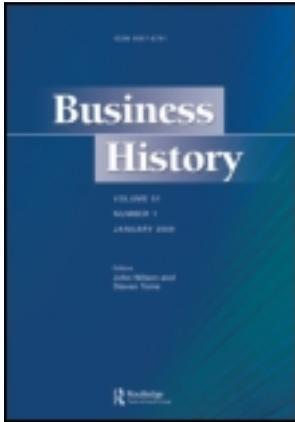


This article was downloaded by: [René Taudal Poulsen]

On: 27 July 2011, At: 02:57

Publisher: Routledge

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



## Business History

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/fbsh20>

### Downfall delayed: Danish shipbuilding and industrial dislocation

René Taudal Poulsen<sup>a</sup> & Henrik Sornn-Friese<sup>b</sup>

<sup>a</sup> Department of Environmental and Business Economics, University of Southern Denmark, Esbjerg, Denmark

<sup>b</sup> Department of Innovation and Organizational Economics, Copenhagen Business School, Frederiksberg, Denmark

Available online: 27 Jul 2011

To cite this article: René Taudal Poulsen & Henrik Sornn-Friese (2011): Downfall delayed: Danish shipbuilding and industrial dislocation, *Business History*, 53:4, 557-582

To link to this article: <http://dx.doi.org/10.1080/00076791.2011.574692>

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: <http://www.tandfonline.com/page/terms-and-conditions>

This article may be used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan, sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

## Downfall delayed: Danish shipbuilding and industrial dislocation

René Taudal Poulsen<sup>a\*</sup> and Henrik Sornn-Friese<sup>b</sup>

<sup>a</sup>*Department of Environmental and Business Economics, University of Southern Denmark, Esbjerg, Denmark;* <sup>b</sup>*Department of Innovation and Organizational Economics, Copenhagen Business School, Frederiksberg, Denmark*

This article analyses the decline of the Danish shipbuilding industry. European shipyards dominated global shipbuilding markets in the first half of the twentieth century, but began to be challenged by the Japanese from the 1950s and by the South Koreans from the late 1970s. More recently, China has taken over large slices of the global shipbuilding market and currently is the world's largest shipbuilding nation. As a result of this new competition, European shipyards closed *en masse* and Europe experienced a process of maritime deindustrialisation in the 1970s and 1980s. Danish shipyards were not immune to these challenges, although maritime deindustrialisation in this country was almost two decades later than in many other European countries. This article examines how Denmark was able to escape this general maritime deindustrialisation for so long and offers three explanations: institutional, entrepreneurial and political.

**Keywords:** globalisation; industrial dislocation and decline; shipbuilding

### Introduction

Shipbuilding is a prime example of the significant structural shifts that have taken place in industrial production in the twentieth century (Cho & Porter, 1986; Dicken, 2007). For instance, in 1914 British merchant shipbuilders were responsible for some 59% of global gross tonnage. Currently, British shipbuilders are barely visible in the global shipbuilding statistics, and account for less than 0.1% of the total world market (Jamieson, 2003). The near disappearance of British shipbuilding has been both heavily debated and studied and displays many similarities to the decline of other both American and European industries such as textiles, steel, automobiles, consumer electronics and semiconductors.<sup>1</sup> There is general agreement that by the mid twentieth century shipbuilding had become a mature industry, characterised by high labour intensity and employment of low or medium-skilled labour, and that its competitiveness derived mainly from cost efficiencies and process rather than product innovation (Todd 1991). It was for these reasons that East Asian late-movers were able to overtake the European market leaders after 1950.

Overall, there was a major shift in global shipbuilding and general dislocation of shipbuilding activity from Europe to East Asia in the latter half of the twentieth

---

\*Corresponding author. Email: [rtp@sam.sdu.dk](mailto:rtp@sam.sdu.dk)

century. In 1956, Japan overtook the British to become the world's largest shipbuilding nation and South Korea ambitiously and successfully entered the global shipbuilding market in the 1970s. China and Vietnam have recently emerged as major shipbuilding nations, with China in 2010 being the largest shipbuilding nation in the world. East Asian growth is generally attributed to several factors, but access to a large, cheap and educated workforce, productivity increases and government support in the early phases of industrialisation are usually identified as crucial to the success of its shipbuilding industry (Amsden, 1989; Chida & Davies, 1990; Stopford, 2009; Todd, 1991). In the early phase of East Asian industrialisation, Japanese shipbuilders generally focused on the construction of relatively simple vessels, such as tankers, general cargo ships and bulk carriers. They were most competitive in the segments where direct labour costs accounted for a large part of the total costs of a vessel. That most other shipbuilders, in Europe primarily, made bad choices and gained inadequate support is another important part of the story.

Figures 1 and 2 present gross tonnage (GT) data and depict the massive structural shift in global shipbuilding that took place from 1975 to 1985 as European shipyards lost ground to Japanese and South Korean shipbuilders.<sup>2</sup>

The shipbuilding industry has always depended on demand for seaborne transportation, which increased significantly during the twentieth century. In the 1960s, demand for seagoing vessels to transport especially crude and refined oil soared, accompanied by increases in vessel sizes. However, after the OPEC oil embargo in 1973, and extending well into the late 1980s, bulk shipping markets suffered severe recession, and demand for new tankers and bulk carriers declined accordingly. Most shipbuilders, including the Japanese, reduced production in this period. When demand began to increase in the latter half of the 1980s, the Japanese and South Koreans quickly built up production to its pre-recession levels. In the

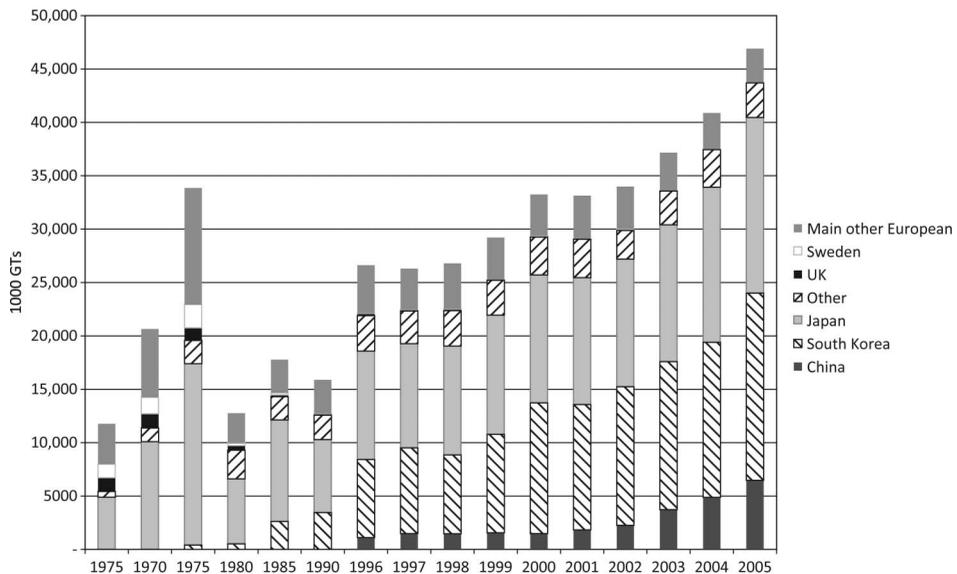


Figure 1. Shifts in global shipbuilding, 1965–2005, GT by country of build.

Source: Institute of Shipping Economics and Logistics (ISL), *Shipping Statistics Yearbook* (2006, pp. 275–277).

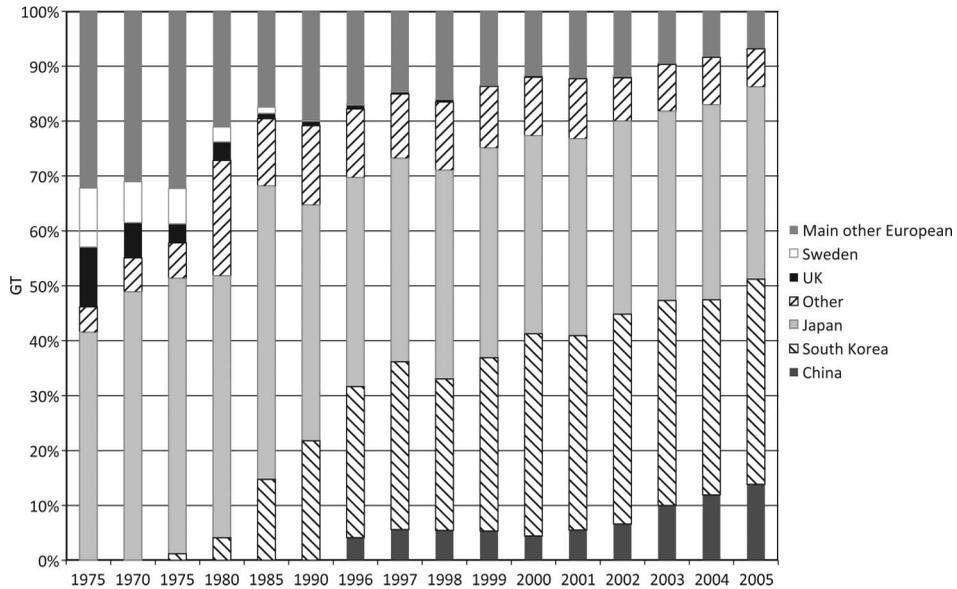


Figure 2. GT completed globally, by country of build, 1965–2005.

Source: Institute of Shipping Economics and Logistics (ISL), *Shipping Statistics Yearbook* (2006, pp. 275–277).

1970s and 1980s, the Japanese adapted very successfully to the new realities of shipbuilding and the structural change that had occurred. Also, the Japanese government supported its national shipyards and the reorganisation of the industry at a crucial time (Chida & Davies, 1990; Todd, 1991). This contrasts with the situation for most European shipbuilders, which never recovered from the shipping crisis despite numerous mergers in a bid to increase efficiency. Since the late 1980s, demand for seaborne transport has increased continuously as has demand for new ships, but only a very few European shipbuilders have profited (Harlaftis, 1996; Tenold, 2001; Thowsen & Tenold, 2006; Wijnolst & Wergeland, 1997).

Danish shipbuilding presents an interesting case in light of these developments in world shipbuilding. It shows a significant peculiarity in relation to the timing of its maritime deindustrialisation, which occurred almost two decades later than in many neighbouring countries. We look at how Denmark managed to ride maritime deindustrialisation for so long. The article is structured as follows. The next section describes the development of European shipbuilding from the mid 1960s up to 2010, in some detail, and compares developments in Denmark. Succeeding sections present the method and data of the analysis; explore the entrepreneurial, political and institutional aspects of Danish shipbuilding; and offer some conclusions about the reasons for the peculiar Danish development.

### European maritime deindustrialisation

Tables 1 and 2 present trends in European shipbuilding from 1965 to 2005. Shipbuilding in the United Kingdom, The Netherlands, Sweden, France, Germany and Norway declined rapidly in the 1970s. The UK dominated the global shipbuilding market from the mid 1800s, but after the closure of the Suez Canal

Table 1. Annual number of ships delivered by country, 1965–2005 (Index 100 = 1965).

