

NEWCASTLE UNIVERSITY
SCHOOL OF ENGINEERING

**Towards a better understanding of the commercial
shipbuilding market**

Summary research report
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Contents

1. Introduction.....	1
2. The type of market.....	3
3. Price determination and cross-price behaviour.....	6
4. Market Segmentation.....	8
5. Cycles and volatility	11
6. Forecasting of newbuilding demand	17
7. Summary of recommendations for further research.....	19
8. References	20

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1. Introduction

- 1.1. The economics of commercial shipbuilding are under-researched (Heaver, 2012, p. 28; Woo *et al.*, 2013) and the subject is not widely understood in terms of economic fundamentals¹. The commercial shipbuilding market is clearly established as one of the four '*shipping markets*' (Stopford, 2009, p. 175), and its under-representation in research cannot be explained by any lack of issues that need to be resolved: commercial shipbuilding remains an economically difficult sector².
- 1.2. The fundamental lack of understanding was found to be a problem in 2003, when the European Union tried to prosecute a complaint through the World Trade Organization, seeking redress for alleged anti-competitive practices and subsidies. The WTO panel concluded that the EU had failed to establish sufficiently the nature of the international commercial shipbuilding market and its pricing mechanisms. Fundamentally, the panel concluded that the EU had failed to establish definitively that a commercial shipbuilding market exists at all. Particular difficulties were related to the issue of *Cross-Price Elasticity* and the identification of '*Like Products*'.
- 1.3. Like products (also referred to as *similar products* or *substitutable products*) are at the core of competition law and determine whether or not products that are physically different can be regarded as being part of the same market. Is an LNG tanker, for example, part of the same market as a container ship? They cannot be substituted functionally by the user (an LNG tanker cannot be used to carry containers and vice versa) and the relationship between them from an economic perspective can be difficult to see. When viewed from the perspective of the producer (i.e. the shipyard), however, likeness is dependent on whether the two products can form part of the shipyard's product mix, that is to say can be competitively constructed by the shipyard. If different ship types can be substituted to competitively utilise the shipyard's facilities, they can correctly be identified as '*like products*'. For like products, demand for one will contribute to the determination of price of another, referred to as '*cross-price elasticity*'. Thus, injurious pricing for one ship type can be seen as damaging to a different ship type that is a like product. Such a relationship could not be established to the satisfaction of the WTO panel in the EU's 2003 action.

¹ This comment is based on analysis of contributions to the two main journals relating to maritime economics, presented in the two papers cited.

² The shipbuilding market differs to the other three sectors (the freight market, the sale and purchase market and the demolition market) in that it relates to manufacturing industry, rather than trade and transport. This may partially explain why it receives less attention in maritime economics, which is dominated by trade and transport economics. Other difficulties relate to problems of measurement of shipyard capacity and difficulty in understanding the heterogeneity of apparently differing products. These difficulties are addressed later in this paper.

- 1.4. Research undertaken at Newcastle University³ between 2012 and 2017 aimed to clarify the difficulties faced in seeking to regulate competition using WTO instruments and to improve knowledge of the working of the market. This report summarises some of the key conclusions of that work, which it is hoped will contribute to the work of OECD WP6. It also includes recommendations for further research, aimed ultimately at improving the economic sustainability of the sector.
- 1.5. The following subjects are summarised:
- the nature of the market, which is essentially based on trade in shipyard capacity, rather than the trade in ships (which are constructed after a significant lag from the time of contract signature and allocation of forward capacity (a 'slot'), when price is normally fixed);
 - the determination of price and, in particular, the cross relationship between prices of products (ships) that appear to be physically very different and therefore unrelated (for example, a container ship compared to an LNG tanker);
 - the segmentation and boundaries of the market (is a harbour tug, for example, part of the same market as a VLCC?);
 - the nature of cycles and volatility in commercial shipbuilding, which causes so much difficulty for those participating in the market, and consideration as to whether anything could be considered to damp the damaging exaggerated nature of the cycle's peaks (i.e. to reduce over-ordering);
 - the problems of forecasting newbuilding demand that lead to unreliable results, with proposals for modifying the forecasting methodology.

³ The research was funded internally by the Newcastle University. Full results can be found in: Stott, P. (2017) '*Competition and subsidy in commercial shipbuilding*'. PhD thesis. Newcastle University.

