	68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	68
Pori	2	119	1	134	1	215	0	0	0	0	1	868	1	1066	0	0	6	2402
Turku	11	647	5	642	3	709	4	1507	0	0	0	0	0	0	0	0	23	3505
Särkisalo	1	87	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	87
Turku and Pori county	14	853	6	776	4	924	4	1507	0	0	1	868	1	1066	0	0	30	5994

AREA	20 > 100		100 > 200		200 > 300		300 > 500		500 > 700		700> 1000		1000> 1500		1500> 3000		SUM TOTAL	
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Tammisaari	0	0	1	133	0	0	0	0	0	0	0	0	0	0	0	0	1	133
Helsinki	6	345	4	613	1	225	10	4142	15	9594	1	743	9	10737	1	2045	47	28444
Porvoo	3	126	1	171	0	0	0	0	0	0	0	0	0	0	0	0	4	297
Loviisa	1	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	35
Uusimaa county	10	506	6	917	1	225	10	4142	15	9594	1	743	9	10737	1	2045	53	28909
Kotka	11	313	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	313
Hamina	3	88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	88
Viipuri	29	1219	6	726	0	0	0	0	0	0	0	0	0	0	0	0	35	1945
Johannes	0	0	1	166	0	0	0	0	0	0	0	0	0	0	0	0	1	166
Koivisto	2	107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	107
Viipuri county	45	1727	7	892	0	0	0	0	0	0	0	0	0	0	0	0	52	2619
Savonlinna	0	0	2	223	0	0	0	0	0	0	0	0	0	0	0	0	2	223
Joensuu	0	0	3	343	0	0	0	0	0	0	0	0	0	0	0	0	3	343
Inland	0	0	5	566	0	0	0	0	0	0	0	0	0	0	0	0	5	566
Sum total	74	3271	27	3561	9	2084	16	6493	17	10692	4	3101	10	11803	2	3632	159	44637

APPENDIX I: 6A. SAILING VESSELS BY SIZE-CLASS, 1913

(Excluding barges, lighters and inland fleets)

AREA	20 > 100		100 > 200		200 > 300		300 > 500		500 > 700		700>1000		1000>1500		1500>3000		SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Tornio	3	290	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	290
Raahe	3	163	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	163
Kemi	1	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	75
Iijoki	2	69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	69
Kalajoki, Pyhäjoki	1	37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	37
Oulu county, total	10	634	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	634
Kokkola (& surr.)	12	574	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	574
Pietarsaari	1	84	0	0	0	0	0	0	0	0	1	751	0	0	0	0	2	835
Vaasa	7	232	0	0	0	0	0	0	0	0	0	0	1	1446	0	0	8	1678
Kristiinan-kaupunki	0	0	0	0	0	0	1	306	0	0	0	0	0	0	0	0	1	306
Mustasaari parish	4	92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	92
Vaasa county, total	24	982	0	0	0	0	1	306	0	0	1	751	1	1446	0	0	27	3485

AREA	20 > 100		100 > 200		200 > 300		300 > 500		500 > 700		700>1000		1000>1500		1500 >3000		SUM TOTAL	
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Mariehamn seamans house district	85	2599	4	535	8	2061	9	3498	6	3722	5	4503	2	2504	3	5654	122	25076
Vårdö s.h. district	36	1486	12	1777	6	1429	6	2367	4	2199	3	2698	4	4955	10	19523	81	36434
Åland, total	121	4085	16	2312	14	3490	15	5865	10	5921	8	7201	6	7459	13	25177	203	61510
Rauma (& surr.)	13	553	3	387	21	5286	18	6675	4	2224	3	2485	1	1468	2	3357	65	22435
Uusikaupunki (&. surr.)	25	692	1	185	6	1565	4	1502	1	595	0	0	2	2720	12	21220	51	28479
Turku	12	608	1	102	0	0	0	0	1	550	1	759	1	1384	2	3696	18	7099
Kustavi, Taivassalo	15	515	2	257	0	0	3	1255	1	552	0	0	0	0	0	0	21	2579
Rymättylä	5	128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	128
Parainen	30	1056	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	1056
Nauvo, Korppoo	25	725	1	102	0	0	0	0	0	0	0	0	0	0	0	0	26	827
Perniö, Särkisalo	21	1058	3	362	0	0	0	0	0	0	0	0	0	0	0	0	24	1420
Kemiö, Västanfj. Hiittinen	32	1235	0	0	0	0	2	778	0	0	1	709	0	0	0	0	35	2722
Turku and Pori county, total	178	6570	11	1395	27	6851	27	10210	7	3921	5	3953	4	5572	16	28273	275	66745

AREA	20	> 100	100 > 200		200 > 300		300 > 500		500 > 700		700>1000		1000>1500		1500 >3000		SUM TOTAL	
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Hanko (& surr.)	8	377	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	377
Tammisaari (& surr.)	14	374	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	374
Helsinki (& surr.)	80	2370	0	0	1	228	0	0	0	0	0	0	1	1147	3	5664	85	9409
Porvoo (& surr.)	68	2304	0	0	0	0	0	0	1	571	0	0	0	0	0	0	69	2875
Loviisa (& surr.)	42	1718	1	105	0	0	0	0	0	0	1	954	0	0	0	0	44	2777
Uusimaa county, total	212	7143	1	105	1	228	0	0	1	571	1	954	1	1147	3	5664	220	15812
Kotka (& surr.)	17	919	5	710	0	0	0	0	0	0	0	0	0	0	0	0	22	1629
Hamina (& surr.)	28	1713	2	228	0	0	0	0	0	0	0	0	0	0	0	0	30	1941
Viipuri	1	56	1	186	1	270	3	1073	0	0	0	0	1	1466	0	0	7	3051
Säkkijärvi	15	814	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	814
Johannes	9	477	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	477
Koivisto	178	10859	15	1905	3	754	0	0	0	0	0	0	0	0	0	0	196	13518
Lavansaari, Seiskari	57	3511	26	3380	0	0	0	0	0	0	0	0	0	0	0	0	83	6891
Uusikirkko, Kuolemaj.	62	2711	1	114	0	0	0	0	0	0	0	0	0	0	0	0	63	2825

AREA	20	> 100	100	> 200	200	> 300	300	> 500	500	> 700	700	>1000	1000	>1500	1500	>3000	SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Viipuri county, total	367	21060	50	6523	4	1024	3	1073	0	0	0	0	1	1466	0	0	425	31146
Sum total	912	40474	78	10335	46	11593	46	17454	18	10413	15	12859	13	17090	32	59114	1160	179332

APPENDIX I: 6B. STEAMSHIPS BY SIZE-CLASS, 1913.

(Inclusive of auxiliaries, excluding tugs and inland fleets)

AREA	20	> 100	100	> 200	200	> 300	300	> 500	500	> 700	700	>1000	1000	>1500	1500	>3000	SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Oulu	6	149	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	149
Oulu county	6	149	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	149
Kokkola	3	158	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	158
Vaasa	5	147	0	0	2	553	2	844	2	1099	4	2996	0	0	0	0	15	5639
Kaskinen	0	0	1	150	0	0	0	0	0	0	0	0	0	0	0	0	1	150
Vaasa county	8	305	1	150	2	553	2	844	2	1099	4	2996	0	0	0	0	19	5947
Åland	1	45	1	128	0	0	0	0	0	0	0	0	0	0	0	0	2	173
Pori	2	101	1	134	0	0	0	0	0	0	0	0	0	0	0	0	3	235
Rauma	3	128	1	194	0	0	0	0	0	0	0	0	0	0	0	0	4	322
Turku	16	854	10	1497	4	916	5	1994	1	644	0	0	1	1412	0	0	37	7317

AREA	20 > 100		100 > 200		200 > 300		300 > 500		500 > 700		700>1000		1000 >1500		1500>3000		SUM TOTAL	
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Taivassalo	1	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	41
Parainen	1	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	21
Särkisalo	2	132	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	132
Kemiö	2	137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	137
Turku and Pori county	27	1414	12	1825	4	916	5	1994	1	644	0	0	1	1412	0	0	50	8205
Helsinki	9	519	4	597	3	692	9	3871	17	10827	2	1456	10	11843	5	8777	59	38582
Porvoo	3	126	1	171	0	0	0	0	0	0	0	0	0	0	0	0	4	297
Loviisa	2	56	1	125	0	0	0	0	0	0	0	0	0	0	0	0	3	181
Uusimaa county	14	701	6	893	3	692	9	3871	17	10827	2	1456	10	11843	5	8777	66	39060
Kotka	10	270	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	270
Hamina	5	156	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	156
Viipuri	31	1350	1	100	0	0	0	0	0	0	0	0	0	0	0	0	32	1450
Säkkijärvi	1	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	73
Koivisto	1	78	1	105	0	0	0	0	0	0	0	0	0	0	0	0	2	183
Viipuri county	48	1927	2	205	0	0	0	0	0	0	0	0	0	0	0	0	50	2132
Savonlinna	0	0	2	238	0	0	0	0	0	0	0	0	0	0	0	0	2	238
Joensuu	0	0	4	496	0	0	0	0	0	0	0	0	0	0	0	0	4	496

AREA	20 > 100		100 > 200		200 > 300		300 > 500		500 > 700		700>1000		1000 >1500		1500>3000		SUM	TOTAL
	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto	no	nto
Kuopio	0	0	1	118	0	0	0	0	0	0	0	0	0	0	0	0	1	118
Inland	0	0	6	734	0	0	0	0	0	0	0	0	0	0	0	0	6	734
Sum total	104	4541	28	3935	9	2161	16	6709	20	12570	6	4452	11	13255	5	8777	199	56400

Source: Manuscript ship lists *(finansexpeditionen, handels- och industriexpeditionen, sjöfartsinspektören)*; Finnish Official Statistics, ser. I and I B; Finnish published ship-lists.

APPENDIX II:1A. The current value of merchant tonnage by size-class, according to the insurance sample.

1 = number of cases
2 = average tonnage
3 = average value per net ton, Finnish marks

1865 SAMPLE

	Size-class	1	2	3
Sailing vessels	20>200	34	140	192.2
	200>300	35	248	210.1
	300>500	55	412	197.8
	500>700	45	563	198.9
	700>1000	9	761	216.8
	1000—	1	1,025	292.7

1875 SAMPLE

	Size-class	1	2	3
Sailing vessels	20>200	9	158	188.2
	200>300	19	258	240.1
	300>500	49	420	203.7
	500>700	70	602	171.5
	700>1000	21	819	189.9
	1000—	2	1,098	246.1
Auxiliaries	200>300	2	276	366.6
	300>500	3	355	403.0
Steamships	20>200	3	175	1,071.7
	200>300	6	243	909.5
	300>500	4	347	619.3

1885 SAMPLE

	Size-class	1	2	3
Sailing vessels	20>200	7	143	145.0
	200>300	12	255	133.5
	300>500	31	415	143.7
	500>700	31	598	134.2
	700>1000	23	806	129.7
	1000—	6	1,121	154.6
Auxiliaries	300>500	1	368	243.8
Steamships	20>200	5	168	727.8
	200>300	4	251	641.7
	300>500	7	355	650.3
	500>700	4	598	631.5

1895 SAMPLE

	Size-class	1	2	3
Sailing vessels	20>200	2	130	108.0
	200>300	9	254	101.7
	300>500	12	417	123.8
	500>700	10	627	92.1
	700>1000	20	845	90.7
	1000—	14	1,254	92.9
Steamships	20>200	2	146	702.6
	200>300	4	260	431.8
	300>500	11	366	461.4
	500>700	10	626	332.0
	700>1000	1	893	271.5

1905 SAMPLE

	Size-class	1	2	3
Sailing vessels	20>200	—	.	.
	200>300	2	276	70.2
	300>500	8	393	103.2
	500>700	5	620	91.5
	700>1000	12	910	75.3
	1000>1500	15	1,303	108.4
	1500—	8	1,726	143.4
Steamships	20>200	1	130	422.8
	200>300	4	253	414.3
	300>500	10	407	701.1
	500>700	4	573	529.9
	700>1000	2	745	449.3
	1000—	1	1,162	312.9

1913 SAMPLE

	Size-class	1	2	3
Sailing vessels	20>200	-	.	.
	200>300	3	254	89.0
	300>500	4	392	80.2
	500>700	6	578	75.1
	700>1000	6	868	86.7
	1000>1500	7	1,329	91.8
	1500—	19	1,946	80.6
Steamships	20>200	3	169	731.7
	200>300	5	256	384.9
	300>500	10	407	524.9
	500>700	5	574	462.1
	700>1000	3	751	444.6
	1000>1500	2	1,287	231.5
	1500—	1	1,616	232.1

NB: The 1905 and 1913 samples do not include *FÅA* ships.
Source: The registers of *Sjöassuransföreningen i Finland.*

APPENDIX II:1B. The accounting values of *FÅA* ships.

