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**DEPARTMENT OF MARITIME STUDIES
M.Sc. IN SHIPPING MANAGEMENT**

**THE EFFECTS OF SHIPPING CYCLES
CHARACTERISTICS ON THE OPERATING COST
BEHAVIOUR OF SHIPPING FIRMS**

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Masters' Dissertation

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ABSTRACT (Shipping Cycles, Operating Costs and Market Behavior)

This thesis investigates the characteristics of shipping cycles and their effects on the operating cost behavior of shipping companies. The primary aim is to comprehend how shipping owning companies interpret, analyze and react to the volatility of the shipping market. Adjustability to the fluctuating demand for shipping transport, different freight rates and the inherent characteristics of the shipping cycles, significantly influence the cost structure and performance of shipping companies. The results of this study demonstrate the primary aspects of shipping cycles, including their stages, their characteristics and their duration. Based on these findings, we observe and examine how successfully shipping firms handle cyclical volatility, through strategic structure and managerial plans. In addition to the theoretical aspects, this research provides practical approaches which are crucial for the sustainability and development of shipping companies, within an unpredictable environment. The comprehension of the market conditions and the selection of an effective cost management strategy are crucial for the accomplishment of operational efficiency, mitigation of financial distress and successful investing decisions. The strategies that facilitate quick adjustability and rapid responses are valuable tools that aim economic growth. In the final analysis, this thesis will address the effects of different shipping stages and how they are managed. Policy, fleet size and future expectations are the main elements that determine the company's approach in the cyclical volatility. This study displays how different shipping companies adopted different strategies that target long-term sustainability and strong presence in the market.

ΠΕΡΙΛΗΨΗ

(Ναυτιλιακοί Κύκλοι, Λειτουργικά Κόστη και Συμπεριφορά Αγοράς)

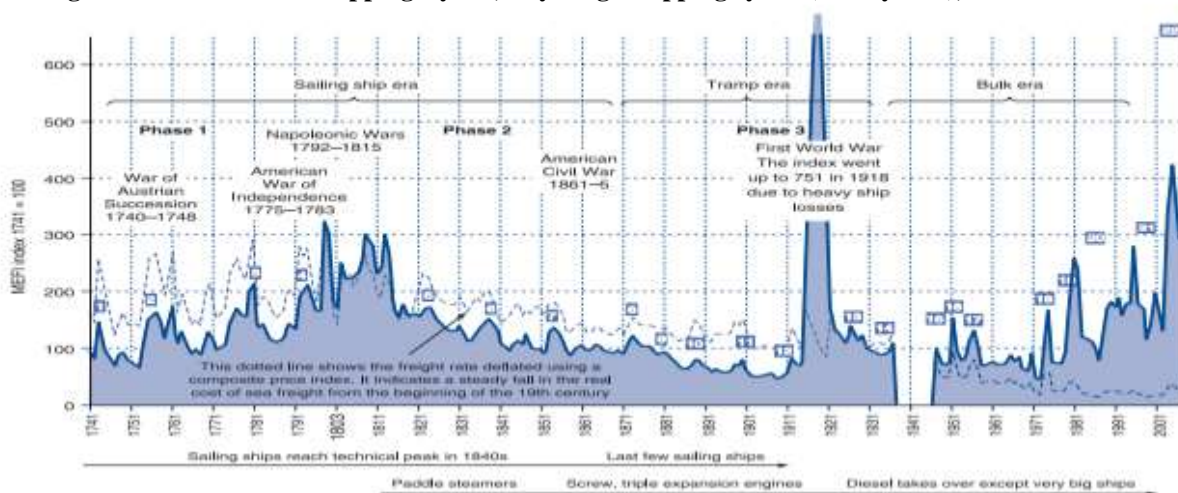
Η συγκεκριμένη διπλωματική εργασία διερευνά τα χαρακτηριστικά των ναυτιλιακών κύκλων και τις επιπτώσεις τους στη συμπεριφορά του λειτουργικού κόστους των ναυτιλιακών εταιρειών. Ο κύριος στόχος είναι η κατανόηση του τρόπου με τον οποίο οι ναυτιλιακές εταιρείες ερμηνεύουν, αναλύουν και αντιδρούν στη μεταβλητότητα της ναυτιλιακής αγοράς. Η προσαρμοστικότητα στη μεταβαλλόμενη ζήτηση για ναυτιλιακές μεταφορές, τα διαφορετικά ναύλα και τα εγγενή χαρακτηριστικά των ναυτιλιακών κύκλων επηρεάζουν σημαντικά τη δομή του κόστους και την απόδοση των ναυτιλιακών εταιρειών. Τα αποτελέσματα αυτής της μελέτης αναδεικνύουν τις βασικές πτυχές των ναυτιλιακών κύκλων, όπως τα στάδιά τους, τα χαρακτηριστικά τους και τη διάρκειά τους. Με βάση αυτά τα ευρήματα, παρατηρούμε και εξετάζουμε το πόσο επιτυχώς οι ναυτιλιακές εταιρείες διαχειρίζονται τη κυκλική μεταβλητότητα, μέσα από στρατηγικά και διοικητικά σχέδια. Εκτός από τις θεωρητικές πτυχές, η έρευνα αυτή παρέχει πρακτικές προσεγγίσεις, οι οποίες είναι κρίσιμες για τη βιωσιμότητα και την ανάπτυξη των ναυτιλιακών εταιρειών σε ένα απρόβλεπτο περιβάλλον. Η κατανόηση των συνθηκών της αγοράς και η επιλογή μιας αποτελεσματικής στρατηγικής διαχείρισης κόστους είναι καθοριστικής σημασίας για την επίτευξη λειτουργικής αποδοτικότητας, τη μείωση των οικονομικών πιέσεων και τη λήψη επιτυχημένων επενδυτικών αποφάσεων. Οι στρατηγικές που διευκολύνουν την ταχεία προσαρμοστικότητα και τις γρήγορες αντιδράσεις αποτελούν πολύτιμα εργαλεία που στοχεύουν στην οικονομική ανάπτυξη. Τέλος, αυτή η διπλωματική εργασία αναλύει τις επιπτώσεις των διαφορετικών σταδίων των ναυτιλιακών κύκλων και το τρόπο που διαχειρίζονται. Η πολιτική, το μέγεθος του στόλου και οι μελλοντικές προσδοκίες αποτελούν τα κύρια χαρακτηριστικά που καθορίζουν την προσέγγιση της εταιρείας στη κυκλική μεταβλητότητα. Αυτή η μελέτη παρουσιάζει τον τρόπο με τον οποίο διάφορες ναυτιλιακές εταιρείες υιοθέτησαν διαφορετικές στρατηγικές, με στόχο τη μακροπρόθεσμη βιωσιμότητα και την ισχυρή παρουσία τους στην αγορά.

1. INTRODUCTION

1.1 Background

The shipping industry is crucial to the global trade of commodities, facilitating more than 80% of the total world's goods transport. Maritime transport is the backbone of global trade, as more than 80 percent of goods, are transported by sea. Developing countries that depend on shipping, account for around 55 percent of seaborne exports and 61 percent of imports. (World Bank Group, 2023). This emphasizes the importance of sea international trading activity, especially for developing countries while ports are closely connected to the overall growth, operating as vital hubs and facilitating the processes. Additionally, the shipping market is subject to many fluctuations in demand and supply, depending on numerous economic aspects and factors. The periods of volatility are characterized as shipping cycles. Additionally, shipping cycles have been likened to waves crashing upon a shore. They might seem harmless in appearance, but their impact turned different, once encountered. This comparison aims to prove that shipping cycles are challenging to forecast but are essential in forming a long-lasting strategy for a sustainable growth (Stopford, 2009). Their duration can vary upon industry's specific events, geopolitics, seasonality, new market's conditions, regulatory changes etc. Reports from the industry have shown that the duration of a shipping cycle might range from 7 to 15 years. Based on following figure and between the years 1741 and 2007, the dry cargo shipping cycle (mainly coal), experienced 22 shipping cycles which three of them extended slightly beyond 15 years. However, the cyclical behavior was studied and analyzed that a typical shipping cycle last approximately 7 years. (Chisté and Vuuren, 2013).

Figure 1. / Overview of Shipping Cycles, Dry cargo shipping cycles (mainly coal), 1741-2007



Stopford (2009), Maritime Economics. Dry cargo shipping cycles (mainly coal), 1741–2007. Based on Appendix C. Page 105.

As referenced, the difference in duration of shipping cycles (7-year and 15-year) is attributed to short and long-term cycles, within the industry. In particular, short-term cycles last up to 7 years and can be influenced by seasonality and short economic causes. These cycles are more susceptible to fluctuations, requiring rapid responses from the involved parties. On the contrary, long-term cycles might exceed 15 years and are formed by solid and profound factors, such as global economic growth, technological advancements or regulatory changes. These prolonged shipping cycles represent deeper and more enduring driving factors. The understanding of their differences is indispensable in forming effective strategies, implemented based on the expected duration the shipping cycles.

1.2 Research Objectives

The aim of this research is to provide a comprehensive outlook on the interaction between market cyclical changes, firms' strategic adjustability and cost behavior. In particular, this study seeks to provide a thorough analysis of the main characteristics of shipping cycles and their effects on shipping firms, including their influence on operational decisions, the adoption of new strategies and new cost structures. It covers all phases of shipping cycles; trough, recovery, peak and collapse, employing financial data from container, bulk and wet shipping firms in order to analyze and examine their strategic responses. The motivation behind this research emanates from the need to comprehend how shipping cycles operate, affect, determine and shape the shipping environment, the opportunities and threats they create and how shipping companies manage to navigate this volatility. This study contributes to the literature, by bringing theoretical insights with practical aspects, proven by observation, numbers and figures addressing cost behavior and providing a fresh perspective on operational efficiency in the maritime sector. The implications are important, providing profound insights of the cyclical volatility, guidance in strategic investing decisions and cost structure. that should prioritize operational flexibility, cash reserves and effective cost management and planning throughout the shipping cycles.

1.3 Methodology

This research brings together both theoretical analysis with available documented data. Public financial statements were employed, from multiple shipping companies in order to observe, interpret and analyze their financial behavior, within the cyclical volatility. In other words, the theoretical part is developed through a thorough review of literature,

related to shipping cycles and cost behavior. Documented data is incorporated in the study and collected through financial statements analysis, published by shipping companies. To achieve more precise results, the qualitative (observed or recorded) and quantitative data (counted and measured) are also utilized.

1.4 Thesis structure

The thesis is divided into eight chapters. The first parts of this thesis provide a quick introduction about the aim of the study, providing brief insights on the cyclical volatility and cost structure strategies, applied by shipping firms to sustain successful operations. The following chapters provide a wider range of literature aspects in terms of shipping cycles' characteristics and how they affect the cost behavior of shipping companies. Additionally, the theoretical framework emphasizes on factors that impact the shipping cycles. Subsequently, other chapters delve into practical results from collected data and methods used. In order to support the aim of the study to deliver key insights, results and guidance, the analysis integrated additional findings and implications to achieve more advanced outcomes.

CHAPTER 1:

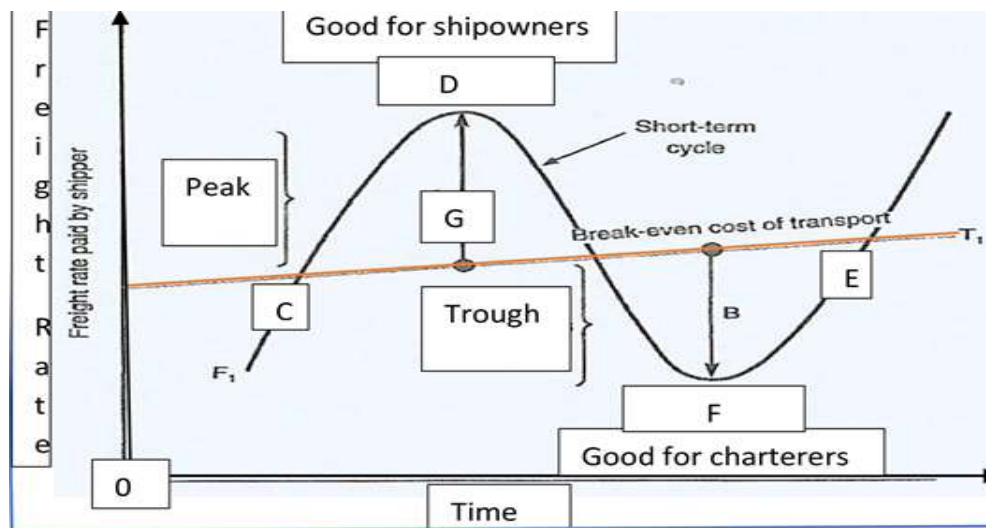
2. LITERATURE REVIEW ABOUT SHIPPING CYCLES & IMPLICATIONS

The shipping industry is inherently cyclical and can be categorized by phases, such as trough, recovery, boom and recession. Profound understanding of these stages is important for the firms to develop and maintain a sustainable strategy. This strategy should be based upon management preparedness, flexibility in adoption new methods, effective strategies, operational efficiency and financial resilience that promote risk-hedging strategies, management, sustainability, strategic planning and risk assessment. The understanding of these characteristics and their effects that shipping cycles have on companies' cost operating management and strategies are the main topics that will be analyzed.

2.1 Stages of Shipping Cycles

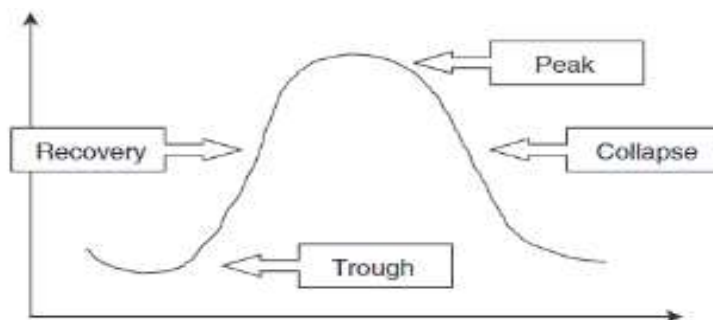
As shown in the figure 2, shipping cycles are categorized into four stages. As depicted, high demand for sea transport drives up the freight rates, benefiting ship-owners, as they experience a significant increase in revenues and liquidity. Reversely, during periods of low demand, the freight rates shift to the lowest point. Charterers/Shippers benefit from the low demand being able to select the most competitive vessels, at the lowest feasible market freight rates. (Goulielmos, 2020).

Figure 2 / The shipping cycle.



Goulielmos, A. (2020) an Anatomy of Cycles in Shipping Industry.

Figure 3 / Depiction of Shipping Cycles and Opportunities



Roberta Scarsi (2007). The bulk shipping business: market cycles and ship-owners' biases.

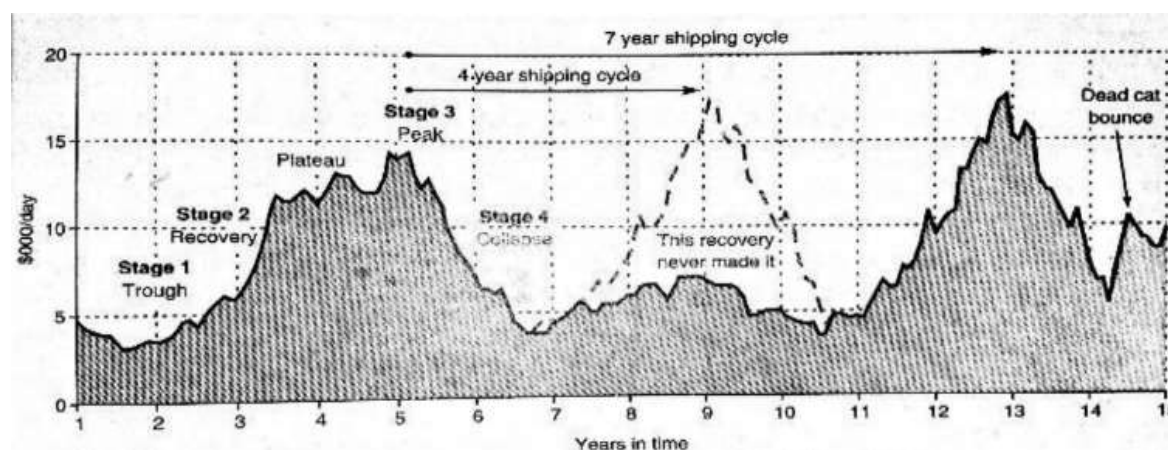
Its stage has a different impact on the shipping industry and explicitly affects the stakeholders, including ship-owners, bareboat charterers, disponent owners, ship yards, policy makers and investors. The inherent characteristics of the cyclical stages can create new opportunities but also unexpected challenges. The challenges are numerous, including making prompt decisions, managing the fleet effectively and implementing a

successful overall planning. These factors open and facilitate new opportunities for a ship-owning company to gain a competitive advantage.

2.2 Analysis of Shipping Cycles

The phrase “this time is different”, once mentioned, presented the importance of seizing unique opportunities, by making promptly strategic investments. Each shipping phase provides opportunities that when capitalized properly, can facilitate change and growth.

Figure 4 / Depiction of 7-year Shipping Cycle



Martin Stopford (2009). Maritime economics, page 122

2.2 (I) Stage 1. Trough

The trough stage is a period that the demand for shipping services is considerably less than the supply of available vessels. (Scarsi, 2020). This leads to a considerable excess of vessels, relative to the available cargo. In other words, the market experiences clear signs of surplus and ships queue at loading points, while they also executing their voyages in slow steaming in order to lessen sailing expenses and save fuels. (Stopford, 2009).

The excess supply of available vessels is primarily attributed to the influx of newly constructed vessels entering the market, many of which were ordered during peak periods of shipping cycles. As it is the lowest point in the cycle, the market experiences severe market distress. Trading activities and freight rates are markedly low, often below the operating costs, due to an economic downturn or current instability in the global economic conditions. A considerable amount of older and obsolete vessels move into lay-up, signifying the temporary cease of their operations. The temporary termination of their commercial activity is a cost-effective technique due to the

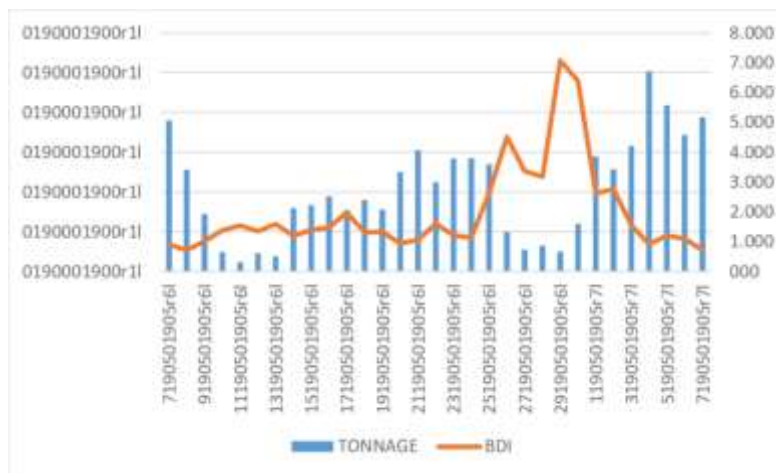
operational cost, exceeding their daily earnings. Adverse shipping economic conditions lead to limited demand for shipping transport, resulting in significant decrease in ships value, and in turn, in the shrinking demand for new acquisitions. A decline in value is connected to high perceived risk, leading New-Built and Second-Hand vessels to dry up.

At the other hand, the demolition market experiences increasing activity and the price per lightweight goes to the lowest point. Typically, when shipping market struggles with low demand and consequently low freight rates, companies tend to reduce costs and increase liquidity, by scrapping older vessels. However, due to the decreasing demand for sea services, the demand for New-Built Vessels is low, which in turn reduces the demand for steel, closely related to the demolition market. Relevant research analyzed some statistical data and found that high scrapping prices are offered when freight market conditions are favorable. (Mikelis, 2007).

Based on this research, we conclude that there is a positive interrelation between freight rates and scrapping prices. To put it differently, selling a vessel to the demolition market during trough stage, results in a significant low returns. The demolition market after refining and processing the steel, can only sell it at discounted prices to shipyards. Additionally, in order to broaden the scope of the topic, the following Figure 5 indicates that high Baltic Dry Index (translated in strong demand for ships employment and high freight rates) discourages the scrapping of vessels and reversely a depressed Baltic Dry Index shows market weakness, encouraging scrapping activity.

Therefore, vessel scrapping activity accelerates during prolonged downturns. Based on the same Figure, during Low BDI, ship owners are likely proceed to scrapping decisions for aging fleet, availing themselves to quick liquidity breathing room, ensuring their presence in the market. The blue bars represent the tonnage of ships sent for scrapping and the orange line is the key indicator of freight rates. As mentioned, we observe an inverse relationship.

Figure 5 / The inverse relationship between BDI and Tonnage Sent for Scrapping



Bloomberg, Athenian Shipbrokers. (2009). Tonnage Sent to Scrapping and Baltic Dry Index Source

Furthermore, during the trough stage, liquidity is a key component that defines the firm’s position in the market, enabling the application of new techniques that can support the survival. Numerous ship-owning companies proceed to cost-cutting measures to ensure their sustainability. These measures may include fleet reduction, providing immediate liquidity relief to repay possible debts and deliver other financial liabilities. Another strategy that is commonly observed, is downsizing larger vessels and replacing them with smaller ones in order to align with the market’s demand. This measure lessens the impact of fluctuating market and vessels with high capacity, such as Capesize, are replaced. (Fan & Xie, 2021).

Nevertheless, companies with a stronger presence in the market, robust financial strategy and cash reserves, tend to purchase vessels from bankrupt ship-owning companies, at the lowest shipping cycle and at distressed prices. Increasing the number of vessels in the company’s fleet allows them to significantly expand their market share, strengthen their position while they wait for the market recovery. This strategy is also referred as “buying into the falling knife” (Miller, 2023).

Example

The year of 2008 was marked by a severe recession, with the shipping industry reaching historically low levels, clearly defining the trough stage. (Baltic Exchange, weekly report 28, 2017). The bankruptcy of leading financial institutions, such as Lehman Brothers, pushed another global depression that drastically reduced consumer demand for goods and consequently dropped global trade volumes. (Lehman Brothers

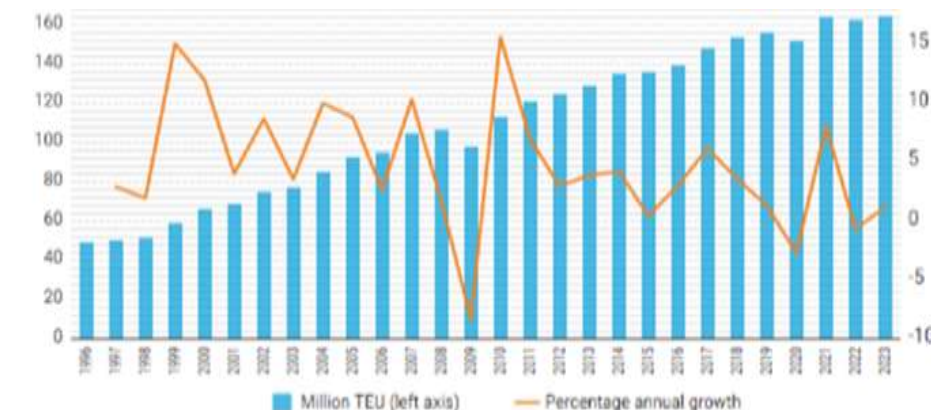
Bankruptcy Overview, 2019). This global market contraction instantly contributed to the declining demand for sea transport.

