ENGLISH SUMMARY

EFFICIENT BUSINESS ACTIVITY IN SMALL OSTROBOTHNIAN TOWNS

Profitability and Productivity of Shipping by Sail during the Eighteenth and Nineteenth Century

I INTRODUCTION

Aim of the study

It is a generally agreed that the productivity of shipping increased from the early seventeenth century until the early twentieth century. The causes for this development have been under discussion in literature. Douglass C. North has argued that organisational changes were more important for the productivity changes in ocean shipping prior to the mid-nineteenth century, whilst in the latter part of the nineteenth century "all the emphasis must be on technological change" (North 1968, 953). Most of the technological changes occurred in the latter part of the century (the change from sail to steam, and from wood to iron and steel). Still, there were minor technological changes even before this fundamental change and, on the other hand, shipping organisation developed gradually especially during the latter part of the nineteenth century.

This study analyses both the technological and organisational changes that affected the productivity of shipping. Technological changes are categorised as changes in ships (average size, speed, etc.) and shipping services (ports etc.), whilst organisational changes are discussed at the general level of business activities: the importance of the improvements in economic organisations that affected productivity of shipping by reducing transaction costs. Namely, to minimise transaction costs in order to make the organisation operate more effectively.

In both technological and organisational development the role played by individual actors was crucial: whether they chose the most efficient solutions. Rationality of the actors is therefore deterministically (over) simplified: rational actors choose the most efficient and profitable solutions. Rationality is seen, however, as a pattern of economic behaviour, but not as a synonym for the wealth-maximising behaviour. Rationality is in this study seen as "bounded rationality" (Simon): actors were willing to operate in the "most efficient" way but were not able to do so due to the biological, social, physical etc. limitations. Most of all: actors were lacking vital information or the information offered was imperfect. From these limitation transaction costs grew. Actors had to build up mechanisms in order to lower these costs. Unfortunately, usually these

mechanisms at the same time produced costs. Also, government played an important role in reducing transaction costs by securing property rights: by offering commercial aid to the shipowners, by enforcing contracts, and so on.

This study examines the issue of productivity changes both at the technological (Chapter V) and organisational level (Chapter VI). In order to analyse technological and organisational changes, one must first have a picture of the profitability and productivity development during the time period. This is done here by using simple input-output -model. We will first analyse the profitability development of the shipping industry in the time period (Chapter III), and then a model of productivity change is created (Chapter IV).

This study examines the issues related to productivity of shipping at the entrepreneurial level. The main question of this study is how the shipowners took into account the rising costs and falling profits? Did they develop their enterprise to be more productive in order to cut expenses? Were they willing or even able to make their enterprise more efficient? How did they try to affect the issues related to productivity, namely the technological issues and the organisational efficiency? The starting point is therefore rather deterministic (but fruitful): did the shipowners understand the (economic) gains of productivity improvements?

There are several problems in specifying inputs and outputs. In a historical study it is essential to know who determined the inputs and how, and who obtained the results. It is, however, difficult to link together human activity and an economic "mechanism", because it is almost impossible to measure human activity. We usually know the starting-point and the final outcome, yet we can not specify the activity in between. We can illustrate the change (for example in productivity) as a relation between the starting-point and the result (output:input), but we are limited to demonstrate only the essential causes for the changes. In this study the causes are summarised as several exogenous factors (international freight- and commodity markets, foreign trade and shipping policies etc., Chapter II), governmental institutional constraints, and activity of private enterprises themselves (Chapter VI) as well as the technological changes in vessels and shipping industries (Chapter V).

This study utilises three small Ostrobothnian towns, namely Raahe, Kokkola and Pietarsaari, as the main subjects for the research. These three were among the main shipping towns in Finland up to the mid-nineteenth century. Together their tonnage consisted circa 20–30 per cent of Finland's total merchant tonnage in the time period (Chart 1.1.). Their shipping industries flourished from the mid-eighteenth century on when they obtained the so-called staple rights. They were successful up to the late nineteenth century: together with the cease of shipping by sail also their importance as the major maritime towns in Finland faded away. Although Finland was a rather peripheral shipping area at the time, it still had a quite large merchant marine. Compared to the population, Finnish total tonnage was the fifth largest in the 1870s, right after Greece.

Sources

This study uses as sources several archives of private shipowning trading houses. For Raahe we have utilised the archives of trading house Sovelius (which consist of the shipping firms J. Lang & Co., Sovelius & Co. and also scattered documents from some other shipping enterprises), J. Lundberg & Co. (which consists of trading houses Fellman, Lundberg and Lundström) and Rein. For Kokkola we have employed the archives of trading house Donner together with the more scattered archives of trading houses Falander (from mid-eighteenth century) and Kyntzell (there is a collection of notes made from trading house Kyntzell's material made by a Finnish author before the original material was destroyed). For Pietarsaari the materials of trading houses Malm and Strengberg have been preserved. Fortunately, these trading houses were the most important ones in the sample towns during the time period. Unfortunately, they consist mainly of the material from the nineteenth century. Business accounts and letters are among the trading house materials used.

Also, some archives of the proper authorities are used. The most important ones are the annual reports to the Swedish Board of Trade on shipping and trade in each town, based on the Customs accounts. During the era of Russian rule, the same material was sent to Finnish senate. From the probate inventories (*bouppteckningar*) one can study the values of vessels and the economic success of the shipowners. In order to study the exact shipping routes of the vessels, the registers of the Finnish Marine Insurance Association are used. The archives of Kokkola's Seamen House (*sjömanhus*) provide the material in order to study labour productivity. Reports from the Swedish and Danish Consulates offer information on the eighteenth century business networks. The consular letters consist of ship and price lists and analysis of the economic and political situation in each port and country. Ship lists from the Danish Sound Toll account books provide not only the number and tonnage of the ships passed through the Sound, but also the names of the ship-agents in Elsinore (*Helsingör*).

