POTENTIAL CAUSES FOR IMBALANCES BETWEEN SUPPLY AND DEMAND IN INDUSTRY SECTORS

The literature in the area of industrial organization discusses various causes of excess capacity and excess supply. This section aims to summarize these sources by distinguishing between influences of three types:

- **Structural**: economies shift to new industries and an economy's fundamental structure is altered, owing to technological, cost-related or demand-related changes, changes in the pattern of international-trade, changes of the structure in the organization of companies and changes that are permanent or very long-lived.

- **Cyclical**: temporary disturbances owing to changes in an economy's activity which tend to return to its previous level over a few years.

- **Non-market-related**: government measures and strategic decisions that are taken by market participants and may have a long-term impact on the situation of an industry.

While under-capacity in an industry is mainly a temporary problem as the industry will usually attract new investment, overcapacity may persist for long periods of time with adverse consequences. For instance, overcapacity often leads to oversupply which puts pressure on prices and hampers firms' economic health.

Such oversupply that follows overcapacity is explained by the fact that companies cut prices to dispose output. In turn, when one company starts to cut prices the others quickly follow because they fear that the price cutter will be able to increase its market share at the expense of others.

Structural sources

This section lists several structural reasons for excess capacity and excess supply including:

- Long delivery times of vessel,

- long lead times in adding shipyard capacity,

- capacity expansion dynamics,

- role of ship finance,

- capacity to inventory vessels,

- limited opportunities to re-orientate into other markets,

- technological shocks,

- economies of scale,

- low to medium entry barriers and high exit barriers,

- push from the buyers' side,
- overbuilding of capacity in customers' industries.

The shipbuilding industry is characterized by **long delivery times** of vessels with usually two to three years between orders and ship delivery. Such time lags curb the ability for ship owners to quickly adjust to evolving market conditions (e.g. decline in freight rates, economic downturn). For example, despite the financial crisis, great recession and contraction of international trade in 2009, the level of global ship completions were historically high in 2010 and 2011 owing to the lags between orders and ship deliveries. Moreover, such large time lags between ordering and delivery may contribute to oversupply of vessels. As ship owners face difficulties to precisely predict future economic growth, the capacity of the new vessels they ordered may surpass future actual demand two to three years later when the vessel is put into operation. Strategically, ship owners have incentives to hold reserve capacity by ordering more vessels in the first place with the aim to ensure meeting future demand rather than carrying the costs of supply shortage if demand eventually surpasses vessel capacity (Fusillo, 2003). Contractual penalties for cancelling an order are very diverse and usually do not discourage this practice. However, statistical evidence by Kalouptsidi (2014) implies that the shipbuilding industry's feature of time to build has positive effects on the supply situation in the bulk shipping market. The author finds that without any time to build the bulker fleet would be twice as volatile and around 15% larger than under no time to build. New buildings were even seven times more volatile and vessel prices were about 14% lower in the absence of long construction times.

Long lead times in adding capacity may encourage firms to start new capacity projects early if they have overoptimistic expectations on economic growth (Porter, 1980). In this regard, expectations about future demand and those about competitors' behaviour are crucial. Since firms in such industries with long lead times of capacity expansion face an increased penalty if they are left behind without capacity, even risk-averse firms will be more prone to invest even though the capacity decision itself is risky. This argumentation is closely linked to the contribution of Fusillo (2003); if the costs of supply shortage is higher than the cost of carrying excess capacity the firm has more incentives to err on its decision to expand capacity rather than on facing supply shortage during periods of high demand (i.e. similar cause of oversupply due to long delivery times of vessels). This depends closely on contractual penalties and bankruptcy legislation. In this regard, shipyards may be inclined to add capacity to avoid supply shortage in future times of strong demand.

