

PANDEMIC RISK MANAGEMENT IN CRUISE BUSINESS: HOW TO PREPARE FOR THE FUTURE

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Summary

The purpose of this study is to help cruise operators to mitigate the adverse effects of pandemics. There are two research questions in this study. First, I investigate whether cruise business suffers substantially from the pandemic risk. Second, I evaluate measures cruise operators could adopt that may help reduce such risk.

For this study qualitative research methods are used. Specifically, grounded theory and case study are used. I collect and analyze literature from different fields of study, unrelated to each other. Combination of results from those studies allowed me to gather useful knowledge to answer the research questions. Moreover, I used empirical evidence about past pandemics, particularly the covid-19 emergency, to confirm findings from literature analysis.

I find a substantial pandemic risk for the cruise sector due to: (1)- increasing probability of new pandemic breakouts, and (2)- the vulnerability of cruise business model for health emergencies. In addition, I develop preventive measures for this issue. Furthermore, this study develops response strategies and alternative business plans to be adopted during pandemics. Overall, while pandemic risk is a serious issue in the cruise business, this study proposes actions that can be taken to effectively manage and minimize the extent of the issue.

TABLE OF CONTENTS:

INTRODUCTION	2
LITERATURE REVIEW	7
METHODOLOGY	17
ANALYSIS AND RESULTS	21
ESTIMATING LIKELIHOOD OF NEW PANDEMICS.....	21
COUNTING THE DAMAGES OF PANDEMIC BREAKOUT.....	23
ASSESSING DAMAGES UNDER PANDEMIC EMERGENCY.....	27
POST-PANDEMIC RISK ANALYSIS.....	33
PREVENTIVE MEASURES.....	36
GOING THROUGH THE EMERGENCY: ALTERNATIVE BUSINESS PLANS.....	41
A PLAYBOOK FOR THE NEXT PANDEMIC.....	45
CONCLUSIONS	48
REFERENCES	51
APPENDIX	56

INTRODUCTION

In January 2020 WHO classified covid-19 as a public health emergency of international concern. It raised the highest level of alert on every country¹. From that moment on, the new virus began circulating worldwide. The virus even reached countries like Canada, Australia and the Russian Federation having a relatively low population density². Until February 2020 cruise ships seemed immune to the virus. One of the ships belonging to Princess Cruises departed on 20th January 2020 for a roundtrip from Yokohama port³. Having positive cases registered onboard, such ship went back to Yokohama port on 5th of February 2020. Japanese Ministry of Health, Welfare and Labor ordered a 14-day quarantine onboard for passengers and crew⁴. This incident concluded with a total of 712 positive cases among 3711 people on board⁵. A detailed timeline of events and the physical structure of Diamond Princess are available in the appendix. Percentage of those positive to covid-19 was as high as 17%⁶. This event raises some questions. Is this just the case of covid-19 or are cruise ships vulnerable to future pandemics too? The cruise sector may suffer from a pandemic risk. If this is the case, is there anything that cruise operators can do to hedge against such risk? This study tries to answer those questions.

The Diamond Princess incident received extensive coverage in the news, and even attracted some criticism towards government intervention. Evaluation of such intervention is difficult to make. It should be considered that, when the fact happened, knowledge about the characteristics of the new virus was limited. We should also consider that protecting the health of those onboard was not the only issue. Making potentially positive passengers disembark and go back to their home country would

¹ <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/interactive-timeline#!>

² <http://statisticstimes.com/demographics/countries-by-population-density.php#:~:text=Greenland%20is%20the%20least%20densely,followed%20by%20Namibia%20and%20Australia.>

³ <https://www.princess.com/html/global/brochures/au/au-aus-asia-2019-2020.pdf>

⁴ Justin McCurry, Rebecca Ratcliffe, *Newborn among 28,000 coronavirus cases as death toll passes 550*, The Guardian, 5 Feb. 2020

⁵ <https://www.nhk.or.jp/special/plus/articles/20200507/index.html>

⁶ National Institute of Infectious Diseases, *Field Briefing: Diamond Princess COVID-19 Cases, 20 Feb Update*, 21 Feb. 2020

have let potentially positive passengers spread the virus offboard. In addition to this, another problem could have been the one of clandestine immigration. Japan is not new to this issue. As a matter of fact, there were 106 disembarked passengers missing in the year 2018⁷. Some passengers could have chosen to remain in Japan illegally instead of going back home as ordered. This is even more probable for passengers coming from a country having a high number of covid-19 cases. Unpaid medical bills, especially by non-residents who did not hold travel medical insurance, could have been another problem. Several sources report unpaid medical bills from tourists visiting Japan⁸. While this circumstance is usually extremely rare, it was much more likely to happen in that circumstance. This is because the probability of receiving expensive medical treatment was higher for the passengers with respect to normal circumstances.

Therefore, it is difficult to judge the response to the incident by the Japanese government. However, it is generally good practice to learn from the past. Quoting George Santayana, "*Those who cannot remember the past are condemned to repeat it*"⁹- and history repeated itself after 50 days. An almost identical incident happened in Italy with Costa Victoria. One woman disembarking in Greece tested positive for covid19, and the other passengers remained quarantined onboard in Civitavecchia¹⁰. Several similar cases happened all over the world. However, they did not receive as much coverage by the media as the Princess Cruises incident. This may be because other governments adopted a different strategy. One example is World Dream, where the government adopted a different strategy. In the World Dream incident passengers could disembark, but it was exceedingly difficult to trace them afterwards¹¹. In a more recent case, Italy also adopted the opposite strategy with respect to what

⁷ Kenta Miyahara, Kyushu News Center, Shotaro Asano, Nagasaki Bureau, 18 Feb. 2019, *106 foreigners went missing in 2018 after arriving in Japan on cruise ships*, Mainichi Japan

⁸ <https://asia.nikkei.com/Spotlight/Japan-immigration/Foreigners-unpaid-bills-give-Japanese-hospitals-a-headache2>

⁹ George Santayana, *The Life of Reason*, 1905.

¹⁰ <https://www.thelocal.it/20200325/coronavirus-fears-on-cruise-ship-docked-in-rome-after-case-confirmed>

¹¹ Sidney Leng, He Huifeng, *China scrambles to locate passengers on cruise after at least four diagnosed with coronavirus*, South China Morning Post, 4 Feb. 2020

Japan did with the Diamond Princess case. On 10th June 2021, two passengers positive to covid-19 on an MSC cruise ship could disembark. The cruise operator organized a transfer of those passengers¹².

I try to give an answer to some of the questions which arises from those events. To do so I verify whether there is a pandemic risk for the overall cruise business. I also present possible countermeasures to future pandemics. Particularly, I consider both preventive measures and alternative business plans to be used during pandemics. To verify the presence of a pandemic risk, I investigate about the probability of pandemics happening the near future and evaluate damages arising from such pandemics. Such damages are divided into three categories: (1)- occurring when a new virus is discovered, (2)- occurring while the health emergency is going on, (3)- occurring after the end of the health emergency. Regarding possible measures to reduce the damages from new pandemics, I firstly considered preventive measures. Then, I also develop alternative business plans which cruise operators can use during pandemic emergencies. Those may be safer and more profitable than running ordinary operations as much as possible. The main reason for making this study is that I believe preparing for the future is important for any business. If more pandemics are happening in the future, cruise operators should start acting from now. When a pandemic breaks out, it may be too late to think about a strategy to reduce its damages.

Furthermore, covid19 has not just been a crisis in the cruise sector, but for the whole hospitality industry. I investigate about cruise business instead of the hospitality industry because the response to pandemics may vary greatly across countries. As an example, the response to the breakout of the covid-19 varied across EU member states. While Italy was under extensive lockdown and imposing curfews, Slovenia was barely adopting a partial lockdown¹³. In the case of future pandemics governments of different states are likely to adopt different measures. This is also because constitutions and laws are different across jurisdictions. In countries like Italy, governments can

¹² Jack Guy and Livia Borghese, *Cruise passengers test positive for Covid-19 in Italy*, CNN, 10th June 2021

¹³ <https://www.bbc.com/news/world-europe-54839429>

extensively limit the freedom of movement of citizens. Extensive business shutdowns are also possible. On the contrary, in countries like Japan the government cannot enact such rigid measures¹⁴. New pandemics could also spread in each country in a different way. Furthermore, the hospitality industry includes hotels and recreational facilities. Those are not used just for vacation but may be used for business travels or by nearby residents. As a result, the impact of new pandemics across hotels would probably vary according to the target customers of such hotels. Even when considering just the tourism industry, the situation is not homogeneous. Different kinds of tourism involve different social interaction. A visit to a nightlife district of a large city would probably be less safe than relaxing in the nature. As a result, during pandemics such as covid19 damages suffered by facilities such as hotels will terribly vary. For instance, shopping tourism would probably suffer a pandemic crisis more than nature tourism. This may cause accommodation facilities in popular destinations for such type of tourism to be more affected by pandemics. In addition, a new pandemic would likely affect domestic and international tourism differently. For all these reasons, there would have been little meaning in focusing on the entire hospitality industry.

In this regard, cruise business it is much easier to investigate the cruise business. Cruise ships are most of the time navigating on the sea. As a result, even if a government implemented strong measures to contrast a new pandemic, cruise operations would be comparably less hit by such measures. However, if all governments deny disembarkation of passengers, the cruise business will inevitably stop operating. In addition, cruise business has two other peculiarities. First, cruise operators run cruises all over the world. This means cruise business covers all geographical areas. Second, all its customers are tourists. While no law prohibits to live permanently on a cruise ship, the cost is so high that very few customers are willing to do it. Cases of customers living on cruise ships have been reported¹⁵, but they are just exceptions to the norm. Finally, cruises generally have ports of call in different countries, so they can be considered international travels. I am interested in studying about the effect of

¹⁴ Lawrence Repeta, *The coronavirus and Japan's Constitution*, The Japan Times, 14 Apr. 2020

¹⁵ <https://www.cntraveler.com/stories/2016-05-06/this-man-has-been-living-on-cruise-ships-for-twenty-years>

pandemics on international tourism businesses, as well as measures to reduce such effect. For the above-mentioned reasons, I think the cruise sector is the perfect niche to focus on for such study.

LITERATURE REVIEW

The research questions of this study are extremely broad, and the study focuses on a niche industry. Research related to pandemics in the field of business administration is also new. For those reasons, it is not possible to find previous studies covering the same research questions. Studying about the pandemic risk means covering different areas of studies not academically correlated to each other. Healthcare professionals focus their analysis on defining factors of risk, symptoms and therapies for illnesses including those caused by viruses. They do not deal with the economic consequences of such illnesses. Studies by business do not usually relate to medical findings. Studies about cruises are generally just descriptive. This research combines findings from medicine, environmental sciences, and business administration. It focuses on the future and equips cruise businesses with strategies for new pandemics.

Heuristic and common sense suggests that pandemics are nothing more than natural events. Society, including businesses such as cruise ones, would have limited possibilities of stemming the problem. Yet there are areas of research that are not new to developing solutions to pandemics. Virology and medicine are areas where the reaction to pandemics like COVID-19 has not been to allow the virus to circulate naturally. Researchers in medical field acquire knowledge about new viruses They use knowledge about anatomy and pass through a systematic approach. In the case of covid-19, they have developed vaccines that are a better way to prevent the spread of illness.¹⁶

Similarly, to medicine, business administration knowledge could be used to deal with the economic aspects of pandemics. As medical researchers acquire information about new viruses, business researchers can also acquire critical data about the possible effects of the new pandemics on different sectors. By incorporating this information into managerial knowledge, it may be possible to develop innovative business solutions for new pandemics. These solutions aim to alleviate the financial impact

¹⁶ <https://www.who.int/news-room/q-a-detail/vaccines-and-immunization-vaccine-safety>

of such disasters on specific sectors. However, differently from medicine, there are not standard procedures to develop solutions decided at international level or by either external or state authorities. Business executives ought to develop their own solutions to pandemics. In compliance with local laws and hopefully respecting CSR best practices, they should choose the best alternatives and adopt the most effective precautions to survive as smoothly as possible during a pandemic.

