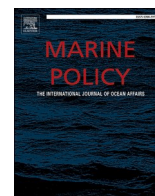




Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



The impact of 2008 financial crisis and COVID-19 pandemic on the demand and supply of seafarer officers: Evidence from China

Lijun Tang¹

Plymouth Business School, University of Plymouth, Cookworthy Building, Drake Circus, Plymouth PL4 8AA, UK

ARTICLE INFO

Keywords:

Crew change crisis
Maritime education and training
Seafarer development
Seafarer labour market
Seafarer shortage

ABSTRACT

During the shipping market boom in the 2000s, China adopted initiatives to expand its maritime education and training (MET) capacity, which significantly increased the supply of seafarer officers in the next few years. Drawing on multiple types of statistical information, including MET enrolments, seafarer numbers, seafarer wages, and labour market analyses, this paper examines the outcomes of the initiatives in the aftermath of the 2008 financial crisis and the COVID-19 outbreak. It shows that the financial crisis together with the expanded training capacity led to a serious oversupply problem, characterised by a lack of job opportunities, depressed wages, and slow career progression for junior officers. When the situation improved in 2017, however, a shortage of junior officers ensued, and their number plummeted quickly. The recent COVID-19 pandemic increased the demand for Chinese officers. Nevertheless, the decline in the number of 3rd officers continued. This paper discusses the causes and policy implications of the quick reverse from an oversupply to an acute shortage.

1. Introduction

Maritime shipping is seen to be the epitome of a globalised industry [18]. This is not because it carries about 80 % of world trade by volume [39], but because shipping companies routinely optimise their operations to reduce costs by spreading their businesses across several countries. It is a common practice that ship owners/managers, regardless of where they are domiciled, register ships in Flag of Convenience countries (e.g. Panama and Liberia) and source seafarers from relatively cheap labour supply countries (e.g. the Philippines, China, India, and East European countries) through local crewing agencies. This practice gives rise to a global seafarer labour market [18].

To develop a good understanding of the seafarer labour market, the Baltic and International Maritime Council (BIMCO) together with the International Chamber of Shipping (ICS) have been conducting surveys of seafarer labour supply and demand on a global scale regularly since 1990. The key finding of these surveys since their inception 30 years ago has been invariably pointing to a current and predicting a future shortage of seafarer officers. While this finding is influential in the industry, research has shown that due to data reliability issues, BIMCO/ICS surveys tend to significantly underestimate the supply [19,21]. Through analysing the seafarer statistical data released by the maritime authorities of the Philippines, Tang and Bhattacharya [34] demonstrate

that in practice there is a serious oversupply of Filipino junior officers.

To understand the dynamics of seafarer supply and demand, however, finding out whether there is a shortage or oversupply is just the first step. It is more important to find out the associated causes, consequences, and implications. This paper focuses on the demand and supply of Chinese seafarer officers. Through analysing the impact of the 2008 financial crisis and the COVID-19 pandemic on the demand and supply of Chinese seafarer officers, it explores the causes, consequences and implications of supply/demand imbalances. It is organised as follows. The next section discusses the relevant literature to contextualise this research. After explaining the research method, this paper discusses the impact of two crises.

2. The seafarer labour market and Chinese seafarers

BIMCO/ICS reports on the demand and supply of seafarers have been influential in the industry, but not without criticism. To estimate the seafarer labour supply, BIMCO/ICS surveys collect the estimated numbers of seafarers in labour supply countries from the national maritime authorities. This approach has two problems [19,21]. First, some countries do not have established systems to record seafarer information. Second, many countries may have a good record of issued seafarer certificates, but the number of certificates is not the same as that

E-mail address: Lijun.tang@plymouth.ac.uk.

¹ ORCID: 0000-0002-6815-0625.

<https://doi.org/10.1016/j.marpol.2022.105263>

Received 27 December 2021; Received in revised form 19 July 2022; Accepted 28 August 2022

Available online 31 August 2022

0308-597X/© 2022 The Author(s). Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

of active seafarers. Certificates are generally valid for five years, during which period attrition occurs and many seafarers would leave the profession. No national maritime authorities have made the effort to collect data on seafarer attrition. For example, while the European Maritime Safety Agency (EMSA) has good statistical data of seafarers with valid certificates issued by the European Union (EU) member States, they acknowledge that they do not have information on the number of active seafarers in the EU [15]. It remains a problem to work out the number of active seafarers. For the reasons mentioned above, surveys conducted by different teams can produce results with staggering discrepancies. Leggate [19] showed the difference between the [18] study and the BIMCO/ICS 2000 survey. While both studies assimilated data from the same sources, the former reported a total number of 997,803 seafarers and BIMCO/ICS did 455,583 from the same 35 countries. In the literature, seafarers are often divided into two groups: ratings and officers, and the latter are also referred to as qualified seafarers. While this paper focuses largely on seafarer officers and in most places the term 'seafarer officers' or 'officers' is used, when the word 'seafarers' is used alone, it refers to both groups of seafarers.

Over the past 30 years, BIMCO/ICS reports have persistently pointed to a shortage of seafarer officers. Given the data issues discussed above, the persistence of the shortage, however, should not be seen as unproblematic. Shipping draws seafarers from a global pool, and major seafarer supply countries compete fiercely to supply seafarers to the industry. The Philippines, China and India have been expanding their training capacities and adopting policies to boost the employment of their seafarers; and as a result, the seafarer populations in these three countries have been growing [36]. Similarly, traditional maritime countries have also adopted measures to promote seafarer training. The UK government, for example, has implemented the tonnage tax and the Support for Maritime Training (SMarT) scheme to sponsor cadet training since the 1990s in the hope of increasing the number of British seafarers [17]. The effort taken to supply more seafarers and the persistent shortage do not seem to add up. Moreover, shipping is a cyclical industry [31]. When the market is depressed, a large number of ships would be either demolished or laid up, resulting in many seafarers losing employment. This again casts doubt on the persistent shortage claim.