Capacity expansion dynamics can explain the increase in excessive capacity. In an industry characterized by non-linear unit costs of capacity expansion (i.e. degressive unit costs), such as is the case in shipbuilding each non-collusive firm will add more capacity (i.e. large units) at less frequent intervals than it would be the case in sectors for which unit costs are not degressive. In this way, firms can save on the fixed costs to install new capacity. However, fluctuating demand will cause uncertainty for firms to expand capacity and the large units of capacity expansion will likely surpass demand (Fusillo, 2003; Sharkey, 1982)[6]. For instance, this dynamic capacity expansion problem was a major factor in the overcapacity of colour picture tubes that developed in the late 1960s. Many firms producing television sets perceived the need to assure a supply of tubes, but the size of an efficient tube plant was very large relative to that of a television set assembly plant. Demand did not grow rapidly enough to absorb the massive colour tube capacity that had been put on stream all at once (Porter, 1980).

Developments in **ship finance** are likely to have a major influence on ship supply and shipyard capacity. Ships are by nature highly tradable goods and exports are therefore an essential feature of this industry. In this regard, export credit agencies are granted an important role for the competitiveness of a yard. With financing schemes of "front end payment" or "tail end payment", the financial risks are high and considerably influence the buyers' choice for contracting with a specific yard. In the former scheme,

the significant down-payment is made by the buyer while in the latter one the shipyard is forced to finance the building costs upfront. Easy access to finance especially in the years preceding the financial crisis is likely to have contributed to over-ordering.

Limited capacity to inventory vessels may have also contributed to oversupply. Yards have hardly capacity to inventory vessels. High costs of building up an inventory of unused vessels and the tailor-made nature of certain ships force yards to sell the vessel to the market (even at low prices) rather than store it in case of cancellation.

A recent report showed that **re-orientation opportunities for shipyards are possible but could be very risky**. There are cases in which some shipyards chose to re-orientate their activities into niche markets during periods of low demand for merchant vessels. However, only a handful of yards succeeded. Often yards lack experience of operating in new markets (e.g. ship repair or niche markets such as cruise ships) as well as the necessary technology or supplier relationships. Such a lack of re-orientation possibilities imply that yards are not able to easily escape the situation of overcapacity in the shipbuilding industry or direct their capacity to other activities.

Technological shocks lead firms to simultaneously invest to prevent being left behind. As a consequence, it could make existing capacity redundant and contribute to overcapacity (David and Salo, undated). Moreover, if the new technology leads to productivity increases, it adds automatically capacity further.

Economies of scale or significant learning economies could lead to overcapacity. The firm with the largest capacity or which adds capacity the first may have a cost advantage, putting pressure on all competitors to move quickly and aggressively (Porter, 1980).

In a similar vein, some industries can experience an increase of the minimum efficient scale (MES). In this scenario, larger plants are significantly more efficient than smaller ones, for instance, due to technological innovation and economies of scale. As a consequence, unless demand is growing rapidly the number of plants in the industry must shrink to avoid overcapacity. Unless every firm has several plants and can consolidate them, some firms will necessarily have to reduce market share, something they try to avoid. Therefore, firms will build larger new facilities to reach the MES, creating overcapacity. This mechanism occurred in the oil tanker shipping industry, where the new super-tankers are many times the size of the older vessels. The capacity of super-tankers ordered in the early 1970s far exceeded the market demand (Porter, 1980). A similar trend is currently taking place in the containership market as shown by a recent report by the International Transport Forum on mega ships (ITF, 2015).

Low to medium entry barriers and high exit barriers can attract many firms during times of high profits but once the industry reaches maturity with low profits, firms are reluctant to close down when results deteriorate. As a consequence, capacity stacks up in the industry and profitability is usually chronically poor. For example, an industry might end up in this position if suppliers or lenders (e.g. governments) will readily finance entry, but once in, the firm would face fixed financing costs but stays in the market due to high exit barriers (Porter, 1980). The global shipbuilding industry is characterized by medium entry barriers which discourage firms from entering the market, but also increases the costs to exit it. Entry barriers include delivery times, reliability of yards, location of production and logistics. In specialty vessel markets (i.e. cruise ships or yachts) – part of the industry that is often characterized by a higher growth potential – entry barriers are higher as the construction of those vessels requires technological and organisational expertise, experience, and a highly skilled labour force.