II THE DEVELOPMENT OF TONNAGE AND EXOGENOUS FACTORS

Chapter II provides a general picture of the development of tonnage in the sample towns as well as the data on the important exogenous factors affecting the business. The "standards" for economic fluctuations in some important freight rates are presented here(Chart 2.2.) and also the number of ships passing through the Danish Sound (Chart 2.2.). The freight rates were falling during the whole nineteenth century, whilst the volume of shipping was rising all the time: in mid-nineteenth century three times more ships passed through the Sound than in the mid-1760s. To simplify: the volume of trade grew, which caused the need for more transport capacity. But when the supply of transport surpassed the need as a consequence of the growth of tonnage and, on the other hand, the

growth of productivity, freight rates fell consequently opening new possibilities for trade. This meant that competition tightened as did also the productivity of the international shipping industry. As far as the international framework is concerned, Finnish shipowners had to put weight on the productivity of the vessels and the efficiency of the shipping organisation in order to maintain their possessions in international shipping.

Kokkola obtained staple rights in 1765, which meant that she was allowed to engage in foreign trade directly. Raahe and Pietarsaari obtained staple rights in the 1790s, but they were also allowed to practise direct foreign trade from the mid-1760s on: their ships were forced to use Kokkola as their customs port. After the mid-1760s, the import and export business and, related to them, the shipping business grew in these towns. At first, shipping only provided support for the export and import business, but soon ships were engaged in the international cross trading as well.

From the middle of the eighteenth century to the First World War, Finnish shipping by sail faced at first a period of growth (ca. 1760s to 1870s), and then stagnation (ca. 1880s onwards).(Chart 2.3.) Growth accelerated during the first part of the nineteenth century as a consequence of international economic growth, liberalisation of international shipping (especially repeal of British Navigation Acts) and the improvements in Russian legislation (trade and shipping agreements with several countries). The Crimean War (1854–1856) was disastrous for Finnish shipping. Due to the war shipowners lost a sizeable share of tonnage in sales, captures, and sunken ships. After the War there was an active rebuilding in Raahe and Pietarsaari, but Kokkola lost its position after the war and partly already before the war: the last sailing ship in Kokkola was built in 1863.

Shipping declined in the sample towns during the late nineteenth century: stagnation started already in the late 1860s. At the beginning of the twentieth century, there were no more ocean faring merchant fleets in these towns. The death of shipping was mostly caused by exogenous factors: wooden sailing ships were no longer competitive in international freight markets.

III PROFITABILITY OF SHIPPING

Introduction

Chapter III examines the profitability of shipping in the time period (especially Chart 3.5.) and also the shipowners' economic success, wealth, and sound financial position (Charts 3.6.–3.9., Tables 3.6., 3.8–3.9.). The lack of private shipowners' account books makes the study of profitability of shipping industries problematic. There are account books only from few trading houses that operated in the shipping business. The data is merely somewhat representative from the late eighteenth century to the first decade of the nineteenth century, but from the 1820s up to the mid-1890s the data is a quite representative (Chart 3.1.). The number of accounts equals 1205, which corresponds to 1739 financial years.

Another problem relates to the value of money and exchange rates, and even the monetary units used in time period. We have dealt with these problems by deflating the money values with a cost-of-living index (see Appendix Tables I:1–6 for precise dividers of each monetary units and values in 1731–1912).

To calculate an average rate of return, annual net results are compared to the only real "capital stock"; namely, the current ship value. In this fashion we can calculate a crude estimate for the per cent return on the capital. There are, however, difficulties with the data used. Figures for the profitability estimates are collected from several trading house archives. Unfortunately the book keeping procedures were not the same in every case. For example, the account books of trading house Donner are mainly in the form of voyage cashflow accounts, which usually spanned several years. Therefore, the net profits were divided with the number of the years they covered. Ship accounts of the trading house Malm used in this study were all collected into a ledger-account-book, which contained annual accounts of each ship. For Raahe the material provided by the archives of trading house Sovelius (which consist of several shipping enterprises) are mainly either cashflow or annually based accounts. All the accounts were harmonised carefully.

Even the value of "capital stock", namely the price of the ship to which the net result is compared, entails a difficulty. Ship prices were collected from the account books (usually the building value is known, and sometimes even the prise of the sold ship) and from probate inventories. Annual depreciation was calculated for each ship. If there is, however, only one value for the ship, a seven per cent annual depreciation was used. (see especially Chart 3.4., Tables 3.2.–3.5.).

Operating and voyage costs have to be deducted from the gross earnings of the ship. The costs contain wages, outfit for the voyage (which usually also include victualling, minor repairs, and in some cases even crew costs), insurance, brokerage, charges, port dues etc., and the capital costs; namely, annual depreciation (See Chart 3.2.). The owners of the ship were in many cases the owners of the cargoes as well, which makes it difficult to estimate the earnings of the ship. Fluctuations in commodity prices, therefore, affected the shipping enterprise as well. Because it is almost impossible to separate the earnings and the costs of the ships' "cargoes of their own", these cargo costs were calculated as the "normal" costs for each vessel. These " cargoes of their own" consist not only of their own export and import cargoes but sometimes also cheap bulk cross trading cargoes such as salt and coal. These were bought with the ships' "own money", not shipped for freight earnings. (Table 3.1., Chart 3.3.)