In fact, there are reports lamenting the situation in which a large number of seafarer officers (especially junior officers) in the Philippines [1] and India [3] could not find employment in the 2010s. In a qualitative study, Leong [20] interviewed 20 ship and crewing managers based in Singapore and these managers pointed out that the supply of junior officers was abundant. More recently, Tang and Bhattacharya [34] analysed statistical data on the deployment and certification of Filipino officers and found that between 2015 and 2017, about 60 % (or more than 20,000) of the newly certified junior Filipino officers were not deployed as officers. In the UK, a review of the tonnage tax and the SMarT scheme showed that the success was largely insignificant due to the limited demand for British junior officers who were much more expensive compared with their counterparts in other countries [16]. There cannot be a shortage without sufficient demand. Given that the seafarer labour market is a global one and that if ship managers could not recruit enough officers from a particular country, they could easily turn to other countries with abundant supplies, it is inferred from the above evidence that the shortage of officers has not been persistent [34].

The key message from the above discussion is that two factors, shipping market fluctuations and the national government policies, are likely to affect the demand and supply of seafarers of a particular nation. More specifically, shipping market fluctuations have an impact on the demand for seafarers, whereas government policies may aim to increase the supply of seafarers. Starting from this premise, this paper examines how the demand and supply of Chinese seafarer officers are influenced by these two factors. Regarding the first factor, the 2008 financial crisis and the COVID-19 pandemic led to fluctuations in the market. As will be shown later, the first crisis curbed the demand for Chinese officers, and the second one increased the demand. In terms of policies, they will be

spelled out next in the process of discussing Chinese seafarers.

China is one of the top seafarer-supplying countries in the world. There are two categories of Chinese seafarers: ocean-going seafarers who work on vessels trading internationally, and those who work on ships trading domestically. This paper focuses only on the former and the term 'seafarer' hereafter refers exclusively to ocean-going seafarer. In 2020, China boasted to have 592,998 registered seafarers and about 70 % of them worked at sea in the year [25]. While it has a big national fleet manned by Chinese seafarers, China also has a well-established crewing agency industry [7,45], dispatching 114,843 Chinese seafarers to work on foreign-flagged vessels in 2020 [25]. Seafarers are trained and certified according to international standards and their certificates are internationally recognised. As such, Chinese seafarers can work either in the national fleet or on foreign-flagged vessels and participate in the global labour market.

Chinese seafarers first entered the global labour market in 1979 by working on Japanese ships. They were dispatched by China Ocean Shipping Company (COSCO), the biggest shipping company in China, who set up the first Chinese crewing agency, COSCOMAN (COSCO Manning Cooperation Inc). The 1980s and 1990s witnessed a growing number of Chinese seafarers deployed overseas by an increasing number of newly established crewing agencies [45]. Dispatching seafarers to work on foreign ships not only opened a new employment channel but also generated additional incomes for shipping companies and crewing agencies and foreign currencies for the country. As such, the authorities set up the China Coordination Council for Overseas Seamen Employment (COSE) in 1989 to promote seafarer labour export [35,43]. In the mid-1990s, around 20,000 Chinese seafarers worked on foreign vessels, by 2000, the number doubled to 40,000, and since the 2010s, the number have exceeded 100,000 [35].

During the shipping market boom between 2003 and 2007, ship managers found it hard to recruit enough seafarer officers to man the expanding world fleet, and a shortage crisis seemed close [20]. Seeing this situation as an opportunity, the Chinese maritime authorities adopted the 'Seafarer Development Initiatives' (SPIs) around 2006 to expand the maritime education and training (MET) capacity and to recruit and train more seafarers especially from relatively under-developed rural and Western parts of China [41]. As a result, the number of MET universities and colleges increased from around 20 in 2000 to more than 80 in 2009 [41], and the annual new MET student enrolments grew from around 6000 in 2000 to more than 50,000 in 2010 [32]. MET graduates in China were awarded three types of academic qualifications depending on the programs in which they were enrolled – bachelor's degrees, higher education diplomas (HED), and vocational education diplomas (VED). Degree programs involved four-year full-time studies, while a HED took three years to complete and a VED required two-year full-time studies. The SPIs introduced another two types of MET programs. One was a one-year extra training course for final year university students in non-maritime degree programs, and the other was a two-year vocational training course offered by newly established MET institutions to those who graduated from senior high school but failed to gain admission into the higher education system [41]. In the latter program, however, the students were not subsidised by the government and had to pay high tuition fees (up to four times higher than what other MET students needed to pay) to cover the full costs of running the course.

The initiatives increased the number of Chinese officers in the global labour market. However, two years after implementing the initiatives, the financial crisis erupted and depressed the shipping market in late 2008. More recently, the COVID-19 pandemic has led to a crew change crisis. These crises affected the demand for Chinese officers. In China, there are good sources of data documenting the demand and supply of Chinese officers in the past decade or so, which provide a solid empirical base for this research. Furthermore, they also help identify the causes, consequences, and implications of the demand and supply imbalance. The next section explains the data and research method.

3. Research method

The paper draws on two sources of data. The first one is Chinese seafarer statistics released each year since 2014 by the Maritime Safety Administration (MSA) in the form of an annual Chinese Seafarer Development Report. The MSA authorises seafarer exams and issues certificates to seafarers and therefore holds the demographic information of each registered seafarer. They also license shipping companies and crewing agencies and require the latter to electronically submit seafarers' employment information, such as the date of a seafarer joining or signing off a ship, and the serving rank. As such, the MSA is able to collect and collate detailed information about the Chinese seafarer population. Of particular relevance to this paper is the information about MET institution new student enrolments (shown in Table 1), the number of seafarer officers in each rank (Fig. 1), the number of seafarer officers who worked at sea in the year (Fig. 2).