The shipbuilding market faces such exit barriers as listed in Box 1, explaining why shipyards remain in business, even if they are less competitive and unprofitable. Capital investments for facilities and

infrastructure make it difficult to re-orientate away from any economic activity related to vessel production or repairing. As a result of these exit barriers, the profitability of the entire industry can decrease substantially (Porter, 1980).

Not all of these barriers are subject to policy influence. However, several countries support their industries with subsidies as shown by the WP6 Inventory of subsidies and other support. Subsidies curb the natural trend – in particular in mature industries – for old and unprofitable firms to exit the market.

Box 1. Selected exit barriers in industry sectors

Porter, in his seminal work on industrial organization, listed several exit barriers that exist in industry sectors which can also be applied to the shipbuilding industry.

- **Little or no re-sale value** for specialized installations for vessel production, also affecting a yard's ability to re-orientate to new operational activities.
- **Political restrictions** due to the strategic importance of the industry. Concerns about job losses and economic effects in the region discourage local politicians from closing down yards. Governmental support schemes enable unprofitable yards to continue their operations.
- **Emotional barriers**. Yards' management may refuse to make necessary economic decisions to withdraw from the market because of identification with the business, loyalty to employees etc. Emotional barriers exist, in particular, in family businesses and in cases were the management directly built up the business.
- **Information barriers**. Unprofitable operations are internally financed by profitable ones within yards (e.g. repair and maintenance), and their bad performance is hidden.
- **Another exit barrier**: expectations of future profits will be higher than the present costs of maintaining the yard (i.e. fixed costs).

Source: Porter (1980); Bertram (2003).

Push from the buyers' side can also lead to overcapacity in supplier industries when industries try to sell new products to large buyers for which the product is an important input. This cause assumes monopsony power in the market. The reasoning is that the buyers will hesitate to switch to the new product until sufficient capacity is installed to meet their needs without making themselves vulnerable to a few suppliers. Therefore, buyers strongly encourage their suppliers to invest in capacity with promises (directly or indirectly through statements) of future business, although buyers are not required to actually place orders once the capacity is built. It is in the buyers' sole interest to ensure that adequate capacity exists to serve their greatest possible needs even if the capacity expansion will not necessarily match future demand.

Overbuilding of capacity in other industries can be driven by equipment suppliers, through subsidies, easy financing or price cuts. In a battle for orders, suppliers can also make it possible for buyers to build capacity that they would be unable to maintain under normal circumstances. For instance, shipbuilders have encouraged supply increases in the steel industry, among others, due to government subsidies and the urgency to sell vessels to stay in operation, as well as to maintain employment.

Cyclical sources

This section lists several cyclical reasons for excess capacity and excess supply including:

- Vicious circle in the shipbuilding and shipping markets,
- negative economic shocks,

- overly optimistic expectation of future demand,
- new entrants,
- divergence between good and bad performing firms.

The shipbuilding industry may be stuck in a **vicious circle** due to the aforementioned characteristics and as vessel replacement, one of the two key demand drivers, is endogenous to the shipbuilding and shipping markets. This could lead to vicious circles where low ship prices lead to increasing demand for new vessels, which in turn decrease vessel prices further.

Figure 18 presents in more detail the shipping market cycle where excess shipyard capacity may lead to excess vessel supply as shipbuilding companies sell at low prices with the aim to increase their capacity utilisation ratios in order to cover fixed costs. As a consequence, freight rates and ship prices decrease, vessel demolition increases and the fleet capacity decreases. With the subsequent recovering of freight rates, vessel demand will increase leading to the expansion of shipyard capacity and over-ordering.

Tinbergen (1931) showed that the shipbuilding market is strongly linked with freight levels, which are notably dependent on the volume of goods shipped. In the author's analyses the time lag between demand for shipping capacity and actual availability of capacity plays an important role. On the basis of a supply-demand approach, Tinbergen analyses the newbuilding market drawing on the cobweb theorem – a model where supply adjusts to price with a specific time lag. For instance, presence of low total vessel tonnage in the market leads to high freight rates.