1 = number of cases
2 = average tonnage
3 = average value per net ton, Finnish marks

	1895			
		1	2	3
Passenger/cargo ships	300>500	9	372	491.7
Cargo ships	500>700	8	644	523.9
Passenger ships	500>700	2	650	1,003.5
All ships	500>700	10	645	619.8
	1905			
		1	2	3
Passenger/cargo ships	300>500	7	418	684.1
Cargo ships	500>700[1]	8	652	383.2
Passenger ships	500>700[2]	3	637	811.0
All ships	500>700	11	648	499.9
Cargo ships	1000>1500	2	1,271	502.5
Passenger ships	1000>1500	2	1,134	1,088.3
All ships	1000>1500	4	1,202	795.4
	1913			
		1	2	3
Passenger/cargo ships	300>500	7	401	594.2
Cargo ships	500>700[1]	12	637	396.1
Passenger ships	500>700[2]	2	624	715.5
All ships	500>700	14	635	441.7
Cargo ships	1000>1500	2	1,271	393.5
Passenger ships	1000>1500	2	1,134	922.1
All ships	1000>1500	4	1,202	657.8
Passenger ships	1500—	1	1,997	1,001.5

1 Including one ship of 711 net tons.
2 Including s/s *Wellamo*, 613 nt, which was used exclusively on the Baltic. The value per ton was FIM 943.4 in 1905 and FIM 848.3 in 1913.

Source: The ledgers of the *FÅA*.

APPENDIX II:2. The numbers of seamen, masters included, by size-class in the Finnish merchant marine, 1860-1913.

	Size-class							
	under 100	100> 200	200> 300	300> 500	500> 700	700> 1000	1000> 1500	1500—
A1. 1859—69, Large and medium-sized sailing vessels (accounting data)								
Number of ships	—	—	5	14	22	2	—	—
Average tonnage	.	.	224	433	571	736	.	.
Number of seamen	—	—	61	220	327	36	—	—
Seamen per 100 net tons	.	.	5.5	3.6	2.6	2.4	.	.
A2. 1865, Sailing vessels (ship lists)								
Number of ships	169	160	41	90	26	—	—	—
Average tonnage	60	135	285	412	526	.	.	.
Number of seamen	727	1035	536	1384	412	—	—	—
Seamen per 100 net tons	7.1	4.8	4.6	3.7	3.0	.	.	.
B. 1875, Sailing vessels								
Number of ships	14	118	119	104	32	9	—	—
Average tonnage	34	151	242	368	581	789	.	.
Number of seamen	39	919	1139	1219	478	150	—	—
Seamen per 100 net tons	8.2	5.2	4.0	3.2	2.6	2.1	.	.
C1. 1885, Sailing vessels								
Number of ships	247	66	111	95	41	12	6	—
Average tonnage	44	153	243	381	581	821	1113	.
Number of seamen	809	465	1028	1059	558	193	118	—
Seamen per 100 net tons	7.4	4.6	3.8	2.9	2.3	2.0	1.8	.

	Size-class							
	under 100	100> 200	200> 300	300> 500	500> 700	700> 1000	1000> 1500	1500—
C2. 1885, Steamships								
Number of ships	17	4	3	4	2	—	—	—
Average tonnage	55	152	250	346	678	.	.	.
Number of seamen	121	52	46	68	37	—	—	—
Seamen per 100 net tons	12.9	8.5	6.1	4.9	2.7	.	.	.
D1. 1895, Sailing vessels								
Number of ships	455	60	92	97	29	14	12	1
Average tonnage	44	140	250	380	588	835	1108	2154
Number of seamen	1565	399	847	1047	366	204	206	24
Seamen per 100 net tons	7.8	4.7	3.7	2.8	2.1	1.7	1.5	1.1
D2. 1895, Steamships								
Number of ships	27	5	5	11	10	—	—	—
Average tonnage	47	138	230	382	652	.	.	.
Number of seamen	168	47	69	184	185	—	—	—
Seamen per 100 net tons	13.3	6.8	6.0	4.4	2.8	.	.	.
E1. 1905, Sailing vessels								
Number of ships	149	13	43	54	14	16	11	5
Average tonnage	36	139	257	378	576	865	1310	1761
Number of seamen	399	85	413	593	174	250	209	113
Seamen per 100 net tons	7.5	4.7	3.7	2.9	2.2	1.8	1.5	1.3
E2. 1905, Steamships								
Number of ships	12	9	4	14	15	1	9	1
Average tonnage	59	139	233	403	640	743	1193	2045
Number of seamen	80	82	56	244	273	17	220	28
Seamen per 100 net tons	11.3	6.5	6.0	4.3	2.8	2.3	2.0	1.4

	Size-class							
	under 100	100> 200	200> 300	300> 500	500> 700	700> 1000	1000> 1500	1500—
F1. 1913, Sailing vessels								
Number of ships	156	8	27	29	11	9	6	8
Average tonnage	34	128	253	378	590	855	1328	1804
Number of seamen	413	54	258	317	139	128	115	186
Seamen per 100 net tons	7.8	5.3	3.8	2.9	2.1	1.7	1.4	1.3
F2. 1913, Steamships								
Number of ships	18	11	4	9	15	2	9	3
Average tonnage	51	154	229	412	638	728	1221	1886
Number of seamen	113	121	52	167	277	36	203	101
Seamen per 100 net tons	12.3	7.2	5.7	4.5	2.9	2.5	1.8	1.8

Source: 1859—1869 accounting data (see appendix IV:1); other sample years: ship lists of *sjömanshus* and local *länsmän*.

APPENDIX III:1. The structure of tonnage in the insurance (voyage) sample (Ships with voyage data from the registers of the *Sjöassuransföreningen i Finland* and from shipping accounts).

1 = number of ships
2 = tonnage (net tons)
3 = average duration of observations (months)

1 8 6 5 sample

	Sailing vessels			Steamships		
Size-class	1	2	3	1	2	3
20>100	5	464	17.6	—	—	—
100>200	29	4301	17.8	—	—	—
200>300	35	8692	17.7	—	—	—
300>500	55	22646	19.0	—	—	—
500>700	45	25323	18.0	—	—	—
700>1000	9	6851	18.3	—	—	—
1000+	1	1025	19.0	—	—	—
Total	179	69301	18.2	—	—	—

1 8 7 5 sample

	Sailing vessels			Steamships[1]		
Size-class	1	2	3	1	2	3
20>100	2	181	13.0	—	—	—
100>200	8	1247	16.3	5	815	12.0
200>300	21	5387	17.0	10	2544	11.0
300>500	48	20380	18.5	6	2103	14.2
500>700	70	42164	20.8	—	—	—
700>1000	21	17203	25.0	—	—	—
1000+	2	2196	27.5	—	—	—
Total	172	88758	19.2	21	5462	12.1

1 Incl. auxiliaries (5 ships). This figure includes aux. *Achtma* from which the engine was removed during the year 1875 and which was classified as a sailing vessel in appendix I:2.

1 8 8 5 sample

	Sailing vessels			Steamships[2]		
Size-class	1	2	3	1	2	3
20>100	2	178	12.0	—	—	—
100>200	6	980	16.4	5	837	12.0
200>300	15	3695	14.7	4	1004	11.8
300>500	31	12867	19.5	8	2856	11.4
500>700	32	18973	20.7	4	2391	7.5
700>1000	23	18528	21.5	—	—	—
1000+	7	7745	24.4	—	—	—
Total	116	62966	19.6	21	7088	10.9

2 Incl. auxiliaries (1 ship).

1 8 9 5 sample

	Sailing vessels			Steamships		
Size-class	1	2	3	1	2	3
20>100	1	78	12.0	—	—	—
100>200	3	508	10.7	2	291	7.0
200>300	11	2775	12.1	4	1038	9.5
300>500	13	5312	17.8	11	4031	12.0
500>700	12	7540	17.6	10	6263	6.5
700>1000	20	16903	19.8	1	893	8.0
1000>1500	12	13669	22.3	—	—	—
1500+	2	3884	22.5	—	—	—
Total	74	50669	18.0	28	12516	9.2

1 9 0 5 sample

	Sailing vessels			Steamships		
Size-class	1	2	3	1	2	3
20>100	—	—	—	—	—	—
100>200	1	195	12.0	1	130	12.0
200>300	3	782	12.0	4	1011	12.0
300>500	9	3586	16.8	15	6092	11.5
500>700	5	3098	20.4	14	8743	10.4
700>1000	15	13580	21.4	3	2200	11.3
1000>1500	16	20586	24.6	5	5970	7.8
1500+	8	13806	23.5	—	—	—
Total	57	55633	21.1	42	24146	10.7

	1913 sample					
	Sailing vessels			Steamships		
Size-class	1	2	3	1	2	3
20>100	—	—	—	—	—	—
100>200	1	186	12.0	3	506	12.0
200>300	4	1013	12.5	5	1281	12.0
300>500	5	1879	16.8	13	5292	12.0
500>700	7	4026	19.3	17	10588	11.4
700>1000	7	6170	15.6	4	2963	12.0
1000>1500	9	11759	23.9	6	7382	10.3
1500+	21	40853	21.1	2	3613	8.5
Total	54	65886	19.4	50	31625	11.5

Source: Data file based on the registers of *Sjöassuransföreningen i Finland (Åbo Akademi*, Maritime Archives), logs (Rauma, Uusikaupunki and Kustavi *sjömanshus)* and shipping accounts (see appendix IV:1).

APPENDIX III:2A. Loaded voyages and transport by sailing ships in the insurance sample (excluding coastal voyages).

This is the "raw" data which shows how many voyages, net tons and miles the ships in the insurance sample accumulated during the periods they were followed. The data for cross-trade cargo was used to estimate the total cross-trade transport production of the Finnish sailing fleet. Corresponding data for export and import cargo for 1865 and 1875 was used for estimating transport by urban vessels in these trades, 1865 and 1875. Coastal and Baltic export and import cargo, however, was estimated using the official shipping statistics as well, plus a few primary tables found in the "special archives" of the Central Statistical Office. As far as "peasant" shipping was concerned, respective data was computed directly from the ship-lists of the *länsmän* (see appendix III:2B).

For subsequent sample periods, export and import cargo was recorded according to the official shipping statistics, totalling both urban and "peasant" ships. The insurance sample data was exploited only to compute data for cross-trade (and no distinction was made any more between urban and "peasant" vessels, except

for 1884/86 when transport in Baltic and North Sea cross-trade was estimated separately for urban and "peasant" ships).

For all the sample years, the data which was used in extrapolating total net tons and ton-miles in different trades is also presented below as *annual* figures. For each ship, voyage data was reduced to represent one-year's sailing by dividing the net tonnage and ton-miles accounted on each voyage by the number of years (and fractions) it was followed. (For example, if a ship of 200 net tons recorded 2500 naut.miles on a voyage, and this was part of an 18-month observation, 133.3 net tons and 333,333 ton-miles are recorded for this voyage.) The figures normally also include periods of lay-up (if the observation ended with the ship returning to its home-port, the observation period included refitting time). However, there were cases when this could not be determined, or when there was no data on laying up. Thus, it is possible that the figures are slightly inflated but the trend should be very slight, hardly exceeding the error of the estimate. Moreover, the extrapolation (see below) was fairly conservative, which should counteract any inflation tendency.