Profitability

One might say that seafaring was a profitable business because so much money was invested in new ships every year.(Chart 3.5.) On the average, vessels of the sample towns produced 11 per cent profit on the capital invested. Changes in profits varied roughly according to international freight conditions. The annual

rate of return was at its highest during the turn of the eighteenth and nineteenth century. This was due to the ongoing European Revolutionary Wars (1792–1815): restlessness at the seas offered good freight earnings for ships with neutral flags, such as the Swedish flag. After the cease-fire, the Finnish shipping faced a crisis, which was caused by both lesser demand in the markets and the new institutional situation: adjusting to the statutes of the Age of Autonomy. The earnings increased again from the mid 1820s on. The average rate of return from the 1830s to the 1860s was about 10–20 per cent. Shipowners like Peter Malm jr. from Pietarsaari succeeded fairly well at the time (see especially Appendix Table III:9). There seems to be a constant fall in the rate of return from the early 1860s on. The rate of return dropped below zero during the mid-1880s and again in the 1890s, although at the same time the value of capital stock (value of the each vessel) was very low, because ships were already old and almost worthless. Shipping offered low returns from the late nineteenth century on.(Chart 3.5.)

Economic success of trading houses

Shipping played a key role in the trading houses' business. Shipping was not only one of the major branches of the trading houses' operations, but it also provided support for other areas of interests, foremost the export and import business. Shipping produced a great deal of the trading houses' revenues (Chart 3.8.) and vessels were an important part of the owners' property (Chart 3.9.). According to the probate inventories, the ships provided about one fifth of the owners' gross assets, and in some cases the share was even higher.(Tables 3.7.–3.8.)

Thus, shipping had quite a direct influence on the owners' prosperity. An interesting question is, whether the shipowners prospered in the time period? At the time, property of trading houses was understood as the owners' private property. Therefore, wealth can be studied by looking at the owners' probate inventories. A simplified assumption is made that the wealth of the deceased person is related to the economic success in business operations. Quite naturally, wealth can also be inherited.

Merchants in the area prospered in the time period: the average property in probate inventories was about hundred times larger during the turn of nineteenth and twentieth century than it was during the early eighteenth century (Chart 3.6.). Shipowners succeeded better than all tradesmen on the average (Chart 3.7.). Wealth in the sample towns concentrated to the hands of few rich trading houses during the time period. Shipping played a key role in the enrichment of the merchants: of the 15 largest estates of deceased persons, only two belonged to persons whose fortune was not linked to shipping (Table 3.6.). Prosperity concentrated to very few trading houses: of these 15 estates, six belonged to the members of Malm family from Pietarsaari and six to Franzén-Sovelius family from Raahe. Shipowners were also on more sound financial footing compared to the other merchants (Table 3.9.).

IV PRODUCTION AND PRODUCTIVITY

Introduction

The diminishing returns put the shipowners backs against the wall no later than by the middle of the nineteenth century. The only way of responding to the tightening competition was to cut the expenses, to increase the productivity of the vessels. The most interesting question is how and in what time frame did the shipowners improve the productivity of the vessels – or whether they improved it at all.

Chapter IV examines the issues related to the production and productivity of the sailing vessels. This is done by using a simple input-output -model. The level of production is measured in ton-miles (length of the journey multiplied by the tonnage of cargo shipped). Unfortunately we do not know the exact tonnage of the cargo or the utility of the cargo hold in each journey; only if the vessel had cargo or not. Therefore, a simplistic presumption is made that the vessel was fully utilised when it had cargo. Thus, in the measurement of ton-miles the net tonnage of the vessel is multiplied with the distance sailed ((net)ton-mile, ntml). The distance between the departure and arrival port causes a second problem: we do not know the exact sailing routes of each vessel. This problem is handled here by using steamboat routes as basis for the calculation. Of course, steamboats used more "direct" routes than sailing vessels, which had to adjust for the winds and sea currents. This is not, however, a major problem, because the most interesting question remains: the direct distance between ports and how effectively each vessel managed to cover it (namely, speed of the vessels, which is presented in more detail in Chapter V).

The productivity of a merchant fleet is usually measured with the number of ton-miles produced by 1 dwt (dead weight tons) of ships. In this case, the productivity is measured by summing up the annually produced (net)ton-miles with cargoes onboard (output) and dividing this figure by the tonnage used (input). In this way a simple productivity measurement, net-ton mileage (nt-mileage), is achieved.

As the sources for the study of production and productivity, the private shipowners' account books and letter are used and, for the mid-nineteenth century, also the record books of Finnish Marine Insurance Association. These materials consist of 5287 individual voyages between two ports. The material is more representative for the nineteenth century, especially in the latter part of the century when the insurance data is available. (Chart 4.1.)

Production and productivity

The level of ton-mile production as well as the nt-mileage productivity grew during the nineteenth century. (Charts 4.2.–4.4.) The level of production grew at least threefold between the 1830s and 1870s due to the longer voyages and growing average vessel size. At the same time, nt-mileage productivity doubled. The periods of productivity rise were the turn of the 1810s and 1820s, the 1840s and 1850s, and the turn of the 1850s and 1860s. During the early part

of the nineteenth century productivity grew more rapidly than the level of production, but from the mid-nineteenth century on the level of production grew more than productivity (Chart 4.4.). This meant that shipowners had bigger ships that sailed longer, but far more often than before with ballast voyages.

Causes for this development can be found in several exogenous factors: the beginning of the "freedom of the seas" during the nineteenth century opened new possibilities for Finnish vessels, which made lengthier voyages and therefore improved production and productivity. At the time Finnish ships operated more and more in international cross trading: ships were no longer laid up at home ports during the winter time, which consequently affected the productivity.

It seems to be clear that improvements in the nt-mileage productivity were closely related to the growth in the level of production: ships were larger and voyages longer. As compared to profitability (indices in Chart 4.5.), it can be said that shipowners tried to exert an influence on the productivity when profitability was declining. But even more clearly, the level of production had a tendency to rise when profitability fell – or vice versa, overproduction lowered profitability. This is an essential finding to answer the question we posed: shipowners tried (and succeeded) to improve productivity when profitability declined.