The Baltic Dry Index (BDI), as the key indicator of global shipping cost, dropped from 11.000 points, in May 2008, below 700 points, in December 2008. This decline demonstrated that operating costs exceeded freight rates, leading to the termination of operations and ships' lay-up. Additionally, ships' values underwent a substantial decrease and particularly, the price of 5-year-old Bulk Capesize carrier fell from \$150 million, in 2008, to \$50 million, in 2009. This instant dive in assets' depreciation brought plenty bankruptcies, as companies were unable to cover their operating costs and remain lucrative.

2.2 (II) Stage 2. Recovery

At this stage, the market condition is characterized by a rise in demand for shipping transport, driven by economic recovery and increase in global trade. In particular, the year of 2023 was defined by a gradual increase of container trading volumes, pushed by consumers' demand. (UNCTAD, 2023). Due to the improved industrial activity, freight rates increased and stabilized while the market sentiment becomes optimistic. The following figure indicates the global container trade between the years of 1996 and 2023, depicting the numbers of twenty-foot equivalent units (TEU) and the annual percentage growth rate across the years. Despite the fluctuations over the years, the focus is on the modest recovery in 2023, as global trade began to bounce back from the previous disruption in 2022, as observed. Within the framework of improving the clarity of the figure 6, the orange line represents the year-on-year change in the volume of global containerized trade, whereas TEU, indicated by the blue bars, represents the total volume of good transported in containers globally.

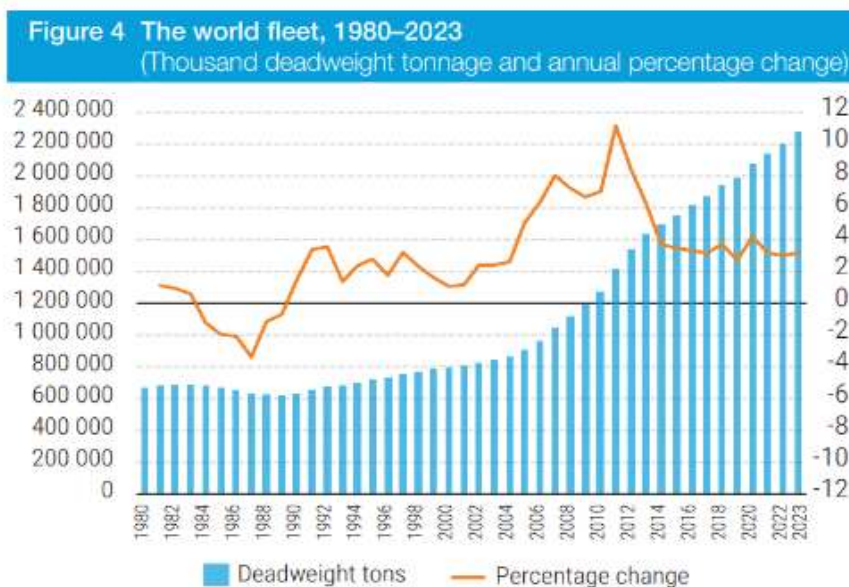
Figure 6 / World Seaborne Trade Evolution



UNCTAD secretariat, based on data from MDS Transmodal (MDST), World Cargo Database, 1 June 2023.

Hence, global prevailing economic conditions determine the industrial activity that can drive the demand for sea transport. At the recovery stage, global trade volume starts to increase, leading to an active shipping activity. This is also observed to the previous reference of the containerized trading. Subsequently, the higher demand stabilizes the freight rates leading to a predictable revenue stream for shipping companies. As mentioned in the trough stage, shipping companies deactivate ships as a reductive cost measure against the unfavorable market condition. In the recovery stage, they gradually reactivate ships that were in lay-up, implementing a comprehensive risk assessment. The following Figure displays the world's fleet fluctuations over the years from 1980 to 2023, based on deadweight tons (DWT). As previously referenced, during the trough stage, shipping companies decide to deactivate vessels due to weakened demand for shipping transport. On the contrary, as recovery commences, the gradual increase in DWT reflects the gradual reactivation of vessels, usually supported by the favorable market conditions. After 2012, fleet growth began to show a diminishing increase mainly due to the relatively low market, depicting in overall global deadweight tons (DWT). Within the framework of improving the clarity of Figure 7, the orange line represents the year-on-year percentage change in the world fleet's capacity, whereas deadweight tons (DWT), indicated by the blue bars, represents the total tonnage capacity of the global fleet over time.

Figure 7 / "World Fleet Development, Deadweight Tonnage and Annual Growth Rate



UNCTAD calculations, based on data from Clarksons Research, 2023

After reactivation or investing in new vessels, shipping companies tend to invest capital to technology, maintenance and upgrades, aiming to achieve stronger presence, through advanced operational efficiency and developed management system. While these measures are costly to implement, they are essential for ensuring long-term sustainability in an increasingly competitive market. The recovery stage is observed with higher liquidity rates, providing the opportunity of reinvesting for upgrades that will attract advantageous freight rates. In 2021, as a year of increasing demand for shipping services, ships value start to rise and more investing initiatives took place, such as purchases of new-built vessels. (Lloyd's list article, 2021). The increase of ships' value was driven by improved freight rates which was apparently a strong sign of market's recovery. In 2021, major shipyards, particularly in China, experienced a sharp rise in orders, compared to 2020. (Lloyd's list article, 2021).

Example

Following the severe 2008 financial crisis, the global economy gradually started to recover and with it, the shipping market. During the years from 2010 to 2013, the freight rates began to rise, bringing optimism, as the global trade commenced to recover. The reactivation of laid-up vessels commenced but the utilization of fleet was not in pre-crisis conditions. The prices of ships began to bounce back to higher valuations, even though they could not reach their peak levels.

The investments took place after thorough risk-assessment and measured forecasts, based on the current data. It was clear that the final sentiment of investments was improved with new ships orders, in place. Ultimately, ships prices tend to rise during recovery phases, but over-investments may be sparked by the sentiment of over-optimism. Although laid-up vessels were activated, fleet utilization remained below the pre-crisis era, indicating that new investments should be handled conservatively, under the execution of careful risk assessment. (Greenwood and Hanson 2015).

2.2 (III) Stage 3. Peak

In the Peak phase, we notice the highest point in the shipping cycle. Robust global financial activity, strong demand from manufacturing, energy and commodities, lead to full fleet utilization and intensive profitability margins. This is indicated by a strong shift in market's condition, in which companies are able to maximize their fleet utilization. Maximization of fleet utilization is a clear sign of the peak stage which is

linked to the ongoing trend in freight rates. Due to the full fleet utilization, shipping companies operate their vessels at full capacity, increasing the voyages speed and fuel consumption in order to follow up with the rising demand. Vessels' availability become tight and the demand for shipping services overcome the supply of vessels in the market. (Stopford, 2009). During the peak stage, the balance between supply and demand is tight, forcing shipping companies to operate their vessels at the maximum speed. (Akers, 2017).

The ship-owning companies avail themselves of the favorable conditions, placing new orders for new-built vessels. (Nomikos and Tsouknidis, 2022). However, the time for their final delivery depends on the shipyard capacity and workload, which possibly experience delays. This delay is attributed to the numerous orders in place. Shipyards have a substantial role in defining the delivery time, especially during peak stages. (Clarkson Research, 2006). Additionally, it is common that new-built contracts are sold at higher prices than initially agreed. Acquiring an existing contract expedites the process of the final delivery of a vessel, avoiding the delays associated with being on the waiting list. Therefore, the demand for second hand vessels might be higher, taking into account that their operation and employment can commence instantly after delivery, taking advantage of the cash-intensive current market conditions. (Stopford, 2009). Modern ships are sold for higher prices than the New-Built, while obsolete vessels are still in demand to operate.

Additionally, during the peak stage, shipping owning companies have the bargaining power and the freight rates mostly reach two or three times the operating costs. During the peak stage, operating costs are kept comparatively low compared to the freight rates, creating great margins and enhancing profitability. Intensive and continuous cash flow find companies willing to undertake the risk of expansion, pursuing a higher share in the market. (Lun, Lai and Cheng, 2010). Nevertheless, participants appear overly confident, initiating in new investments that could cause over-supply of vessels and in turn, a new global recession. Last but not least, the banking sector plays a pivotal role. Banks tend to finance many investing initiatives in acquiring new or second hand vessels. It is an effort for leveraging the booming shipping market, via profits from interest rates.

The optimistic sentiment results in high frequency rate of financing, as banks anticipate strong returns due to the robust market dynamics. Nevertheless, the tendency of intensive financing can be considered perilous, as the peak stage is usually followed by a collapse in the cyclical shipping market. Banks are important institutions in financing many investing strategies, driven by their expectations of future returns. (Kavussanos and Tsouknidis, 2016). However, excessive financing can be perilous, as the peak stage is typically followed by a market collapse. The up-to-date/accurate analysis and assessment of specific variables-captured through current and expected conditions, risk appetite and interest rates pricing emerges as key factors in explaining default probabilities of bank loans.

Example

The years leading up to 2008 were historically marked as one of the most flourishing eras for the shipping industry. The prevailing thriving global trade, specifically driven by evolutionary economic development of China and other emerging markets, led the freight rates to soar. The Baltic Exchange Index (BDI) indicated exceptionally high points, in particular 11.000. Intense profitability, activated an outstanding number of new orders for new-built vessels, with the anticipation to increase their share in the booming shipping market.

The shipyards were operating at their full capacity, prolonging the delivery day due to the workload. Indicatively, the valuation of large bulk carriers, such as Capesize, escalated. The price of a five-year-old Capesize reached a valuation of \$150 million, illustrating the intensity of shipping services demand. However, all this enthusiasm and over-confidence led to cupidity, which resulted in market collapse due to oversupply of available vessels, combined with a depression of global economy. (Miller, 2021).

2.2. (IV) Stage 4. Collapse

The collapse stage is a crucial and often devastating phase, characterized by the oversupply of vessels, which results in the shipping market downturn. The oversupply of active vessels marks a steep slowdown in the shipping industry, as supply surpasses demand. (Stopford, 2009). The demand for sea transport neither equilibrates with nor exceeds the number of available vessels. Consequently, vessels start to compete with each other in prices, followed by a sharp decrease in freight rates, as demand plummets. It is regarded as one of the most significant indicators of the collapse stage. (Karakitsos

and Varnavides, 2014). The plummet of prices is mostly evoked by the shrinking demand for sea transport due to the global economic recession (Global crisis of 2009), geopolitical developments, tariffs (Trump Policy of USA, imposing tariffs against China), disruptions, pandemics (Covid-19) and wars (Russia-Ukraine).

Global disruptions, as mentioned above, have a profound impact on the market, affecting the freight rates and contributing to a further push towards the collapse. (Miller, 2021). The market is transformed in a way that the shipping companies are unable to command high prices and the negotiation power goes to charterers and shippers. The sudden change can leave the ship-owners, operators and disponent owners unprepared, leading to financial impasses. Oversupply of vessels, especially those that purchased during the era of excessive optimism, contribute to the collapse of peak phases. The delivery of vessels may also occur amid a continuing decline in demand, which can ultimately cause a deeper recession in the oversaturated shipping market. (Akers, 2017). As a consequence, the available cargo can be transported at considerable low rates, due to the competition.

Less modern vessels proceed to lay-up or to idling conditions, while the operating costs surpass the freight rates. Simply, great losses force the vessels to be temporarily kept out of service. Ship values face a noteworthy fall, as the market is at the lowest levels. Subsequently, both new-built and second-hand vessels are not in demand, resulting in their sharp loss of value. Banks, as witnessing the decline in asset values, become unwilling to take on the risk of borrowing. They become reluctant and apprehensive to use the vessels, as collaterals, due to their low value. Credit conditions become tighter, leading to a bigger recession. The lack of financing, the low freight rates and the intense price competition force ship-owners to sell vessels at distressed prices and the least efficient ships culminate into the scrap market. During the collapse stage, considering all the aforementioned, many shipping companies strive to cover their operating expenses, lacking the ability to meet the financial obligations towards suppliers, financial institutions and common financial obligations. The inability of successful repayment leads small players in the industry to declare bankruptcy.

In other words, weak companies exit the market, while stronger companies with cash reserves gain more market share, solidifying their presence, as they anticipate the recovery. Companies that are able to survive during this era, proceed to significant

restructuring, re-negotiation of terms in debt payments, reducing their fleet and cutting unnecessary expenses in order to stay afloat. In conclusion, a collapse in the shipping industry can disrupt the global supply chain, leading to delays and increased costs of goods. This disruption can also halt global economic growth, which heavily relies on the exchange of goods and Development. (UN Trade and Development, 2024).

Example:

The economic decline after the year of 2008 was catastrophic, having caused the most severe consequences in the history of shipping industry. When the global recession commenced, the demand for sea transport declined significantly, resulting in a rapid decline in freight rates. Consequently, the low freight rates led to the devaluation of new-built and second-hand vessels.

The delivery of ordered ships increase the supply for shipping services, causing a deeper recession, by flooding with excess capacity. As a result, the prices of vessels, both new-built and second-hand, declined further and the least effective ships ended up in scrap yards. For instance, the price of Capesize carriers dropped from a valuation of \$150 million to \$50, in 2009.

Numerous bankruptcies immersed, also in financial institutions that their activity was grounded on shipping services and financing new purchases. (Notteboom, Pallis, Rodrigue, 2021). The most notable casualties were Eastwind Maritime and Britannia Bulk Holdings. Efforts to mitigate the effects of the collapsing stage of shipping industry, were made by regulatory bodies and governments through providing financial support and scrapping incentives to equilibrate the market again.

2.2. (V) Dead Cat Bounce

The phenomenon of a “dead cat bounce” describes a temporary and superficial recovery in the shipping market which can occur due to temporary events, such as seasonality, rather than a fundamental improvement in the market conditions. Those recoveries are common, especially during periods of financial downturn, as noted in 2009 crisis. (Chiste and Vuuren, 2013). They demonstrate an immediate increase in demand for shipping services that ultimately leads to the increase of freight rates and asset values. However, the underlying market conditions, such as the imbalance between supply and demand, remain unresolved. Hence, as the market shows signs of recovery, the improvement is not based on sustainable foundations. (Dry Baltic Index, Bulk Report

Week 28, 2017). Throughout the extensive global economic recession of 2008, the shipping industry experienced a “dead cat bounce”, evoked by the following underlying reasons.

Short-term recovery

Temporary factors, such as high seasonal demand, mainly in the dry sector (i.e. grains) result in a peak trade period. Disruptions, such as port/canals closures may extend time charter parties’ contracts. (TAC, Index, 2024). For instance, any event and geological tension that could cause the closure of Suez Canal, force all the ships to follow the round route of Africa, passing by the Cape of Good Hope in order to have access in the Mediterranean Sea. As consequence, this extends the transit time, reducing the number of available vessels on the spot market, resulting in short increase in freight rates and consequently in ship values. (Wilson, 2024). Therefore, the operational lifespan of the vessels has increased and the available vessels on the spot market become less.

Misinterpretation by Market Participants

The transient recovery may lead to a misinterpretation, among the stakeholders in the shipping industry. Analysts attempt to translate the temporary bounce as a sign of broader market recovery; however, positive indications might be considered premature to celebrate due to the lack of strong foundations to support the ongoing recovery. (Chan, 2024). False optimism may occur to those that have not construed the real market conditions and not detected the temporary events that caused this superficial recovery. This might induce new investments, such as new purchases or reactivating laid-up vessels.

Subsequent Decline

Due to the weak underlying market conditions, the short-lived recovery is unsustainable. As the short-term factors disappear, the freight rates and ship values return to their previous declining trajectory, clearly reflecting the actual status of the market and the imbalance between supply and demand. (Chan, 2024). An example that could solidify the aforementioned is the year of 2008, when BDI (Baltic Dry Index), after indicating signs of recovery, unresolved factors brought back the imbalances, such as excess ship capacity. (Chiste & Vuuren, 2013).

Example: The Post-2008 Financial Crisis

A prime example of a “dead cat bounce” occurred, following the 2008 global economic downturn. During 2009-2010, the Baltic Dry Index (BDI) indicated a short-lived rise, mainly driven by increasing inventory levels in some industries, in the expectation of a

future demand (BDI, Week Report and week 28). In spite of the increase for ship employment, it was verified with the passage of time that the recovery was temporary, as the fundamental imbalance between the supply of ships and demand for sea transport was still in place. As a result, the Baltic Dry Index (BDI) indicated a further decline in prices, continuing the financial distress in the industry. In conclusion, the “dead cat bounce” phenomenon does not illustrate any improvement in the underlying factors of a sluggish market, but a temporary event or series of events that provoked an increase in the demand of ships’ employment. The identification of the “dead cat bounce” is highly important by the stakeholders and policymakers in order to refrain from wrong decisions that could result in financial disasters. (Chan, 2024).

CHAPTER 2:

3. LITERATURE REVIEW and INSIGHTS OF OPERATING COST DYNAMICS, COST BEHAVIOR and MANAGEMENT.

3.1. Early observations into Cost Behavior in relation to shipping cycles

Once vessels are acquired, companies must then focus on balancing operational costs, as the vessels age. As previously referenced, the shipping sector experiences cyclical changes in demand, mainly due to global economic conditions, customer demand and geopolitical events. Shipping cycles closely affect the operating costs and financial performance of shipping companies. (Karakitsos and Varnavides, 2014). Effective strategic approaches, sustainable plans and prompt responses are essential for managing effectively the arisen costs and new challenges, especially in an asset-intensive industry. As shipping cycles are closely linked to the market volatility in demand, ranging from high, moderate to low levels, shipping firms have adopted internal managerial methods to interact accordingly to assure profitable operations and successful internal strategies. Throughout the peak phases, the shipping firms focus on scaling up, whereas during downturns, they endeavor to minimize operations expenditures. (Ting and Tzeng, 2003). Analyzing the cyclical variations helps in comprehending cost structures, financial implications and detect strategies that optimize cost management.

3.1. (I) Further preliminary Observations/Implications into the cost behavior

As previously discussed, it was highlighted that the intensity of the activities is related to the market conditions. An increase in the intensity of activities leads to higher

investments. Therefore, the intensity of activities, investments, and market conditions are closely interconnected. Decisions linked to vessels acquisition, market positioning, cost management and behavior are driven by the prevailing demand for sea transport that determine the financial outcomes and in turn the long-term sustainability. Effective strategic decisions can be also those that aim expansion during downturns, when prices are low, as a way to increase their fleet size. This expansion anticipates market recovery, based on the cyclical shipping behavior. (S&P Global, 2023). However, the decision of fleet expansion is influenced by many factors, such as firm's policy, size, available cash flows, credibility among global banks and opportunities observed. For instance, we can assume that big sized shipping companies may tend to purchase vessels during trough or collapse stage in order to avail themselves to low prevailing prices, anticipating the recovery to come. Those decisions enlarge the company's share in the market but create immediate financial obligations. Nevertheless, shipping firms must carefully choose their cost behavior and management, taking into account their Strength/Weaknesses, the market's Opportunities/Threats and the capability of maintaining the positive balance between operating costs and revenue opportunities.

3.2. Asset Life Cycle Considerations

Before delving into the aspects of operating cost behavior and its parameters, it is important to first comprehend the life cycle of vessels. Having thoroughly analyzed the aspects of shipping cycles, it is evident that the vessel lifespan is inherently linked to these stages, which are pivotal for the formation of company's financial strategy, while each shipping phase also influences the years of active operation for vessels. For instance, an obsolete vessel can be still in active operation during periods of high demand. Initially, companies experience a high capital outlay at the vessel's acquisition, couple with depreciation costs that impact profitability. As vessels age, their performance naturally declines, leading to increased capital expenditure in order to prolong their life and efficiency. Later, the costs of repairs and maintenance increase significantly and their life expectancy depends on the market's conditions. If the freight rates do not cover their operating expenses, the cost of retaining it encourages disposal decisions.

3.2. (I) Early Stages: Acquisition and Depreciation

Purchasing new vessels results in a significant capital expenditure, usually financed from stockholders equity or bank loans. The financing of new purchases lead to

increased fixed costs, in the form of depreciation which refers to the gradual wear and tear, caused by the regular use of the assets as well as interest payments. High depreciation expenses compress the profitability of the overall company's financial stance. Shipping companies must keep track on the annual fixed costs effectively, especially during downturns when revenues are low. Financial Planning is essential to avoid the profit margin erosion.

3.2. (II) Mid-Life Stages: Balancing Operating Costs

As vessels reach their middle stage of their life cycle, the focus shifts to operational efficiency. Adapting an effective regular maintenance planning contributes to operations optimization, offsetting fixed and variable operational expenses. At the middle age of a vessel's life, cost behavior of shipping firms focus on investing in regular repairs, refinements and maintenance in order to upgrade the vessel, maximizing their operational output to spread the costs over a larger volume of activity.

3.2. (III) Late Stages: Maintenance, Repairs and Disposal

At the later stage of a vessel's life, the costs of repairs, preservation, and maintenance begin to rise. Obsolete technology, accumulated wear and tear over the year, replacements of ship parts, frequent damages and general mechanical refinements escalate the cost for operating an old-aged vessel. The decision of operating an aging vessel is based on the market conditions. More specifically, in a strong market, investing in new-technology vessels enables the shipping company to successfully deal with the big capital outlay thanks to high rates of cash inflows. However, obsolete vessels are still in demand for shipping services due to the elevated cargo volumes.

The decision of purchasing new vessels and selling obsolete ones during peak time can be aligned with the company's policy. For instance, some companies might demonstrate a behavior that proceeds to the purchase of new-built vessels in order to stay operationally effective and simultaneously keep the outdated vessels in their fleet in order to use them during the peak time, boosting their cash inflows. A more specific example is Diana Shipping Incorporation that is known for adapting this policy. The company strategically employs expanded fleet to increase profit during periods of high demand. When market begins to fall in freight rates, the company has demonstrated a policy of selling them, often at a time that could take advantage of highly priced second hand vessels before the final downturn. At the same time, they proceed to new-built orders in order to maximize their capacity, attempting to meet rising demand, becoming

more technologically advanced and gaining a competitive share advantage.

3.2. (IV) Last Stages: Disposal of Vessels

The timing of disposal is based on many factors, such as operational capability of the vessel, market condition, and costs of operation and compliance with safety standards, securing the prevention of accidents. (Acik, 2017) Particularly, operational capability refers to the situation when the efficiency of the vessels declines. This decline is might linked to higher fuel consumption, decrease in knots that leads to higher costs of refinements and maintenance. Market dynamics are considered as an important factor which is taken into account from the companies in order to proceed to scrapping resolution. When the market demand for aged vessels are still at high levels, companies usually operate them, due to the elevated cash inflows, even though the operating costs are higher compared to the new ones. Operational Costs show a steady rise as the age of ship is increasing. Specifically, older vessels are subject to higher fuel consumption, higher salaries to the crew members as a compensation arisen from the inherent danger and higher insurance costs.

