Commercial shipbuilding explained in three (and a bit) charts.

Dr Paul Stott, Newcastle University

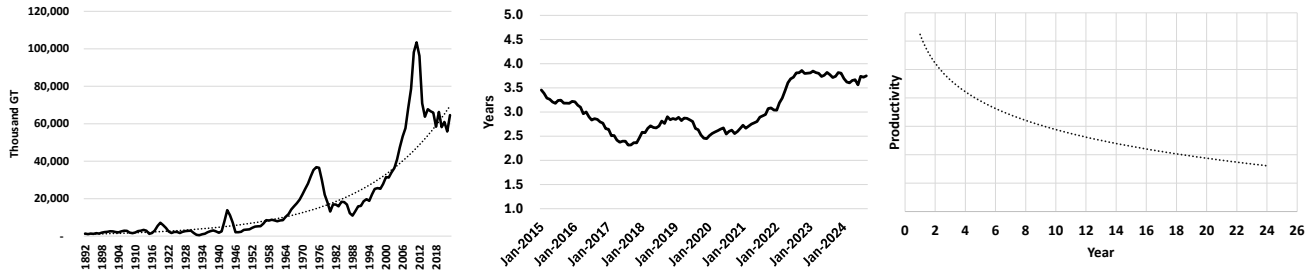

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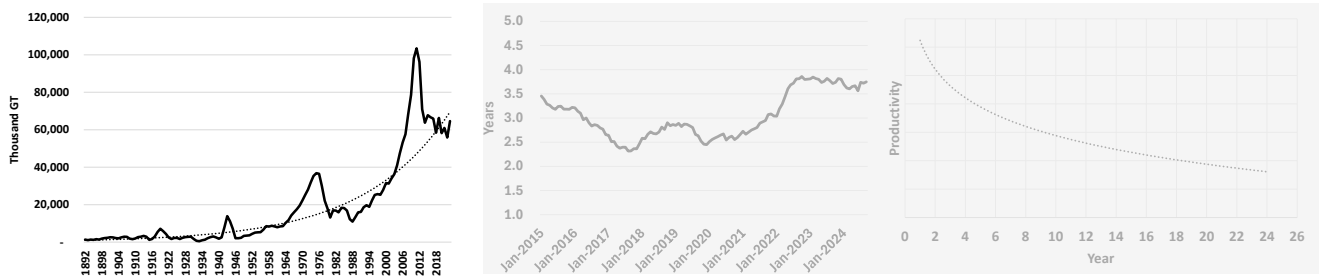
Chart 1 – global output long term.



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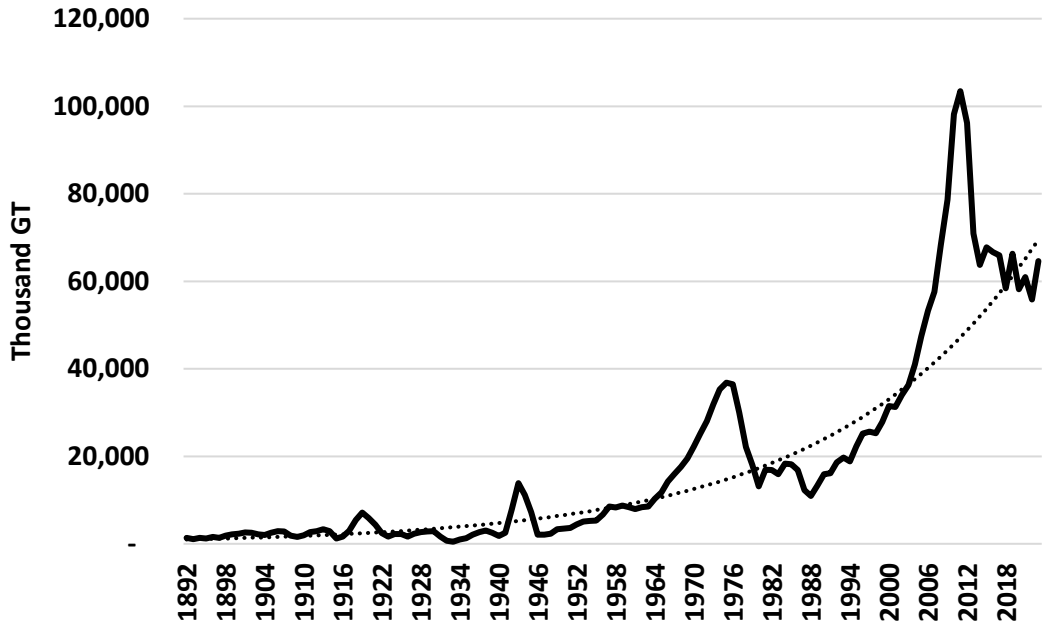
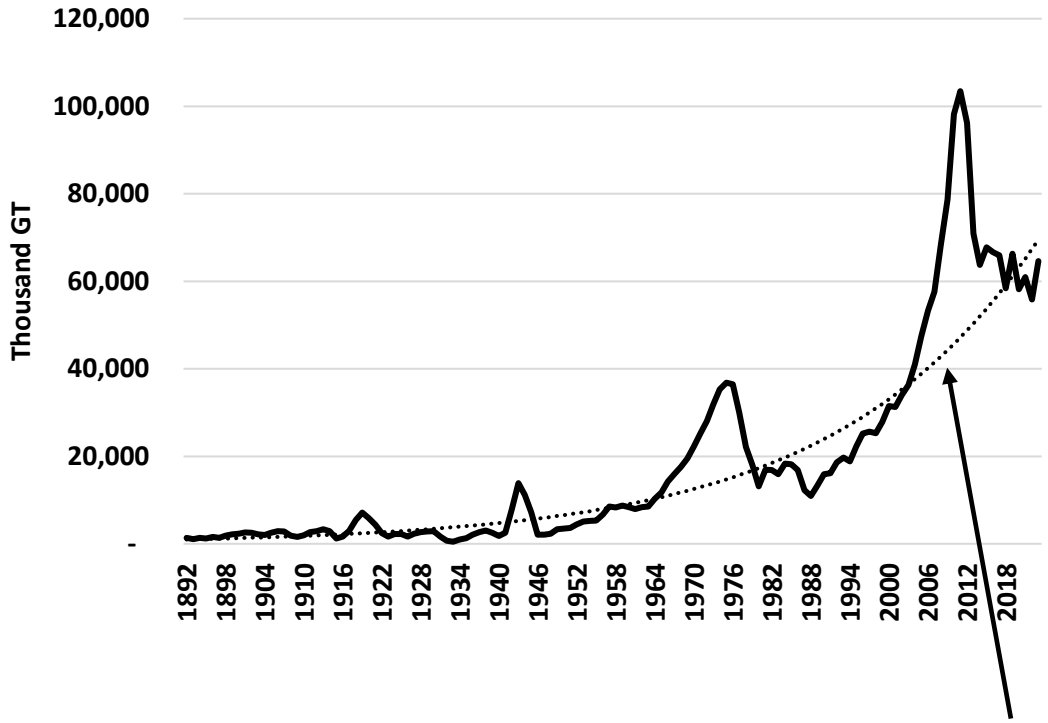


- Long-term output, tells a story of significant volatility.
- Commercial shipbuilding is more volatile than any other industry (except perhaps farming).
- This means that business risk is high and the finance sector, for most of the time, is wary of shipbuilding.
- Peaks = high profitability
- Troughs = low profitability / subsidy