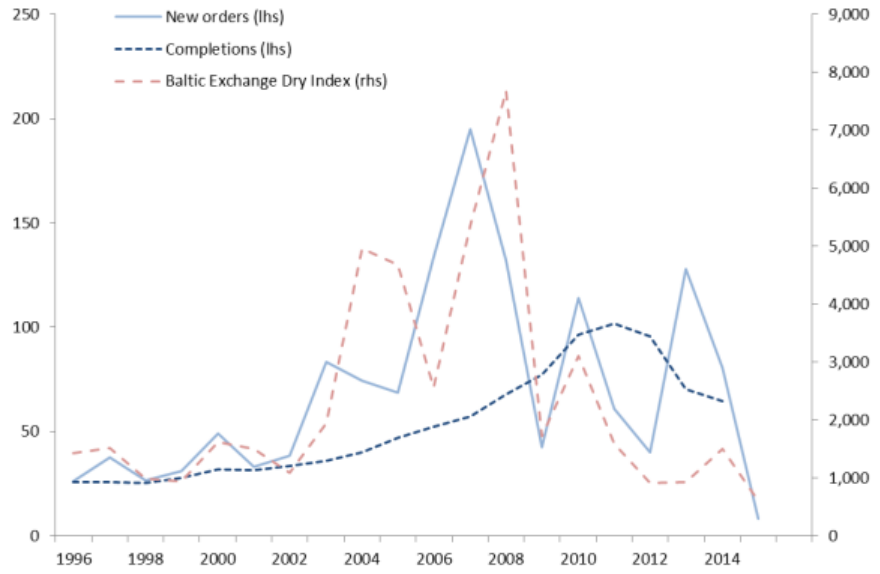
Figure 18. Shipping market cycle

Source: Presentation by P. van Kuijen (Damen) / Sea Europe / JECKU at the November 2014 WP6 meeting. Shipping Market Cycle Modeled after M. Stopford, Maritime Economics.

Figure 19 shows the high level of correlation between freight rates, proxied by the Baltic Dry Index (BDI), and new orders of vessels. Such a strong relationship confirms the interconnectedness of the situation in freight and shipbuilding markets. Moreover, capital expenditures in the global shipbuilding industry increased threefold within only three years between 2005 and 2008, indicating that the industry strongly increased its investments in 2005 at the same time as ship orders peaked. As several new orders have been cancelled during the financial crisis many shipyards were left with overcapacity due to their strong capacity expansions prior to the crisis. This development illustrates the close linkages between freight rates as a driver for new orders which likely pushes developments in yards' production capacity. In the subsequent years, Figure 19 shows that completions increased but not to the same extent as new orders because of numerous order cancellations and postponements in 2007 and 2008.

Figure 19. Global shipbuilding new orders, completions and freight rates (BDI)

New orders and completions in gt; 1996 – 2015



Source: Clarkson, IHS.

Box 2. Causality tests between freight rates, vessel orders and capital expenditures

Our statistical results of a Granger causality test[7] with four time lags confirm that changes in freight rates (i.e. BDI) caused new orders (at a 1% confidence level) (See Appendix 5). For a more coherent analysis a structural model would be needed but simple correlation tests, such as with Granger causality, provide some evidence. Although further statistically significant results with two and three time lags imply that both BDI and new orders caused each other in the short-term (i.e. they are inter-correlated) the clear results of the test with four time-lags suggests that in the long term ship owners react to changes in freight rates by ordering of new vessels (Appendix 5).

Furthermore, it seems that new orders have had an influence on capital expenditures (results as statistically significant at the 1% confidence level), implying that new ordering could have partly caused capital expansion (Appendix 5).

Negative economic shocks and/or overly optimistic expectation of future demand could contribute to excess capacity. Negative economic events, such as financial and economic crises, lead to a cyclical decline in demand and restrictions in financing for buyers and suppliers, thereby equally affecting the supply side and the demand side, and leading to overcapacity. In a rapidly growing industry, in young industries or in advanced industries during boom periods, firms expand the scale of production and sometimes take short term losses or lower profits in expectation of higher future demand. Such an overly

optimistic expectation of future demand can result in overcapacity (David and Salo, undated); as firms simultaneously respond to favourable conditions by investing in new plants to be able to take advantage of the expected demand increase. These risks are reinforced in industries supplying commodity-like products (see Box 3).

