COMPETITION AND SUBSIDY IN COMMERCIAL SHIPBUILDING

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1. Introduction

1.1. Despite steeply declining output and very difficult trading conditions, international commercial shipbuilding remains a major global industry. $80.4 billion worth of new ships were delivered in 2016 with Japan accounting for 17% of that total. This is a relatively low annual value: the shipbuilding market is cyclical in terms of both demand and price is currently in a trough phase. Output peaked most recently in 2010/11, when the value of deliveries exceeded $140 billion per annum.

1.2. The importance of the industry extends well beyond the shipyards themselves, with around 70% of the value of commercial shipbuilding typically being in the supply chain, benefitting steel and marine equipment manufacturers. The diversified high economic value of commercial shipbuilding has been utilised as part of national economic development strategies in Japan, South Korea and, most recently, China.

1.3. The modern commercial shipbuilding industry was established in Japan following WWII\(^1\). Study of the history of the industry reveals that politics, in addition to commercial business motives, has been a strong feature of its development. In particular, government intervention has commonly been used to support capacity during periodic downturns, for example in Europe in the 1980s, and to assist in the start-up of new industries. The scale of modern shipbuilding and the investment required, coupled to the risk involved in a highly cyclical market, suggests that it would be difficult, if not impossible, to establish a significant presence in commercial shipbuilding in the modern era without government support. Such government interventions create the potential for market distortions from time to time.

1.4. Despite the economic importance of the industry, the shipbuilding business is under-researched at the academic level and relatively poorly understood in terms of economic fundamentals. This 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 in the industry in South Korea. 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 that a commercial shipbuilding market exists at all. The problem was related to the range of different products that shipyards typically include in their product mixes and how these are linked economically, in particular in relation to price. How could it be shown, for example, that economic behaviour in a shipyard in one country producing a particular product (for example an LNG tanker) could affect prices for a different product (for example a container ship) in a different shipyard in a different country?

1.5. Research undertaken at Newcastle University\textsuperscript{2} between 2012 and 2017 aimed to address the WTO panel’s concerns and to improve the knowledge of the working of the international commercial shipbuilding market. This report summarises some of the key conclusions of that work and how they relate to the industry in Japan. It has been prepared by Dr Paul W Stott, senior lecturer in marine production and shipping market analysis\textsuperscript{3}.

2. Executive summary

2.1 Commercial shipbuilding output demonstrates a very strong cyclical pattern over the long term. 4 large peaks of output can be seen over the past 125 years, with peaks occurring roughly every 30 years. The peaks have been followed by extended trough periods, which have been accompanied by low capacity utilisation and poor trading conditions for shipbuilders. The underlying causes of this behaviour persist and there is no reason currently to assume that this pattern will not propagate in the future.

2.2 The shipbuilding cycles are exaggerated by the effects of shipyard backlog. At the peak of output in 2011 the backlog of work in the global orderbook exceeded five years. There are ‘no brakes’ on output and delivery of unwanted ships persists long after it has been realised that the fleet is expanding too quickly to be absorbed by growth in seaborne trade. The result is overcapacity in the fleet and extended periods of poor freight rates. This suppresses shipbuilding demand and in turn contributes to the overheated nature of subsequent peaks. It is not proposed that the cycles of shipbuilding demand themselves could be modified, but actions could be considered to try to reduce the level of over-ordering and the exaggeration of the cycle, leading to better sustainability in both shipping and shipbuilding. This is recommended for further study.

2.2 It is widely considered that international commercial shipbuilding may be regarded as a ‘hegemony’, that is to say is dominated by a single competitor nation’s industry, and that the market leading nation shifts over time. Study of market share back to the 19\textsuperscript{th} century shows that a dominating position has been held by industries in the United Kingdom, followed by Japan, South Korea and, most recently, China. The true existence of a hegemony is questioned, however, and belief in the inevitability of these shifts is not helpful in considering shipbuilding strategy at the national level.

2.3 It is true that the industry in the United Kingdom has seen a decline from dominating market leader to zero, since WWII. The shipbuilding industry in Japan has also subsequently seen a decline as the lead shifted to South Korea, but the Japanese industry’s decline does not have the same characteristics as were seen in the United Kingdom. Most importantly, the factors that led to the United Kingdom’s

\textsuperscript{2} The research was funded internally by the School of Marine Science and Technology. Full results can be found in: Stott, P. (2017) ‘Competition and subsidy in commercial shipbuilding’. PhD thesis. Newcastle University.