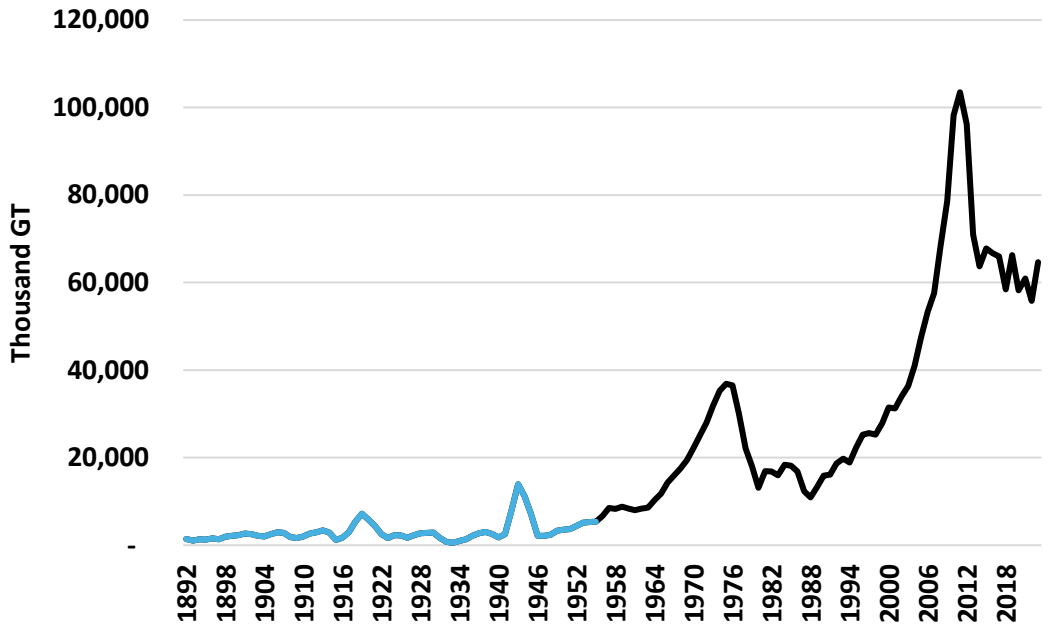


3.1%pa average growth trend

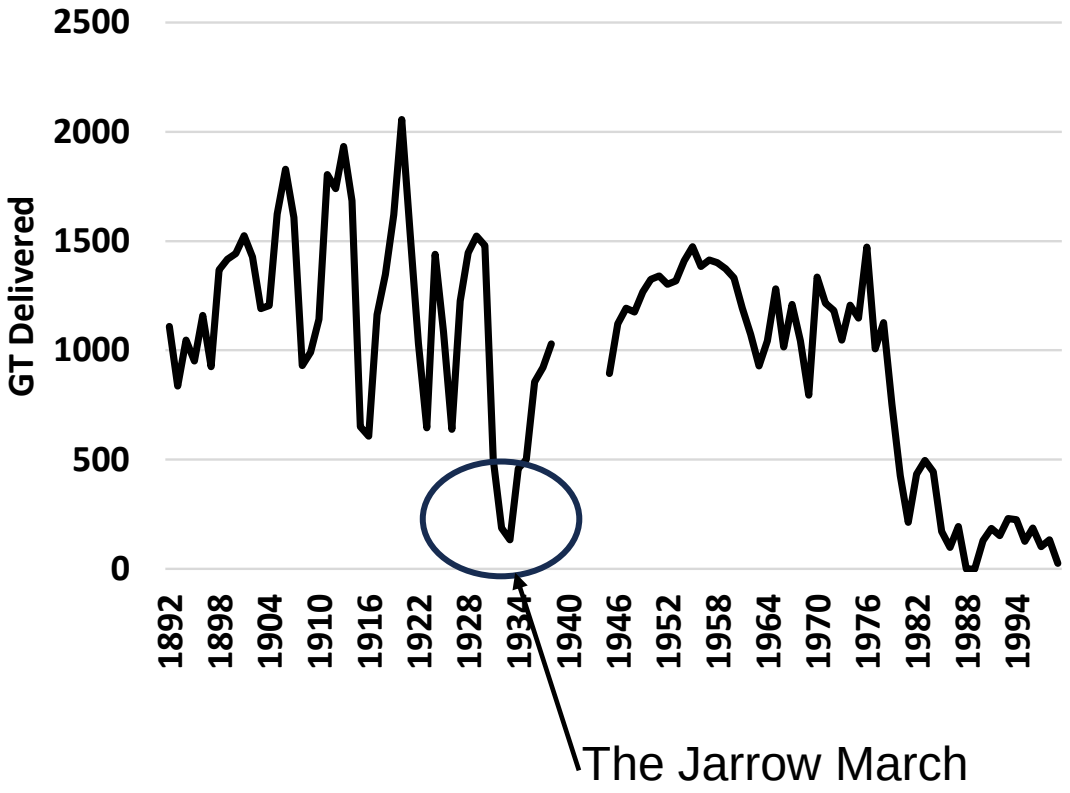
- Average peak length: 5.7 years
- Average trough length: 25 years
- 5 poor years for every 1 good year!

Why bother?

- High economic multiplier;
- Small and specialised (the focus of continental European commercial shipbuilding) is much less volatile than the average;
- Commercial shipbuilding has strategic importance – in terms of resilience for a maritime nation and support for naval shipbuilding.
- Commercial shipbuilding supports the maritime eco-system. Without this the entire dependence is solely on naval shipbuilding, to support everything and to develop and maintain capability at all levels and suppliers. That is a tall order for 2 or 3 companies.



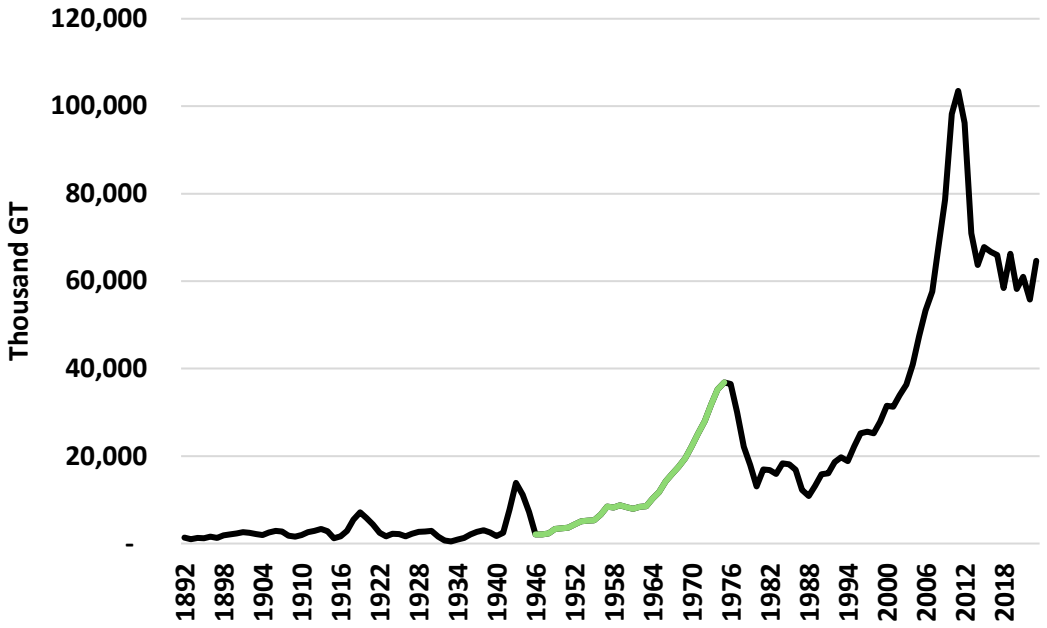
- UK's period of global dominance – Japan took over the lead after 1955.
- UK was dominator of an industry that ceased to exist after WWII.