Cruise business is less covered in literature than the hospitality industry. However, this study relies on sources about different fields of study. For each one, it is possible to find literature relevant for the research questions. Using the methodologies explained in the following section, I try to develop solutions and precautions to deal with pandemics. What I try to investigate in this research is whether cruise companies can achieve better business outcomes by taking appropriate measures related to pandemic risk. I summarize the research questions as follows:

Question 1:

H0: There is no pandemic risk for the cruise sector.

H1: The cruise sector suffers from a pandemic risk.

Question 2:

H0: Cruise operators cannot reduce pandemic risk.

H1: If cruise operators adopt some strategies, they can hedge against pandemic risk.

Since measuring financial outcomes depends on total and marginal revenues as well as profits as required, pandemic risk must also be measured. If costs are considered limited to fixed costs marginal profits are equal to marginal revenues. Given the amounts of profits of a cruise business per year without pandemics happening equal to π and the expected loss per year due to pandemic risk R , the expected profit for any year is mathematically expressed as $\pi - R$. If the cost of implementing measures to deal with pandemics per year is C , then the hypothesis is verified if and only if expected profits

with measures implementation are greater than those without any measure adopted. Given $0 < a < 1$ the portion of damages born after measures adoptions:

$$\pi - a * R - C > \pi - R \text{ or simplified } (1 - a) * R > C$$

In other words, for the hypothesis to be proven, financial resources spent on preventing damages related to pandemic risk must be lower than the expected benefit of implementing such measures. Such benefits are directly proportional to damages due to pandemic risk. Therefore, it is important to quantify such risk. The simplest way to quantify it is through expected losses occurred due to pandemic. Expected losses from an event are defined as the product between the probability of a pandemic happening and the expected damages given the occurrence of a pandemic. Therefore, the probability of such event occurring is the first element to be discussed in this research. Given that R is directly proportional to such probability it is necessary to discuss whether pandemics in the future are a concrete possibility or not. If risk of new pandemics should be approximately null, there is no rationale in researching about preventive measures and solutions to a problem the sector would never encounter. In addition to this for a concrete pandemic risk to exist damages arising from pandemics should not be economically negligible. It is not only helpful to investigate the damage caused by a pandemic to verify the hypothesis developed, but also to have a benchmark to evaluate the effectiveness of the proposed measures. This means being able to compare the operators' performance regularly with that during pandemics if to suggest measures are applied. While this is not inherent in answering research questions, it could constitute the basis for further research. It is also useful to establish a break-even point. This means a value where the suggested action manages to ensure that operators can fully protect themselves from the pandemic risk. It may result that, adopting alternative business plans during pandemics, profits are higher with respect to regular times. This circumstance is highly unexpected as it would imply that there is a more profitable way to use cruise businesses' assets with respect to regular operations. If such method existed, unless for some reasons it would be applicable just under pandemic emergency, cruise operators would probably already have made appropriate adjustments to their business model. That is why, despite being somewhat effective, I do not expect proposed measures to solve the problem of pandemic risk in the cruise business but just alleviate it.

I will classify damages from pandemics into three categories. The first one is damages arising at the occurrence of pandemic, which is in the moment immediately after the news report the breakout of a new virus. At this stage, it is impossible to know extensively about the characteristics of the new virus as well as countries where it has already spread. The second one concerns damages arising during the whole pandemic emergency. This time ranges from the moment the virus has spread worldwide to the end of the pandemic emergency. I consider a pandemic emergency ended when the new virus has no more significant effect on public health and cruise operations. Last this research will also investigate about damages arising after the health emergency has ceased. Even when a pandemic is over, there may be a drop in demand for cruise holidays. This can be due to endogenous or exogenous factors. Examples of those are a change in consumer preferences or loss of consumer confidence. It is necessary to investigate about demand for cruises after pandemics because demand of any non-inferior good or service is negatively associated with a drop in income ¹⁷. This is a likely scenario for a future pandemic.

According to previously mentioned specifications the hypothesis to be tested is mathematically:

$$(1-a) \cdot Pr \cdot Dmg > C$$

Pr is the probability of a pandemic happening in one year and Dmg is the damage incurred if a pandemic happens. For this research, cruise operators must spend a relevant amount to implement the suggested measures only when a pandemic happens. For preventive measures those whose costs are negligible they should be implemented if and only if effective. The parameter a in the equation is a measure of effectiveness of proposed solutions to pandemic risk. Exact quantification of such parameter is not useful for this research. Given $C=0$, $Pr>0$, $Dmg>0$ the inequality becomes verified for any value of a different from 1. This implies that a costless measure is recommended whenever it

¹⁷ Ramachandra, *Economic, Accountancy and Management*, Tata McGraw-Hill publishing, 2006, p.29

has some efficacy. This means that if an inexpensive measure is effective, it should be implemented regardless of how much it is effective. Implementation of such measures is independent of the probability of a pandemic happening. Alternative business plans do not involve any expenditure if pandemics do not happen. They make use exclusively of assets already possessed by cruise companies. Since cruise operators must pay expenses regarding the fleet irrespectively of the usage of ships, the only real cost of implementing those business plans is the opportunity cost of operating regularly. However, if operations need to cease due a pandemic, this opportunity cost is null. Therefore, if ships cannot run ordinary operations, even alternative business plans have negligible implementation costs. I will also propose measures which have substantial implementation costs. While I cannot verify if it is possible to implement those measures profitably, their implementation would bring benefits aside of pandemic management. Therefore, cruise operators should evaluate individually whether benefits those measures brings are greater than the costs.

To develop this research, I proceed by steps. First, I assess the likelihood of new pandemics. The risk of new pandemics is studied in environmental sciences and virology. Therefore, it is necessary to relate to previous studies in these fields. An article recently published, *Zoonotic host diversity increases in human-dominated ecosystems*¹⁸, studies the correlation between deforestation and loss of biodiversity. Those two trends which will probably continue in the coming years. Books such as *The Norovirus: Features, Detection, and Prevention of Foodborne Disease*¹⁹ and OECD publication²⁰ also investigate about the risk of future pandemics with similar results. Those sources are important to verify the probability of pandemics happening in the future. Those studies were made within the past years but are still antecedents to the covid19 outbreak. Therefore, their results cannot have been influenced by

¹⁸ Gibb, R., Redding, D.W., Chin, K.Q. *et al.* *Zoonotic host diversity increases in human-dominated ecosystems*, Nature, 5 Aug. 2020

¹⁹ Paul K S Chan, Hoi Shan Kwan, Martin, *The Norovirus: Features, Detection, and Prevention of Foodborne Disease*, Elsevier, 2017

²⁰ OECD (2011), *Future Global Shocks: Improving risk governance*, OECD Reviews of Risk Management Policies, OECD Publishing

an over-reaction to the covid-19 outbreak. The book *The Norovirus: Features, Detection, and Prevention of Foodborne Disease* is also particularly important because it focuses on Norovirus. Cruise operators have always been particularly concerned about such virus. This study also explains that new viruses could be like the Norovirus. Since it is crucial to understand the characteristics that a new virus is likely to have, this piece of literature is a milestone for this research. Furthermore, not only are medical and environmental science studies available, but it is also possible to consult timelines of pandemics from the recent past in several websites. This research makes use of empirical evidence of pandemics from the year 2000. I arbitrarily chose to focus research about past pandemics from that year onward. This is because I investigate about them to evaluate likelihood of future pandemics. Since there is probably little correlation between the risk of future pandemics and pandemics happened a long time ago, it would be useless to look at breakouts too far in the past.

In addition to understanding the likelihood to experience new pandemics, it is also necessary to investigate about likely symptoms and possible ways of spreading of new viruses. This is because it is impossible to develop preventive measures of something which is totally unknown. There is no study able to predict with certainty characteristics of new viruses. However, I assume that they will have characteristics in common with gastroenteritis, pneumonia, and influenza. Those were the main illnesses associated to viruses in the past. There is plenty of literature of various kinds, ranging from books to articles and websites about the characteristics and ways of spreading of such illnesses. For the sake of synthesis, since it would be difficult to cite all those sources reporting same information, I selected three recently updated websites managed from authoritative sources. Regarding pneumonia I retrieved useful resources from NHS website. This is the biggest UK website covering the topic, with more than 2000 organizations referring to it²¹. I extrapolated information about influenza from the American Centers for Disease Control and Prevention. This is an organization whose mission includes detecting and responding to new illnesses, to protect public health in the nation²². Information is likely

²¹ For more information refer to <https://www.nhs.uk/about-us/about-the-nhs-website/>

²² <https://www.cdc.gov/about/organization/mission.htm>

to be accurate because a complex organizational chart of healthcare professionals manages this organization²³. Regarding gastroenteritis illness, I will rely on the relevant web page from Harvard Medical School. I could also have used a wide range of books and research paper having the same content of those websites. However, I do not need to get extensive medical information about those illnesses. This is because there is no evidence that viruses which will cause new pandemics will be the same of those which I took into consideration. I used such viruses as a benchmark to rely on when it comes to developing strategies to limit the damages of new pandemics. For those reasons, I prefer to look at those sources rather than more in-depth studies. While they are not the best for retrieving in-depth medical information, they are the best for this study for their conciseness and reliability.

I also needed to rely on previous literature to assess the impact of pandemics on cruise businesses. Instead of just assuming that the cruise sector would be damaged from a new pandemic, I looked at which kinds of damages it would suffer from. That is why I rely on sources looking at the issue from more than one perspective. Godwell Nhamo writes about the vulnerability of cruise ships to pandemics. He assesses which pandemics have been the most impacting for the cruise industry. In addition to this, he evaluates which kinds of virus cruise ships are particularly vulnerable to. He also provides an explanation about why viruses can easily spread across cruise ships. His work is extremely relevant as it also analyzes the impact of covid-19 on the cruise industry²⁴. The main limitation of this book is that it is just descriptive. It explains the problem of cruise ships being vulnerable to viruses but do not suggest any solution. Other studies examine in detail single aspects of pandemics on cruise ships. This is the case for *The COVID-19 Pandemic: The Deadly Coronavirus Outbreak* book, which focuses on analyzing spread of covid-19 in all areas of the world, including cruise ship. This piece of literature provides reasons for which the physical structure of cruise ship is so vulnerable to pandemics. It also reports an accurate analysis of covid-19 outbreak episodes on different cruise ships and evaluates the

²³ <https://www.cdc.gov/about/pdf/organization/cdc-org-chart.pdf>

²⁴ Godwell Nhamo, *Counting the Cost of COVID-19 on the Global Tourism Industry*, Springer Nature, 2020

response to such outbreak from a medical perspective²⁵. Although this study is concerned only with medical issues, knowledge of the main causes of cruise ships' inability to cope with pandemics is fundamental. Acknowledging the reasons why such ships are a vehicle of virus transmission, It is also possible to identify issues that might be resolved relatively easily by cruise operators to mitigate this spread.