	1965	1970	1975	1980	1985	1990	1996	2000	2005
Denmark	100	90	100	91	67	50	43	14	12
Finland	100	93	70	82	57	36	14	5	2
Germany (FR)	100	87	77	50	64	46	38	27	32
Italy	100	109	93	105	68	61	82	95	50
Netherlands	100	80	113	65	71	52	75	83	61
Norway	100	105	125	73	52	36	38	25	9
Sweden	100	51	61	35	26	18	4	1	–
Belgium	100	140	160	150	200	60	60	–	–
UK	100	79	65	39	20	16	13	9	5
France	100	127	57	24	24	25	18	20	8
Globally	100	122	121	107	87	76	85	80	105

Source: Institute of Shipping Economics and Logistics (ISL), Shipping Statistics Yearbook (2006, pp. 275–277).

Table 2. Annual deliveries, GT, by country, 1965–2005 (Index 100 = 1965).

	1965	1970	1975	1980	1985	1990	1996	2000	2005
Denmark	100	248	463	99	219	189	227	178	236
Finland	100	147	163	122	130	151	206	136	4
Germany (FR)	100	127	241	36	54	83	116	95	119
Italy	100	137	198	62	22	93	165	143	89
Netherlands	100	428	695	82	122	110	164	205	118
Norway	100	153	229	45	27	17	36	25	2
Sweden	100	122	174	28	16	2	2	3	–
Belgium	100	129	173	119	114	50	3	–	–
UK	100	104	91	33	13	10	15	8	0
France	100	177	237	58	41	12	43	41	9
Globally	100	176	288	108	151	135	226	283	399

Source: Institute of Shipping Economics and Logistics (ISL), Shipping Statistics Yearbook (2006, pp. 275–277).

in 1956, British shipyards quickly lost ground. The closure of the canal rapidly changed the important tanker markets connecting the oil producing countries in the Persian Gulf with the oil consuming countries in Western Europe and the United States. The oil tankers had to travel the much longer distance around the Cape of Good Hope, which greatly affected the economics of operating large ships. At the same time it became technically practicable to build larger ships, since it was no longer necessary to take account of the size constraints imposed by the physical dimensions of the Suez Canal. Because large tankers, bulk carriers, and ore carriers are the simplest and most labour-intensive types of vessels to build, the growing importance of the bulk markets in world seaborne trade provided a major stimulus to the further growth of shipbuilding in Japan, which had come back into large-scale shipbuilding at the start of the 1950s, and subsequently spurred development of shipbuilding in other, less developed East Asian countries.

In 1956, Japan overtook the UK as the largest shipbuilding nation. British shipbuilders continued to use the old labour-intensive construction methods and concentrated on high-value passenger and cargo liners, for which there was decreasing demand at the time (Jamieson, 2003). When British shipbuilders finally

acknowledged the pressing need to invest in welding equipment and facilities suited to building large ships, it was really too late, and its response was too little. According to Lorenz (1991) this was the result of management uncertainty about the need to reform work administration methods, and a lack of trust between labour and management. The new labour government that had come into power in the UK in 1964 at first tried to control the crisis by restructuring the British shipbuilding industry based on an initiative that came out of the recommendations of a Commission of Inquiry into the Shipbuilding Industry, set up in 1965 under the chairmanship of Sir Reay Geddes of Dunlop Holdings. The merging of British shipyards into a small number of groups – the Upper Clyde Shipbuilders (UCS), Scott Lithgow Ltd., Robb Caledon Shipbuilding, Swan Hunter and Tyne Shipbuilders, Doxford, and Austin and Pickersgill Ltd. (A&P) – however, did little to improve the competitiveness of the British yards (Johnman & Murphy, 2002). Government then opted to nationalise the shipbuilding industry and in 1977 formed the government-owned British Shipbuilders Corporation, which took on ownership and management of the British shipbuilding industry until the end of the 1980s.

Sweden was another successful shipbuilding nation in the 1950s and 1960s, but suffered abysmal decline in the 1970s. By 1980 Swedish shipyards were delivering only a third of the number of vessels they had produced in 1965, and the reduction in tonnage was even greater in that period. In 1950, Swedish shipyards accounted for 10% of world production and this market share had been maintained in the 1960s, making Sweden among the most efficient producers in the world. In 1965, four Swedish shipyards were in the global top 20 of shipyards measured by tonnage launched: Götaverken (no. 4), Eriksberg (10), Kockums (12) and the Uddevalla Shipyard (20). In 1964, Götaverken opened its new highly efficient Arendal Shipyard in Göteborg, and the other three yards expanded production facilities massively, opening several new building docks. Although the profitability of Swedish shipyards declined substantially during the late 1960s, the industry continued to grow. In the early 1970s Sweden was the second largest shipbuilder in the world after Japan. However, because of their focus on the heretofore booming market for very large crude carriers (VLCC) and ultra large crude carriers (ULCC), the Swedish shipyards suffered severely during the shipping crisis following upon OPEC I, and most Swedish shipyards closed in the period 1973 to 1979 (Bohlin, 1989; Olsson, 1996; Stråth, 1987).<sup>3</sup> The remaining ones struggled on for a few years, but by 1987 the last significant Swedish merchant shipyard – Kockums in Malmö – had ceased production.

The cases of Norway and Finland are rather different: both continued to be successful in shipbuilding. Many Norwegian shipyards were involved in the booming North Sea oil industry in the 1970s, shifting their focus from merchant shipping to offshore operations. For instance, the Stord shipyard, which previously had built VLCCs, successfully transferred to the offshore sector when the oil crisis changed shipping and global oil consumption patterns. Similarly, the shipyard in Haugesund managed to transfer to offshore construction (Langhelle & Dalhaug, 1999; Mjelva, 1996). In Finland, the shipbuilding industry changed its focus to niche markets for innovative and sophisticated cruise ships, ferries and ice-strengthened vessels, which required extensive outfitting work. Finnish shipbuilders also benefited from several large orders for advanced ice-breakers and various general cargo vessels from the neighbouring Soviet Union (Aker Yards; 2006; Møller, 1972). Note that the numbers in Tables 1 and 2 for Finnish shipbuilding in 2005 underestimate its shipbuilding activity. The collapse of Finnish shipbuilding did not occur until after 2005. In 2010,

the remaining three Finnish shipyards were acquired by the South Korean shipbuilding conglomerate, STX, allowing the South Koreans access to important know-how in the construction of cruise ships, a market that has always been a European stronghold. These cases demonstrate that some European shipbuilders were able to postpone or avoid the general maritime deindustrialisation that occurred in Europe in the 1970s and 1980s.

### *The Danish anomaly*

Shipbuilding in Denmark developed along a slightly different path, declining much later than most of the European shipbuilding nations. In the mid 1970s, Danish shipbuilding accounted for 5–6% of total Danish industrial employment, a higher percentage than in any other European country except the Netherlands (Stråth, 1987, p. 183). The modern Danish commercial shipbuilding industry goes back to the mid nineteenth century and Copenhagen-based machine shops and engine-building companies. The Burmeister & Wain (B&W) shipyard, Frederikshavn Shipyard and Elsinore Shipyard and Engine Works were established in the late nineteenth century, but the real breakthrough in Danish shipbuilding happened in the period of World War I, when neutral Denmark profited from a boom in the shipping industry. In the 1910s, four leading Danish shipowners – Mr A.P. Møller, the United Steamship Company (DFDS), the J. Lauritzen shipping company and the East-Asiatic Company (EAC) – set up their own shipyards and went on to dominate Danish shipbuilding until the mid 1980s (see Figure 3). A number of smaller yards, most of which are still in operation, emerged alongside these major companies.

In the post-World War II period, rapid and steadily growing demand for seaborne transportation spilt over to the Danish industry, which expanded to meet this demand. Like most other European shipyards, from the 1950s to the mid 1970s, Danish shipbuilders were building more and ever-larger ships. In 1959, the Odense Steel Shipyard moved to the small island of Lindø, whose geographical characteristics allowed considerable expansion. Since that time the yard has been popularly known as the Lindø Yard. After an expansion in the 1960s, the Lindø Yard began to focus on construction of long series of VLCC and ULCC, adopting a strategy similar to that of Sweden, described above. The other major Danish shipyards also expanded. B&W focused on construction of long series mainly of Panamax bulk carriers, and during this period the other Danish yards increased their output of ferries, liners and sophisticated smaller vessels.

From the mid 1970s, the shipping crisis and declining demand for seaborne transportation had a negative effect and resulted in a contraction of Danish shipbuilding.<sup>4</sup> However, the Danish case was an anomaly. The structure of the industry remained intact until the late 1990s, with the vast majority of Danish shipyards still in service up to that time. From 1980 to 1996 the Danish market share in global shipbuilding was 2–3% (see Figure 4) and, while employment in Danish shipbuilding declined from the mid 1970s, production remained high until the late 1990s (Figure 5). Measured by GT, Danish shipbuilders performed better than their neighbours until the late 1990s (Tables 1 and 2). Interestingly, the Lindø Yard's continuing production effectively concealed the process of deindustrialisation in Denmark (see Figure 5).

This article offers three explanations for Denmark's delayed maritime deindustrialisation. The traditional explanation for the decline in European shipbuilding emphasises the role of cost competition and economic efficiency as