The annual figures were extrapolated according to the percentage of sample tonnage to total (urban or total Finnish) tonnage in the size-class (or size-classes, "reference" tonnage class) within which the average or typical tonnage of the trade category in question fell (see also p. 144). At the beginning of the period, when variations in tonnage were fairly large within many trades, reference tonnage classes were wider than after the 1870s. If average tonnage in the sample fell between two tonnage classes, or in a class which significantly differed from the neighbouring ones in terms of representativeness, the class which produced a higher sample percentage was selected (usually this was the higher size-class), so as to produce a conservative estimation. The figures below show the actual reference tonnage classes as well as the resulting sample percentages in the main trading categories:

1 = reference tonnage class

u = urban ships: this implies that the figures for "peasant" ships were calculated separately from the respective ship-lists

t = all Finnish ships

"sh.stat" = the percentage was determined by comparing the sample with the total cargo registered in Finnish shipping statistics (this, of course, only applied to certain cross-trade estimates)

"other" = the special procedure for estimating transport in Baltic and North Sea cross-trade, see below

2 = sample percentage of reference tonnage class

	1865		1875		1885	
	1	2	1	2	1	2
North Sea	u 100>500	57	u 300>500	76	u 300>500	58
Other European	u 200>700	59	u 500>700	95	sh.stat.	78
Atlantic	u 200>700	59	u 500>1000	93	t 500>1000	78
World	u 500—	57	u 500—	89	t 700—	90

	1895		1905		1913	
	1	2	1	2	1	2
North Sea	other	..	other	..	other	..
Other European	sh.stat.	99	sh.stat.	78	sh.stat.	41
Atlantic	t 700>1500	81	t 1000>1500	75	t 1000>1500	69
World	t 700—	82	t 1000—	84	t 1500—	69

(For example, if the reference category was urban ships 300>500 net tons and the sample amounted to 76 % of this reference tonnage, the reduced *annual* averages of net tons and ton-miles in this case are multiplied by 1.32.)

The volume of transport in Baltic cross-trade was estimated by supposing that it was mainly carried on by "peasant" vessels. Thus, for 1865 and 1875 it was computed directly from the respective ship-list, and for 1885 by supposing that transport per net ton was roughly the same as in 1875. For subsequent years, the volume was assumed to be 10 % of Baltic export cargo, except in 1913, when it was assumed to be the same as the total tonnage of loaded Finnish sailing vessels registered in the Swedish shipping statistics as clearing for or entering from Baltic ports.

The volume of transport in North Sea cross trade was computed in a similar manner for "peasant" vessels for 1865, 1875 and 1885,

and for urban vessels according to the sample percentages presented above. For subsequent sample years the total volume (for all Finnish vessels) was estimated from a combined index, which took into account: (A) the volume of sailing vessel export cargo to North Sea ports, (B) the total tonnage of sailing vessels 300>500 net tons and (C) the tonnage of loaded Finnish sailing vessels clearing six major North Swedish timber ports (according to the Swedish shipping statistics). The index was as follows (1884/86 = 100):

	1894/96	1904/06	1912/13
A	99	75	49
B	85	56	32
C	94	54	35
(A+B+C)/3	93	62	39

The results of the estimations are presented in tables 3:5—15.

Trade areas:

Baltic ports = all Baltic ports and Kattegat ports south of the line from Skagen to Gothenburg (excluding Gothenburg).

North Sea ports = North Sea and Skagerrak ports, all British and Irish ports, the South of Norway and the French Channel ports.

Other European = ports north of Stavanger and south of Ouessant, including the Mediterranean and the Black Sea.

Atlantic = down to the line from Cape Horn to the Cape of Good Hope (excluding the European coasts).

Southern Atlantic (not extrapolated for total tonnage) = ports beyond the line from Cap Verde (Dakar) to Trinidad.

World = the rest of the World.

Outward = voyages from Northern Europe to other parts of Europe or the World, or from Europe to other parts of the World (e.g. westward over the Atlantic). Not extrapolated for total tonnage.

1 = number of voyages in the sample during the whole observation period
2 = average tonnage of sample vessels
3 = total sample cargo during the whole observation period, net tons
4 = total sample nautical mileage sailed during the whole observation period
5 = estimated *annual* total sample cargo, net tons
6 = estimated *annual* total sample of net-ton-nautical-miles (1000)

1865 SAMPLE

a) Export cargo from Finland

Trade area	1	2	3	4	5	6
Baltic ports	25	124.9	3,124	17,880	2,294	1,657
North Sea ports	118	384.9	45,415	161,540	29,682	40,574
Other European	98	347.1	34,015	268,710	22,178	61,218
Atlantic	3	188.7	566	19,080	357	2,238
— thereof South Atl.	3	188.7	566	19,080	—	—
World	—	.	—	—	—	—

b) Import cargo to Finland

Trade area	1	2	3	4	5	6
Baltic ports	27	129.0	3,484	19,070	2,515	1,786
North Sea ports	22	338.8	7,454	28,990	4,938	6,716
Other European	69	349.6	24,123	198,380	14,963	43,685
Atlantic	8	320.4	2,563	42,440	1,409	8,704
— thereof South Atl.	5	225.0	1,125	31,560	—	—
World	—	.	—	—	—	—

c) Cross-trade cargo

Trade area	1	2	3	4	5	6
Baltic ports	—	.	—	—	—	—
North Sea ports	30	311.3	9,338	35,890	6,123	7,302
Other European	274	415.4	113,812	671,560	70,940	172,807
— thereof outward	130	422.8	54,961	330,980	—	—
Atlantic	143	384.6	54,999	603,480	32,776	139,206
— thereof outward	68	396.6	26,970	294,740	—	—
— thereof South Atl.	30	297.2	8,915	156,000	—	—
— thereof outward	15	302.2	4,534	81,800	—	—
World	41	645.6	26,471	328,430	17,111	136,711
— thereof outward	10	659.8	6,598	128,300	—	—

1875 SAMPLE

a) Export cargo from Finland

Trade area	1	2	3	4	5	6
Baltic ports	34	174.1	5,921	21,990	5,357	3,375
North Sea ports	127	496.7	63,082	182,050	36,896	54,574
Other European	62	390.3	24,197	165,260	14,657	38,437
Atlantic	2	182.2	365	12,690	212	1,364
— thereof South Atl.	2	182.2	365	12,690	—	—
World	1	654.9	655	12,780	302	1,852

b) Import cargo to Finland

Trade area	1	2	3	4	5	6
Baltic ports	17	179.2	3,047	11,370	2,748	1,769
North Sea ports	8	316.1	2,529	10,040	1,567	1,917
Other European	74	430.5	31,854	215,150	19,300	57,014
Atlantic	3	511.2	1,534	16,180	872	4,647
— thereof South Atl.	—	.	—	—	—	—
World	—	.	—	—	—	—

c) Cross-trade cargo

Trade area	1	2	3	4	5	6
Baltic ports	3	281.9	847	1,810	—	—
North Sea ports	30	440.0	13,200	38,010	8,781	11,189
Other European	89	419.4	37,327	216,750	25,237	60,720
— thereof outward	47	447.2	21,018	122,060	—	—
Atlantic	287	586.0	168,185	1097,890	95,193	372,527
— thereof outward	69	555.2	38,311	294,540	—	—
— thereof South Atl.	28	558.4	15,635	138,670	—	—
— thereof outward	24	595.6	14,294	120,880	—	—
World	80	775.2	62,020	880,170	27,839	308,141
— thereof outward	31	781.8	24,236	347,620	—	—

1885 SAMPLE

a) Export cargo from Finland

Trade area	1	2	3	4	5	6
Baltic ports	55	220.3	12,114	33,740	—	—
North Sea ports	38	473.9	18,009	53,260	—	—
Other European	102	508.1	51,828	274,930	—	—
Atlantic	—	.	—	—	—	—
World	—	.	—	—	—	—

b) Import cargo to Finland

Trade area	1	2	3	4	5	6
Baltic ports	12	161.5	1,938	9,790	—	—
North Sea ports	6	550.0	3,300	8,150	—	—
Other European	61	487.8	29,753	170,280	—	—
Atlantic	—	.	—	—	—	—
World	—	.	—	—	—	—

c) Cross-trade cargo

Trade area	1	2	3	4	5	6
Baltic ports	—	.	—	—	—	—
North Sea ports	8	300.9	2,407	8,060	1,829	1,678
Other European	29	498.6	14,459	63,260	8,437	19,603
— thereof outward	9	430.8	3,877	17,220	—	—
Atlantic	177	684.6	121,168	700,320	67,686	274,733
— thereof outward	41	725.7	29,753	173,900	—	—
— thereof South Atl.	13	563.0	7,319	69,110	—	—
— thereof outward	10	567.2	5,672	56,400	—	—
World	27	947.0	25,570	265,350	12,018	117,581
— thereof outward	9	965.9	8,693	106,630	—	

1895 SAMPLE

a) Export cargo from Finland

Trade area	1	2	3	4	5	6
Baltic ports	48	242.4	11,634	27,800	—	—
North Sea ports	22	508.8	11,193	27,680	—	—
Other European	42	686.7	28,841	112,510	—	—
Atlantic	1	404.0	404	6,470	—	—
— thereof South Atl.	1	404.0	404	6,470	—	—
World	—	.	—	—	—	—

b) Import cargo to Finland

Trade area	1	2	3	4	5	6
Baltic ports	4	383.8	1,535	2,490	—	—
North Sea ports	5	612.3	3,061	5,730	—	—
Other European	24	610.4	14,650	65,940	—	—
Atlantic	—	.	—	—	—	—
World	—	.	—	—	—	—

c) Cross-trade cargo

Trade area	1	2	3	4	5	6
Baltic ports	1	368.0	368	300	—	—
North Sea ports	9	575.8	5,182	7,590	3,140	3,060
Other European	11	626.2	6,888	23,180	5,056	11,347
— thereof outward	4	537.2	2,149	11,300	—	—
Atlantic	123	854.4	105,094	512,925	65,760	272,407
— thereof outward	20	916.7	18,335	88,960	—	—
— thereof South Atl.	23	1,014.0	23,321	125,540	—	—
— thereof outward	9	1,149.0	10,341	48,450	—	—
World	18	1,142.2	20,559	196,560	10,461	110,903
— thereof outward	11	1,143.1	12,574	118,670	—	—

1905 SAMPLE

a) Export cargo from Finland

Trade area	1	2	3	4	5	6
Baltic ports	23	300.5	6,912	14,040	—	—
North Sea ports	21	793.6	16,666	29,545	—	—
Other European	17	506.3	8,607	44,560	—	—
Atlantic	—	.	—	—	—	—
World	—	.	—	—	—	—

b) Import cargo to Finland

Trade area	1	2	3	4	5	6
Baltic ports	1	971.o	971	510	—	—
North Sea ports	5	729.1	3,646	7,190	—	—
Other European	16	588.6	9,417	43,170	—	—
Atlantic	—	.	—	—	—	—
World	—	.	—	—	—	—

c) Cross-trade cargo

Trade area	1	2	3	4	5	6
Baltic ports	2	687.5	1,375	1,650	—	—
North Sea ports	16	678.7	10,859	15,340	8,347	8,037
Other European	4	607.8	2,431	11,610	0,728	2,032
— thereof outward	2	814.5	1,629	7,960	—	—
Atlantic	52	948.8	49,336	293,990	25,023	143,464
— thereof outward	12	940.7	11,289	69,480	—	—
— thereof South Atl.	32	993.1	31,780	197,960	—	—
— thereof outward	8	1,019.8	8,159	53,640	—	—
World	72	1,432.1	103,108	801,180	53,666	593,863
— thereof outward	26	1,444.7	37,562	263,520	—	—

1913 SAMPLE

a) Export cargo from Finland

Trade area	1	2	3	4	5	6
Baltic ports	38	334.8	12,721	24,290	—	—
North Sea ports	9	634.0	5,706	11,110	—	—
Other European	7	443.4	3,104	18,190	—	—
Atlantic	—	.	—	—	—	—
World	3	845.0	2,535	25,000	—	—

b) Import cargo to Finland

Trade area	1	2	3	4	5	6
Baltic ports	5	294.8	1,474	3,240	—	—
North Sea ports	2	540.0	1,080	2,150	—	—
Other European	8	464.5	3,716	20,710	—	—
Atlantic	—	.	—	—	—	—
World	—	.	—	—	—	—

c) Cross-trade cargo

Trade area	1	2	3	4	5	6
Baltic ports	1	560.0	560	150	—	—
North Sea ports	10	702.7	7,027	11,400	5,373	5,728
Other European	1	1,665.0	1,665	1,830	0,905	1,657
Atlantic	44	1,030.8	45,355	235,130	23,069	123,669
— thereof outward	19	1,114.2	21,170	100,890	—	—
— thereof South Atl.	28	1,144.5	32,047	165,400	—	—
— thereof outward	17	1,093.0	18,581	95,850	—	—
World	87	1,795.0	156,162	869,030	87,035	860,918
— thereof outward	28	1,859.5	52,065	316,060	—	—

Source: See appendix III:1.