Compliance with Safety Standards is a strict prerequisite for legal operations, imposed by regulatory bodies. Adherence to those obligatory standards require costly upgrades, refinements, maintenance, repairs and regular replacements of non-operational parts etc. Eventually, at a point that a company is unable to comply with those standards and/or achieve positive margins of their operations decides to sell it to the demolition Market. Shipping companies balance and analyze those factors in order to minimize operational costs and maximize profits and cash inflows through optimization of fleet efficiency and financial performance. Taking into account all the aforementioned, shipping companies employ different methods and methodologies in order to assess the feasibility of changes, behaviors and initiatives. In the following sections, key terms and methodologies used by shipping companies to make strategic decisions are analyzed.

3.3. Basic types of Expenses

As mentioned in the previous analysis of Asset Life Considerations, fixed and variable costs are essential in determining the company's profitability. Hence, before delving into the insights of operating cost behavior of shipping firms during the years of cyclical volatility, it is highly important to first explain some terms, ideas and their parameters that are commonly applied in companies' daily operations.

3.3. (I) Fixed Costs

In the shipping industry, fixed costs refer to expenditures required to maintain vessels and support operations. The range of those costs are mainly defined by the nature of the industry. In particular, in asset-intensive industries, such as shipping, the magnitude of fixed costs is significant. Regardless the scale of operations, the fixed costs persist even during financial downturns, leading to major strategic changes and the budget tightening. (Ferrari, Marchese and Tei, 2018). Conversely, the effect of fixed costs are alleviated during expansion, as these costs are distributed across a higher volume of shipping activities, enhancing cost efficiency. However, they cannot be exempted. During declined volume of operations, especially noticed throughout the trough and collapse stage, the fixed costs continue to accrue, lessening the profitability levels. For better understanding of fixed costs, some examples are the following:

Vessel Depreciation. Depreciation is an inevitable expense from the regular use of the vessel and operational stress over time. It also refers to the loss of value due to the wear and tear. Typically, the cost is incurred annually, regardless of the level of usage. (Ting and Tzeng, 2003).

Bank Loan Interests. The repayment of a loan is a pre-defined and standardized expense which does not vary according to the shipping activity, unless re-negotiated. Bank loans could be granted for investing purposes, such as purchasing a new-built vessel.

Insurance Costs. The cost of insurance usually does not depend on the level of shipping activity but mainly on the places of voyages operations. It is considered a regular cost which guarantees the financial security of the ship-owner or cargo-owner in case of an accident or loss.

Crew salaries. The salaries for the office employees, engineers and general staff are fixed in spite of the operational intensity.

Port Fees. Port fees constitute certain fixed costs, closely linked to regular operations. They can be neglected in certain routes which might necessitate the coverage of additional mileage. Additionally, annual charges are payable; notwithstanding, the number of visits to the port.

Dry Docking and Special Survey. In particular, Dry Docking and Special Survey are fixed costs related to regular maintenance, repairs, inspections, audits for regulatory compliance that takes place at scheduled dates, specifically every 2.5 years and 5 years

respectively. The aforementioned are mandatory costs imposed by Classification Societies, Flag States and International Maritime Organization (IMO).

3.3. (II) Variable Costs

Variable expenses fluctuate based on the intensity of the operations and arise from new activities that incur costs for their execution. They are in direct proportion to the volume of activities. For instance, during trough stage, shipping services are in low demand, consequently keeping the variable costs at low levels. Companies endeavor to downsize any unnecessary expense by optimizing vessel usage. Despite the reduction of variable costs, the challenges for the companies remain high in order to successfully deal with fixed costs. Additionally, during recovery stage, the shipping activity commences to reach higher levels, gradually elevating the variable costs. Furthermore, at the peak stage of shipping cycles, increased activity leads to higher costs in fuels, maintenance, lubricants, supplies, port fees etc. In spite of the intensity of sea services, it is crucial for the shipping companies to adopt an effective cost management plan to preserve high profitability margins. Lastly, when demand reaches lower levels, the operations slow down and shipping companies scale down any unnecessary variable cost. Expense-cutting instantly mitigates the financial strain, commonly noticed in the collapsed stage. For a clearer understanding of variable costs, here are some examples:

Bunkering Costs. Bunkering is referred to fuel supply and it is closely linked to the distance travelled. Operational intensity and longer voyages are proportional to the levels of bunkering, which results in higher costs.

Port Loading/Unloading Charges. Port loading and unloading charges can vary depending on the frequency of voyages operations. High demand for sea transport leads to increased frequency of voyages, which in turn escalates port loading and unloading charges due to the greater volume of cargo being handled.

Pilotage Fees. Similarly, as described in port Loading and Unloading Charges, the frequency of voyages also determine the total fees paid to maritime pilots that assist in navigating vessels. More visits in ports, due to the demand for shipping services, bring higher pilotage fees.

Agency Fees. Operational intensity arise higher fees payable to agents that facilitate the operations of vessels and management of logistics in ports. The complexity of their work becomes more challenging during the peak phase of the shipping market. More port activity results in higher agency fees and reversely.

Supplies. The cost of supplies such as food, water and other necessities are based on the frequency of vessel's voyages and it is different in every stage of shipping cycle. The volume of supplies expenses can vary and it is closely linked to the length and number of voyages.

Maintenance and Repair Costs. Unexpected repairs are often occurred by higher level of employment and utilization of the vessel. High usage increases the possibility of regular damages, due to the wear and tear.

3.4. Operating Leverage and Break Even Point Analysis

3.4. (I) Operating Leverage

Having described the concepts of fixed/variable costs, it becomes important to examine how they can affect a company's overall performance. One key concept is the operating leverage. It highlights the relationship between fixed and variable costs within a company's operations and indicates the company's capability to make profits from sales.

High vs Low Operating Leverage

A company with High Operating Leverage has a high degree of fixed costs. Therefore, a small increase in sales results in a higher profit. This occurs primarily because the fixed costs have already been covered. At the other hand, if sales decline, the fixed costs remain at the same level. Regardless of the activity's intensity, the fixed costs cannot be lessened, whereas, Low Operating Leverage determines the amount of variable costs. The more intense the operations become, the greater the increase in variable costs. (Giannopoulos, Merikas, and Schröder, 2013).

Examples

Maersk Line possesses a large fleet and in turn, a significant share in the liner shipping sector. Considering that, Maersk has High Operating Leverage, while fixed costs are not significantly subject to fluctuations. Thus, in periods of rising demand, freight rates and cargo volumes can substantially influence the profitability. Conversely, Genco Shipping & Trading focuses on ships chartering rather than possessing ownership of them. This policy allows them to avoid fixed costs when the market's demand for shipping services is low. It is considered conservative and relatively safe, during trough or/and collapse stage, lessening the cash outflows and mitigating the effects of weak periods.

3.4. (II) Break-Even Analysis (BEP):

Break-Even Analysis is essential in the shipping industry as it offers valuable insights by identifying the point at which shipping company's revenues equal its operating costs. Both fixed and variable costs are calculated and taken into consideration. (Luvesh Constantine).

Example, information given, as following:

Fixed costs: \$400.000 monthly for vessel ownership, crew salaries, insurance, maintenance and unexpected repairs from damages.

Variable Cost per Container: \$250, including fuels, loading and discharging fees.

Freight Rate per Container: \$500 earned per container transported.

Break-Even Point (BEP) =

Fixed Costs / (Freight Rate per Unit – Variable Cost per Unit)

Applying the numbers, BEP= \$400K / (\$500-\$250) => BEP= 1.600 containers.

Core Idea

Given those numbers, the company should transport at least one thousand six hundred (1.600) containers a month to cover all the costs incurred due to its operation. Any point less than the Break-Even Point will cause losses for the company. On the contrary, any number above the Break-Even Point contributes to the company's profitability.

Further insights

Based on this analysis, shipping companies take important decisions such as pricing, capacity utilization and cost management. During slowdowns, shipping companies operate their vessels with exceptional discounts in order to survive, as a way to diminish their expenses. According to BEP, discounting the freight rate necessitates the increase of voyages in order to offset the revenues lost from the discounts. Therefore, companies must assess their capacity and operational efficiency in-detail in order to avoid damages. Companies with High Operating Leverage, following the strategy of lowering the freight rates, must increase the numbers of voyages in order not to be subject to negative cash flow. At the worst and frequent scenario, companies proceed to sell non-current assets in order to diminish fixed costs. In contrast, companies with Low Operating Companies, can easily reduce fixed costs, preserving cash flow and ensuring sustainability during the trough and collapse phase.

3.5. Interrelation of Fixed/Variable Costs, Break-Even Analysis and Operating Leverage in the shipping cycles.

The cyclical nature of the shipping market can determine the cost structure of the companies, based on the peculiarities and asset-intensity. As mentioned, these phases include trough, recovery, peak and collapse. Each stage impacts the firm's cost structure differently, necessitating a successful adaptation. The link between a cost structure, market conditions and company's uniqueness is essential to manage profitability, stability and development, led by successful strategic decisions.

3.5. (I) Trough and Collapse Phases: Cost stress and Strategic Responses

A global economic recession drives the shipping market into the trough or collapse stage, with the exception of some seasonal changes (DBI Bulk report – Week 28). As previously discussed, fixed costs remain stable regardless of the intensity of operations. Thus, it is clear that financial distress endangers the company's viability, as freight rates may not cover these costs. Especially, companies with High Operating Leverage undergo a steep cash outflow due to high fixed costs. As the market is not recovering, companies usually resort to expense-cutting measures, by selling their assets. This approach aims to scale down inevitable fixed costs, while it improves the liquidity levels, contributing to overall sustainability. At the same time, variable costs are minimized by avoiding the undertaking of unprofitable voyages. Break-Even Analysis becomes crucial, as companies must determine the point at which their operating revenues cover operating expenses, helping to inform their pricing strategy ensuring profitability.

3.5. (II) Recovery and Prosperity Phases: Intensification of Profits and Cost Efficiency

Recovery is the subsequence of trough stage, with clear signs of market's improvements. In the recovery stage, reactivation of laid-up vessels is noticed while ship-owners start placing new orders, anticipating better market conditions. (Haralambides, 2020). Companies experience rising demand for shipping services that leads to higher freight rates, frequency of voyages, cargo volumes and consequently higher variable costs. At this phase, companies with High Operating Leverage are able to spread fixed costs across a larger range of activities and frequency of voyages, achieving cost efficiency and better economies of scale. (Panayides and Cullinane, 2017). As previously mentioned, Capesize Dry Bulk Carriers transport exceptionally high amount of cargo, reducing the cost per ton of cargo. Companies operating Capesize

vessels benefit from High Operating Leverage due to the large cargo volumes they can transport, in a single voyage. In contrast, companies with smaller vessels and Lower Operating Leverage need to perform more voyages to transport equivalent cargo volumes, which increases their variable costs.

3.5. (III) Peak Phase: High Cost and Revenues

At the peak stage, the operating activity is at its highest levels. The market experiences high demand for shipping services and intense utilization of vessels (Stopford, 2009). Extensive use of vessels generate higher variable costs, while the fixed costs remain stable. Despite the growth, shipping costs are one of the most misunderstood or miscommunicated terms in shipping. If not quoted, monitored or controlled properly, they could lead to a major setback. (Maritime Transport of the UN Trade and Development, 2023). The development of an effective cost management is important, while the surge in revenues should be handled in a way that keep the profitability high, despite the rise in variable costs. Companies with High Operating Leverage can achieve substantial profits, maintaining operational efficiency and capacity utilization, while companies with Low Operating Leverage, must follow a careful expansionary policy since they are more susceptible to changes in variable and fixed costs

3.6. Comprehension and Conclusions

The shipping cycles determine the lifespan of vessels which in turn influences the operating cost behavior, the financial strategy and the overall decision making within shipping companies. During the first stage of acquisition and purchase, substantial capital outflows and imminent depreciation expenses increase the financial pressure. As vessels proceed to the mid-life stage, shipping companies focus on fleet optimization and operational efficiency through strategic maintenance, updates and route optimization in order to reduce fuel consumption and transit time. These approaches are important in keeping expenses and costs under control that are related to the aging of vessels. Those costs are typically classified into fixed and variable categories. In particular, fixed costs are persistent regardless of the intensity of the operations (i.e. depreciation, insurance), whereas variable costs are closely related to the operational intensity (i.e. fuels, repairs). They are important factors to take into account, devising financial strategies and operational plans, as both fixed and variable costs significantly impact a company's profitability and decision-making process.

The decisions are often related to investments, new initiatives and cost-cutting techniques. For instance, decisions of fleet expansion are based on the level of fixed/variable costs and market conditions. Typically, purchases of new-built vessels are pursued during favorable market conditions, aiming to achieve better positioning in the market, economies of scale and capacity enhancement. For instance, during favorable market conditions, Capesize carriers are in high demand due to their capabilities in carrying big volumes of cargo, as a way to reduce the costs per ton. As mentioned, during different phases of the shipping cycle, companies face varying challenges, influenced by factors such as fixed and variable costs, the lifespan of vessels, and overall liquidity. In the context of dealing with the setbacks, shipping companies have developed key terms that have implemented in their daily decision-making process.

Specifically, the concept of operating leverage becomes essential during the cyclical volatility, as companies with High Operating Leverage benefits from increased activity but they are in risk during economic downturns. Another analysis used, is the Break-Even analysis, which indicates the financial benchmark which determines the intensity of the operations needed to cover the costs. In conclusion, operating cost behavior and investing decisions follow a complex framework that includes considerations from vessels life cycle, cyclicity, the level of fixed/variable costs and key methods that extract results and support decisions.

CHAPTER 3:

4.1. DELVING INTO THE COST BEHAVIOR ASPECTS OF SHIPPING FIRMS

4.1. (I) Preliminary Aspects of Cost Management Methods and Techniques

The following analysis aims to provide different approaches employed by shipping firms to effectively handle the cyclical volatility. In particular, those approaches are focused on managing operational expenses and maintaining financial stability. Different shipping cycles (Trough, Recovery, Peak, and Collapse) necessitate different adaptive strategies that in turn influence the cost structure. For instance, during downturns, shipping companies shift their focus on cost-cutting techniques, such as fuel efficient measures and route optimization. Additionally, during peak periods, shipping

companies capitalize on high demand and profits by proactively maintaining and updating their vessels ensuring operational continuity. Debt management is also essential. In particular, in high-demand periods, shipping companies are able to leverage increased revenues to negotiate better borrowing terms, such as lower interest rates which will benefit them during periods of recession.

In the framework of cost management, during booming periods, shipping companies tend to spread fixed costs across the intensity of operations, enabling them to increase their profit margins and proportionally lessen the costs. (Drobetz, Ehlert and Schröder, 2021). Another strategy employed in order to increase resilience is the fleet and revenue diversification. This strategy proves effective during periods of low demand, mitigating the single market dependency. In other words, expanding into different type vessels and activities (i.e. logistics and distribution) can strengthen the company's positioning even during periods of market decline. Another technique that is discussed in the following sections is the leasing options and sale-leaseback methods. Specifically, they offer liquidity by avoiding cash outlay on new purchases while they provide flexibility to adjust their fleet size, according to the market demand.

Last but not least, the relationship with suppliers, shippers and partners is essential, especially during collapsing stages. Trust that leads to flexible terms and reliability can strengthen the competitive position and prevent massive capital outlay. Building upon these strategic foundations, the following analysis delves into each approach in detail, exploring how shipping firms tactically navigate each stage of the cycle to sustain resilience and optimize operational performance.

4.1 (II) Methods of Cost Management

4.1.1 Operational Efficiency Strategies

To effectively manage costs during volatility, shipping companies utilize a Cost Optimization Framework that is focused on Operational Efficiency. This framework includes key strategic techniques, such as Fuel Efficiency, Maintenance-Repairs, Technology-Innovation and Asset Utilization. Those strategies are important to cost-saving operations, while keeping the performance at high levels. More precisely, fuel efficiency refers to proper hull maintenance and mechanical upgrades, mainly focusing on keeping the consumption at low levels. Additionally, route optimization helps to lessen the costs of fuels while it contributes to cost-saving framework. Other techniques

that support fuel savings and contribute to the overall optimization of the operations are regular repairs, maintenance and investments in technology. Last, achieving the maximum asset utilization signifies that vessels operate at full capacity, spreading fixed costs across higher levels of activities.

Fuel Efficiency

Considering that the fuel costs are one of the main arising operating expenses, measures such as proper hull maintenance and mechanical upgrades to keep the consumption at low levels are important in cost controlling. Additionally, accurate calculation of the distance between loading and discharging Port, weather conditions, port fees and fuel consumption rates facilitate the optimization of route. (Opsealog, 2023).

Maintenance and Repairs

Regular and proactive maintenance at a high-demand market can mitigate the financial damages in hull machinery or to the mechanical parts breakdown. Apparently, any incident of damage that could cause a capital outlay is more detrimental to occur during market downturns (Opsealog, 2023).

Technology and Innovation

Investing in advanced technological equipment, automated systems and advanced mechanical parts can bring operational effectiveness, optimizing route and cost-saving operations. (Anan, Higuchi and Hamada, 2017).

Asset Utilization

An effective way to mitigate the financial effects of fixed costs on the companies' sustainability is to spread them across lucrative activities. Maximizing Asset Utilization through effective planning, efficient routing/scheduling and reducing idle time brings about more profits and better cost-effective outcomes. (Kuosa, 2023).

Short Conclusion

In summary, the aforementioned Cost Optimization Framework targets to achieve operational efficiency through fuel efficiency, repairs, maintenance, technological innovation and maximum asset utilization. The employment of those strategies improve the overall performance while reducing costs, both key elements in keeping financial resilience in the market's fluctuating nature.

4.1.2 Expansionary and Risk Mitigation strategies

Beyond operational efficiency, shipping companies adopt other strategies that aim to hedge against the risk of volatility through the expansion in different activities. This

expansion targets to strengthen financial stability and overall resilience through a wider range of activities, such as supply chain and logistics, revenue and fleet diversification and flexible leasing options. Those activities support cash flow while they reduce dependency on the single-market fluctuations. Applying those strategies in a well-structured framework enables shipping companies to easily adapt in market changes, hedging against the economic slowdowns and reinforcing a competitive advantage.

Diversification of Revenue Sources

Diversification of revenue sources is a strategy that hedges against the risk of the cyclical nature of shipping industry, strengthening self-sufficiency and ensuring consistent cash flows. (Hellenic News, 2023). The shipping cycles, characterized by periods of high and low demand influence the economic performance of the companies. Diversifying the sources of revenues, operating different type of vessels and expanding the activities into more economic areas can stabilize their cash inflow and securitize financial sustainability.

Diversification of Fleet Operations

Within the shipping industry, it is widely recognized that the volatility of freight rates is different between different types of carriers, i.e. LNG, tankers and bulk carriers. Investing in various types of vessels is a strategy that targets different market needs, enabling the company to reduce operational risk and take advantage of different market opportunities. Due to the seasonality of some products, such as grains, the high demand for transportation significantly contributes to the overall profitability. (Kavussanos, 2001). Simultaneously, investing in tankers during a period of historically low wet cargo demand, such as the Covid-19 era, leads to reduced operational activity. Despite the idle activity, the improved revenues from seasonality in different shipping market can cover the fixed expenses of tankers and sustain their operations. As a result, the company's global share remains intact. Based on the inherent nature of market's cyclical behavior, the market is expected to show recovery, resulting in the reactivation of tankers. Maintaining a stable global market share throughout the fluctuations enables greater participation in the booming market, leading to increased profits. (Stopford, 2009).

Leasing

Another effective way to ensure a constant and stable income for the company is the engagement in leasing activities. Leasing enables companies to earn profits from inactive or less effective vessels, as a way to successfully deal with the market

volatility. Leasing contracts enable shipping companies to shift some operational risks to third parties, minimizing their exposure to the market fluctuations. (Peter S. Douglas, 2006). Additionally, leasing allows the estimations of future cash flows, enabling them to effectively plan their investments and financial initiatives. (Peter S. Douglas, 2006). Leasing contributes to optimism, thanks to cash in-flows to the shipping firms, particularly during downturns when freight rates are at low levels. Leasing contracts and agreements, such as bareboat charter parties or/and time charters parties agreements, permit companies to transfer their operational risk to third parties, maximizing vessels utilization, while avoiding lay-ups and ultimately ensuring stability in cash flows. (Peter S. Douglas, 2006). Even in periods of low demand, the return is contractually agreed and cannot be changed, unless negotiated. Adopting a policy that supports leasing can provide financial solidity, operational capacity, which can lead to gradual development and expansion. However, leasing limits substantial cash inflows during periods of high demand. (Ying Li, 2006).

Leasing as a Flexible Alternative to Ownership

Instead of proceeding to new acquisitions, shipping companies might lease vessels instead. (Peter S. Douglas 2006). Within the framework of this policy, shipping firms minimize their fixed costs, such as maintenance, upgrades or idle off-hire time. As operations increase, leasing allows companies to manage rising expenses in proportion to activity levels, ensuring that cash inflows and outflows remain balanced and under control. However, leasing might be costly during seasons of high demand. Example of such cases could be Maersk that often lease vessels instead of buying, allowing them to avoid massive capital outlay, adapt a more flexible expansionary strategy that aligns to the market demand.

Sale and Lease Back Method

Another strategy, as a flexible financial tool and closely linked to leasing, is the Sale and Lease Back Method. It is a commonly used technique to boost liquidity, by selling and subsequently employing the vessels again, under a leasing contract. (Lianjun and Bhogal, 2020). This method provides the financial breathing room needed for the company to deliver financial obligations without compromising operational capacity. (Cooper and Brimmer-Landy, 2021). In other words, higher liquidity, operational flexibility and fixed costs diminution can be related to this strategy, resulting in decreased operational burden and improved cash reserves stability. This method is commonly used especially in periods of financial distress. Numerous shipping

companies have used this strategy, during collapsing stages in order to boost internal liquidity, key element in keeping the financial confidence within the company. Beyond the leasing techniques that target risk mitigation, many shipping firms also focus on optimization of supply chain and logistics operations. Advancing the supply chain system, shipping firms lessen their level on dependency on freight rates fortifying them against market volatility. Expanding on different activities and getting involved in a wider range of economic sectors strengthen their financial structure. (A.P Moller – Maersk, 2022 by Soren Skou, CEO).

Logistics and Supply Chain

The integration of logistics services in the operational portfolio of the company involves warehousing, supply chain services and distribution. The expansion of activities reduces dependence on the freight rates which contributes to hedge against the shipping market fluctuations and provides a balanced financial structure, especially in periods of uncertainty (Hellenic Shipping News, 2023). Maersk exemplifies this technique by expanding its operations into logistics as well. (A.P Moller – Maersk, 2022 by Soren Skou, CEO).