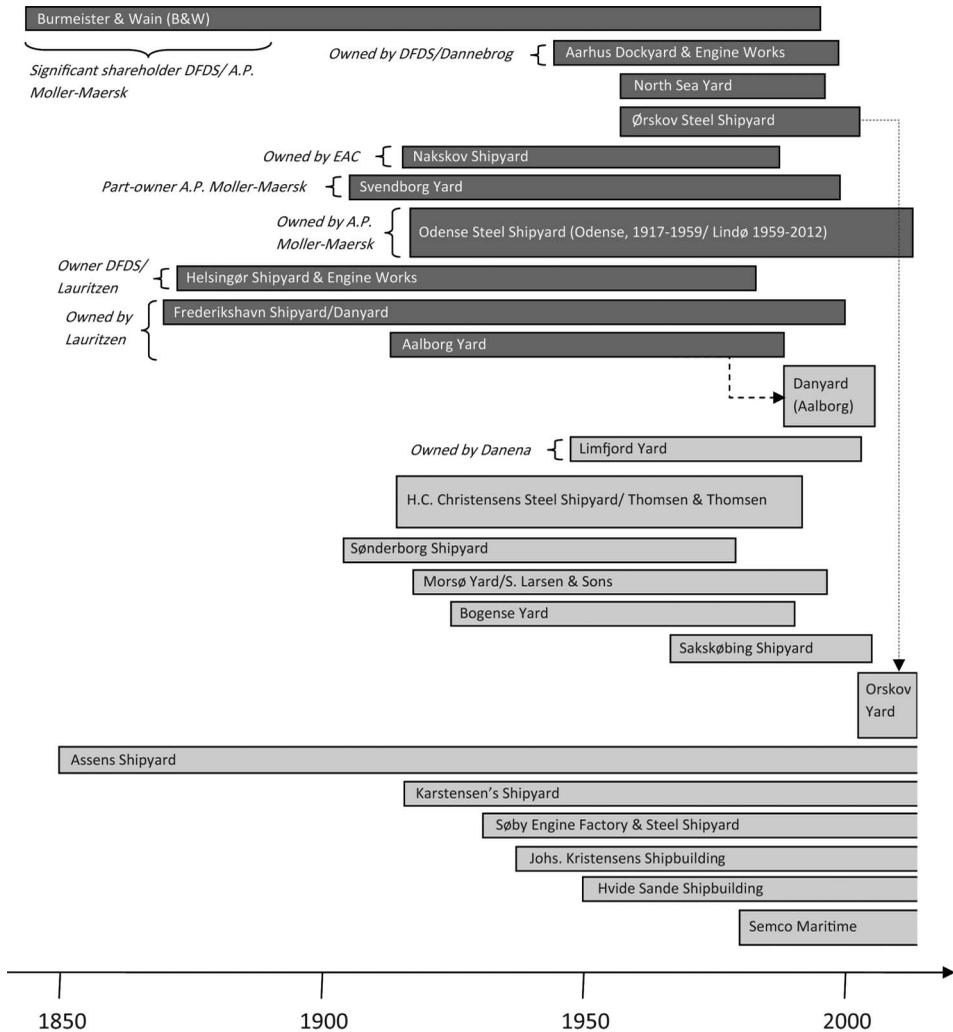


Figure 3. Timeline of major Danish new-build shipyards.  
 Notes: Dark grey blocks are major shipyards with a capacity for vessels exceeding a length o.a. of 100 metres; light grey beams are minor shipyards.  
 The shipyards in Frederikshavn and Elsinore were originally controlled by the United Steamship Company (DFDS). From 1964, J. Lauritzen held over 50% of DFDS stocks and consequently absorbed the DFDS shipyards.  
 In the period 1968–71 the Svendborg Steel Shipyard was controlled by A.P. Moller-Maersk which had a majority share in the yard. Originally, the Århus Dockyard was controlled by DFDS, but it was owned by Dannebrog in 1971–89.  
 Sources: Møller (1972), Jeppesen et al. (2001), Søndergaard et al. (2007).

the prime driver of the process, but this is not a sufficient explanation of why, for some 20 or more years, Denmark's path of development differed from events in the shipbuilding industries in other European countries. We would contend that traditional explanations tend to exaggerate universal economic forces and understate the important roles of strategic choice and entrepreneurship in the decline of the industry, and to ignore the political and cultural-institutional influences and aspects. This article explores the extent to which the development of Danish shipbuilding can

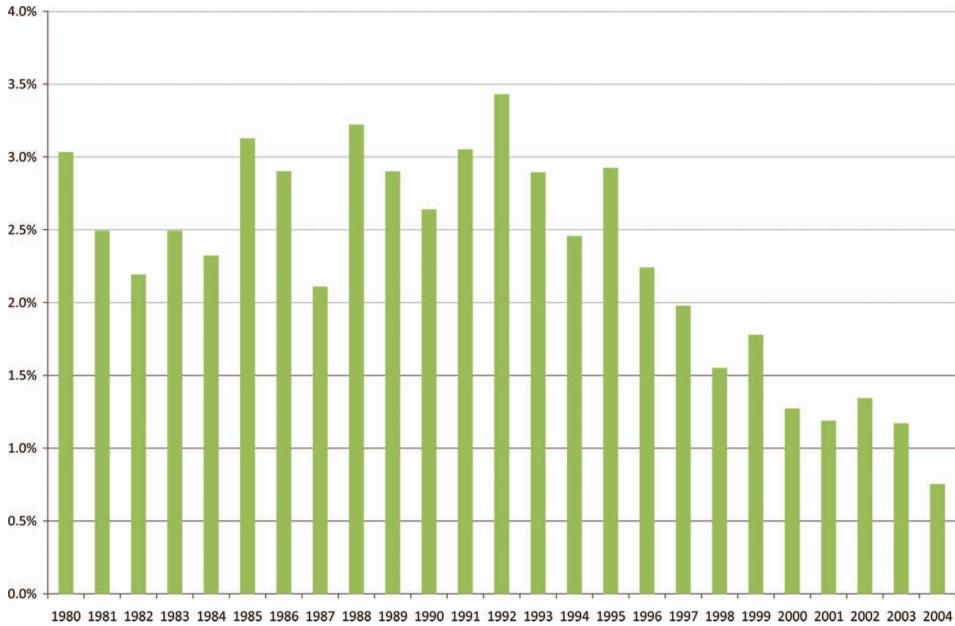


Figure 4. Danish market share of global shipbuilding, 1980–2004.  
 Source: Retrieved 10 October 2008 from <http://www.shipbuilders.dk>

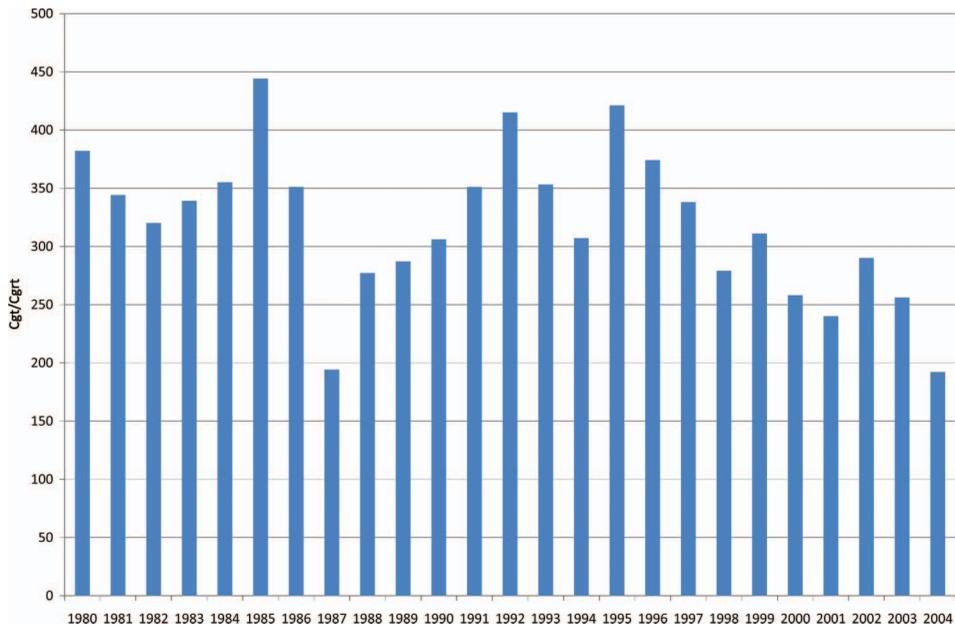


Figure 5. CGT/CGRT produced by Danish shipyards, 1980–2004.  
 Source: Retrieved 10 October 2008 from <http://www.shipbuilders.dk>

be explained by less universal forces such as: 1) entrepreneurial drive, which resulted in the strategic choices made by Danish shipyards rendering them superior to their rivals in other European countries; 2) political will and political support for the

shipyards; and 3) institutional aspects, which meant that Danish shipyards were to an extent sheltered from the general forces of international competition, for example, by being vertically integrated with Danish shipping companies with the will and means to support them financially. The remainder of this article investigates these three explanations.

In the section on entrepreneurial aspects we focus on the strategic choices made by the Danish yards. By developing state-of-the-art vessels with innovative designs they were less exposed to competition from the East Asian yards, which tended to focus on standard designs, and were able to maintain their competitiveness in the global market. We examine the strength of this argument. The second explanation is related to the impact of government policies on Danish shipbuilding. European governments' involvement in shipbuilding was historically very strong. For regional and social reasons European governments often resorted to subsidies and supporting orders if yards were struggling and their attempts to maintain the structure of the shipbuilding industry had an influence on its development. The third explanation, the institutional explanation, is related to the impact of ownership on the industry's development. Most of the large Danish yards were owned by Danish shipping companies, and we examine the interaction between the shipping companies and the yards. Shipowners could support the yards by placing orders for new vessels, and strengthened technological development by ordering advanced vessels. Shipowners also supported the yards financially when necessary, something that independent, foreign shipbuilders could not do. Thus, there is a central question around whether Danish shipyards were able to survive for so long because they were fat rather than fit.

## Method

We constructed two longitudinal databases, one on the Danish shipyards' order books in the period 1958–2007 and one on Danish shipping companies' orders in the period 1950–2007. The source of both sets of data is statistics from *Sofart* – a well-known Danish shipping journal, which was published monthly from 1950 to 1985 and weekly thereafter. It published annual lists of Danish shipyards' order books since 1958, and lists of deliveries from Danish shipyards to Danish shipowners, and details of new ships for Danish shipping companies were published from 1950. The journal collected the information annually from the individual shipyards' and shipping companies' updates to their order books and orders, respectively. Information from international maritime news sources, such as Lloyd's Register/Fairplay, supplements these lists. Comparison between the *Sofart* information and the shipyards' own published lists of vessels delivered shows that the *Sofart* information is reliable.<sup>5</sup> For some years, mainly in the 1970s, no data were assembled, and in 2002 *Sofart* disconnected publication of this information. However, it continued to collect the data and gave us access to information for the years 2004 and 2007.

The *Sofart* new-build lists provide an excellent understanding of the basis of the Danish shipbuilding industry and lend themselves to a comparative study of the industry's order book structure from the 1950s to the present day. While the order books do not give information about the customers' reasons for ordering a ship from Denmark, they provide clear information on what and for whom Danish shipyards built. Thus, they enable discussion of the three explanations for the Danish case. In short, the new-build lists show the extent to which holding companies and the

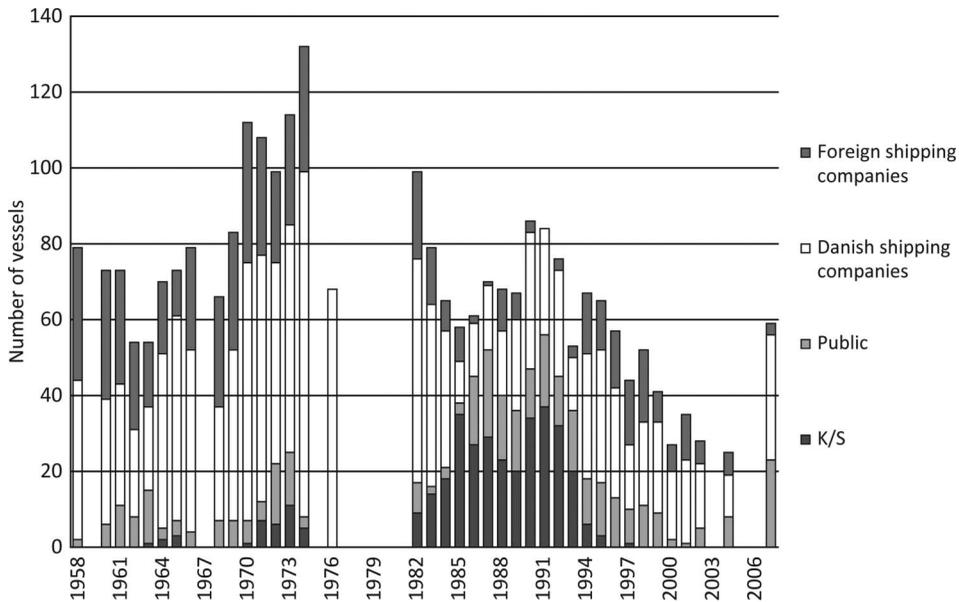


Figure 6. Danish shipyards' order books, by customers. Source: *Sofart* (1958–2002). Unpublished data for 2004 and 2007 made available by *Sofart*. Data for other missing years were not available.