APPENDIX III:2B. Transport by "peasant" vessels, 1875.

These are the total figures for the Finnish "peasant" fleet. In a few cases, missing data was extrapolated by using size-class-specific averages. Apart from supplying transport volumes for 1875, these figures were also used to compute the average cargo in different trades and size-classes (see appendix III:2C), which were used to complement the fragmentary voyage data of 1865, and, together

with the data in appendix III:2D, to estimate the volume of cross-trade by "peasant" vessels in 1885.

Baltic ports = all Baltic ports and Kattegat ports south of the line from Skagen to Gothenburg (excluding Gothenburg).

North Sea ports = North Sea and Skagerrak ports, all British and Irish ports, the South of Norway and the French Channel ports.

Other European = ports north of Stavanger and south of Ouessant, including the Mediterranean and the Black Sea.

Atlantic = down to the line from Cape Horn to the Cape of Good Hope (excluding the European coasts).

World = the rest of the World.

Outward = voyages from Northern Europe to other parts of Europe or the World, or from Europe to other parts of the World (e.g. westward over the Atlantic).

1 = number of voyages
2 = average tonnage
3 = total tonnage
4 = total nautical miles
5 = total net ton — nautical miles (1000)

(all figures are per 12 months)

a) Export cargo from Finland

Trade area	1	2	3	4	5
Baltic ports	139	164.5	22,930	78,645	12,937
North Sea ports	218	268.3	62,319	276,850	74,279
Other European	—	.	—	—	—
Atlantic	—	.	—	—	—
World	—	.	—	—	—

b) Import cargo to Finland

Trade area	1	2	3	4	5
Baltic ports	8	139.1	1,113	4,900	682
North Sea ports	27	281.0	9,910	31,860	8,953
Other European	—	.	—	—	—
Atlantic	—	.	—	—	—
World	—	.	—	—	—

c) Cross-trade cargo

Trade area	1	2	3	4	5
Baltic ports	65	160.5	10,450	41,985	6,739
North Sea ports	286	282.1	82,940	320,730	90,478
— thereof outward	162	307.1	49,755	195,900	60,161
Other European	10	381.9	3,819	32,990	12,599
— thereof outward	3	401.3	1,204	10,000	4,013
Atlantic	3	460.3	1,381	9,100	4,189
World	—	.	—	—	—

APPENDIX III:2C. "Peasant" tonnage and transport by size-class, 1875.

1. Tonnage by size-class

Size-class	100>200	200>300	300>500	500>700	700—
Total "peasant" tonnage	22,084	34,927	32,455	5,845	715

2. Average amount of cargo (other than coastal) by trade, net tons per ships' net ton (or voyages per ship, averages weighted by ship size)

Size-class	100>200	200>300	over 300
a) Export cargo from Finland			
Baltic ports	0.64	0.20	0.05
North Sea ports	0.26	0.82	0.71
b) Import cargo to Finland			
Baltic ports	0.05	—	—
North Sea ports	0.02	0.10	0.11
c) Cross-trade cargo			
Baltic ports	0.36	0.06	0.015
North Sea ports	0.36	0.89	1.125
Other European and Atlantic	—	0.02	0.11

3. Average length of voyage by trade, nautical miles

a) Export cargo from Finland	
Baltic ports	560
North Sea ports	1190
b) Import cargo to Finland	
Baltic ports	610
North Sea ports	900
c) Cross-trade cargo	
Baltic ports	645
North Sea ports	1090
Other European and Atlantic	3240

Source: Ship-lists of rural districts, 1875.

APPENDIX III:2D. "Peasant" tonnage insured with the insurance association of Turku province: average annual length of sailing period by size-class, 1884—85.

1 = Number of cases (insured vessels)
2 = Average net tonnage
3 = Average annual sailing period, months
4 = Number of ships in year-round traffic (not laid up)
5 = Average annual sailing period in main sample (urban vessels) 1884/86, months

Size—class	1	2	3	4	5
<200	6	168.5	5.3	—	5.3
200>300	19	255.3	6.6	—	9.2
300>500	17	338.9	7.4	1	9.0
500>700	6	606.8	8.7	2	11.3

Source: *Åbo läns enskilda sjöassuransförening*, register-books 1884—85; data file of the insurance sample (column 5).

APPENDIX III:3A. Loaded voyages and transport by steamships in the insurance sample. (All foreign voyages in 1875 and 1885 samples, subsequently only cross-trade voyages).

This is the data for steamships found in the insurance sample, in principle corresponding with that for sailing vessels presented in appendix III:2A. It was used to estimate the volume of steamship cross-trading for all sample years, and also the volume of other steamship foreign traffic before the 1890s (from 1891 onwards, the information could be found from the working tables of shipping statistics; before this shipping statistics could not be used because of extensive double registering in steamship line traffic). For the 1860s, the insurance registers included no steamships.

Although the data was used in a similar manner, in principle, than that for sailing vessels there were, however, certain important differences. Above all, the insurance registers did not specify voyages for liner ships sailing within the Baltic but only indicated the route in question. Thus, for such vessels the data was first completed by estimating their traffic frequences (numbers of round-trips). This was done using both existing litterature (which often quotes time-tables) plus the statistics of 1894 (thus supposing that typical tour frequencies were roughly similar). For ships which sailed both to Russia and Sweden, the route was divided in two parts, Helsinki — Sweden (Stockholm) and Helsinki — Russia (St.Petersburg).

Thus, a lot of data in this appendix did not solely depend on the insurance data but resulted wholly or mainly on other sources and estimations. These cases are indicated by an asterisk (*).

On the other hand, the samples covered large steam tonnage so well that in many cases they were equal or practically equal with total figures. Such was the case with cross-trade before the turn of the century (samples 1875, 1885 and 1895) and liner traffic to the Southern Baltic and beyond the Sound in samples 1875 and 1885. It also seems possible that the sample of 1875 only missed two steamships sailing regularly to Russia and Sweden.

The main problem, as far as extrapolation is conserned, was to estimate the volume of steamship traffic to Russia and Sweden. From the mid-1870s, typical sizes of ships on steamer lines to Russia and Sweden ranged from 150 to 350 net tons. Since the

lower end of this scale fell in sizes which were typical on domestic coastal routes (the traffic of which is not counted here) it was decided to use 300>500 net tons as reference tonnage class for the 1885 sample. This resulted a sample ratio of about 80 %. Conserning the sample of 1875, only the estimated transport of two vessels sailing to St. Petersburg and Sundsvall, respectively, was added to the observations. In addition to permanent liners, there were also a few vessels which trafficked abroad less regularly, or did not sail on permanent lines. In order to keep the estimation conservative, these were omitted.

Around 1865 no known steamship sailed beyond the Baltic, and the number of those trafficking regularly to Germany, Sweden and Russia is known fairly well from existing litterature. As before, it is possible that some occasional foreign traffic also was found, but again it was omitted.

As mentioned above, until the turn of the century the total volume of cross-trading was regarded equal with the voyages found in the samples. For the samples of 1905 and 1913, the tonnage engaged in such trading was first estimated by subtracting the known liner tonnage from the total in relevant size-classes (over 500 net tons); also the 1914 data of steamships sailing abroad was used. Then the total volume was extrapolated in a similar manner as for sailing vessels.

Because most steamers were followed for one full year only, all figures below are per year.

1 = number of voyages in the sample
2 = average tonnage of sample vessels
3 = total sample cargo, net tons
4 = total sample net-ton-nautical-miles (1000)

1875 SAMPLE

a) Traffic from Finland

Trade area	1	2	3	4
Russian ports	165.0	224.9	35,110*	10,320*
Swedish ports	75.0	229.2	17,550*	6,320*
South Baltic ports	43.0	277.0	12,080*	7,080*
North Sea ports	10.0	290.0	2,900	3,730
Other European	1.0	340.0	340	1,100

b) Traffic to Finland

Trade area	1	2	3	4
Russian ports	133.0	224.9	35,110*	10,320*
Swedish ports	87.0	229.2	17,550*	6,320*
South Baltic ports	44.0	277.0	12,100*	7,160*
North Sea ports	3.0	295.0	810	1,030
Other European	1.0	340.0	340	1,140

c) Cross-trade cargo

Trade area	1	2	3	4
Baltic ports	3.2	251.0	803	522
North Sea ports	4.0	293.5	1,174	1,018
Other European	9.8	319.9	3,135	6,484
Atlantic	2.8	383.5	1,074	3,570
World	—		—	—

1885 SAMPLE

a) Traffic from Finland

Trade area	1	2	3	4
Russian ports	212.0	281.4	43,460*	16,930*
Swedish ports	90.0	272.3	23,460*	8,450*
South Baltic ports	57.0	290.3	16,920*	10,750*
North Sea ports	19.0	598.0	11,430	13,770
Other European	1.0	664.0	664	1,930

b) Traffic to Finland

Trade area	1	2	3	4
Russian ports	212.0	281.4	43,460*	16,930*
Swedish ports	90.0	272.3	23,460*	8,450*
South Baltic ports	59.0	290.3	17,840*	11,110*
North Sea ports	21.0	598.0	12,820	15,200
Other	1.0	664.0	664	4,350

c) Cross-trade cargo

Trade area	1	2	3	4
Baltic ports	2.0	558.0	1,116	614
North Sea ports	12.5	569.7	7,121	6,667
Other European	4.0	649.0	2,596	4,879
Atlantic	1.0	664.0	664	3,685
World	—		—	—

1895 SAMPLE

(Cross-trade only) Trade area	1	2	3	4
Baltic ports	—	.	—	—
North Sea ports	3.0	478.7	1,436	434
Other European	33.0	676.1	22,312	43,528
Atlantic	1.0	649.0	649	3,109
World	—	.	—	—

1905 SAMPLE

(Cross-trade only) Trade area	1	2	3	4
Baltic ports	—	.	—	—
North Sea ports	6.0	1250.8	7,505	8,177
Other European	23.0	998.5	22,966	56,695
Atlantic	5.0	783.8	3,919	13,408
World	—	.	—	—

1913 SAMPLE

(Cross-trade only) Trade area	1	2	3	4
Baltic ports	—	.	—	—
North Sea ports	4.6	1055.6	4,856	3,433
Other European	5.2	648.6	3,373	11,168
Atlantic	3.6	1162.0	4,183	26,047
World	—	.	—	—

Source: See appendix III:1.