Supply Chain Process Refinements

In addition to diversifying their service offerings into supply chain and logistics, shipping firms enhance their resilience by refining and optimizing their operations. (A.P Moller – Maersk, 2024, Larsen). Strong relationships with reliable suppliers, combined with optimized supply chain operation, result in punctuality to loading process, minimizing delays. Effective warehousing, along with proper preservation and distribution of cargo, can have a significant impact on the carrier's performance. A professional approach without cargo damages, loaded on time, maximize the efficiency of the operations. Same applies to the Port of Discharge. Additionally, the knowledge of reliable and efficient Ports is important, closely affecting the operations. The frequency of congestion and regular cargo claims are some key aspects that can be taken into consideration. Optimization of Supply Chain Operations at the Ports and the knowledge of Port's peculiarities can eliminate valuable idle time and provide the shipping company with a competitive advantage in the market. (Ifekanandu, 2024).

Short Conclusion

In summary, shipping companies tend to choose strategic expansions on activities, in different economic areas in order to lessen the impact of cyclical volatility. Diversifying their revenues sources, through Fleet Diversification offers the flexibility needed in

order to endure any single-market change in demand. They also shift their focus on strategies that allow them to solidify their presence in their market. One of those strategies are centered on leasing options. Leasing is an effective technique to adjust capacity, based on the market needs. For instance, due to financial difficulties, companies sell their vessels and lease them back to increase liquidity without reducing capacity. This method is effective while it significantly reduces fixed cost obligations, keeping the same tonnage capacity while maintaining liquidity levels high. Furthermore, the strategic expansion into logistics and supply chain activities facilitates seamless operations, enabling them to sustain stability reflecting in cash flow steady growth. These strategies together, allow shipping companies to diminish the risk of the single-market volatility, while strengthening their position and ensuring operational efficiency with cash flow growth stability.

4.1.3. Debt Structure Aspects - Financial Resilience and Cost Optimization

As previously mentioned, the cyclical nature of shipping industry necessitates the adaption of effective financial strategies, such as debt management in order to sustain operational resilience. More specifically, periods of high demand for shipping transportation lead to a noteworthy rise in revenues, enabling shipping companies to claim more advantageous terms of borrowing, such as low interest rates. Low interest rates reduces financial strain, stabilizing cash flows. The borrowing agreement can be conducted in variable or fixed interest rates terms. Securing the latter allows the repayment of debt at the same low interest rates, even during market downturn. At the other hand, variable interest rates fluctuate based on the market volatility, as risk hedging strategy from the borrowing institutions. Important aspects of the structure in interest rates are analyzed in the following sections.

Fixed and Variable Interest Rates – Aspects in Cost Predictability and Flexibility

Fixed interest rates provide specific advantages that enable the companies to mitigate the risks of the cyclical shipping market and forecast future cash outflows, helping the company to establish financial and budget stability. Fixed and predictable expenses enable optimal payment planning, helping to allocate resources and capital more effectively in different activities. This allows to maintain operational efficiency, even in unfavorable market conditions. However, fixed interest rates may be higher than the current variable interest rates, lessening potential savings, especially during periods of increasing demand.

Conversely, variable interest rates are uncertain and considerably fluctuating, following the market conditions. Their shaping is inversely proportional to the market's current risk. (G. Carmichael and B. Handford, 2014). For instance, during the collapse stage, borrowing institutions tend to mitigate the risk by implementing higher interest rates to the borrowers. It is common for shipping firms to hedge against risk, by adopting a policy that combines the advantages of both fixed and variable interest rates. (G. Carmichael and B. Handford, 2014). The integration of both Fixed and Variable Rates Loans allows a hybrid approach that lessens the risks of the volatility, capital saving when rates are low and, simultaneously, support an effective budgeting plan, cost control and a quicker adaptation to changing market conditions. However, the inclusion of both borrowing ways can arise confusion and disorganization.

Shipping firms that apply this method must strategically clarify the purposes in the cost behavior policy, assess the potentiality and threats and successfully convey them internally. The comprehension from the workforce must be successful in order to precisely deliver the policy and gain the advantages of both borrowing methods.

Flexible Debt Structuring

Building on the advantages of combining fixed and variable interest rates, shipping firms also employ flexible debt structuring to adapt borrowing terms in line with market fluctuations and revenue conditions. Specifically, flexible debt structure allows companies to re-negotiate the terms aligned to their debt obligations with their current sources of revenues. For instance, during periods of collapse, companies often re-negotiate to extend the repayment period or secure a temporarily reduced monthly interest rate to minimize cash outflow. Flexible debt structure is based on the possibility of negotiation while it also depends on the historical credibility.

Furthermore, during the stage of collapse, shipping companies negotiate the incorporation of a grace period, which allows for additional time beyond the initial deadline. This period permits deviation from the original payment plan. This term can be incorporated on the day of loan approval through mutual agreement between the lender and borrower. The acceptance of this terms is mostly based on the credibility and repayment ability of the borrower.

Conclusions and Implications

The inherent cyclical nature of shipping industry requires resilience and effective strategy that ensures stability. Employing techniques that combine both fixed and

variable interest rates in debt structure enables shipping companies to keep budget predictability and cost saving, in balance. However, this approach requires careful guidance and internal communication in order to turn out effective. Additionally, flexible debt structure provides favorable changes in the repayment method based on the market conditions and level profitability. This enables shipping companies to mitigate liquidity pressures.

Consequently, together those strategies assist firms to navigate financial volatility, reducing risk and maintaining sustainability. The alignment of debt structure in accordance to the market and profits conditions is substantial for the company's better position and long term future growth.

Convertible Debt

Building on flexible debt structuring strategies, convertible debt offers shipping companies an alternative means to alleviate financial strain by transforming debt obligations into equity, thus reducing immediate cash outflows and enhancing liquidity during periods of distress. (Heckert, 2015, KPMG Germany). Shipping companies tend to either issue bonds or notes to investors as a method to directly access capital. (Drobtz, Ehlert, Schröder, 2021). This increases the company's debt obligations, causing financial pressure. During periods of downturns and at a later time, the debt can be incorporated in the company's equity, obtaining part of the ownership. (Heckert, 2015, KPMG Germany). This method exempts the company from repaying the initial borrowed capital, ultimately preventing cash outflows and providing financial breathing room. This strategy is often employed during periods of low profitability and financial distress. An example of the application of this method could be the Israeli shipping company, ZIM Integrated Shipping Services.

4.1.4 Conclusions, Implications and Results

Within the inherent cyclical behavior of shipping industry, shipping companies prioritize sustainability, operational continuity and constant growth. As analyzed in the previous sections, the key foundations that shipping companies develop are focused on Operational Efficiency, Expansionary and Risk Mitigation Strategies and Debt Structuring. Those key elements not only strengthen the company's position and preparation for all the phases of shipping volatility, but create necessary surplus to build cash reserves and in turn contingency funds, key factors that for sustainability.

The strategies that focus on Operational Efficiency mainly aim to control costs, boost productivity, facilitate operations and in turn maintain the profitability. This can be achieved through fuel efficiency, regular maintenance, technological updates and optimization of Asset utilization. Those approaches minimize unexpected costs helping to create cash reserves that serve as a shock absorber in difficult times enabling the company to withstand any possible financial pressure. (Johansen, 2021). Additionally, beyond approaches on the Operational Efficiency, shipping companies tend to mitigate the effects of single-market collapse by expanding their activities in different economic areas. In particular, diversifying their income sources lessens their reliance on freight rates, enabling them to foster financial stability and boost their cash reserves and contingency funds. As a consequence, any disruption that could cause a financial distress is now better managed internally.

Within the framework of cost management, shipping companies also emphasize Debt Structuring. A strategic balance of fixed and variable interest rates offers cost predictability and flexibility, while adaptive repayment terms, such as grace periods, extensions or/and convertible debt alleviates the pressure during economic slowdown contributing to the overall liquidity. Liquidity is closely connected to cash reserves and contingency funds enhancing the company's ability to manage operational costs and unexpected financial strains.

In conclusion, Operational Efficiency, Revenue Diversification and Flexible Debt Structuring aim to effectively contribute to cash management, contingency fund and cash reserve accumulation. Through these interlinked approaches, shipping companies are strongly positioned to navigate disruptions, ensuring financial stability and effective operations.

Financial Reserves and Contingency Funds

As discussed above, Financial Reserves and Contingency Funds are mainly a result of different approaches in the framework of cost management within shipping volatility. In the context for a profound understanding, the following paragraphs provide thorough aspects of these terms.

Building Financial Reserves

The cyclical nature of the shipping industry encourages the adaption of risk-hedging policies. A robust level of cash reserves can re-assure long-lasting sustainability, even in periods of low profits or unplanned financial damages. In practice, periods of high

cash inflows facilitate the strengthening of this approach while enabling companies to build stronger reputation and providing financial security among their stockholders. (Conway, 2012). High cash reserves attracts more investors, by providing confidence in the company's capability to repay debts, while brings more initiatives in new acquisitions and upgrades in operational efficiency.

Companies with stronger liquidity not only maintain operational stability but also capitalize on market opportunities during recovery phases, further strengthening their market position. (YEO, 2016). Therefore, even during trough and collapse stage, the operation of the company can remain sustainable, supported by the existing liquidity. In conclusion, high liquidity rates bring trustworthiness, new investments, and a positive reputation, all of which reinforce the company's competitive advantage in the market and longevity.

Contingency Fund

Reserving a financial safety net enables a shipping firm to manage unexpected expenses or emergencies effectively, supporting its sustainability. Particularly, establishing a Contingency Fund with reserved funds is an effective strategy to ensure seamless and long-lasting operations. Contingency Funds serve as shock absorbers and they are designed to address emergencies without obstructing the daily operations. (AngelOne). As outlined previously, due to the volatility of shipping market, cash reserves are crucial for ensuring the coverage of unexpected cost such as damages, regulatory costly changes, operational disruptions or/and human mistakes, that result in financial distress. Establishing well-funded contingency reserves, companies are well prepared to respond to emergencies and secure a strong presence.

CHAPTER 4:

5.1. Integration of Monitoring, Scenario Planning and Stress Testing for Strategic Decision-Making

In the previous sections, it was examined how shipping companies formed their operating cost behaviors, throughout different stages of shipping cycles. The management of fixed and variable costs, asset utilization methods and cost management laid a foundation that enabled to further deepen on strategic financial resilience and adaptability. Comprehending those principles, the following section will focus on the financial monitoring and budgeting during the shipping stages, proving aspects of

financial decisions and Key Performance Indicators. In addition to that, monitoring and budgeting can be solidified by careful scenario planning that prepares shipping companies to assess possible outcomes and events, by implementing different strategies and models in order to support resilience and long-lasting progress.

5.1.1. Financial Monitoring and Budgeting

Building on the aforementioned cost behaviors, effective financial monitoring and budgeting now emerge as crucial component. Shipping companies are subject to constant fluctuations in revenues and costs, mandating a thorough monitoring of cash account and systematic budgeting. Key Performance indicators (KPI) are essential in keeping successful monitoring and budgeting. In particular, KPIs are measures employed to assess and quantify the performance of the company towards its goals, by breaking down operational efficiency, costs and revenues resulting in profits and overall financial outlook. Indicatively, the following KPIs, relevant to shipping activities, are the most important while they signify the position of the company.

Freight rates, which are the main source of income for shipping activities.

On-Hire and Off-Hire periods, which indicate the efficiency and utilization of assets

Operating Costs, which are divided to Fixed and Variable Costs.

EBITDA/Fixed Costs Ratio, a metric which indicates the company's capability to cover fixed costs from the profits generated.

Financial Monitoring and Budgeting in different shipping phases.

Trough Stage

As discussed in the first chapter, trough stage is a challenging period that shipping companies strive for their survival. The demand for shipping services is considerably low, resulting in underutilization of vessels' capacity. To address the unfavorable market conditions, decisions related to laid-up of vessels are taken in order to minimize fixed cost and retain a positive cash account. At this stage, financial monitoring is essential and concentrates in cost-cutting measures, lowering operational expenses and deactivating valuable assets. Those methods are implemented in order to minimize fixed costs, preserve liquidity and manage obligations. The focus on Financial Monitoring and Budgeting is to provide sustainable solution to keep the liquidity in a sustainable level to ensure the company's strong positioning.

Indicative Example: In 2008, during global economic downturn, Diana Shipping Inc. faced a significant decline in freight rates from \$45.000 to \$25.000 per day, leading to

a significant financial stress. The total costs, Fixed and Variable costs, became equivalent to the total revenues making the re-evaluation of the budget a necessity. In particular, Diana Shipping Inc. renegotiated pricing contractual terms with its suppliers and postponed investments. The main goal was to drop the cost ratio below 1.0, a measure demonstrating that earnings exceed the total expenses.

Recovery Stage

During the periods of recovery, a gradual rebound of market conditions is noted by an increase in demand for shipping services. Higher demand leads to higher freight rates and in turn leads to the reactivation of laid-up vessels. The confidence progressively grows and shipping firms begin to invest in maintenance, technology and upgrades in order to optimize their operational capacity and overall performance. At this phase, financial monitoring includes data analysis on the ongoing market's trend in order to assess different investments opportunities and ensures long-lasting market's recovery. Careful attention on the right investing timing is prioritized, under financial monitoring, ensuring a balanced and calculated cash expenditure.

Indicative example: After the market's signs of recovery at 2010, Tsakos Energy Navigation experienced an increase in freight rates to \$35.000 per day resulting in the overall higher earnings from the operational activities. After executing a financial monitoring and budgeting control through the evaluation of the market's condition and the current profitability, the shipping company invested in technology to improve fuel efficiency, expecting significant savings per day, accurately calculated, based on the continuity of market's growth. The decision was taken after analyzing the interaction of events, such as rising trading demand, predicted trends, current earnings and possible outcomes for the investment

Peak Period

During peak periods, the demand for shipping services reaches an exceptional high level resulting to an outstanding high freight rates, possibly up to 10 times higher than the operational costs. Due to the intensity of cash inflows, shipping companies proceed to massive investments, ordering new vessels (New-Built or Second Hand) in order to keep up with the market's demand and increase their operational capacity, aiming to obtain a bigger share in the market. However, excessive expenditures and investments carry the risk of causing another recession due to overcapacity. Key Performance indicators (KPIs) can be vital in protecting the company from overinvesting or capital overspending, after forecasting the upcoming downturn due to overcapacity.

Additionally, They can provide useful insights of market's decline development, urging the company to sell expensive assets at the peak stage at the highest price, before the market commences to transition to the collapse stage.

Indicative example: During the peak period between the years of 2007 and 2008, Maersk Lines experienced a surge in demand for shipping transportation, enabling the company to proceed to fleet expansion in order to respond effectively. However, considering the risk of overcapacity, Maersk analyzed several KPIs, such as Vessels Utilization rates and EBITDA margins, in order to mitigate the risks of overexpansion, ensuring long-term growth. The company's preventive measures to get prepared for the upcoming collapsing stage, contributed to rabid adaption of new strategies, such as leasing options providing flexibility and preparedness through a successful cost management and cost monitoring.

Collapse Period

The collapse period is followed after peak, mainly due to overexpansion, overcapacity, global economic recession, geopolitical tensions or occurrence of global unprecedented events, such as pandemic (Covid-19 in 2020). In contrast to the peak phase, during collapse periods, shipping companies actively compete with each other due to the lack of cargos to be transported. Less efficient and competitive vessels are not able to scale down their minimum acceptable daily freight rate, lacking the ability to follow the market's trend. Soon, this results to their final deactivation, leasing them directly to the demolition market. In the collapse stage, financial monitoring must be flexible to react in different market's condition with prepared and sustainable planning, such as liquidation of assets before the market shows sign of collapse, fast debt restructuring and possible acquisitions in order to strengthen the company's position and secure longevity.

Indicative example: After the peak in freight rates in the year of 2008, shipping companies experienced a phenomenal drop in their profit margins, necessitating immediate financial monitoring and different cost management approach. Number of companies, including Navios Maritime Holdings implemented cost-cutting measures and strategies to intensify liquidity, such as activities engaged in selling vessels, renegotiated debt terms with borrowing institutions and scaled down operating expenses in order to retain a sustainable account of cash reserves.

Short Conclusions

In conclusion, effective financial monitoring and budgeting enable shipping companies

to navigate the fluctuations of the shipping market, through the utilization of Key Performance indicators, important to ensure financial sustainability. These practices, including cost management provide a thorough framework to support company's seamless operations. The comprehension of these approaches enables the integration of scenario planning methodology that reinforces company's preparedness.

5.1.2 Scenario Planning and Risk Management

The use of scenario planning and risk management techniques is essential for handling uncertainties, such as rapid changes in fuel prices and other financial risks. Given the uncertainty of multiple factors, shipping firms employ different range of models and strategies in order to secure sustainable operations, such as scenario planning strategies. It enables shipping companies to refrain from financial consequences of demand and supply shocks, taking into account possible events and scenarios. (Nomikos and Tsouknidis, 2022). The following analysis will demonstrate how shipping firms hedge against the risks of uncertainty, using scenario analysis, employing variables and considering all possible series of events in the global market.

Sensitivity Analysis (Example of Fuel Price Increase)

Sensitivity Analysis is an essential tool, employed by shipping companies, in order to assess how different scenarios affect their performance in terms of profitability and operational efficiency. In the case of varying fuel prices, the evaluation of every possible event, such as an increase of 5% or 15% or 25%, is fundamental in order to detect how different scenarios impact the operational costs, profit margin and general profitability, closely linked to cash flows. Sensitivity Analysis assesses how different variables affect factors, such as fuel prices. The aim of this analysis is to establish measures to keep the profitability ratio, as stable as possible. (Constantin Luvesh). Thus, the analysis of possible events and the detection of sensitivities allow companies to identify their reliance. Awareness is a key component that reinforce company's position, assisting it to develop new strategies against potential challenges. For instance, following the assumption that the result of sensitivity analysis in fuel price terms increases by 25%, high dependence is evident, tightening profit margins. At this case, companies adjust their operating methods into low speed voyages and shift their focus on fuel efficient technologies that contribute to the reduction of fuel consumption. The integration of sensitivity analysis strategy is essential in retaining financial stability, promoting risk assessment analysis and preparing the company for any

unexpected event.

Monte Carlo Simulation - Fuel Price Example

Monte Carlo simulation uses probabilities, random sampling and statistical models to prepare and plan strategies for different scenarios. This method takes every possibility in future prices of fuel and depict the impact on operating costs and profit margins. Assessing and defining the likelihood of changes in fuel prices and the possible outcomes helps the company to react effectively in changes. This model contributes to having a clear and a more comprehensive outlook of possible trajectories, enabling the company to develop an optimal and well-prepared risk planning and decision making process.

Scenario Example in Fuel Prices

Due to the volatility in fuel prices, shipping companies seek to mitigate the effects of the uncertainty through the employment of Monte Carlo Simulation. It provides solid preparation for future fluctuations, paving the way for management strategy effectiveness. The steps of this model are the following: -

Step One: Defining the Variables

The Company observes historical ranges of fuel prices, as recorded in the past and considers the lowest and highest points. For instance, the lowest scenario is \$2.5 per gallon and the highest \$5.0 per gallon. The company also utilizes recent data to monitor fuel consumption per voyage, depending on route, weather conditions, ship size and weight. The numbers of this observation are incorporated in the simulation, from the highest to the lowest point. Let's assume that the consumption ranges between 100.000 to 200.000 gallons per trip.

Step Two: Assigning Probability Distributions

This model is based on expected variability upon likely future fuel prices. For instance, shipping companies set presumptions of a normal distribution that stands \$4.00 with a possible deviation range of \$0.80. Similar approach is followed for setting a normal distribution of fuel consumption per voyage, centered to 120.000 gallons, with a deviation of 5.000 gallons.

Step Three: Running the Model

Shipping companies run numerous possible variable combinations (simulations), such as fuel prices and fuel consumptions, ending up to the total fuel cost for a typical voyage

Step Four: Analysis of Results

After successfully running possible combinations, the focus shifts to a more narrowed

range of fuel prices. For instance, results may demonstrate the following:

70% Probability:

Total fuel costs are estimated to range between \$8 million to \$10 million.

20% Probability:

Total Fuel costs are estimated to exceed 10 million which is related to higher costs and consequently to higher risk.

10% Probability:

Total Fuel costs are estimated to be lower than 8 million which indicates low expenses and less risk.

Step Five: Decision-Making

Decisions are taken based on the aforementioned results and firm's policy in risk-tolerance. In case the results demonstrate an upward price tendency, shipping companies usually endeavor to hedge against the risk by proceeding to agreements in reserving and locking current fuel prices. On the contrary, if the perceived risk is not high but at the same time, fuel prices are likely to fluctuate upwards, some shipping companies may invest and upgrade their hull and mechanical fleet's parts in order to optimize their vessel's sailing ability. Additionally, shipping firms define a budget as a security amount, intended to be used only in case of results deviations and unexpected developments.

Short Conclusions

In conclusion, Monte Carlo Simulation assists the comprehension of how different variables closely affect the firm's operations. The model provides potential scenarios of how prices and variable can fluctuate, preparing the strategies of shipping companies. The preparation is crucial while it reduces financial risks, damages, enabling to the adaption and rabid practices adjustments.

Stress Testing in Currency Volatility

Stress testing is a technique used by companies in order to test their performance within an unstable environment. The shipping industry is subject to many fluctuations, making the potential outcome unknown. In particular, the volatility of different currencies affect the firm's activities, finances and overall performance. The Stress Testing technique is used through the following specific steps that assist its applicability.

Step One

Shipping companies narrow down their analysis, by defining the currencies that they mostly make the transactions. Any possible currency fluctuation affect the overall

financial outlook of the company.

Step Second

At this step, companies analyze previous data, assessing how currencies reacted to global changes, such as geopolitical tensions, stock market developments, economists' forecasts and psychological factors (Market's optimism or pessimism). They usually assume extreme or moderate scenarios in order to prepare against the riskiness and exposure of uncertainty.

Moderate scenario: US Dollars value drops by 10% against EUR.

Extreme Scenario: US Dollars value rises by 25% against EUR.

Step Third

The third step includes the evaluation of the impact in various scenarios. The operational activities are affected in the event of currencies fluctuation, which cause immediate disruption in transactions with international clients. Also, contracts expressed in foreign currency terms are affected and must be modified in order to mitigate the impact of damage. Additionally, shipping firms evaluate the degree of the effect in the operating expenses, such as fuel costs and re-adjustment of crew salaries, unless paid in different currency. The third step usually contains an analysis of the impact on internal debt obligation to foreign institutions or third parties, operating under different currency. By quantifying those effects, shipping companies are able to prepare actions.

Step Four

At this step, the company makes assumptions and create different scenarios, simultaneously occurred, measuring the total effects. For instance, in the event of EUR depreciation followed by US dollars appreciation. The results provide crucial guidelines in handling possible risks and different scenarios combined. A commonly used strategy is holding different currency reserves to hedge against the risk of fluctuations.

Step Five

Going through all the previous steps and running different scenarios, shipping companies gather all the information and end up to some crucial conclusions, assisting them to identify their weak points. The identified vulnerabilities contribute to the development of strategies that focus on the following:

Hedging against risks.

For example, the incorporation of specific terms in the contracts and agreements,

explicitly state the possibility of price re-adjustments in the event of future currency fluctuation in comparison to another specific currency.

Accepting transactions in different currencies.

Holding cash reserves in different and more stable currencies fortifies the company's financial stability and make it less dependent on domestic economic downturns.

Avoiding volatile currencies.