International shipping and trade accelerated from the 1830s on, which had an effect on the sailing ship productivity (Charts 4.8.–4.12.). After the British commercial restriction were removed in the first half of the nineteenth century, the carrying trade became more important for the Ostrobothnian ships. Ships were widely used, for example, in the grain trade from Odessa to Great Britain. The shipowners' own import and export shipments provided a foundation for the whole shipping industry. According to the material, however, the growth of the merchant fleet was closely related to the growth of the tonnage engaged in the international freight trades. These trades were also usually more productive than the traditional shipments of their own cargoes (Chapter 4.12.).

International freight trades, on the other hand, caused new problems. Especially the number of ballast voyages increased (Charts 4.6.–4.7.), because most of the world's commodity routes were – and still are – semiproductive (North 1968, 963–964). Vessels carried bulk cargoes only one way and returned in ballast; they were seldom fully utilised all of the time. The fact that a ship was sailing in ballast did not necessarily make its operation unproductive or unprofitable. In some cases there was no use loading a cheap bulk cargo if the ship could in the same time sail in ballast to some other port to get a more valuable cargo with better freight earnings. Usually the ship did not get a return cargo from the port it took its own or a freight cargo, but it had to sail to some – hopefully nearby – port to get the next cargo. This was especially case in the north Atlantic trade: there were large amounts of cargoes to be shipped from Northern America to Europe, but seldom from Europe to Americas. The number of ballast voyages accelerated especially from the 1860s on when the

north Atlantic trades offered more often cargoes for Finnish vessels. In this trade the level of production was high, but productivity and even profitability fairly low (Table 4.10.)

If we take a look at the other areas, we find out that the level of production, productivity, and even profitability were at highest levels in the "world trade", namely in the longest journeys, though the number of cases is fairly small. In this trade the freight rates were reasonably high due to the fact that there were not so many ships capable of this trade compared to the shorter routes. Productivity was good simply because the number of port stops were limited (Table 4.10.). On the coastal and Baltic shipping productivity was weak, because there were proportionally more port stops, and ships were more often laid up for the winter. On the other hand, profitability was quite good in coastal and Baltic shipping due to the fact that usually the value of capital stock was low: often small and cheap crafts were used in this trade. (Table 4.8.). In the Northern Sea, the Mediterranean, and the Black sea "short sea shipping" the level of production grew up to the 1860s and 1870s due to the own export and import cargoes and cross trading. Productivity was quite good especially in the Mediterranean and Black Sea trade, because the vessels were seldom in ballast. In the Northern Sea trade, profitability was quite low due to the owners' own cargoes (see Appendix Table III:4). (Table 4.9.)

Factors of production

The costs of shipping grew and the competition tightened all the time. The productivity of capital involved, however, grew also during the latter part of the nineteenth-century due to the fact that the value of the capital stock (price of the vessels) fell as crafts aged (Chart 4.13.).

The reduction of labour inputs was perhaps the easiest way to increase a vessel's productivity. The seamen's real wages doubled during the nineteenth century (Chart 4.15.). In order to cut expenses, shipowners had to improve labour productivity. There seems to be a general agreement that the labour productivity rose from the seventeenth century to the early twentieth century. That was, however, linked with other forms of productivity changes: growing size of sailing vessels; reduced port-times (which was connected to the improved productivity at the ports), increased safety on the ships, and so on.

A practical measurement in order to study seamen productivity are man-ton ratios, which means computing the amount of seamen on board to every 100 net register tons (Tables 4.4.–4.6.). The data suggest that the labour productivity was not a major issue in Finnish shipping before the 1860s, and even after that only in the largest vessels. This was related to the fact that in Finland labour costs were small compared to competitors because of the low level of wages (Table 4.3.). It appears that the largest ships were developed to be less labour intensive, whilst small ships required proportionally more seamen than the large vessels. During the late nineteenth century, the number of seamen per ton was decreasing rapidly in Finland. At the time less labour-intensive ship types were preferred (barques and large briggs).

As compared to the ton-mile production (in this case *läst*-mile production) the labour productivity grew up to the 1870s: the level of production grew more than the average wages, and at the same time the number of seaman per ton fell down. From the turn of the 1870s and 1880s the labour productivity plummeted. Although less seamen were recruited, the average wage level rose more than the average production. (Charts 4.16.–4.17.)

During the late nineteenth century the technological improvements in sail and rigging were major factors affecting the labour productivity. In the Finnish case, it seems to be more likely that the shipowners diminished the amount seamen on board only after the profits begun to fall. That did not necessary have anything to do with the technological or other improvements in the vessels. It is probable that the ships were slightly "overcrowded" during the late eighteenth and early nineteenth century. Thus, at first, crew members on board were reduced by recruiting only the necessary amount of seamen for the journey. The technological improvements in ports made it possible to cut the amount of seamen on board, because there was no more need to keep "extra hands" for the loading and unloading of the cargoes.

V PRODUCTIVITY AND TECHNOLOGICAL CHANGE

Introduction

Usually it has been said that there were no real technological developments in sea transports before the steam replaced sails, and iron and steel took the place of the wooden vessels. C. Knick Harley, Yrjö Kaukiainen, Helge W. Nordvik, and David Alexander have shown that sailing ships were quite efficient up to the World War I. Sailing ship technology developed with small steps in the shadow of shipping industry's large technological leap: the change from sail to steam and from wood to iron and steel.