APPENDIX III:3B. Loaded voyages and transport by steamships on regular lines, 1894.

1 = number of round trips
2 = total cargo (out and home), net tons[1]
3 = total net-ton-nautical-miles (1000)

Trade area	1	2	3
Russian ports	389	130,656	53,180
Swedish ports	219	80,998	31,380
Baltic ports	85	58,190	43,640
North Sea ports	95	122,712	141,840
Other European	7	9,512	35,440
Atlantic	—	—	—
World	—	—	—

1 No reduction for emigrant ships' return cargo.

Source: Finnish Official Statistics I: p. II, 86.

APPENDIX IV:1. Shipping accounts used in this study.

The data is in the following order: name of ship, tonnage, years for which data exists on gross income, ditto on net result (any gaps in the material are indicated by "fr" = fragmentary) and, in the case of larger collections, archival signa. If the collection in question includes vessels of different domiciles, the domicile of each vessel is given after its name (in brackets); otherwise the domicile is given after the name of the archive. The names of steamships are printed in **bold**.

Oulu Provincial Archives

Archives of the Sovio trading house (Raahe)

Ahto	640		67—78
Aino	503	72—88	61—88
Hera	1037	93—96	91—98
Ilpotar	624		64—80
Impi	638	68—95	67—95
Iris	753	83—94	86—94
Jenny	448	57—75	56—75
Kalervo	580	74—85	64—85
Lempi	600		68—73
Matts August	628	74—98	73—98
Oscar&Georg	509	82—83	
Roska	616	67—87	66—87
Saama	624	73—93	69—94
Unto	624	70—73	68—80

Archives of the Snellman trading house (Oulu)

Freden	436	57—73	57—73
Grefve Berg	598		64—72
Helios	524	69—86	60—77
Toivo	945	71—85	70—88

Archives of the Bergbohm trading house (Oulu)

Birger	742	91—92	
Karl	755	81—93	87—93
Oulu	147	65—81	

Archives of the Antman trading house (Oulu)

Seura	111	63—69	63—69

Pietarsaari (Jakobstad) Town Archives *("Sjömansarkivet")*

Jacobstad	583		62—72	Sign.	Jc:4
Mainio	377		52—90	"	Jc:1—2
Rauni	376		60—73	"	Jc:3
Superb	468		60—63	"	Jc:5
Vanadis	1020	82—92		"	Jc:37
Vesta	781		66—75	"	Jc:5—6

Nikula, *Malmska handelshuset i Jakobstad*, p. 374—

Rapide	545	68—72	

(Vidén), *Wasa—Nordsjö Ångbåts Ab*, p. 26, 38—39 (Vaasa/Vasa)

Fennia	205	74—81, 85—88	74—81,85—88
Patria	526	85—88	85—88
Clio	558	85—88	85—88
Iris	261	85—88	85—88

Norrvik, *Briggen Carl Gustaf* (Kristiinankaupunki/Kristinestad)

Carl Gustaf	342		75—87

Ahlstrom Oy, central archives, Noormarkku
Ledgers of A.Ahlström (Pori)

Garibaldi	773		71—73
Lankoski	620		66—75
Saarikoski	611		79—88
Suomi	805		69—74
Weljekset	246		60—62

Saarinen, "Rosenlew—yhtymän purjelaivanvarustus" (Pori)

Veritas	554	61—90	61—90

Kåhre, *Under Gustaf Eriksons flagga*, p. 55—

Lochee (Uusi-kaupunki)	1654	09—13	

Ålands Sjöfartsmuseum

Archives of Robert Mattsson (Vårdö, later Mariehamn)

California	2460	11—13	
Dundee	1998	10—13	
Endymion	1286	02—06	
Finland	546		88—08
Gessner	619	95—96	88—00
Hera	1037		98—01,08—09
Hermes	1012	01—14	00—14
Iris	753	01—06	
John Gill	931	00—08,14	01—14
Lima	971	04,06—07	
Mercur	657	98—00	
Mermerus	1671	04—09	00—13
Pehr Brahe	560	97—00,10—13	
Roxane	544	99	
Satama	476	99—00	
Slamat	889	12—13	12—13
St.Julien	1042	04	

Åland Provincial Archives

Archives of Gustaf Erikson (Mariehamn)

Borrowdale	1191	11—15

Kåhre, *Den åländska segelsjöfartens historia* (all the following vessels were either from Mariehamn or other parts of Åland)

Altai	397	03	91—07
Bachus	1234		97—02
Borrowdale	1191		00—09
Cedia	397		06—13
Emelia	284	93	
Isabel Brown	1231		04—10
Lotos	1197		98—03
Ocean	1239	02—08	00—11
Pera	1647		11—14
Prompt	1381		09—14
Silemi	132		98—04
Thomasina	1665		07—14

Turku Provincial Archives

Archives of G. A. Petrelius, ledgers (Turku/Åbo)

Aimo	780	85—90
Arvio	775	85—89
Jalo	1273	85—87
Lennätär	598	85—87
Neptun	416	85—89
Rurik	829	85—90
Turku	492	85—88

Åbo Akademi, Maritime archives

Amur (Turku)	207	62—69	62—69	Sign.	216
Astraea (Turku)	611	66—68	67—68	”	163
Atka (Turku)	373	60—73	60—73	”	221—224, 388
Esmeralda (Turku)	765	93—04	96—01	”	234—5
Express (Turku)	259	71—73	71—72	”	235—6, 323
Finland (Turku)	540	61—73	61—73	”	239—40
Marion Light—body (Turku)	2136	13—14		”	282
Pampa (Turku)	1633	13—14		”	282
Skandia (Turku)	272	79	78—80	”	260
Siivo (Turku)	324	91		”	249
Storfursten (Turku)	586	95—00	95—00	”	260—1
Aino (Luvia)	256	99—00		”	23
Kosack (Rauma)	244	97—98		”	23
Ystävät (Uusikaupunki)	654	89—95		”	209
Europa (Mariehamn)	984	99—00		”	KK7
Ada (Hitis)	215		73,75, 76—80	”	32,263
Albert (Vfjärd)	225		76—85	”	32
Alma (Vfjärd)	207	87	73—78, 82—85	”	23,32
Amanda (Vfjärd)	205		74—85	”	32
Amur (Nagu)	207	74—75		”	KK7
Anna (Vfjärd)	350		74—84, 95—97	”	32
Ele (Vfjärd)	210		81—97	”	32
Elsa (Korpo)	222	73—74, 76	73—74, 76—77	”	132

Emelia (Vfjärd)	323		69—80	”	32
Emma (Vfjärd)	215		77—83,97	”	32,363—4
Erika (Vfjärd)	238		71—96 (fr)	”	32
Gustafva (Vfjärd)	310		83—85	”	32
John (Vfjärd)	348		75,77,96	”	363—4
Lina (Vfjärd)	348		73—97 (fr)	”	32
Nyfart (Kimito)	269		81—85, 93—97	”	32
Orient (Korpo)	442	05		”	412
Oskar (Korpo)	528	00—02	98—02	”	162
Lina (Vfjärd)	281	81—82,95		”	249—50
Selma (Vfjärd)	152		70—73	”	32
Veni (Kimito)	312		93—97	”	32
Viktor (Vfjärd)	204		75—78	”	363—4
Finska Skolskepps Rederiet (Helsinki)					
Favell	1309	11—14	11—14	Sign.	337
Fennia	2262	11—14	11—14	”	338
Glenard	1728	11—14	11—14	”	337
Finska Ångfartygs Ab (Helsinki)					
Sirius	664	84—13	84—13		
Orion	698	84—13	84—13		
Capella	607	88—13	88—13		
Argo	643	89—91	89—91		
Regulus	649	89—05	89—05		
Vesta	590	89—13	89—13		
Ceres	587	89—13	89—13		
Pallas	691	90—13	90—13		
Rhea	666	91—13	91—13		
Urania	664	91—13	91—05		
Astraea	635	91—13	91—13		
Uleåborg	404	92—13	92—13		
Jakobstad	392	92—13	92—05		
Wasa	392	92—99	92—99		
Von Döbeln	413	92—13	92—13		
Torneå	497	92—13	92—13		
Norra Finland	340	92—09	92—09		
Åbo	283	93—97	93—97		
Finland	376	93—98	93—98		
Express	255	94—01	94—01		
Titania	1210	96—01	96—01		
Oberon	1214	96—01	96—01		
Tor	190	96—13	96—13		

Ariadne	1223	97—01	97—01
Wellamo	613	98—13	98—13
Castor	564	98—01	98—01
Oihonna	470	98—13	98—13
Pollux	711	98—13	98—13
Virgo (I)	413	98—05	98—05
Arcturus	1117	99—13	99—13
Polaris	1150	99—13	99—13
Algol	1270	02—13	02—13
Leo	1271	02—13	02—13
Juno	651	06—13	06—13
Virgo (II)	572	06—13	06—13
Vega	514	06—13	06—13
Ursus	116	06—13	06—13
Leda	693	08—13	08—13
Titania	1997	08—13	08—13
Prinsessan Margareta	781	09—12	09—12
Taurus	160	10—13	10—13
Mira (ex. Virgo)	413	12—13	12—13
Poseidon	406	12—13	12—13
Lyra	205	12—13	12—13

Lindberg, *Ångbåssjöfart i Åbo 1836—1928*, ch. VII—VIII (Turku)

Aura	211	83	83
Bore I	723		98—99
Finland	357	83,85—86	83, 85—86
Grefve Berg	148	67,72	67, 72
Nordkusten	281	96	96
Pehr Brahe	323	81	81
Suomi	240	67	67
Åbo	283	83, 85—86	83, 85—86
Österbotten	246	67,72	67, 72

Börman, *Åboländsk bygdeseglation*, app. 11

Ada (Hitis)	217	81	81
Agent (Nagu)	263	72—96	72—96
Agio (Nagu)	325	83—86	83—86
Aimo (Nagu)	780	89—94	89—94

Alma (Vfjärd)	207	85,87,96	85,87,96
Anna (Nagu)	519	82—86	82—86 (fr)
Bertha (Dfjärd)	316	75—92 (fr)	75—92 (fr)
Veni (Kimito)	312	84—85,00—08	95—08 (fr)

Jyväskylä Provincial Archives

Archives of August Eklöf Ab. (Porvoo)

Hilda	291	69—74	69—74
Regina	594	74—16	71—16

Archives of Paul Wahl & Co (Wiborg)

Ahkera	122		62—68
Auguste	398		62—69
Ilmatar	259		62—69
Lloyd	163	75—77	75—77
Martin Luther	1025		64—66
Velox	130		62—67

Klamin suvun vaiheita, p. 80,96 (Virolahti)

Avu	389	67—70	67—70
Philemon	356	73—78	73—78

APPENDIX IV:2A. Gross income and net result per year and net ton in the Finnish sailing fleet, 1860—1914.