2. The type of market

- 2.1. Whilst there is only a small body of research to support the contention, it is generally assumed that a commercial shipbuilding market exists. This assumption implies that a key factor relating to the economic concept of 'a market' applies to shipbuilding, which is to say that prices of products within that market (i.e. ships) are linked to common factors of supply and demand. In other words, the prices of different ship types would be expected to rise and fall together. Such price links have been demonstrated to exist in past research .
- 2.2. Shipbuilder Maxwell Ballard, almost a century ago, expressed surprise when his analysis showed that prices of different ship types moved together in parallel over time (Ballard, 1921). Ballard had expected that price determination would have been specific to particular products and the link between prices of different products had not been expected. This research was repeated for a wider range of products by Wijnolst and Wergeland in the 1990s, with the same conclusion (Wijnolst and Wergeland, 1996). Prices for different products move in parallel, suggesting that they are indeed part of the same market.
- 2.3. It is generally assumed that the market is essentially constituted by products, being the different ship types demanded by the shipping industry. The results of the research conducted at Newcastle University, however, suggests that commercial shipbuilding is based on the trading of a factor of production, shipbuilding capacity, and that price is derived from the underlying value of that capacity. This explains the cross-price behaviour between products that compete for the same units of capacity. To understand this, it is necessary to consider what actually changes hands at the point of contract signature, when the price of a new ship is fixed.
- 2.4. With some rare exceptions, at the time of conclusion of a shipbuilding contract the vessel being contracted does not exist. What is actually being traded is a promise to provide future capacity to build such a vessel at a specified future time: commonly referred to as a 'slot'. What is essentially being traded at the point that the price is fixed, therefore, is not a ship but shipyard capacity.
- 2.5. A unit of capacity in the modern commercial shipbuilding industry is normally flexible to enable a shipyard to react to changes in demand for different products over time⁴. Without such flexibility, a shipyard will be vulnerable to market shifts. The products within the limits of flexibility of a unit of capacity for a particular shipyard are normally referred to as the shipyard's '*product mix*'. Products that form part of a shipyard's product mix will be compatible

⁴ Exceptions to this have included the construction of Liberty Ships and T2 tankers in US '*emergency shipyards*' in WWII, 'tanker factories' such as Mitsubishi Kawasaki in Japan in the 1970s and, currently, European cruise-ship builders. Such exceptions, however, have normally turned out to be a response to specific market conditions and have tended to be transient.

with that yards investment in fixed and human capital, supply chain, experience, track record and other factors of competitiveness such as customer relationships. The products that form that mix are substitutable for the builder in economic terms in the utilisation of capacity. This is at the core of the concept of *'like product'* in competition law as it relates to commercial shipbuilding.

- 2.6. To confirm the significance of the trade in capacity and its relationship with the product mix, consider the situation where a contract is cancelled. If a contract were to be cancelled before construction commences, the shipyard would make every effort to re-sell the slot concerned, but the new contract would not necessarily be for the same ship type as that cancelled. The capacity would be directed to whatever product presented the best economic opportunity for the yard at the time of the re-sale, and which is compatible with the shipyard's product mix.
- 2.7. The lag between contract signing and start of construction⁵, which is the essential feature of the forward nature of the trade in capacity, is a variable, dependent on the state of the market. An estimate of the development of backlog in the market as a whole is presented in Figure 1, calculated by dividing current orderbook (measured in CGT) by actual output over the preceding year⁶.

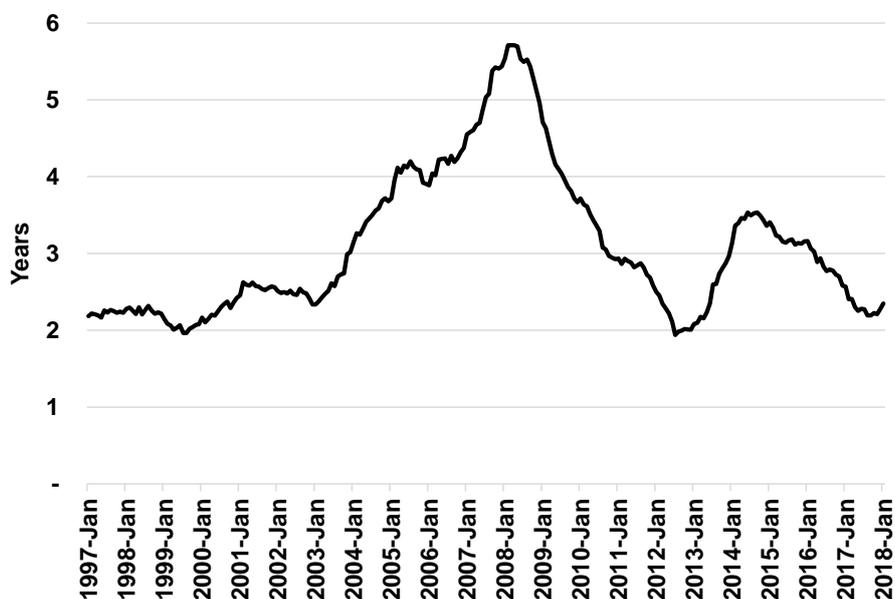


Figure 1 – Estimate of backlog in commercial shipbuilding in years, 1997 to 2018

- 2.8. Backlog has economic significance for both buyer and builder. For the buyer, it represents scarcity of capacity and quantifies the level of business risk in

⁵ Referred to hereafter as 'backlog'.

