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Why Poland's Yacht Builders Are Among World Leaders

Abstract

Objective: The aim of this paper is to demonstrate how a high-skilled competitively-priced Polish labour force, thriving amid manufacturing policies which are far from a coalition of coincidences, has created a specialist yacht-building sector – and a superyacht one with exceptional potential.

Research Design & Methods: After the superyacht sector is defined and described, this theoretical and empirical study sets out to apply basic correlation and regression in order to isolate demand and production factors most likely to explain and ensure continued success. Limited data and previous research produces a clear result nonetheless. Compared with boatyards in nascent or mature boatbuilding nations, manufacturing nations with a strong labour market – a highly-skilled, cost-competitive workforce – are delivering persistent prosperity with promise of further growth. This, for the first time, weighs the comparative importance of supply-side factors driving production, as well as it points to the way for further work to understand its success.

Findings: A positive relationship between overall global fleet size and the numbers of millionaires in producer countries is confirmed by correlation and regression analyses, which proves three hypotheses. First, the dominant influence of competitive labour resources; second, the much lesser role of tax policy among other factors, such as industry path dependency and education levels, which are also key economic drivers of growth. The third, subsidiary hypothesis also holds: that a sector with special advantages – in this case luxury products in a resilient marketplace – can to some extent avoid the disadvantages of an economy's small size while outperforming other manufacturing segments. The findings confirm that the global superyacht market presents significant opportunities for expansion and enterprise for producers such as Poland.

Implications/Recommendations: The EU recognises the importance of marine industries to trade and enterprise. However, to take advantage of assured superyacht market growth, policymakers need to continue to nurture a skilled labour pool with funding and training support. They could also cut corporation tax to specifically support boatbuilders, perhaps introducing a lower tier for innovating and expanding industries under Industrial Revolution 0.4 strategies.

Contribution/Value Added: The values of this article include the following: an in-depth examination of a specific sector with appeal to work and wealth creators worldwide; identifying a special labour market premium in Poland as well as low-cost producer nations and unrecognised upside opportunities for all market participants.

Keywords: yachts, superyachts, boatbuilding, manufacturing, labour policy, corporate tax

Article classification: research article, theoretical article

JEL classification: 02, 04

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Introduction

The objective of this article is to show how an abundance of competitively priced specialist labour has put Poland among countries best placed to benefit from steadily rising demand for superyachts in the years ahead. As the global fleet swells in size, this research highlights Poland's progress and further opportunities as a big boat manufacturer, the result of factory economy advantages, but also its path dependency (i.e. a political science concept describing the process by which an industry becomes self-perpetuating) with a solid tradition of boat construction from the smallest craft to superyachts which are sailing or motor boats of over 25m in length. On the supply side, it proves labour costs playing the key role in producers' competitiveness, just as wealth does for a growing cohort of buyers. On that demand side, the global market is directly dependent on numbers of wealthy individuals capable of buying boats, and together they form the global order book. Since 95% of yachts built in Poland are exported, the market is determined by global forces rather than a domestic pool of wealthy individuals, which is an opportunity for any expanding manufacturing nation. This work sets out the origins of this industry in Poland and its potential, still being unlocked in several manufacturing nations, and builds a model to explain the main determinants of such a 'factory economy' performance. It is an attempt to explain Poland's attractiveness for yacht-building in general and future superyacht production in particular. Three research questions arose:

1. Are wage rates the major determinant among the factors of production for boatbuilders?
2. How important is tax among other factors influencing the production of superyachts?
3. A relatively small economy can be sidestepped as an essential condition for manufacturing strength by a specialist sector which can use its overriding advantages to compete for resources.

I argue that the market for yacht-making in factory economies operates to some extent independently from worldwide and domestic forces, creating products with particular characteristics for purchasers with enhanced financial resilience. The following review shows that the growth of this industry can be attributed to a set of factors of varying importance; the evaluation of these variables exposes the dominance of wage costs as the main explanatory factor. However, before a set of determinants are tested, an explanation of the global demand backdrop sets the scene. The boatbuilding market is put in the global context, Poland's strong contribution is defined, and the influences bearing on comparative manufacturing strength – especially tax and labour regimes – are explored. Then, an empirical analysis follows with the purpose of confirming the dominant relationship between production output and wages, forming the core of an economic model to explain the sector's enduring robustness.

Literature review

Background to this study of superyacht production involves a fast-growing market for highly-specialised luxury goods, with a regenerating pool of buyers. Market buoyancy has returned at a time when the worldwide pool of 520,000 individuals with a net worth of over $30m is expected to grow, according to Knight Frank's studies (2021). Essentially, the location of these millionaires does not bear on production possibilities, because the market is export-led. Furthermore, superyacht owners are known to be tax-sensitive despite their wealth shield, and will simply sail to lower charging jurisdictions, while workforces are mostly tied to boatyard clusters. An important subset of target buyers involves millennial billionaires (now aged 23–38). The Forbes Real-World Billionaires (2021) identifies 78 of them, with the following breakdown: the USA – 33.3%, China – 20.5%, Germany – 10.3%, Russia – 5.1%, Brazil – 5.1%, and Hong Kong – 5.1%. This is a pool of wealth being topped up by the newly wealthy. Shorrocks et al. (2021) suggest that another wave of millionaires created during the pandemic will release pent-up

demand in coming years. Their research for Credit Suisse suggests that in the past year the global number of millionaires expanded by 5.2m to reach 56m millionaires, and estimates this will exceed 84m by 2025, up 28m from 2020 (Shorrocks et al., 2021). The number of yachts moves in step with the number of millionaires, as the correlation in Table 1 shows.