Companies might cease the acceptance of specific currencies due to some geopolitical events, domestic political instability or domestic economic pessimism that can significantly affect the value of the currency. Subsequently, the step five is crucial in determining the selection of proper financial strategies, changes in policies and the development of contingency planning, which prepares the company for potential series of events, successfully mitigating the impact.

Short Conclusions

In conclusion, Stress Testing is an essential strategic tool that enables the companies to lessen the effects of fluctuating variables, helping to develop advanced techniques for every possible outcome. The development of contingency planning reduces the reliance on the unprecedented changes and solidifies the financial stance of the company.

Interrelations Conclusions and Implications

As discussed in the previous sections, the characteristics of shipping cycles, the insights of Asset Life Cycle and Fixed/Variable Costs, including the methods on Cost Management cover a wide range of strategic considerations, essential for navigating market volatility. Based on these principles, including the aspects of Financial Monitoring, Scenario Planning and Stress Testing provides a wide solidified approach that reinforces the resilience of shipping companies within the cyclical volatility. These practices, when used together, transform reactive management into proactive.

Financial Monitoring and Budgeting

Key Performance Indicators are key elements to monitor real-time data and support shipping companies with the right financial decisions. For instance, KPIs indicate the necessity for cost-cutting measures, during the trough stage. On the contrary, during peak periods, they show potential possibilities in investing but also linked threats, such as overcapacity. This ongoing financial oversight builds on the thesis's analysis of fixed and variable cost management that shipping companies have followed based on their financial situation and market's positioning.

Scenario Planning

Scenario planning is essential within the operation of shipping companies. They leverage data from financial monitoring and run various simulations for possible outcomes. Changes in fuel prices, demand and market's needs are considered while it proactively develops internal mechanisms to deal with any potential change. In shipping, those mechanisms are often oriented towards fuel efficiency strategies and technological updates. Scenario Planning develops Contingency Plans that fortify the company's resilience in any possible outcomes/event. For instance, if scenario planning reveals a high sensitivity to fuel price fluctuations, a company can proactively mitigate this risk through route optimization or upgraded technology investments. As discussed in the previous sections, those techniques are built on cost-saving measures and Asset Efficiency.

Stress Testing

Stress Testing is a managerial technique that evaluates the possible outcomes after extreme scenarios. This strategy measures the company's resilience in severe outcomes that closely affects the operational costs and profitability. The example given, was the currency fluctuation that could disrupt the operational functionality of the organization. Through this approach, companies are able to identify their weak points in their financial structure and start employing diversified techniques to mitigate the consequences and prevent financial damages.

Integration

Those practices together build a cohesive internal system that provides real-time data, possible outcomes, contingency plans and preventive actions. Financial monitoring offers valuable data that contributes to decision making, scenario planning provides flexibility and stress testing reveals the company's resilience and weak points. The employment of these strategies enable shipping companies to successfully navigate the market cycles by adapting methods that fostered rapid shifts.

CHAPTER 5: HYPOTHESIS

Integrated Financial Resilience: A Multi-Tool Hypothesis for Navigating Shipping Market Cycles

At this chapter, the development of the following hypothesis will strengthen the findings and results of the previous analysis. Tools, such as Operating Leverage, Break-

Even Analysis, Methods of Management, Monte Carlo Simulation, will verify the insights discussed, with practical approaches.

Hypothesis: “Shipping companies that effectively include Operating Leverage, Break-Even Analysis, diversified revenues techniques (specifically, Fleet diversification and Fuel efficiency), flexible debt structuring can achieve long-lasting sustainability and resilience throughout the years of shipping cycles. These strategies are interrelated and if used efficiently, offer strategic resilience against the market volatility. These strategies enable shipping companies to build a more solid financial structure that favors liquidity and assists to maintain profitability across various market stages. Additionally, the integration Monte Carlo Simulation strengthen this framework, providing scenario planning techniques that deepen on possibilities enabling a better preparedness. These combined approaches are expected to build a strong system that secures liquidity, avoids financial setbacks and supports steady cash flows, fostering long-lasting sustainability and competitive advantage.”

This study uses a quantitative methodology to test the results of this hypothesis. In particular, the utilization of real numbers and figures from the market in Operating Leverage, Break-Even Analysis and diversified Cost Management enables to ascertain the implication of the hypothesis. Key financial metrics, such as Fixed and Variable costs from market’s key players (Maersk, Hapag-Lloyd and ZIM) reveal the sensitivity in revenues fluctuations, while the integration of Operating Leverage and Break-Even techniques provide insights of cost minimization and maximization of profit. Cost Management is also analyzed in the form of fleet diversification and fuel efficiency. It provides practical insights of their contribution. Finally, Debt structuring is reviewed for liquidity impacts, assessing the impact of fixed and variable interest rates. It provides a practical view of structural debt management, emphasizing the positive outcomes by demonstrating the positive impact of a combined fixed and variable borrowing interest structure. In addition to that, Monte Carlo simulations model is also employed to realistically profit stability under varied scenarios, allowing for proactive risk management.

6.1. Operating Leverage (DOL) and Break-Even Point (BEP)

Building on this hypothesis, this section describes the practicality surrounds the Operating Leverage and Break-Even Point, as key indicators of measuring company’s

financial resilience. By analyzing fixed and variable costs reveals the cost sensitivity which its understanding enables performance optimization across various shipping cycles.

6.1 (I) Operating Leverage (DOL)

Operating leverage measures the sensitivity that a company has in its operating income from changes in sales. Capital intensive industries, like shipping, are subject to high fixed costs, such as depreciation, interest rates from borrowing and regular maintenance, following standard procedures, such as Dry Docking and Special Survey. The following model employs approximate figures from A.P. Moller – Maersk A/S.

DOL = CONTRIBUTION MARGIN/OPERATING INCOME, OR

DOL = SALES-VARIABLE COSTS/EBIT (OPERATING INCOME).

The result of this mathematical equation depicts the change in percentage, in the operating income, similar to the percentage change in sales, deducting variable costs. The result of the equation provides clear insights about the cost structure of shipping companies.

Applying data from Maersk (2022), the estimated number results are the following:

Revenues: \$81.5 billion

Fixed Costs (Depreciation&Amortization): \$6.19 billion

Variable Costs (estimated at 60% of revenues): \$48.92 billion

EBIT (Operating Income): \$30.86 billion

CONTRIBUTION MARGIN

= \$81.53B – \$48.92B = \$32.61 billion, DOL = 32.61/30.86=1.06.

Explanation

The degree of Operating Leverage for Maersk shows that any change in revenues that amounts to 1%, change the operating income by 1.06%. This happens because fixed costs stay the same as sales grow. When revenue rises, the extra income from each sale, after covering variable costs, mostly adds to profit, since fixed costs do not increase. This result demonstrates that Maersk is dependent on high fixed costs, such as vessel depreciation. Essentially, Maersk can take advantage of periods of high demand to

spread fixed cost across the intensity of the operations while it can also maintain an effective cost control to prevent losses. While DOL is based on estimated variable costs, the methodology is effective enough to still allow slight deviations. In essence, fixed costs do not fluctuate with sale, thus any additional revenues contributes to profits.

Example of High dependence of Fixed Costs (Depreciation Example) Depreciation is the major and inevitable fixed cost for shipping companies, as resulted from the use of their non-current assets, such as vessels. Effective management and consideration of assets depreciation ensures that companies can maintain profitability and positive value of their assets. At this example, we will employ data from Maersk' financial report (2022). As mentioned, due to its fleet size, the fixed costs remain high. The number of depreciation exemplifies the economic burden that the company has to sustain, annually.

Straight-Line Depreciation Formula:

Depreciation Expense = Acquisition Cost – Residual Value / Years of Useful Life. This depreciation formula gives the annual depreciation expense which enables the shipping firms to effectively plan their fleet renewal and capital expenditures.

Application of Data: Maersk

Initial Cost of Fleet \$93.68 billion

Residual Value: \$10 billion

Useful Life of Vessels: 25 years (Est.)

Annual Depreciation Expense=

93.68 billion – 10 billion / 25 = \$3.35 billion annually.

Explanation: Maersk undergoes a depreciation expense at \$3.35 annually, which represents the company's impact on the operating income and on assets reduction in value. Strategic fleet renewal and capital investments, Maersk mitigates the impact of depreciation, improve the performance in the financial statements and its profitability in the income statement.

6.1 (II) Break-Even Point (BEP)

Break-Even analysis is an extremely useful quantitative tool that defines the numbers of units that must be transported in order to cover the fixed and variable costs, such as depreciation, insurance, fuels etc. Break-Even point signifies the point whereby the companies manage profitability. As the shipping industry is a capital intensive, Break-

Even analysis helps shipping companies to achieve fleet utilization and operational cost reductions.

Formula for Break-Even Point (BEP)

BEP =

FIXED ASSETS/ (FREIGHT RATE PER UNIT – VARIABLE COSTS PER UNIT).

The formula calculates the minimum number of containers or voyages that have to be transported or performed to cover fixed and variable costs.

Applying data from ZIM Integrated Shipping Services Ltd. (2022), the estimated number results are the following:

Fixed Costs (Depreciation and Amortization 2021) which amounts to \$774.7 million.

Other fixed costs amount to \$1.5 billion.

Total Fixed Costs = \$2.2747 billion.

Average Freight Rate per Container (Est.): \$1.000.

Variable Costs per container (fuel, crew): \$250 (Industry Average).

$BEP = 2.2747 / (1.000 - 250) = 3.0$ million containers. In conclusion, ZIM must transport roughly more than 3.0 million containers annually in order to preserve its profitability and cover all of its cost. This BEP number underscores the dependence of ZIM to increased operational volumes. Due to the inherent cyclical volatility which results in different freight rates, ZIM should reduce its reliance, by refining its cost structure.

6.1 (III) Conclusions/Implication/Results

The analysis of ZIM's and Maersk's Operating Leverage and Break-Even Point verifies the theoretical insights from the first sections. As a result of the high amount of fixed costs, Maersk has High Operating Leverage. As the commercial activity intensifies, the fixed costs are spread over great volumes. In particular, the degree of Operating Leverage for Maersk shows that any change in revenues that amounts to 1%, change the operating income by 1.06%, and mainly because fixed costs stay stable as sales increase.

In addition to Maersk' numbers, the mathematical equation expressed the high fixed costs of ZIM' Break Even Point, underlying the minimum amount of containers that must be annually transported in order to maintain profitability. (3.0 million). This BEP number underscores the dependence of ZIM to increased operational volumes. During the cyclical changes, it is essential for high-leverage shipping companies to effectively capitalize economies of scale, as a way to lessen the effect of high fixed cost. On the contrary, in trough phases, managing break-even thresholds becomes critical to mitigate

financial strain. Hence, the strategy towards cost structure is substantial for cost optimization, important element to sustain the profitability.

6.2. Methods of Cost Management

6.2. (I) Operating Efficiency

(Example: Fuel efficiency through route optimization, regular hull maintenance)

As mentioned in the theoretical parts, implementing operational efficiency strategies, can significantly lessen the operating costs and contribute to greater volume of cash reserves. The following part will develop a mathematical proof which will verify the cost saving technique in fuels, through route optimization and regular hull maintenance. Firstly, we will define the variables, as following:

FC: Fuel Consumption (in metric tons), **FP:** Fuel Price (per metric ton),

DFC: Daily Fuel Cost, **AFC:** Annual Fuel Cost, **FSP:** Fuel Savings Percentage, **AFS:** Annual Fuel Savings (annual savings from reduced fuel consumption), **MC:** Maintenance Cost (annually) and **NAS:** Net Annual Savings.

Specifically, some of the variables are calculated according to the following mathematic equations:

DFC (Daily Fuel Cost): $DFC = FC * FP$

AFC (Annual Fuel Cost): $AFC = DFC * 365$

AFS (Annual Fuel Savings): $AFS = AFC * FSP$

NAS (Net Annual Savings): $NAS = AFS - MC$.

Subsequently, in order to verify the initial implications, we proceed to the formation of the following assumption, based on the market standards:

Fuel Consumption: A large container ship consumes approximately 150 metric tons of fuel per day.

Fuel Price: As of November 2024, the average price of marine fuel is \$600 per metric ton.

Fuel Saving Percentage: Implementing optimized routing and regular hull maintenance can lead to a 5% reduction (range 5%-7%) in fuel consumption. (IMO Study on Greenhouse Gas Emissions, 2020.)

Maintenance Cost: Annual hull maintenance costs are estimated at \$500,000 (range \$500k – \$700k).

Selecting all the numbers from logistical assumptions and defining the calculation methods, we proceed to the final results. (American Bureau of Shipping, Maritime Cost Analysis Report, 2022).

DFC (Daily Fuel Costs) = 150 Tons per day * \$600 per ton = \$90k per day.

AFC (Annual Fuel Costs) = \$90k per day * 365 days = \$32.85 million per year.

AFS (Annual Fuel Savings) = \$32.85 million * 0.05 = \$1.643 million per year.

NAS (Net Annual Saving) = \$1.643 million - \$500k = 1.143 million per year.

Before culminating into conclusions, we summarize the results in the following Table:

| VARIABLES | RESULTS |
|-------------------------------|----------------------|
| Fuel Consumption (FC) | 150 metric tons |
| Fuel Price (FP) | \$600 per metric ton |
| Daily Fuel Cost (DFC) | \$90k |
| Annual Fuel Cost (AFC) | \$32.85 million |
| Fuel Savings Percentage (FSP) | 5% |
| Annual Fuel Saving (AFS) | \$1.643 million |
| Maintenance Cost (MC) | \$500k |
| Net Annual Savings (NAS) | \$1.143 million |

The implementation of optimized routing contributes to fuel savings and in turn to the increase of annual savings. These measures not only reduce fuel consumption but also enhance operational efficiency and profitability.

6.2. (II) Expansionary Strategy

(Revenues diversification - Leasing and Fleet Diversification Examples)

6.2. (II) 1. Leasing

The strategy of leasing is very effective in maintaining financial stability and securing regular and steady cash inflows. This approach is essential during the market volatility, especially during downturns. The following example specifies the variables, as following:

(LP): Monthly Lease Payment, (MCR): Market Charter Rate (Revenues), (OC): Monthly Operational Costs (Expenses) and (ME) Missed Earnings that could have potentially been earned during peak periods. Recent market reports from sources like Clarksons Research, Drewry, or BIMCO, revealed the approximate numbers that reflect the reality for Panamax or Post-Panamax container vessels.

(LP): Lease Payment = \$200k per month

(MCR): Market Charter Rates:

Trough \$150k, Collapse \$100k and Peak \$350k per month.

(OC): Operating Costs: \$80k per month.

In the following calculations, it will be proven that leasing strategies secure steady cash flow but sacrifice profits that could have potentially been earned, during the peak phase of shipping cycles.

Leasing Cash Flows per month (LCF) = LP + OC = \$200k + \$80k = \$280k.

Cash Flow per month (OCF):

Trough: \$150k - \$80k = \$70k

Collapse: \$100k - \$80 = \$20k

Peak: \$350k - \$80k = \$270k

Missed Earnings from Leasing during Peak Phase:

$MCR_{peak} - LP = \$350k - \$150k = \$150k.$

The following table depicts the numbers and results, as mentioned above.

| PHASE | CHARTER RATE(EST.) | LEASE PAYMENT | OPERATIONAL COSTS | NET INCOME | COST OF LEASING | MISSED EARNINGS |
|----------|--------------------|---------------|-------------------|------------|-----------------|-----------------|
| TROUGH | \$150k | \$200k | \$80k | \$70k | \$280k | \$0 |
| COLLAPSE | \$100k | \$200k | \$80k | \$20k | \$280k | \$0 |
| PEAK | \$350k | \$200k | \$80k | \$270k | \$280k | \$150k |

In summary, leasing strategy provides great liquidity stability, following a more risk friendly pattern while it might sacrifice important profits, during peak market performance.

6.2. (II) 2. Fleet Diversification: Reduction of Risk

As mainly noted in the theoretical section, fleet diversification is an effective strategy to successfully deal with different shipping phases for each section within the shipping industry. It is known that the wet shipping sector experiences different years of trough, recovery, peak and collapse, compared to liner and dry bulk shipping. Hence, the diversification of the fleet composition enables the companies to counterbalance downturns in one segment with more stable or profitable operations in another. By adopting a strategy of diversified fleet, companies can better sustain their overall performance, mitigating the negative impact of market volatility, ensuring that their

operations in sectors experiencing downturns remain supported. Given the nature of Hapag-Lloyd's operations, the company's vulnerability to fluctuations in liner shipping freight rates is taken into consideration. The company's dependence on liner freight rates is high, causing an impact its revenue stability, profitability, and capacity to navigate market volatility effectively. On the contrary, Maersk operates a more diversified fleet, which includes container ships and other segments, reducing the impact of market fluctuations in a single sector. In the following methodology, applying the correlation coefficient enables shipping companies to assess vessel selection for fleet diversification across different sectors.

Mathematical Calculations using Correlation Coefficient

The correlation coefficient measures, how closely the returns of two segments (such as container shipping and bulk shipping) move together.

$$R = \frac{\sum (X_i - X) * (Y_i - Y)}{\sqrt{\sum (X_i - X)^2 * \sum (Y_i - Y)^2}}$$

X_i & Y_i = Returns from different shipping Segments,

X & Y = Aver. Returns for each segment.

Hapag-Lloyd / Data Application (YEAR 2022)

Considering that Hapag-Lloyd is heavily reliant on liner shipping industry, we will compare returns from container and bulk shipping.

| YEAR | Container Shipping (X) | Bulk Shipping (Y) |
|------|------------------------|-------------------|
| 2018 | 12% | 8% |
| 2019 | 9% | 6% |
| 2020 | (3)% | (5%) |
| 2021 | 18% | 10% |
| 2022 | 14% | 7% |

STEPS:

Calculating the average returns

$$X = (12 + 9 + (3) + 18 + 14) / 5 = 10\%, Y = (8 + 6 + (5) + 10 + 7) / 5 = 5.2\%$$

Deviation from the mean

For X:

$$X_1 - X = 12 - 10 = 2 \mid X_2 - X = 9 - 10 = -1 \mid X_3 - X = -3 - 10 = -13 \mid X_4 - X = 18 - 10 = 8 \mid X_5 - X = 14 - 10 = 4.$$

For Y:

$$Y1 - Y = 8 - 5.2 = 2.8 \mid Y2 - Y = 6 - 5.2 = 0.8 \mid Y3 - Y = -5 - 5.2 = -10.2 \mid Y4 - Y = 10 - 5.2 = 4.8 \mid Y5 - Y = 7 - 5.2 = 1.8.$$

Squared Deviations

For X:

$$(2)^2 = 4 \mid (-1)^2 = 1 \mid (-13)^2 = 169 \mid (8)^2 = 64 \mid (4)^2 = 16$$

$$\text{Sum of squared deviations for X} = 4 + 1 + 169 + 64 + 16 = 254.$$

For Y:

$$(2.8)^2 = 7.84 \mid (0.8)^2 = 0.64 \mid (-10.2)^2 = 104.04 \mid (4.8)^2 = 23.04 \mid (1.8)^2 = 3.24$$

$$\text{Sum of squared deviations for Y} = 7.84 + 0.64 + 104.04 + 23.04 + 3.24 = 138.80.$$

Product of Deviations

Multiplying each deviation for X and Y:

$$2 * 2.8 = 5.62 \mid (-1) * 0.8 = -0.8 \mid (-13) * (-10.2) = 132.6 \mid 8 * 4.8 = 38.48 \mid 4 * 1.8 = 7.24.$$

Sum = 5.62 + (-0.8) + 132.60 + 38.48 + 7.24 = 183. After following all the above, steps, we have gathered all the necessary data to calculate the **Correlation Coefficient**:

$$R = 183 / \sqrt{(254 * 138.8)} = 183 / 187.68 = 0.975 \sim 1. \text{ **Strong Positive Correlation.**}$$

The correlation coefficient (R) ranges between -1 and +1. In particular, R=1 signifies positive correlation, R=0 no correlation and R=-1 negative correlation. Given the examples from liner and bulk shipping companies, we previously observed that the years of shipping cycles were identical (Trough 2015, Recovery 2017, Peak 2021, Collapse 2022). Ending up to strong correlation, strong positive correlation between container shipping and bulk shipping is verified.

As mentioned in the theoretical part, fleet diversification provides financial stability while one segment can financially support the other, while the years of shipping stages for each shipping sector differ. Therefore, it is reasonable to compare the tanker sector

with the container sector. The goal of the following methodology is to provide a more practical approach. The following key variable will facilitate the verification of the implications.

Rcontainers: Revenues from containers,

Rtankers: revenues from Tankers,

TR: Total Revenues = Rcontainers + Rtankers,

Econtainer: EBITDA (Earnings before Interest, Taxes, Depreciation, and Amortization) from containers,

Etanker: EBITDA (Earnings before Interest, Taxes, Depreciation, and Amortization) from containers,

TE: Total EBITDA = Econtainer + Etanker

Reserves: Reserves after covering operating needs

Ctotal: Operating total costs

RCR: Reserve Coverage Ratio = Reserves / C total

In addition to the variables, it is essential to classify the stages of each shipping sector.

Wet Shipping Sector.

Trough Stage, 2017. (BIMCO Report, 2016)

Recovery Stage, 2020. (Baltic Exchange Investor Indices, 2023)

Peak Stage, 2021. Rico Sector (2023),

Collapse Stage, 2022. (Rico Sector, 2023)

Liner Shipping Sector.

Trough Stage, 2015. (UNCTAD, 2015)

Recovery Stage, 2017. (UNCTAD, 2018)

Peak Stage, 2021. (Greg Miller, 2021) and (UNCTAD (2021).

Collapse Stage, 2022. (Miller Greg, 2023)

Hypothetical estimates are employed for the facilitation of the methodology, as depicted in the following board.

Depiction of Revenues: Mutual Support across the stages

| Years | Shipping Stages (Liner) | Rcontainers | Shipping Stages (Wet) | Rtankers | TR |
|--------------|--------------------------------|--------------------|------------------------------|-----------------|-----------|
| 2015 | Trough | 30 | - | - | 30 |
| 2017 | Recovery | 40 | Trough | 15 | 55 |

| | | | | | |
|-------------|----------|----|----------|----|----|
| 2020 | - | - | Recovery | 20 | 60 |
| 2021 | Peak | 55 | Peak | 25 | 80 |
| 2022 | Collapse | 35 | - | - | 35 |
| 2023 | - | - | Collapse | 18 | 53 |

Considering the board above, we observe the followings:

2017: Despite the trough stage in the wet market (total revenues of 15), the liner section supports the overall operation, while the demand is recovering, contributing with a revenue of 40. This support counterbalances the declining performance of wet section, resulting in total revenues of 55.

2020: The tanker segment started to show signs of recovering, with a total revenues of 20. The contribution provides higher total revenues to the company, considering the recovering liner section in addition.

2021: Both segments are flourishing, significantly strengthening the overall profitability making this growth more sustainable.

In conclusion, one segment supports the other, proving long-lasting profitability, primarily driven by varying shipping forces across different years for each segment.