⁶ Output for the preceding 12 months is used in this relationship as a proxy to represent 'active' capacity.

placing the order whilst facing uncertainty relating to shipping market conditions (and thereby earning potential) on delivery. For the builder, backlog represents scarcity of work and the business risk relates to the period up to the point at which the shipyard will run out of work. For example, for a shipyard that typically takes nine months to construct a vessel, the backlog would become critical below nine months, at which point the yard is working on its last orders.

- 2.9. The use of backlog in economic analysis of shipbuilding addresses problems that arise from the impossibility of obtaining an accurate absolute value for capacity at any point in time. This is a difficulty that some researchers have referred to as the “*shipyard capacity measurement problem... Shipbuilding capacity is difficult to measure and different sources quote different figures*” (Haralambides *et al.*, 2005, p. 82). Backlog provides a proxy that works around this problem.
- 2.10. Backlog drives a number of the features of the market (both in shipbuilding and shipping) that lead to difficulties. One of the most significant is that there are ‘*no brakes*’ on output following the realisation that overcapacity is developing in the fleet and that shipping market conditions are deteriorating, as happened in 2008, for example. The effect is to exaggerate cycles in both shipping and shipbuilding, leading to irrationally high peaks followed by extended trough periods. This is discussed further below.

3. Price determination and cross-price behaviour

- 3.1. For the commercial shipbuilding market to exist, products within that market must be subject to the same forces that determine price. Much of the effort of Newcastle University's research has been aimed at demonstrating that this is indeed the case, through analysis of cross-price behaviour between different ship types.
- 3.2. A summary of prior research on newbuilding prices can be found in the PhD thesis on which this paper is based (Stott, 2017a)⁷. Researchers generally agree that newbuilding prices are determined by a combination of the rational value to the purchaser and shipbuilding costs, with the relative importance of these two values varying depending on the state of the newbuilding cycle.
- 3.3. In addition to these fundamental drivers, prices are affected by three other factors, listed in Table 1.

Price determinant	Description
Freight rates	Determine the rational value for the buyer or, in other words, determine what the buyer can afford to pay.
Shipbuilding costs	Determine the minimum price that a shipyard can charge without making a loss or requiring a subsidy.
Demand for substitute products	This relates to the discussion earlier, where it was established that price is determined by the underlying value of capacity, which is inherently flexible between products in the product mix.
Backlog	The significance of backlog to buyer and builder was discussed above. Backlog is found to be the most significant predictor of price in statistical analysis.
Subsidy	Subsidy has been found to be persistent in the industry throughout its history and has a clear modifying effect on price ⁷ .

Table 1: Determinants of newbuild price

- 3.4. The determinants of price have been identified and, using correlation and linear regression analysis, it has been possible to confirm that cross-price elasticity exists in commercial shipbuilding, that is to say that price and demand are linked for different ship types within the market. The price leaders in the recent peak market were LNG tankers and large container ships. This will come as no surprise to those who have been working in the industry over this period.
- 3.5. The implications of this are that price behaviour for one ship type can be shown to effect prices of different ship types that are like products. For

⁷ Please contact the author for a summary of prior research on price and subsidy if required.

example, suppressed prices of LNG tankers may effect the price of container ships, tankers or dry bulk carriers.

- 3.6. It has only been possible to examine this for cargo-carrying vessels over 5,000 GT, however. Price behaviour in the small ship and passenger market segments and links between segments have not been analysed and are recommended for further research. For example, it is not known to what extent price behaviour of LNG tankers may affect prices for OSV, in the smaller market segment, or prices for Cruise Ships. See further discussion in the following section, on market segmentation.
- 3.7. Whilst specific modelling of price has been successful, a generalised model of newbuilding price has not yet been achieved and this is recommended for further research. The price determinants are known but econometric difficulties remain. Similarly, a revised supply and demand function has been established in sketch form, but requires formal analysis to establish it definitively.

4. Market Segmentation

- 4.1. Having established that the market exists, a question arises as to whether all ship types are part of a single market (as concluded, for example by Wijnolst and Wergerland (Wijnolst and Wergeland, 1996, p. 183)). Is it conceivable, for example, that a harbour tug can be said to be part of the same market as a VLCC? Similarly, can it be said that a passenger ship is part of the same market as a Capesize dry bulk carrier?
- 4.2. To examine the limits of the market in terms of product characteristics, two approaches have been used. The first examined the market by size of products and the second in terms of investment and the competitive links between the characteristics of different products and that investment.
- 4.3. When examined by ship size, the market itself offers no absolute boundaries between segments. A pragmatic approach was therefore taken, examining product types, hull material, volume of demand, the nature of competition and demand volatility. On this basis, four segments of the commercial shipbuilding market are proposed, as summarised in Table 2⁸.
- 4.4. The market for large cargo-ships, over 5,000 GT, accounted for about 85% of all shipbuilding work in the period evaluated (measured by CGT). Virtually all of this largest segment was fabricated in steel and involved construction of large cargo vessels. This segment is proposed to constitute the '*International Commercial Shipbuilding Market*', which was the subject of the EU's prosecution in WTO in 2003.
- 4.5. The separation of large passenger ships from the large cargo-ship segment is based on analysis of the matching of products to investment in physical and human capital and supply chain characteristics. The balance of both skills and work content (steel to outfit) in particular is dissimilar in the passenger segment when compared to cargo-ship construction, leading to inefficient coverage of investment and reduced performance in large shipyards designed for high volume series building of large cargo vessels. Typical series length, work volume, contract durations, material characteristics (in particular the use of thin plate), work flow and contractual conditions are also different. In essence, construction of passenger vessels does not efficiently key in to the same factors that determine competitiveness in the large cargo-ship segment, and vice versa.
- 4.6. Having said this, time series' of prices for passenger ships have not been available to investigate dissimilarity of price behaviour when compared to