In addition, the examination of consumer confidence and trends in the cruise or hospitality industry in the event of major disasters is useful for the scope of this research. A Graduate Employment Guide for the tourism industry can be used in a useful way to describe trends across the hospitality industry following events such as COVID-19. As there is a shift in demand for different kinds of holidays immediately after one of such events occur, cruise operators may be able to adapt or prepare for such change. I related to a source about employment because employment in any sector is positively correlated with customer demand in that sector This means that said source also contains useful information about demand for cruises after a pandemic break out. Additionally, literature on consumer confidence in the cruise industry after a pandemic or other disruptive event is available. Robert Clark is one of the main authors writing about consumer confidence and drop of cruise occupancy rates during any major event in the industry²⁶. A full chapter focuses on the impact of SARS on the cruise and hospitality industry, as well as the importance of the tourism industry to the entire economy.

I also relate to literature for finding solutions to mitigate the pandemic risk. The measures to be taken are based on the analysis of the documentation. To analyze better protection of the health of passengers and staff during the pandemic surges, I will discuss several measures. I do not need to discuss extensively about the effectiveness and availability on the market at a reasonable price of personal protective and personal medical equipment. Examples of those are masks and clinical thermometers.

²⁵ Tapas Kumar Koley, Monika Dhole, *The COVID-19 Pandemic: The Deadly Coronavirus Outbreak*, Taylor & Francis, 2020

²⁶ Robert Clark, *In Hindsight: A compendium of Business Continuity case studies*, IT Governance Publishing, 2014

The same cannot be said about the implementation of telemedicine onboard. Implementation of telemedicine is extremely complex but has been studied by medical researchers in ships carrying passengers for different purposes. For this reason, the recommendation for such a measure is based on the conclusions of these studies. They are published mainly in the form of academic papers. *Implementation of a 24-Hour Teleradiology Service for Cruise Ships: A Pilot Study*, is about a telemedicine experiment. Passengers onboard were able to get 24/7 medical service. This includes medical screenings, which are commonly performed by radiology departments in hospitals.²⁷ While this study focuses on analyzing the potential of such a service, Monika Petra Puskeppeleit focuses instead on the requirements for an efficient implementation of telemedicine services onboard²⁸. This research is especially important in assessing the extent to which and what needs to be done by cruise ship operators to successfully implement this service on board. Rifat Latifi takes a step forward with a practical cruise ship telemedicine project, the MEDASHIP project²⁹. He illustrates services available with satellite technology. He also considers other issues such as data security and reduction of costs with respect to an emergency evacuation for a passenger.

Governments all over the world recalled attention to individual behaviors during covid-19 pandemic. Countries such as Italy even made individual behaviors such as wearing masks compulsory at times.³⁰ With this regard, *Passenger Behaviors During Norovirus Outbreaks on Cruise Ships* specifically tackles the issue of virus outbreaks on cruise ships from passengers' perspective³¹. It conducts an in-depth analysis of the causes that have led to large-scale norovirus outbreaks on cruise ships by

²⁷ Frank Oliver Henes, Per Stappenbeck, Enver Tahir, Angelina Koehler, Berthold Petutschnigg, Gerhard Adam, Peter Bannas, *Implementation of a 24-Hour Teleradiology Service for Cruise Ships: A Pilot Study*, American Journal of Roentgenology, 2020

²⁸ Monika Petra Puskeppeleit, *Improving telemedicine onboard Norwegian ships and drilling platforms*.

A study of intersectoral co-operation in Maritime Medicine, Nordic School of Public Health, 2008

²⁹ Rifat Latifi, *Current Principles and Practices of Telemedicine and E-health*, IOS Press, 2008

³⁰ <https://www.bbc.com/news/world-europe-54454450>

³¹ Antonio J. Neri, MD, Elaine H. Cramer, MD, George H. Vaughan, MPH, Jan Vinjé, PhD, Hugh M. Mainzer, DVM, *Passenger Behaviors During Norovirus Outbreaks on Cruise Ships*, Journal of Travel Medicine, 2008

surveying a huge sample of passengers involved in such incidents. Such piece of literature is important for evaluation of practical implementation of medical measures onboard.

In addition to those cited, I refer to several other sources. However, it would not be possible to list each of them here. The choice is to cite here some of the most relevant sources referred to. In addition, I need to explain why some sources apparently unrelated to the topic are used. Finally, in the treatment of medical topics related to cruise affairs, it is fundamental to explain the criteria for selection of sources rather than others containing similar information.

METHODOLOGY

I chose the research methodologies considering that I research on the cruise sector. This is just a fragment of the hospitality industry. This means using quantitative methodologies is troublesome. To make statistical analysis, two conditions are necessary. First, the sample size should be large enough. Second, samples should be independent one another. The cruise sector is an oligopoly, so it is extremely difficult to gather enough data. Another problem is that data may not be independent one another. This is often the case in oligopolies. In oligopolies a small number of firms are in strategic interaction among each other. This means that the strategy of one cruise operator has an influence over the others³².

Some elements for validating the alternative hypothesis for the first research question pertains to areas of science which are outside business. Those are the probability of pandemics happening in the future and the effect of a new virus on cruise operations from a medical standpoint. However, for the purpose of this study, it is not necessary to get in-depth knowledge about those. It is not necessary to quantify exactly the probability of a new pandemic happening each year. To have a potential pandemic risk, this probability just needs to be non-null. I observe whether it has been significantly present from year 2000 onward. Then I verify whether it is increasing or not. This is because considering the function $P(t)$ where P is the probability of a new pandemic happening and it is represented by the year, if $P(t)$ is strictly increasing in t , and $P(t=2021) > 0$ we can assume $P(t > 2021) > 0$. To prove that probability of new pandemics is increasing, I refer to literature about natural science. To prove that probability of new pandemics is non-null this year, I look at the timeline of pandemics from year 2000 onward.

Regarding evaluation of damages suffered because of a pandemic, I used covid19 as a case study for such estimation. For damages at the outbreak of a new virus, I study the fluctuations of share prices on the stock market for cruise operators. As for damages throughout the pandemic emergency, I used

³² N. Gregory Mankiw, *Principles of Economics*, ninth edition, Cengage learning, 2021, p.336

grounded theory methodology. Such methodology aims at observing events, together with written documents such as books and academic articles. It tries to focalize on essential parts of such events to develop theory upon them³³. In this study I observe past pandemics from 2000 to present and the impact on the cruise sector afterwards. I also look at cases of ships running regular operations during covid-19. From the trends observed, following an inductive approach, I try to derive generalities about future pandemics and their impact on cruise sector. To apply this methodology, I must consult several sources. Using this methodology is generally a mental challenge which involves trying to develop theory from observations and combinations of other studies in different fields³⁴. In addition to this, as analyzed by Juliet Corbin and Anselm Strauss in their book about qualitative research methods, I also hope that this study will have relevance beyond academia and will be useful for practical scopes³⁵.

Research about damages during the pandemic emergency articulates in two main pillars. The first one is the study of the impact of pandemic emergencies on financial statements of cruise operators. The second one is evaluating two opposite strategies used during covid19 emergency. The first one is to ignore the health emergency and conduct business operations as usual. The second one is to shut down operations until the pandemic emergency ends. While cruise operators tended to use the first strategy, it was not always possible to adopt it. Governments sometimes issued sails bans. This forced cruise operators to adopt the second strategy. The study on damages when adopting the strategy to ignore the pandemic emergency is necessary. This is because damages caused by sails bans, if operations can be run without issues, should not be considered as pandemic damages. They should be considered political damages, which means damages arising due to the actions of governments.

As for evaluation of post-pandemic damages, I make use of grounded theory and case study methodologies. I observe trends and assume them to be constant for future pandemics. In addition to this I try to proxy customers bookings in the years after pandemics by researching about google

³³ <https://measuringu.com/qual-methods/>

³⁴ Juliet Corbin, Anselm Strauss, *Basics of Qualitative Research*, SAGE, fourth edition, 2015, p. 8-9

³⁵ Ibidem, p.10

research on the keyword “*cruise booking*”. I put this in relation to search on the keyword “*pandemic*” through google trend analysis and discuss the results. Those results are however very approximative. Data available in google trends only shows results for searches made in English. It would also have been useful to get the total amount of searches of the keyword “*pandemic*” just for those interested in cruising and exclude searches of “*cruise bookings*” made for purposes other than looking for a holiday to book. Even with such limitations, this attempt to use quantitative research was useful to strengthen the findings from empirical evidence related to covid19.

Overall, I used mainly qualitative research methodologies in this study. Those have several advantages. They allow for more flexibility. They also allow to get more meaningful insights³⁶. Those advantages allow to conduct research without an exact pre-defined pattern. This is particularly important for this study. Since the two research questions are related to each other, the research process depends on findings at each step. For instance, if the cruise business does not suffer from damages after pandemic emergencies, there is no reason to research about strategies to limit such damages. The table below summarizes the flow of research:

Issues relevant for this research	Conditions for investigating about the issue:
Probability of new pandemics (P)	none
Damages at new virus breakout (D ₁)	P>0
Damages during pandemic emergency (D ₂)	
Damages after pandemic emergency (D ₃)	
Development of measures to be taken	P>0 and D ₁ + D ₂ + D ₃ >0

As the table shows, it is impossible to forecast the entire outline of research before its start.

Qualitative research has one more advantage. I investigate effects of future pandemics assuming new viruses will be like influenza, gastroenteritis, and others. This could seem a strong limitation. However, since I use qualitative research methodologies, this is not the case. Qualitative research methodologies

³⁶ <https://www.scribbr.com/methodology/qualitative-research/>

allow to understand the reasoning behind results. That is why, even if a virus different from those considered spreads, this research can be useful. Another advantage qualitative methodologies have over quantitative ones is the possibility to conduct research smoothly and in a less costly way. Extensive numerical data are necessary when using quantitative research methodologies. In addition to this, use of sophisticated statistical software is often necessary. Instead, with the methodologies used for this research, I do not need either. Information about cruise sector, medical literature, financial statements, and previous experiences for the cruise sector dealing with pandemics are widely available. All those sources allow to make meaningful conclusions even without much numerical data. Having hitherto described the content, methods, and existing literature about this research, I give an overview of the results of this research.

ANALYSIS AND RESULTS

ESTIMATING LIKELIHOOD OF NEW PANDEMICS

First, I investigate about the probability of new pandemics to verify whether pandemic risk exists. To do so, I analyze timeline of pandemics from year 2000 onward. 10 pandemics have broken out from 2000 to 2020. If I consider pandemics antecedent to that year but happening at the same time frame the number rises to 11³⁷. This means approximately one pandemic every two years. Looking into pandemics which deeply affected the cruise sector, studies about cruise business would cite SARS in 2003 and MERS in 2016³⁸. Those studies also cite the 2008 financial crises. Any major event deeply affecting global economy will have an impact on cruise sector. This is something economic theory would expect since for normal good (and services) such as cruise travels, consumption increases as income increases³⁹. In addition, since cruises are not necessities but luxury goods, the impact of any economic event affecting impact is even stronger. The consumption of luxury services is even more dependent on income than for necessities⁴⁰. Although covid-19 has been by far the most devastating in terms of cases and deaths considered, this has not been the only pandemic since year 2000. Pandemics have instead been a regularly recurring event in this century.