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exit from commercial shipbuilding are not present in the industry in Japan. Both the United Kingdom and Japan’s industries derived their success in commercial shipbuilding from a strong technical lead and a strong domestic market. The United Kingdom lost both these factors and this was a root cause of the decline of the industry in that country. Japan, conversely, has lost neither factor and the characteristics of the industry’s development is therefore very different to the case of the United Kingdom.

2.4 South Korea has no significant domestic market and has never developed a technological lead. The root cause of dominance for the industry in that country can be found in the development of economies of scale, linked to a strong domestic supply chain. South Korea’s factors of success are therefore very different to the preceding two market leaders, Japan and UK. South Korea’s strategy has led to a highly concentrated industry, with 7 ultra-large shipyards, each processing over three million tonnes of steel per annum at the peak. The sustainability of this strategy over the longer term is questioned, however, when viewed against the highly cyclical nature of demand. Whilst such mega-yards are undoubtedly highly efficient at peak times, low capacity utilisation away from the peak periods may offset the advantages gained from scale over the full cycle. Economy of scale provides limited competitive advantage in the periods where the market is unable to provide the scale of workload needed. Study of the development of shipyards’ backlog of work suggests that the industry in South Korea may be more vulnerable than that in Japan in the current poor market conditions.

2.5 The commercial shipbuilding market is found to exist in three sectors: the Workboat Market below 500 GT, the Small Ship Market between 500 and 5,000 GT and the International Commercial Shipbuilding Market above 5,000 GT. The sectors are demarcated by differences in products, domestic ordering preference and workload, the largest sector accounting for about 90% of all commercial shipbuilding. Perhaps most importantly the three sectors are also differentiated by the nature of the shipbuilding cycle. All three sectors exhibit volatility but only the largest sector is subject to the extreme cyclical behaviour that was described earlier.

2.6 The shipbuilding market is characterised not by the sale of products but by the sale of capacity. That capacity has to be flexible to build a range of products, the product mix, and the relationship between capacity and product mix leads to linked prices between products.

2.7 To be compatible (substitutable) within a shipyard’s product mix, the different products that make up that mix must key in to the shipyard’s factors of competitiveness. Analysis of these factors shows that the range of compatible products is wide. The main exceptions are LNG, for which barriers to entry exist, and Cruise and Ferry, for which barriers to entry exist and for which the nature of investment in the shipyard and its skills and supply chain is different to the main cargo-carrying sectors.

2.8 Analysis of newbuilding prices has revealed that cross price elasticity exists in international commercial shipbuilding, but more work is needed to fully understand
the market’s pricing mechanisms. Cross price elasticity shows that the price of one ship type can be influenced by demand for a different ship type and that over the period 2003 to 2015 the most influential products determining newbuild prices were large container ships and LNG tankers.

2.9 The issue of ‘like product’ or ‘substitutability’ of products has been addressed and a framework proposed to review this issue in the context of anti-competitive disputes in commercial shipbuilding. For example, it is demonstrated how a VLCC tanker and a capesize dry bulk can be argued to be substitutable in the shipbuilding market, even though the two products are clearly not substitutable for the shipping sector. The tanker cannot carry coal and the bulk carrier cannot carry crude oil, but this is of no relevance to the shipbuilder, providing that the two product types are compatible with the shipyard’s factors of competitiveness.

2.10 Specific issues relating to ‘likeness’ are identified as relevant to the industry in Japan, relating to the relationship between Japanese shipowners and Japanese shipyards. Under the concept of ‘customers tastes and habits’, referring to case law in WTO dispute resolution processes for ‘subsidy and countervailing measures’, this relationship is relevant and should be defended.

2.10 The research has provided clarification of issues that were faced in a ‘subsidy and countervailing measures’ dispute prosecuted by the EU in 2003 for alleged anti-competitive practises in South Korean shipbuilding. There remain issues in relation to the WTO process for dispute resolution for shipbuilding, however, that may need to be addressed if WTO is to be an effective mechanism for the resolution of subsidy disputes in commercial shipbuilding in future.