N = number of cases
Aver. = Weighted average
Dev. = Standard deviation (s) of unweighted arithmetic average
Err. = Standard error of estimate ($s/\sqrt{N}$)
£ = Pounds sterling and fractions
FM = Finnish marks and fractions

NB: Year denotes here total accounting time, incl. eventual laying up.

a. All vessels sailing through the year

Period	Gross income					Net result				
	N	Aver.		Dev.	Err.	N	Aver.		Dev.	Err.
		£	FM	FM	FM		£	FM	FM	FM
1858—62	4	4.34	119.8	12.6	6.3	8	1.71	47.2	11.4	4.0
1861—64	8	5.30	142.9	42.7	15.1	18	1.63	43.9	26.2	6.2
1863—67	13	5.82	153.5	45.2	12.5	29	1.41	37.3	31.1	5.8
1866—69	13	4.52	115.2	35.2	9.8	33	0.89	22.8	21.0	3.7
1868—72	22	4.39	111.2	26.6	5.7	53	0.95	24.1	19.2	2.6
1871—74	21	4.40	111.0	24.5	5.3	43	1.02	25.8	16.1	2.4
1873—77	23	4.04	115.8	19.9	4.2	41	0.72	18.7	21.0	3.3
1876—79	13	3.57	93.8	22.8	6.3	28	0.41	10.6	11.4	2.1
1878—82	14	3.51	88.9	17.1	4.6	25	0.39	9.9	11.6	2.3
1881—84	17	3.41	86.3	14.1	3.4	22	0.25	6.3	11.2	2.4
1883—87	21	3.00	76.1	14.5	3.2	33	0.15	3.7	9.0	1.6
1886—89	14	3.15	79.9	14.1	3.8	32	0.34	8.8	12.7	2.3
1888—92	22	3.10	78.5	15.3	3.3	30	0.37	9.4	14.6	2.7
1891—94	14	2.71	68.7	13.6	3.6	16	0.13	3.2	9.5	2.4
1893—97	15	2.73	69.0	20.7	5.3	17	0.35	8.8	8.8	2.1
1896—99	16	3.10	78.5	24.5	6.1	19	0.52	13.2	10.3	2.4
1898—1902	11	3.03	76.9	22.0	6.6	19	0.71	17.9	14.8	3.4
1901—04	8	2.37	60.1	12.8	4.5	18	0.59	14.9	15.5	3.6
1903—07	9	2.24	56.9	7.1	2.4	24	0.32	8.1	7.4	1.5
1906—09	6	2.30	58.5	12.0	4.9	18	0.27	6.8	6.4	1.5
1908—12	8	2.70	68.4	12.1	4.3	28	0.42	10.6	7.8	1.5
1911—14	13	3.13	79.8	26.3	7.3	21	0.78	19.8	15.1	3.3
1913—14	5	4.29	109.9	24.2	10.8	8	1.25	32.1	17.7	6.2

b. Long-trading vessels over 400 net tons

Period	Gross income					Net result				
	N	Aver.		Dev.	Err.	N	Aver.		Dev.	Err.
		£	FM	FM	FM		£	FM	FM	FM
1858—62	3	4.19	115.7	11.3	6.5	5	1.75	48.3	13.8	6.9
1861—64	5	4.96	133.8	48.2	21.5	9	1.87	50.4	24.4	8.1
1863—67	8	5.34	140.6	38.9	13.8	15	1.58	41.8	22.0	5.7
1866—69	10	4.06	103.5	30.4	9.6	22	1.01	25.8	18.8	4.0
1868—72	16	4.41	111.8	22.2	5.5	40	1.03	26.1	14.7	2.3
1871—74	17	4.46	112.5	19.1	4.6	36	1.05	26.4	13.2	2.2
1873—77	20	4.06	106.3	19.5	4.4	33	0.78	20.3	19.4	3.4
1876—79	13	3.57	93.8	22.8	6.3	24	0.44	11.5	10.1	2.1
1878—82	14	3.51	88.9	17.1	4.6	20	0.49	12.4	9.1	2.0
1881—84	17	3.41	86.3	14.1	3.4	19	0.29	7.3	10.2	2.3
1883—87	19	3.05	77.3	12.5	2.9	28	0.17	4.2	7.8	1.5
1886—89	14	3.15	79.9	14.1	3.8	29	0.39	10.0	12.1	2.2
1888—92	22	3.10	78.5	15.3	3.3	29	0.40	10.2	13.8	2.6
1891—94	14	2.71	68.7	13.6	3.6	16	0.13	3.2	9.5	2.4
1893—97	15	2.73	69.0	20.7	5.3	17	0.35	8.8	8.8	2.1
1896—99	15	3.08	77.8	24.8	6.4	19	0.52	13.2	10.3	2.4
1898—1902	10	3.01	76.4	22.2	7.0	19	0.71	17.9	14.8	3.4
1901—04	8	2.37	60.1	12.8	4.5	18	0.59	14.9	15.5	3.6
1903—07	9	2.24	56.9	7.1	2.4	24	0.32	8.1	7.4	1.5
1906—09	6	2.30	58.5	12.0	4.9	18	0.27	6.8	6.4	1.5
1908—12	8	2.70	68.4	12.1	4.3	28	0.42	10.6	7.8	1.5
1911—14	13	3.13	79.8	26.3	7.3	21	0.78	19.8	15.1	3.3
1913—14	5	4.29	109.9	24.2	10.8	8	1.25	32.1	17.7	6.2

c. Vessels laid up for the winter (sailing on the Baltic and the North Sea)

Period	Gross income					Net result				
	N	Aver.		Dev.	Err.	N	Aver.		Dev.	Err.
		£	FM	FM	FM		£	FM	FM	FM
1858—62	0	..	..	.	.	0	..	..	.	.
1861—64	1	(3.8)	(101.5)	.	.	1	(0.66)	(17.8)	.	.
1863—67	3	3.81	100.3	18.8	10.8	3	0.39	10.2	8.9	5.2
1866—69	3	3.57	90.9	19.9	11.5	3	0.60	15.3	12.5	7.2
1868—72	2	(4.3)	(107.8)	8.2	4.1	3	0.95	24.1	18.8	10.9
1871—74	4	3.80	95.8	23.6	11.8	11	1.43	36.2	16.2	4.9
1873—77	8	3.45	90.3	18.3	6.5	28	1.24	32.4	14.5	2.7
1876—79	7	3.09	81.9	17.9	6.8	20	0.69	18.2	16.2	3.6
1878—82	8	2.72	68.7	11.6	4.1	22	0.55	14.0	11.6	2.5
1881—84	8	2.61	66.1	13.0	4.6	17	0.82	20.9	6.9	1.7
1883—87	8	2.16	54.9	11.1	3.9	22	0.38	9.7	6.0	1.3
1886—89	6	1.79	45.5	10.7	4.4	8	0.47	11.9	7.1	2.5
1888—92	8	2.04	51.8	11.9	4.2	10	0.48	12.2	6.3	2.0
1891—94	6	2.06	52.2	10.7	4.4	13	0.40	10.1	5.5	1.5
1893—97	10	1.78	45.1	7.0	2.2	24	0.36	9.1	5.3	1.1
1896—99	7	1.69	42.6	9.6	3.6	18	0.39	9.8	5.3	1.3
1898—1902	9	1.66	42.0	10.3	3.4	15	0.38	9.7	6.7	1.7
1901—04	9	1.62	41.2	10.2	3.4	11	0.10	2.5	12.8	3.9
1903—07	12	1.52	38.6	11.9	3.4	14	0.06	1.5	10.4	2.8
1906—09	6	1.45	37.0	15.7	6.4	7	0.29	7.3	3.7	1.4
1908—12	4	1.98	50.2	19.6	9.8	5	0.22	5.7	6.5	2.9
1911—14	3	2.68	68.4	5.8	3.4	6	0.36	9.2	9.8	4.0
1913—14	2	(2.7)	(68.4)	8.0	5.7	3	0.55	14.0	8.7	5.0

Source: Data file collected from the accounts specified in appendix IV:1.

APPENDIX IV:2B. Gross income and net result of Finnish steamships, per year and net ton, 1860—1913.

N = number of cases
Aver. = Weighted average
Dev. = Standard deviation (s) of weighted arithmetic average
Err. = Standard error of estimate (s/√N)
£ = Pounds sterling and fractions
FM = Finnish marks and fractions

NB: Year denotes here total accounting time, incl. eventual laying up.

a. Data from diverse accounts before 1900

1 = all vessels
2 = passenger vessels
3 = bulk cargo vessels

Period	Gross income					Net result				
	N	Aver.		Dev.	Err.	N	Aver.		Dev.	Err.
		£	FM	FM	FM		£	FM	FM	FM
1865—68:1	4	28.33	719.5	299.7	149.9	3	(—0.5)	(—11.8)	.	.
1871—80:1	12	15.27	394.6	163.2	42.1	10	3.91	101.0	55.2	17.5
:3	7	13.06	337.0	..	..	7	4.36	112.6	..	..
1880—86:1	7	15.31	388.1	52.4	18.5	8	3.36	85.4	34.2	12.9
:3	1	(16.81	426.4)	..	..	1	(5.48	139.0)	..	..)
1885—89:1	10	12.78	324.2	78.2	24.7	10	3.56	90.2	31.5	10.0
:3	8	12.52	317.7	..	..	8	3.55	89.8	..	..
1896—99:1	1	(24.37	616.3)	.	.	3	(4.32	109.3)	60.6	35.0

b. Data from the accounts of *Finska Ångfartygs Ab* : detailed calculations.

1 = Cargo ships over 500 nt, sailing beyond the Sound
2 = Passenger ships over 500 nt ("emigrant ships")
3 = Baltic passenger (passenger/cargo) ships

Period	Gross income						Net result				
	N	Aver.		Dev.	Err.	N	Aver.		Dev.	Err.
		£	FM	FM	FM		£	FM	FM	FM
1885: 1	2	13.78	349.5	89.4	63.2	2	2.08	52.7	34.6	24.5
1895: 1	8	14.98	378.5	76.0	26.9	8	1.92	48.4	35.1	12.4
:2	2	49.21	1243.5	12.9	9.1	2	7.99	202.0	3.7	2.6
:3	9	14.84	375.0	165.4	55.1	9	1.74	44.0	87.3	29.1
1905: 1	10	13.28	336.9	60.7	19.2	10	1.88	47.6	29.4	9.3
:2	4	72.29	1834.1	500.1	250.1	4	11.95	303.1	107.6	53.8
:3	7	16.98	430.9	171.9	65.0	7	1.66	42.1	66.2	25.0
1913: 1	12	18.45	468.3	109.7	31.7	12	2.72	69.2	47.7	12.8
:2	4	88.39	2244.2	722.0	361.0	4	9.05	229.7	178.2	89.1
:3	5	33.74	856.7	218.7	97.8	5	6.83	173.5	75.0	33.6

c. Data from the accounts of *Finska Ångfartygs Ab* : gross income (cash) and profits (excluding company overhead costs) of individual ships.

1 = Cargo ships over 500 nt, sailing beyond the Sound
2 = Passenger ships over 500 nt ("emigrant ships")
3 = Baltic passenger (passenger/cargo) ships

MK= average in Finnish marks; % = passenger income percentage of gross income

Time	Gross income						Profits		
	1		2		3		1	2	3
	MK	%	MK	%	MK	%	MK	MK	MK
1885—87	340.2	2.1	—	.	—	.	57.7	—	—
1886—89	363.4	2.5	—	.	—	.	87.6	—	—
1888—92	398.3	2.2	—	.	—	.	73.5	—	—
1891—94	382.4	2.4	1049.7	44.6	285.2	40.8	40.7	86.3	5.2
1893—97	365.7	2.3	1339.8	40.9	386.8	41.3	45.0	234.2	72.4
1896—99	344.7	1.5	1565.8	45.9	460.8	39.1	44.4	301.7	91.7
1898—1902	331.8	1.0	1641.1	62.1	453.0	35.4	51.8	224.3	36.8
1901—04	308.0	1.3	1666.4	70.2	453.5	32.9	28.6	181.7	23.0
1903—07	326.6	2.4	2064.8	72.7	494.1	34.5	28.9	257.3	40.3
1906—09	314.8	1.9	2203.5	75.0	533.8	43.1	28.4	290.0	55.2
1908—12	343.0	—	1468.1	72.5	580.1	52.1	45.9	143.8	74.9
1911—13	415.1	0.0	1538.9	68.7	721.7	52.2	76.2	162.3	150.4
1912—13	427.8	0.0	1724.4	71.1	760.1	50.3	84.4	190.0	156.5

Source: Data file collected from the accounts specified in appendix IV:1.

APPENDIX IV:3. Estimates of gross income.

a. Sailing vessels

1863/67

1. According to tonnage and average income for different shipping categories

	Tonnage in question	Aver. income FIM/nt	Resultant gross income 1000 FIM
Long-traders	103,000	141	14,523
Baltic and North Sea traders	48,600	98	4,763
Coastal traders	33,400	60	2,004
	Total		21,290

2. According to tons and the regression of nautical miles to income per ton (y=20.93+0.010x, net tons and ton-miles according to table 3:7) for cross trade, and average freight per ton in principal export and import transport; for coastal trade as in table 1. Thousand FIM.