The second set of data is real-time market information and analyses. In 2010, China Shipping Information (CSI), a website established by Zhejiang Shipping Market, started to collect information from shipping companies and crewing agencies every month and publish the average wages of seafarers in each rank and each of the three sectors: dry bulk shipping, tanker shipping, and container shipping. In 2013, another website headquartered in Dalian – Shipping Online (SOL) – also started to collect and publish similar information. The seafarer wage information published by the two websites varied only marginally (the difference was around USD 100), which indicated that both sources of information were reliable. Furthermore, both websites also conducted and published seafarer market analyses to assess the demand and supply balance. However, CSI stopped publishing market analysis in 2014, while SOL continued. Given that the information provided by the two websites largely mirrored each other, the seafarer officer wage data and market analysis used in this paper consisted of two parts. The first part (2010–2014) was collected from CSI, and the second part (2015–2021) was collected from SOL. Due to limited space, this paper only presents the average wages of deck officers in the dry bulk shipping sector in December each year (see Fig. 3). Although seafarers in dry bulk shipping earn slightly less than their colleagues in the other two sectors, the trend of wage fluctuation is the same. Similarly, engineers' wages mirror their counterparts in the deck department.

Together, the two sources of data provide a wide variety of information, including MET enrolments, seafarer officer numbers in each rank and each year, seafarer wage changes in each rank, and regular qualitative labour market analysis. The analysis of these sets of data consisted of three steps. First, the annual (or monthly) statistical data on MET enrolments and seafarer officer numbers and wages were sorted

Table 1
Number of newly enrolled MET students in China 2004–2020.

	Bachelor's	HED	VED	Others	Total
2004	2869	6401	1153	0	10,423
2005	3271	7959	1462	0	12,692
2006	3702	7973	4155	6595	22,425
2007	4094	9290	7864	10,664	31,912
2008	4604	9182	15,472	15,052	44,310
2009	4589	11,026	18,318	12,245	46,178
2010	4475	12,829	23,324	13,341	53,969
2011	5273	13,050	15,767	9373	43,463
2012	5271	9683	7349	5857	28,160
2013	5512	10,537	3289	2514	21,852
2014	5378	8666	1585	1164	16,793
2015	4862	8211	1414	473	14,960
2016	5826	7932	1547	30	15,335
2017	5102	6415	1239	47	12,803
2018	6526	9112	1304	47	16,989
2019	6064	10,911	1769	120	18,864
2020	5905	10,758	2237	284	19,184
Total	83,323	159,935	109,248	77,806	430,312

(Source: [32]; Chinese Seafarer Development Report 2015–2020).

and combined into the respective table and graphs, which made visible the fluctuations and trends over the years. Second, the table and graphs were cross-examined in relation to each other to identify how the fluctuations in one set of data might influence (or be influenced by) those in another. Third, the labour market analysis data and relevant literature, which provided detailed contextual information, were used to interpret the fluctuations and make sense of the causes and consequences of these fluctuations.

It is worth noting that this paper does not estimate the demand for Chinese officers based on the number of ships employing them. It is impossible to identify which shipping companies intend to employ Chinese seafarers (instead of seafarers from other countries). Even Chinese shipping companies could flag out their ships and employ foreign seafarers. Instead, this paper relies on the information mentioned above and the labour market principles: when seafarer officers' wages fall and at the same time a large number of MET graduates enter the market and find it hard to secure employment, an oversupply can be ascertained; and vice versa.

The next two sections present the findings and discuss how the 2008 financial crisis and the current COVID-19 pandemic influenced the demand and supply of Chinese officers respectively.

4. The impact of the financial crisis

Table 1 clearly shows that the total number of MET students started to increase rapidly from 2006. The increases were largely due to the two additional MET programs introduced by SPIs. The one-year extra training course for final year university students in non-maritime degree programs (as 'Others' in Table 1) started in 2006, and the two-year vocational education course provided by newly established MET institutions significantly expanded the number of vocational education diploma (VED) students. The growth trend associated with these two programs, however, reversed dramatically from 2011 and the number of newly recruited students plummeted in the following years. Regarding the bachelor's degree and HED programs, the student numbers also fluctuated, but without rapid rises and falls.

One fundamental reason for the dramatic rise and fall in student numbers in the 'VED' and 'Other' programs was the global demand for seafarers. In 2001, China joined the World Trade Organisation (WTO) and gradually became the manufacturing centre of the world, which boosted its imports of raw materials and exports of manufactured products. It contributed to high growth rates in international trade and led to increased demands for shipping services. Against this background, shipowners commenced a period of large-scale ordering of new ships between 2004 and 2008, and new-building activities reached the highest level in history ([37]; see also Table 2). As new ships generated demand for seafarers, the rapid expansion of the world fleet made it harder for ship managers to recruit a sufficient number of seafarer officers and some managers felt that the shortage would develop into a crisis soon [20]. As mentioned earlier, it was in this context that the SPIs were introduced.