Danish government contributed to the order books of the shipyards, and reveal which vessel types the yards built. Figure 6 shows the Danish shipyards' customers from 1958 to 2007, grouped into foreign and Danish shipping companies, the Danish government and other public agencies, and Danish K/S (limited liability) companies.

Additional data sets on global production of ships by type from the 1970s to 2010 are available from a statistical publication produced by the Institute of Shipping Economics and Logistics (ISL) in Bremen (ISL, 2006). We compare Danish and foreign yards' orders by type, and evaluate the technological level of the Danish yards in the global context. Based on Compensated Gross Tonnage (CGT), we can construct a typology of complexity of ship types (Stopford, 2009). The higher the CGT, the more complicated the vessel to build. In this typology, gas carriers, cruise ships, naval ships, ferries and research vessels are ranked as the most complex types, with oil tankers, bulk- and ore-carriers and general cargo ships representing the least advanced ship types. Container ships are between these two extremes; they require less work input from the shipbuilders per tonnes of deadweight.

We supplement our quantitative analysis with a study of the owner shipping companies' annual reports (the EAC, J. Lauritzen and A.P. Moller-Maersk). These reports contain information relevant to the nature of the relationship between owners and yards.

### The entrepreneurial explanation: innovation

The developing shipbuilding nations in East Asia introduced new production techniques (such as the 'parallel shipbuilding' technique, introduced by the South Korean shipyards), which allowed them to outcompete European shipyards. History shows that firms in the nations suffering the most from deindustrialisation invested

insufficiently in new production techniques, which resulted in relatively low levels of productivity growth. Many firms preferred to squander their profits on high dividends and wages, providing generous returns to stockholders and workers (see Harrington & Warf, 1995). This was the case among shipbuilders in Scotland and England.

In response to the global shift in shipbuilding activity, many European shipbuilders decided to differentiate by moving into higher value-added niche markets (such as research ships, luxury cruisers and icebreakers), which required sophisticated engineering know-how and high standards of workmanship (Cho & Porter, 1986). Eventually even the British shipbuilders began to build for niche markets, including hydrofoils and hovercraft.

This raises certain questions. Were Danish shipyards better positioned strategically than the shipyards in most other European countries? Did Danish shipyards survive for longer simply because they were more competitive than their European rivals? In mature industries, such as shipbuilding, competition tends to focus on process rather than product innovation. Those in mature industries that are unable to make the transition to more process innovation will be unable to compete effectively and will be likely to fail (Utterback, 1994). However, it may be that Danish shipbuilders were able to survive the difficult years from the 1970s to the 1990s because they were building more advanced vessels than their foreign competitors, that is, they were involved in product innovation. It has been noted that the success of an industry may depend on its ability continuously to transform both products and processes (Malerba & Orsenigo, 1996), and some studies show that, even in mature industries, innovation is often characterised by a balance between product and process innovation, enabling prices to be kept relatively constant while producing more sophisticated products (Adner & Levinthal, 2001). To examine this aspect, we compare the products of Danish and foreign shipyards.

Table 3 compares the composition of Danish and global order books by vessel type. Overrepresented types in Danish order books have values exceeding 1, whereas underrepresented vessels have lower values. For instance, if a particular vessel type made up 5% of Danish orders and 10% of global orders, the difference is represented in Table 3 by the figure 0.5. Since at least the 1960s, the global market for shipbuilding has consisted predominantly of relatively simple oil, bulk and ore carriers and general cargo ships. Together, they represented more than 40% of global order books. The international fishing industry had problems with fleet overcapacity, which caused a relative decline in the market for fishing vessels, but the construction of relatively sophisticated container ships was a rapidly growing market.

Danish production differed markedly from global production. Oil and bulk carriers and general cargo ships were relatively insignificant for the Danish shipyards. In contrast, container ships figured largely in Danish order books, from the late 1980s onwards. The Danish shipyards were relatively quick to respond to the changes promoted by containerisation around 1970, with major shipyards such as B&W and Naskov involved in building state-of-the-art container vessels in the early 1970s. Notably, the B&W-built sister ships *Selandia* and *Jutlandia*, delivered in 1972, were among the fastest and largest contemporary container carriers (The Motor Ship, 1972). However, the volume of the container shipping market in the 1970s was relatively small compared to other shipping markets (Broeze, 2002), and B&W did not get any further orders for container ships. Naskov got some more orders in the mid 1970s, but did not succeed long term in the container market as physical plant restrictions prevented it from building sufficiently large container ships. However,

Table 3. Comparison of Danish and global order books, by type of vessel, 1975–2005.

	Oil tankers	Bulk/oil carriers	Ore & bulk carriers	General cargo	Container ships	Liquid gas & chemical carriers	All fishing types	Miscellaneous
1975	1.25	–	1.22	1.42	7.41	0.66	0.56	0.78
1980	0.42	–	3.11	1.45	0.83	1.10	–	1.60
1985	3.31	–	0.10	0.96	0.52	–	–	2.01
1990	2.04	–	1.07	0.31	11.00	1.69	0.04	0.36
1991	0.62	9.58	1.66	0.17	8.29	1.32	–	1.05
1992	1.64	12.47	0.34	0.13	6.20	–	–	0.78
1993	1.31	25.47	–	0.10	5.19	–	–	1.35
1994	0.64	23.27	1.09	–	4.59	1.54	–	0.78
1995	0.33	–	0.72	–	3.20	2.25	–	1.39
1996	–	–	0.12	–	3.15	2.01	–	1.76
1997	–	–	–	–	2.09	4.16	0.23	1.42
1998	–	–	–	–	1.17	2.44	1.22	1.65
1999	–	–	–	–	3.69	0.57	3.18	1.09
2000	–	–	–	–	3.55	–	3.22	0.66
2001	0.54	–	–	–	2.65	–	1.52	1.41
2002	0.52	–	–	–	2.94	–	1.88	1.15
2004	–	–	–	–	7.19	–	2.00	0.54
2005	–	–	–	–	2.53	–	5.51	1.33

Notes: The 'Miscellaneous' category contains mostly advanced ships such as passenger ships, ferries, roll on/roll off ships, reefers, offshore vessels and cable layers. Vessel types that were overrepresented in Danish order books relative to global orders have values exceeding 1. Vessel types that were underrepresented in Danish order books relative to global orders have values below 1.

No data were available from *Sofart* for the years 1975 and 1980. For comparison with ISL data for 1975 and 1980, we therefore use data from *Sofart* for the years 1974 and 1982, respectively.

Source: *Sofart* (1975–2004); ISL (2006); unpublished data supplied by *Sofart* (2004–07).

from 1980 the Maersk-owned Lindø Yard had a stronghold in the construction of large, fully cellular container ships for the holding company's own container shipping branch, Maersk Line. From the late 1980s, the shipyards in Århus, Frederikshavn (Ørskov and Danyard) and the North Sea Shipyard built long series of container feeder ships, which are the smaller vessels used to collect the containers from ports and transport them to the central container terminals for loading onto the big container ships. This indicates that Danish shipyards successfully penetrated an expanding and very significant market. Danish shipbuilders were highly innovative in this field. In fact, the Lindø Yard built the first container ship (the *Marchen Maersk*, delivered in 1988) capable of carrying 13 rows of containers within the constraints of a panamax hull. The Lindø Yard has continued to build the first of every new generation of the largest container ships (the *Regina Maersk* in 1996, the *Sovereign Maersk* in 1998 and the *Emma Maersk* in 2006).

Danish shipbuilders were among the first movers in the construction of double hulled VLCC in the early 1990s. In 1993, the Lindø yard built the world's first double hulled VLCC, the *Eleo Maersk* for A.P. Moller-Maersk (*Sofart*, 1993), however, Asian shipbuilders quickly overtook in this area.

Danish shipyards were also the market leaders in other segments, notably construction of advanced chemical carriers and reefers. In the 1990s, they were building highly advanced chemical tankers, and they had a monopoly in the reefer businesses from the 1930s. The yards in Elsinore, Aalborg and Frederikshavn were constructing reefers for the holding company J. Lauritzen, and had developed strong

expertise in this field. For many years, Danyard – in Aalborg and in Frederikshavn – had the leading edge in construction of reefers, and in the early 1990s built the world's largest and most efficient of these vessels (the *Ditlev Lauritzen*) for J. Lauritzen (The Motor Ship, 1990).

Finally, Danish shipyards were strong in the construction of passenger ships and ferries. Danish shipyards were generally very innovative, in some cases building truly trend-setting passenger ships. For example, Aalborg Shipyard built the first two cruise ships for Carnival Corp., which was established in the early 1970s and became a leading global cruise ship company. Carnival based its subsequent long series of cruise ships on ideas developed for the Aalborg ships (Brogren, 1982, 1985, 1990, 2000; Stråth, 1987).

With the exception of B&W – which in the 1980s and early 1990s focused exclusively on long series of uncomplicated bulk carriers, oil bulk and ore (OBO) carriers and product carriers – Danish shipyards were very versatile and able to switch quickly from the construction of one type of vessel to another. Over the years, the type composition of Danish yards' order books changed much more radically than did global order books (ISL, 2006; *Sofart*, 1975–2004).

Danish shipbuilders remained competitive longer than the shipyards in Denmark's neighbour countries. Their competence in building advanced ships and their focus on niche markets influenced the global competitiveness of Denmark's shipyards from the 1970s to the 1990s. For the Lindø Yard, this strategy was the outcome of vertical integration into the Maersk Group, which began ordering very advanced ships from its own yard and demanded product innovation. Despite the general maturity of the shipbuilding industry, Danish shipbuilders were successful product innovators. The markets for advanced ships generally fluctuated less widely than the tanker and bulk markets during the shipping crisis in the 1970s and 1980s. Also, emerging East Asian competitors, in the early stages of their industrialisation, tended to focus on simple vessel types such as tankers and bulk carriers (Chida & Davies, 1990). We can conclude, therefore, that the strategies of product innovation and niche markets clearly postponed maritime deindustrialisation in Denmark.

Comparison of the Danish and the Finnish shipbuilding industries raises another question. Finnish shipyards continued to prosper almost to the present day – based on their niche strategy of constructing passenger ships and ferries, so why did the Danish shipbuilding industry not develop along similar lines to become a global leader in niche ship construction in the early twenty-first century? One of the reasons was the physical characteristics of Danish shipyards, which did not allow full-scale involvement in the construction of large, innovative passenger vessels. The shipyard in Elsinore did build a few cruise liners in the 1970s and early 1980s, but the site of this shipyard in the city centre of Elsinore was too small for the construction of the large cruise ships demanded in the 1980s. The Aalborg yard was bigger and it built two large cruise ships for Carnival in the 1980s, but it also suffered physical restraints imposed by the Limfjord, the narrow channel leading to the shipyard. Also, in the late 1980s, the J. Lauritzen Group did not have sufficient resources for a large-scale investment in cruise ship construction (Lange, 1995) and the opportunity to penetrate the attractive cruise ship market was lost.