Cross-trade:	Baltic	165.5
	North Sea	1,029.8
	Other European	5,758.1
	Atlantic	3,703.9
	World	3,138.8
	Total	13,796.1
Export:	Baltic	1,764.4
	North Sea	2,546.6
	Other	1,864.7
	Total	6,175.7
Import:	Baltic	432.0
	North Sea	116.6
	Other	638.0
	Total	1,186.6
Coastal trade		2,004.0
	Grand total	23,162.4

1. According to tonnage and average income for different shipping categories

	Tonnage in question	Aver. income FIM/nt	Resultant gross income 1000 FIM
Long-traders	95,900	106.3	10,194
Baltic and North Sea traders	112,740	90.3	10,180
Coastal traders	29,030	60	1,742
	Total		22,116

2. According to tons and the regression of nautical miles to income per ton (y=13.43+0.001x, net tons and ton-miles according to table 3:7) for cross trade, and average freight per ton in principal export and import transport; for coastal trade as in table 1. Thousand FIM.

Cross-trade:	Baltic	215.6
	North Sea	2,299.0
	Other European	1,205.8
	Atlantic	5,543.8
	World	3,944.9
	Total	13,209.1
Export:	Baltic	1,019.2
	North Sea	3,842.0
	Other	656.0
	Total	5,517.2
Import:	Baltic	370.0
	North Sea	72.0
	Other	575.0
	Total	1,017.0
Coastal trade		1,741.8
	Grand total	21,485.1

1. According to tonnage and average income for different shipping categories

	Tonnage in question	Aver. income FIM/nt	Resultant gross income 1000 FIM
Long-traders	64,300	77.3	4,970
Baltic and North Sea traders	117,260	54.9	6,438
Coastal traders	26,510	50	1,326
	Total		12,734

2. According to tons and the regression of nautical miles to income per ton (y=21.2+0.0033x, net tons and ton-miles according to table 3:7) for cross trade, and average freight per ton in principal export and import transport; for coastal trade as in table 1. Thousand FIM.

Cross-trade:	Baltic	105.0
	North Sea	2,046.7
	Other European	343.5
	Atlantic	3,187.9
	World	755.5
	Total	6,438.6
Export:	Baltic	650.0
	North Sea	1,184.0
	Other	1,120.0
	Total	2,954.0
Import:	Baltic	108.0
	North Sea	132.0
	Other	416.0
	Total	656.0
Coastal trade		1,325.5
	Grand total	11,374.1

1. According to tonnage and average income for different shipping categories

	Tonnage in question	Aver. income FIM/nt	Resultant gross income 1000 FIM
Long-traders	74,700	69.0	5,154
Baltic and North Sea traders	76,940	45.1	3,470
Coastal traders	29,720	45	1,337
	Total		9,962

2. According to tons and the regression of nautical miles to income per ton (y=9.4+0.0054x, net tons and ton-miles according to table 3:7) for cross trade, and average freight per ton in principal export and import transport; for coastal trade as in table 1. Thousand FIM.

Cross-trade:	Baltic	92.8
	North Sea	1,155.8
	Other European	111.8
	Atlantic	2,710.6
	World	867.4
	Total	4,938.4
Export:	Baltic	884.8
	North Sea	1,177.6
	Other	420.0
	Total	2,482.4
Import:	Baltic	60.0
	North Sea	176.0
	Other	304.0
	Total	540.0
Coastal trade		1,337.4
	Grand total	9,298.2

1. According to tonnage and average income for different shipping categories

	Tonnage in question	Aver. income FIM/nt	Resultant gross income 1000 FIM
Long-traders	78,100	56.9	4,444
Baltic and North Sea traders	68,220	38.6	2,633
Coastal traders	37,960	45	1,708
	Total		8,785

2. According to tons and the regression of nautical miles to income per ton (y=11.6+0.0027x, net tons and ton-miles according to table 3:7) for cross trade, and average freight per ton in principal export and import transport; for coastal trade as in table 1. Thousand FIM.

Cross-trade:	Baltic	94.7
	North Sea	729.3
	Other European	19.7
	Atlantic	948.7
	World	2,651.3
	Total	4,443.7
Export:	Baltic	828.0
	North Sea	858.0
	Other	163.8
	Total	1,849.8
Import:	Baltic	40.0
	North Sea	117.0
	Other	99.0
	Total	256.0
Coastal trade		1,708.2
	Grand total	8,257.7

1. According to tonnage and average income for different shipping categories

	Tonnage in question	Aver. income FIM/nt	Resultant gross income 1000 FIM
Long-traders	91,100	79.8	7,270
Baltic and North Sea traders	47,760	68.4	3,267
Coastal traders	40,470	50	2,024
	Total		12,561

2. According to tons and the regression of nautical miles to income per ton (y=20.9+0.0026x, net tons and ton-miles according to table 3:7) for cross trade, and average freight per ton in principal export and import transport; for coastal trade as in table 1. Thousand FIM.

Cross-trade:	Baltic	135.6
	North Sea	751.0
	Other European	49.5
	Atlantic	1,221.9
	World	5,874.4
	Total	8,032.4
Export:	Baltic	1,440.0
	North Sea	864.0
	Other	140.0
	Total	2,440.0
Import:	Baltic	195.0
	North Sea	187.0
	Other	82.5
	Total	464.5
Coastal trade		2,023.5
	Grand total	12,960.4

Source: Tables 3:4—9, appendix IV:2A, accounts specified in appendix IV:1.

b. Steamships

C. 1865

Shipping category	Tonnage in question	Aver. income FIM/nt	Resultant gross income 1000 FIM
A. Over 100 nt	2,110	545	1,150.0
B. Under 100 nt	555	330	183.2
Total		1,333.2	

NB:Foreign traffic = category A.

C. 1875

Shipping category	Tonnage in question	Aver. income FIM/nt	Resultant gross income 1000 FIM
A. North Sea liners	251	309	77.6
B. Auxiliaries	1,960	250	490.0
C. Baltic ships over 100 nt	4,695	415	1,948.4
D. Under 100 nt	1,295	290	375.6
	Total		2,891.6

NB:Foreign traffic = category A + B + C.

1883/87

Shipping category	Tonnage in question	Aver. income FIM/nt	Resultant gross income 1000 FIM
A. North Sea liners	2,450	297	727.5
B. Auxiliaries	370	200	74.0
C. Baltic ships over 300 nt	3,280	340	1,115.2
D. 100>300nt	3,940	340	1,339.6
E. Under 100 nt	2,080	220	457.6
	Total		3,713.9

NB: Foreign traffic = category A + B + C + 0.8x(category D) = 2,988

1893/97

Shipping category	Tonnage in question	Aver. income FIM/nt	Resultant gross income 1000 FIM
A. Emigrant ships (FÅA)	1,300	1,340	1,742.0
B. Liners sailing beyond the Baltic	5,650	370	2,090.5
C. Tramps sailing beyond the Baltic	1,570	240	376.8
D. Baltic ships over 300 nt	5,620	370	2,079.4
E. Baltic ships 100>300 nt	4,995	200	999.4
F. Baltic ships under 100 nt	2,815	150	422.1
	Total		7,710.2

NB: Foreign traffic = category A + B + C + D + 0.7x(category E) = 6,988.

1903/07

Shipping category	Tonnage in question	Aver. income FIM/nt	Resultant gross income 1000 FIM
A. Emigrant ships (FÅA)	3,570	2,065	7,372.1
B. Liners sailing beyond the Baltic	10,500	325	3,412.5
C. Tramps sailing beyond the Baltic	14,500	160	2,320.0
D. Baltic ships over 300 nt	7,100	400	2,840.4
E. Baltic ships 100>300 nt	5,645	200	1,128.4
F. Baltic ships under 100 nt	3,270	150	490.7
	Total		17,564.1

NB: Foreign traffic = category A + B + C + D + 0.8x(category E) = 16,848.

1911/13

Shipping category	Tonnage in question	Aver. income FIM/nt	Resultant gross income 1000 FIM
A. Emigrant ships (FÅA)	4,900	1,540	7,546.0
B. Liners sailing beyond the Baltic	19,450	415	8,071.8
C. Tramps sailing beyond the Baltic	14,500	190	2,755.0
D. Baltic ships over 300 nt[1]	6,900	580	4,009.0
E. Baltic ships 100>300 nt[1]	6,045	333	2,015.7
F. Baltic ships under 100 nt	4,540	200	908.2
	Total		25,305.7

NB: Foreign traffic = category A + B + C + D + 0.65x(category E) = 23,692.

1 Including 1,360 nt of cargo vessels in category D and 2,820 nt in category E; respective average income was estimated at 300 and 250 FIM/nt.

Source: Tables 3:10—15, appendix IV:2B, accounts specified in appendix IV:1.

APPENDIX IV:4. Estimation of value-added.

a. Sailing vessels

1863/67

	Tonnage category		
	Long traders	Baltic and North Sea traders	Coastal traders
Tonnage in question	103,000	48,600	33,400
Net result:			
Value per net ton, FIM	41.8	15.0	13.5
Total quantity, 1000 FIM	4,300	729	450
Wages:[1]			
Value per net ton, FIM	14.1	11.5	10.7
Total quantity, 1000 FIM	1,455	560	357
Masters' salaries:[2]			
Value per net ton, FIM	9.1	11.5	9.5
Total quantity, 1000 FIM	937	561	317
Food costs:[3]			
Value per net ton, FIM	12.0	9.8	..
Total quantity, 1000 FIM	1,237	476	..
Total value-added:			
Value per net ton, FIM	77.0	47.9	33.7
Total quantity, 1000 FIM	7,929	2,326	1,124

1 Wages were computed using the known average wages per man and man-ton ratios. For long traders, the working year was computed at 12 months, for Baltic and North Sea traders at 7 months and for coastal traders at 6.5 months.

2 Masters' salaries were been computed according to the known average monthly salaries (working year as for wages) and average *kaplake*. On coastal vessels they were assumed to total 60 FIM/month.

3 Food costs were computed at 85 % of wages.

1873/77

	Tonnage category		
	Long traders	Baltic and North Sea traders	Coastal traders
Tonnage in question	95,900	112,740	29,030
Net result:			
Value per net ton, FIM	20.3	32.4	15.0
Total quantity, 1000 FIM	1,947	3,653	436
Wages:[1]			
Value per net ton, FIM	13.1	11.4	12.5
Total quantity, 1000 FIM	1,259	1,280	362
Masters' salaries:[2]			
Value per net ton, FIM	8.8	8.5	10.5
Total quantity, 1000 FIM	847	956	305
Food costs:[3]			
Value per net ton, FIM	9.8	8.6	..
Total quantity, 1000 FIM	946	957	..
Total value-added:			
Value per net ton, FIM	52.1	60.7	38.0
Total quantity, 1000 FIM	4,999	6,846	1,103

1 Wages were computed using the known average wages per man and man-ton ratios. For long traders, the working year was computed at 12 months, for Baltic and North Sea traders at 7 months and for coastal traders at 6.5 months.

2 Masters' salaries were computed according to the known average monthly salaries (working year as for wages) and average *kaplake*. On coastal vessels they were assumed to total 70 FIM/month.