3. Long term development of demand and cycles

3.1 Long term analysis of output of commercial ships shows that cyclical peaks have recurred about every thirty years for the past 125 years. This pattern can be seen clearly in the time series presented in Figure 1.
3.2. Each successive peak has been exponentially larger than the previous peak, but the most recent two cycles (with peaks in 1975 and 2011) have been relatively similar in magnitude when compared to the size of the fleet at the time of the peak, with output equivalent to about 11% of the total gross tonnage of the fleet in each year. This cyclical pattern has led to difficulties in commercial shipbuilding. In the period following WWII, two strong growth phases have led to investment in capacity that subsequently becomes redundant in the decline and trough phases. This has led to periodic economic difficulties, through the effects of overcapacity on price and from under-utilisation of investment and assets. These difficulties are felt not only in the shipyards but also in the supply chain.

3.3. No attempt has been made to forecast the future of demand and the propagation of this cycle. It is possible to say, however, that the underlying causes of the cycle have not changed and there is no reason currently to assume that this cyclical behaviour will not propagate in future.

4. Market leaders and Japan’s place in global shipbuilding

4.1. There has been a succession of dominating shipbuilding nations over the period examined and this has led some economists to postulate the existence of a ‘hegemony’ in the international commercial shipbuilding market, that is to say a market that is dominated at any time by a single nationality of supplier, the nationality shifting between countries over time. The market lead moved from the UK to Japan following WWII, then to South Korea in the 1990s, and then to China in the 2000s.

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4 Source: P W Stott, using information from Lloyd’s Register returns and data available from Newcastle University’s Shipbuilding Special Collection. Accurate data for the peak of output in the Second World War (WWII) period is not available.

5 Tentative estimates for the peaks in 1919 and 1944 suggest that output was equivalent to 14% and 19% of fleet size in each year respectively. It is postulated that these higher percentages include an uplift to replace war losses, but that an underlying general cycle, as has persisted in the post-war period, also appears to have been present in the market at the earlier time.

The postulated series of hegemonies can be seen in Figure 2, which tracks the market shares of the industry’s leading suppliers since 1892.

Figure 2 – Share of the global commercial shipbuilding market held by the leading shipbuilding country, 1892 to 2014

4.2. Figure 2 would support the assertion of shipbuilding being a successive hegemony but the true existence of a hegemony is questioned. Acceptance of this supposed pattern without question presents the danger of a ‘self-fulfilling prophesy’, suggesting that the demise of the previous market leader is inevitable in the progression of the industry. In the pattern as it currently presents itself this would suggest that Japan may follow the UK and see the demise of commercial shipbuilding, whilst South Korea will maintain a significant presence in the next cyclical upturn, during which China will take the lead. The only evidence for this pattern, however, is the ‘circumstantial’ evidence shown in this diagram.

4.3. It is true to say that the share of the UK shipbuilding industry has decreased virtually to zero, as output has in most of European shipbuilding (excluding the lucrative cruise sector). The UK’s market dominance was based on two factors: technical leadership of the industry developed in the late 19th and early 20th centuries coupled to a strong demand generated by a significant home market. The UK lost the technological lead by the 1920s as other nations caught up and then overtook the British industry, and British investment and technology subsequently

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7 Source: P W Stott, using information from Lloyd’s Register returns and data available from Newcastle University’s Shipbuilding Special Collection.
became obsolete in the post-WWII era. The UK’s home market also subsequently disappeared in the shift from Empire to globalisation following WWII.

4.4. Japan’s industry developed as part of the country’s ‘economic miracle’ that followed WWII and the market leadership was essentially based on the same underlying factors that led to the previous UK market dominance: technological leadership in the radically new shipbuilding strategies developed post-WWII, coupled to a strong home market\(^8\). Japan has lost neither of these factors as the UK had done previously, and the loss of leadership in Japanese shipbuilding does not have similar characteristics to the loss of leadership in the UK. Japanese shipping companies remain important buyers of new ships and there remains an element of preference to build these wherever possible in Japanese shipyards. The underlying causes of demise of the UK industry are therefore not present in the Japanese case and there is no reason to suppose that the industry in Japan will inevitably follow the UK in decline.

4.5. Japan’s ascendancy was aided by a significant increase in commercial shipbuilding volume that accompanied the development of globalisation following WWII and the industry developed on a scale far greater than anything that had preceded it. This is illustrated in Figure 3, which shows output from the market leading nationalities, rather than the share shown in Figure 2. Peak output has increased with each successive leader, and it is clear that Japanese shipbuilding has not declined in the way that the British industry did before it.