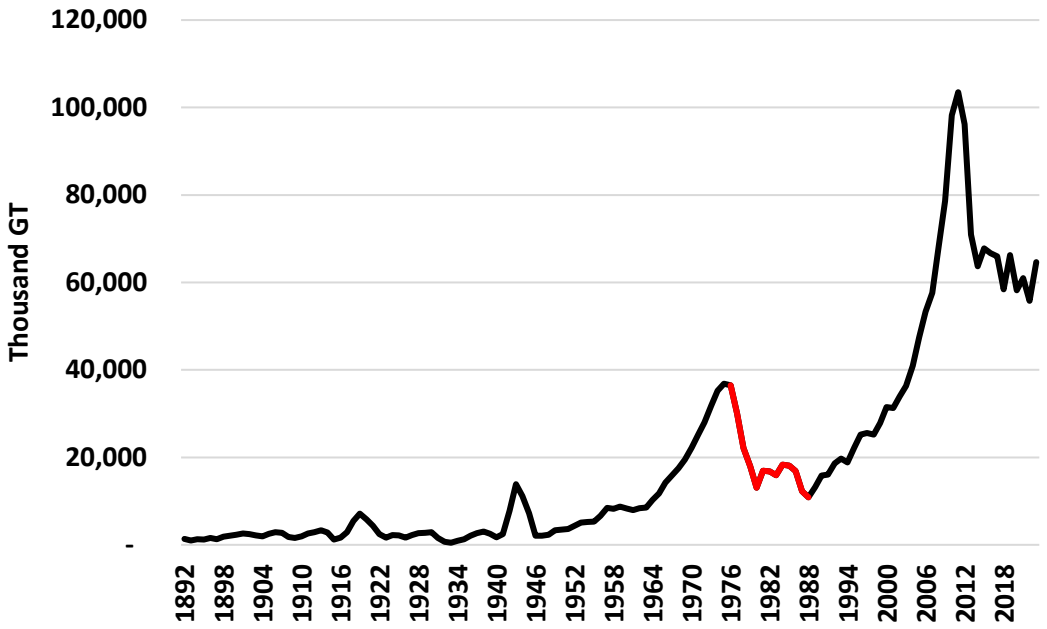
- Volatility during UK's heyday was extreme. The modern industry is less volatile but still more volatile than any other industry sector.
- UK's average industry output of around 1 million tons per annum is, in the modern era, about 1/7 the output of a single large Korean yard.

Further information: Paul Stott (25 Sep 2023): Shipbuilding Policy in the UK: The Legacy of a Century of Decline and its Influence on Naval Procurement, The RUSI Journal, DOI: 10.1080/03071847.2023.2250389

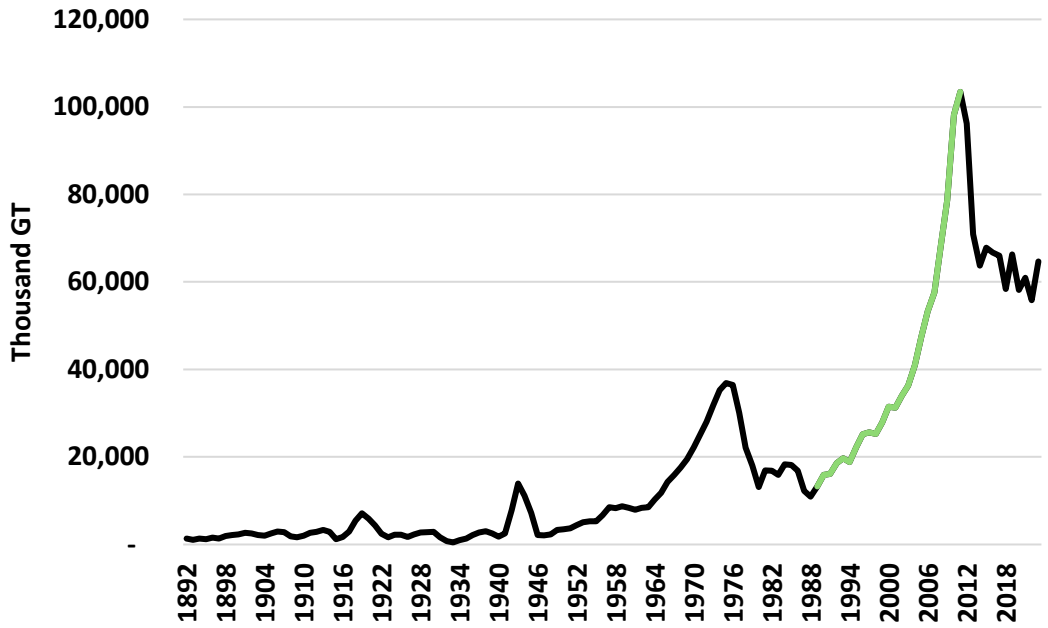
Mastering|Shipbuilding|Management



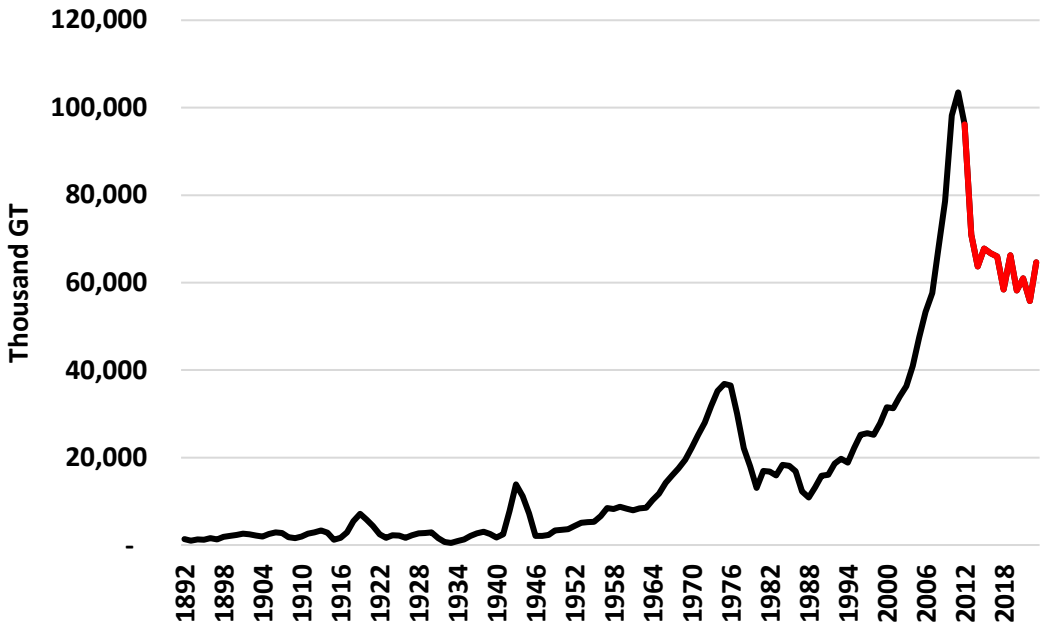
- Globalisation, kicked off by Bretton Woods, led to 30 years of solid growth and the modern industry was established.
- Significant investment in Japan and Europe.
- Ship finance strongly positive towards the sector.



- South Korea enters shipbuilding and invests heavily in large shipyards.
- Widespread closures in Europe.
- UK industry closes.
- Subsidy **limited** to 35% by the EU.
- Europe hangs on to some sectors of the large ship sectors (cruise, ferry, car carrier, mid-size container).
- Ship finance exits the industry.



- 22 years of solid growth with a boom stimulated by China's economic emergence post-2000.
- Ship finance eventually becomes positive about the sector again.
- Significant expansion of capacity in South Korea.
- China enters the sector in a big way.