Shipowners in the sample towns did not equip steamships, though they owned shares in the Finnish steamship companies, and after the mid-nineteenth century they also owned small coastal steamers. But they never equipped large ocean faring steamers, due to the fact that sailing ships produced profits up to the late nineteenth century. The demand for shipping is volatile and quick to change, while supply changes more slowly. This means that it is useless to incorporate new technology, since the older technology can also be used for profit during any upswing. There was no need to invest large sums of money on the expensive and risky new technology if the same returns could be achieved with the *average* rather than with the *best*-practice technology. By the end of the nineteenth century steamships were far too expensive and, furthermore, traders gained better profits from other areas of business activities.

The definition of an optimal cargo-carrying sailing ship is problematic. The optimal vessel carries as much as and as fast as possible cargo safely from one place to another. Market fluctuations and even inconsistent factors affected shipping – most of them being fluctuations in the weather conditions. The

economic criteria for optimal ship design is not only a question of economics, it is closely related to naval architecture and ship engineering as well. There were generally several different ways of designing a sailing ship; all of them might have been technically feasible but it is likely that one were to overcome the others. Operational flexibility was an important factor: the more different types of cargoes each vessel could carry efficiently, the more attractive it was commercially.

Traders were willing to invest in modern technology, though they were not creative in the sense that they actually discovered or gave support to the development of new innovations on their own. All new technology was imported from abroad. Their "own" contribution was to simplify rather than innovate. The success was based on the domestically built, large, and simple soft-wood vessels.

Ostrobothnian area (especially Pietarsaari and Kokkola) became important for shipbuilding in the late seventeenth century when the Swedish crown opened shipyards in the area. The basic reason for the state's interest were the almost unlimited sources of raw materials and the long time tradition of shipbuilding in local coastal trade. At the same time the big trading companies in Stockholm started to order ready-built ships from the area. In the eighteenth century the shipbuilding and trade in ships became massive: in 1779 altogether 34 newly-built crafts were sold from Kokkola to Stockholm. The actions of the Swedish state at the end of the seventeenth century in order to concentrate shipbuilding activities formed the basis of the later seafaring of the Ostrobothnian area: there was already experience to build large ocean faring vessels. Shipbuilding, and the sale of new ships to Stockholm and outside the realm, were a significant part of the business activities from the 1740s to the end of the eighteenth century. (Table 5.1.)

Already during the early part of the eighteenth century, there were trained shipbuilders in these towns, and even the famous Swedish naval architect Henrik af Chapman was well known in the towns. He visited Pietarsaari and Kokkola in the late 1750s and drew up plans for at least one big sailing ship to be built in Kokkola. But Chapman was not the only naval architect whose drawings were used in the Ostrobothnian towns. Drawings were ordered abroad already during the eighteenth century. Technological knowledge possessed by the builders and embodied in the ship drawings show that traditional shipbuilding was increasingly being replaced by modern designs.

Average size and technology

Growth in the average size of ships relates strongly to increases in productivity, because the costs per unit do not increase at the same pace as the size of the ship increases. For example, larger ships required proportionally lesser seamen on board than the smaller ones did. For the shipowner the usage of larger ships was one of the simplest ways to increase productivity and efficiency.

The average ship size grew at the time period, both in Finland (Chart 5.1.) and in the sample towns (Tables 5.2.–5.3.). The average size of the ships was a

little bit under 100 *lästs* (one *läst* equals 1.85 net register tons). (Table 5.2.) The largest vessels (over 300 *lästs*) were rather rare, only 3,4 per cent of the total tonnage built. Medium sized (100–300 lästs) vessels were preferred by the shipowners. Only from the mid-nineteenth century on large vessels over 400 or even 500 *lästs* were built. (Table 5.3.) The growing average size in the nineteenth century was related to the increasing importance of the foreign cross trading and diminishing coastal trade with Sweden.

For the shipowners the use of new and well equipped vessels which were in good condition was one way to succeed in the international markets: these ships usually gained good and profitable freight cargoes. These kinds of ships were usually sold after a few years of sailing. On the other hand, shipowners could also prefer keeping the ships in their own use for a long time. Usually these were also simple vessels in which capital and maintenance costs were fairly low, so that also "second class" cargoes produced enough profits.

The average age of the sailing ships in the sample towns was five years, but the fleet was ageing. (Table 5.4.) This was due to the structural change taking place in the whole shipping industry. Up to around the 1840s and the 1850s, Ostrobothnian shipowners competed in the international markets for the best freights with quite a new fleet. But during the latter part of the nineteenth century only cheap bulk cargoes could be carried with sailing ships. Now shipowners preferred to keep the ships in their own use as long as possible. The whole shipping industry in the area declined from the first class to the second. Best cargoes were carried by steamers or iron-hulled sailing vessels. Still, especially during the 1870s, large and expensive ships were built in the sample towns: these ships were meant to compete for the "best" cargoes.

The number of different ship types was quite large in the early eighteenth century, but the number of types diminished during the latter part of the eighteenth century and during the nineteenth century (Appendix Tables V:1–3). There was a clear technological shift towards simpler and inexpensive cargo carriers. Still, the changes in the ship types were only partly related to the technological changes – in some respects it was related to the attempts to simplify the names of the different ship types. As a consequence of diminishing trade in ships, the number of different ship types diminished also, as the Ostrobothnian traders preferred certain simplified ship types such as barques and briggs. The ships built for the towns' own use were most likely not as well equipped as the ships sold abroad.

In the mid-nineteenth century Raahe a special kind of a ship was developed: large (about 600–700 net-ton) and simple brig type, which was inexpensive to build and expedient to handle. Actually it was only a simplified version of a three-masted barque: only one mast was "cut off". These ships were, however, slow and plainly equipped, thus they were not able to gain expensive cargoes requiring speed. Large briggs were mainly used in carrying bulk cargoes, for example in the timber trade from North America to Europe in the 1870s.

Speed of the vessels

The speed of a ship was of secondary importance in the merchant shipping during the time period. Vessels were built to carry the cargoes as safely and inexpensively as possible. During the late nineteenth century there was no need for more speed by sail, because all the cargoes that required fast delivery were transported by steamers.