To prove that the probability of new pandemics in the future is increasing, I consider relevant literature. OECD issues an alarming report stating that a new form of influenza A type virus spread is likely to occur in the future. It cites more than one precedent in the past century⁴¹. This report is extremely relevant as it also tries to forecast economic consequences of such possible pandemic. It explains that

³⁷ Gillian Moran-Perez, *A Timeline of Outbreaks from 2000 to Present*, Daily Sundial, February 13, 2020

³⁸ Godwell Nhamo, David Chikodzi, Kaitano Dube, *Counting the Cost of COVID-19 on the Global Tourism Industry*, Springer Nature, 2020, p. 142

³⁹ Michael Eugene Wetzstein, *Microeconomic Theory: Concepts and Connections*, Thomson/South-Western, 2005, p. 93

⁴⁰ Ibidem, p.94

⁴¹ OECD, *OECD Reviews of Risk Management Policies Future Global Shocks Improving Risk Governance: Improving Risk Governance*, OECD Publishing, 2011, p.29

such pandemic would particularly affect tourism. This is because it would become impossible to travel due to restrictions. It is reasonable to assume that it would also be impossible to carry out cruises' operations. I also evaluate the likeliness of new pandemics based on determinants of such events. Studies about urban ecology and macroecology link deforestation and consequent reduction of biodiversity to an increased likelihood for new pandemics to break out⁴². A link between environment health and probability of new viruses to break out is widely present in literature. Indian Institute of Technology Indore finds this link studying the case of Wayanad District of Kerala in southern India⁴³. There are plenty of other books like the one of Kristina Wright that cites a link between deforestation and new diseases affecting humans⁴⁴. Trends like exploitation of the environment and deforestations are not likely to suddenly stop after covid-19. It will probably take time before they are effectively deal with. Despite the efforts by the United Nations⁴⁵ and environmental questions becoming more and more urgent, it takes time to change the relationship between human activity and nature. Individual countries such as Japan have also committed to tackle environmental issues fixing 2050 as the date for becoming carbon-free⁴⁶. This implies that environmental issues are a long-term goal, and a drastic change is not possible. As a result, if it is true that efforts made by national states are praiseworthy, new pandemics are likely to take place before they reach those long-term goals.

BBC also covers the topic of the likelihood of new pandemics. According to their article, most of pandemic diseases are zoonotic and they can be caused by a wide variety of animals⁴⁷. That is why if a new pandemic breaks out, it is not possible to predict from which country it will spread. As a result, a large part of the world may be the first to experience a new virus breakout. As a result, ships making

⁴² Gibb, R., Redding, D.W., Chin, K.Q. et al. *Zoonotic host diversity increases in human-dominated ecosystems*. Nature 584, 398–402 (2020)

⁴³ Indian Institute of Technology Indore, *Integrated Risk of Pandemic: Covid-19 Impacts, Resilience and Recommendations*, Springer Nature, 2020, p. 68

⁴⁴ Kristina Wright, *The Big Book of Infectious Disease Trivia: Everything You Ever Wanted to Know about the World's Worst Pandemics, Epidemics, and Diseases*, Simon and Schuster, 2021, p. 195

⁴⁵ United Nations, *United Nations Framework Convention on Climate Change*, 1992

⁴⁶ Ryusei Takahashi, Japan lays out plan to steer economy away from carbon by 2050, The Japan Times, Dec 25, 2020

⁴⁷ <https://www.bbc.com/future/article/20210111-what-could-the-next-pandemic-be>

stops at almost any port in the world may be affected by a new virus at the early stage of breakout. Naomi Forrester-Soto also claims in her article that it is not possible to predict where a pandemic will start. Origin will only be clear in retrospect by looking at viruses already circulating in animals⁴⁸.

In the light of evidence presented by studies in different fields, the probability of experiencing new pandemics is non-null. Exact place and timing of occurrence are both unpredictable. The type of disease is likely to be an Influenza type one or at least somewhat like previous pandemics in terms of characteristics relevant to the cruise business. As a result, I analyze if and what kind of damages such pandemic could cause on cruise sector. I also try to find ways to hedge against such damages if existent.

COUNTING THE DAMAGES OF PANDEMIC BREAKOUT

I evaluate damages suffered from the cruise sector in a possible future pandemic based on past events and structural information about ships. I will consider two issues associated to the moment of a new virus breakout. First, I consider the threaten to passengers' health. Second, I will analyze what happens in the stock market for cruise shares in such an occasion.

A study by Godwell Nhamo outlines the numerous norovirus outbreaks in cruise ships and the devastating impact of previous pandemics such as SARS and MERS. It identifies the causes of vulnerability of the cruise sector in the physical structure of ships as well as their business model⁴⁹. Since larger ship size is associated with more fuel expenses, cruise operators tend to have ships, large enough to grant the comfort of the guests. However, those ships do not allow for effective social distancing between people onboard. Embarking and disembarking passengers in different countries is also something unavoidable for the profitability of cruises, especially long ones such as world cruises. Other studies more focused on medical field, with the comprehensive study of covid-19 pandemic on

⁴⁸ <https://theconversation.com/where-in-the-world-will-the-next-epidemic-start-145189>

⁴⁹ Godwell Nhamo, David Chikodzi, Kaitano Dube, *Counting the Cost of COVID-19 on the Global Tourism Industry*, Springer Nature, 2020, p. 142

all countries, including cruise ships. They also identify the vulnerability of cruises to pandemics to be attributable to the structure of ships. They define those as *densely populated cities with unhygienic conditions and fertile playgrounds for biological foes*⁵⁰.

Another approach for defining vulnerability of cruises to pandemics is to look at demographic characteristics of those onboard. About customers, there are several surveys studying their profile. According to CLIA study in 2006 the average age of passengers on cruise ships was 49⁵¹. This value is particularly high if considered that even Japan, which even considers aging population a challenge for the community itself⁵², had a median age ranging from 43 to 44.7 from years 2005 to 2010⁵³. The median is, by definition, the point in the frequency distribution for which we observe in half of the population. Therefore, such statistic implies that on a typical cruise 50% of passengers are 50 or older. To see the implications of this fact, I look at statistics about covid-19 in Japan as of March 2021. Among deaths registered in this country, 9203 of the 9321 deaths occurred in this range of population age. At the same time cases registered for those elderly than 50 are lower than those observed in all the other population⁵⁴. Similar analysis could be done for almost any country. This means that the elder a person, the more likely to occur in complications if he or she gets infected. This implies that in case of a new pandemic half of the customers onboard would be at high risk of having severe consequences from a virus infection. The risk of having many passengers who require extensive medical treatment is particularly dangerous for cruise ships. This is because, as explained in travel medicine studies, if symptoms get serious it is more difficult to treat them onboard⁵⁵. Cruise operations

⁵⁰ Tapas Kumar Koley, Monika Dhole, *The COVID-19 Pandemic: The Deadly Coronavirus Outbreak*, Taylor & Francis, 2020, p.30

⁵¹ Manuel Butler, *Cruise Tourism: Current Situation and Trends*, World Tourism Organization, 2010, p. 148

⁵² John W. Traphagan, John Knight, *Demographic Change and the Family in Japan's Aging Society*, SUNY Press, 2003, p.73

⁵³ <https://www.statista.com/statistics/604424/median-age-of-the-population-in-japan/>

⁵⁴ <https://www.statista.com/statistics/1105162/japan-patients-detail-novel-coronavirus-covid-19-cases-by-age-and-gender/>

⁵⁵ Peter A. Leggat, *Risk assessment in travel medicine*, Travel Medicine and Infectious Disease, Volume 4, Issues 3–4, 2006, p.127-134

during pandemics seem to have negative externalities on the ports they visit as well. According to a study in transportation research analyzing movements of cruise ships during covid-19 in March 2020 *ports accepting cruise ships still operating until March reported higher covid-19 infection rate than those who did not*⁵⁶. This is also a matter of concern for cruise operators for many reasons. First, this study implies that there is significant virus transmission in ships. This implies that the operations carried out during pandemics are relatively unsafe. In addition to this, if more awareness on this topic should rise, more countries would deny disembarkation of passengers at their ports. It would lead to cruises having to stop completely their operation. Furthermore, if cruises are identified as the source of damages to cities and dimension of damages is quantified, cruise operators may be sued under many jurisdictions for such damages. Liability for transmitting pandemic, especially in cases like this where also maritime law is involved, is an extremely complex law topic. Its discussion is outside the scope of this research. However, cruise operators should be aware of possible developments of legislations regarding this issue in the future. As a result of this analysis, cruise ships are vulnerable to pandemics from a medical standpoint. Each cruise ship could in principle be the next one involved in dealing with a new pandemic.

I will now present analysis of the reaction to a pandemic by the stock market. For this study, I consider covid-19 pandemic and observe three of the main cruise companies discussed on the news. Those are Royal Caribbean Group (RCL), Carnival Corporation & plc (CCL), Norwegian Cruise Line Holdings Ltd. (NCLH). According to Henzy Richter, Senior Associate Consumer Goods Research, because of sailing bans and travel suspensions, Caribbean and Norwegian stocks dropped more than 70% while Carnival Corporation ones dropped approximately 60%⁵⁷. However, experts forecast a drop of just 34,7% of revenues for the year 2020⁵⁸. This clearly suggest a misalignment between investors'

⁵⁶ Hirohito Ito, Shinya Hanaoka, Tomoya Kawasaki, *The cruise industry and the COVID-19 outbreak*, Transportation Research Interdisciplinary Perspectives, Volume 5, 2020

⁵⁷ <https://www.sustainalytics.com/esg-blog/cruising-post-covid-19-lessons-and-challenges-for-the-cruise-ship-industry/>

⁵⁸ *ibidem*

reaction to pandemic and the reality faced by those companies. It is possible to see that investors overreacted to this event. While a detailed analysis of mechanisms behind this phenomenon is outside the scope of this research, the aspect of interest is whether and to which extent cruise operators' damages are reflected by drop in share prices. To investigate about this aspect, I consider prices of the above-mentioned company stocks on 1st March 2020 (first column) and 1st February 2021 (2nd column), 11 months later, and interest facts appear from the table below⁵⁹:

Royal Caribbean Group		Carnival Corporation & plc		Norwegian Cruise Line Holdings Ltd.	
32,17	71,58	13,17	21,31	10,96	24,72

Annual returns of shares purchased 1st of March and sold 1st February are extremely impressive: over 133% for Royal Caribbean Group, approximately 67,5 % for Carnival Corporation and over 155% for Norwegian Cruise Line Holdings. Such returns are doubtlessly abnormal, considering a global economic growth forecasted at -4,9% in June⁶⁰. In addition to this, there is no apparent justification for a difference in returns between those three companies. They are in the same sector and therefore equally affected by covid-19 emergency. They also had similar price falls on March 2020. While minor issues about company management could lead to differences in the returns of their shares, it is difficult to rationally justify that Norwegian Cruise Line was more than twice as profitable as Carnival Corporation. Shareholders seem to not react completely rationally to the news of a pandemic breakout. Such breakout is associated with a steep decrease in shares value, followed by a gradual yet fast recovery. A corollary of this is that fluctuations of share prices are, in the cruise sector during pandemic, a bad proxy for measuring the overall damages incurred because of a pandemic. This is the reason why I choose to examine different sources of damages due to pandemics rather than using shares as a proxy for the overall damages. A more accurate analysis of damages does not only allow to claim on more precise grounds that pandemic risk exists, but also allow to develop more appropriate strategies to hedge against it.