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\(^9\) Source: P W Stott, using information from Lloyd’s Register returns and data available from Newcastle University’s Shipbuilding Special Collection.
4.6. South Korea’s ascendancy to the market lead was based on a different set of factors to the preceding market leaders. South Korea has never had a strong domestic market to provide a baseload of work for the shipyards and, unlike the previous two market leaders, has been dependant predominantly on exports. Only 6\% of CGT\textsuperscript{10} produced by South Korean shipyards at the peak of output in 2011 was for domestic buyers, compared to 66\% for Japanese output in the same year. South Korea also never developed a technological lead, as both the UK and Japan had done previously, but concentrated on the pursuit of competiveness through investment in volume and economies of scale, both in the shipyards and in the domestic supply chain. Elements of competiveness include a strong local supply chain for steel and marine equipment coupled to contracts that control the makers list, directing work to that supply chain.

4.7. Figure 4 presents an illustration of the development of volume and economy of scale in market leaders since 1960, showing the output from the market leading shipyard at the start of each decade. South Korean market leader DSME in 2010 produced eight times the tonnage and nine times as many ships compared to Japanese market leader, Mitsubishi Nagasaki, in 1970. Comparing the peak years 1975 and 2010, the market leader HHI Ulsan at the recent peak produced four times the tonnage and six times the number of vessels, compared to Mitsubishi Nagasaki at the previous peak. The largest Korean yards are estimated to have been processing over 3 million tonnes of steel per annum each at the recent market peak.

\textsuperscript{10} Compensated Gross Tonnage – a non-dimensional measure of shipbuilding work content.
4.8. The relative strengths of the domestic supply chains is illustrated by comparing the proportion of domestic purchases of main engines in 2010. In that year 92% of main engines were domestically sourced by South Korean shipbuilders, compared to 99% by Japanese builders but only 41% by Chinese builders, where the marine equipment supply chain is, so far, less well developed.

4.9. The pursuit of competitiveness through volume and control of the supply chain has been facilitated by the increasing volume of demand that can be seen in Figures 1 and 3 and by the standardisation\(^{11}\) of the main products by suppliers. This is illustrated in Figure 5 that shows the reduction in product variety and increase in product volumes by reviewing the product mixes of the market leaders in 1960 and around the two subsequent market peaks in 1975 and 2010. The form of this diagram follows that developed for analysis of output in the automotive sector and demonstrates that shipbuilding has broadly followed the same development track in terms of volume and standardisation as found in that sector\(^{12}\).

\(^{11}\) Quasi-standardisation is probably a better term. Products in the modern era are not identical as the Liberty Ships were in WWII, but are very similar between contracts. VLCCs, for example, vary little between ships from the same suppliers or even between suppliers and long runs of very similar ship types are now the norm in most of commercial shipbuilding.

4.10 The horizontal axis shows number of different products built over the year (for example, VLCC, Suezmax, LNG, etc.) and the vertical axis the average number of each product delivered in the year. The combination of the two values (number of products x volume per product) equals total number of ships delivered in the year shown. The chart shows that in 1960 each product from the market leading German shipbuilder was more or less unique (with a value of 1 on the vertical axis), with little or no standardisation. By 1975 the market leading ‘tanker factory’ in Japan was series-building a single product type – VLCCs (with a value of 1 on the horizontal axis). Concentration on a single product was found to be unsustainable, however, and in 2010 the market leader was offering a product mix of 9 different ship types over the year, with an average output of 7 of each.

4.11 South Korea’s strategy has led to the development of a highly concentrated industry dominated by a small number of ultra-large shipyards. 7 major shipyards at the peak of output in 2011 accounted for 83% of CGT produced in South Korea in that year, each yard producing over 1 million CGT per annum. As the market has declined the proportion of total South Korean output produced by these 7 largest yards has increased to 88% in 2017. Figure 6 presents a comparison of the level of concentration of suppliers in Japan and South Korea in 2011.

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14 The analysis looked at 1 year’s output only, not taking into account potential sister ships in other years.
4.12. The difference in concentration of capacity represents an important difference between the industries of South Korea and Japan. The number of shipyards delivering vessels over 5,000 GT has reduced from 24 in South Korea in 2011 to 13 in 2017, compared to a reduction from 53 shipyards to 51 in Japan. It is postulated that the greater concentration of capacity in South Korea has led to vulnerability in the face of the inevitable cyclical downturn. The ultra-large shipyards of South Korea were undoubtedly highly efficient at the peak of the market in 2011, but significant under-utilisation of the investment in the falling market raises a question relating to the viability of this strategy in the face of a market that is so strongly cyclical. Without access to the volume needed for efficiency, the economic viability of strategy that pursues competitiveness primarily through scale is open to question.