However, in 2008 the financial crisis brought an abrupt end to the economic and trade boom and hit the shipping industry hard. In 2009, world seaborne trade volumes dwindled by 4.5 % resulting in an oversupply of shipping services; the container shipping sector suffered more heavily with the demand falling by 9% [38]. To cope with the crisis and manage the oversupply situation, shipowners canceled orders for new ships if they could or postponed their deliveries, and at the same time took some ships out of service by either laying them up or scrapping them. In 2010, about 12 % of the global container fleet was laid up and anchored at different harbours with a skeleton crew onboard to ensure safety [38]. These measures reduced the demand for seafarers. However, MET student recruitments in China kept expanding till 2010 as shown in Table 1. Furthermore, it took at least two years for MET students to complete their school-based training, and degree and higher education diploma programs took longer. When the students of the 2006 batch

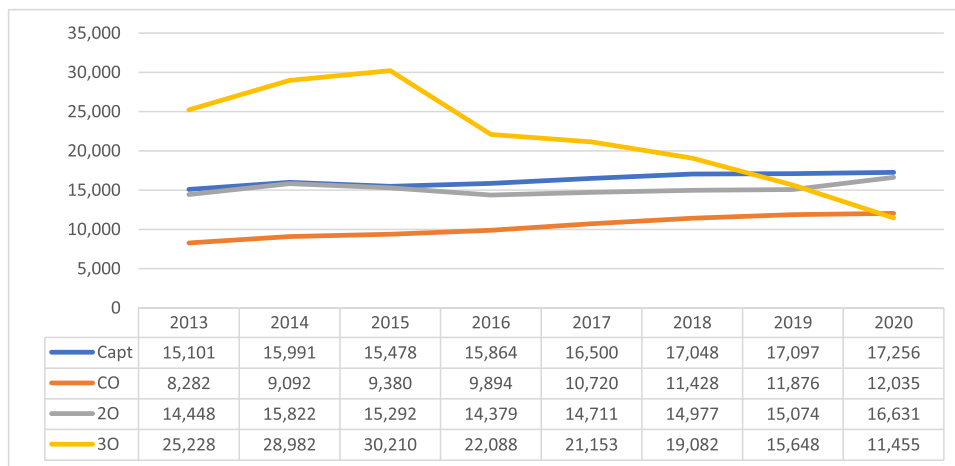


Fig. 1. Number of certified deck officers 2013–2020 (Source: Chinese Seafarer Development Report 2013–2020).

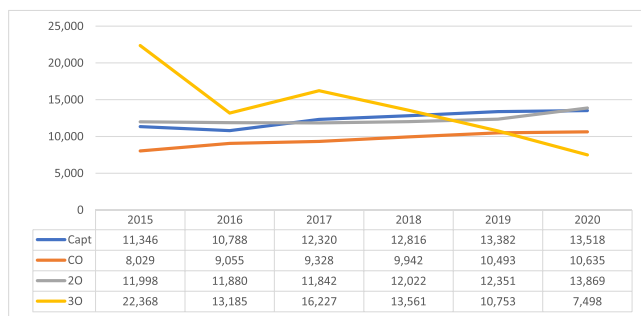


Fig. 2. Number of deck officers with sea-time in the year 2015–2020 (Source: Chinese Seafarer Development Report 2015–2020).

entered the labour market, the market was already in crisis. The data showed that the crisis caused a series of challenges for new MET graduates and junior officers in the next few years. In 2010, the recurring message in the market analysis reports was that while there was a shortage of chief officers and 2nd engineers, 3rd officers and 4th engineers were abundant partially because of the expanded MET capacity as shown in Table 1. This is compatible with Leong’s [20] research finding that around 2010, the supply of senior officers was still tight but there was no shortage of junior officers at a global level. In the

next few years, the same message continued to occupy the headline of market analysis reports. The market analysis in April 2011 [12] reported that 3rd officers and 4th engineers were abundant in the market with a large number of them unable to find suitable employment and their market wages being depressed.

By the end of 2011, the market analysis report commented that the supply of chief officers and 2nd engineers remained tight, but the situation for the newly certified 3rd officers and 4th engineers was bleak. In this context, it was recommended that newly certified junior officers

Table 2 Number of ships (1000 gross tons and above) owned by Chinese companies and worldwide.

	Number of ships owned by Chinese companies	Number of ships worldwide
2001	2216	30,508
2002	2236	30,465
2003	2321	30,228
2004	2415	29,791
2005	2612	31,097
2006	2893	32,814
2007	3184	34,822
2008	3303	36,313

Source: UNCTAD Review of Maritime Transport 2001–2008.

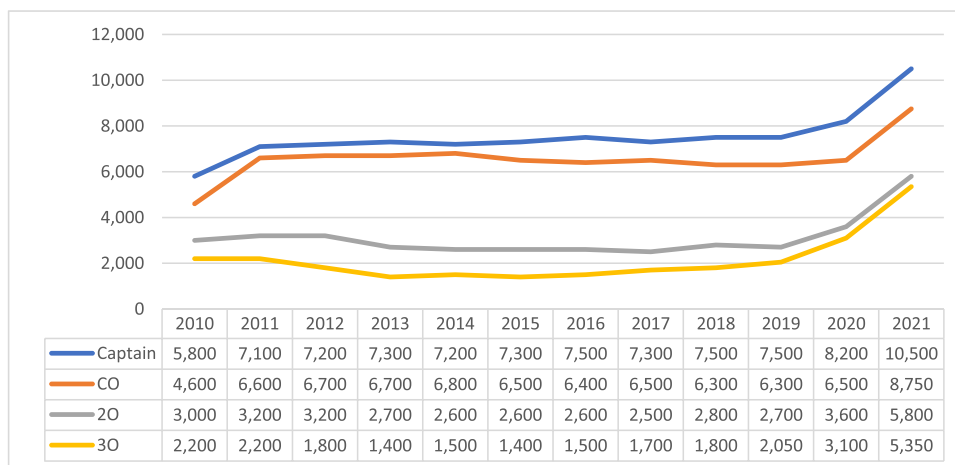


Fig. 3. Average monthly salary in December each year from 2010 to 2021 (in USD) (Source: CSI 2010–2014; SOL 2015–2021).

should take a long-term view, that is, taking offers for rating positions (ABs and oilers) as opportunities to accumulate experience and skills [11]. As such, apart from limited employment opportunities and depressed wages, many new graduates and junior officers had to accept slow career progression [11].