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<https://finance.yahoo.com/quote/RCL?p=RCL&.tsrc=fin-srch>
<https://finance.yahoo.com/quote/CCL?p=CCL&.tsrc=fin-srch>
<https://finance.yahoo.com/quote/NCLH?p=NCLH&.tsrc=fin-srch>

⁶⁰ International Monetary Fund, *A Crisis Like No Other, An Uncertain Recovery*, World Economic Outlook Update, June 2020

ASSESSING DAMAGES UNDER PANDEMIC EMERGENCY

National states adopted two opposite strategies to deal with pandemics. The first one is the lockdown strategy. It implies closing unessential business activities and limiting the freedom of movement of people. This has been the case for countries like Italy, imposing in February 2020 a strict lockdown with only exemption for strictly necessary activities⁶¹. The other extreme is the openness strategy. It involves taking basic precautions and trying to run business activities as much as possible. This is what countries like Japan did for most of the emergency. They encouraged people to take necessary precautions but left to individuals the right to choose if and to what extent undertaking any activity. During covid-19 pandemic, cruise operators have also had those two alternatives. Operators generally adopted, unless otherwise instructed by governments, the openness strategy.

This poses the question about which of those two strategies is the most appropriate. This question implies that there is a trade-off between public health preservation and economic activity. To solve this issue, I relate on an article by Joe Hassel focusing on countries. It shows more coronavirus deaths per million people associated with lower economic growth for the period⁶². This is probably because regardless of whether the population is legally allowed to go outside and purchase goods and services, long-term demand for those will go down anyway. This is because the more people perceive an activity to be dangerous for their health, the more they choose to refrain from it. If this is true for the general economy, it is reasonable to investigate whether it is also true in the cruise sector. Cruise services do not fall into what is commonly considered a necessity. Literature shows for the whole hospitality industry a sudden drop in the occupancy rate of reception facilities whenever a major disaster such as terrorist attack or anything concerning with health happens. Robert Clark cites the case of Costa

⁶¹ *Coronavirus, Conte: "In Italy until March 25, shops except food and pharmacies are closed. Possible reductions on transport. Effects for 14 days"*, La Repubblica, 11 March 2020

⁶² Joe Hassel, *Which countries have protected both health and the economy in the pandemic?*, Our World in Data, 1st Sept. 2020

Concordia in 2012 as an example⁶³. There are also other elements causing a further impact on the cruise business at pandemic breakout. Covid-19 pandemic also brought an economic recession, which furtherly impacted cruise sector. As outlined in a book about employment in the tourist sector, whenever a major event bringing economic recession occurs, is a switch from international tourism to destinations closer to travelers' domicile⁶⁴. Whatever the cause of this shift, this switch negatively affects the cruise sector. While hotels, even if focused on international customers, can relatively easily retarget as facilities for inbound tourism, this is not the case for cruise sector. Cruises are, by definition, international travels. As a result, whichever of the above-mentioned strategies cruise operators adopt, they will suffer from a loss in revenues.

I also analyze whether it is technically possible to run cruises safely during a new pandemic. To successfully run a cruise during a pandemic like covid-19, cruise operators need to focus on two fronts. The first one is preventing passengers from getting infected. The second one is the early isolation of all infected patients. Cruise business model involves having passengers embark at a port, stopping at various ports (named ports of call) and making excursions. The cruise service ends when the ship arrives to the destination port, which can be the same or different from embarkation port. Excursions are an element of concern since passengers are usually free to choose between company-organized tours or visiting places on their own. In the latter case, there is no guarantee on the fact they would not encounter any positive person. Even in the case of choosing an organized excursion it is difficult to grant complete safety for passengers. according to findings from major cruise companies' websites, the length of excursions often reaches 8 hours⁶⁵. Therefore, it would be difficult to reserve places exclusively for customers for such long time. Furthermore, most excursions give customers free time.

⁶³ Robert Clark, *In Hindsight: A compendium of Business Continuity case studies*, IT Governance Publishing, 2014, p.149

⁶⁴ Sally Everett, Nicola Cade, Abigail Hunt, Deborah Lock, Katie Lupton, Steve McDonald, *The Tourism, Hospitality and Events Student's Guide to Study and Employability*, SAGE, 2020, p.307

⁶⁵ Costa Cruises, Princes Cruises, Royal Carribean, Oceania Cruises considered for observation.

This is to reduce operational costs for the cruise company and allow passengers not physically fit to visit places for 8 hours to relax in nearby facilities.

If passengers get infected, early containment onboard is also likely to be a failure for medical reasons. First, in the case of covid-19 and possible future viruses, contagion is made even by asymptomatic patients⁶⁶. As a result, there will be passengers onboard who are asymptomatic and contagious. The second issue is identification of symptomatic patients. In the case of covid-19, the criteria commonly adopted by facilities is to consider potentially infected those whose temperature is above 37.5 C. This is quite effective since high temperature is a characterizing symptom of this virus⁶⁷. This approach may not be equally effective in the case of a new pandemic. First, symptoms of a new virus may also be the same of other illnesses. In the case of covid-19, high temperature is also associated to seasonal flu⁶⁸. Effectiveness of this approach also depends on high correlation between testing positive for covid-19 and experiencing high temperature. If a symptom is always associated with an illness, those not experiencing that symptom do not suffer from that illness. An illness may have more symptoms each occurring with a low probability when a patient becomes infected. Let us suppose that those symptoms are also those of commonly contracted illnesses. In this case, it would be necessary to isolate each passenger showing any of those symptoms. This would inevitably lead to isolating many passengers who have not contracted the new virus. It would have enormous repercussions on customers' satisfaction and customers' confidence when booking cruises. This is even a more complicated problem if norovirus outbreaks onboard are considered, Literature reports as much as 353 outbreaks from 2009 to 2020⁶⁹. If year 2020 is excluded in calculations, this amount is equivalent to approximately a breakout every 11.2 days. A new virus similar enough to norovirus would make it

⁶⁶ Carol Holtz, *Global Healthcare: Issues and Policies*, Jones & Bartlett Learning, 2020, p.7

⁶⁷ <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/coronavirus-disease-covid-19#:~:text=symptoms>

⁶⁸ <https://www.cdc.gov/flu/symptoms/symptoms.htm>

⁶⁹ Godwell Nhamo, David Chikodzi, Kaitano Dube, *Counting the Cost of COVID-19 on the Global Tourism Industry*, Springer Nature, 2020, p.142.

difficult to distinguish between a norovirus outbreak or an outbreak of the new virus. If treatments for the two illnesses were different, there would be the potential for a dangerous emergency onboard.

In the case of the covid-19 pandemic, news reported that even a four-day cruise to nowhere departing from Singapore with Quantum of the Seas ship failed to get no cases⁷⁰. This is just the last of a series of failures observable in this sector when it comes to dealing with pandemics. Business Insider updated a more exhaustive list 9th April 2020 which reports a total of 35 ships with covid-19 infected passengers⁷¹. This means that cruises during pandemics are not completely safe. Additionally, even if possible, cruise operators would experience a decrease in the demand for cruises. The consequence of this analysis is that it is impossible for cruises to ignore health emergencies. Cruise ships are floating cities. There is no reason why a virus affecting daily operations in cities would not do the same on cruise ships. Cruises are subject to the same mechanisms as the general economy. Therefore, I develop alternative ways to use the assets of cruise companies rather than insisting on running regular operations regardless of the virus.

I also evaluate financial damages occurred throughout the emergency. Damages which occur during the emergency are directly proportional to the length of the emergency. The length of the emergency depends on how long it takes to solve it. There are three common solutions for a pandemic. The first one is to develop and distribute a vaccine. The second one is development of an effective and widely available treatment. Finally, pandemics may sometimes also end naturally by reaching herd immunity in the population. Generally, pandemics end with either mass vaccinations or development of a treatment. It is impossible to predict how long research, development, and distribution of medical products for a new virus would last. It is nevertheless reasonable to make some assumptions.

⁷⁰ <https://english.kyodonews.net/news/2020/12/eb18224a512d-cruise-returns-to-singapore-after-passengers-positive-covid-19-test.html>

⁷¹ Áine Cain, Mark Matousek, Ruobing Su, *All the cruise ships that have had confirmed cases of COVID-19 onboard*, Business Insider, Apr 13, 2020

First, it is unreasonable to assume lockdowns due to a pandemic would last over many years. This is because lockdowns have a negative impact on public health and economy. Economic damages occur because if the business activities are shut down, there is a decrease in GDP. Damages to public health have also been widely observed in the case of the covid-19. To cite one evidence, I consider the case of Italy in year 2020. According to AIFA, Italian agency for drugs, there was a significant increase in consumption of medicines related to mental health issues with respect to the previous year⁷². There will inevitably be a point in time for which, regardless of the existence of a virus circulating, people would restart daily activities. Even with a dangerous virus circulating, the world cannot afford to adopt lockdowns for many years. In case it was impossible to develop drugs to deal with a new virus, the solution could be to ignore it and reach herd immunity. After all, this is what happened before the development of modern medicine. A plague pandemic happened in years 1347-1348. In that case, there was no lockdown and nature decided who lived and who died. The number of deaths with respect to population was enormous⁷³. That is why we do not use this approach in modern times.

Therefore, if a new pandemic happens, researchers will try to develop drugs or vaccines to deal with it. Time for development and distribution of vaccines and drugs can vary enormously. In the case of covid-19, the distribution has not yet been completed after over 1 year and a half from the virus breakout. To describe the length of a new pandemic, it is not possible to predict any length of time with certainty. However, according to this analysis, I consider a time of 1 to 2,5 years, normally distributed with mean 1,75 years (1 year and 9 months) a good approximation. In times when cruise ships cannot run ordinary operations, two things happen. First, revenues become null. Secondly, governments may subsidize cruise operators for the loss of revenues. This was the case during covid-19 emergency for the Royal Caribbean Group. The company announced monthly losses ranging

⁷² Cristina Da Rold, *Lockdown: More vitamins and benzodiazepines, but fewer erectile dysfunction drugs*, *IlSole24Ore*, 29 Oct. 2020

⁷³ <https://www.history.com/topics/middle-ages/black-death>

between 150 to 170 million USD and the Caribbean Development Bank allocated 140 million to support this cruise operator⁷⁴. Based on financial statements of cruise companies, an average total loss of approximately 3,36 billion USD would occur in case of a new pandemic for the Royal Caribbean Group. I could compute the same calculation for any cruise operator. I can do this using the following formula:

Total damages in emergency= estimated revenues before emergency*(operating income/revenues)* length of emergency- operating income forecasted during emergency

If cruise operators completely stop cruises, then operating income forecasted during emergency=0. For simplicity, I consider length of emergency= 1,75 according to the previous analysis. The above-mentioned formula becomes:

Total damages in emergency= estimated revenues before emergency*(operating income/revenues)*1,75

Looking at annual report for year 2018 of Carnival Cruises ⁷⁵ , I compute operating income/revenue=3325/18881= 0,176, which multiplied by 1,75 leads to 0,308. This means that for each USD of revenues forecasted for year 2020 given pandemic a total loss, ignoring time-value of money, I can estimate a loss of 0,308 USD. From this formula I also calculate how much the cost of interrupting operations per day per ship is. To do so I assume that every operator would have same operating income/revenues of Carnival Cruises, and that each ship owned by Carnival Cruise has the same financial characteristics (fixed costs, variable costs, revenues, profitability, and others). This is because data at ship level are not available. According to 2018 financial report Carnival Cruise owned 104 ships⁷⁶. Those generate, according to estimations on financial statements 181,548 million USD each in revenues per year. This means an approximately 55,9 million profit loss per ship per pandemic emergency. This is equivalent to 87,515 USD profit losses per ship per day.