In this context, there is a wealth of opportunity for enterprising boatbuilders. Dempsey (2021) reports a surge of orders, with many owners seeking seclusion from the pandemic (see Figure 1). The author estimates the global fleet at 5,700 while the record number of 208 superyachts was also brought onto the sales and chartering market in the first half of 2021, worth some $1bn, compared with 131 superyachts the previous year. This orders surge builds on the 2019 global fleet of 5,600 superyachts. The Superyacht Builders' Association says that an average of 80 new superyachts are being delivered annually, with the industry growing at 7.8% a year (Petts, 2019). Individual prices start at around £15m and rise to over £200m, with this global fleet expected to reach at least $10bn in market value by 2025, according to Madara (2020). The author agrees that this marine subset particularly depends on the steady supply of millionaire and billionaire buyers, as billionaires typically own just over two superyachts each. In general, products such as yachts, fine art, private jets, collectable cars, and fine wines are expected to benefit from the lifting of COVID-19 restrictions in what some have described as a 'Roaring Twenties' bounce-back for experiential luxury providers, with many of them recovering since 2008 faster than personal goods-makers are.

Table 1. Pool of purchasers – correlation between number of millionaires and total superyachts built

Year	No. of millionaires in millions*	Total yacht production**
2013	13.7	692
2014	14.7	735
2015	15.4	734
2016	16.5	754
2017	18.1	760
2018	18	773
2019	19.6	830
2020	20.8	807
Correlation	Column 1	Column 2
Column 1	1	
Column 2	0.934761125	1

Sources: * Capgemini 2/7/2021, ** Boat International Global Order Book 2021, Excel analysis.

In my unpublished research (Greaves, 2020), total future fleet growth is forecast using the 2018 Superyacht Report as a data series and extrapolating upward linear growth and discounting unforeseen exogenous factors to give a continuing average yearly rise of around 11.9% (four percentage points higher than Petts), as is shown in Figure 2, which also shows the doubling in 2021 and possible tripling by 2026. The method was to average previous years' growth and calculate the exponential growth this would produce if continued. Thus, in the nine years from 2013, the total of 4,637 superyachts will advance to 9,748 in 2022 – the 10,000 mark is in sight.

The total global market will at least quadruple 50 years on from the 2008 crisis, recovering in the medium term from the market contraction of 2008–2012. This industry will develop on the back of solid demand as the global economic order reshuffles away from the G7 countries' dominance to that of the E7, or emerging seven nations: China, Brazil, India, Indonesia, Mexico, Russia, and Turkey. They will come to dominate the world's top economies by 2050 (Greaves, 2019) with India slipping to the second place, behind China and ahead of the USA.

Poland, meanwhile, has an important share of global production, its superyacht output being the tip of a well-established broader yacht production iceberg. The supply factors it employs – its labour and materials – are the result of years of concentrated

Figure 1. Strong recovery – superyachts on order or in build in the period 2007–2021

Source: Boat International (2021)* redrawn by author.

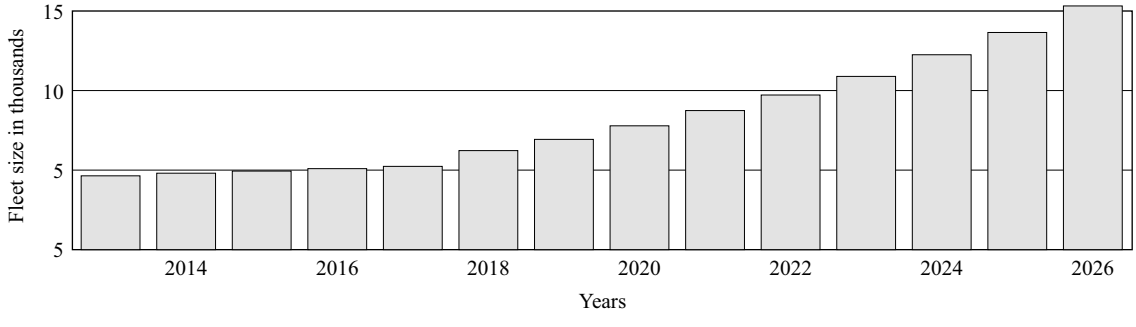
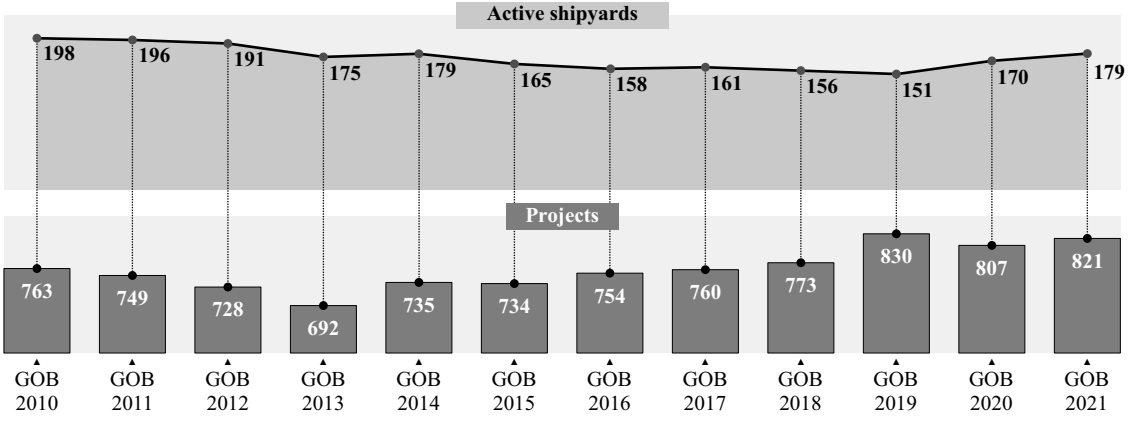