The oversupply of newly certified 3rd officers and 4th engineers together with the nature of the two programs explained why the student numbers in the 'VED' and 'Other' programs plummeted around 2010 (see Table 1). VED students were not subsidised by the government; they were willing to pay high tuition fees because they hoped that they could earn good salaries after graduated to embark on a seafarer officer career [41]. Those who enrolled in the 'Other' program to take the one-year extra training course had the same hope. This hope, however, failed to materialise due to the slumped market. Consequently, these two programs became unattractive. In March 2012, the market analysis pointed out that the oversupply situation of junior officers was so depressing that it discouraged prospective students from applying for MET courses [9]. As a result, many MET institutions could not recruit enough students and had to cancel classes [9]. A similar message was repeated in the March 2013 market analysis [10].

Due to the lagged effect, however, the number of certified 3rd officers (and 4th engineers) continued to grow (see Fig. 1). To understand this effect, it is necessary to examine the estimated timeline to become a certified officer from a MET student. When a MET student completes the college-based training and graduates with a diploma or degree, he/she would not acquire a seafarer officer's certificate (known as Certificate of Competence or CoC) at that point. To obtain a 3rd officer or 4th engineer certificate, he/she would need to pass the CoC exams and serve on-board ships for a cumulative 12 months (known as sea-time) as a cadet. Therefore, the earliest time that the students started in 2010 could obtain their junior officer certificate would be in 2013. Considering that to acquire a 2nd officer or 3rd engineer certificate, a 3rd officer or a 4th engineer needs to accumulate another 18 months sea-time in the rank, it is understandable that the number of 3rd officers continued to grow. It peaked in 2015 (see Fig. 1), five years after the student number did so in 2010.

As mentioned in Section 2, certified seafarers are not the same as active seafarers. A Chinese officer certificate is valid for five years, during which period the certificate holder may stop working at sea. Since 2015, the MSA has also provided information on the number of officers in each rank who had sea-time in the year (see Fig. 2). Those who had sea-time in the year can be seen as active seafarers. Since the data on active seafarers are available only from 2015, it is difficult to know whether the number of active 3rd officers peaked in 2015 or earlier. What is clear is that it declined after 2015.

The wage data in Fig. 3 faithfully reflected the supply and demand imbalance. In the period from 2013 to 2016, while the number of 3rd officers peaked (see Fig. 1), their monthly wages dropped to the bottom at USD 1400–1500 (see Fig. 3). The wage depression further discouraged people from entering the seafaring career¹, since one of the major reasons for people to work at sea is the higher salary compared with what they could earn working ashore [36].

In relation to Fig. 2, it should be noted that sea-time does not necessarily mean the time served in the certified rank. They may serve at a lower rank. For example, a certified 3rd officer could serve as a rating (able seaman) because he/she could not secure a 3rd officer position due to oversupply. It is well known that the majority of Chinese seafarers work on single nationality crewed ships [35], and that on each ship, there is one position for each officer rank. As such, it is expected that the number of officers in each rank should be more or less the same if they serve in the certified rank. Figs. 1 and 2, however, show that until 2017, 3rd officers, with or without sea-time in the year, significantly outnumbered other ranks. In 2015, for example, the number of 3rd officers (30,210 in total, and 22,368 with sea-time) almost doubled that of 2nd officers (15,292 in total, and 11,998 with sea-time). This indicates that a significant number of 3rd officers with sea-time in these years served as

ratings², which reflects the market analysis message discussed above that due to oversupply, many 3rd officers had to take rating positions. As a result, their career progression was significantly delayed.

Figs. 1 and 2 further indicate that except for 3rd officers, the number of certified officers did not fluctuate but grew at rather stable though low rates. This suggests that the dramatic decline in the number of 3rd officers during the 2015 and 2017 period was not caused by the promotion to a higher rank, but a result of attrition, a great number of them exiting the profession. The reason for exiting was the combination of the few factors pointed out above: the difficulty of securing a 3rd officer position, declining junior officer wages, and slow career progression.

As the numbers of 3rd officers and MET enrolments continued to fall, the data suggest that the supply and demand balance started to shift in 2017. During these few years, a good number of 3rd officers obtained a 2nd officer certificate, and many 2nd officers acquired a chief officer certificate. As a result, it was no longer difficult to recruit chief officers in the market; there was a small surplus of chief and 2nd officers. The market analysis in July 2017 report that the oversupply of 3rd officers and 4th engineers had been eased and that the demand and the supply were gradually balanced [27].

This shift of balance was also reflected by the slight increase in 3rd officers' salaries (see Fig. 3).

The market analysis reports in 2018 and 2019 suggest that while the demand and supply of all ranks were in relative balance, minor shortages and oversupplies appeared from time to time. Oversupplies were largely related to the two ranks of chief officer and 2nd engineer, and they were reflected by the situation in which employers found it was easy to recruit seafarers in these two ranks and that newly certified chief officers and 2nd engineers found it difficult to get promoted (to the newly certified rank). Shortages were associated with 3rd officers and 4th engineers, especially in 2019. This was caused by the continued decline in the number of seafarers in these two ranks as shown in Fig. 1 and Fig. 2.

5. The impact of the COVID-19 pandemic

COVID-19 broke out at the beginning of 2020 and spread quickly worldwide, leading to a global pandemic in March. In response, many countries closed their borders and put restrictions on international travel, which caused a crew change crisis in the shipping industry. For Chinese seafarers, crew changes were suspended from early February when the Chinese authorities imposed domestic travel restrictions. By April, China had managed to put the pandemic under control and removed the lockdown measures. Gradually it started to allow crew changes between Chinese seafarers in domestic ports, and by June such operations, though under strict quarantine control, had become largely routinised [33]. This released the pent-up demand for seafarers to replace those whose off-signing was overdue, which according to the market analysis at the end of June [29] exacerbated the shortage of 3rd officers and 4th engineers and pushed up their wages.