4.13. The current state of the market certainly supports a contention that the industry in South Korea may be more vulnerable than that in Japan, where technical lead and the domestic market continue to contribute to competitiveness. For South Korea, on the other hand, the level of competitive advantage derived from high volume production has declined since the peak. South Korea’s orderbook continues to decline and output and capacity utilisation in the 7 major builders is therefore inevitably likely to decline further. Japan’s orderbook and deliveries have declined significantly since the peak of 2011 but remain relatively stronger than Korea. Output from South Korea in 2017 was only 56% of that achieved at the peak, compared to 68% in Japan.

4.14. Vulnerability of shipbuilders is reflected in backlog, being the quantity of work contained in the committed orderbook, measured in years, taking into account active capacity. The development of the backlog over time in the commercial shipbuilding industry as a whole is presented in Figure 7.
Figure 7 – Estimated backlog of work in international commercial shipbuilding measured in years\textsuperscript{15}

4.15. It can be seen that backlog has remained above two years at all points in the past twenty years, and rose to over 5 years at the market peak. Backlog is maintained through the balance of orders with capacity and active capacity has reduced as demand has fallen in recent years, through redundancy of workers and subcontractors in particular. Physical capacity per se is difficult to reduce temporarily and tends to persist. Backlog is psychologically significant for shipbuilders. For example, for a shipyard that typically takes 9 months to build a ship, if the backlog were to fall below 9 months the yard would be working on its last orders and rapidly running out of work and the need for new contracts will be desperate. A backlog below 18 months means that the shipyard would be working towards the last order situation and the need for new contracts will become pressing.

4.16. The relative vulnerability of the industries in Japan and South Korea can be seen in the relative development of backlog, presented in Figure 8. South Korea’s estimated backlog has fallen to about 18 months and is continuing to fall as the orderbook declines. Japanese shipbuilding, on the other hand, has so far managed to maintain the estimated backlog above two years. It is concluded from this that the industry in South Korea may be struggling to a greater extent to maintain the level of order intake needed to adequately utilise the seven ultra-large shipyards.

\textsuperscript{15} For development of this and other backlog charts, see: Stott, P.W. (2017) ‘\textit{Competition and Subsidy in Commercial Shipbuilding’}. PhD thesis. Newcastle University.
4.17. Japan’s shipbuilding industry may find that having once been the industry’s dominating leader but having lost that lead, with the political, social and economic difficulties associated with the decline, could easily lead to an un-justified negative political view of the industry, as has happened in the UK. In the prevailing poor market it is important that Japan rationally evaluates the value of the commercial shipbuilding industry to the country, and that this evaluation is not clouded by an assumption of the inevitably of decline as the market lead shifts to other countries.

4.18. More research is needed to better understand the shipbuilding cycle and its causes. The cycle is exaggerated at the peaks by over-ordering, which essentially results from the nature of backlog in shipbuilding: the delivery of new orders persists for years (up to 5 years at the 2011 peak) following the realisation that fleet capacity is growing too rapidly to be absorbed by growth in seaborne trade. Put another way, there are no brakes on the system and over-ordering leads to overcapacity in the fleet, which in turn leads to low freight rates that reduce ordering of new tonnage for extended periods, leading to the decline and trough phases of the shipbuilding cycle. The exaggeration of the cycle suggests that the trough phases are longer than they could be and that capacity utilisation is lower than it needs to be, due to the development of excess capacity to produce the exaggerated peak.

4.19. Whilst it is not suggested that anything could be done to alter the cycle per se, it may be possible to develop methodologies that would reduce the level of exaggeration of the cycle and the amount of over-ordering. One such methodology would be the development of a leading indicator that warns when the market has become over-heated. Reduction of the exaggeration of the cycle may be beneficial to both the shipbuilding and the shipping industries over the long term, and this is recommended for further study.

Figure 8 – Estimated backlog of work in commercial shipyards in Japan and South Korea measured in years
5. The nature of the commercial shipbuilding market and competitiveness

5.1. Research at Newcastle University concluded that the commercial shipbuilding market was found to exist as an economic entity but it is not a single market\textsuperscript{16}. Three sectors are proposed, demarcated by size:

- the \textit{Workboat Market}, below 500 GT;
- the \textit{Small Ship Market}, between 500 and 5,000 GT and;
- the \textit{International Commercial Shipbuilding Market} above 5,000 GT.