⁸ A fifth segment is shown in the table, classed as 'boat building', which is outside the scope of this work.

cargo-carrying vessels, which would confirm absolutely whether or not such ships are part of the same market⁹.

- 4.7. Other significant differences between the proposed market segments include changes in the buyers' attitude to transactional risk and the relative cost of contract management in relation to total contract cost, with the likelihood of ordering at home increasing as ship size reduces. Above all, however, the greatest difference between segments relates to the level of market volatility. Analysis of output reveals that only the International Commercial Shipbuilding Market is subject to the extreme cyclicity described later in this paper. The two smaller market segments do experience volatility, but not to the same extent as the large ship segment over 5,000 GT. The passenger segment shows relatively high volatility, but has been primarily in a growth phase over the period examined, and cyclical peaks have not yet appeared. This conclusion may change when the fleet moves from the development phase to the mature phase of its life cycle.
- 4.8. The remainder of this paper addresses the International Commercial Shipbuilding market exclusively, which is identified as a coherent market, including verification of cross-price behaviour between products in that segment.

⁹ Such data could be provided in the form of indices, rather than absolute values, to preserve confidentiality of prices for the builders.

Sector Name	Vessel Size	Hull materials	Proportion of market by work content (CGT) and by number of vessels [in parentheses], 2008 to 2012	Main Products	Proportion of domestic and regional ordering ¹⁰	Demand volatility: coefficient of variation for the period 1963 to 2012 ¹¹
Boat building	<100 GT	Not assessed				
Workboat market	100 to 500 GT	Composites, Aluminium and Steel	3% [26%]	Tugs, fishing vessels and other workboats: inland waterway and small cargo carrying ships. (87% workboats)	57% domestic 16% regional 73% total	20%
Small ship market	500 to 5,000 GT	Aluminium and Steel	9% [23%]	OSV, small cargo carrying ships and larger workboats. (52% workboats)	43% domestic 11% regional 54% total	26%
Passenger ship market¹²	>5,000 GT	Steel	3% [1%]	Cruise and ferry	40% domestic 21% regional 61% total	70%
International commercial shipbuilding market	>5,000 GT	Steel	85% [50%]	Large cargo ships. (~ 100% cargo carrying)	26% domestic 13% regional 39% total	87%

Table 2 – Primary characteristics of the four proposed commercial market segments

¹⁰ Based on the domicile countries of buyer and builder. Domestic implies built in the country of domicile of the buyer. Regional implies built outside the country of domicile of the buyer but within the same geographic region. Regions include: Africa, Central America, Central Asia, East Europe, Far East, Middle East, Mediterranean Europe, North America, North Europe, Oceania, South America and South East Asia.

¹¹ Based on annual output, using the coefficient of variation to measure volatility.

¹² Given the downturn in cargo-ship construction since 2011 and the increase in the market for new cruise ships, the relative importance of the passenger sector will have increased significantly compared to the period shown in this table.

5. Cycles and volatility

- 5.1. In the period post-WWII the international commercial shipbuilding industry has been through two major cycles, as illustrated in Figure 2. This figure presents both absolute values for output, measured in GT delivered, and the relative magnitude of this output to the total extant fleet at the time of that delivery¹³.