Figure 2. A steadily rising tide – predicted market growth in the years ahead

Source: Boat International Global Order Book* author's calculation.

expertise, clustered in centres of excellence with the workforce having a specialised skill-set and managers' ready access to supply chain factories. With centuries of boatbuilding along the Baltic, Poland's yacht-building tradition was consolidated when the former Soviet leadership chose it to build yachts for all the Eastern Bloc countries. Then, exports began in the 1980s – initially to the northern and western parts of Europe, followed by North America. Bankruptcies followed the collapse of communism, and privately owned boatbuilders appeared to replace them. Poland's ports then went on to host many foreign brands' production facilities, including factories for France's Beneteau and the USA's Brunswick. One home-grown business is catamaran builder Sunreef Yachts in Gdańsk, which started from 10 to 14 boats a year in the founding year of 2002, but then launched a record 24 in 2019. In 2018, amidst a wave of consolidation among yards, Poland's largest producer Delphia was bought by Beneteau. Delphia, the maker of some 25,000 boats since its establishment in 1990, has annual sales worth around 30m euros. Sunreef Yachts stands out as the second generation of Polish yacht-builders; in 2020, it sold more than 130 catamarans between 40ft and 110ft. High-quality domestic brands have also gained a following, among them Parker, Delphia, Sunreef's catamarans, Galeon (the largest Polish brand, partnered with the USA's MarineMax), and Conrad, Poland's custom yacht leader. Overall, the Polish Chamber of Marine Industry and Water



A recovery from falling yard numbers after the 2008 crisis stalled rather than halted a long-term progress.

Figure 3. A Decade of Growth – active shipyards and project totals

Source: Boat International Global Order Book (GOB) 2021* rescaled by author.

Sports (Polboat, the industry trade body, (Day 2018)) estimates that total leisure boat production in Poland has increased by about 10% a year since 2009, with shipyards in 2017 making up to 22,000 yachts of all sizes and classes. Day (2018) disclosed that in 2017, Norwegians bought the biggest amount of Polish-made boats, spending 70m euros on them, with France being next at 46m euros.

Salandre (2020a, p. 1) also charts this steady rise from the end of communism, crediting entrepreneurs with early impetus, taking advantage of a "qualified and inexpensive workforce, structures in place and a willingness to open up to the west and to the market economy". Poland today remains mainly a subcontractor for other countries' brands, boosting the country's trade balance, since Polish production is exported for around 480m euros ($540m) a year, a total that has almost doubled in five years. In short, as Salandre asserts (2020b), the production quality has risen, whereas the costs have fallen, leaving Poland the largest-volume leisure boatbuilder in Europe, just as Italy remains well ahead by overall value of production. Factories in Poland manufacture boats for French, Scandinavian, and American brands, making the country the second largest recreational boatbuilder in units (with the exception of the USA) and Europe's largest exporter of them to the USA. Polboat (Day 2018) concurs that the leading export markets include Norway at $77m, France at $61m, and the USA at $57m a year. Poland's boatyards are mainly in Gdańsk, Ostróda, and Augustów, as more than 1,000 companies employ over 40,000 people in clusters of manufacturing expertise, according to Polboat (2018). From this solid yacht-making base, Poland has increased its annual tally of superyachts to six. Moreover, its general success in manufacturing has placed Poland among the 140 countries ranked in the 2018 Global Competitiveness Report (published by the World Bank's Economic Forum) as the 37th most competitive nation. In the US Department of Commerce's guide to trading with Poland, Bereza (2020) identifies Industry 4.0 (the Fourth Industrial Revolution) as the backdrop for Poland's growing manufacturing power on the continent. As it is the sixth largest manufacturer within the EU, manufacturing contributes 22.4% of total GDP, nearly a quarter. In addition, Su and Yao (2017) stress the importance of any manufacturing sector when an economy is reviving or in a middle-income

stage development, pulling all other sectors and optimised underlying mechanisms in which a larger share of manufacturing in an economy promotes private savings and accelerates technological accumulation. Given a strong base, catching up with high-income economies is then a process of eliminating the productivity gap.