### **Political explanations: government orders and taxation regime**

Some 60 years ago, Joseph Schumpeter (1939) noted that, across the world, there were industries that would not have existed without political stimulus; at the same

time, we can find industries – including the international shipbuilding industry – that are overgrown or in an otherwise unhealthy state because of political stimulus. Shipbuilding has been the recipient of the most government support in terms of subsidies and other forms of state intervention – including government ownership of shipyards, in former world leading shipbuilding nations such as the UK, Sweden and the Netherlands. Traditionally, the shipbuilding industry in Europe played a key role in industrial employment. Therefore, during times of mass unemployment in the 1970s and 1980s, the focus of European policy-makers on the shipyards increased (Berggren, 2002; De Voogd, 2002, 2007; Devos, 2002; Johnman & Murphy, 2002; Stråth, 1987). In industrial regions that depended heavily on employment in the shipyards (e.g. Glasgow in Scotland, Uddevalla in Sweden, and Nakskov and Frederikshavn in Denmark), shipbuilding was a crucial industry and was supported by governments through direct subsidies, government orders, nationalisation, or favourable tax legislation designed to encourage new orders (Stråth, 1987). Between 1976 and 1983 the Swedish government, for example, spent close to 20 billion Swedish Kroner (SEK) (about one-third of the amount paid to the crisis-ridden Swedish manufacturing sector) to restructure its shipbuilding industry. This led eventually to the formation of the government-owned Svenska Varv AB, which in 1977 took over almost all shipbuilding activity in Sweden (Magnusson, 2000).

Clearly, this and the continued achievements of Danish shipbuilding beg the question of the state's role in postponing maritime deindustrialisation in Denmark. Danish government directly subsidised its yards to the same extent as other European Union member states. From 1969, direct subsidies to shipbuilding were endorsed by the EU in an attempt to counteract what was seen as 'unfair' competition from East Asian shipyards. European shipbuilders accused their Asian competitors of price dumping based on government subsidies. In order to match world market ship-building prices, the EU allowed member states to grant direct building subsidies of up to 28% of a vessel's building costs. The rules were changed several times and the percentages were gradually reduced before subsidies were abolished in 2005. The Danish government also allocated direct subsidies to its shipyards under this scheme, but did not subsidise the Danish shipbuilders more than other European countries (Erhvervsministeriet, 1996). Hence, direct government subsidies were not the overriding reason for the success of the Danish shipbuilding industry relative to other European countries.

For shipbuilders in small countries competition based on subsidies was very difficult. In a 1995 analysis of the Danish shipbuilding industry, the Danish Ministry of Business concluded that Danish shipbuilders were highly efficient and would continue to be globally competitive if all direct subsidies were abolished globally (Erhvervsministeriet, 1995). Danish shipbuilders generally were against government subsidies, and advocated for an international level playing field. The annual report of the Danish Shipbuilders' Association for 2001/2002 states that: 'For many years, the association has allocated considerable resources to the fight against shipbuilding subsidies. One of the most important goals of the association is to work for a maritime market with equal competition' (Danish Shipbuilders' Association, 2002, p. 25).

Two other aspects of government support – government orders and favourable taxation – would seem more relevant to this analysis because, indirectly, they contributed to competitiveness. From Figure 6 we can see the extent to which the Danish government and other public agencies (even local town councils) filled the order books of Danish shipyards. In the 1960s and 1970s public orders rarely exceeded

10% of total order books; in the difficult times in the 1980s and 1990s they represented about 20% of the yards' order books. Overall government orders were not sufficient to sustain Danish ship production, but some shipyards (especially Elsinore, Nakskov and increasingly Aalborg) were heavily reliant on public orders. The timing of these government orders seems to have been crucial. When the order books in Elsinore and Nakskov were slim, in the early 1980s, orders for five large ferries for the Danish state railways (DSB) enabled them to continue production for some time (Johansen, 1997; Stråth, 1987). Public orders mainly consisted of ferries for the DSB and naval ships, which, although they were on average smaller than the merchant ships, required a lot of outfitting and thus were important for the yards in terms of workload.

However, government shipbuilding orders played a very small role in the survival of the Danish shipbuilding industry: they were too few and too small to fill the order books of the shipyards. The most crucial government support was indirect. Since shipbuilding contracts involve substantial financing from buyers, creating a sheltered local market for the financing of ships is vital for the competitiveness of a national shipbuilding industry. History is rife with examples of governments deliberately influencing local financial markets to provide favourable ship financing (Stokes, 1997). In Denmark, and also in Germany and Norway, government influence on local ship financing was based on the limited partnership markets (in Denmark and Norway known as the K/S market and in Germany as the KG market), which gave tax benefits to individuals investing in ships. A K/S (*kommanditselskab*) company has several owners, some of whom are general partners with unlimited liability, while others are limited partners whose liabilities are restricted to their fixed contributions to the partnership. The limited partnership market in Denmark developed in the 1960s and became an important means for generating new-build business for the Danish shipyards that were struggling against increasing competition from low-cost countries in East Asia. According to Danish tax legislation, vessels built in Danish yards could be financed through the K/S system, in order to support Danish shipbuilding. Many private investors were attracted by K/S investments, because it allowed them to defer income tax payments. The Danish K/S system was subject to fierce public debate in the 1980s and 1990s, and many private investors sustained

Table 4. K/S-financed vessels' share of order books in selected shipyards, 1982–95 (%).

Year	B&W	Frederikshavn/Danyard Frederikshavn	Nordsø Yard	Ørskov	Århus
1982	0	82	0	0	0
1983	0	100	0	8	0
1984	29	100	0	38	0
1985	86	100	67	80	0
1986	100	73	43	60	100
1987	100	57	82	0	100
1988	100	0	83	0	0
1989	100	0	90	0	0
1990	82	30	73	0	75
1991	100	40	67	27	0
1992	100	45	44	57	100
1993	100	60	40	100	100
1994	43	6	0	40	0
1995	50	0	0	0	0

Source: *Sofart* (1982–95).

heavy losses from their shipping investments. Critics argued that these investments were not based on sound commercial rationales and investors had no understanding of the nature of shipping markets. Following debates in the mid 1990s, the system was phased out (Erhvervsministeriet, 1996; Jensen, 1993; Jeppesen et al., 2001; Konkurrencestyrelsen, 2002; Stråth, 1987).

During the critical years from the early 1980s to the mid 1990s, when the foreign market collapsed, a large part of some yards' order books did consist of K/S-financed ships (see Table 4). In the late 1980s and the early 1990s, the North Sea Shipyard, B&W, Danyard, Ørskov and Aarhus Dockyard were all heavily dependent on the K/S market. When the market was abolished in the mid 1990s, Danish shipbuilding started to collapse. The situation for the shipyards quickly deteriorated, and maritime deindustrialisation reduced Danish shipbuilding drastically in just five or six years.

### **The institutional explanation: vertical integration in the Danish shipping industry**

Danish shipyards historically relied mainly on Danish customers who in many cases were also the owners of the yards. After accounting for some 25–50% of order books during the 1950s and 1960s, foreign customers turned their backs on Danish shipbuilders in the face of the shipping crisis in the 1970s and 1980s. The foreign market was almost finished. Danish shipbuilders landed some foreign orders in the 1990s, but the 'home market' continued to provide the bulk of the orders. This strong home market reliance in the 1990s was a sign of low international competitiveness, but was attributable largely to the particular ownership structure within Danish shipbuilding.

Shipowners and shipbuilders inherently have diverging interests (Boyce, 2002; Lange, 2002). However, the leading Danish shipping companies tried to bridge this divergence by acquiring the main Danish shipyards. Shipbuilding in Denmark was vertically integrated with shipowners to a much greater extent than in the other major European shipbuilding nations Sweden, the UK, West Germany, the Netherlands and France (Erhvervsministeriet, 1995; Stråth, 1987). So, did this vertical integration contribute to the endurance of Danish shipbuilding in the period from the 1970s to the 1990s? Vertical integration can contribute in two ways. In times of crisis, holding companies can step in with supporting orders and/or financial support. In theory, at least, the holding companies can ensure work for their own shipyards by placing orders when other shipping companies were hesitant about doing so. By adopting a counter-cyclical ordering strategy, the holding companies were able to support and even promote the shipyards during difficult times when the yards were getting no external orders. Holding companies can also support the shipyards financially in times of recession, and supply additional capital if they make a loss, enabling them to maintain production despite heavy losses over a longer period than competing, independent shipyards. The holding companies of maritime conglomerates took a long-term perspective, and were willing to accept temporary (sometimes huge) losses in the shipyards, because they saw them as a strategic investment. The yards could build state-of-the-art ships for the holding companies' shipping lines and ensured holding companies' access to berths even in times of high demand for shipbuilding (Boyce, 2002; Lange, 2002). Most notably, A.P. Moller-Maersk built long series of highly advanced and record-breaking container ships for the subsidiary Maersk Line in the Lindø Yard. By building the ships in-house in the group, A.P. Moller-Maersk was able to keep secret for a long time both the number of vessels on order and their capacities.