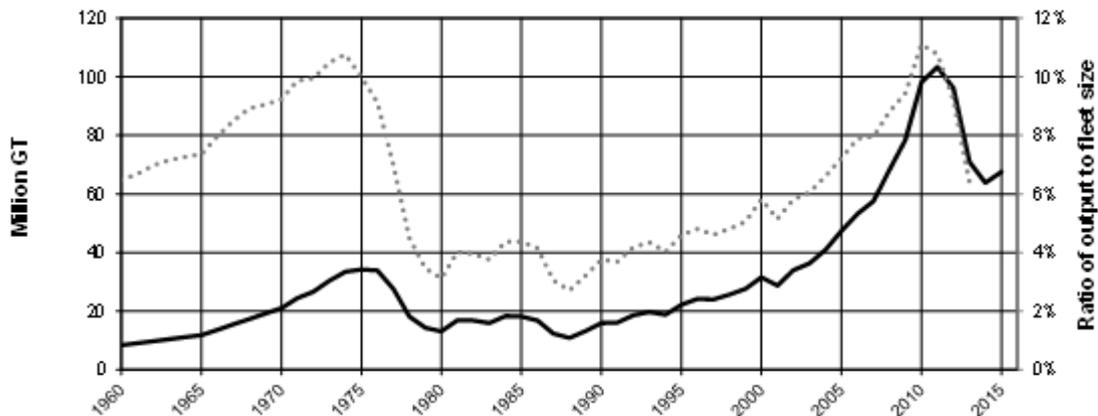


Figure 2 - Commercial shipbuilding output 1960 to 2015 (solid line and left hand scale) and ratio of output to existing fleet size (dotted line and right hand scale)

- 5.2. Evaluation of a longer time series, back to the 19th Century, presented in Figure 3, reveals that these two most recent peaks follow two previous peaks in the pre-WWII period, with an average interval between peaks over the past 125 years of 30.6 years.

¹³ The reason for showing both is that successive peaks in the market have, so far, been exponentially larger than preceding peaks, and tend to mask the size of previous peaks when looking at time series.

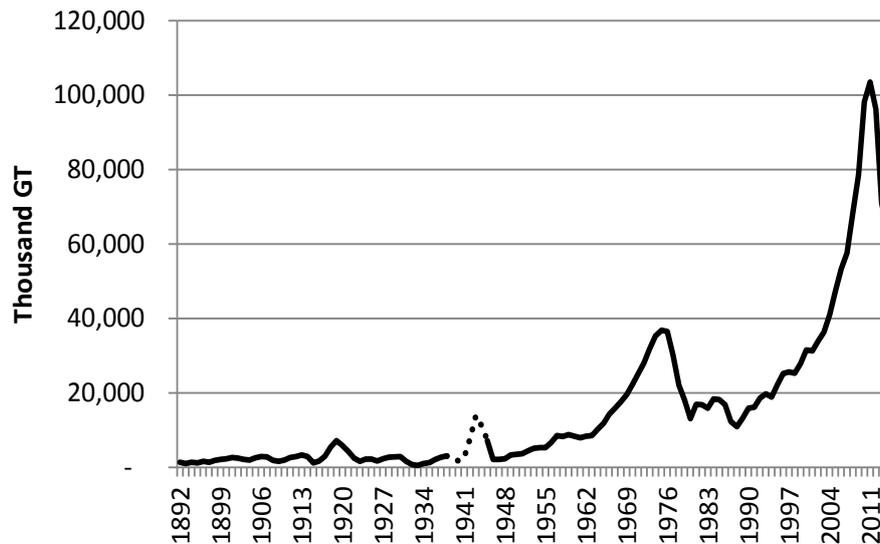


Figure 3 - Commercial shipbuilding output (in gross tons), 1892 to 2014¹⁴

- 5.3. It is established elsewhere that the modern commercial shipbuilding industry, in terms of products, processes and shipbuilding strategy, emerged following WWII (Stott, 2017b). It is difficult to associate these four peaks as being linked, therefore, but the pattern that has emerged from the long term analysis is compelling nonetheless. A consistent significant feature of the peaks is their exaggerated extent, with over-ordering of tonnage followed by protracted trough periods whilst excess shipping capacity generated at the peak is absorbed into the fleet.
- 5.4. The two post-war peak values have been equivalent to about 11% of fleet capacity whilst the two pre-war values were higher than this at 14% for the 1919 peak and 19% for the 1944 peak. It is postulated that both these peaks included an uplift due to replacement of war losses, in addition to any underlying cyclical demand.
- 5.5. More research is needed to understand the nature of the cycle and its generators. Caution is advised particularly because the nature of volatility of output changed significantly following WWII and as the modern industry was established. This can clearly be seen in Figure 4, which presents year-on-year change in output between 1893 and 2014.

¹⁴ Data provided by Clarkson Research for the most recent period. Historical data taken from Lloyd's Register returns, available in the Marine Technology Special Collection of historical data relating to the shipyard industries, at Newcastle University. Complete returns are not available for the WWII period, where data from Japan and Axis Powers is missing. An estimate of output at that time has been made based on available returns from other countries.