Returning to a review of demand and supply side forces, this market displays factors of demand common to other manufacturing sectors, to luxury goods in general, and then displays some peculiar attributes of its own. The whole luxury goods sector appeals to a global consumer with 20–30% of industry revenues from consumers making purchases outside their home countries, according to Achille and Zipser (2020). Demand is shaped by price, buyers' income, consumer taste, and competition. Luxury goods embody demand which is highly price-flexible due to many strong substitutes, with high income flexibility of demand. Kapferer (1997) suggests that the special characteristics of demand include: an excellent quality and craftsmanship, a very high price, exception (rarity, individuality), the aesthetic quality or beauty, inheritance and tradition appeal, brand history, and a (disputable) general lack of practical utility. There is considerable debate beyond the assumption that higher income may lead to increased demand for luxury goods, since among factors of demand for luxuries are the products' special characteristics in the target marketplace, among which being objects of conspicuous consumption is only one. Veblen (1899), who lived in the era of vast J-class wooden superyachts, viewed such purchases as economic behaviour driven by psychological factors such as fear and status-seeking, but also by rational self-interest. The author argued that "unproductive consumption of goods is honourable, primarily a mark of prowess and a prerequisite to human dignity" (Veblen, 1899, pp.33-34). In a collusion of connoisseurs, demand increases, pushing up prices to advertise wealth, which is a dominant signal in a stable of luxury goods that also contains art, classic cars, champagne, watches and, clothing brands. Price theory states that the rich spend more on luxury goods, since they have more wealth (Ikeda, 2006). Another factor is luxuries' determinants. Dubois, Laurent and Czellar (2001) also settled on perceived excellent quality, very high price, scarcity and uniqueness, aesthetics and poly sensuality, ancestral heritage and personal history, and 'super flushness'. Stathopoulou and Balabanis (2019) identify customers' higher motives of conservation, openness to change, self-transcendence, and self-enhancement. Leibenstein's (1950) 'snob-effect' focuses more on owners' desire to differentiate themselves from a society that can make accessible luxuries less appealing. Accepting Veblen's goods effect, the above-mentioned author also added a bandwagon quality to luxuries. Then, there is a push towards a revised paradigm for luxury goods, which Kapferer and Valente-Florence (2019) suggest should reflect that most of the growth comes from emerging countries. Catry (2003) picks up on this, asserting that with increasing incomes, middle classes in underdeveloped countries were spending more on 'out-of-reach' brands, which is a trend in products ranging from sneakers to superyachts. The classic price-pull effect has big ticket prices stimulating demand, with some buyers always ready to pay more for perceived prestige goods. Such goods can signal wealth, power, and social status, and, as Wiedmann and Hennigs (2019) claim, they can also induce value-added perception in terms of price, visibility, uniqueness, self-identity, and hedonic and materialistic conspicuousness.

These special considerations are being made in the context of increased trade in high-quality goods between countries of higher income per capita, while economists say that we should expect demand to be higher in societies with larger income disparities, where the impact of social status is stronger. Inequality, it appears, is the luxury goods-maker's friend. The share of wealth held by the world's top 10% rose in 2020, as did the share of the top 1% and the Gini coefficient. Martin and Mayneris (2013) say that these goods are more sensitive to income distribution, while their export markets are more diversified and

thus less sensitive to distance. In this light, Poland as an overwhelmingly big exporter is a beneficiary. The factors of demand for luxury goods, both price- and income-flexible, are therefore special, subtle, and shifting. These influences are reflected in a clear correlation (Table 1) between the number of millionaires and yachts built by year, demonstrating positive income flexibility of demand amid upward linear growth. Another demand factor supports the growth thesis – a relatively recent eco-luxury trend for voyages that contribute to the science and technology of environmental protection. Some 64 explorer yachts for cruisers conducting scientific experiments were built in 2020 compared with 58 the previous year. Despite this trend, industry executives have always had to be prepared to resist critics who assign a stigma to the ownership of 'playthings of the rich', seen as widening inequality and disproportionately contributing to climate change (Dempsey, 2021). A counterargument is that this sector will always have a big pool of buyers as well as rising growth with an embedded resilience to economic slowdowns and recessions (Greaves, 2019), and it will always play a highly visible part in pulling the wider shipbuilding sector back to full activity after the relative doldrums of those downturns.

This review also reveals that the sector's progress has largely been in the form of organic growth. Development of all production evolves in a series of stages, according to Baldwin (2018). First, individuals consume what they produce, and as transport develops and society evolves, they optimised, leading to overproduction. Production and consumption become unbundled as living standards rise. Then, over time, size becomes optimised. International competition had encouraged productivity and curbed prices until the 1990s, when advanced information and technology communications stepped up the unbundling of ideas and production processes. This second unbundling was propelled by ICTs-related advances, with international differences in wage rates making it profitable. Supply chains developed, which led to geographical optimal size (industrial clusters), while optimised size enabled trade at all levels, with the power of foreign investment to transfer production ideas and processes. With the latest unbundling, in just two decades the world has seen the G7's shares of world GDP and trade tumble 50% and 32% respectively, with middle-order countries such as Poland being best-placed to gain. What is more, for policy-making institutions in rich countries, new-paradigm optimized size is, as Baldwin says, "individual, sudden and unpredictable" (2018, p. 2). Add to this far-reaching and brutal in impact, since it leads to a reordering of industry at the local level, adjustment directly influenced by global forces. It means that economies in which outsourcing business for multinationals is an increasing part of output might be eventually overtaken by specialist rivals relying on domestic supply chains, cutting out overseas parent companies or middlemen. Production in low-wage 'factory economies' is thus the future for manufacturing, especially for developing economies. Furthermore, as Baldwin and Lopez-Gonzalez (2013) argue, supply chain trade has optimally-sized global economic relations. They point out that Poland, Korea, India, Indonesia, Thailand, and Turkey are nations that have seen their share of global manufacturing output rise by more than 1 percentage point of the global total. This revolution's winners, they say, are grouped in clusters; there is a strong geographical dimension to the manufacturing revolution. Identifying the Czech Republic and Poland as typical factory economies, the authors point to a dependence on the nearest advanced technology manufacturing economy, namely Germany. Costs of production are further controlled by path-dependent factors of investment planning, government support, and favourable trade (tax and tariff) terms. As Krugman (1991) noticed, boatbuilding fits in with economic geography as a path-dependent process, with agglomeration economies tending to lock in urban or manufacturing locations, and externalities that they face together may further embed path dependence, a feature then reinforced by corporate