In the next few months, the pandemic and crew change crisis served to increase the demand for Chinese seafarers for a few reasons. First, China was the top shipbuilding country, but its international travel bans meant that foreign seafarers were not allowed to enter China. As such, all new-building deliveries in Chinese shipyards could only be made using Chinese seafarers [5]. Second, Chinese ports received by far the largest number of ship-calls in the world because it was the top trading nation [40]. As such, there were more opportunities to conduct crew changes between Chinese crews in Chinese ports than between seafarers of other nationalities in their home ports. In the context that many countries (including China) did not allow foreign crew changes within their borders, it was convenient to employ Chinese seafarers [5]. Third, as China successfully controlled the pandemic, it was less likely that Chinese crew would bring the virus to a ship, as the 2020 September market analysis pointed out that many international management companies and shipowners who used to employ foreign crews switched

to Chinese crews [30].

The increased demand for Chinese officers in 2020 raised seafarer wages, especially for junior officers, as indicated in Fig. 3. While the increased wages indicated an acute shortage of Chinese officers, this does not necessarily mean that there was a shortage of officers in the global seafarer labour market as pointed out in the most recent BIMCO/ICS [4] and Drewry [14] reports. According to the recent MARINA [23] report, the number of deployed Filipino officers fell from 143,190 in 2018, to 97,400 in 2019, and then to 50,277 in 2020. Furthermore, more than 10,000 Filipino seafarers passed the junior officer certificate exams and obtained the certificate each year in this period [23]. It can be safely deduced from these figures that more than 100,000 Filipino officers were undeployed in 2020. These 100,000 Filipino officers could easily fill the gaps caused by the shortage of Chinese officers if COVID-19 related travel restrictions were not in place. Therefore, the acute shortage of Chinese officers was caused by the pandemic-induced restrictions which made it challenging for ship managers to recruit seafarers from certain countries.

The wage increases for Chinese officers were more significant in 2021. This was largely due to the Delta variant eruption in India in April 2021 which affected the deployment of Indian seafarers. The June market analysis reported that many shipowners and ship management companies had temporarily stopped deploying Indian seafarers since April and had to employ seafarers from China and other countries instead [28]. Thus, it can be said that Chinese seafarers benefitted from the pandemic. Bockmann and Walia [5] noted, 'A crew-nationality arbitrage has emerged, with preference being given to seafarers who are easier to relocate, such as the Chinese, to the detriment of Indian and other southeast Asian countries.'

Unlike the 2008 financial crisis, the pandemic has increased the demand for Chinese officers. However, at this point, the SPIs did not increase the MET enrolments significantly as they did in the first few years of adoption (see Table 1). Furthermore, although the number of new MET student enrolments have been slowly bouncing up since it bottomed in 2017, not many MET graduates are willing to pursue a career at sea [22,42]. Table 3 shows that only about a third of MET students went to sea upon graduation, with fewer of them doing so each year. For most students, maritime education is just another way to acquire an academic degree or diploma, rather than a road to a career at sea (see also [22,42]). As a result, while the number of graduates increased, the number of those who started a seafaring career slightly fell. As the wage levels for junior officers remained low between 2012 and 2019, lower than those in 2011, the disinterest in the seafaring career was not surprising [32,42]. Consequently, the number of 3rd officers continued to decline, as clearly indicated in Fig. 1 and Fig. 2.

The decline in the number of 3rd officers has not led to a decline in higher ranks (see Figs. 1 and 2). This is largely due to a lagged effect – a third officer needs 18 months sea-time to obtain a 2nd officer certificate, and will then need at least another 12 months sea-time (serving as 2nd officer) and a few months of college training and exams to obtain a chief officer's certificate. On average it takes five to eight years to become a chief officer. This lagged effect can only delay the decline in higher ranks, however. It can be expected that very soon the number of 2nd officers and chief officers will be hit by the dwindling pool of 3rd

officers.

It may be the case that the significant salary increases during the pandemic would make working at sea attractive again. However, the current salary level is unlikely to last. Chinese crewing companies used to rely on relatively cheaper services to expand market shares [35,44]. The Drewry [13] manning report indicated that among the top seafarer supply countries, Chinese seafarer officers commanded the lowest wage rates between 2003 and 2017. In 2017, for example, a Chinese dry bulk captain's wage would be USD 8100 (higher than Fig. 3), while for the Filipino counterpart, it was USD 8500, and Indian and East European captains' wages were even higher. The pandemic has made Chinese seafarers more expensive than other nationalities in Asia [5]. It is unlikely that a large number of Filipino and Indian seafarers would be absent from the market for long; once they come back, the supply and demand balance would be shifted again, which inevitably would affect Chinese seafarers' wages and employment.

6. Conclusion

This paper examines how the shipping crises coupled with the seafarer training policies affected the demand and supply of Chinese seafarer officers. In the mid-2000s, hoping to take advantage of the increasing demand for seafarers, the Chinese authorities took initiatives to expand the MET system, which led to a quick expansion of MET enrolments [32,41]. The 2008 financial crisis, however, led to a shipping market crisis, which curbed the demand for seafarers. When the first batch of the students after the initiatives graduated, they found that the market for junior officers was already crowded. In the next few years, a large number of new graduates continued to enter the market, leading to a lack of job opportunities, depressed wages, and slow career progression. The dire situation was improved only around 2017, nine years after the financial crisis. Furthermore, the improvement was made at a huge cost: MET enrolments have been significantly reduced, the number of MET institutions reduced from more than 80 in 2009 [41] to 59 in 2020 [42], and a large number of MET graduates and junior officers abandoned their seafaring careers. The COVID-19 pandemic increased the demand for Chinese officers, partially because the pandemic made it practically difficult for ship managers to recruit seafarers from the Philippines and India. However, the depressed wages in the previous years had made working at sea unattractive and as a result the decline in the number of junior officers continued.