⁷⁴ W. Andy Knight & K. Srikanth Reddy: *Caribbean response to COVID-19: a regional approach to pandemic preparedness and resilience*, The Round Table, 2020

⁷⁵ Carnival Corporation & Plc, 2018 Annual Report

⁷⁶ Ibidem

Three important corollaries derive from this financial analysis. First and foremost, it is possible to have a rough estimation of damages even at the time of breakout of pandemic. This is a tool cruise operators can use to evaluate how much a pandemic would cost to their companies. Second, the cruise business is also vulnerable to pandemics because it is an economy of scale. Damages due to a pandemic are directly proportional to revenues which vary according to the size of operations. Cruise operators tend to enlarge their fleet for being operationally more efficient. This makes them more vulnerable to pandemics. Last, for the purpose of this study, income/revenues and the length of a new pandemic are both exogenous factors. Revenues in regular times are also something which cruise operators try to maximize rather than reduce. That is why there is no variable in the above-mentioned formula that cruise operators can control to reduce the pandemic risk. That is why I try to think outside the box and develop alternative ways to run business during pandemics.

POST-PANDEMIC RISK ANALYSIS

Analysis of the pandemic risk would be incomplete without evaluation of risks after the pandemic emergency. For the sake of simplicity, I suppose that the end of the pandemic emergency happens with a mass vaccination. However, I could similar results even when the end of the pandemic emergency happens differently.

From this point onward I concentrate the analysis on evaluating critical points for the cruise sector even after the pandemic emergency has ceased. First, I analyze consumer confidence after pandemics. Findings from literature reveal that, after an initial shock from the pandemic breakout, investors showed faith in the industry. As soon as bookings reopened, cruise sales were sometimes even double

with respect to the previous year.⁷⁷ A more extensive qualitative study of risk perception in the cruise business developed the topic more in detail. In this study, participants were asked whether the covid-19 will prevent them from booking cruises again. Feedback from the public was quite mixed. Researchers considered this to be dependent on individuals' different personalities⁷⁸. This study is particularly significant because it does not manage to identify a clear link between pandemic and post-pandemic bookings. On the contrary, the news reported in February 2020 an increase of bookings by 9% for cruises in 2021, when the pandemic was expected to be over. Most customers having to cancel cruises accepted credits for future bookings⁷⁹. Other sources report the press conferences held by CEOs of major cruise companies. They expressed satisfaction about bookings in 2021 and did not mention concern due to the pandemic crisis⁸⁰. Anyway, literature outlines the importance of adopting proper communication strategies after a sanitary crisis onboard. It cites numerous cases regarding Princess Cruises⁸¹. With established communication protocols, cruise operators can manage health-related crises from a marketing perspective. Finally, I look at a survey on Italian cruise enthusiasts published on 26th May 2020. It asked them whether they thought the cruise sector would be more affected by covid-19 pandemic than the whole tourism sector. Over 80% of respondent guessed this would be the case. The interesting fact about this survey is that when asked to justify their answers, just approximately 50 days after the beginning of Diamond Princess case, only 5% of respondents reported that to be the cause of trouble for the cruise sector⁸². Finally, I look at google trends data for the years 2004 to 2020 to verify correlation between the number of searches for keywords "pandemic"

⁷⁷ Godwell Nhamo, David Chikodzi, Kaitano Dube, Counting the Cost of COVID-19 on the Global Tourism Industry, Springer Nature, 2020, p. 382.

⁷⁸ Radic, A.; Law, R.; Lück, M.; Kang, H.; Ariza-Montes, A.; Arjona-Fuentes, J.M.; Han, H. *Apocalypse Now or Overreaction to Coronavirus: The Global Cruise Tourism Industry Crisis*, Sustainability, 2020

⁷⁹ Grace Panetta, *Cruise ship bookings for 2021 are already on the rise despite multiple COVID-19 outbreaks*, Business Insider, Apr 13 2020.

⁸⁰ <https://www.travelpulse.com/news/cruise/surprise-cruise-bookings-continue-to-rise-for-2021.html>

⁸¹ Ross Dowling, Clare Weeden, *Cruise Ship Tourism*, 2nd Edition, CABI, 2017, p. 226-227

⁸² <https://www.statista.com/statistics/1120355/opinions-on-the-coronavirus-impact-on-cruises-according-to-italians/>

and “cruise bookings”. I attempt to find a correlation between a pandemic emergency going on and cruise bookings. Results of this analysis do not show any correlation at 5% level of significance.

The only find a post-pandemic concern for cruise operators about the adoption rate of the vaccine solving the pandemic emergency for both customers and staff onboard. According to CDC in 2011, cruise staff mainly come from countries where immunization rates are relatively low. For the said staff, vulnerability rate for illnesses like rubella can exceed 10%⁸³. Regarding adoption rates by customers, statistics reveal that in higher per capita countries less than 90% of the population think vaccines are important for children to have. Most of the customers come from those countries.⁸⁴ However, in the case of vaccines against covid-19, which were developed in much less than the average time, studies report a much lower willingness to adopt them. Sources report it to be as low as 60%⁸⁵. As a result, cruise operators should not expect, especially immediately after the end of a pandemic emergency, that every single customer will be vaccinated. In addition to this, the vaccines for a new virus will probably not have a 100% efficacy rate. This means that there could be vaccinated people susceptible to the virus. Consequently, the main relevant risk after a pandemic is to experience a virus breakout onboard after reopening sales. This is easily avoidable by making customers submit proof of immunization before getting on board.

In the light of this analysis the cruise business suffers from a pandemic risk. Probability of experiencing breakouts of new viruses in the future are not negligible. The cruise business suffers from damages from the moment a new virus breaks out until the end of the pandemic emergency. I do not detect substantial damages for cruise businesses after the end of the health emergency. The first

⁸³ CDC, *CDC Health Information for International Travel 2012: The Yellow Book*, Oxford University Press, 2011, p. 476

⁸⁴ Hannah Ritchie, Samantha Vanderslott, *How many people support vaccination across the world?*, Our World in Data, August 01, 2019

⁸⁵ Cary Funk, Alec Tyson, *Intent to Get a COVID-19 Vaccine Rises to 60% as Confidence in Research and Development Process Increases*, Pew Research Center, Dec. 3, 2020

research question had as null hypothesis the absence of a pandemic risk for the cruise sector. In conclusion of this first analysis, I can reject the null hypothesis for that research question. I now also use of this analysis to tackle the second research question.

PREVENTIVE MEASURES

Cruise operators may need to take preventive measures regarding new pandemics in advance. This does not only mean physically preparing ships. I present measures different from changing ships design. First, I look at preventive measures from a financial management perspective. Shares of cruise companies bought at the breakout of covid-19 exhibited abnormal long-time returns. Ahead of pandemics, it would be useful for cruise operators to establish a cash reserve. They could use such cash reserve to buy back shares when their price suddenly falls. This would bring cruise operators enormous returns from this investment. I consider the case for which a pandemic breaks out in 10 years' time from now. I suppose a reserve for buyback shares is hold in cash. When the new pandemic breaks out price of cruise companies' shares falls exactly as in the case of the covid-19 pandemic. The cruise operator decides to use such reserve to buy back shares. If shares' prices follow the same pattern as in the case of covid-19, such cruise operator gets a return from 60% to 150% after 11 years. This is equivalent to a nominal annual return ranging from approximately 4,4% to 8,7%. A simple average of those extreme values is 6,55% rate of return. For the sake of simplicity, I consider that reserves for share buybacks are held in cash. In practice, cruise operators can also invest such reserve in liquid and risk-free assets to boost the return. According to data from Goldman Sachs, the average 10-year market return was 9,2% per year over the past 140 years⁸⁶. This means that holding cash for 10 years and then investing in cruise stocks for 1 year when a pandemic breaks out brings, on average, more than 71% of the returns the investor would have by investing for 11 years in the average-performing stock. Therefore, cruise operators should carefully consider establishment of such a reserve. In addition to this, if investors know that cruise companies are adopting this investing strategy, there would be two

⁸⁶ Liz Knueven, *The average stock market return over the past 10 years*, Insider, Aug 25, 2020

consequences. The first one would be investors more willing buy shares of cruise operators. This is because they would know that in case the price of those shares would decrease too much because of a pandemic, the company would buy them back. This is particularly important for non-professional investors who do not have much experience in investing into the stock market. Those investors may be concerned about the possibility of losing their savings in times of crises. Secondly, a company usually makes buyback shares when it thinks they are undervalued⁸⁷. By buying back shares at the breakout of a pandemic the company communicates to the market that it strongly believes in its survival to the pandemic. This could lead to an increase in investors' faith in the company. In any case this measure needs to be prepared well in advance. Cruise operators should establish a price threshold for this extraordinary share buyback and communicate this strategy in an optimal way to the public.

From an operation management perspective, when a new pandemic breaks out cruise operators will be running some cruises. It is necessary to avoid that the new virus will spread ships involved in those cruises. There is no perfect way to do this, but I present an easily applicable strategy which will probably be effective. This is based on empirical observation of the course of events during the covid-19 emergency. Cruise operators should make high-quality protective masks and basic medical equipment available in each cabin. and make customers use those in case of a new emergency breakout. Wearing masks onboard and regularly checking data about personal health data should be mandatory from the announcement of a new virus breakout. When scientists discover that a new virus is spreading among humans, they need to study it. It is natural that such study takes some time. Therefore, health authorities may not recommend immediately to wear a mask since they do not know if such masks can prevent the spread of the new virus. Regardless of whether health authorities recommend the use of a mask and measurement of medical data such as temperature and oxygenation, cruise operators should enact severe protocols. I justify the presence of basic medical equipment in each cabin and

⁸⁷ *Outlook Profit*, Vol. 1, Num. 14, Outlook Publishing, Sept. 5, 2008

adoption of rigid protocols independently from knowing whether they are useful or not with the following arguments.

First, customers, especially the elderly ones, would probably feel safer knowing that in any case they can have equipment for measuring items such as their temperature, blood oxygenation, heart beats and blood pressure and others in case they need to do so. Instruments for such measurements are widely available with limited costs if cruise operators buy them in times where no health emergency is going on. Under no pandemic emergency, demand for such medical equipment is therefore lower than during health emergencies. Second, if a new virus has symptoms in common with common illnesses, it is difficult to identify passengers infected with the new virus before it becomes too late. Making customers wear masks will at least prevent the spread of viruses such as influenza and covid-19. For instance, there was a huge reduction in flu cases in Japan in the 2020-2021 season⁸⁸. Since medical staff onboard is limited, if no passenger gets illnesses other than a new virus, the few medical professionals onboard can concentrate on treating those cases. Furthermore, the presence of medical equipment on cabin makes customer easier to follow medical instructions given onboard. Suppose a new virus caused a decrease in the oxygenation of blood. It would be difficult to detect such decrease without the use of a pulse oximetry. It is unlikely that a customer embarking on a cruise brings such instrument with him or her.

Implementation of IT solutions onboard can also be an effective measure to tackle the problem of viruses spreading onboard. All major cruise companies do not allow customers to pay for onboard expenses by using cash. Instead, they generally provide an ID card to be used for such expenses. This also serves as a document for embarking and disembarking from the ship. Furthermore, passengers use this ID card as cabin key. As an alternative to ID cards, cruise operators could implement mobile

⁸⁸ <https://www.nippon.com/en/japan-data/h00867/>

applications⁸⁹. During the covid-19 crisis, some states developed a technology for tracking movements. This was the case of South Korea. Those who entered the country either wore a bracelet or downloaded an app which tracked their movements⁹⁰. Despite being effectively such app raised concerns about the violation of human rights related to uses of such tracing systems⁹¹. A technology collecting individual data about movements can raise concerns over privacy issues. Japan instead developed a contact tracing app which does not collect personal data⁹². Apps for tracking movements are not something new to the world. Neither are tracking bracelets, widely used under some jurisdiction such as America for home arrest. The offender wears a bracelet and public authorities can verify if he or she leaves the domicile⁹³.