history and industrial culture. David's (1985, 1987) work on path dependence identified three conditions: technical interrelatedness of system components, increasing returns to scale using common techniques, and "quasi-irreversibility of investment". Boatbuilding is locked into all these conditions, with countries built on trade already having these cornerstones of shipbuilding tradition, which had formed around ports and their hinterlands.

Turning to review another supply-side factor, Poland's low 19% corporate tax rate appears to give a distinct competitive advantage over boatbuilders in other countries. The optimised corporate tax rate – on capital gains and investment income – forms part of a broadly favourable tax regime outlined by the OECD's annual Revenue Statistics report (2020), which explains that the tax-to-GDP ratio in Poland rose by 0.2 percentage points, i.e. from 35.2% in 2018 to 35.4% in 2019, set against the OECD's average decrease from 33.9% to 33.8%, well in the middle order rankings. However, tax policymakers should not stifle enterprise or consumer spending. Pigou (1947, pp. 40–45) stressed the importance in a finite economy of "the part to be played… by the amount of the aggregate sacrifice and the manner in which this aggregate is distributed among the taxpayers," arguing that the least aggregate sacrifice was the ultimate principle of taxation, with the maximum aggregate welfare being the correct goal of government. However, set against OECD countries' 36 regimes, Poland ranked only 34th in 2020. The index by Bunn and Asen (2020) measures the degree to which the 36 countries' tax systems promote competitiveness through low tax burdens on business and neutrality through a well-structured tax code, with consideration of more than 40 variables. However, any advantage may disappear. Countries' relative corporate tax positions will be levelled by the universal corporate tax deal agreed in June 2021 by the leading advanced nations (Giles and Strauss, 2021. Vital questions concern the rate that any minimum is set at, whether countries can step outside the OECD to undercut it, and whether nations can levy it on revenue earned in countries that chose not to adopt a base limit. This race to the bottom rate will most benefit emerging market producers, Poland being among them. On a personal tax note, Poland is starting to increase its burden for high-earners, as it seeks to use tax as a tool to address a shrinking and ageing workforce, and attract more professionals from abroad, i.e. those earning over 1m PLN and required to pay a solidarity tax. The KPMG partner Tomasz Wiśniewski (2019, p. 7) put this down to a "strong economy and dynamically rising salaries"), with 14m Poles earning over 7.1 thousand PLN a month and with the fastest growth among taxpayers earning more than 1m PLN a year. A useful response to the loss of key skilled workers by migration was the July 2019 abolition of income tax for the majority of those under 26 – a cohort of around 2m workers.

However, tax aside, this quantitative analysis proves emphatically that among business inputs, a deep pool of skilled and competitively-priced labour in Poland is the country's star attraction to investors and producers, which is by far the dominant factor in manufacturing success. Broadly, incentives to invest in 14 Special Economic Zones since Poland's accession to the EU in 2004 have seen the highest unemployment rate in the EU cut to remain below the EU average since 2012. Boatbuilding is among favoured industrial sub-sectors, because since 2019, 44% of the 674,800 newly-created jobs were among the smallest enterprises, employing up to nine people. The highest number of vacancies was in manufacturing. The growing labour market resilience, with wage growth chasing fast productivity gains, is set against a backdrop of robust GDP growth. Moreover, labour productivity has grown faster than on average in the OECD, with a reallocation of labour to higher productivity market services and industrial sectors. In the run-up to Poland's accession to the EU, Piotrowski and Sztanderska (1999) showed how in the period of 1995–1997 average wages in industrial activities were the highest

of all sectors. Their study highlighted how at the point of joining the EU, Poland had a higher rate of natural unemployment than most EU states, which the authors attributed to the then low level of economic activity, its low employment rate, and considerable growth in its labour pool – a substantial reserve of underemployment. Lewandowski and Magda (2018) chart this swing from unemployment of 20% in 2000 to around 5% today, with real wages rising 54% until 2016; as growth has accelerated, inequality has declined and the minimum wage has risen. The cost-competitive workforce behind this revival remains a store of value for investors and entrepreneurs alike.

The research questions resulting from this review led to a test of three consequent hypotheses: (1) that wage rates are the major determinant among the factors of production for boatbuilders; (2) that tax is a smaller determinant among other factors influencing the production of superyachts; and (3) that a relatively small-sized economy can be sidestepped to some extent as an essential condition of manufacturing strength by the enterprising specialist sector. These are properly formulated below.