3 Food costs were computed at 75 % of wages.

1883/87

	Tonnage category		
	Long traders	Baltic and North Sea traders	Coastal traders
Tonnage in question	64,300	117,260	26,510
Net result:			
Value per net ton, FIM	4.2	9.7	8.5
Total quantity, 1000 FIM	270	1,137	225
Wages:[1]			
Value per net ton, FIM	10.9	9.8	10.0
Total quantity, 1000 FIM	700	1,145	266
Masters' salaries:[2]			
Value per net ton, FIM	5.0	6.8	9.3
Total quantity, 1000 FIM	324	803	247
Food costs:[3]			
Value per net ton, FIM	7.7	7.0	..
Total quantity, 1000 FIM	497	813	..
Total value-added:			
Value per net ton, FIM	27.9	33.2	27.8
Total quantity, 1000 FIM	1,791	3,898	738

1 Wages were computed using the known average wages per man and man-ton ratios. For long traders, the working year was computed at 12 months, for Baltic and North Sea traders at 7 months and for coastal traders at 6.5 months.

2 Masters' salaries were computed according to the known average monthly salaries (working year as for wages) and average *kaplake*. On coastal vessels they were assumed to total 60 FIM/month.

3 Food costs were computed at 71 % of wages.

1893/97

	Tonnage category		
	Long traders	Baltic and North Sea traders	Coastal traders
Tonnage in question	74,700	76,940	29,720
Net result:			
Value per net ton, FIM	8.8	9.1	15.0
Total quantity, 1000 FIM	657	700	446
Wages:[1]			
Value per net ton, FIM	9.5	9.6	10.7
Total quantity, 1000 FIM	711	739	318
Masters' salaries:[2]			
Value per net ton, FIM	4.7	5.8	9.1
Total quantity, 1000 FIM	350	450	270
Food costs:[3]			
Value per net ton, FIM	5.7	5.8	..
Total quantity, 1000 FIM	426	443	..
Total value-added:			
Value per net ton, FIM	28.7	30.3	34.8
Total quantity, 1000 FIM	2,144	2,332	1,034

1 Wages were computed using the known average wages per man and man-ton ratios. For long traders, the working year was computed at 12 months, for Baltic and North Sea traders at 7 months and for coastal traders at 6.5 months.

2 Masters' salaries were computed according to the known average monthly salaries (working year as for wages) and average *kaplake*. On coastal vessels they were assumed to total 60 FIM/month.

3 Food costs were computed at 60 % of wages.

1903/07

	Tonnage category		
	Long traders	Baltic and North Sea traders	Coastal traders
Tonnage in question	78,100	68,220	37,960
Net result:			
Value per net ton, FIM	8.1	1.5	12.0
Total quantity, 1000 FIM	633	102	456
Wages:[1]			
Value per net ton, FIM	8.4	9.4	9.7
Total quantity, 1000 FIM	654	640	367
Masters' salaries:2			
Value per net ton, FIM	3.2	5.6	9.1
Total quantity, 1000 FIM	249	379	344
Food costs:3			
Value per net ton, FIM	5.4	6.1	..
Total quantity, 1000 FIM	425	416	..
Total value-added:			
Value per net ton, FIM	25.1	22.5	30.7
Total quantity, 1000 FIM	1,961	1,537	1,167

1 Wages were computed using the known average wages per man and man-ton ratios. For long traders, the working year was computed at 12 months, for Baltic and North Sea traders at 7 months and for coastal traders at 6.5 months.

2 Masters' salaries were computed according to the known average monthly salaries (working year as for wages) and average *kaplake*. On coastal vessels they were assumed to total 60 FIM/month.

3 Food costs were computed at 65 % of wages.

1911/13

	Tonnage category		
	Long traders	Baltic and North Sea traders	Coastal traders
Tonnage in question	91,100	47,760	40,470
Net result:			
Value per net ton, FIM	19.8	9.2	20.0
Total quantity, 1000 FIM	1,804	439	809
Wages:[1]			
Value per net ton, FIM	9.5	13.0	11.2
Total quantity, 1000 FIM	861	622	455
Masters' salaries:2			
Value per net ton, FIM	3.4	8.1	10.3
Total quantity, 1000 FIM	306	386	415
Food costs:3			
Value per net ton, FIM	6.1	8.5	..
Total quantity, 1000 FIM	560	404	..
Total value-added:			
Value per net ton, FIM	38.8	38.8	41.5
Total quantity, 1000 FIM	3,531	1,851	1,679

1 Wages were computed using the known average wages per man and man-ton ratios. For long traders, the working year was computed at 12 months, for Baltic and North Sea traders at 7 months and for coastal traders at 6.5 months.

2 Masters' salaries were computed according to the known average monthly salaries (working year as for wages) and average *kaplake*. On coastal vessels they were assumed to total 70 FIM/month.

3 Food costs were computed at 65 % of wages.

Source: Net result: appendix IV:2A; wages, masters' salaries and food costs: tables 2:25—29.

b. Steamships

C. 1865

	Tonnage category	
	Over 100 nt	Under 100 nt
Tonnage in question	2,114	555
Net result:		
Value per net ton, FIM	100	60
Total quantity, 1000 FIM	211	33
Wages:[1]		
Value per net ton, FIM	26.3	57.7
Total quantity, 1000 FIM	56	32
Masters' salaries:[2]		
Value per net ton, FIM	11.8	29.4
Total quantity, 1000 FIM	25	16
Food costs:[3]		
Value per net ton, FIM	17.1	37.5
Total quantity, 1000 FIM	36	21
Total value-added:		
Value per net ton, FIM	155.2	183.8
Total quantity, 1000 FIM	328	102

1 Wages were computed using the known average wages per man and man-ton ratios. For all steamships the working year has been computed at 6.5 months.

2 Masters' salaries were computed according to the known average monthly salaries (working year as for wages) and average *kaplake.* 3 Food costs were computed at 65 % of wages.

C. 1875

	Tonnage category		
	Over 100 nt		Under
	Steamships	Auxiliaries	100 nt
Tonnage in question	4,947	1,960	1,297
Net result:			
Value per net ton, FIM	100	50	50
Total quantity, 1000 FIM	495	98	65
Wages:[1]			
Value per net ton, FIM	28.5		64.8
Total quantity, 1000 FIM	197		84
Masters' salaries:[2]			
Value per net ton, FIM	9.6		26.3
Total quantity, 1000 FIM	66		34
Food costs:[3]			
Value per net ton, FIM	18.5		42.1
Total quantity, 1000 FIM	128		55
Total value-added:			
Value per net ton, FIM	142.5		183.5
Total quantity, 1000 FIM	984		238

1 Wages were computed using the known average wages per man and man-ton ratios. For all ships except auxiliary steamers the working year has been computed at 6.5 months.

2 Masters' salaries were computed according to the known average monthly salaries (working year as for wages) and average *kaplake*. 3 Food costs were computed at 65 % of wages.

	Tonnage category			
	Over 100 nt			Under
	North Sea liners	Auxil-iaries	Other	100 nt
Tonnage in question	2,456	368	7,211	2,080
Net result:				
Value per net ton, FIM	47.0	20.0	70.0	40.0
Total quantity, 1000 FIM	116	7	505	83
Wages:[1]				
Value per net ton, FIM		27.1		56.5
Total quantity, 1000 FIM		272		118
Masters' salaries:[2]				
Value per net ton, FIM		9.3		29.6
Total quantity, 1000 FIM		93		62
Food costs:[3]				
Value per net ton, FIM		17.6		36.7
Total quantity, 1000 FIM		177		76
Total value-added:				
Value per net ton, FIM		116.6		163.0
Total quantity, 1000 FIM		1,170		339

1 Wages were computed using the known average wages per man and man-ton ratios. For North Sea liners and auxiliaries the working year has been computed at 12 months, for others at 6.5 months.

2 Masters' salaries were computed according to the known average monthly salaries (working year as for wages) and average *kaplake*.

3 Food costs were computed at 65 % of wages.

		Tonnage category North Sea & long traders	Baltic traders	Coastal traders
Tonnage in question	a)	1,300	9,120	4,310
	b)	5,650		
	c)	1,570		
		8,520		
Net result:				
Value per net ton, FIM	a)	231.0	47.6	30.0
	b)	37.5		
	c)	30.0		
Total quantity, 1000 FIM	a)	300	434	129
	b)	212		
	c)	47		
		559		
Wages:[1]				
Value per net ton, FIM		24.1	24.9	52.4
Total quantity, 1000 FIM		206	227	226
Masters' salaries:[2]				
Value per net ton, FIM		8.9	11.6	29.9
Total quantity, 1000 FIM		76	106	129
Food costs:[3]				
Value per net ton, FIM		16.9	17.3	34.8
Total quantity, 1000 FIM		144	158	150
Total value-added:				
Value per net ton, FIM		115.6	101.4	147.1
Total quantity, 1000 FIM		985	925	634

a = emigrant ships (passenger ships sailing beyond the Baltic)
b = liner cargo ships
c = tramp cargo ships

1 Wages were computed using the known average wages per man and man-ton ratios. For long traders, the working year was computed at 12 months, for Baltic and North Sea traders at 7 months and for coastal traders at 6.5 months.
2 Masters' salaries were computed according to the known average monthly salaries (working year as for wages) and average *kaplake*.
3 Food costs were computed at 70 % of wages.

1903/07

		Tonnage category North Sea & long traders	Baltic traders	Coastal traders
Tonnage in question	a)	3,570	11,170	4,900
	b)	10,500		
	c)	14,500		
		28,570		
Net result:				
Value per net ton, FIM	a)	257.0	34.0	30.0
	b)	27.8		
	c)	23.0		
Total quantity, 1000 FIM	a)	917	380	147
	b)	292		
	c)	334		
		1,543		
Wages:[1]				
Value per net ton, FIM		20.0	26.5	36.9
Total quantity, 1000 FIM		572	296	181
Masters' salaries:[2]				
Value per net ton, FIM		7.5	14.5	36.7
Total quantity, 1000 FIM		215	162	180
Food costs:[3]				
Value per net ton, FIM		15.0	19.9	27.8
Total quantity, 1000 FIM		429	222	136
Total value-added:				
Value per net ton, FIM		96.6	94.9	131.4
Total quantity, 1000 FIM		2,759	1,060	644

a = emigrant ships (passenger ships sailing beyond the Baltic)
b = liner cargo ships
c = tramp cargo ships

1 Wages were computed using the known average wages per man and man-ton ratios. For long traders, the working year was computed at 12 months, for Baltic and North Sea traders at 7.5 months and for coastal traders at 6.5 months.
2 Masters' salaries were computed according to the known average monthly salaries (working year as for wages) and average *kaplake*.
3 Food costs were computed at 75 % of wages.

1911/13

	Tonnage category				
		North Sea & long traders		Baltic traders	Coastal traders
Tonnage in question	a)	4,900	d)	6,930	6,790
	b)	19,450	e)	3,770	
	c)	14,500			
		38,850		10,700	
Net result:					
Value per net ton, FIM	a)	151.0	d)	125.0	40.0
	b)	56.4	e)	30.0	
	c)	45.0			
Total quantity, 1000 FIM	a)	740	d)	866	271
	b)	1,094	e)	113	
	c)	653			
		2,487		979	
Wages:[1]					
Value per net ton, FIM		20.9		34.6	44.2
Total quantity, 1000 FIM		812		370	300
Masters' salaries:[2]					
Value per net ton, FIM		6.4		9.2	39.5
Total quantity, 1000 FIM		247		98	268
Food costs:[3]					
Value per net ton, FIM		15.7		25.9	33.1
Total quantity, 1000 FIM		609		277	225
Total value-added:					
Value per net ton, FIM		106.9		161.1	156.7
Total quantity, 1000 FIM		4,155		1,724	1,064

a = emigrant ships (passenger ships sailing beyond the Baltic)
b = liner cargo ships
c = tramp cargo ships
d = Baltic passenger ships
e = Baltic cargo ships

1 Wages were computed using the known average wages per man and man-ton ratios. For long traders, the working year was computed at 12

months, for Baltic and North Sea traders at 7.5 months and for coastal traders at 6.5 months.

2 Masters' salaries were computed according to the known average monthly salaries (working year as for wages) and average *kaplake*.

3 Food costs were computed at 75 % of wages.

Source: Net result: appendix IV:2B; wages, masters' salaries and food costs: tables 2:25—29.