In the case of cruise ships passengers would probably accept to use an app which tracks interaction between them. Such app could also contain other information and functions which are beneficial for customers. For instance, cruise operators could also allow to book excursions from that app. In addition to this, such mobile application should also be used as key. Furthermore, there are several other functions this app could serve. If such application is used by all customers, it would be much easier for cruise operators to identify the new virus cases at an early stage. In addition to protecting health, tracking passengers' movements on ship would give cruise operators important marketing insights and other relevant statistics. Additionally, if cruise operators knew how many customers occupy each onboard facility during the day, they could also allocate personnel more efficiently. Implementing a mobile application with a tracking function would have a minimal cost with respect

⁸⁹ <https://www.cruisecritic.com/articles.cfm?ID=1165>

⁹⁰ Aaron Holmes, *South Korea is relying on technology to contain COVID-19, including measures that would break privacy laws in the US — and so far, it's working*, Insider, May 2, 2020

⁹¹ Mark Ryan, *In defence of digital contact-tracing: human rights, South Korea and Covid-19*, International Journal of Pervasive Computing and Communications, Emerald Publishing, Aug. 6, 2020

⁹² Kyodo News, *Japan gov't offers free coronavirus contact-tracing app*, Jun 19,2020

⁹³ Leonard Territo, James B. Halsted, Max L. Bromley, *Crime and Justice in America: A Human Perspective*, Third Edition, West Group, 1992, p.518

to the potential of such feature. As an alternative to mobile applications, cruise operators could also choose to just implement a tracking function on ID cards.

Another important point in the management of any health emergency is treating quickly and effectively infected patients. In a situation where a new virus spreads onboard, having limited medical personnel and equipment onboard, this could be a difficult challenge. However, one possible solution comes from IT sector with improvement of telemedical systems. Telemedicine would also be beneficial under regular circumstances. Several pilot studies specifically conducted on passengers' ships prove that this may be the future in maritime medicine. A study on teleradiology conducted on 75 medical documents collected on ship was extremely successful. 92% Of cases managed to get reports within 30 minutes, and the remaining were delayed due to issues of receiver hospital⁹⁴. This response time is impressive because it would allow to get approximately 48 daily reports by partnering with hospitals in different time zones. Furthermore, in case of a new virus spreading, communication with facilities on land would also be useful to make research about virus characteristics and possible treatments. While 48 responses per day could not seem a significant number, it can make the difference during a pandemic emergency. To establish to which extent such an innovation is useful, I observe the timeline of covid-19 infections during the Diamond Princess incident. Excluding asymptomatic patients, cases began to spread from February 17 reaching the peak of symptomatic patients on March 23⁹⁵. There has been an increment of patients for 35 days. If treatment of the covid-19 had been possible using radiology, this technology would have allowed to treat 1680 patients. Given that the highest number of infected patients was 381 and looking at the contagion curve response times would have allowed any patient to get reports in less than a week. Of course, treatment of most viruses does

⁹⁴ Frank Oliver Henes, Per Stappenbeck, Enver Tahir, Angelina Koehler, Berthold Petutschnigg, Gerhard Adam, Peter Bannas, *Implementation of a 24-Hour Teleradiology Service for Cruise Ships: A Pilot Study*, American Journal of Roentgenology, April 2020, Vol. 214, No. 4: pp. 754-760

⁹⁵ <https://www.statista.com/statistics/1099517/japan-coronavirus-patients-diamond-princess/>

not have anything to do with radiology. This observation is just to show the potential of telemedicine in improving medical services onboard.

Other studies outline new innovations in the telemedical field. They cite two important novelties specifically designed for cruises. The first one is the MEDASHIP project. It enables, using satellite technology and some technological equipment, to get medical assistance from land. Another project regards teleconsultation, available through just the use of a camera⁹⁶. Projects involving telemedicine onboard have been developed since 2008. Telemedicine will probably increase in efficiency and reduction in implementation costs as new technologies become available. Cruise operators need to prepare for telemedicine in advance. Preparation is not only from a technological point of view, but also from a human resources management and procurement perspective. This is the focus of a research in Public Health field. It conducts surveys on personnel working onboard and outlines the importance of interorganizational networking to successfully introduce maritime telemedicine⁹⁷. Only 45% of participants had experience in telemedicine, so this is still an innovative field which companies as well as medical professionals need to explore more.

GOING THROUGH THE EMERGENCY: ALTERNATIVE BUSINESS PLANS

Regarding operations management after the breakout of a new virus, I focus on alternative business plans. Many alternatives are possible, but I just consider three plans. First, it is possible to use cruise ships as medical facilities for infected patients. Given the rise in demand for hospital beds during medical emergencies, this plan is potentially profitable. It is also not something that has been attempted before. U.S. already conceptualized the possibility to transform cruise ships into hospitals under

⁹⁶ Rifat Latifi, *Current Principles and Practices of Telemedicine and E-health*, IOS Press, 2008, p.72

⁹⁷ Monika Petra Puskeppeleit, *Improving telemedicine onboard Norwegian ships and drilling platforms*.

A study of intersectoral co-operation in Maritime Medicine, Nordic School of Public Health, June 2008

different circumstances in 1998⁹⁸. Carnival also offered this possibility to the U.S. government during the covid-19 emergency, in exchange for reimbursement of the fixed costs of the ships employed⁹⁹. Such proposal would be extremely convenient for cruise companies. Its acceptance would limit the damages to just the cost of capital of the pandemic years. This is because while the government operates ships, cruises cannot make profits on their assets. From a financial perspective, this alternative would also be beneficial for governments. Cost of hospitalization per night can reach over 400 USD in many European countries as well as Japan¹⁰⁰. It may be cheaper for such governments to rent ships cruises and use them as hospital beds. The main issue about this business plan is that cruise operators do not have the capabilities to run facilities like hospitals. The only possibility is therefore to rent ships to governments.

The second plan would be to leave ships anchored at ports. Customers could use recreational facilities and ships would become business centers. To verify the technical feasibility of this plan, I researched about facilities commonly offered onboard. To do so I rely on public information available on the websites of the major cruise operators. I summarized commonly available facilities in the table below:

⁹⁸ *S. 668, S. 803, and the Domestic Cruise Ship Trade: Hearing Before the Subcommittee on Surface Transportation and Merchant Marine of the Committee on Commerce, Science, and Transportation, United States Senate, One Hundred Fifth Congress, First Session*, U.S. Government Printing Office, 1998, p.35

⁹⁹ Hannah Sampson, *Carnival offers its cruise ships as makeshift hospitals during coronavirus outbreak*, *The Washington Post*, March 20, 2020

¹⁰⁰ <https://www.finder.com/most-expensive-countries-to-be-hospitalized-in>

category	service name	service content
dining	casual restaurant	restaurant with basic menu
	buffet restaurant	buffet used for breakfast, lunch and dinner
	specialty dining	restaurant with exotic cuisine (i.e. Italian, French, Japanese...)
	luxury restaurant	exclusive restaurant with limited access and/or famous chefs
	room service	possibility of having dining delivered to cabin
cafes and bars	ice cream shop	shop selling ice creams (either take-away or seats available)
	chocolate shop	cafe serving western-style chocolate deserts and sweets
	casual drinks bar	bar serving basic alcohol drinks, soda-based drinks, juices in casual atmosphere
	afternoon tea	elegant cafe serving traditional English tea experience in the afternoon
	cocktail bar	bar serving sophisticated cocktails
	smoking bar	bar where smoking is allowed, sometimes offering cigars selection
	coffee bar	bar with starbucks-style menu
	stylish bar	bar offering alcohol drinks in a particular environment
entertainment	night bar	bar dedicated to drinks after dinner with nightclub atmosphere
	children club	activities organized for children and teenagers
	karaoke	western-style karaoke (people singing in front of the public)
	live music	music performed either by singer or piano bar in the cruise lounges
	movies and theater	place functioning as a theater and/or cinema
	live performances	magic tricks, stand-up comedy, game shows and other kind of live performances
	parties	nightclub-style parties
sport and wellness	casino	casino usually including slot machines, poker, blackjack, roulette and other games
	swimming pool	swimming pool, sometimes correlated with jacuzzi and/or aquapark
	spa and massage	spa also offering massage treatments
	jogging track	jogging route around the ship
	gym	gym sometimes offering classes (i.e. yoga, fitness, dance...)
shops	sport activities	various sports depending from company and ship (fencing, archery...)
	next cruise plan	service selling future cruise packages to guests
	gifts	various goods (champagne bottles, sweets, flowers) delivered to guest cabin
	luxury shop	shop selling luxury goods (jewellery, watches...)
	clothing shop	shop selling clothes and other basic accessories for daily needs
additional services	photography	selling photos taken to customers on the cruise
	art auction	pieces of art sold through auctions taking place onboard
	medical services	doctors onboard and pharmacy available
	internet service	wi-fi and phone calls not included but can be bought through packages
accommodation	bingo	bingo games organized onboard at specific time
	laundry services	laundry
	cabin	cabin

It is possible to offer most of those services with proper protocols. The main doubt about this business continuity plan would be evaluating market demand. Demand for recreational facilities will decrease during pandemics because of the fear of contagion. The main advantage of this plan would be the possibility of collocating ships in ports of countries whose cost of living is extremely high. Cruise operators may be able to charge competitive prices with respect to local facilities. Cruise operators have expertise in the field they are offering services. That is why they may be able to prevent the spread of the new virus to an acceptable level with proper protocols. Cruise operators can select the least risky facilities on this standpoint and open just those.

Finally, depending on the screening methods and accuracy of a new virus, a third business plan may be possible. If there was an accurate method to detect the new virus and incubation period should not be too long, one option would be to use cruise ships as long-term virus-free resort rental. In this

business plan, staff lives permanently onboard. Customers first must stay quarantined in a facility nearby the ship. When it is sure they are not infected by the new virus, they are embarked. Those customers will live onboard until the end on pandemic emergency, or for a minimum term decided beforehand. Customers could benefit from this service by avoiding the discomfort of refraining from certain activities. Since no one living in the ship is infected by the new virus there is no risk of contracting the infection. This is particularly beneficial for those who can study or work remotely. They can keep their job while enjoying life onboard after their working hours. In addition, this option would probably suit high-income retired people as they do not have to perform activities on land to earn income. They are the population segment likely to be the most vulnerable to a new pandemic. Rental price of staterooms would be extremely high as the supply would be terribly limited with respect to the potential demand. The only drawbacks of this plan are resilience and marketing. In case of failure of protocols to grant passengers safety, the company would have to face the legal consequences of such failure. In addition to this, promoting this service could be a difficult challenge from a marketing standpoint.

In conclusion, all three alternatives have profitability potential but also some drawbacks. I cannot verify commercial viability of such business plans. However, profitability of each of those plans would probably be lower than the one during regular times. This is because the second and third business model are also implementable under regular circumstances. If they were more profitable than the ordinary operations, cruise operators would adopt those plans even when no emergency is going on. Regarding the first business plan, it would be difficult for cruise operators from a CSR perspective to charge governments more than that amount. There is also the ethical question of who would benefit by cruise ships in such difficult times. While a floating hospital would serve those in need, standard hospitality and shopping facilities would serve ordinary people and a virus-free resort would only serve the richest people who can afford it. Cruise operators should also consider how the public would perceive any of those three business plans. In the end, there is no perfect solution for cruise operators. They should choose the business continuity plan which best suits the specific situation and the needs

of the company. Choice of a different way to operate is however necessary. Precedent analysis shows that in the long run just continuing with regular operations is not beneficial in the long run.