In terms of economic returns, it is impossible to say whether a ship should be fast or slow, or consisting of some particular hull-form in order to speed up the ship (Goss 1968, 61). Furthermore, sail area and the number of seamen on board were also important elements affecting a ship's speed. The shipowners basically deployed their ships on routes that each ship was best suited for. Slow but stable barques with large cargo holds were ideal for carrying timber and other bulk cargoes, which were typical cargoes for the Finnish ships.

Still, speed was an important factor. If a shipowner could improve his vessels to sail more quickly that would improve the productivity of a ship to result in more voyages in a certain time. Indeed, ship speed developed in the time period (Table 5.8.). This was due to the technological improvements: rigging improved, ship hulls got narrower, and the hulls were covered with metal plates. Furthermore, there were many improvements in navigation equipment, and also the ports developed, which shortened the port stops. Even the speed of communication developed.

The proportion of beams to length are used as ratios in order to examine intrinsic speed capabilities. The basic presumption is that the more meagre a ship was the more rapidly it could sail. The hull forms developed only a little before the mid-nineteenth century. On the latter part of the nineteenth century, however, hulls developed to be narrower, which most probably affected the ship's speed. Especially the hulls of the largest vessels were narrow during that period, though there were quite a few narrow vessels built already during the eighteenth century. (Table 5.9.)

Using zinc or copper to cover the hulls became common in the mid-nineteenth century. Metal plates did not, however, increase the ship's speed that much – although there are examples that ship speed did increase due to the zinc or copper plates. The use of the metal plates was more or less related to the fact that the metal plated ships were stronger than soft-wood vessels and could obtain better freights in long-distance shipping due to earning higher classifications from insurers.

The increased speed of the vessels is closely related to the time spent in ports while loading and unloading and waiting for the cargoes. The port times could be extremely long, in many cases even months. The time spent in port decreased during the time period. (Tables 5.10.–5.11.) Vessels spent roughly half of their voyage time after the departure from the home port and returning from the foreign ports. This share grew during the first half of the nineteenth century (from 53 to 55 per cent) and diminished during the latter part of the century (to 46 per cent). The question of port times is, however, problematic due to the fact that loading and unloading were essential parts of the production. Furthermore,

if the cargo was not sold immediately in the foreign port, the ship served as a "warehouse" for the cargo. The delay in ports was reduced after the ports improved due to technological advances, and the information channels, especially the telegraph and the wireless radio were developed, though port times are rather reflective of the market changes instead of the development of port efficiency (Kaukiainen 1991a, 210).

The home-port times diminished gradually due to cross trading: ships were used in the international business during the winter times, whilst in "older times" ships were usually laid up at home during the whole winter (Table 5.12.). This was, of course, a clear productivity improvement: shipowners wanted to keep their ships at sea as much as possible.

VI PRODUCTIVITY OF ORGANISATIONS

Introduction

In order to achieve the most efficient production, the most efficient organisation is needed. Efficient organisation is, however, difficult to determine and even more difficult to study. In Chapter VI the theory of transaction costs is used in order to specify the productivity of organisations. A basic assumption is made that transaction costs and efforts to minimise them affected essentially the productivity of shipping organisations.

The role played by entrepreneurs or individual actors is emphasised: they co-ordinate the factors of production and direct the resources. Therefore, it is important to understand the behaviour of these actors, and furthermore, the patterns of activities between the actors or between the organisations created by the actors. Productivity of organisations is understood as an outcome from the activity of actors and organisations: how efficiently did they manage to handle their business operations. One of the basic problems in understanding economic behaviour is asymmetric information: parties in the transaction just do not posses enough knowledge about the commodity to be exchanged or about each other. Reliability is one of the key features in economic relationships.

The problem of reliable information was pronounced during the past due to the undeveloped information systems and because there were no sophisticated methods to minimise the costs related to reliability. These problems were extremely difficult in international trade and shipping, where parties involved in transaction did not have any information about each other.

The costs of reliability can be understood as transaction costs, which arise as a consequence of imperfect information, and related to that, because of the imperfect markets. Transaction costs can be seen as costs of employing the price mechanism: costs of organising the production, costs of negotiating and concluding contracts, and costs of enforcing contracts. Basically it is the question of the efficiency of markets and the efficiency of the organisations that operate in the markets. Namely, the lower the transaction costs are the more effectively markets and organisations operate. Therefore, organisations had to build mechanisms in order to lower transaction costs.

It is usually impossible to quantify transaction costs – on the other hand, exact calculations are unnecessary. The most important task is to know how these invisible costs affected the economic activity and how the actors tried to minimise them, namely, tried to get their economic organisation to operate in the most efficient manner.

The problem of reliability can be analysed by using the so-called principal-agent model. The main object of this model is to find out whether the agent really was working in the best interest of the principal. The agent may have acted opportunistically in order to promote self-interest when he had information that was different and better than possessed by the principal. Because of the uncertainty, the principal had to build mechanisms in order to lower the possibility of cheating. These measures usually create transaction costs: the more reliable the agent, the lower the costs.

Finnish shipowners had to develop and maintain relationships with other trading organisations at home and abroad. They need some kind of mechanisms in order to avoid the difficulties that arose from the principal-agent problems in order to lower transaction costs. In order to lower the transaction costs, the merchants had some kind of a merchant network, and they tried to develop their networks in order to minimise the problems related to the reliability. Also, the state could enforce contracts by securing the property rights of the contracting parties.