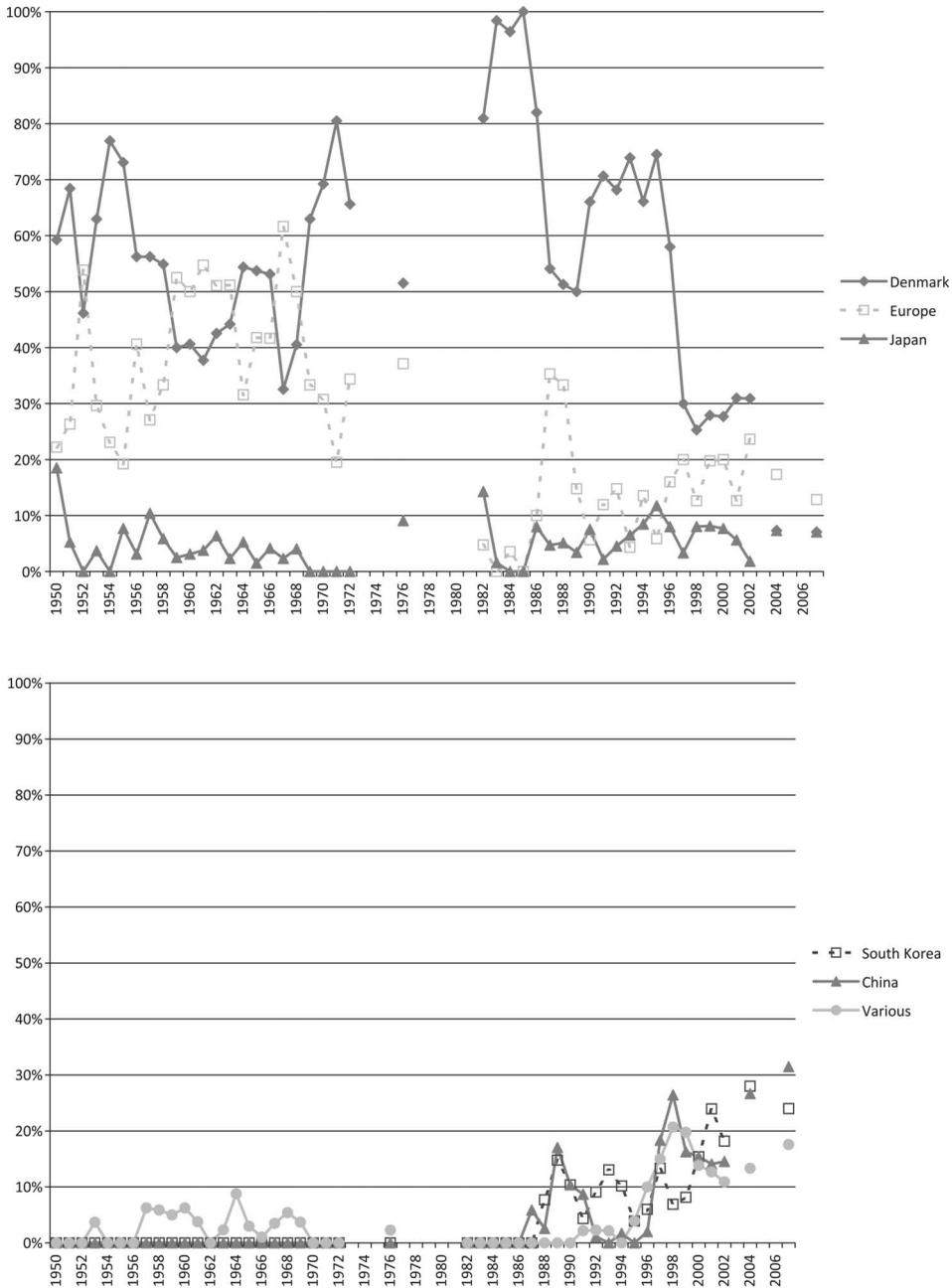


Figure 7. New-builds for Danish shipping companies, by yard region, 1950–2007.  
 Note: Deliveries for the period 1950–72 and orders for the period 1976–2007.  
 Source: *Sofart* (1958–2002); unpublished data for 2004 and 2007 made available by *Sofart*.  
 Data for other missing years were not available.

Danish shipping companies clearly had a preference for Danish shipbuilders (see Figure 7). Comparison of Figures 1 and 7 shows very clearly the peculiar Danish development. The bulk of Danish shipping companies' orders stayed in Europe for

Table 5. Parent company orders as a percentage of total orders held by selected shipyards, 1960–2007.

	Odense	Nakskov	Elsinore	Aalborg	Frederikshavn/ Danyard	Århus/ Dannebrog
1960	36	18	0	14	60	50
1961	40	22	0	17	50	33
1962	36	25	11	14		25
1963	43	25	20	0	0	100
1964	55	17	17	0	0	0
1965	50	57	50	0	0	0
1966	46	80	36	0	0	0
1968	17		14	29	0	0
1969	31	0	13	38	0	
1970	30	22	0	26	0	0
1971	50	25	0	31	0	0
1972	48		0	40	0	0
1973	53		0	38	0	100
1974	43	29	40	13	0	75
1982	82	0	0	0	0	0
1983	73	0	0	0	0	0
1984	58	0		0	0	0
1985	29			0	0	0
1986	25*	0		0	0	0
1987	0*			0	0	0
1988	0*				9	0
1989	60*				21	
1990	82*				17	0
1991	100				0	
1992	79				0	0
1993	73				0	0
1994	73				0	0
1995	100				0	0
1996	100				0	0
1997	100				0	0
1998	58				0	0
1999	100				0	
2000	100					
2001	100					
2002	82					
2004	79					
2007	80					

Note: \*The main part of the order book consisted of K/S financed vessels for A.P. Møller.

Source: *Sofart* (1958–2002); unpublished data for 2004 and 2007 supplied by *Sofart*.

much longer than the global average. Only in the late 1990s did the balance of Danish orders shift to East Asia. This does not mean that Danish shipping companies were late to recognise the potential of East Asian yards. A.P. Møller-Maersk was building ships in Japan in the 1950s, and has continued to do so. However, until the shipping crisis of the early 1970s, the bulk of the Danish shipping companies' orders was divided between Danish and other European yards. During the 1970s and 1980s crisis, Danish shipowners abandoned the European shipbuilding market, and turned to Danish builders and the massive shift of Danish shipowners' new-build orders to East Asian shipyards did not happen until the late 1990s. Orders for simple ships, such as oil tankers and bulk carriers, were the first to move to East

Asia; construction of sophisticated container ships, passenger ships and chemical tankers continued in Danish shipyards for some time longer.

In order to explore the impact of vertical integration on Danish shipbuilding more carefully, we analyse the order books of the main shipyards owned by Danish shipping companies. Table 5 shows the holding companies' shares of the orders books in six different shipyards.

### *The J. Lauritzen Group*

J. Lauritzen was established in 1895 as a conventional tramp shipping company. In the 1930s the company diversified successfully into specialised shipping and acquired interests in shipbuilding and industry. Up to the late 1990s, the group was a highly integrated shipping conglomerate whose main activities were reefer and bulk carriers, shipbuilding (it owned the major shipyards in Elsinore, Aalborg and Frederikshavn), and the manufacture of marine equipment (Lange, 1995). However, apart from orders for vessels from its Aalborg yard during the first part of the 1970s, and from the Elsinore shipyard in 1974, the J. Lauritzen Group did not fill the order books of its own shipyards in the difficult 1970s to the 1990s. However, the Group provided huge financial support to the yards. J. Lauritzen was a solid and expanding shipping group in the 1970s and for a long time was able to afford to support the ailing shipyard in Elsinore, which made continuous losses during the 1970s and 1980s. Board meeting minutes show that non-commercial motives (i.e. social concerns for the shipyard workers in a time of high unemployment) sustained management's support for the shipyard much longer than narrow financial concerns would have allowed (Lange, 1995). Lauritzen finally decided to shut down production in 1983, when the order book was empty. The shipyard also suffered from an unfavourable location with no space for expansion.

The group's yard in Aalborg performed much better, making profits until 1985. However, in 1986 the situation suddenly changed. Heavy losses combined with a slim order book and a financially weak holding company proved fatal to the yard. In the early and mid 1980s several Lauritzen shipping subsidiaries had launched a series of ambitious but highly unsuccessful shipping projects. These investments exhausted the group's resources. Thus, Lauritzen was unable to support the yard in Aalborg to the same extent as it had done in Elsinore, either financially or with in-house orders (Lange, 1995). The Aalborg yard delivered its last merchant ship in 1988. Under the name Danyard Aalborg, the yard continued for a few years with small-scale production of fibreglass ships for the Navy.

The last remaining merchant shipyard in the Lauritzen group, Danyard Frederikshavn, continued production until 2000. It built a successful long series of advanced reefers for external customers, based on a design it had developed initially for Lauritzen's own subsidiary, Lauritzen Reefers, and fitted with equipment developed by Lauritzen's own equipment factories Sabroe and Lanng & Stelman (J. Lauritzen, 1993). It received a large order from Stolt Nielsen Parcel Tankers for nine sophisticated chemical tankers between 1993 and 1997. However, soaring costs and long delays in the production of these complicated ships resulted in heavy losses for the shipyard after 1994. In 1996, the yard made a loss of over 1 billion Danish Kroner (DKK), and required financial support from the holding company (J. Lauritzen, 1997). The shipyard was able to deliver all nine ships thanks to Lauritzen's continuous financial support. On delivery of the last ship in 2000, Lauritzen finally exited

the shipbuilding sector and closed down the yard in Frederikshavn (J. Lauritzen, 2001). In this case, Lauritzen certainly postponed closure of the Frederikshavn shipyard for some years through its continuous financial support of the yard.

### *The East-Asiatic Company*

The East-Asiatic Company was one of the founding companies of the modern Danish shipping industry. It was established in 1897 and developed rapidly into a dominant Nordic conglomerate engaged in shipping, trading and industry. In 1916, the EAC established its own shipyard in the southern small island town of Nakskov. The story of the EAC and its relations with its Nakskov shipyard shows many similarities to developments in the J. Lauritzen Group. The Nakskov Shipyard profited significantly from its strong relations with the EAC, which for many years was one of its most important customers. In most years, the EAC accounted for at least a third of all Nakskov orders. Notably, in the mid and late 1970s, when shipping and shipbuilding markets were generally depressed, the EAC placed large orders with Nakskov. It ordered advanced cellular container ships, a series of product tankers and a series of five multipurpose liner ships (so-called liner replacement vessels). This last is illustrative of the extent to which EAC was willing to support its own yard, beyond what simple cost-benefit analysis would recommend. EAC ordered two liner replacement vessels at the Mitsui Shipyard in Japan at the price of DKK 85 million per ship and five ships at its own shipyard in Nakskov at the price of DKK 115 million per ship. Had it placed the entire order with Mitsui, EAC could have had almost two more ships for the same total amount (Lauritzen, 2008). The EAC was highly committed to building ships in its own shipyard, but after heavy losses in many EAC subsidiaries in the 1980s its willingness to support the shipyard was exhausted. After delivery of two ferries for the DSB in 1985 and 1986, the shipyard closed down. The weakened EAC could not step in with supporting orders or more financial support (Bjerrum, 1993).

### *A.P. Moller-Maersk Group*

The A.P. Moller-Maersk Group is the largest shipping conglomerate in the world. It goes back to the establishment of two separate companies in the early twentieth century, the Steamship Company Svendborg (founded in 1904 by Mr A.P. Møller and his father Mr Peter Mærsk Møller) and the Steamship Company of 1912 (founded in 1912 by Mr A.P. Møller). As a result of successful investments in liner and tanker shipping in the inter-war period, the group expanded rapidly. When it entered the retail and the oil exploration businesses in the 1960s, it was the largest corporation in Denmark. A.P. Møller founded the Odense Steel Ship Yard in 1917, and this later was acquired by the group (Hornby, 1988). This case has similarities with and important differences from the above two cases. From its very early years the Odense Steel Shipyard was the main producer of liner ships and tankers for the rapidly expanding Maersk fleet, supplying the bulk of A.P. Moller-Maersk's new vessels. In the 1960s and early 1970s, it had changed its name to the Lindø Yard, and specialised in building large crude oil tankers (VLCC and ULCC) for the big international oil companies (e.g. Shell and Esso) and for a number of, mainly, Greek and Norwegian shipping companies, but the A.P. Moller-Maersk Group remained its largest customer.

The building of large crude oil tankers required massive investments, and physical expansion, and the Lindø Yard soon became the largest local company in Northern Funen, employing more than 6500. When the 1970s shipping crisis caused

demand for oil tankers to collapse, the yard successfully changed to production of container ships and other more advanced ship types, but its level of activity was drastically reduced for many years. The Lindø Yard delivered an oil tanker in 1977 (the *Karen Maersk* for the A.P. Moller-Maersk Group) and then stopped building oil tankers for more than a decade. This explains the sudden and dramatic drop in the tonnage delivered by Danish shipyards in 1980, reported in Table 2. The Lindø Yard resumed construction of advanced tankers in the early 1990s, building the world's first double hulled VLCC.