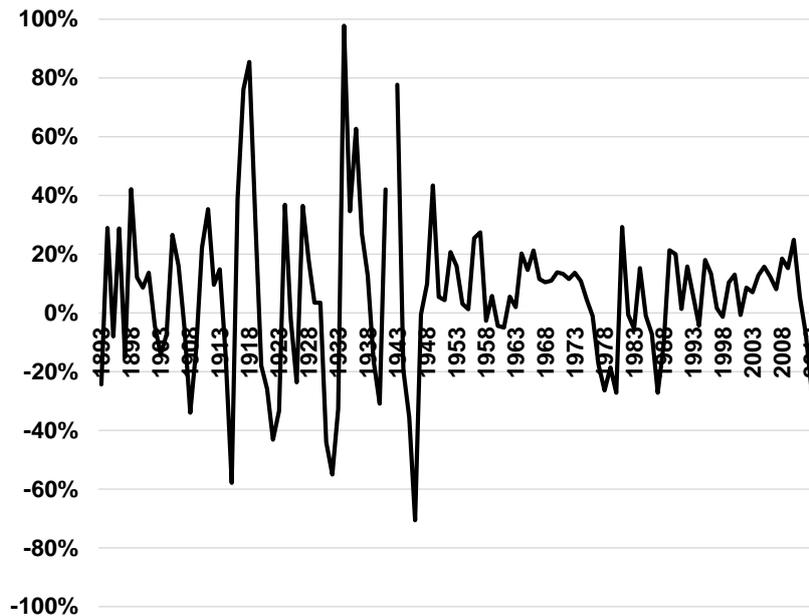


Figure 4 – Year on year change in commercial shipbuilding output, 1893 to 2014¹⁵

- 5.6. It can be seen by visual inspection of Figure 4 that the nature of the volatility of output changed with the establishment of the modern industry following WWII. Volatility halved, as measured by the coefficient of variation. The effect has been that the market has seen much longer periods of sustained growth in the modern era, with associated investment in expansion of capacity. This change in the characteristic of the cycles has accentuated some of the negative features of the cycle.
- 5.7. The cycle causes difficulties for both shipbuilders and ship owners. In a keynote address to London Shipping Week in September 2017, the Chief Executive of ship operator Euronav posed the question: “*How do you stop shipowners overbuilding their market?*” (Pierce, 2017). TradeWinds, the industry newspaper in which this was reported, referred to this as “*potentially the toughest shipping question of all*”. These comments reflect a proposition that has emerged from Newcastle University’s research that the cycles are exaggerated in two respects. Firstly, that peak production levels are higher than they should rationally be for sustainability of the related industries, with the result that the industry builds more shipping capacity than the fleet can absorb and more shipbuilding capacity than can be sustained over the long term. Secondly, that this then leads to extended trough periods, which are longer than they perhaps need to be. Excess fleet capacity generated at the peak periodically suppresses ordering: “*Improvements in freights lead to a tendency to over-order and depressions to a tendency to postpone even replacements*” (Parkinson, 1960, p. 79).

¹⁵ The figure for 1944 (204%) is omitted for the sake of clarity of the graph. It is also excluded from calculations because it appears as an outlier and is an estimate, rather than a confirmed actual value.

- 5.8. The steep decline and extended trough phases of the cycle cause problems for shipbuilders because capacity utilisation deteriorates and prices fall. This is a significant cause of company failure and in some cases leads to a need for Government assistance to maintain capacity in anticipation of a market upturn. Subsidies and shipyard closures were a strong feature of the industry during that phase of the cycle in the 1980s and that situation is repeating at the same stage of the cycle at the time of writing this paper.
- 5.9. Table 3 presents a summary of the drivers of the cycle and the causes of the exaggeration of the peaks, including comments on future prospects for demand.
- 5.10. Whilst it is unlikely, and undesirable, that anything could be done to eliminate the cycle of shipbuilding demand, a valid question that should be addressed is whether anything could be done to try to reduce the damaging exaggeration of the cycle, at the root of which is the tendency to over-order at the peak, coupled to the effects of backlog. This is strongly recommended for further research, in particular relating to a 'leading indicator' that would warn investors when backlogs are becoming too long and ordering is far exceeding the rate at which the shipping industry can absorb the investment in new ships.

Cycle factor		Comments
Underlying drivers of demand	Expansion of seaborne trade	Demand generated by the need to carry expanding sea-borne trade. At present it is not anticipated that seaborne trade will cease growing, although there are, of course, many political, trade and global development scenarios where this could be an outcome.
	Reinvestment cycles	Demand generated by the need to replace obsolete ships. There is no reason to expect that reinvestment cycles will not continue in shipping.
	Emergence of new fleet sectors	The development of new and more efficient 'very large' and 'ultra large' crude oil carriers (VLCCs and ULCCs) was a significant feature of demand contributing to the 1975 peak and the development of 'ultra large' container ships and the expansion of the LNG fleet were significant in the 2011 peak. Fleet development responding to changes in trades and technical developments is likely to continue.
Cycle drivers	Cycles in the shipping industry	Cyclicity is one of the fundamentals underlying the shipping market (Thanopoulou, 2002, p. 623). There is a strong synergic relationship between the shipping and shipbuilding cycles. The trough phase of the shipbuilding cycle, where replacement demand may be suppressed, leads to an improvement in the supply and demand balance in the fleet, which, coupled to the lag between order and delivery, contributes to the periodic achievement of irrationally high freight rates (Stopford, 2009, p. 160 to 169). Periodic high freight rates in turn stimulate peaks of investment in new tonnage. The generation of overcapacity leading to suppression of demand, followed by un-checked over-ordering when the markets recover, from the current perspective, appears likely to be a self-perpetuating feature of the cycle.