- Europe retrenches into sustainable sectors – loses all large ship markets except cruise.
- Finance exits.
- Japan and Korea struggling and China in the ascendent (now the market leader).

Sustainable in Europe:

- Cruise
- Specialised vessels
- Workboats
- Superyachts
- Naval and security

Further information: Sea-Europe market intelligence report 2025: should be available through SMI.

These sectors are:

- Mostly smaller ships (but **not** low value)
- Competitive advantage can be found in design and tech.
- Strategically important in Europe
- Good regional demand with high incidence of local ordering
- Not of interest to the large FE yards
- Less volatile than large commercial

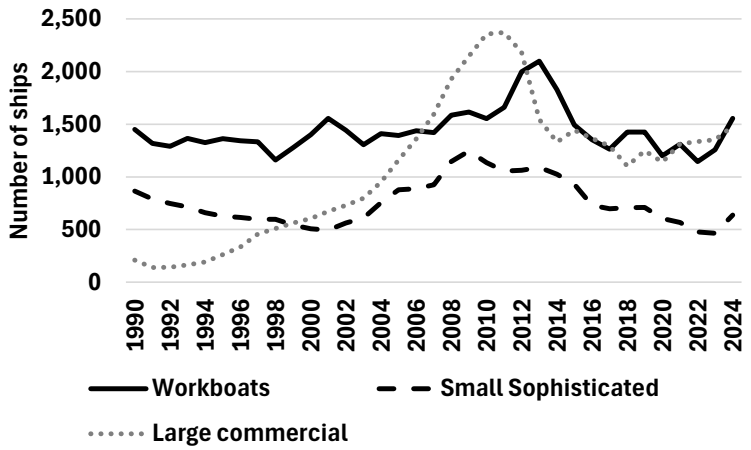
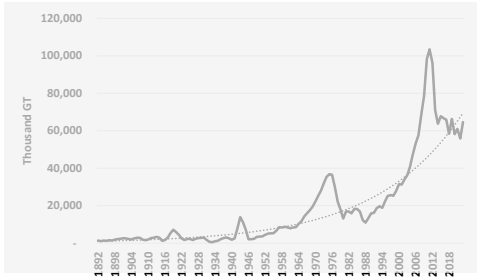
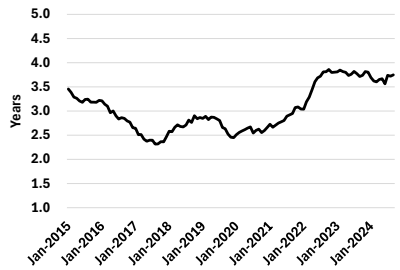
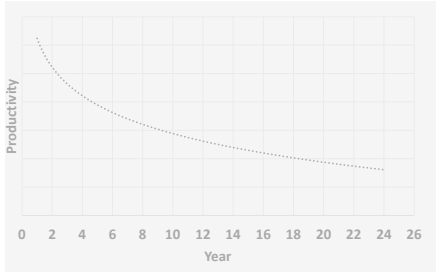


Chart 2 – Commercial shipbuilding backlog.







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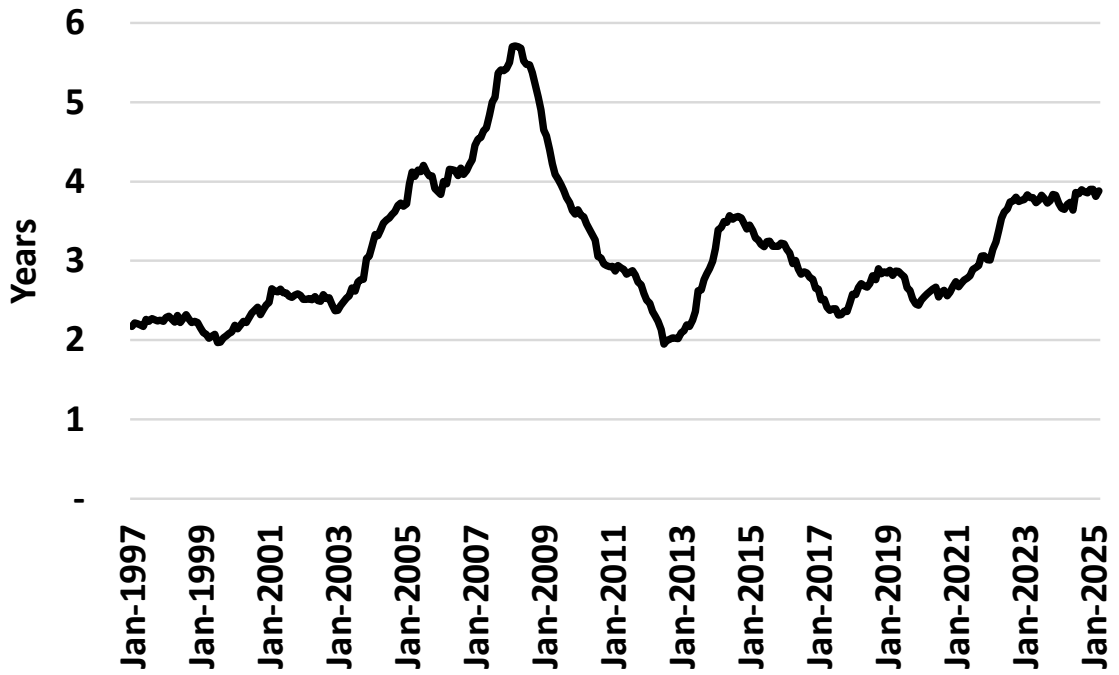
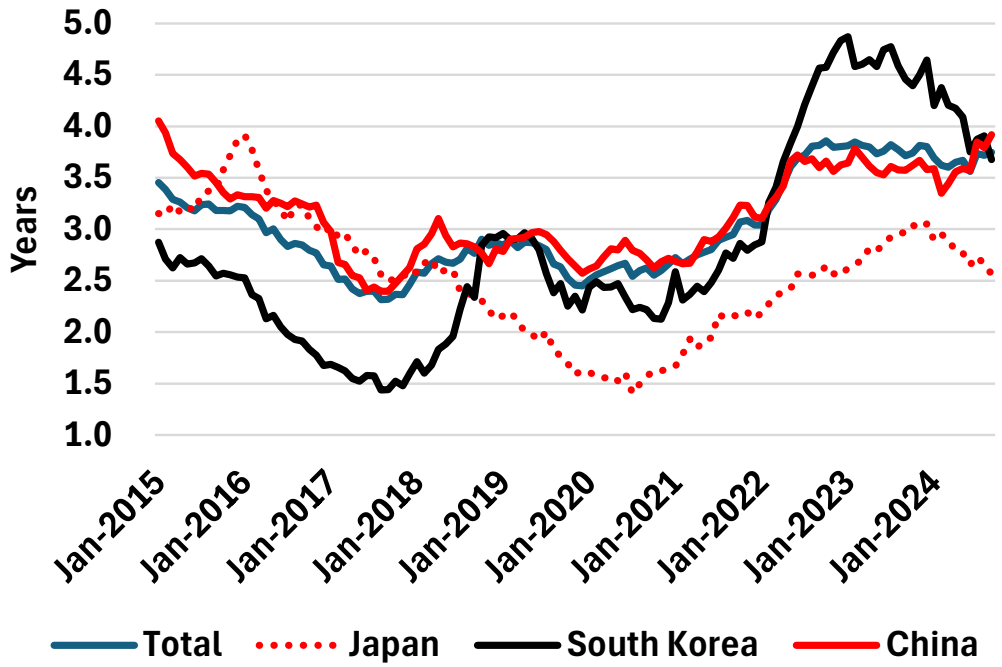
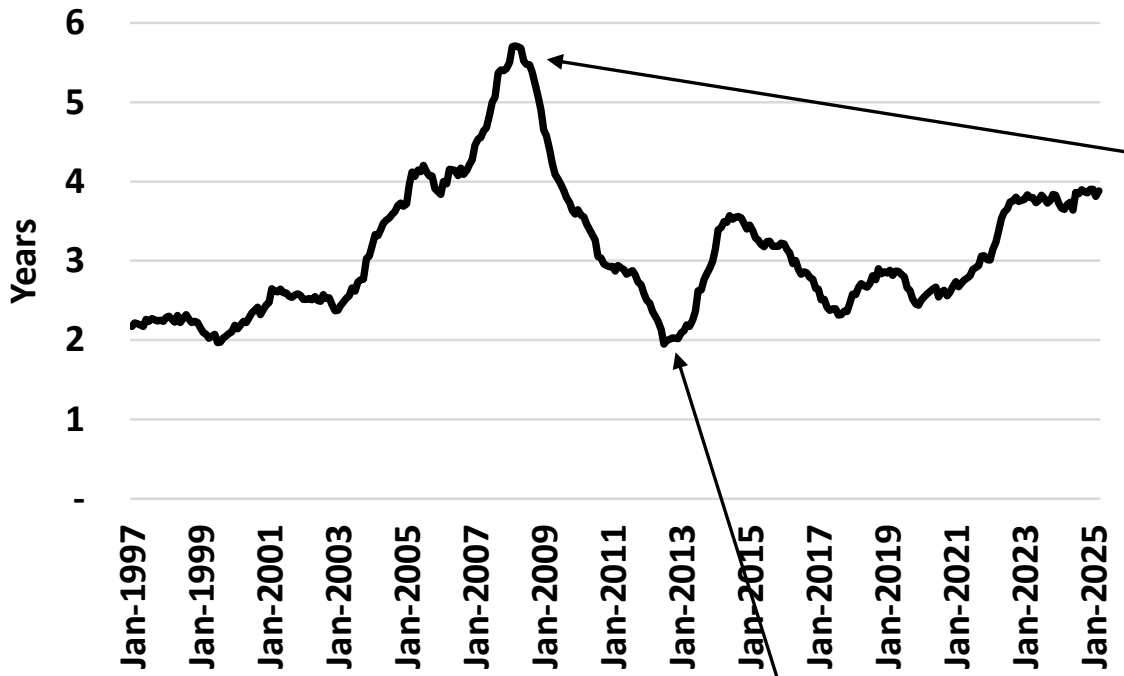