A.P. Moller-Maersk has strongly supported the Lindø Yard, filling its order books mainly with container ships for Maersk Line. In this case, the holding company's support was crucial for the survival of the shipyard. Most other European VLCC/ULCC shipyards closed down in this period (De Voogd, 1993; Olsson, 1996; Stråth, 1987; Todd, 1991). Since the mid 2000s, the Lindø Yard has made heavy losses and A.P. Moller-Maersk has had to support it financially. Despite critical statements on productivity at the shipyard from the Chairman of the Board of A.P. Moeller-Maersk, Mr Michael Pram Rasmussen, the Maersk group's involvement in shipbuilding continued until very recently (A.P. Moller-Maersk, 2005, 2006). In August 2009, the Group announced that the yard would close by 2012. The last container ship was delivered in the spring of 2009 and all future container ships for Maersk Line are being constructed in East Asian shipyards, which hold massive orders from the group.

The A.P. Moller-Maersk Group also had controlling interests in other major Danish shipyards. Mr A.P. Møller invested heavily in B&W during the early 1960s and for many years the Group was a significant minority shareholder. In 1968 the Group acquired majority shares in the renowned Svendborg Shipyard, which at the time was in financial trouble. A.P. Moller-Maersk intended to make Svendborg Shipyard a supplier for the Lindø Yard, but the plan was never implemented, and in 1971 the shipping conglomerate sold its shares in the Svendborg yard. Note that the historical connection between A.P. Moller-Maersk and the Svendborg Shipyard goes back to the yard's foundation in 1926 through a public partnership that included Mr A.P. Møller and the manager of the Odense Steel Shipyard, Mr M.A. Westh (Søndergaard, Larsen, Petersen, & Hermansen, 2007).

### *A few other cases*

There was also much smaller scale vertical integration in Danish shipbuilding. The small Limfjord Shipyard in Aalborg was founded in 1947 by the Aarhus-based shipping company, Danena Ltd., and remained in Danena's ownership until its closure in 2002. It relied extensively on new-build and repair orders from Danena, building mainly dredgers to be used in the Baltic Sea, the North Sea and Danish territorial waters (Mikkelsen, 1997). Eventually, the Aarhus Dock Yard & Engine Works was vertically integrated with Danish shipping. It was controlled by DFDS until 1971 and by the Dannebrog Group from 1971 to 1989. It also received some orders from the holding companies (Bramsen, 1983; Simonsen, Thorsøe, Sonne, Jensen, & Kjær, 1995), however, these did not figure largely in the Aarhus yard's order books.

It is clear that vertical integration in the Danish maritime industry explains part of the peculiar development of Danish shipbuilding and contributed to delay the decline of Danish shipbuilding in Odense, Elsinore, Frederikshavn and, to some extent, in Nakskov. Becoming part of a maritime conglomerate, allowed the major Danish shipyards to survive for another two decades partly because their holding

companies were strongly committed to a vertical integration strategy. In no other shipbuilding nation has a shipping company's vertical integration strategy linked the two industries so closely and for so long (Stråth, 1987).

### **Conclusion**

Danish shipyards survived for almost 20 years longer than their counterparts in neighbouring European countries. This questions the straightforwardness of industrial dislocation in shipbuilding from Europe to East Asia, which otherwise characterises the dominant, functional explanation, based on economic efficiency as the prime driver of the process. While cost and cutthroat competition were issues that clearly were significant to the general process, the analysis in this article suggests strongly that institutional, entrepreneurial and political aspects were all major complementary, and necessary, explanatory factors. The shipping companies that owned the Danish shipyards were strongly committed to the industry and, in the case of Odense, the owner was crucial to the success of the yard from the 1980s to the present day. Moreover, the industry was favoured by the Danish government through the K/S financial scheme, which ensured the bulk of the orders in the late 1980s and early 1990s. Finally, innovative production and niche strategies played important roles in the survival of Danish shipbuilding from the 1970s to the 1990s. With regard to political will and political support, Danish shipbuilding was not in an exceptional position compared to the shipbuilding industry in neighbouring European countries, but the K/S financial scheme was unique to Denmark and to Norway. The entrepreneurial and institutional explanations were also very particular to the Danish case. Except for the shipyards in Norway and Finland, very few shipyards in Europe were as innovative as the Danish yards, in terms of developing new vessel types, and in no other shipbuilding nation had the industry been linked so closely to the shipping industry, in terms of ownership, as in Denmark.

Whether these three aspects were also sufficient explanations is more uncertain. For example, it was clear that the K/S scheme mattered much to some of the major shipyards (the North Sea Shipyard, B&W, Danyard, Ørskov, and Aarhus Dockyard), but had less of a bearing on the success of other major yards. It was also quite clear that had it not been for the vertical integration strategy of the A.P. Moller-Maersk Group, the Lindø Yard would not have survived for so long, but such an ownership integration explanation seems less important to some of the other major shipyards. It should furthermore be noted that there were important interaction effects between the entrepreneurial and the institutional aspects. Demanding orders from the owner holding companies contributed to the development of innovative products at the yards. For example, demanding orders from Maersk Line brought the Lindø Yard to the frontline of container ship development. J. Lauritzen's demanding orders similarly propelled Danyard into a leading position in the construction of sophisticated reefers

Despite these positive conditions, Denmark was unable to withstand maritime deindustrialisation in the late 1990s, and shipbuilding in the Danish economy has lost much of its former importance. When the holding companies' resources were strained and government changed the taxation regime in the late 1990s, Danish shipbuilding started to crumble.

Globalisation has produced large shifts in global industrial production patterns and, accordingly, European economies have changed structurally. In the Danish

case, this change happened later than in other countries in Europe. In retrospect, whether support for the industry from holding companies and the Danish government was worthwhile is questionable. Certainly, from a financial viewpoint supporting the shipbuilding industry was very costly for the Lauritzen group, which suffered heavy losses. From a purely business perspective, the losses sustained by Lauritzen in Elsinore and Frederikshavn were not worthwhile. Also, Lauritzen's commitment to shipbuilding did not enable the long-term survival of the shipyards. Similarly, government orders for ferries from Elsinore and Nakskov only postponed the crisis a few years, but did not solve the structural problems within the industry. Thus, the politicians merely postponed structural adjustment of the industry.

Until recently, the jury was still out on the case of the Odense Steel Shipyard, which continued to build innovative mega-container ships for Maersk Line. However, Maersk Line recently placed an order for 32 new container ships, not at Lindø, but in South Korea. The last container ship for Maersk Line was delivered from Lindø in the spring of 2009 and that same year the owners announced that the yard would close by 2012. This shift indicates that the last remaining Danish, maritime conglomerate has reconsidered its strategy.

Was it worthwhile for government to support the industry or did this support result in a net loss to society? This is a question not addressed in this paper, but a recent report by the Danish Competition Authority concludes that government support for shipbuilding was generally a waste to Danish society (Konkurrencestyrelsen, 2002). The report argues that government only postponed what was a necessary structural change in the economy. Most shipbuilders had made heavy losses and showed only a slow increase in productivity. They were also creating fewer jobs with sub-suppliers than other industries. Finally, most shipyard workers quickly found new jobs when the yards closed during the years of general economic growth around 2000. In other words, government wasted resources that could have been used more efficiently elsewhere.

### Acknowledgements

The authors would like to thank the Danish Maritime Foundation for funding. Thanks go also to Mr Erik Bastiansen, Mr Mogens Schrøder Bech and Professor Kevin Cullinane for constructive comments on earlier drafts of this article, and to Mr Torkil Adersen for help over the histories of a few of the shipyards in the analysis. Special thanks are due to Mr Søren Lund Hviid from *Sofart* for making available the order lists from 2004 and 2007. Finally, the authors are grateful to two anonymous reviewers for valuable comments.

### Notes

1. On the decline of British shipbuilding see Stråth (1987), Lorenz (1991), Todd (1991), Burton (1994), Johnman and Murphy (1998, 2002, 2005), and Jamieson (2003). On the decline of the British economy see Elbaum and Lazonick (1986) and Broadberry (2004).
2. Maritime economist Martin Stopford (2009) shows the structural shift in global shipbuilding based on the number of ships built around the world. However, number of ships does not take account of differences in vessel size and the workload involved in building these ships. Generally, the outfitting of advanced vessels (e.g. container ships, gas carriers, specialty vessels and passenger cruisers) is more labour-intensive than the construction of oil tankers and bulk carriers. Also, large ships require more man-hours of work than smaller ships. Therefore, tonnage is a more reliable measure of workload. Gross tonnage (GT) is a cubic measure of the total enclosed space in a ship, expressed in tons: a ton is equivalent to 100 cubic feet. Compensated Gross Tonnage (CGT) is an even better measure of workload (Wijnolst & Wergeland 1997). It is based on the vessel's tonnage and takes account of the work content of different vessels, weighting, e.g. passenger ships higher than oil tankers.

3. Merchant oil tankers carry a wide range of hydrocarbons, from crude oil to refined petroleum products. Crude carriers are among the largest oil tankers, ranging from around 55,000 tdw (tons deadweight) to over 550,000 tdw. The VLCC (200,000–320,000 tdw) and the ULCC (320,000–550,000 tdw) are popularly referred to as ‘supertankers’.
4. See Tenold (2001, 2006) on the global shipping crisis and Jeppesen et al. (2001) on Denmark.
5. Ships delivered from the North Sea Yard, Aarhus Dockyard, B&W and the Nakskov and Elsinore shipyards are listed in Mikkelsen (2004), Simonsen et al. (1995), Eriksen (1993, p. 141–160), Koch (2005, pp. 201–204), and Jørgensen (2003, pp. 71–97). For the list of ships delivered by the Aalborg yard, see Aalborg Stadsarkiv, archives of Aalborg yard: New-build list, A 36, Æ 107, lb. No. 5.

### Notes on contributors

René Taudal Poulsen is Associate Professor at the University of Southern Denmark. He has published on contemporary maritime history and marine environmental history.

Henrik Sornn-Friese is Associate Professor at Copenhagen Business School. He has published on contemporary maritime history, maritime clusters, regional economic development, industrial dynamics, and industrial policy.