Table 3: Generators of the commercial shipbuilding cycle and its exaggerators (continued over page)

Cycle exaggerators	Backlog	<p>The lag between ordering a ship and its delivery is inevitable due to the nature of the industry. The lag means that ships continue to be delivered (for up to six years in the 2011 peak) even though demand for new ships has evaporated. This leads to periodic overcapacity that exaggerates the peak and lengthens the trough.</p>
	Sentiment and lack of memory in the system	<p>Following the peaks, investment in new ships is seen as high risk by both ship owners and financiers, due to extended periods of low freight rates and poor returns. In this situation shipowners dramatically reduce investment and “<i>postpone even replacement</i>” (Parkinson, 1960, p. 79), or in other words reinvestment demand is suppressed. Once equilibrium returns to the shipping market ship operation becomes highly profitable, in part due to the lag between order and delivery and the nature of supply and demand functions in shipping, and shipping once again becomes a target for investors.</p> <p>Very poor investment conditions in the market following the peak in 1975 led to an exodus of banks from shipping finance, such that “<i>in 1986 no more than a handful, say 12 to 15 banks, were actively looking for new business</i>” (Stopford, 2017). With this exodus went experience and knowledge. This is coupled to a pitch between peaks of over 30 years, which means that a lot of expertise in general will have retired from the market by the time recovery starts. Inexperienced investors may be overly swayed by prevailing market conditions without sufficient knowledge of the cyclical behaviour of the market, contributing to over-ordering.</p>

Table 3 (continued): Generators of the commercial shipbuilding cycle and its exaggerators

6. Forecasting of newbuilding demand

- 6.1. The established method for forecasting newbuilding demand is based on a combination of demand for reinvestment coupled to demand for fleet development and expansion. This methodology does not have a strong track record for accuracy. It is proposed here that two flaws in the method could be addressed to improve the accuracy of forecasting and this is recommended for further study.
- 6.2. The first flaw is that the existing model forecasts the wrong thing. It forecasts the rational demand for new ships to satisfy the need of seaborne trade. Investment in new ships, however, is not based on a rational evaluation of transport needs, but on a demand (at times an imperative) to invest in new ships. This is not the same thing. Methodologies to try to predict the demand for investment in new tonnage need to be developed.
- 6.3. The second flaw is in the assumptions for reinvestment. These tend to be based on the economic life of the vessel, with scrapping typically taking place at between 20 and 25 years. The need to replace capacity that is scrapped out of the fleet will clearly have an effect on demand for new ships, but this effect is indirect. Demand is created by the effect of scrapping on the balance of supply and demand in the fleet and this is not a manifestation of the reinvestment cycle.
- 6.4. Research at Newcastle University shows that the typical buyer of a new vessel will reinvest when the vessel reaches around ten years old, at which point the ship is traded on through the second hand markets (Stott, 2014)¹⁶. This suggests that a reinvestment peak should be expected at ten years, not at 20 to 25 years.
- 6.5. Early research on reinvestment looked for an ‘echo’ or ‘wave’ phenomenon in newbuilding demand, but failed to find any significant manifestation of this (Tinbergen, 1931; Einarsen, 1938). Einarsen distinguished between ‘*reinvestment*’ and ‘*replacement*’, which is essentially the change that is suggested here.
- 6.6. Figure 5 shows demand from the 1975 peak in newbuilding output projected forwards for 20 and 25 years against the progression of output in the recent peak. It can be clearly seen that there is no simple ‘echo’ or ‘wave’ phenomenon here and that the normal forecasting technique would incorrectly predict reinvestment demand on this basis. What can also be seen, however, is a minor peak at around ten years from the original 1975 peak, which it is

¹⁶ The 2014 research found that 1 in 5 vessels, taking into account the three main ship types (wet and dry bulk and container) remained with the original owner for the ship’s full life. Replacement is therefore applicable to 80% of the original demand. Ownership behaviour of other ship types has not yet been researched. Updated research supervised by the author at Newcastle University, funded by the Prime Foundation, has confirmed that this pattern has not changed in the modern fleet (Mihaylova, 2018).

proposed could be the actual manifestation of reinvestment in shipbuilding demand.