Research methodology… and a model to float all boats

Four economic variables or proxies were used to test factors bearing on manufacturing success. Other variables were considered when testing the first two hypotheses stating that predominantly wages and tax rates could prove key indicators of either positive or negative influence. The totals of millionaires were quickly discounted, since, although being a vital market incentive, they represent a fluid international pool of demand, making national factors hard to separate. Intuitively, a successful boatbuilding country will have a good competitiveness rating by most measures, including a low tax burden, plentiful low-cost skilled labour, and – consequently – a large annual total of superyachts built. The dataset (see Table 2) presents all superyacht-producing nations. It needs to be remembered, however, that since Poland is among leaders by volume of all yachts produced, it has the industrial structure capable of becoming a superyacht challenger producer, and the placings of competitor nations are by no means assured for the future. As the world economic order will be shifting towards emerging nations as the leaders are struggling for raw materials and operating margins, this is where manufacturing opportunities will arise, and one result will be a trading arena in which Poland's yacht-building industry can overthrow considerations of sheer economy size or maturity as a determinant of manufacturing prowess.

Furthermore, opportunity is reflected in output totals for each country, which includes a hidden subset described as speculative production – superyachts not built to order. This is on top of the steady growth that underlines the industry's internal momentum or path dependency. Speculative builds are an indicator of market sentiment. Yards' appetite for risk has been fading, since 2020 saw a decline of 6.6% in the number of speculative projects being built, reflecting uncertainty before the first full year of the COVID-19 pandemic. However, they still account for over 39% of the global order book; with 59% of its orders being speculative, Turkey is leading countries, hoping to lure casual buyers. Furthermore, the production data from active shipyards shows a general revival of the industry, since their total jumped from 151 in 2019 to 170 in 2020. Half of the projects at these nine newly active yards were speculative – a vote of long-term confidence. The number of active yards reached a peak in 2008–2009, with 199 of them before the crisis, while the analysis involving two years' totals of builds and orders – carried out based on limited time series data – reveals a clear path dependency in the industry, upholding output levels year by year. Thus, the concepts and observations in the literature led me to formulate the following three hypotheses: (1) wage rates constitute a dominant factor of production in the boatbuilding sector; (2) tax levels, while at first an alluring advantage, are, in fact, related to output levels, but in an extremely weak way; and

(3) a specialist sector can outperform in a smaller economy.

Results of the quantitative investigation and the findings coming from them

The analysis to determine the influence of factors of production started with a smoothing log scaling of two comparable years of output from the countries in the limited set (only 22 nations produce superyachts – a sample which is smaller than ideal, but acceptable), compared by regression to a small selection of independent variables. The aim was to use these two years to establish a dependent relationship with past production, and then to regress against known wage rates and tax levels in order to test dependency.

In the input Table 2, y and y-1 represent the two years of output compared from the datasets 2018–2019 and 2020–2021 from the Global Order Book produced by trade magazine Boat International (2020). The next two columns include their log10 equivalents that are set against the corporate tax and wage data from CIT Tax Foundation and Trading Economics (2021), the latter being wage costs for Q3 2020.

A previous regression confirmed annual total output's coefficient, with tax levels alone being extremely weak: a coefficient of 0.0019, R^2 of 3.72E-06, and adjusted R^2 of -0.0588. Having set aside millionaires' data as unhelpful, another variable (L) was added to build a simple industry model in order to explain output. This choice represents another proxy for cost or supply factors – average labour costs in $US – which turns out to be decisive. Including a third variable was considered, roughly described as education E, as a proxy for skill-sets and training levels, industry expertise, or know-how. Without that, however, a simple equation has been created:

$$Yy_t = Yy_{t-1} + T_t + L_t \quad (1)$$

Here, Yy_t is total output or production, Yy_{t-1} is the previous year's output, T_t is corporate tax rate, L_t is average labour costs in a country in $US (E, for know-how, is omitted due to the lack of data). The R^2 result explains 87% of the variance in the dependent variable (output), while the significance of F indicates an exceptionally low probability of mistake when acknowledging that, combined together, the independent variables influence total output. This simple model works well when the p-value of wages (0.02) shows its significance in a strong negative (downward sloping) relationship. Had all the wage figures been divided by 1,000, it would have seen a labour coefficient of -0.007. The p-value (significance of F) is extremely low (3.92^{-7}), confirming a strong regression equation.

The results of this analysis verify the first hypothesis (1), namely that in the case of Poland and all manufacturers of superyachts, wage rates in the labour market are the leading determinant among the factors of production. The result also proves (2) the relative unimportance of tax levels, as an extremely weak relationship is revealed. Last but not least, what emerges is (3) the positive possibility of outperformance by a small economy having a specialist sector with a specific market. In this respect, Poland is accompanied by Brazil, India, Indonesia, Malaysia, Mexico, and Turkey. All the data can be aggregated to produce an annual global index series, which could then be a guide to the industry's health – any substantial change would cause concern, and other variables can be included after further research.

Discussion

This limited statistical inquiry, with its necessarily small sample size of 22 observations, produces a clear result that labour – or average wage earnings as applied here – shares a clear relationship with superyacht output. This is the first time this has been specified and it constitutes a possible basis for further research. This central finding also supports the position on path dependency advanced by Krugman (1991) and David (1985), the factory economy theses of Baldwin and Lopez-

Table 2. Regression data for all superyacht producing nations

Countries producing superyachts are listed alphabetically, comparing two full years' output, via log scale, to tax and wage rates. It shows path-dependency of the present on past production as well as a strong relationship to wage rates (negative, downward slope). The number of millionaires is given for information only.