This issue is studied in three sections. First, we will concentrate on the role of the state as the "safeguard" of business operations, namely, in securing the property rights. After that, the issues related to the transformation in the hometowns are discussed. Thirdly, we will concentrate on the issues related to the transaction: the business operations abroad. At all these levels the basic concepts used are principal-agent theory, economic and social networks, and transaction costs. To simplify: principal-agent problem gives rise to transactions costs, which can be reduced by networks, or by governmental activity (by securing the property rights).

The state and the entrepreneur

By securing the property rights governmental activity affected the productivity of shipping organisation. During the Mercantilist Era government secured quite effectively the property rights of those few who had the privileges for shipping and trade. Though the mercantilist economic policy limited trade and shipping, it also enabled the success of merchant shipping in Raahe, Kokkola, and Pietarsaari. Swedish mercantilist regulation was maintained also during the Russian rule. Old privileges were dissolved from the 1850s to 1870s.

Swedish government did not only secure the privileges of the merchants in the home country; the security of property rights was also extended abroad. Swedish government created a far-reaching consulate network abroad in order to help the merchants' foreign trade and shipping. (Table 6.1.) When Finland was joined to Russia (1809), the merchants lost this government aid, since Russia did not have as advanced of a consulate network abroad as Sweden did.

Finnish traders used the services provided by the Swedish consuls even during the Russian era simply because the consuls were usually private merchants with whom Finnish shipowners had already well established business relationships. For example, Swedish consul Isaac Glöerfelt used to arrange Sound toll payments for the Finnish ships during the era of Swedish reign. When Finland was connected to Russia, Glöerfelt and his long-time business partner Adam Gradman still handled large part of the Finnish ships' toll payments up to mid-nineteenth century (Table 6.6.).

Russia had her own consulate network, but the role played by the consuls was not as crucial during the nineteenth century as it was during the eighteenth century. The Finnish shipowners had now already established business relationships abroad and they did not need the governmental aid as much as they did during the mid-eighteenth century, when they were only starting their own foreign trade and shipping. Russia concluded several trade agreements with foreign nations during the first part of the nineteenth century, which also helped the Finnish shipowners transactions.

Organisation of transformation

Trade and shipping were not yet separated: the ships were built and owned by the large trading houses and their owners. Even the shipowner and shipper were not necessarily separated. The role played by the entrepreneur was crucial. Efficiency of the organisation depended on the personal capabilities and managerial skills of the owner. He or she had to make the crucial decisions: for example, when to buy or sell a ship or what cargo a ship should load. Although there were only few decisions to be made, the consequences of possible errors were extensive due to the large investments in shipping. (Stopford 1988, 50)

Therefore, the managerial skills of the owner were crucial for the organisational efficiency. It is impossible to determine which skills and capabilities entrepreneurs should had in order to guarantee success in their business activities in the most efficient way. Success can be seen, for example, in the growth of the personal wealth of the owners or in the rate of return of the vessels (Chapter III). This does not, however, tell anything about the dynamics of the business operations. The know-how of the entrepreneurs is sometimes emphasised, which simplifies decision-making mechanisms into rather trivial assumptions on, for example, the influence of formal education on the business activities. Acquired knowledge and skills are still the simplest ways to explore this issue. The most interesting question is whether the family-owned trading houses were willing to invest in the future; namely, how much importance did the family firms put on the skills of the future owners?

Shipowners seldom had formal education. More often they acquired their skills by working as trainees in the trading houses home and abroad. Sometimes merchants worked as shipmasters in their youth. In many cases the sons of Finnish merchants worked as a trainees in the foreign trading houses and acquired skills and knowledge to be used later on their own merchant career. For example, the most significant nineteenth century merchant of Jacobstad,

Peter Malm Jr., worked as a trainee in a Liverpool firm, Peter Sörenson Son & Co., at the turn of the 1810s and 1820s. During that time he established several personal contacts with British merchants, which he utilised for decades.(Nikula 1948, 56–64)

The problems of family-owned trading houses culminated in the succession processes. The firms and their owners were willing to "invest" in the future; namely, in the schooling of the second (and even third) generation. There were several cases where marriages of the sons and daughters of the owners were arranged in order to maximise the future possibilities of the family firm. Although families invested in future generations, there were several examples where these investments failed to bring desired results.

The financing of the shipping enterprise caused several problems. Vessels were expensive and money was scarce. During the eighteenth century every single ship was usually owned by partnership shares of several merchants. By owning a ship together traders could minimise the risks and raise more capital for shipbuilding. During the early eighteenth century the most important shipowners in Pietarsaari and Kokkola did not have any other minor shareholders in their ships. In Raahe, however, a key feature in the success of town's shipping industries during the latter part of nineteenth century was the fact that the ships were owned in small shares. In some Raahe "companies" (like J. Lang & Comp. and F. Sovelius & Comp.) ships were owned by family members (brothers, cousins etc.), but in some other companies small shares were owned practically by almost all of the town merchants (like in the case of Lundberg & Comp., Rein & Comp., and Durchman & Comp.). (Table 6.5.)

Money was loaned from the home town and other Finnish towns, but also from abroad (Table 6.2.). This can be detected from the probate inventories where the liabilities are documented. Most of these debts were a consequence of the normal trade: orders or payments were handled through bills of exchange. Money was seldom used; therefore, dealings were based on credit. During the eighteenth century many were indebted to Swedish merchants, but during the nineteenth century money was more often loaned from the large German trading houses, and sometimes also from certain British trading houses. (Table 6.3.)

Traders in each town formed a local social network, which was utilised in order to mobilise the required knowledge and capital. The ties were not only business-related; big trading houses were often connected through marriage or by blood. For example, in the case of Pietarsaari, the most important trading houses had broad and close relationships through marriage or blood with the other trading houses inside the town and with the neighbouring towns as well (Table 6.4.). In some cases these networks were extended to the large trading centres in Sweden and abroad also (Ojala 1997e).