EBITDA Analysis: Profitability across the stage

EBITDA represents the operating profitability, before Interest, Taxes, Depreciation, and Amortization. It is a valuable tool that indicates the earned revenues from operations. Its consideration is a valuable tool to observe and examine the consistent profitability with mutual support from the different shipping sections.

| Years | Shipping Stages (Liner) | Econtainers | Market Stage (Wet) | Etankers | TE |
|--------------|--------------------------------|--------------------|---------------------------|-----------------|-----------|
| 2015 | Collapse | 8 | - | - | 8 |
| 2017 | Recovery | 12 | Trough | 5 | 17 |
| 2020 | - | - | Recovery | 7 | 19 |
| 2021 | Peak | 25 | Peak | 10 | 35 |
| 2022 | Collapse | 10 | - | - | 10 |
| 2023 | - | - | Collapse | 6 | 16 |

Considering the board above, we observe the followings:

2017: The Total EBITDA is generally considered low but supported by the ongoing recovery of liner segment. This provides essential breathing room, in contrast to companies that operate exclusively in the tanker sector.

2020: Tankers started to recover showing an increasing activity, while liner segment is still rising. The recovery of both sections solidifies the company's positioning, while the recovery becomes more sustainable.

2021: This is the year of maximum operating revenues, leading to maximum EBITDA thanks to simultaneously peak of both sectors.

In conclusion, the complementary aspect of EBITDA solidifies the importance of mutual support across different shipping stages.

Consistent Cash Reserves from Diversifies Fleet

Considering the boards above and as mentioned the theoretical parts, fleet diversification provides steady cash inflows that contribute to consistent cash reserves. The Reserve Coverage Ratio (RCR) indicates how stability in revenues contribute to sustainability of liquidity.

| Years | Shipping Stages (Liner) | Reserves | Ctotal | RCR = Reserves / Ctotal |
|--------------|--------------------------------|-----------------|---------------|--------------------------------|
| 2015 | Collapse | 30 | 20 | 1.5 |
| 2017 | Recovery | 50 | 20 | 2.5 |
| 2020 | - | 60 | 20 | 3.0 |
| 2021 | Peak | 70 | 20 | 3.5 |
| 2022 | Collapse | 40 | 20 | 2.0 |
| 2023 | - | 35 | 20 | 1.75 |

Considering the board above, we observe the followings:

During the years of 2015 and 2023 that signify the collapse of liner and tanker segments respectively, the RCR remains higher than 1.5 which indicates that steady operations revenues contributes to sufficient cash reserves. One segment support the operation of the other, maintaining liquidity. This is also approved throughout the years of 2017 and 2020. In particular, liner section shows recovery while tanker segment is in trough. However, the ratio is growing due to the mutual support. Lastly, the year of 2021 signifies the highest level of reserves when both segments peak.

In conclusion, the persistency in cash reserves, even in periods of low activity, ensures the sustainability of the operations.

Summary Tables / Implications and Conclusions

| Years | TR: Total Revenues | TE: Total EBITDA | RCR: Reserve Coverage Ratio |
|-------|--------------------|------------------|-----------------------------|
| 2015 | 30 | 8 | 1.5 |
| 2017 | 55 | 17 | 2.5 |
| 2020 | 60 | 19 | 3.0 |
| 2021 | 80 | 35 | 3.5 |
| 2022 | 35 | 10 | 2.0 |
| 2023 | 53 | 16 | 1.75 |

This analysis confirms that diversifying fleet, consisting of tankers and container ships provide financial resilience through steady cash inflows that contribute to the total cash reserves. In particular, when one sector is in the collapse stage, the other support its operations, considering that the stages between two sectors are influenced by different factors. The profitability remains stable throughout all the stages that enables shipping companies to plan their cost structure, contributing to a direct access to financing for future investing initiatives.

6.2. (III) Debt Structuring

In the following analysis, the aim is to prove that a hybrid approach in adapting Fixed and Variable interest rates in the Debt Structuring allows shipping companies to control cost more effectively. The variables used for this analysis are the following:

(FIR): Fixed Interest Rates (Percentage of Stable Interest Rate).

(VIR): Variable Interest Rates (Percentage of changing Interest Rate).

(TAD): Total Amount of Debt (Both Variable and Fixed Costs).

(CD): Convertible Debt to Equity.

Based on these variables and sources from Moody's Investor Service Reports, HSBC and Clarksons Research, we concluded to these numbers and figures, with approximate estimations that correspond to the market tendencies.

Assumptions:

Total Amount of Debt: \$100 million.

Fixed Rate: 5%.

Variable Rate: Recovery conditions 4%, Trough Conditions 6%, Peak conditions: 3%.

Debt Structure: 60%.

In the following calculations, it will be proven that Mixed Debt Structuring allows shipping companies to control cost more effectively.

Calculations

Formula of Total Interest Costs with Mixed Rates:

$$\text{TIC} = (\text{D} * \text{Fixed Portion} * \text{FIR}) + (\text{D} * \text{Variable} * \text{VIR})$$

Under Normal conditions, the formula changes, as following:

$$\text{TIC recovery} = (100 \text{ million} * 0.6 * 0.05) + (100 \text{ million} * 0.4 * 0.04) = 6.8 \text{ million}$$

Under Trough conditions, the formula changes, as following:

$$\text{TIC trough} = (100 \text{ million} * 0.6 * 0.05) + (100 \text{ million} * 0.4 * 0.06) = 7.4 \text{ million}$$

Under Peak conditions, the formula changes, as following:

$$\text{TIC Peak} = (100 \text{ million} * 0.6 * 0.05) + (100 \text{ million} * 0.4 * 0.03) = 6.4 \text{ million}$$

Additionally, under convertible debt, the debt of \$20 million can be converted to equity.

| Condition | FIR | VIR | TAD | CD | Adjusted Cost |
|-----------------|--------------|--------------------------------|---------------|---------------------------|---------------|
| Trough | \$ 3 million | \$1.6 million (4% of \$40M) | \$6.8 million | | \$6.8 million |
| Recovery | \$ million | \$2.4 million (6% of \$40M) | \$7.4 million | -\$1 million (from CD) | \$6.4 million |
| Peak | \$ 3 million | \$2.4 million (6% of \$40M) | \$6.4 million | | \$6.4 million |

In summary, the fixed rates provides the steady and predictable cash inflows that enable the shipping companies to plan investing decisions and apply better debt management. However, leasing option limits the possibility of higher profitability during peak shipping market.

(IV) Overall Conclusions

The inherent cyclical volatility of the shipping market necessitates an effective approach and techniques in cost management, resilience-building and strategic

planning. The implementation of operational efficiency, through fuel optimization, regular maintenance and upgrades, and revenue diversification through expansion in different activities, can reduce costs and build financial reserves that support the overall sustainability. Additionally, shipping companies strengthen their operations and stabilize their income by diversifying their fleet and proceeding to leasing agreements. Those techniques contribute to consistent cash reserves. Subsequently, including both fixed and variable interest rates and/or convertible debt possibility provides wider debt options that enable shipping companies to prevent cash outflows. Collectively, these strategies enable the accumulation of cash reserves and in turn to the formation of contingency funds, which operate as shock absorbers in economic slowdowns. The interrelation of these approaches support long-term sustainability, fortifies resilience and ensures seamless operations.

6.3 Scenario Planning and Risk Management

The use of scenario planning and risk management techniques is essential for handling uncertainties, such as rabid changes in fuel prices and other financial risks. Given the uncertainty of multiple factors, shipping firms employ different range of models and strategies in order to secure sustainable operations, such as scenario planning strategies. It enables shipping companies to refrain from financial consequences of demand and supply shocks, taking into account possible events and scenarios. (Nomikos and Tsouknidis, 2022). The following analysis will demonstrate how shipping firms hedge against the risks of uncertainty, using scenario analysis, employing variables and considering all possible series of events in the global market.

6.3. (I) Monte Carlo Simulation: Management of Risk and Profit Estimation for ZIM.

Monte Carlo simulations are advanced statistical tools that are employed from shipping companies in order to increase their scenario planning mechanism, build-up their risk assessment and preparedness for different future developments.

Employing the example of ZIM Integrated Shipping Services, we will develop a simulation that can predict different scenarios and outcomes within a volatile environment.

Key Inputs and Assumptions

Fixed costs \$2.27 billion, as calculated. Depreciation and amortization amounts roughly at \$ 774.7 million and an estimation of other Fixed Costs at \$1.5 billion.

Based on the industry's standards, we estimate that the cost per container is \$250.

Due to the volatility of the market, we assume that the revenue per container is \$1000 with a standard deviation of \$100. Additionally, based on the intensity of ZIM's operations, we estimate an annual shipment volume of 3.5 million containers annually.

Mathematical calculations behind the Monte Carlo Simulation.

Using this simulation, we are able to generate 10.000 different freights rates that follow a specific pattern which ranges from \$900 to \$1.100.

Profit Calculations Formula

Profit =

$(\text{Freight Rate per Container} - \text{Variable Cost per Container}) * \text{Number of Containers} - \text{Fixed Costs}$. OR

$\text{Profit} = (\text{Freight Rate per Container} - 250) * 3.5\text{million containers} - 2.27\text{billion USD}$.

The freight rates are taken from the normal distribution, a process which enables the shipping company to simulate different outcomes in profits.

Breakdown of the Simulation.

Steps:

1.As previously mentioned, the freight rate is expects to follow the normal distribution of \$1.000 with a deviation range of \$100. Hence, rates as low as 800 and as high as 1.200 are not possible.

2. Profit Calculation for Each Scenario.

Freight Rate = \$1.020

$\text{Profit} = (1.020 - 250) * 3.5 \text{ million} - 2.27 \text{ billion}$.

$\text{Profit} = 770 * 3.5 \text{ million} - 2.27 \text{ billion} = 2.695 \text{ billion} - 2.27 \text{ billion} = \425 million

Freight Rate = \$900 (Lowest scenario possible)

$\text{Profit} = (900 - 250) * 3.5 \text{ million} - 2.27 \text{ billion}$.

$\text{Profit} = 650 * 3.5 \text{ million} - 2.27 \text{ billion} = 2.275 \text{ billion} - 2.27 \text{ billion} = \$ 5 \text{ million}$

At the lowest possible scenario, ZIM would experience a small profit of **\$5 million**.

Freight Rate = \$800 (Worst-case scenario):

$\text{Profit} = (800 - 250) * 3.5 \text{ million} - 2.27 \text{ billion}$.

$\text{Profit} = 550 * 3.5 \text{ million} - 2.27 \text{ billion} = 1.925 \text{ billion} - 2.27 \text{ billion} = - \345 million .

In this scenario, ZIM would experience a loss of \$345 million.

In conclusion, the execution of the 10.000 simulations enables potential outcomes, categorized as following: Mean Expected Profit ~ \$350 million, Best-Case Scenario ~ &700 million, Worst-Case Scenario ~ -\$345 and Standard deviation of Profit ~ \$200 million. Standard deviation of Profit shows the amount of profits that can deviate from the mean expected Profit due to the inherent associated risk.

Conclusions and Final Thoughts

The Monte Carlo simulation showed the ZIM'S sensitivity in the fluctuating variables, ranging the income statement from \$700 million in profit to \$345 in loss. Additionally, having a standard deviation of \$200 million in profits highlights the importance of adopting a more active risk management strategy to better monitor and the freight rates and the associated risks. As mentioned in the theoretical section, contingency planning is essential especially when freight freights fall below \$900 per container. For the mitigation of the effect, the focus must shift to cost cutting measures and into the diversification of revenues streams. At the other hand, when freight rates rise to 1.100 per container, there is a high opportunity for expansion focusing on operational efficiency, optimization of operations and in new revenues sources. In conclusion Monte Carlo Simulation is a valuable tool that enable shipping companies to prepare themselves for different scenarios and fortify their adjusting capabilities rabidly.

6.4. Final conclusion and implications of Hypothesis

This section of hypothesis proposed that the combination of Operating Leverage, Break-Even Analysis, Cost Management techniques and Monte Carlo simulation would reinforce the positioning of the companies throughout all the stages of shipping volatility, fostering and protecting liquidity. It was employed as a hypothesis to test whether the interconnected strategies, when used simultaneously, can provide steady cash inflows and preventing liquidity reduction. More specifically after thoroughly analysis, the Operating Leverage and Break-Even analysis indicates the sensitivity of profit margins due to the change of fixed and variable costs. Due to the shipping capital-intensive market, profit margins are susceptible to changes. The effective use, application and comprehension of these models is essential.

Additionally, Cost Management techniques explicitly complete these strategies, by supporting operations towards effectiveness and diminution of cash outflow. Fleet diversification and fuel efficiency are one of them. Additional layer of resilience is the

debt structuring that supports flexibility in borrowing, ensuring the preservation of liquidity. Subsequently, Monte Carlo Simulations tie these strategies together, providing scenario cases to predict possible outcomes and enhance the preparedness. The interconnection of these approaches build a strong system in which tools support the others, proving important financial buffers and long-term sustainability.

General Notes: Some of the financial figures were taken from reputable sources, such as Clarksons Research, Drewry Maritime Research, the Baltic Exchange, International Maritime Organization (IMO) studies, and financial reports from major industry players like Maersk and ZIM Integrated Shipping Services.

CHAPTER 6: METHODOLOGY

7. ANALYSIS OF COST BEHAVIOR

In the current chapter, the focus shifts on the operating cost behavior of shipping companies, throughout all the stages of shipping stages. This section will elaborate on the Chapter 1. with more practical aspects, real numbers and figures from different financial statements of different shipping companies. The analysis focuses on the liner shipping which subsequently expands on the dry and wet sector. The analysis commences with two major liner shipping companies, proving their published numbers and aspects during different stages of shipping cycle. According to the market data, we noticed a complete 7-year shipping cycle and particularly Trough (2015), Recovery (2017), Peak (2021) and collapse (2022).

By gathering information and making comparison from the companies' financial statements, important conclusions will be drawn regarding their behaviour in different economic conditions. This behavior can be influenced by many factors, such as policy, structure, strategic decisions, number of fleet available and unprecedented events. As mentioned, employing financial statements, we are able to notice the changes among financial accounts, such as Property, Plant and Equipment (PP&E), inventory, fuel reserves, accrued liabilities, retained earnings and new investments that take place during these phases. The following analysis is based on the aspects that were previously discussed aiming to link the practical part with the theoretical one in order to provide a thorough understanding of the topic.

7.1. Financial Data Overview

The following board depicts the key numbers from financial statements and reports of Maersk and Hapag-Lloyd shipping companies over the year of each shipping stage (2015, 2017, 2021, 2022).

Maersk/Important Financial Accounts in ESD millions

| KEY ACCOUNTS | YEARS | | | |
|---|--------------------------------|------------------------------|----------------------------------|----------------------------------|
| | 2015 | 2017 | 2021 | 2022 |
| PP&E | 43,999 (Report 15, p.28,40) | 31,071 (Report 17, 65,76) | 27,303 (Report 21,p.80,95) | 28,194 (Report 22, 81,95) |
| Inventories | 781 (Report 15, p. 28) | 974 (Report 17, p. 65) | 1,457 (Report 21, p. 80) | 1,604 (Report 22, p. 81) |
| Acc. Liabilities | 26,669 (Report 15,p.28,34) | 31,802 (Report 17, p.65, 71) | 26,683 (Report 21,p.80) | 28,648 (Report 22,p.81.88) |
| Retained Earnings | 32,068 (Report 15,p.30) | 27,069 (Report 17, p.67) | 41,787 (Report 21,p.82) | 61,646 (Report 22,p.83) |
| Current/Non-Current Lease Liabilities | 1,507 (Report 15,p.48) | 2,745 (Report 17,p.85,91,95) | 10,551 (Report 21,p.103.112,113) | 11,614 (Report 22,p.103,113,114) |
| New Investments in PP&E (*Numbers from merges are Excl.) | 7,313 (Report 15,p.40) | 5,364 (Report 17,p.76) | 3,284 (Report 22,p.96) | 3,641 (Report 22,p.95) |

Maersk, Annual Financial Reports (2015, 2017, 2021, 2022)

Hapag-Lloyd/Important Financial Accounts in EURO millions

| KEY ACCOUNTS | YEARS | | | |
|-----------------------------------|---|--|--|--|
| | 2015 | 2017 | 2021 | 2022 |
| PP&E | 6,143.60 (Report 15, p.117,159,167) | 8,966.50 (Report 17, p.204) | 11,764.80 (Report 21, p.144,180,194) | 13,140.20 (Report 22, p.146,180,194) |
| Inventories | 94.10 (Report 15, p.159) | 186.40 (Report 17, p.64,150,208) | 337.20 (Report 21, p.144, 198) | 440.00 (Report 22, p.146) |
| Acc. Liabilities | 1,336.70 (Report 15, p.231) | 1,612.40 (Report 17, p.226) | 2,462.50 (Report 21, p.214) | 2,792.9 (Report 22, p.216) |
| Retained Earnings | 3,052.30 (Report 15, p.227) | 3,173.90 (Report 17, p.150) | 12,608.80 (Report 21, p.148) | 23,447.3 (Report 21, p.150) |
| Operating Lease Liabilities | 149.5 (Report 15, p.231) | 123.60 (Report 17, p.223) | 2,423.1 (Report 21, p.209) | 2,660.10 (Report 22, p.131) |
| New Investments in PP&E | 540.0 (Report 15, p.13) | 459.10 (Report 17, p.106,108) | 1,308.60 (Report 21, p.128) | 1,553.6 (Report 22, p.131) |

**Acc. Liabilities = Trade Accounts payables + Other Liabilities.

Hapag- Lloyd, Annual Financial Reports (2015, 2017, 2021, 2022)

7.2. Ratio Analysis and Adjustments for Compatibility

Accurate results are important in order to draw correct conclusions and ensure the utter comprehension of cost operating behavior. Adjusted prices are crucial for executing accurate and reliable comparisons. The purpose of discounting PP&E account is mainly due to the inflationary impacts that heavily affect its real value over time. Hence, adjusting inflation gives more accurate picture of a company's financial outlook.

Inflation-Adjusted Boards

We adjust past values to 2022 terms in order to be able to compare the numbers for each year across all categories, the proper formula should be:

Adjusted Value=Nominal Value×(1+Inflation Rate)ⁿ .

n is the number of years between the past year (i.e. 2015) and the target year (2022).

The Inflation Rate is for each year based on U.S bureau of Labor Statistics, Customer Price Index and European Central Bank, Customer Price Index is:

USD: **0.7%** 2015, **2.1%** 2017 and **7%** 2021

EUR: **0.3%** 2015, **1.3%** 2017, **5.0%** 2021.

Maersk/Important Financial Accounts Inflation-Adjusted in 2022 terms, ESD millions

| KEY ACCOUNTS | YEARS | | | |
|---|-----------|-----------|-----------|-----------|
| | 2015 | 2017 | 2021 | 2022 |
| PP&E | 46,200.75 | 34,473.40 | 29,214.21 | 28,194.00 |
| Inventories | 820.1 | 1,080.65 | 1,558.99 | 1,604.00 |
| Acc. Liabilities | 28,003.55 | 35,284.43 | 28,550.81 | 28,648.00 |
| Retained Earnings | 33,672.71 | 30,033.15 | 44,712.09 | 61,646.00 |
| Current/Non-Current Lease Liabilities | 1,582.41 | 3,045.58 | 11,289.57 | 11,614.00 |
| New Investments in PP&E (*Numbers from merges are Excl.) | 7,678.95 | 5,951.37 | 3,513.88 | 3,641.00 |

Hapag-Lloyd/Important Financial Accounts Inflation-Adjusted in 2022 terms, EURO millions

| KEY ACCOUNTS | YEARS | | | |
|------------------|----------|----------|-----------|-----------|
| | 2015 | 2017 | 2021 | 2022 |
| PP&E | 6,284.99 | 9,605.93 | 12,353.04 | 13,140.20 |
| Inventories | 96.30 | 199.79 | 354.06 | 440.00 |
| Acc. Liabilities | 1,363.73 | 1,725.46 | 2,583.53 | 2,792.9 |

| | | | | |
|-----------------------------|----------|----------|-----------|-----------|
| Retained Earnings | 3,116.52 | 3,391.17 | 13,239.03 | 23,447.30 |
| Operating Lease Liabilities | 152.68 | 132.24 | 2,554.76 | 2,660.10 |
| New Investments in PP&E | 552.72 | 490.57 | 1,373.03 | 1,553.60 |

To ensure accurate comparisons, the table values must be converted from Euros to USD using the exchange rates on December 31 of each year. The exchange rates used are 1.09 USD (2015), 1.20 USD (2017), 1.13 USD (2021), and 1.07 USD (2022), as provided by the European Central Bank.

Hapag-Lloyd/Important Financial Accounts Inflation-Adjusted in 2022 terms, ESD millions

| KEY ACCOUNTS | YEARS | | | |
|-----------------------------|----------|-----------|-----------|------------|
| | 2015 | 2017 | 2021 | 2022 |
| PP&E | 6,850.64 | 11,527.11 | 13,958.93 | 14,060.014 |
| Inventories | 104,96 | 239.74 | 400.08 | 470.80 |
| Acc. Liabilities | 1,363.73 | 2,070.55 | 2,919.38 | 2,988.403 |
| Retained Earnings | 1,486.46 | 4,069.40 | 14,960.10 | 25,088.61 |
| Operating Lease Liabilities | 166.42 | 158.68 | 2,886.87 | 2,846.307 |
| New Investments in PP&E | 602.46 | 588.68 | 1,551.52 | 1,662.35 |

7.3. Depictions of Financial Accounts fluctuations across the Years

The following section presents the fluctuation of financial accounts over the shipping stages. Each data point shows the variation across the years.

| MAERSK, PP&E ACCOUNTS | HAPAG-LLOYD, PP&E ACCOUNTS |
|------------------------------|--|
| 2015 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {13} | 2015 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {10} |
| 2017 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {12} | 2017 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {12} |
| 2021 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {10} | 2021 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {14} |
| 2022 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {9} | 2022 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {15} |

SECOND DIPICTION / COMPARATIVE RESULTS

| MAERSK, INVENTORY ACCOUNTS | HAPAG-LLOYD, INVENTORY ACCOUNTS |
|----------------------------|---------------------------------|
| 2015 {▲▲▲▲▲} {5} | 2015 {▲▲▲▲▲} {4} |
| 2017 {▲▲▲▲▲▲▲} {6} | 2017 {▲▲▲▲▲▲▲▲▲} {7} |
| 2021 {▲▲▲▲▲▲▲▲▲▲▲} {9} | 2021 {▲▲▲▲▲▲▲▲▲▲▲▲▲} {9} |
| 2022 {▲▲▲▲▲▲▲▲▲▲▲▲▲} {10} | 2022 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {10} |

THIRD DIPICTION / COMPARATIVE RESULTS

| MAERSK, ACCRUED LIAB. ACCOUNTS | HAPAG-LLOYD, ACCRUED LIAB. ACCOUNTS |
|--------------------------------|-------------------------------------|
| 2015 {▲▲▲▲▲▲▲▲▲} {7} | 2015 {▲▲▲▲▲▲▲▲▲} {6} |
| 2017 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {10} | 2017 {▲▲▲▲▲▲▲▲▲▲▲} {7} |
| 2021 {▲▲▲▲▲▲▲▲▲▲▲} {8} | 2021 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {9} |
| 2022 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {9} | 2022 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {10} |

FOURTH DIPICTION / COMPARATIVE RESULTS

MAERSK, RETAINED EARNINGS
EARNINGS

HAPAG-LLOYD, RETAINED

2015 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {13}

2015 {▲▲▲▲▲▲▲} {6}

2017 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {11}

2017 {▲▲▲▲▲▲▲▲▲▲} {8}

2021 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {15}

2021 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {12}

2022 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {18}

2022 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {13}

FIFTH DIPICTION / COMPARATIVE RESULTS

MAERSK, LEASE LIABILITIES

HAPAG-LLOYD, LEASE LIABILITIES

2015 {▲▲▲▲▲▲▲▲▲▲▲} {9}

2015 {▲▲▲▲▲▲▲▲▲} {6}

2017 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {11}

2017 {▲▲▲▲▲▲▲} {5}

2021 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {15}

2021 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {12}

2022 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {18}

2022 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {11}

SIXTH DIPICTION / COMPARATIVE RESULTS

MAERSK, NEW INV. IN PP&E

HAPAG-LLOYD, NEW INV. IN PP&E

2015 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {13}

2015 {▲▲▲▲▲▲▲▲▲} {6}

2017 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {11}

2017 {▲▲▲▲▲▲▲} {5}

2021 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {10}

2021 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {12}

2022 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {11}

2022 {▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲} {13}

7.4. Numbers Interpretation / Perception of approaches during shipping cycles

As mentioned in the first parts of this dissertation, shipping cycles drastically change the shipping firm's approach, revenues, expenses, structure and policy aiming to ensure a long-term profitability and liquidity. According to the aforementioned facts, figures and numbers, we are ready to cite our observations from different variables noticed

from different financial statements of Maersk and Hapag-Lloyd liner shipping companies, across different shipping phases, starting from the trough and ending up to the Collapse stage.