5.2. The three sectors are differentiated by:

- \textit{market volume}, which reduces exponentially with ship size;
- \textit{difference in products}, an OSV, for example, belonging in a different market sector to large container ships;
- the extent of \textit{domestic ordering preference}, which increases as ship size reduces and;
- the nature of \textit{volatility}. Volatility exists in the smaller sectors but only the large sector experiences the extreme cyclical behaviour described in the previous sections of this report.

5.3. The research at Newcastle University concentrated on the international commercial shipbuilding sector. The two smaller sectors (workboat and small ship) and price links between the three sectors, investigating, for example, whether the price for an OSV is influenced by price movements in the market for large ship types, has not been undertaken.

5.4. There are two key principles that must be clearly understood to correctly analyse the commercial shipbuilding market:

a) the market is constituted by the sale of shipyard capacity, not the sale of products and ship prices fluctuate in response to changes in the value of that capacity:

b) shipyard capacity in the modern industry has to be flexible between different products that are technically compatible with that capacity.

5.5. At the point at which a shipbuilding contract is concluded, the buyer does not (except in rare circumstances) purchase a ship. The contract is a promise to provide capacity at some future time (commonly referred to as a ‘slot’ in a yard’s build programme) to build that ship. If the contract were to be cancelled prior to the commencement of production of the ship, the shipyard would endeavour to re-sell that slot but this would not necessarily involve replacing the order with the same originally contracted ship type. The re-sale would be to whichever product

represents the best value at the time of the re-sale and which is compatible with the shiyard’s product mix.

5.6. Virtually all modern shipbuilders offer a range of ship types that are technically compatible with the yard's investment, normally referred to as the 'product mix'. Examples of single product yards have existed, including currently the leading cruise ship builders in Europe, but such specialisations have tended to be temporary, supported by transient market conditions. Other examples include the liberty ship emergency shipyards in the United States in WWII and ‘tanker factories’ developed in Japan in the 1960s. The leading such factory was Mitsubishi Nagasaki, which series-built VLCCs up to the 1975 market peak and was the global shipbuilding market leader at the time of that peak. Shifts in the market, however, meant that the focus only on large tankers was found to be unsustainable. An initial large volume of orders established the VLCC as a ship type in the ten years between 1968 and 1978, leading to the conditions that supported series building of that ship type as a single product. After that time the demand for VLCCs crashed, not recovering substantially until the 1990s. The Mitsubishi ‘tanker factory’ therefore had to look for work in other sectors to utilise capacity.

5.7. To survive, therefore, shipbuilders have to offer a product mix to utilise capacity, to respond to demand shifts in the market between product types. It follows that the units of capacity offered to the market, and on which value in shipbuilding is based, have to be flexible between different products. This provides the basis on which prices between different products are linked and explains how pricing behaviour in one ship type can influence the price of a different ship type.

5.8. The products that make up a shipyard’s product mix have to be physically compatible with the capacity being sold and have to key into the factors of competitiveness that determine how that capacity successfully wins contracts. The factors that determine compatibility are:

a) compatibility with the fixed capital investment in the shipyard. This is in two parts. Firstly the product must be compatible with the investment in the launching and workshop facilities in terms of its size. Secondly, the balance of work content inherent in the product, in particular in terms of steelwork and outfit work, should be compatible with the investment in workshops and the skills balance of the workforce.

b) The volume of orders available should be sufficient to gain capacity utilisation at an achievable level of market share.

c) The extent to which the product offers the potential for development of standard ships, which offer volume and can be tied in to the supply chain.

d) The effects of barriers to entry, as exist, for example, in the construction of cruise ships or LNG tankers.

5.9. A framework has been developed to enable these factors to be reviewed together to analyse technical compatibility between the main commercial shipbuilding products. An example for large (post-panamax) products is presented in Figure 9. The features of this diagram are:
1. the diameter of the circles represents demand volume;
2. patterned shading of the circles indicates barriers to entry (for LNG and cruise);
3. positioning on the horizontal axis (net tonnes of steel per CGT) provides a proxy for compatibility with a shipyard’s workshops and skills balance;
4. positioning on the vertical axis (ship size represented by GT) provides a proxy for compatibility of ship size with the investment in workshops and launching facilities;
5. the dark shaded circles represent products for which series of quasi-standard designs can be offered whilst the white circle represents a niche product, where short series or unique designs remain the norm.