The close family relationships were not necessary to achieve the most efficient solutions, to minimise the risks related to principal-agent problematic. This is due to the fact that family networks were usually very strong by nature, and family members were economically tied to each other. If one branch of the

family-based network was in financial difficulties, it usually harmed the other family members as well (for example, the case of trading houses Donner from Kokkola and Malm from Pietarsaari during the mid-nineteenth century).

Organisation of transactions

In organising transactions the basic problem was the reliability of information. Actors were lacking information, they received it slowly, and there were even problems with the reliability of information, mostly due to the reasons mentioned. Douglass C. North emphasises the change from the personal to impersonal trade: in personal trade actors knew each other and therefore the problems related to obtaining reliable information were non-existent (and therefore also there were no transaction costs). When the scale of exchange grows, personal relationships usually change into impersonal, although actors usually strive to maintain personal commitments between actors. This is, however, more and more complex the larger and the more complex the exchange is. Transaction costs grow because more weight must be put on the contracts and enforcing mechanisms, as well as on the information itself. Impersonal exchange results in very high costs of transacting if no effective coercive power exists to enforce the contracts. Government can secure contracts with its mechanisms.

We have chosen seven procedures which were used in order to minimise the problems caused by principal-agent problems (1–7). They all lowered transaction costs. How much is not an important issue, only whether these procedures were used. Firstly, there is a personal commitment between the actors in the transaction and in the other end, "fully" impersonal market relationships, which also had means of lowering the transaction costs.

1. *Personal commitment* (kinship by blood or marriage, friendship) of the contracting parties is the oldest way to secure economic transactions (North 1994a). In personal relationships transaction costs were significantly lower than in impersonal trade, since the actors knew each other. This fact usually diminished the principal–agent problem, however, not necessarily. Social norms and ethical behaviour mechanisms of individual actors affect the costs of transactions in impersonal trade as well (such as honesty, integrity etc.). The costs that were reduced by such norms tend to grow in the face of impersonal exchange: impersonal exchange raises the rate of opportunism, and even the values associated with the exchange altered.

2. The problems of reliability could be reduced by creating *persistent and long-term social and economic networks*. Personal commitment and long-term economic relationships (networks) were probably the most efficient way to minimise the risks related to the principal-agent problems. Because the Finnish principals did not (usually) know their foreign agents personally, they tried to create persistent and long-term exchange with certain foreign agents. The parties involved in the exchange had repeated dealings and they possessed a great deal of knowledge about each other, and these impersonal networks acquired personalised characteristics in the long run as well – this self-

enforcing mechanism lowered transaction costs. Networks provided continuity and stability in economic operations; namely, they reduced risks in an uncertain world. There are several cases of the long-term business relationships, which lasted in the best cases circa hundred years. In the Danish Sound, for example, the Finnish ships' clearings were usually handled by the same shipping agencies from on year to another (Table 6.6.). In this case the Finnish shipowners shared the information provided by the same shipping agency: reliability and long-term business contacts were more important than the competition with the other shipowners.

3. One way to avoid the principal-agent problem is to use *intermediates* in economic operations. The use of personal representatives increased the rate of personal commitments in order reduce the principal-agent problems, and consequently, lower the transaction costs. Intermediates created the trust between actors who did not knew each other personally. Shipmasters were the most important intermediates for the Finnish shipowners. Still, there were principal–agent problems between the owner and the master as well: owner of the ship could never know if the captain worked in the best interest of the owner. This problem was avoided with the so-called "kaplake" system, which gave the captain a share of the profit of the ship, usually five per cent. Foreign trading houses and agencies sent their "travellers" to Finland in order to build new contacts, and the Finnish merchants sent their representatives abroad – usually these were the sons of the owners of the Finnish merchant houses.

4. The shipping agencies obtained their *payments as a share of the profit* as did the captains. This procedure was developed in order to reduce the problems produced by the lack of confidence and opportunism: foreign agencies were tied to the good return of the vessels. But as any effort to lower transaction costs, these at the same time produced costs.

5. Also, *formal agreements* between the shipowner and the foreign agent played an important part in order to minimise the risks of uncertainty. In this case, the role played by the state was crucial in enforcing contracts.

6. In some cases the Finnish shipowners used *threats* in order to "scare" their foreign business partners. Even these extreme methods provided good results: the foreign agent knew that by cheating he would not only loose the business connection in question, but the possibilities of establishing others as well, due to the information links between the Finnish principals. Even the tightest competitors discussed and shared the information provided by the different foreign agents. Sometimes these discussions led to serious conflicts between the Finnish traders and the foreign trading agencies.

7. Markets created mechanisms that lowered transaction costs and excluded possibilities of cheating. The most important aspect was the *competition between agents*. Competitors made sure that the Finnish principals became aware if any hint of cheating existed, and the competition ensured that the commission percentages were at a reasonable level. On the other hand, trust and reputation were highly valued among the contemporaries, so the risk in cheating was high.

VII CONCLUSIONS

The aim of this study was to specify whether the shipowners were willing and able to render their shipping business more effective during the eighteenth and nineteenth century. The simple answer is yes: shipping was far more productive during the latter part of the nineteenth century than it was during the late eighteenth century. Efficiency resulted both from technological improvements as well as enhanced business organisation. Productivity of shipping was not, however, the primary goal of the shipowners, nor was even the profitability of shipping. Family-owned trading houses and their owners tried to maintain their economic situation and secure also the future for their children. Shipping business was only an apparatus to achieve this. When profitability of shipping declined during the latter part of the nineteenth century, trading houses abandoned the shipping business and invested their money in different branches of the economy, most of all in the growing Finnish manufacturing industries. Yet at first they still tried to obtain returns from shipping by improving the productivity of shipping. This was, however, not enough: shipping practically ceased to exist in the sample towns during the last years of the nineteenth century.