7.4. (I) PP&E (Property, Plant and Equipment) during all the stages of shipping cycles

Trough (2015)

Trough stage is a period that the demand for shipping transportation is considerably less than the supply of available vessels. Hence, the trading activities and freight rates are markedly low, often below the operating costs, due to an economic downturn or current instability in the global economic conditions. The year of 2015 was marked by a historical global fleet decline due to the imbalance between supply and demand. (UNCTAD, 2015). Additionally, freight rates were clearly fluctuating, showing signs of Trough stage. Based on the facts and figures presented from Maersk and Hapag-Lloyd liner shipping company, a different approach is noticed at the levels of PP&E throughout the shipping cycles.

Maersk shipping company, as a prominent and leading shipping company in container shipping, demonstrated a high asset base despite the unfavorable market conditions during trough and collapse phase. This reflects its powerful presence in the market which enables to preserve its fleet number in high levels and in turn its share in the market (\$46,200.75 and 28,194.00 billion respectively, Inflation Adjusted). However, across the years, despite the booming economy, we noticed a shift in decreasing PP&E and focusing instead in lease liabilities. This approach focused on the excessive capital outlay control rather than on aggressive overexpansion.

On the contrary, Hapag-Lloyd seems to demonstrate generally an increasing but conservative approach keeping their PP&E account increasingly under control, ensuring sustainability during cyclical volatility, over uncontrolled expansion. According to the theory mentioned, during the trough stage, companies tend to minimize their expenses and prevent unnecessary cash outflows as a measure to keep their liquidity high allowing them to remain competitive in the market and anticipating for the recovery to come. The divergence between those two companies' PP&E accounts reveals the different approach of Maersk to increase their share in the booming economy by intensifying their lease contracts. This is clear indication of measured

approach, despite the increasing retained earnings.

Recovery (2017)

As highlighted in the first parts of this dissertation, the recovery stage is consist of global increased trade volume, leading to an active shipping activity. Subsequently, the higher demand stabilizes the freight rates leading to a predictable revenue stream for the shipping firms. As verified by The Review of Maritime Transport UNCTAD 2018 “The year of 2017 indicated signs of market’s higher demand. Specifically as highlighted “In 2017, global port activity and cargo handling of containerized and bulk cargo expanded rapidly, following two years of weak performance. This expansion was in line with positive trends in the world economy and seaborne trade. Global container terminals boasted an increase in volume of about 6 per cent during the year, up from 2.1 per cent in 2016. World container port throughput stood at 752 million TEUs, reflecting an additional 42.3 million TEUs in 2017”.

According to the numbers extracted from the financial statements, we noticed that despite the recovery phase, Maersk declined its PP&E accounts by 25.4%, reflecting the previous impact of trough stage. In contrast to other shipping companies’ approach during recovery signs that Maersk tend to expand their fleet, Maersk decided to focus instead on a different approach that emphasizes fleet optimization rather than aggressive policy in capital outlay, also considering the negative impact of trough stage in the operations of the company. This strategy seems to be connected to a conservative approach that focuses on careful market evaluation and decision-making based on verified data indicating the sustainability of the market. At the other hand, Hapag-Lloyd marked an exceptional increase of 68.26%. As referenced earlier, this decision of expansion and larger fleet preservation demonstrates its capability to absorb higher market risks, aligning its assets more closely with the demand.

Peak (2021)

In the Peak phase, we notice the highest point in the shipping cycle. Stronger foundations in global financial activity and high demand for manufacturing, energy and commodities lead to sea borne trade intensification which in turn results in full fleet utilization and intensive profitability margins. The maximization of fleet utilization is a clear sign of the peak stage which is connected to an ongoing freight trend of increasing freight rates and intense liquidity. (Stopford, 2009). Additionally, the year of 2021 was a remarkable year widely recognized year as a peak stage characterized by

unprecedented demand and record-high freight rates. (Greg Miller, 2021) (UNCTAD, 2021). Subsequently, based on the Hapag-Lloyd's financial records, we observe an increase of PP&E accounts by 21%, endeavoring to deliver the rising demand. However, Maersk demonstrated a different approach by exceptionally intensifying its lease liabilities by 200,7% and decreasing its PP&E by 15,2%. This decrease is mostly due to the accumulated depreciation effect. This approach is measured against the risk of future upcoming economic slowdown but actively participating in the market's high demand.

The decrease of PP&E accounts enables the Maersk shipping company to spend more capital in the operational activities, aiming the fleet optimization and operational efficiency, while accumulating more earnings. The increasing cash inflows can operate as a buffer for the future economic downturns. Simultaneously Hapag- Lloyd's PP&E showed a more aggressive investing approach, expanding its own fleet and decreasing dependence on lease agreements. This approach shows the anticipation of the company for a longer sustainability of the market's growth. The bilateral exhibition of activities intensification indicates the focus on maximization operational efficiency and achieving significant share of the market's demand through lease agreements, fleet expansion and properties acquisition for logistics facilitation. Both shipping owning companies availed themselves of the favorable conditions following operational intensification

Collapse (2022)

The year of 2022, container line profits plummet from a historic peak. (Miller Greg, 2023) Particularly, profits from the liner shipping industry met a historical decrease in 2021. The decline became sharper in the second half of 2022, observing continually falling demand, overcapacity of available vessels and low freight rates. Especially, during the fourth quarter of 2022, profits and revenues per container unit had plummeted clearly indicating the collapse of the peak shipping stage. In 2022, Maersk dropped the PP&E account to \$28,194 billion which is a decline of 3.5%.

Additionally, even though Hapag-Lloyd increased PP&E at the end of the year 2022, it was marked by a decelerating growth rate in expansion from 21% (2017 to 2021) to 0.7% (2021 to 2022), obstructing the company's expansionary policy. Based on the theoretical aspects analyzed, during the collapse stage we observe that shipping firms proceed to cut-backs in order to restrain and keep under control the capital expenditures

arisen by their acquisition, such as fixed costs that are not dependent on their intensity of their operations. In general, shipping companies with smaller scale in the market are more susceptible to market downturns.

7.4. (II) Retained Earnings

Trough (2015)

In the trough stage, both companies showed a cautious approach to profitability. Of special note, Maersk possessed \$33.67 billion and Hapag-Lloyd retained \$1.48 billion. Those cash reserves operate as contingency Funds aiming to deal with the volatility of market and especially against the weak shipping phases. Despite the declining demand for sea transport, both companies succeeded in retaining earnings, considering their size, ensuring liquidity to navigate the downturn and finance their operations.

Recovery (2017)

The year of 2017 marked a significant growth in profits for both companies. Specifically, Lapag-Lloyd performances in retained earnings were impressively improved reaching a spike of 170.7% (From \$1,486.46 to \$ 4,069.40). Additionally, Maersk experienced significant cash inflows for operating activities, keeping their retained earnings at high levels. However, the increase was not achieved mainly due to repayments of debts and capital outlay for new lease contracts that aimed to be used during the imminent booming years.

Peak (2021)

As previously noted, the year of 2021 was remarkably favorable for the liner shipping industry. Maersk's retained earnings account reached \$44,712.09 million marking an outstanding increase of 48.87% compared to year of 2017 where recovery commences. Same noted for Hapag-Lloyd, retained earnings skyrocketed by 267,6% reaching \$14,960.10 million. These earnings depict the capability of the companies to leverage the high freight rates and operate with full capacity and operational efficiency. It is both noticed by the companies that they retained those earnings to expand or/and upgrade their fleet either through new lease contracts or PP&E investments in the effort of capitalizing more the opportunities that the market offers.

Collapse (2022)

Following the booming year of 2021, the demand for liner shipping routes declined. Especially during the fourth quarter of 2022 year, both companies experienced declining trajectory of their retained, due to the market shrinking conditions. The effects

of the declining market in 2022 was more obvious the next fiscal year. Previous high earnings provide the stability to allow them to absorb the operational costs during the downturn.

7.4. (III) Inventories

Inventories and fuel reserves are important elements, especially in the liner shipping industry which is subject to sharp fluctuations. The management of these financial accounts affects operational efficiency and liquidity.

Trough Stage (2015)

In the context of minimizing operational costs, shipping companies tend to minimize inventories and fuel reserves throughout economic downturns. Based on the financial accounts, both Maersk and Hapag-Lloyd kept those accounts at low levels at times of weak demand. In particular, Maersk inventories were at \$820.00 million while Hapag-Lloyd's recorded \$140.00 million. The relatively low numbers demonstrate the approach of the companies to keep their operating costs at low levels, avoiding the financial burden of keeping them stowed. This technique is commonly used in order to mitigate unnecessary costs and keep the total expenses under control. Trough stage is a period with limited trading activity leading to companies' hesitation to keep to hold unused inventory and fuels reducing important costs.

Recovery Stage (2017)

As the market began to show signs of recovery, both companies increased their inventories. Maersk surged their inventories to \$1,080.65 million from \$820.00 million in 2015 and similarly, Hapag-Lloyd augmented their inventories to \$239.74 million from \$104.96 million, demonstrating its aggressive policy to prioritize its preparedness for the market's peak demand. This uptick confirms the theoretical aspects of shipping cycles, where companies start to increase their resources anticipating increased demand. The intensification of resources prepares them to amplify operations and trade volumes.

Peak Stage (2021)

As previously referenced, at the peak shipping phases, we notice full fleet utilization, intensification of voyages speed and fuel consumption in order to follow up with the rising demand. Consequently, companies increase their inventory and fuel reserves in order to participate more actively in the booming market. Following the given example, Maersk inventories spiked to \$1,558.99 billion, which indicates an increase of 44.26%.

Similarly, Hapag-Lloyd reached \$400.08 million in inventories, showing an outstanding surge of 66.88%. This approach of a remarkable surge in these accounts demonstrate the need for maintaining constant operational continuity, minimizing the risks of shortages or price volatility in fuels and general important supplies. Any disruption in fuel supply or other useful elements for the operation of the ships that may occur during high demand for shipping services can obstruct the profitability of the company. The profitability is closely linked to the ability of the company to operate all of its vessels at full capacity and efficiently. Any disruption of any market that supplies the vessels can block seamless operations. Those measures described are also mentioned as hedging strategies against unprecedented events.

Collapse Stage (2022)

As the market demand starts to fall, both shipping companies started to progressively diminish the increasing rate of inventories in order to scale down their expenses. Considering the turn to a decline in demand, Hapag-Lloyd decelerated inventory account growth from 66.88% to 17.67%. Likewise, Maersk diminished drastically growth trajectory of inventory account from 44.26% to 2.8%. As previously noted, especially in the theoretical parts, companies seek to avoid expenses related to large inventories when demand and freight rates are favorable. Comparing the approach in peak and collapse stage, we observe the shift from operational expansion to liquidity preservation.

7.4. (IV) Accrued Liabilities

Accrued Liabilities are referred to the company's obligations that have been incurred but have yet to be paid. Usually, those liabilities are commonly noticed during periods of expansion where high operational activity is noticed. Overdue or delayed payments allow companies to expand and simultaneously keeping liquidity at high levels for general operational needs.

Trough (2015)

During trough stages, shipping companies aim to avoid cash outflows while their capacity in earning them back is limited due to the weak market conditions. This is a strategic approach using accrued liabilities to keep cash flows under control and perhaps utilize them for seasonal opportunities. Based on the data recorded from both companies, we observe delaying tendencies in repaying accrued liabilities. In particular, Maersk and Hapag-Lloyd reported accrued liabilities of \$28,003.55 and

\$1,363.73 million, in that order. It is evident that both shipping companies delayed payments to suppliers and other creditors, aiming to stabilize their liquidity. The economic slowdown marked both companies to low profits and comparatively less cash reserves leading them to deferred payments techniques to manage liquidity which is closely related to sustainability and financial longevity.

Recovery (2017)

As the conditions in the market showed to recover, it is observed that despite higher cash inflows, both companies increased their accrued liabilities. Maersk increased its accrued liabilities from \$28,003.55 to \$35,284.43, an increase equals to 26%. Simultaneously, Hapag-Lloyd increased its accrued liabilities from \$1,363.73 million to \$2,070.55 million, marking an increase of 51.8%. Despite the market's signs of recovery, both companies did not decrease their accrued liabilities but they prioritized their spending into their activities in order to maximize their operations efficiency and fleet capacity optimizations.

Peak Stage (2021)

As previously noted, the year of 2021 was a year of activities intensification, as it was marked by an exceptional increased demand for shipping services. In the previous parts of the analysis, Maersk and Hapag-Lloyd adopted an expansionary policy, committing in more lease agreements and investing in new vessels acquisition and infrastructure in order to maximize fleet utilization, operational capacity and gain a bigger share in the flourishing market. Those expansions necessitated capital outlay which in reality resulted in increased accrued liabilities. In the year of 2021, Lapag-Lloyd's accrued liabilities increased by 41% reaching \$2,919.38 million from the previous record of \$2,070.55. Despite the intensification of cash inflow, Lapag-Lloyd's preferred to delay their payments and instead invest those capitals in the operations, allowing them to boost further their revenues and profitability.

On the contrary, Maersk decreased its Accrued Liabilities as an opportunity to better present its financial reports, mainly in the aim of attracting more investors and maintaining a healthy relation with the creditors. The policy of intensifying operations through lease contracts, instead of fleet purchasing prevented the massive capital expenditure, allowing them to decrease accrued liabilities effectively. In particular, Maersk's accrued liabilities account dropped from \$35,284.43 to \$28,550.81, which is equivalent to a decrease of 19%.

Collapse Stage (2022)

The year of 2022 was characterized by a significant collapse in the market. The accrued liabilities sought to be slightly increasing during economic downturn for both liner shipping companies. In particular, Maersk's liabilities rose to \$28,648.00 million, a slight increase of 0.3% while Hapag-Lloyd reached \$2,988.38 million, which amounts to increase of 2.5%. At this stage, we notice that despite the collapse shipping phase, both companies kept their accrued liabilities carefully measured compared to the peak time. This approach focuses on keeping outstanding liabilities under control in order to avoid future financial burdens that could severely affect the liquidity during upcoming harsher economic slowdowns.

7.4. (V) Operating Lease Liabilities

Operating Lease Liabilities provide immediate expansion of the company's available fleet without upfront capital outlay. It is an effective way to capitalize on new market opportunities without decreasing important Asset Accounts in the Balance Sheet, such as cash accounts. It is a widely used approach for companies but it necessitates careful financial planning, evaluation and risk assessment. (Andrew Sather, 2020).

Trough Stage (2015)

As the year of 2015 was defined by a dramatic downturn in liner shipping sector, both shipping companies kept their fleet management under a conservative low number. Leasing additional vessels was an unnecessary cost due to the weak demand for sea borne trading. Particularly, Maersk reported operating lease liabilities of \$1,582.41 million and Hapag-Lloyd's stood at \$166.42 million. The avoidance of any long-term financial commitment, including leasing contracts, is a policy followed by both shipping company helping them to manage their cash flows and to prevent any excess capacity that could lead their fleet to lay-ups.

Recovery Stage (2017)

In contrast to the trough stage, recovery stage can encourage more shipping companies to lease vessels as the demand for sea transport starts to rise. However, as noted in the theoretical sections, more conservative approach can be followed considering the possibility of seasonal spikes of demand (Dead Cat Bounce) that are not grounded on real market recovery. According to the financial records from the shipping companies, they seemed to adopt different approaches due to the different perception of risk and the different risk-acceptance margins, as the market starts to recover. In particular,

Lapag-Lloyd decreased its lease liabilities to 2.2% and specifically to \$158.68 million, from the previous report of \$166.42 million in 2015. The slight reduction in lease liabilities demonstrated a focus on fleet optimization and acquisition of its own fleet rather than committing long-term agreements. This policy lessens dependence on lease agreements and focuses mostly on self-sufficiency.

On the contrary, as the market showed signs of recovery, Maersk intensified its lease contracts in order to take advantage of the rising demand, laying the foundation for readiness in the further future improvement of the market. Specifically, Maersk's lease commitments rose to \$3,045.58, reflecting an incredible increase of 92.46%. As referenced, this approach facilitates expansion while avoiding significant capital outflows associated with the acquisition of non-current assets, thereby ensuring financial stability.

Peak State (2021)

Due to the extraordinary increase of demand for commodities in 2022, both companies remarkably intensified their leasing liabilities in order to increase their fleet size and successfully keep up with the rising demand. As recorded from their financial statements, Maersk's Liabilities reached to \$11,289.57 million which signifies an increase of 270,68% while Hapag-Lloyd's leasing liabilities skyrocketed, reaching \$2,886.87 million. As referenced, leasing contracts enable the shipping companies to promptly participate in the market's demand by expanding their fleet without the need for larger capital expenditures, providing flexibility and diminution of risk associated to new acquaintances.

Collapse Stage (2022)

A remarkable advantage of leasing activity is the flexibility and comparatively risk-free strategy that it provides. After the market's downsize, both companies scaled down their fleet size, by reducing the operating lease liabilities. Maersk curtailed the growth of its leasing liabilities by maintaining the account at a nearly stable level with a diminishing tendency for the last quarter of the year 2022. Similarly, Hapag-Lloyd slightly reduced its lease commitments, comprehending the signs of down hilling economy. The reduction reflects the company's approach against economic collapse. In conclusion, the companies leasing contracts enable them to avoid financial strain from excess capacity and adjust their fleet size promptly depending on the market's needs. This strategy protects the preservation of liquidity which keep the company a strong presence in the market.

7.4. (IV) New Investments

New investments can be related to PP&E accounts in terms of fleet expansion, infrastructure and technology. New investments demonstrate the company's capability in leveraging the opportunities that the market provides among different shipping cycles.

Trough (2015)

The year of 2015 was marked by a limited investing initiatives from both shipping companies, as they focused on conserving cash avoiding making large capital outlays and minimizing associated risk. The strategic decision of the companies to refrain from making new investments was driven by weak market conditions. The capital spent was mostly to preserve the continuity of essential operations.

Recovery (2017)

In the theoretical section, it was discussed that higher freight rates and signs of recovery will urge shipping companies to invest in their fleet optimization, infrastructure improvements and technological upgrades in order to prepare themselves for the expected market growth. However, due to the uncertainty of a sustainable recovery, both Maersk and Hapag-Lloyd seemed conservative, prioritizing fleet and operations efficiency rather than expansion.

Peak Stage (2021)

While the year of 2021 was distinguished by a remarkable surge for shipping services, Maersk instead of intensifying new investments in PP&E accounts, rapidly increased their lease commitments to actively participate in the increasing demand. At the same time, Hapag-Lloyd's escalated its new investments, reflecting an increase of 163.55% confirming the company's approach in PP&E investments, supporting its self-sufficiency. These approaches were primarily directed towards the fleet expansion, refinements in port infrastructure in order to facilitate logistics operations ensuring a seamless overall effective operations. The intensification of capital outlay illustrates their confidence in the sustained market peak.

Collapse Stage (2022)

As the market started to show signs of declining demand, investing initiatives scaled back for both companies. Declining demand closely contributed to the shrinking incoming capital. While the collapse in the demand manifested during the fourth quarter of the 2022, the ongoing expansionary policies obstructed by the weak shift of the

market. Despite the positive increase of PP&E investments, both companies focused on keeping the liquidity at secured levels, avoiding long terms commitments that can cause financial weights and delaying unnecessary investments. The behavior demonstrated aligns with the theoretical section of shipping firms that indicates the companies' strategy shift based on the market's conditions. As the collapse stage established at the fourth quarter of 2022, companies demonstrated a prudent expansionary policy.

7.5. IMPLICATIONS, RESULTS and DISCUSSIONS ACROSS SHIPPING CYCLES

The analysis of Maersk and Hapag-Lloyd's financial performance throughout the four shipping phases divulged significant information in how shipping companies address market's fluctuations in demand. Both companies, despite their differing approaches, displayed an acute understanding of the cyclical nature of the shipping markets and provided us with valuable perspectives about the strategic timing of the investments, fleet optimization and cost management.

7.5. (I) Timing of Investments

John Templeton (1999) quoted "This time is different", trying to emphasize the value of precise timing in capital investments across shipping cycles. As observed, during the year of 2017 both Maersk and Hapag-Lloyd showed a conservative approach in new investments. As the market started to signify recovery, gradually new investing or/and expansionary initiatives took place enabling them to prepare their capability for the market's peak. This capability is their presence reinforcement in the market position without simultaneously exposing them to unnecessary risks. As the market surged during the peak stage in 2021, the investing activities noted a remarkable increase. Maersk, as a leading liner shipping company, with large capital base intensified its lease contracts to fully leveraging the booming demand.

In parallel, Hapag-Lloyd followed suit by also adding more non-current assets to support the expansion. The timing of expansion was essential in order to capitalize on the rising demand, gaining more share of the market and ultimately resulting in profitability maximization. Nonetheless, during the year of 2022 which marked a falling market, both companies demonstrated a more cautious approach by reducing their investments and their expenses. These adjustments was necessary measure against the weakened market in order to ensure financial sustainability. It is noteworthy to

mention that both companies made a rabid shift to a more cautious and risk-preventive approach, reflecting their flexible and successful defensive mechanism.