This paper sheds new light on a few issues related to the demand and supply of seafarer officers and has policy implications. Firstly, while previous research demonstrated that the oversupply of junior officers was evident in a few labour supplying countries in the previous decade [1,3,20,34], this paper adds to this body of evidence and shows that there was a problem of oversupply of Chinese officers between 2010 and 2017. Furthermore, this paper highlights that this problem was caused by the combined effect of the shipping market recession (in the wake of the 2008 financial crisis) and the government policy initiatives to expand the MET capacity and train more seafarer officers.

Secondly, this paper puts the consequences of oversupply in the spotlight. So far, whereas a shortage of officers has always been a cause for concern [20] and sets in motion follow-up studies to identify measures that could be taken to mitigate the shortage (e.g. [2,6]), oversupply has rarely been seen as an issue. Instead, it has been perceived to be beneficial by employers [3]. However, this paper shows that the oversupply of Chinese MET graduates and junior officers not only has negative impacts on seafarers and MET institutions but also causes long-term damages to the supply of seafarer officers. This is because the negative impacts make the seafaring occupation unattractive and deter people from taking MET courses or pursuing a seafaring career. In the aftermath of the oversupply in the early 2010s in China, the number of 3rd officers and 4th engineers continue to decline till today, leading to an increasingly acute shortage in the market. Expectedly, the decline will soon spread to higher ranks.

Table 3

The percentage of graduates from the top ten MET institutions starting a seafaring career.

Year	No. of graduates	No. of graduates starting a seafaring career in the year	Percentage of graduates starting a seafaring career (%)
2017	7193	2468	34.3
2018	7404	2332	31.4
2019	8660	2423	28

(Source: [24]).

This understanding of oversupply has policy implications. To prevent the oversupply problem, it is important that the national authorities establish procedures and systems to collect relevant seafarer training, supply, and demand information so as to develop a clear picture of and gauge the current as well as future supply and demand for their national seafarers. Furthermore, the authorities should interpret the collected information in consultation with the employers (shipowners, ship management companies, and crewing agencies), seafarer unions or representatives, and MET institutions. This is because information needs to be interpreted in a relevant context, which is better known by the relevant stakeholders.

Thirdly, this paper shows that the crew change crisis induced by the COVID-19 pandemic has constrained the free movement of seafarers in the global labour market, resulting in a shortage in some countries while a lack of demand in others. This lack of fluidity may have long-term consequences. As the case of Chinese officers has suggested, when a large number of seafarers could not be deployed, they would be forced to abandon the profession and make a living elsewhere, and furthermore, it may discourage people from applying for MET courses for a long time to come. In the long run, it will lead to a shortage of seafarer officers. Therefore, it is crucial to manage the crisis by designating seafarers as key workers across the world.

Fourthly, this paper also highlights that the lagged effect – it takes two to four years for a MET student to graduate and another five to eight years to grow into a senior officer – significantly affects the supply of seafarer officers. As such, it is important for the industry stakeholders to exchange information and work in coordination to assess the market demand and monitor the MET training sizes accordingly. It is bad to have too few MET students; it is undesirable to have too many either. An overheated training market and over-expanded training sector can lead to years of oversupply problems and dampen people's interest in a seafaring career. The latter in turn can lead to a long-term decline of seafarer officers.

Needless to say, this paper also has limitations. It relies on cross-examining different sets of data, such as MET enrolments, seafarer numbers in each rank, seafarer wage changes, and qualitative labour market analyses. While these sets of data are from reliable sources, the information on seafarer numbers and wages before and immediately after the 2008 financial crisis is not available. In this context, this paper draws on relevant information from UNCTAD review of maritime transport reports to infer the demand for Chinese seafarers in this period. Nevertheless, this information is limited and not able to provide a comprehensive picture.

Note:

1. It should be acknowledged that there are also other external factors making junior officers' wages unattractive. One factor is the exchange rate, as seafarers are paid in US dollars. The exchange rates of US Dollar (USD) to Chinese Yuan (CNY) fell from 1:7.97 in 2006 to 1:6.65 in 2016. Another factor is the rapid growth of the Chinese economy. The latter quadrupled and the average disposable income per person per year increased from CNY 7228 to CNY 23,821 between 2006 and 2016 [8].
2. It may be argued that 3rd officers served shorter services than 2nd officers so that more of them could be employed. However, this was very unlikely because crew changes incurred costs and to control costs, ship managers were reluctant to shorten seafarers' contracts [36]. For Chinese officers, the typical contract length is between six (for senior officers) and nine months (for junior officers) [26].

Conflict of interest

The author declares no competing interests.

Data Availability

Data will be made available on request.