- Backlog measures the time between placing an order and receiving a completed ship.
- It has great significance in shipbuilding economics – for example, it is the most significant determinant of price.
- The significance is in part because of the significance in terms of risk for both buyer and builder.
- It is also in part because it determines the value of a slot – it is slots that form the shipbuilding market, not ships.

- Price in commercial shipbuilding is determined by the value of a slot.
- That value will apply to all ship types competing for that slots which are, therefore, substitutes in economic terms for shipbuilders. Typical substitutes for Korean slots (often price leader): Large tanker / dry bulk / LNG / container.
- Cross-price elasticity therefore exists across substitutes – the price of one ship type can be determined by demand for a different ship type.

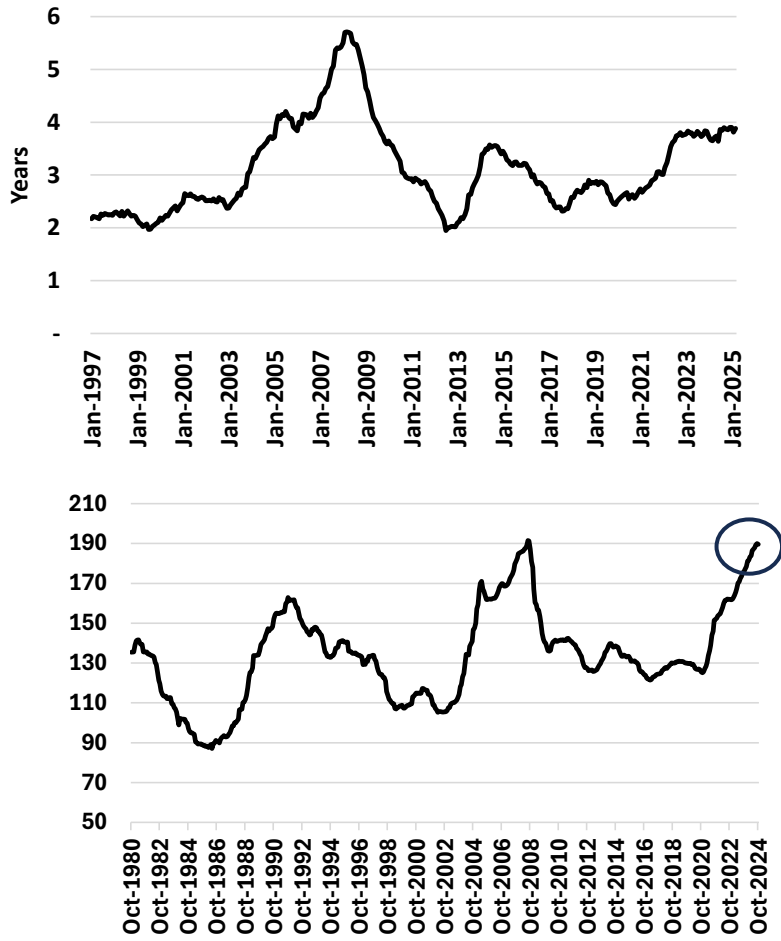


- Backlog is not constant across all builders, giving a level of complexity in the market.



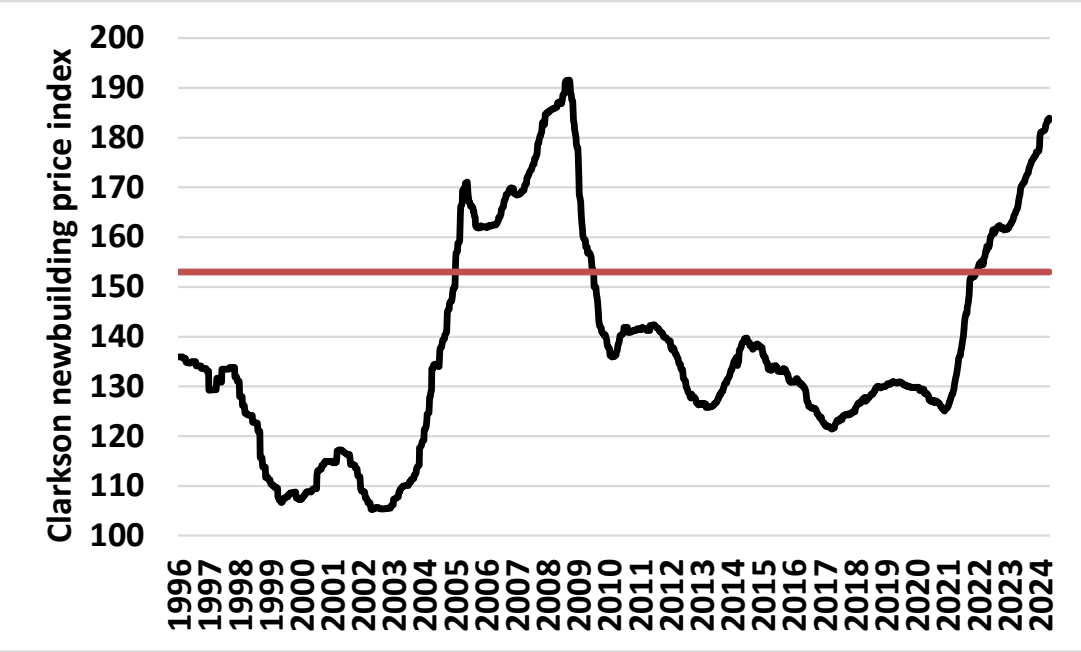
High backlog = buyers' risk.
Above 4 years, buyers become price sensitive.