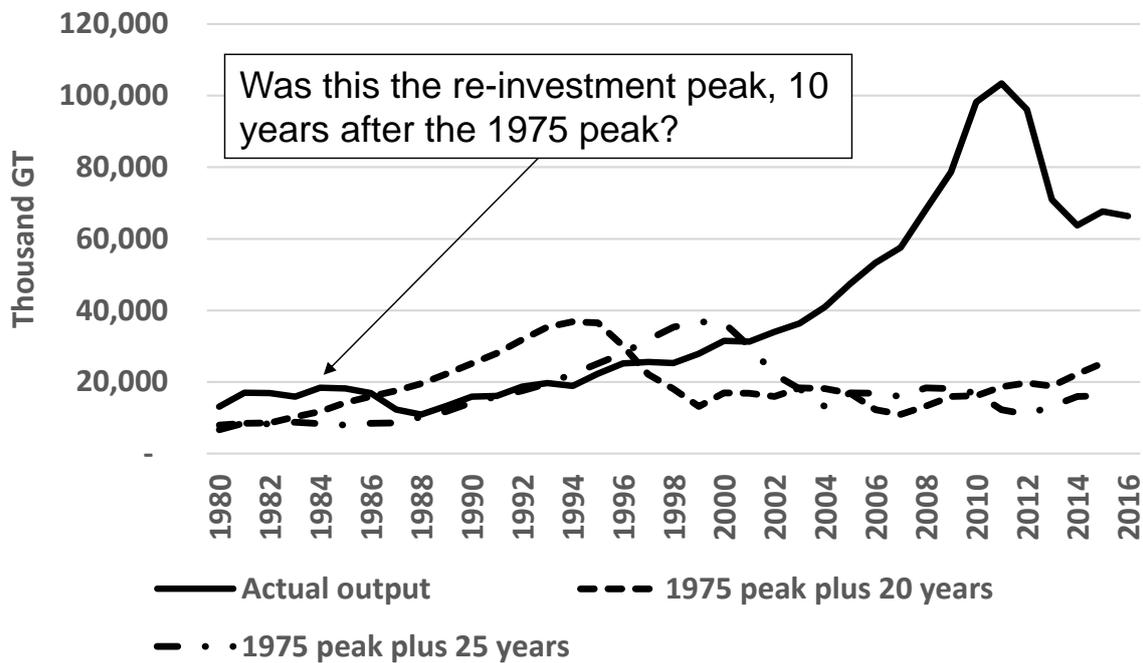


Figure 5 – Reinvestment cycle analysis

6.7. The suggested actual reinvestment demand propogated by the 1975 peak can be seen more clearly when set against that peak, as illustrated in Figure 6.

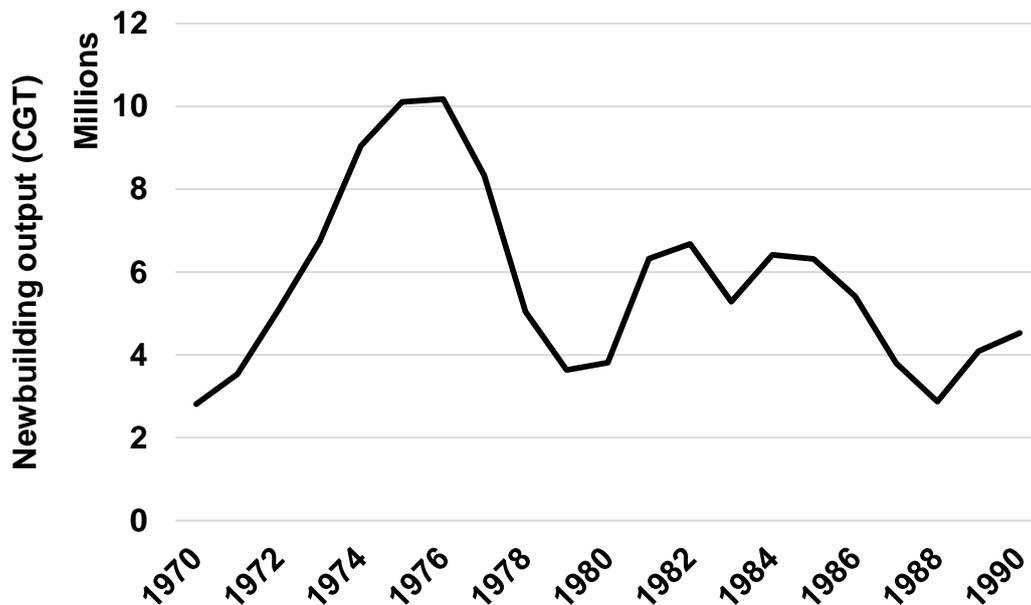


Figure 6 – The suggested manifestation of reinvestment demand at around ten years following the 1975 cyclical peak

7. Summary of recommendations for further research

7.1. The following subjects are recommended for further research:

- Analysis of cross-price links between market segments to confirm the extent of the influence of pricing in the International commercial shipbuilding market on smaller ships.
- Analysis of pricing of passenger ships, to confirm whether or not they are part of the same market as cargo-carrying vessels in economic terms.
- Evaluation of the potential for the establishment of a leading indicator to damp damaging exaggerations of newbuilding cycle peaks.
- Establishment of a generalised model for newbuilding prices and an improved model for supply and demand functions.
- Development of an improved forecasting model for newbuilding demand to achieve more reliable results.

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