Another cyclical cause, similar to structural reasons, for a rapid decline in demand leading to oversupply can be related to an economic recession; in such a situation the lower demand for a product inclines companies to give customers price incentives to purchase the firms' goods. This was also the case in the shipping industry's leading yards to sell ever bigger vessels at low prices in order to be able to continue operating (ITF, 2015).

Box 3. Cyclical risks in industries producing commodity products

In general, cyclical risk of overcapacity is more severe in commodity businesses, as it is the case in shipbuilding, for two reasons:

1. Demand is usually cyclical, leading to overcapacity during downturns and to over-optimistic expectations during upturns.

2. There are only limited possibilities for product differentiation. As buyers' choice is heavily based on price a lack of product differentiation makes costs crucial for firms to stay competitive. If there is no brand loyalty to bind customers, firms are required to have large, modern plans to stay competitive and to achieve their target market share.

New entrants could create or aggravate the problem of industrial overcapacity. They try to ensure significant positions in the industry and incumbent firms refuse to yield. For instance, new entry has been a major cause of overcapacity in industries such as fertilizer, gypsum, and nickel. In general, industries with low entry barriers are prone to overbuilding because firms rush into the market in response to temporarily favourable economic conditions.

Divergence between high and low performing firms – without exit of the latter – can contribute to excess capacity. At the micro level, demand shifts between firms to the most productive ones that gain market share at the expense of less successful ones. Thus, the latter ones may end up in a situation of excess capacity even if demand at the industry level remains unchanged (David and Salo, undated). A slight modification of this reasoning and applying it to the macro level implies that exporting national overcapacity to the world market will not change the problem of global overcapacity as it is only a reallocation rather than a true reduction of capacity.

Non-market factors

This section lists several non-market reasons for excess capacity and excess supply including:

- Protectionist policies,
- policies favouring new capacity investments or curbing restructuring,
- strategic capacity expansion to discourage new entry.

Protectionist policies, such as restrictive trade policies, preferential treatment for national firms and (in)direct operating subsidies are sometimes implemented by governments. Governments aim to develop important industries which confer positive externalities for the domestic economy. However, these market-distorting measures are also likely to worsen the severity of overcapacity. These policies would indeed

hinder the exit of outdated production capacity which in turn slows down the progress of structural reforms.

Policies favouring new capacity investments or curbing restructuring can contribute to excess capacity. Policy measures that artificially support investment include reduced land prices for new yards, subsidies for factory buildings, tax reductions or financing guarantees.

Finance, competition and tax policies may discourage firms from undertaking mergers and acquisitions, impeding industrial consolidation. Moreover, interests of governments and firms can diverge; for instance, local governments which are shareholders of the affected firms (i.e. State-Owned Enterprises, SOEs) and whose interests are harmed may hinder restructuring efforts through administrative constraints. Accommodative monetary and expansionary fiscal policies can also contribute to the increase in capacity by favouring bank credit distributions, allocation of public budget to industrial projects or the implementation of tax holidays.

Strategic capacity expansion to discourage new entry could be also a reason for the propensity for there to be excess capacity. The industrial organization literature analyses the strategic intents of economic actors which can lead to overcapacity. In industries with high sunk costs, firms are more likely to engage in strategic competition and to build-up capacity to discourage new entry (David and Salo, undated). Entrants fear that the incumbent firms may aggressively react to the arrival of new competitors by significantly decreasing prices and increasing output (Fusillo, 2003). However, empirical evidence on the propensity for such behaviour is limited and the results only partly support the theory of excess capacity as an entry deterrent, mostly due to the difficulty in measuring strategic behaviour or intents.[8]

Summary

Generic factors driving supply and capacity expansion

Based on the aforementioned explanations, Table 7 presents factors which could favour capacity expansion or curb capacity reduction in shipbuilding sectors. There is a strong link between excess supply and excess capacity as shown by the series of mechanisms pictured in Figure 18. However, in most cases we can distinguish the factors that affect capacity or supply in the first instance.