A PLAYBOOK FOR THE NEXT PANDEMIC

I describe a practical action plan that cruise operators could use for the next pandemic. Playbooks for new pandemics are not new to the world. The National Security Council developed a pandemic playbook for the U.S. government¹⁰¹. In a more concise way, I develop a strategic plan for cruise operators. Development of such a plan is necessary before a pandemic takes out. When a health emergency breaks out, it may be too late to craft a strategy. I divide the pandemic emergency into four phases:

- 1) Before the emergency breaks out
- 2) From the date of the new virus breakout to 30 days afterwards.
- 3) From 30 days after the virus breakout until the end of the emergency.
- 4) After the end of the emergency.

As discussed, the end of a pandemic emergency can happen in many ways. I consider in this playbook as “*end of the emergency*” the moment when a mass vaccination against the virus is completed. Even after this moment, there may be new cases of infections. However, after the end of the emergency, new infections, deaths, and hospital admissions due to the new virus should be constantly decreasing.

Before a pandemic emergency breaks out cruise operators should take preventive measures. First, they should provide a medical kit in each cabin. This kit should contain high quality face masks. Masks should be either FFP2, KF95, KF94, or other types having similar efficacy. There are laboratories able to verify effectiveness of face masks. Cruise operators should have a random sample of those masks tested in advance. This is because some suppliers may provide fake masks. Those are masks which seem identical to the functioning ones but have little or no efficacy in preventing the spread of viruses.

¹⁰¹ <https://www.pbs.org/newshour/nation/obama-team-left-pandemic-playbook-for-trump-administration-officials-confirm>

The kit should also contain a clinical thermometer, a pulse oximeter, and a blood pressure monitor. In addition, cruise operators should implement telemedicine onboard and partner with hospitals in different time zones such that this service is available 24/7. Passengers should be able to connect with a doctor on land and receive online consultation anytime from their cabin. Furthermore, cruise operators should develop a contact tracing system onboard. They can do this either through a mobile application or through the bracelet currently used as cabin key and mean of payment. In addition, the cruise operator should allocate part of its resources to a fund for buyback shares and emergency expenditure in case a pandemic should arise.

In a second phase a new virus infecting humans is discovered. The contagion will probably be limited in this phase to just a few countries. When this happens, the cruise operators will have some ships on sea and new cruises will be starting in the following days. When the new virus is discovered, the cruise operator should cancel all cruises except those departing within a week and lasting less than 15 days. Regarding those and ongoing cruises, personnel onboard should limit affluence to mass gatherings and inform passengers about the situation. Personnel should instruct customers to wear masks at any time and report any symptom as soon as possible. Passengers should not leave their cabins if their symptoms are like those caused by the new virus. The goal of those measures is to avoid incidents like the one of the Diamond Princess during the covid-19. Regarding financial management, if the cruise operator observes an excessive fall in the price of its shares, it can opt for buyback shares. As outlined, the return on such investment may be enormous.

As analyzed, conducting cruises safely is not possible in the long run. The length of the third phase will probably range from 1.5 to 2.5 years. During this phase, the cruise operator should implement one of the proposed alternative business plans. If the cruise operator judges that those are not feasible, it should develop a suitable plan by itself. It is important that the cruise operator does not continue with daily operations hoping for luck. To implement an alternative business plan marketing and operational

efforts are necessary. Cruise executives should balance financial expenditure and time needed to implement such plan with the revenues it brings.

After the health emergency is concluded, cruise operators can return to the regular operations. Cruise operators can estimate quite precisely the end of a health emergency. They can do this by looking at the progression of the mass vaccination campaigns in different geographical areas. As seen through this study, after the end of a health emergency the occupancy rate of cabins is likely to restore to previous levels. Even if vaccines are widely available, passengers embarking for a cruise may have decided not to get the vaccine. The same issue arises for the crew onboard. Therefore, cruise operators should ensure that those travelling by their ships have been vaccinated. In addition to this, if vaccines do not have a remarkably high efficacy rate and cases in the country of embarkation are still significant, it may be worth to test all passengers before they embark onboard. Cruise operators can use this measure for some months until the spread of the new virus stops completely.

The strategy that I describe in this playbook is probably not the only one possible. In addition to this, cruise operators should adapt it to individual circumstances. Furthermore, this strategy may not be optimal and there is probably scope for improvement. This playbook is nevertheless important because of the second research question. The null hypothesis for the second research question is that there is no strategy that cruise operators could adopt to reduce pandemic risk. These guidelines prove instead that there is at least one strategy which could reduce pandemic risk. Therefore, they lead to rejection of the null hypothesis for the second research question.

CONCLUSIONS

The aim of this research was to find ways to hedge against a possible pandemic risk in cruise sector. I verify the possibility of breakouts of new pandemics. Given the exogeneity of the probability of new pandemics, I develop actionable knowledge for operators to limit damages from pandemics. One of the major findings of this study is rejection of the null hypothesis for the first research question. I find a particularly acute pandemic risk in the cruise sector due to the structure of ships, customers' demographics, and business model. This pandemic risk will probably be present in other sectors. Other segments of the hospitality sector such as all-inclusive resorts probably suffer for such risk given their characteristics in common with the cruise business. Key suppliers for cruise companies who receive most of their revenues by cruise operators are likely to suffer from this risk. As for external validity of this study, some of the results can be extended to other sectors while others do not.

It is extremely difficult to run cruises safely under pandemics in the long run. However, with the adoption of preventive measures, it is possible to complete ongoing cruises at the breakout of a new virus with low risk of incidents. Customers and operators both benefit from those measures even under regular circumstances. For going through the pandemic emergency, one of the three business plans presented may be suitable to hedge against pandemic damages. About risks correlated to the period after the pandemic, I do not find any relevant risk. Therefore, I do not need to develop measures which cruise operators should adopt after the pandemic emergency. Methodologies used throughout the research were also particularly interesting. I show how it is possible to use literature and sources of information in completely different fields such as environmental studies and medicine to evaluate the presence of a risk and develop business solutions to it.

The main limitations of this study are related to the possibility of gathering data. This is for two main reasons. The first one is that the cruise sector is dominated by relatively few key players. Those players possess high market share and high concentration of relevant data, most of which are unavailable to the public. Data from cruise operators either come from financial documents compulsory by law or

from information given to customers for marketing purposes. Having just data available for companies possessing ships in the order of magnitude of 100, it is not possible to have data at ship level. It would be useful to conduct research looking at differences, if any, present between ships located into different geographical areas or having different design. I approximate all ships and cruises to be equal, while each one has its specificities. The second major limitation that cruise sector is a niche sector generally targeting high-income and elderly population. It is difficult to reach such customer base through online media without well-structured and expensive marketing campaigns. This limits the methodologies which I could use. It would have been useful to get feedbacks from customers about alternative business plans. I knew research would have most of those limitations. I knew results would be limited. However, I consider relevance of findings for practical application in cruise business a priority over the reach of high research achievements.

This study could also become the starting point for further studies. It would be useful to make similar research in the hotel industry and compare results with the cruise one. Another interest area of investigation would be the B2B part of the value chain in the cruise business. While looking at the B2C part of the value chain of tourist services can be easier, behind services such as cruises there are many suppliers working in the background. There are also businesses indirectly related, especially in some geographical areas, with cruise activities. Example of those are museums and tourist attractions as well as souvenir shops. The souvenir business also has as customers just non-residents. That is why it would be interesting to analyze the topic of pandemic risk for this business.

This study looks at the issue of pandemics from the standpoint of cruise operators. National states could also be able to take actions for reducing the probability of experiencing new pandemics. This is something that cruise operators cannot do by themselves. Furthermore, the presence of a pandemic risk could also open the way for the development of new financial products. There is currently no financial product able to insure cruise operators about the risk of a pandemic. More awareness of the issue could encourage financial institutions to provide such instrument. While large cruise companies

are likely to survive future pandemic shocks, this may not be the case for small businesses which work together with the cruise industry. This would be beneficial by eliminating a source of entrepreneurial risk. Furthermore, this market could be attractive for insurance companies. Unlike other kinds of insurances, there are no issues about adverse selection or moral hazard. Probability of a new pandemic is exogenous and equal for all businesses in a certain region.

In the end, pandemics affect both individuals and organizations. The main difference between the two is that whereas individuals cannot prepare in advance for new pandemics but can hope on luck, there is no luck in the cruise sector. Both will have to adapt during the pandemic emergency. The latter by having to re-think their business model and the former by making adaptation to a new lifestyle. The main weapon in the hand of cruise businesses is being able to forecast how and to which extent a new pandemic could affect them. The main contribution of this research is therefore not about description of damages during pandemics. It is instead utilizing such a description to identify weak points of the studied business model and suggesting strategies which could reduce the pandemic risk. Since pandemic risk management is a relatively new frontier in business administration, I also hope this study will stimulate intellectual curiosity for the topic of the pandemic risk.

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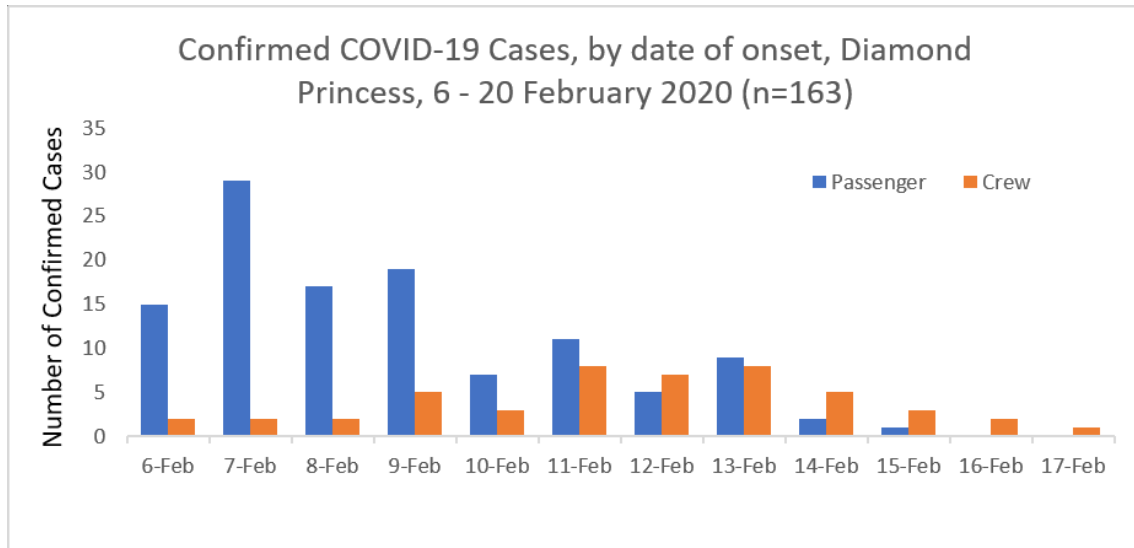
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APPENDIX

Physical structure of the Diamond Princess ship¹⁰²:



Statistics about the Diamond Princess incident¹⁰³:



¹⁰² <https://www.tradewindsnews.com/cruise-and-ferry/diamond-princess-coronavirus-numbers-double-overnight/2-1-751407>

¹⁰³ National Institute of Infectious Diseases, *Field Briefing: Diamond Princess COVID-19 Cases, 20 Feb Update*, 21 Feb. 2020