Country and its total superyacht output Y_t*	**Output in previous year Y_{t-1} ***	**Log of output in base year 2020–2021 Y_t* log**	**Log of output in previous year 2018–2019 Y_{t-1}* log**	**Corporate tax rate T %****	**Average wage rates L US$*****	**Mill-ionaires ********
Australia	2	3	0.30103	0.477121	30	55,207	1,180
Brazil	12	13	1.079181	1.113943	34	9,130	259
Canada	1	21	0.5	1.322219	26.5	97,500	1,682
China	5	6	0.69897	0.778151	25	49,116	4,447
Finland	5	3	0.69897	0.477121	20	46,230	103
France	6	18	0.778151	1.255273	20.5	45,581	20,71
Germany	2	0	0.30103	0.5	30	53,745	81
Italy	379	407	2.578639	2.609594	24	27,207	72
Malaysia	75	74	1.875061	1.869232	0	37,769	1,496
Netherlands	3	4	0.477121	0.60206	1.5	20,007	16
New Zealand	3	2	0.477121	0.30103	25	58,828	832
Norway	2	12	0.30103	1.079181	28	59,723	185
Poland	6	3	0.778151	0.477121	19	55,780	176
South Africa	4	5	0.60206	0.69897	19	17,270	116
Spain	3	0	0.477121	0.5	28	37,922	36
Taiwan	67	64	1.826075	1.80618	25	57,018	528
Turkey	66	76	1.819544	1.880814	20	66,170	94
UAE	8	8	0.90309	0.90309	2	14,331	124
US	109	61	2.037426	1.78533	25	3,074	256
UK	39	29	1.591065	1.462398	25	43,470	18,614
Others	0	3	0.1	0.477121	19	47,147	0
Base year Y_t		Year Y_{t-1}	log10 $_t$ base	log10 Y_{t-1}	T Tax	L average wage	In 1000s

Sources: * Boat International Global Order Book, 2018–19, 2020–21 Boatinternational.com https://www.boatinternational.com/yacht-market-intelligence/luxury-yachts-on-order; ** CIT Tax Foundation (2021) taxfoundation.org. https://taxfoundation.org/publications/corporate-tax-rates-around-the-world/ See Table 6; *** Average earnings in US$ from Trading Economics (2021) https://tradingeconomics.com/country-list/labour-costs; **** Number of millionaires in thousands, CIT Tax Foundation (2021). Excel.

Variables used in data set
Y_t – base year's output 2020–2021
Y_{t-1} – previous year's output 2018–2019
Y_t – log10 of output 2020–2021
Y_{t-1} – log10 of output 2018–2019
T – corporate tax rate in 2021
L – average wage in 2021
M – number of millionaires in thousands (unused)
E – know-how (unused)

Table 3. Regression results and analysis

SUMMARY of the RESULTS for the dependent variable Y_y or Y_t, or output/production in any year Regression Statistics					
Multiple R	**0.931877**				
R Square	**0.868395**				
Adj R Square	**0.846461**				
Standard Error	**0.277282**				
Observations	**22**				
ANOVA					
	Df	***SS***	***MS***	***F***	***Significance F***
Regression	3	9.131899	3.043966	39.59096	3.92E-08
Residual	18	1.383937	0.076885		
Total	21	10.51584			
	Coefficients	**Standard Error**	**t Stat**	**P-value**	**Lower 95%**
Intercept	0.15907	0.198674	0.800655	0.433773	-0.25833
Variable 1 Yt-1	0.978945	0.09667	10.12663	7.36E-09	0.775848
Variable 2 Tax	0.002665	0.006122	0.435376	0.668466	-0.0102
Variable 3 Labour	-7E-06	2.82E-06	-2.47191	0.023647	-1.3E-05

Source: data from Table 2, Excel analysis.

Gonzalez (2013), as well as the dominance of wage rates and labour market conditions suggested by Lewandowski and Magda's work (2018). It shows that any country with this labour force resource is well-placed to benefit from higher future orders and that the labour market itself has resilience. Card et al. (1994) have demonstrated the indifference to rising wages (not necessarily resulting in falling jobs) which may support the factory economy model. In 1992, New Jersey raised its hourly minimum wage from $4.25 to $5.05, after which they asked if that might make some fast-food workers too expensive. Card and Krueger (1994) spotted a natural experiment: eastern Pennsylvania was next to New Jersey, with a similar economy, but Pennsylvania had not changed its minimum wage rate. The authors compared employment in New Jersey and eastern Pennsylvania and found no sign that fast-food jobs had been lost when the minimum wage went up in New Jersey. This distinct labour market advantage will become even more important when Poland loses its corporate tax edge as rates are levelled up within the OECD.

In order to reinforce the explanatory power of the model, adding a measure of technical expertise would further explain the dependencies and improve the significance of results. Such a measure can come from collecting the numbers of trained boatbuilding apprentices or degree-level nautical engineering students. Further research might obtain a set of comparative values by sending questionnaires to producers (aimed at exploring qualification levels and spending on training).

The main result of the analysis is that though path dependency as shown by just one previous year's output is a lead determinate (and earlier years can be expected to have the same compounding relationship), wage levels alone constitute a massive driving force behind the manufacturing output, tax levels are far less significant, while other factors

such as skill-set indicators need closer definition, separation, and testing. In addition to these two outcomes, the data also supports the third hypothesis (3), namely that a country such as Poland, i.e. one with a rich history of manufacturing, can remain at the heart of this flourishing business, because its advantages in taxation and labour supply (with both costs being markedly lower than that of competitors) – coupled with its dominant export market – can overcome the smaller-scale GDP that the country delivers and punch well above its weight in international trade. This begs the question about what other factory-made goods or production satellites of multinational companies can take advantage of these conditions, recalling that overseas groups already see countries such as Poland as a haven for outsourcing to a cadre of managers, leading a highly-skilled workforce in multinational companies.