Low backlog = builders' risk: rarely falls below 2 years (2½ ships in hand)

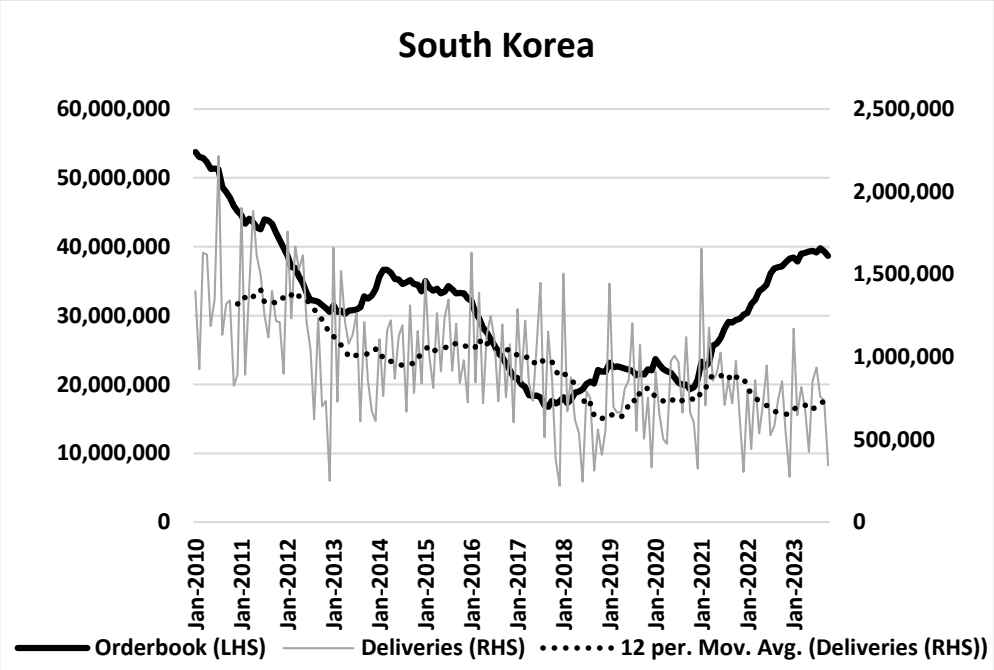


Clarkson Newbuilding Price Index virtually back to peak level

- We are very much in the trough phase of the cycle and backlog is currently much higher than would be anticipated at this stage.
- Price is also higher than would be expected.
- This can only partially be explained by inflation.



- Estimated expected price level at the current stage of the cycle, taking inflation into account.
- Something in the market appears to have shifted.



- The root cause of this shift is labour shortage – leading to the unexpected increase in backlog and, thereby, price.
- Here we see South Korea increasing the orderbook but output is falling.
- A similar signal can be seen in Japan and China.
- Labour shortage is changing the market significantly and will have far-reaching effects on the whole system.
- (Young) people don't want to work in shipbuilding anymore.

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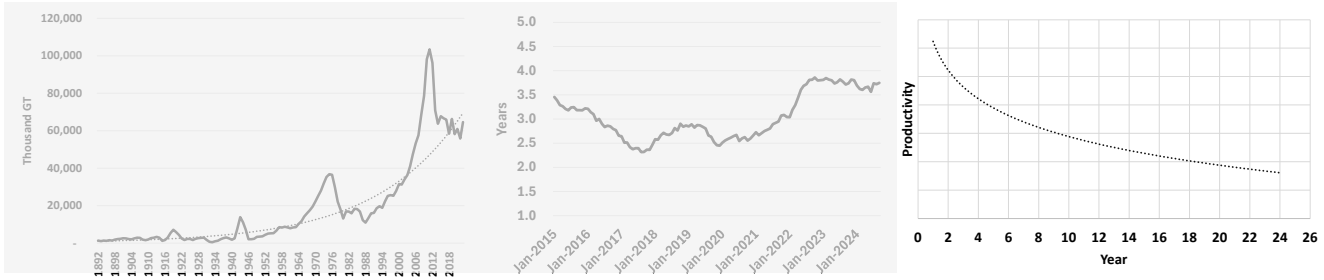
Labour shortage

- (Young) people don't want to work in shipbuilding anymore.
- Automation may seem to be the answer but..
- There is a limit to the level of automation that can be achieved in the current shipbuilding strategy.
- That limit is not imposed by technology.

Barriers to full automation:

- Standard form of contract forces production to start too early;
- Finance wariness of the sector makes working capital difficult to obtain to compensate for that;
- These lead to insufficient pre-production time;
- Accuracy and distortion lead to high skill requirements;
- Investment in the required shop floor technology is difficult due to high risk/low return and capital reluctance.

Chart 3 – The productivity journey.