### References

- Adner, R., & Levinthal, D. (2001). Demand heterogeneity and technology evolution: Implications for product and process innovation. *Management Science*, 47(5), 611–628.
- Aker Yards. (2006). *Annual report 2005*. Oslo: Aker Yards.
- Amsden, A.H. (1989). *Asia's next giant: South Korea and late industrialization*. Oxford: Oxford University Press.
- A.P. Moller-Maersk. (2005). *A.P. Moller-Maersk A/S annual report 2004*. Copenhagen: A.P. Moller-Maersk A/S.
- A.P. Moller-Maersk. (2006). *A.P. Moller-Maersk A/S annual report 2005*. Copenhagen: A.P. Moller-Maersk A/S.
- Berggren, L. (2002). The effects of the shipyard crisis in Malmö, Southern Sweden. In R. Ertesvåg, D.J. Starkey, & A.T. Austbø (Eds.), *Maritime industries and public intervention* (pp. 194–204). Stavanger: Stavanger Maritime Museum/Association of North Sea Societies.
- Bjerrum, C. (1993). *ØK i uvejr: Da ØKs aktiekapital forsvandt i Stillehavet*. Copenhagen: Børsen.
- Bohlin, J. (1989). *Svensk Varvsindustri 1920–1975: Lönsamhet, finansiering och arbetsmarknad*. Göteborg: Göteborgs Universitet.
- Boyce, G. (2002). Shipping and other industries: A comment on vertical relations. In D.J. Starkey & M. Hahn-Pedersen (Eds.), *Concentration and dependency: The role of maritime activities in North Sea communities, 1299–1999* (pp. 155–160). Esbjerg: Fiskeri- & Søfartsmuseet.
- Bramsen B. (1983). *Hundrede år under Dannebrog 1883–1993*. Rungsted: Rederiet Dannebrog.
- Broadberry, S. (2004). The performance of manufacturing. In R. Floud and P. Johnson (Eds.), *The Cambridge economic history of modern Britain, vol. III* (pp. 57–83). Cambridge: Cambridge University Press.
- Broeze, F. (2002). *Globalization of the oceans: Containerization from the 1950s to the present*. St. John's, Newfoundland: International Maritime Economic History Association.
- Brogren, K. (Ed.). (1982). *Designs 1982*. Halmstad: ShipPax/Plus 2 Ferryconsultations.
- Brogren, K. (Ed.). (1985). *Designs 1985*. Halmstad: ShipPax/Plus 2 Ferryconsultations.
- Brogren, K. (Ed.). (1995). *Designs 1995*. Halmstad: ShipPax/Plus 2 Ferryconsultations.
- Brogren, K. (Ed.). (2000). *Designs 2000*. Halmstad: ShipPax/Plus 2 Ferryconsultations.
- Burton, A. (1994). *The rise and fall of the British shipbuilding industry*. London: Constable.
- Chida, T., & Davies, P.N. (1990). *The Japanese shipping and shipbuilding industries: A history of their modern growth*. London: Athlone.
- Cho, D.S., & Porter, M.E. (1986). Changing global industry leadership: The case of shipbuilding. In M.E. Porter (Ed.), *Competition in global industries* (pp. 539–567). Cambridge, MA: Harvard Business School Press.

- Danish Shipbuilders' Association. (2002). *Skibsværftsforeningen: Beretning for Virksomhedsåret 2001/02*. Copenhagen: Danish Shipbuilders' Association.
- De Voogd, C. (1993). *De neergang van de scheepsbouw en andere industriële bedrijfstakken*. Vlissingen: De Ruitser/Den Boer.
- De Voogd, C. (2002). Public intervention and the decline of shipbuilding in the Netherlands. In R. Ertesvåg, D.J. Starkey, & A.T. Austbø (Eds.), *Maritime industries and public intervention* (pp. 240–254). Stavanger: Stavanger Maritime Museum/Association of North Sea Societies.
- De Voogd, C. (2007). Shipbuilding in West Germany and the Netherlands, 1960–1980. *International Journal of Maritime History*, 19(1), 63–86.
- Devos, G. (2002). The Belgian/Flemish shipbuilding industry on the slopes, 1978–95. In R. Ertesvåg, D.J. Starkey, & A.T. Austbø (Eds.), *Maritime industries and public intervention* (pp. 205–222). Stavanger: Stavanger Maritime Museum/Association of North Sea Societies.
- Dicken, P. (2007). *Global shift: Mapping the changing contours of the world economy*. New York: Guildford Press.
- Elbaum, B., & Lazonick, W. (1986). *The decline of the British economy*. Oxford: Clarendon Press.
- Erhvervsministeriet. (1995). *De danske skibsværfters internationale konkurrenceevne*. Copenhagen: Ministry of Economic and Business Affairs.
- Erhvervsministeriet. (1996). *Skibsfinansiering 1986–1995*. Copenhagen: Ministry of Economic and Business Affairs.
- Eriksen, E. (1993). *Værftet bag de 1000 skibe: Burmeister & Wain Skibsværft 1843–1993*. Copenhagen: Burmeister & Wain Holding A/S.
- Harlaftis, G. (1996). *A history of Greek-owned shipping: The making of an international tramp fleet, 1830 to the present day*. London: Routledge.
- Harrington, J.W., & Warf, B. (1995). *Industrial location. Principles, practice, and policy*. New York: Routledge.
- Hornby, O. (1988). *'With Constant Care...'* A.P. Møller: Shipowner 1876–1965. Copenhagen: Schultz Forlag.
- ISL. (2006). *Shipping statistics yearbook 2006*. Bremen: Institute for Shipping and Logistics.
- J. Lauritzen. (1993). *J. Lauritzen Holding A/S 1992*. Copenhagen: J. Lauritzen Holding A/S.
- J. Lauritzen. (1997). *J. Lauritzen Holding A/S 1997*. Copenhagen: J. Lauritzen Holding A/S.
- J. Lauritzen. (2001). *J. Lauritzen Holding A/S 2000*. Copenhagen: J. Lauritzen Holding A/S.
- Jamieson, A.G. (2003). *Ebb tide in the British maritime industries: Change and adaptation 1918–1990*. Exeter: University of Exeter Press.
- Jensen, N. (1993). *Anpartsbogen 1993/94: Investering i kommanditselskaber, partrederier og I/S'er*. Copenhagen: Børsen.
- Jeppesen, H., Andersen, S.A., & Johansen, H.C. (2001). *Dansk Sofarts Historie, vol. 7, 1960–2000 Containere & koncentration*. Copenhagen: Gyldendal.
- Johansen, H.C. (1997). *Jernbanerne i bilimens skygge*. Odense: Jernbanemuseet.
- Johnman, L., & Murphy, H. (1998). The Norwegian market for British shipbuilding, 1945–1967. *Scandinavian Economic History Review*, 46(2), 55–78.
- Johnman, L., & Murphy, H. (2002). *British shipbuilding and the state since 1918: A political economy of decline*. Exeter: University of Exeter Press.
- Johnman, L., & Murphy, H. (2005). *Scott Lithgow: Déjà vu, all over again! The rise and fall of a shipbuilding company*. Research in Maritime History, No. 30. St. John's, Newfoundland: International Maritime Economic History Association.
- Jørgensen, B. (2003). *Helsingør byggede skibe i 100 år: Nybygninger fra værftet i Helsingør 1883–1983 og træk af skibenes og værftets historie*. Elsinore: Helsingør Museumsforening.
- Koch, P. (2005). *Nakskov Skibsværft's historie: Episoder og notater*. Nakskov: Per Kochs Forlag.
- Konkurrencestyrelsen. (2002). *Konkurrenceredegørelse 2002*. Copenhagen: Danish Competition Authority.
- Lange, O. (1995). *Logbog for Lauritzen 1884–1995: Historien om konsulen, hans sønner og Lauritzen Gruppen*. Copenhagen: Copenhagen Business School Press.
- Lange, O. (2001). *Juvelen der blev til skrot: kampen om B&W 1945–1996*. Copenhagen: Gyldendal.

- Lange, O. (2002). Shipping companies and shipyards in Denmark, 1870–1999: An interim account of a delicate balance between interaction and competition. In D.J. Starkey & M. Hahn-Pedersen (Eds.), *Concentration and dependency: The role of maritime activities in North Sea Communities, 1299–1999* (pp. 161–179). Esbjerg: Fiskeri- & Søfartsmuseet.
- Langhelle, A., & Dalhaug, O. (1999). *Fra mekanisk verksted til teknologibedrift: HMM/Umoe 1900–2000*. Haugesund: Umoe Olje og Gas.
- Lauring, K. (2008). *Containertrafik gennem 50 år – container traffic for 50 years*. Elsinore: Handels- og Søfartsmuseet.
- Lorenz, E.H. (1991). An evolutionary explanation for competitive decline: The British shipbuilding industry, 1890–1970. *Journal of Economic History*, 51(4): 911–935.
- Magnusson, L. (2000). *An economic history of Sweden*. London: Routledge.
- Malerba, F., & Orsenigo, L. (1996). The dynamics and evolution of industries. *Industrial and Corporate Change*, 5(1): 51–87.
- Mikkelsen, B. (1997). *Limfjords-Værftet A/S – de første 50 år*. Aalborg: Limfjordsværftet.
- Mikkelsen, B. (2004). *Nordøværftet*. Ringkøbing: Forlaget Betty Nordgas.
- Mjelva, H.K. (1996). Stord verft, 1945–1975. I spenningsfeltet mellom marknad, teknologi og politikk. *Sjøfartshistorisk årbok 1995*, 77–275.
- Møller, L. (1972). *Scandinavian shipbuilding 1971/72*. Copenhagen: Wilkenschildt Publishers Ltd.
- Olsson, K. (1996). *Göteborgs historia: näringsliv och samhällsutveckling, vol. 3*. Stockholm: Nerenius & Santérus.
- Schumpeter, J.A. (1939). *Business cycles. A theoretical, historical and statistical analysis of the capitalist process*. New York: McGraw-Hill.
- Simonsen, P., Thorsøe, S., Sonne, G., Jensen, H., & Kjær, L. (1995). *Aarhus Flydedok A/S 1945–95*. Aarhus: Aarhus Flydedok A/S.
- Skibsværftsforeningen. (2002). *Beretning for virksomhedsåret 2001/02*. Copenhagen: Skibsværftsforeningen.
- Søfart*. (1950–2007). Copenhagen: Foreningen til Søfartens Fremme.
- Søndergaard, M.K., Larsen, J.H., Petersen, H.M., & Hermansen, K. (2007). *Danske jern- og stålskibsværfter ca. 1850–2005*. Esbjerg: Fiskeri- & Søfartsmuseet.
- Stokes, P. (1997). *Ship finance. Credit expansion and the boom–bust cycle*. London: LLP Limited.
- Stopford, M. (2009). *Maritime economics*. New York: Routledge.
- Stråth, B. (1987). *The politics of de-industrialisation: The contraction of West-European shipbuilding industry*. London: Croom Helm.
- Tenold, S. (2001). *Skipsfartskrisen og utviklingen i norsk skipsfart 1970–91*. Bergen: Stiftelsen for samfunns- og næringslivsforskning.
- Tenold, S. (2006). *Tankers in trouble: Norwegian shipping and the crisis of the 1970s and 1980s*. Research in Maritime History, No. 32. St. John's, Newfoundland: International Maritime Economic History Association.
- The Motor Ship. (1972). 'Selandia': 60 years on – 75 000 BHP container ship. *The Motor Ship* (October), 298–302.
- The Motor Ship. (1990). World's largest reefer can be run by crew of six. *The Motor Ship* (September), 38–47.
- Thowsen, A., & Tenold, S. (2006). *Odfjell: A history of a shipping company*. Bergen: Odfjell.
- Todd, D. (1991). *Industrial dislocation: The case of global shipbuilding*. London: Routledge.
- Utterback, J.M. (1994). *Mastering the dynamics of innovation*. Boston, MA: Harvard Business School Press.
- Wijnolst, N., & Wergeland, T. (1997). *Shipping*. Delft: Delft University Press.
- Wijnolst, N., & Wergeland, T. (2009). *Shipping innovation*. Amsterdam: IOS Press.