There is, therefore, no doubt that Poland's ongoing strength as a producer of both yachts and superyachts depends on its labour pool and competitive manufacturing policies which have created conditions for this sector to flourish, to some extent regardless of other macroeconomic forces. The government should mark this progress and, in turn, recognise by future incentives the benefits that the sector has brought in terms of domestic prosperity as well as overseas earnings. This paper highlights how Poland's manufacturers, specifically boatbuilders, embody path dependency, a characteristic also shown in its links to the German industry. In Central and Eastern Europe, only the Czech Republic enjoys such a relationship with a near neighbour, which is an indication of the importance of regional trade alliances among the V4 Group and beyond. From a position of strength, Poland's producers can anticipate strong orders in years ahead and a continuing trading relationship with leading boatbuilders domiciled abroad together with cross-fertilisation of ideas and skills with domestic rivals in the clusters. Meanwhile, weak relationships between some traditional performance indicators such as population size or GDP suggest that manufacturers can use their advantages to work 'outside the box' of established manufacturing norms when output is export-led, and that there is a good reason to help emerging producers gain on the lead boatyards. Poland's position at the crossroads of Europe in terms of transport and communication makes it a natural export hub and gives the country the potential to advance up the manufacturing leader board.

The results underline that Poland is a growing manufacturing power in Europe amid increased demand for innovative manufacturing technologies at a time when the government is promoting development and investment in new technologies, such as additive manufacturing, that will push the economy to the next level with grants to support R&D with the aim of driving the Fourth Industrial Revolution. The task for the government is to retain the stimulus from beneficial labour and tax regimes while embracing technology advances that keep the country's competitive edge. It is time for further heterodox thinking to explain the success of emerging and fledgling companies building boats and other luxury products, since the old order has clearly been challenged. The competitive edge is shown to be down to the high quality and low cost of the workforce, and is likely to also be down to the availability of technical training opportunities and the tradition of apprenticeship learning. Future research could prove helpful in adding to the model a measure of the skill-set in each country, based on training and education, provided that data is collected from boatbuilders themselves; a survey could make it possible to assess the qualifications and overall spending on training. This feeds into the path dependency argument, namely that a consolidated known-how or expertise is linked to tradition and sustained by training boatbuilders in the specialist skills required. In recent years, the European Skills Council for the Maritime Technology Sector has highlighted (2020) that the importance of employment and skills is one pillar of the industry's strategic vision. It wishes to see a Europe-wide degree standard across the continent. Europe has 500,000 direct

jobs in the sector, which makes an annual turnover of 91bn euros spread among 300 shipyards of all types.

Concluding remarks

The strong positive relationship coming from the results of testing the first hypothesis verifies that Poland's particularly competitive wage conditions have played the major role in creating a 'golden pool' of resources, especially labour. These favourable conditions have been capitalised on by manufacturing operations such as boatbuilders, and can be further nurtured and supported so that the challenge of burgeoning demand can be met, particularly for superyachts. The testing of the second hypothesis – the one regarding the very secondary importance of tax levels – confirmed a very weak influence, and one to be eliminated by international corporate tax levelling. But in the context of the third hypothesis – the one about a small economy outperforming the traditional measures of manufacturing prowess – the opportunities are clearly demonstrated. While rewards are there for the taking, this paper also indicates that the link to traditional measures of industrial strength – i.e. GDP growth, income per capita, population growth, or balance of payments – can to some extent be set aside by a progressive sector with its own attractiveness to investors and consumers. These findings beg the question about which other sectors – be it luxury or otherwise – have already carved out a successful production niche or can do so in the future.

The review demonstrated how a shuffling global economic order is set to further play into the hands of all competitive manufacturers, who have everything to gain by meeting the growing needs of luxury purchasers. However, this model and analysis alone cannot fully explain why some boatbuilding nations are way ahead of others. The world-leading Italy's outstanding output in boatbuilding is, in terms of value, more due to historical, technological (especially design), and geographical (exceptionally large and attractive coastline) influences. Boatbuilding tends to cluster around coastal cents of skill and design excellence, such as on England's south-western coast and around Poland's Baltic shipyards. Many industries group themselves together geographically similarly to how it was in the First Industrial Revolution despite today's enhanced communications causing the unbundling described by Baldwin (2018). This polarisation of expertise represents a core of unmeasured value to longer-term prosperity – a store of expertise that can be further investigated to capture another important variable, namely know-how – which may further improve the model's explanatory quality. Indeed, the determinants of previous output can themselves be shown to embody know-how elements that enhance the explanation and reflect an embedded resilience. These first steps in deconstructing the economic forces at work in boatbuilding rely on secondary data from many sources, which is nevertheless authoritative to provide insights into an industry in which there is limited primary data. The necessarily small sample size of selected data can inhibit interpretation, but is still indicative of the forces mostly at work. Further research, including questioning producers about skill-set and training resources, could close in on another key determinant in the sector. If Poland's producers of big boats are to keep catching future waves of demand in the global market, they need to understand more fully what makes them so enduringly successful.

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