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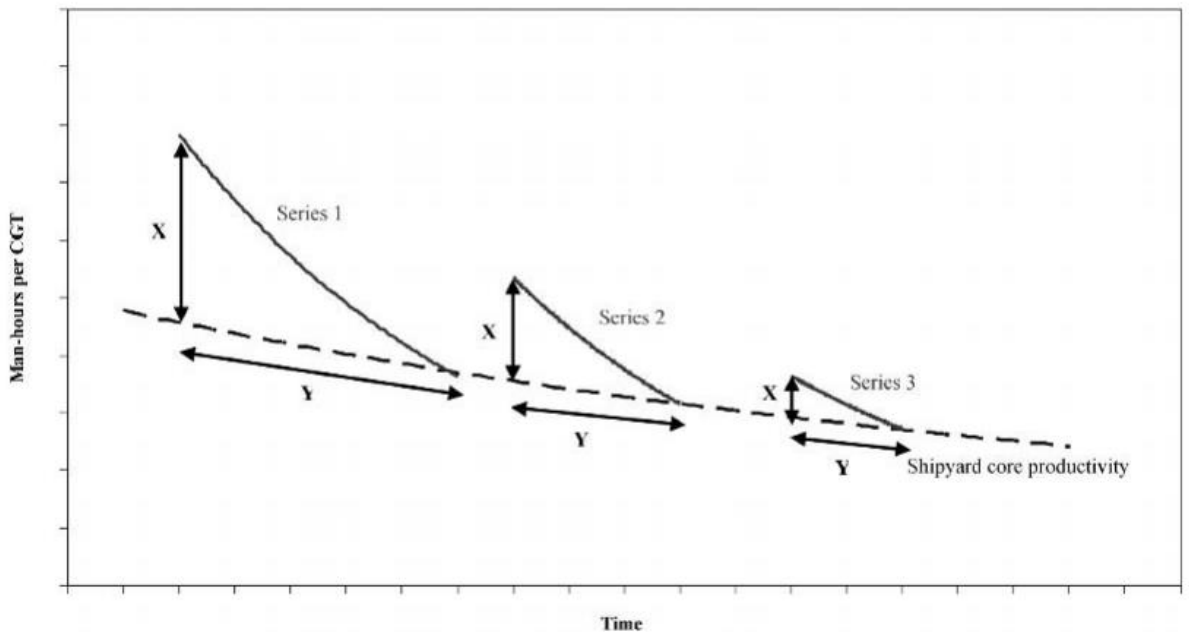
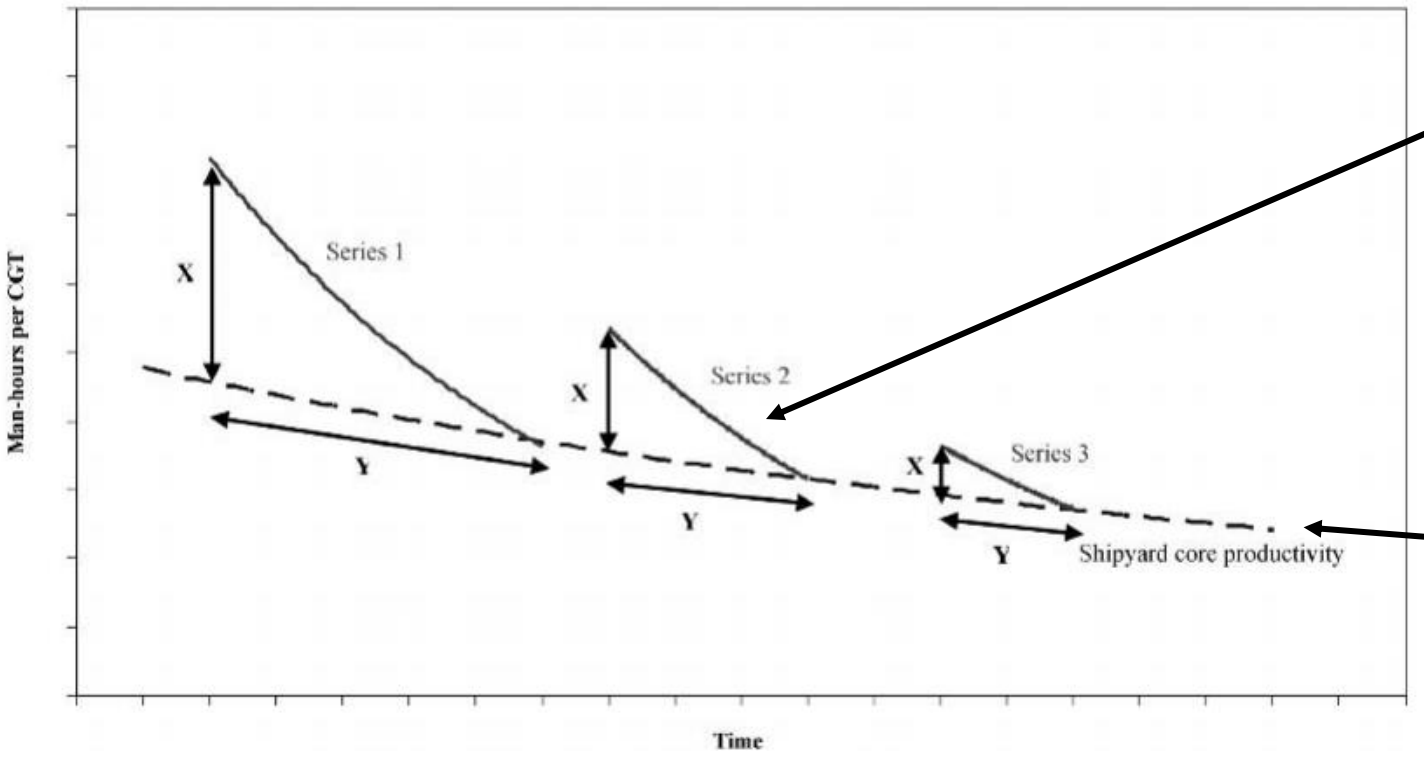


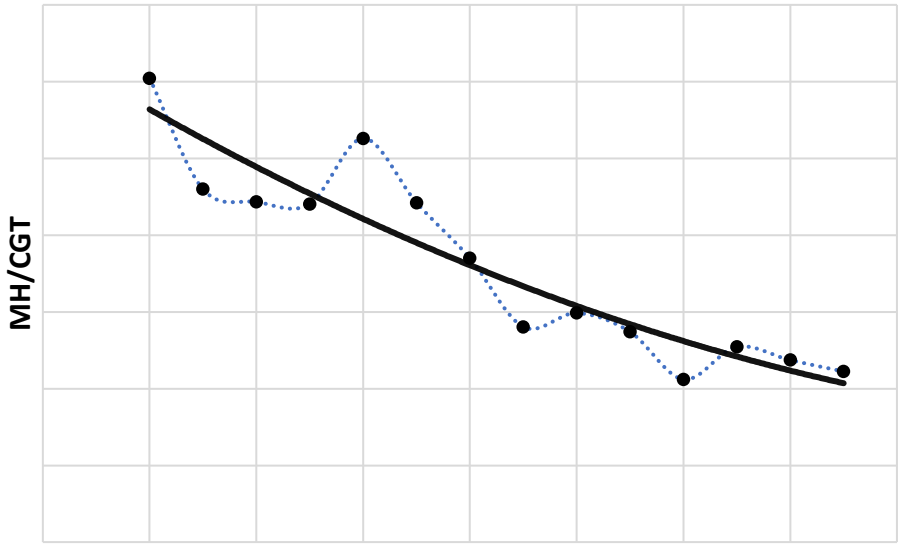
- There is not much published recently on shipyard productivity development.
- This paper from 20 years ago provide a useful view of the principles.

Further information: Craggs, J., Bloor, D., Tanner, B. and Bullen, H. (2004) 'Naval compensated gross tonnage coefficients and shipyard learning', Journal of Ship Production, 20(2), pp. 107-113.



Productivity drops off when things change but eventually should return to the core value

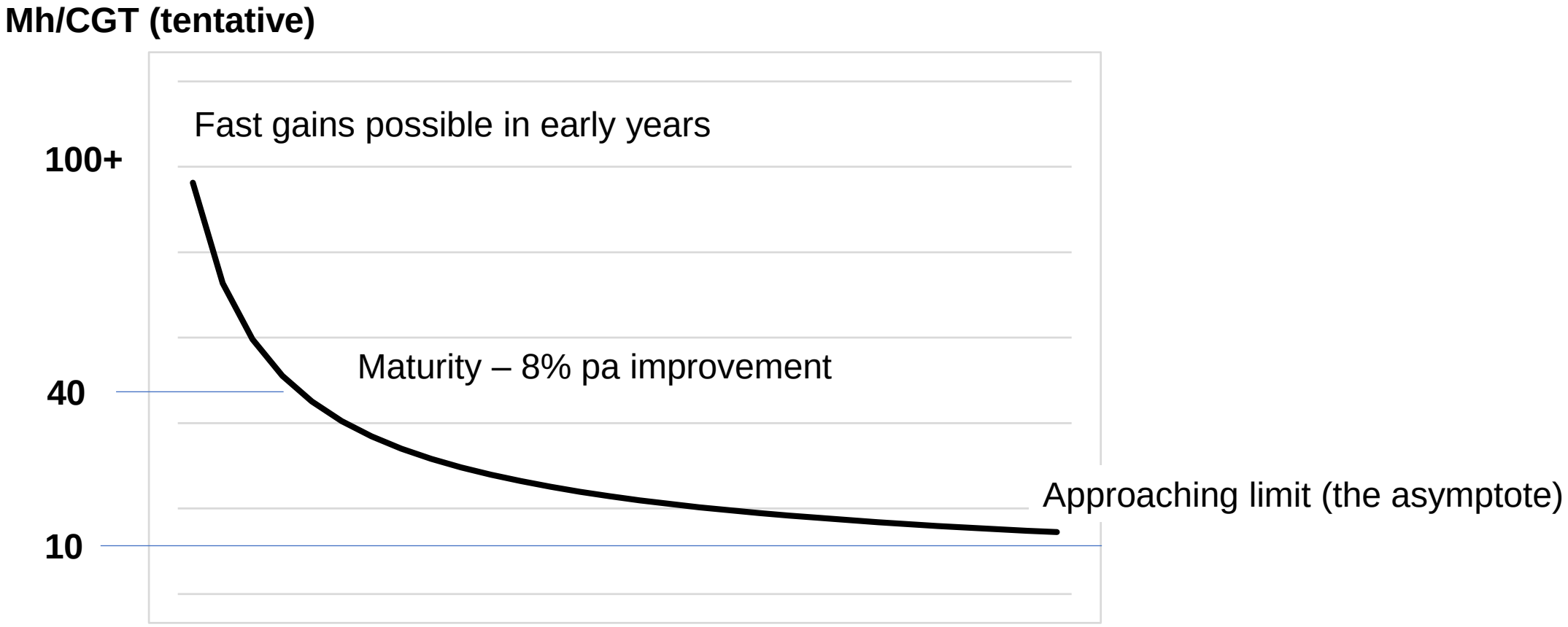
Underlying trend in core productivity through "Institution Learning"