References

- [1] R. Ayeng, PH seafarer deployment cut by more than 100,000, *The Manila Times*, 2019. (<https://www.manilatimes.net/2019/03/30/news/top-stories/ph-seafarer-deployment-cut-by-more-than-100000/532671/>).
- [2] J. Bao, Y. Li, G. Zheng, P. Zhang, Exploring into contributing factors to young seafarer turnover: empirical evidence from China, *J. Navig.* (2021) 1–17.
- [3] P. Baum-Talmor, *Careers and Labour Market Flexibility in Global Industries: The Case of Seafarers* (Phd), Cardiff University, 2018. (<https://orca.cardiff.ac.uk/109438/>).
- [4] BIMCO/ICS, *Seafarer Workforce Report 2021*, ICS, 2021.
- [5] W.W. Bockmann, I. Walia, Global crew changes paralysed by pandemic 'chaos', *Lloyd's List*, 2021.
- [6] L.D. Caesar, S. Cahoon, J. Fei, Understanding the complexity of retention among seafarers: a perspective of Australian employers, *Aust. J. Marit. Ocean Aff.* 12 (1) (2020) 16–41.
- [7] G. Chen, L. Tang, Competing for seafaring labour: social security and agency employment in Chinese shipping, *Global Networks*, 2021.
- [8] China Statistics Bureau, *Disposable income per capita in various years, 2019*. (<http://tjj.quanzhou.gov.cn/tsys/UploadFiles/43sjfb/129ndsj/qzqtjn2019/cn/html/0511.htm>).
- [9] CSI, *Crew Wages Decline as Market Slumps*, CSI, 2012.
- [10] CSI, *Crew Market Off-season, College Enrollment Cold*, CSI, 2013.
- [11] CSI, *Crew Wages Continue to Rise at the End of the Year*, CSI, 2011.
- [12] CSI, *Crew Wages Cut Due to Market Downturn*, CSI, 2011.
- [13] Drewry, *Manning Annual Report 2017*, Drewry, 2017.
- [14] Drewry, *Manning Annual Report 2021*, Drewry, 2021.
- [15] EMSA, *Seafarer Statistics in the EU – Statistical review (2018 data STCW-IS)*, 2020. (<http://www.emsa.europa.eu/publications/item/3977-seafarer-statistics-in-the-eu-statistical-review-2018-data-stcw-is.html>).
- [16] Frazer-Nash Consultancy, *Support for Maritime Training Review*, Frazer-Nash Consultancy Ltd, 2017. (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/627741/support-for-maritime-training-review.pdf).
- [17] V.O. Gekara, *The stamp of neoliberalism on the UK tonnage tax and the implications for British seafaring*, *Mar. Policy* 34 (3) (2010) 487–494.
- [18] ILO, *The Impact on Seafarers' Living and Working Conditions of Changes in the Structure of the Shipping Industry*, International Labour Organization, 2001.
- [19] H. Leggate, *The future shortage of seafarers: will it become a reality?* *Marit. Policy Manag.* 31 (1) (2004) 3–13.
- [20] P. Leong, *Understanding the Seafarer Global Labour Market in the Context of a Seafarer' Shortage* (PhD Thesis), Cardiff University, 2012.
- [21] K.X. Li, J. Wonham, *Who mans the world fleet? A follow-up to the BIMCO/ISF manpower survey*, *Marit. Policy Manag.* 26 (3) (1999) 295–303.
- [22] J. Liu, Y. Ge, Y. Zhang, *Empirical analysis of brain drain of Chinese seafarers: reasons and countermeasures*, *Marit. Transp. Res.* 2 (2021), 100035.
- [23] MARINA, *MARINA Statistical Report 2016-2020*, MARINA, 2021.
- [24] MSA, *2019 Chinese Seafarer Development Report*, China Maritime Safety Administration, 2020.
- [25] MSA, *2020 Chinese Seafarer Development Report*, China Maritime Safety Administration, 2021.
- [26] H. Sampson, N. Ellis, I. Acejo, N. Turgo, L. Tang, *The Working and Living Conditions of Seafarers on Cargo Ships in the Period 2011–2016*, Seafarers International Research Centre (SIRC), 2018.
- [27] SOL, *July 2017 Crew Wage Quote Reference*, SOL, 2017.
- [28] SOL, *June 2021 Crew Wage Quote Reference and Market Commentary*, SOL, 2021.
- [29] SOL, *July 2020 Crew Wage Quote Reference and Market Commentary*, SOL, 2020.
- [30] SOL, *September 2020 Crew Wage Quote Reference*, SOL, 2020.
- [31] M. Stopford, *Maritime Economics 3e*, Routledge, 2008.
- [32] P. Sun, W. Yao, *Recommendations on seafarer training and certification system reform*, *Marit. Educ. Res.* 34 (2) (2017) 1–11.
- [33] L. Tang, *Defending workers' rights on social media: Chinese seafarers during the COVID-19 pandemic*, *Ind. Relat. J.* 53 (2) (2022) 110–125, <https://doi.org/10.1111/irj.12357>.
- [34] L. Tang, S. Bhattacharya, *Revisiting the shortage of seafarer officers: a new approach to analysing statistical data*, *WMU J. Marit. Aff.* 20 (4) (2021) 483–496.
- [35] L. Tang, M.O.S. Llangco, Z. Zhao, *Transformations and continuities of issues related to Chinese participation in the global seafarers' labour market*, *Marit. Policy Manag.* 43 (3) (2016) 344–355.
- [36] L. Tang, P. Zhang, *Human Resource Management in Shipping: Issues, Challenges, and Solutions*, Routledge, 2021.
- [37] UNCTAD, *Review of Maritime Transport 2008*, UNITED NATIONS, 2008.
- [38] UNCTAD, *Review of Maritime Transport 2010*, UNITED NATIONS, 2010.
- [39] UNCTAD, *Review of Maritime Transport 2018*, UNITED NATIONS, 2018.
- [40] UNCTAD, *Review of Maritime Transport 2021*, UNITED NATIONS, 2021.
- [41] B. Wu, *Seafarer Supply and Rural Development in China*, University of Nottingham, 2010.
- [42] W. Yao, Y. Zhao, G. Wu, Y. Xiong, Z. Duan, *The current situation and challenges of Chinese maritime education*, *Marit. Educ. Res.* 38 (4) (2021) 1–16.

- [43] M. Zhao, Chinese seafarers: value for money or cheap labour? *Marit. Rev.* (2000) 11–15.
- [44] M. Zhao, M.S.V. Amante, Chinese and Filipino seafarers: a race to the top or the bottom? *Mod. Asian Stud.* 39 (3) (2005) 535–557.
- [45] Z. Zhao, J.R. Jepsen, L. Tang, The reform of Chinese state-owned ship crewing agencies and implications for China's seafaring labour export, *Marit. Policy Manag.* 43 (6) (2016) 737–747.