Figure 9 – Framework for identification of technical substitutability of products in the large (post-panamax) ship sector\textsuperscript{17}

5.10 The closer two products appear in this framework the greater the compatibility and this diagram illustrates why, for example, from the point of view of a shipbuilder a post-panamax container ship and a suezmax tanker are very similar, despite being very different products from the point of view of the buyer. The diagram also explains why cruise shipbuilding is not like any other sector and would require diversification of investment and skills to successfully gain access on a competitive basis.

5.11 The results suggest that the flexibility of a unit of capacity is wide, with shipbuilders able to technically address most market sectors that are suitably sized for the facilities. The main exceptions are: LNG, for which barriers to entry exist and

for which specific investments and skills are required, and Cruise and Ferry, for which barriers to entry exist and for which the characteristics of investment in both physical and human capital and the supply chain are different to mainstream shipbuilding.

5.12 Consideration of the matching of products with the characteristics of the shipyard, and in particular consideration of the way that the builder pursues competitiveness, can explain why shipyards may or may not be successful in trying to diversify to survive. For example, a shipyard that gains its competitiveness through volume construction of standard products that key into the domestic supply chain of steel and equipment suppliers, is likely to be less competitive in trying to move into offshore fabrication. Offshore products may be large but steelwork is relatively of lower importance when compared to commercial ships, the commercial ship supply chain is of limited relevance (decisions on makers list may not be under the control of the builder and key equipment, such as a main engine, may not be required at all), where contract and project management structures may be different (for example, reflected in the relatively increased importance of outfit and commissioning for offshore products) and where each product in the offshore sector may be more or less unique. Such a shift would key into none of the factors of competitiveness that gave the shipyard an advantage in commercial shipbuilding through volume ship production. Offshore work would not key into the advantages of the established fixed and human capital investments and this shift would therefore represent a major diversification requiring the development of a new set of factors of competitiveness for successful operation.

6. Newbuild prices

6.1. For a market to exist in economic terms, prices of the products in the market should respond collectively to market conditions. The WTO panel in 2003 concluded that insufficient evidence had been presented in these terms to demonstrate that different products in commercial shipbuilding were part of the same market. It is not sufficient that the products are technically compatible as discussed in the previous section, but it must also be established that prices for the different products respond to the same market forces.

6.2. Analysts have long noted that prices for different ship types move up and down in parallel and this has been taken as sufficient by some researchers to conclude that commercial shipbuilding exists in a single market. Whilst this coincidence of price movements is compelling, it is not sufficient from a rigorously analytical point of view to confirm statistically that a single market exists.

6.3. Two methodologies were utilised to examine price behaviour in commercial shipbuilding: correlation between prices for different products and linear regression models for evaluation of price influences. The results were only partially successful.

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due to complexities in the modelling but the results did show that demand for certain ship types were influential in price determination for other different ship types and confirmed that cross-price elasticity exists between different products in commercial shipbuilding. Demand for container ships and LNG tankers were found to have had the strongest influence on prices over the period examined (2003 to 2015). Having said this, the complexities in the cost modelling mean that it has not been possible to generalise results outside that time period and work is ongoing to examine this question further.

6.4. The cost modelling largely concurred with previous conclusions of academic studies of price determination in the commercial shipbuilding sector, in that price was found to be determined by a combination of factors, including:

a) the rational value of the purchase to the buyer, determined by the ship owner’s earnings: in other words, reflecting how much the customer is willing to pay;

b) newbuilding costs;

c) demand.

6.5. The modelling found additionally:

a) demand for alternative (substitutable) products may be more influential on price than the demand for the product itself;

b) backlog was found to be a strong determinant of price;

c) the level of significance of different determinants changed depending on the stage of the demand cycle.

6.6. Backlog is an important parameter for both the buyer of new ships and for the shipyard. For the buyer it represents scarcity of capacity and reflects the business risk faced due to the lag between placing an order and receiving the ship. For a shipbuilder it represents scarcity of work and reflects vulnerability of the business.