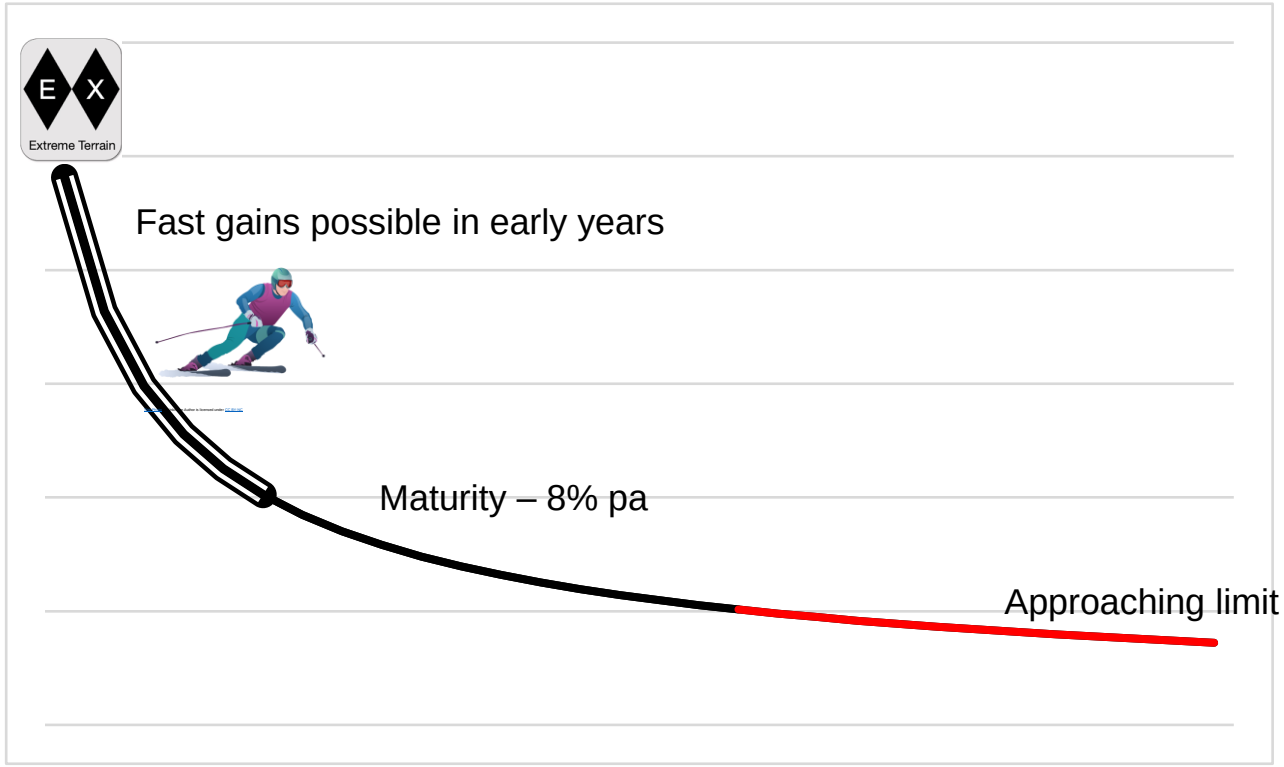


- The shape of the curve was confirmed by a study done by First Marine for EU on Korean shipbuilding.
- Underlying rate of improvement around 7% to 8% per annum was suggested.
- Variability due, inter-alia, to fluctuating workload, which has an effect on productivity.

Qualitative features of generalisation:

- At early stages more significant gains can be made more quickly – this means that the start of the curve must trend towards the vertical.
- For a mature shipyard there must be an asymptote – productivity can never be 0 manhours per CGT so there must be an eventual limit.
- My guess is that limit is around 10 manhours per CGT.


Mh/CGT (tentative)
100+
40
10
Fast gains possible in early years
Maturity – 8% pa improvement
Approaching limit (the asymptote)



A shipyard's position on this ski map has a strong implication for strategy.

Grade	Strategic implications
Double Black Diamond (high infant mortality) 	• There is strong research that shows that a new shipyard will struggle to be successful without government help. • The main reason for this is the period required for a new facility to build up to competitiveness. • The competitiveness curve is not just about productivity – all elements of the business will have to be learned and supply chain and other inputs will have to be developed. • Shipyards that 'dip their toe in the water' will be doomed to yo-yoing around the start point.
Black	• Benchmarking and all normal performance improvement techniques will be applicable here.
Red	• There is only one way to beat the asymptote – eventually you need to apply disruptive technology to the build strategy – you have to find a better way.

The **‘double black diamond’** period:

- Competitiveness means being able to operate commercially at a price set by the market – novice shipbuilders are unlikely to be able to command a premium for lower performance unless protectionism applies.
- Ten years for build-up in large FE yards (with losses incurred while throughput and competitiveness are established) is expensive – order of magnitude possibly as much as the initial capital cost of the yard.
- Smaller yards should be able to achieve much faster build-up, particularly if this period is well planned and supported – say 3 contract cycles to get on to the black run.
- What is unlikely to be possible is competitive performance on contract # 1.

The meaning of ‘competitiveness’ in commercial shipbuilding:

- Commercial shipyards do not compete against other shipyards per se.
- Competition is against the price set by other shipyards that compete for the same work.
- In some sectors it is possible to compete on design and technology: for example in yacht building.
- Mostly, classification precludes competitiveness on the basis of product design.

The **‘red’** period:

- The prevailing shipbuilding strategy is a development of the strategy established in emergency shipyards in the United States in WWII and subsequently perfected in Japan.
- Beating the asymptote means finding a better way.
- Seeing disruption that changes this is difficult – it is hard to imagine what has not previously existed.

Further information: Stott, P.W. (2017) 'Shipbuilding innovation: enabling technologies and economic imperatives', Journal of ship design and production, 33(3), pp. 1-11.

Possible disruptors:

- Perfect accuracy and zero distortion – paving the way to automation.
- Perfect accuracy and zero distortion – paving the way to adhesives in place of welding.
- Revision of standard contracts to shift payment triggers from physical progress to virtual progress, to maximise pre-production time and the potential of simulation and the digital twin.
- Creation of innovative forms of shipyard (separating fabrication and assembly/launching/commissioning) to spread the cost and risk in a shift from human capital to fixed capital (i.e. automation).
- Creation of innovative forms of financing to enable the investment required for automation.