6.7. These findings are consistent with and support the theory developed that ship price is derived from the underlying value of capacity, as well as from tangible elements such as build cost. The variation in significance of influencing factors over time is summarised as follows:

a) In a rising market the influence of the rational value of the purchase to the buyer becomes more significant, with shipbuilders raising prices as fast as possible.

b) In a falling market shipbuilding costs become of greater significance but the shipbuilder will initially be reluctant to reduce prices, with a buffer workload being provided by a strong backlog. As backlog is eroded the shipbuilder will become more motivated to reduce prices. This tendency in a falling market may therefore explain what some researchers\(^\text{20}\) have referred to as ‘stickiness’ in the movement of newbuilding prices, which may not move as might be expected based on the buyers’ rational valuation.

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c) In a trough market shipbuilding costs, modified by government intervention, will present a strong influence.

7. Like products and WTO

7.1. The concept of 'like products' or 'substitutable products' is at the core of understanding the competition between different products that exist in the same market and correct understanding of this concept is central to the successful prosecution of action for anti-competitive practices. Like or 'substitutable' products would show similar responses in terms of price, based on market conditions.

7.2. The concept of like product as it applies to commercial shipbuilding was not successfully established in the ruling of the WTO panel in 2003 and understanding this situation has been a central part of the research undertaken at Newcastle University.

7.3. The confusion of the WTO panel is understandable given the differing nature of the products offered. A container ship, for example, can self-evidently not carry LNG and vice versa – how can it be argued that the two very different ship types are 'like' or 'substitutable' in the context of the market? The answer to this question has been found in the analysis of value and flexibility of capacity and by studying the case law that defines the concept in WTO.

7.4. It has to be established from whose point of view 'likeness' has to be judged. From the point of view of the buyer, the two ship types quoted above are certainly not 'substitutable' and are not like products – they functionally do very different things. From the point of view of the shipbuilder, however, they may be substitutable if they key into the shipyard’s factors of competitiveness and are both compatible with the shipyard’s units of capacity, or in other words that they are part of the shipyard’s product mix. It has been established that the market is constituted by the forward sale of capacity and not specifically by products, and that capacity for a modern shipbuilder has to be flexible between products. It is the limits of this flexibility that provide the definition of like product in commercial shipbuilding. Ships that can be competed for by a unit of capacity are those that are ‘like’ for a shipyard. The functional view of the products from the buyer’s perspective is of no relevance.

7.5. Additionally, there is a specific aspect of the concept of ‘likeness’ in WTO that may be of significance in certain circumstances, for example in the cruise market or relating in general to shipbuilding market behaviour in Japan. This relates to a concept in WTO case law normally referred to as ‘customer’s tastes and habits’. This concept seeks to take into account established customer behaviour and its influence on suppliers to a market, including established relationships between customers and suppliers. Such relationships are relevant to the consideration of ‘like product’. An example would be long established relationships between specific customers and specific shipyards, as is found in the cruise sector. Such a relationship could be regarded as significant in the prosecution of an action where a customer has been lured away from the established supplier with the aid of subsidy provided to a competitor.
7.6. In the case of Japanese commercial shipbuilding, there is a strong coincidence between the products offered by Japanese shipbuilders and the products purchased by Japanese ship owners, and there is a strongly established tendency to purchase at home shipyards. This relationship would be significant in the context of action in WTO where established customers had been persuaded to purchase at other shipyards and where this was the result of anti-competitive behaviour. No such coincidence of products between buyer and seller has been identified in other shipbuilding nations, and this is therefore identified as a specific contributor to competitiveness in Japanese shipbuilding that may be defended.

8. Limitations of WTO in the regulation of competition in shipbuilding.

8.1. Research at Newcastle University has provided a revised perspective that could assist in the prosecution of action for anti-competitive behaviour under the WTOs ‘Agreement on Subsidies and Countervailing Measures’, should the need for such action arise in the future, and which addresses problems faced by such a prosecution in 2003.

8.2. Having said that there remain other barriers to prosecution in WTO, in particular the requirement to demonstrate ‘specificity’, which states that in principle subsidies can only be actionable when they are specific to a particular contract, and that money must specifically change hands in relation to that contract at the time the contract is progressed. Having to prove such specificity in commercial shipbuilding may be practically impossible, particularly given the forward nature of contracts. For this reason it is concluded that shipbuilding possibly needs to be considered as a special case in WTO regulations, as for example is found in agriculture. Political will would be needed to make this change but without this, commercial shipbuilding may remain outside the ability of WTO to regulate competition and potential harm caused to the industry of one country by government intervention in the industry of another country.