7.5. (II) Fleet Optimization and Flexibility

Fleet optimization is one of the most valuable strategic tools used by many shipping companies across different shipping cycles. Observing the behavior of Maersk and Hapag-Lloyd, both companies used operating leases to keep up with the increasing demand of shipping market. The decision of expanding their fleet by creating lease contract commitments enable them to align their fleet size with the booming demand, without experiencing important capital outlay. This approach was mostly noticed by Maersk which provides valuable flexibility to expand or shrink their fleet size based on the market's needs. For instance, as previously discussed, Maersk's operating lease liabilities rose significantly in 2021. On the contrary, both companies reduced their leasing commitments, gradually slowing the growth of new lease contracts. The rabid adjustment of fleet size highlights the profound ability of both companies to ensure full capacity, efficient operation, optimally synchronized with the market's needs. The preparedness and adaptability ensures profitability without incurring overcapacity risks and increased capital expenditures.

7.5. (III) Capital Structure Financial Resilience and Policy Differences

The capital structure and Policy is closely linked to the size of the company. The response across the different phases of shipping cycles is different among different shipping companies. However, the approach has similarities in main aspects during the shipping phases. Employing the results from the Maersk's records, large cash accounts and large scale base offered a latitude to adopt more expansionary investment policy while simultaneously retaining high earnings across cycles. Despite its relatively smaller size, Hapag-Lloyd demonstrated an impressive ability to make rapid adjustments in response to market changes, showcasing flexibility in its operations. However, in general, smaller companies tend to be more conservative, often focusing on maintaining stability and minimizing risks during volatile phases of the shipping cycle. This contrast highlights the strategic differences that can emerge based on company size and resources, where larger firms may have more latitude for aggressive expansion, while smaller firms prioritize risk mitigation.

7.5. (IV) Cash Flow Management

Effective Cash Flow management is paramount in ensuring financial resilience. Throughout the year of 2021, both Maersk and Hapag-Lloyd generated important cash inflows enabling them to reinvest into fleet expansion, technological updates, operational refinements and new lease contracts. Maersk's and Hapag-Lloyd's rising retained earnings reflected the importance of cash accounts of ensuring safety and growth. Safety is related to absorbing financial shocks without affecting the company's position. Strong position might strengthen the company's presence while other companies will might exit the market. The following year of 2021 indicated a collapsing market, making the companies to quickly shift approaches to a more conservative. The priority of both companies in cash preservation, minimization of operational costs particularly through reducing inventories and fuel reserves, helped them to successful absorb the economic shocks, as seen at the accounts presented for 2022. Maersk and Hapag-Lloyd's started to have a decreasing rate growth, signaling the shift to a weakened market that established at the last quarter of the same year.

7.5. (V) Generalized Behavior of Shipping Companies across Shipping Cycles The analysis of Maersk and Hapag-Lloyd records provide us with useful insights of how shipping companies behave and manage operating costs throughout different shipping phases. Based on the analysis made, we are able to exhibit predictable financial behaviors.

Trough Stage

During economic slowdowns, companies emphasizes on the liquidity preservation and cost minimization. Companies demonstrate an avoiding behavior towards new investments, the fleet size is downscaled, including operations-related parts necessary for the voyages such as fuels and inventories. The emphasis given at this stage is the survival, preserving relatively high liquidity compared to other players in the market and maintaining a flexible structure that enables fast adjustment for the upcoming recovery.

Recovery Stage

Recovery stage is followed by gradual increase of demand that encourage shipping companies to cautiously focus on new investments and new lease contacts that will facilitate the fleet optimization and infrastructure upgrades. Necessary elements related to operations are also built up, such as spares, lubricants and fuels in order to support

increasing demand and built the foundations for a competitive readiness in participating at the race of peak stage. Thorough actions towards preparation will ensure sustainable growth synchronized with the market conditions.

Peak Stage

Peak stages are characterized by historically high demand with companies intensifying their expanding activities and focusing in new investments to maximize their efficiency and capacity. Those investments are primarily observed in new vessels leases or acquisitions, new infrastructures and vessels under lease contracts. Increased retained earnings are used again for new opportunities in the effort of leveraging the favorable market conditions. At this stage, it is commonly used by many companies to accumulate important retained earnings as contingency funds in order to provide safety and strength in future upcoming economic downturns.

Collapse Stage

The saturation of the peak shipping phase comes with fleet overcapacity and poor economic conditions due to the contraction of demand. Companies react with reduction of investments as a way to diminish operating costs and maintain their existing liquidity. As previously referenced, retained earnings from the peak phase are kept as contingency/security funds to serve as a buffer during an inactive market.

7.5. (VI) External Factors and Strategic Planning

External factors such as macroeconomic conditions, geopolitical developments and regulatory changes convolute the environment whereby shipping companies operate. However, shipping companies, such as Maersk and Hapag-Lloyd's, developed mechanisms against those events, mitigating the external pressures. For instance Maersk and Hapag-Lloyd showed awareness of the IMO external factor in the introduction of new limits in Sulphur dioxide emissions by retrofitting its fleet and ordering fuel-efficient vessels, while Hapag-Lloyd invested in low Sulphur fuel oil and LNG.

7.5. (VII) Strategic Lessons across shipping cycles

In summary, the strategies employed by Maersk and Hapag-Lloyd highlighted the importance of cautions timed investments, fleet managements and decisions related to cash flow during all the stages of shipping cycles. Their strategies of intensifying their investments in order to benefit from the market's favorable conditions and subsequently scaling them down during weak times, provides us valuable insights of how shipping

companies manage volatility. Companies with larger financial base power, such as Maersk, have performed better flexibility during those cycles. It is observed that they undertake bigger risks while smaller companies follow the same policy with a more cautious way, prioritizing preserving cash and managing risks.

7.6. Verifying Strategic Consistency: A comparative Analysis of ZIM

To further validate the conclusions drawn by Maersk and Hapag-Lloyd policies, we employed financial records from all the years of shipping cycles (2015, 2017, 2021 and 2022) from a smaller liner shipping company, ZIM Integrated Shipping Services. This analysis will focus on determining whether the strategic responses of larger firms align with policies and approaches of smaller players in key financial accounts such as PP&E, Retained Earnings and New investments. This method will verify if the behavior observed in Maersk and Hapag-Lloyd is observed in smaller market's player, focusing on the main elements of adaptability, financial resilience and strategic timing of investments.

7.6. (I) Financial Depiction

In the following board, we included information based on the financial Reports of ZIM's financial statements during the complete shipping cycles, between the years of 2015, 2017, 2021 and 2022.

| KEY ACCOUNTS | 2015 (Nominal) | 2017 (Nominal) | 2021 (Nominal) | 2022 (Nominal) |
|--------------------------|------------------------------------|------------------------------------|---|---------------------------------------|
| PP&E | 824.94 (Report 17, p.28) | 862.03 (Report 17, p.27,28) | 4,392.554 (Report 21, p. 128,156) | 5,751.2 (Report 21, p.123, 149) |
| New Investments | 14.70 (Report 15, p.26) | 93.9 (Report 17, p.27) | 2,665.45 (Report 21, p.126) | 2,612.5 (Report 22, p.149) |
| Retained Earnings | (1,724.891) (Report 17, p.7) | (1,891.879) (Report 17, p.7) | 2,580.6 (Report 22, p.126) | 3,901.9 (Report 23, p.126) |

PP&E = Vessels + Containers + Handling equipment + Computer systems

ZIM Integrated Shipping Services, Financial Reports of 2015, 2017, 2021 and

In order to accurately compare financial data across different years, it is essential to adjust nominal values for inflation, into 2022 terms using inflation-adjusted values. We neutralize the effects of price changes over time, allowing for a more meaningful comparison of performance across all years. Based on U.S. Bureau of Labor Statistics, the inflations rates of USD were formed as following: 2015: 0.7% (0.007), 2017: 2.1% (0.021), 2021: 7% (0.07), 2022: 6.5% (0.065). The proper formula should be: Adjusted Value=Nominal Value * (1+Inflation Rate) ^n. n is the number of years between the past year (i.e. 2015) and the target year (2022).

Inflation- Adjusted Financial Depiction

| KEY ACCOUNTS | 2015 | 2017 | 2021 | 2022 |
|-------------------------|-------------|-------------|-------------|-------------|
| PP&E | 866.22 | 956.42 | 4,700.32 | 5,751.20 |
| New Investments | 15.43 | 104.18 | 2,852.03 | 2,612.5 |
| Retained Earning | (1,811.20) | (2,099.04) | 2,761.24 | 3,901.90 |

7.6. (II) Comparative Analysis of ZIM’s Financial Strategy

As referenced, shipping industry is characterized by high capital intensity and sharp volatility. For a comprehensive analysis of smaller companies, such as ZIM Integrated Shipping Services, we will emphasize on the comparison with Maersk and Hapag-Lloyd. In particular, the focus will be on the key financial accounts such as PP&E, Retained Earnings and New Investments, after inflation adjustments.

Capital investments: PP&E and New Investments

One of the most determining financial account that represents investments in vessels, infrastructure and equipment is the PP&E. The costs for preserving this account is high reflecting the company’s ability to navigate in the market. ZIM investments in PP&E increased from \$15.43 million (2015) to 2,612.5 million (2022) showing its commitment for upgrading and expanding its fleet, focusing also in operational capacity. Despite the fact that ZIM’s PP&E account is much less than Maersk and Hapag-Lloyd, the strategy followed has similar approach. Throughout the years, ZIM emphasized on the importance to optimize its fleet’s operational efficiency and

infrastructure that will enable seamless operations. The difference noticed is clearly in scale which affects the timing of investments. The acquisition of new ships and equipment was managed prudently in times of volatility. In particular, during the years of 2015 and 2016, ZIM initiated an expansion in PP&E account very cautiously, compared to aggressive fleet expansion of Hapag-Lloyd. The relatively low cash reserves reflected a measured exposition of risk while maintained competitive fleet capabilities. Additionally, by the years 2017 and 2021, ZIM increased the new investments from \$104.18 million to \$2,852.03 million, in that order.

This expansionary approach was seen in the previous analysis, aiming to leverage market booming trend by increasing their fleet capacity and efficiency. Despite the comparative small size of ZIM, it is observed that the timing of investments is similar to larger companies, measured with a more cautious approach. Based on the above records and analysis, we conclude that smaller liner companies can adopt a similar investing framework to a large-scale company's investing strategies.

Retained Earnings

As previously mentioned, retained earnings reflect the companies' ability in generating revenues that cover the total expenses. A positive account of retained earnings provide the latitude in reinvesting them towards the operations while preserving a positive balance. However, ZIM recorded negative retained earnings of -\$1,811.20 million in 2015 making a remarkable comeback in 2022, marking a positive balance of \$3,901.90 million. During the years of 2015-2016, the market experienced a severe financial strain, underscoring the severity of the downturn and the challenges faced. ZIM addressed the economic severities by reducing costs, optimizing fleet operations and preserving liquidity rather than depending on heavy borrowings. The new approaches turned the retained earning into a positive balance highlighting the ZIM's success to capitalize on the booming market.

The recovery is impressive if the ZIM's smaller scale and market share are considered, compared to Maersk and Hapag-Lloyd. Having analyzed all the records from the three companies, we observe that Maersk and Hapag-Lloyd, possessing larger operational bases, are more capable in observing financial damages from economic slowdowns rather than their smaller peers, i.e. ZIM. Hence, small sized shipping companies tend to be more conservative in managing their financial reserves, focus on building their

retained earning up to provide them a financial buffer. This approach is based on financial prudence and risk management.

Similarities with Larger Competitors

Taking into account all the records, data and the development of financial accounts, we observe notable similarities between different sized companies. ZIM as a comparative small shipping company relied on its PP&E investments to navigate into the market, ramping up its operational intensity and efficiency in the competitiveness of the market. However, all the approaches, strategies and investments were taken under thorough considerations, cautious risk-assessment aiming to maintain liquidity. Another similarity observed was the timing of the investment in fleet expansion to keep up with the demand. As the market's foundation are stronger, ZIM demonstrated an expansionary policy under more prudent approach. ZIM is an example that proves that smaller companies follow same strategic frameworks, focusing on the increase of operational capacity and efficiency and initiating investments under favorable market conditions. The differences are detected in the scale of investments and in a more rabid investing expansion as a response to market's recovery. Those elements serve as a competitive advantage for bigger companies.

Short Conclusion

The overall behavior of ZIM Integrated Shipping Services Ltd provides a clear insight of a smaller liner shipping company that has adopted strategic decisions from bigger peers, i.e. Maersk and Hapag-Lloyd. The difference lies at a more prudent approach in financial management with a remarkable focus on mitigating the effects of risk in decisions. Conservative approach in investing timing and strict preservation of high retained earnings, demonstrates how smaller shipping firms address shipping volatility. This strategy strengthen their presence in the global market.

7.7. Verification of the applicability of Cyclical Behavior to Dry and Wet Shipping Sector

7.7. (I) Identification of Shipping Cycles

The cyclical volatility observed in the liner shipping industry from the analysis of ZIM, Maersk and Hapag-Lloyd is also observed in other sectors within the maritime industry, such as dry bulk and wet shipping. Both sectors demonstrated similar stages of trough, recovery, peak and collapse. The determination of each stage is influenced by their

nature of their cargoes and external economic and social developments, such as geopolitical events. In particular, the dry bulk sector reached the trough stage in 2015-2016 mainly because of the oversupply of vessels and decreasing demand for commodities. Trough stage followed by a recovery within the years of 2017 to 2019 as demand for raw materials started to increase while fleet capacity decreased. (BIMCO report, 2016). Subsequently, based on the sector experienced a peak during the years of 2021-2022 after Covid-19 era which was marked by global demand surge. (Baltic Exchange, Investor Indices, 2023).

The years of 2023-2024 are predicted collapse, mainly caused by oversupply of vessels and stagnated demand. Likewise, the wet shipping sector experienced a remarkable economic slowdown marking the trough stage in the years of 2017-2018 mainly due to the oil surplus. (KPMG Review, 2018). Recovery follows the trough stage in the years of 2019-2020, while increased geopolitical tensions, such as U.S. – Iran Conflict as well as the onset of the COVID-19 pandemic, caused a spike in the demand for tankers due to oil supply disruptions. (Gupte, 2021).

The following year of 2021 was characterized by a sharp fluctuation of oil prices due to the need for floating storage and the restructuring of trade routes, clearly favoring oil shipping companies. Hence the year of 2021 is marked as the peak phase of this shipping cycles. The sector faced declining demand and increased vessel supply as markets stabilized. (Rico Sector, 2023).

7.8. PACIFIC BASIN / FINANCIAL DATA

The following analysis of the Dry Bulk Shipping Company, Pacific Basin Ltd., focuses to mirror that the strategies of Liner Shipping leading companies, i.e. Maersk, Hapag-Lloyd and ZIM align with other sector within the shipping industry.

Nominal Value Board in million USD Dollars:

| KEY ACCOUNTS | 2015 (Nominal) | 2017 (Nominal) | 2021 (Nominal) | 2022 (Nominal) |
|---------------------|----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| PP&E | 1,611.00 (Report 15, P.61) | 1,797.587 (Report 17, P.53) | 1,906.019 (Report 21, P.83) | 1,772.168 (Report 22, P.81) |

| | | | | |
|--------------------------|------------------------------------|------------------------------------|---------------------------------|---------------------------------|
| New Investments | 146.408 (Report 15, P.72,75) | 258,631 (Report 17, P.63) | 224,459 (Report 21, P.95) | 87,941 ((Report 22, P.93) |
| Retained Earnings | 213.23 (Report 15, P.61,95) | 154.38 (Report 17, P.53,77) | 779.93 (Report 21, P.117) | 705.62 (Report 22, P.93) |

In order to accurately compare financial data across different years, it is essential to adjust nominal values for inflation. By converting past financial figures into 2022 terms using inflation-adjusted values, we neutralize the effects of price changes over time, allowing for a more meaningful comparison of performance across all years. Based on U.S. Bureau of Labor Statistics, the inflations rates of USD were formed as following: 2015: 0.7% (0.007), 2017: 2.1% (0.021), 2021: 7% (0.07), 2022: 6.5% (0.065). The proper formula should be: Adjusted Value=Nominal Value * (1+Inflation Rate) ^n. n is the number of years between the past year (i.e. 2015) and the target year (2022).

Inflation- Adjusted Financial Depiction

| KEY ACCOUNTS | 2015 | 2017 | 2021 | 2022 |
|--------------------------|-----------------|-----------------|-----------------|------------------|
| PP&E | 1,691.62 | 1,994.43 | 2,039.44 | 1,772.168 |
| New Investments | 153.73 | 286.95 | 240.17 | 87,941 |
| Retained Earnings | 223.90 | 171.29 | 834.53 | 705.62 |

Pacific Financial Reports 2015, 2017, 2021 and 2022)

Final Analysis:

PP&E (Property, Plant and Equipment)

In 2015, the adjusted PP&E stands at \$1.691.62 million and we see a gradual increase over years, reaching to \$2,039.44 million in 2021. This year was marked by the peak phase, especially due to ongoing global supply chain disruptions. As the market's demand declines, the PP&E account drops to \$1.772,16 million, showing that Pacific Basin has adopted a more cautious expansionary policy, mainly due to the falling demand. As proved, this behavior is consistent with liner shipping companies, such as ZIM and Maersk, which they demonstrated an enlarging and intensified activity

approach during recovery times and in turn a declining expansionary policy during periods of collapse. For instance, after the year of outbreak of Covid-19 pandemic, both liner and dry bulk shipping companies leveraged the exceptional high freight rates to expand their fleet size or boosted their leasing contracts to participate actively in the market's demand,. This strategy helped them to better positioning themselves. The year of 2022 was characterized as a year of stabilization and companies adopted more conservative expansionary policies. They mostly focused on fleet optimization over expansion. The inflation-adjusted values highlighted how both liner and dry bulk shipping companies carefully managed their PP&E to match the broader market conditions. In conclusion, companies from different shipping sectors optimize their assets differently based on different shipping cycles.

New Investments

As observed from the financial reports, Pacific Basin's investments followed a cyclical pattern which are driven by the market condition. During the year of 2017 which was characterized by rising demand, the new investments raised from \$153.73 to \$286.95 million, reflecting the decision of the company to take advantage of the favorable market conditions. Investing in fleet expansion and infrastructure, the company starts fortifying its position in the market. However, as the market begin to indicate instability, the investing activities diminished to \$87.941 million, in 2022.

This pattern of reduced investments during downturns, followed by strategic capital spending during recoveries, illustrates how shipping companies across various sectors adopt distinct planning strategies in response to market conditions. The Post-Covid period marked with a surge of demand urging capital expenditures while in the late 2022, a more cautious approach was employed. Whether in liner or dry bulk sector, shipping companies prioritize financial flexibility in order to successfully navigate the cyclical volatility. This behavior is commonly observed underlying the significance of adaptive financial management and planning.

Retained Earnings

The profitability of shipping firms is reflected in the retained earnings account. Across the years of 2015 and 2021, Pacific Basin's retained earnings grew from \$223.90 to \$834.53, reflecting the company's ability to leverage favorable market conditions during the years of rising demand. Despite the market weakening trend in 2021, the retained earnings of the company remained high, reaching \$705.62 million, underscoring the strengthened position of the company, after the peak stage. This

performance and behavior indicates the benefits received from the peak phase, having fortified the company’s future sustainability against imminent downturns.

Short Conclusions and Implications

The financial records of Pacific Basin underscores the similarities in financial and behavioral terms in the cyclical market. Both sectors expand PP&E accounts during recoveries in order to build important foundations to capitalize on the upcoming booming market. They also have demonstrated prudent approach in new investments during volatile years. Additionally, they tend to accumulate retained earnings during profitable times in order to establish their strong positioning in the market. Based on the examples given, the behavior of Pacific Basin closely aligns with that of liner shipping, as analyzed for Maersk, Hapag-Lloyd and ZIM. As a result, the financial management is based on the cyclical volatility and it is widespread among the shipping industry, regardless of the sector of operations.

7.9 FRONTLINE Ltd. / FINANCIAL DATA

Introduction

As previously referenced, the cyclical nature of shipping market necessitates a feasible and flexible financial strategy in order to address the effects of the different shipping cycles – trough, recovery, peak and collapse. At this analysis, the focus is on a wet leading company Frontline Ltd. and its strategy over the years. The aim of this analysis is to compare the behavior of a wet shipping company to the major liner companies, such as Maersk, ZIM and Hapag-Lloyd, and demonstrate that both sectors despite their operational differences, adopt similar financial approaches to navigate through the cyclical shipping market. The key focus is on PP&E, New Investments and Retained Earnings, all of which are crucial in aligning strategies based on the market conditions.

| KEY ACCOUNTS | 2017 (Nominal) | 2020 (Nominal) | 2021 (Nominal) | 2023 (Nominal) |
|---------------------|------------------------------------|------------------------------|---|----------------------------|
| PP&E | 2,342,13 (Report 17, P. 3,144) | 3,307.14 (Report 20, P.4) | 3,477.801 (Report 21, P.47, 100,126) | 4,633.169(Report 23, P.49) |

| | | | | |
|--------------------------|------------------------------------|-----------------------------------|-----------------------------------|------------------------------------|
| New Investments | 894.00 (Report 17, P.144) | 854.36 (Report 20, P.132) | 384.73 (Report 21, P. 126) | 1,304.275 (Report 23, P. 72) |
| Retained Earnings | (272.50) (Report 17, P.119) | 8.01 (Report 20, P.104,107) | (3,130) (Report 21, P. 104) | 445.999 (Report 21, P. 101) |

FrontLine Financial Statements 2017, 2020, 2021 and 2023

In order to accurately compare financial data across different years, it is essential to adjust nominal values for inflation, into 2022 terms using inflation-adjusted values. We neutralize the effects of price changes over time, allowing for a more meaningful comparison of performance across all years. Based on U.S. Bureau of Labor Statistics, the inflations rates of USD were formed as following: 2017: 2.1% (0.021), 2020: 1.4% (0.014), 2021: 7% (0.07), 2023: 3.4% (0.034).The proper formula should be: Adjusted Value=Nominal Value * (1+Inflation Rate) ^n.

n is the number of years between the past year (i.e. 2015) and the target year (2022).

Inflation- Adjusted Financial Depiction

| KEY ACCOUNTS | 2017 | 2020 | 2021 | 2023 |
|--------------------------|-------------|-------------|-------------|-------------|
| PP&E | 2,598.60 | 3,400.39 | 3,721.25 | 4,480.82 |
| New Investments | 991.90 | 878.45 | 411.66 | 1.261,39 |
| Retained Earnings | (302.34) | 8.24 | (3,349.10) | 431.33 |

Final Analysis:

PP&E (Property, Plant and Equipment)

FrontLine's PP&E shows its approach to managing fleet and assets investments during the years of cyclical volatility. In 2017, PP&E stood at \$2,598.0 million highlighting the company's efforts to maintain its power position in the market. As soon as the market enters a recovery phase in 2020, the PP&E account reached \$3,400.39, indicating the strategy for growth as a result of the increasing demand. In 2021, the market reached its highest point for tankers demand. FrontLine intensify its expansion activities raising its PP&E account to \$3,721.25 billion, signaling the strong market conditions and the company's investing strategy in fleet expansion. During the year of

2023, based on the latest report of the company, a rise up to \$4,480.82 is made but the future approach seems to be cautiously prepared as the market's softening. We notice that the behavior is closely linked to the strategic behavior demonstrated by Hapag and ZIM, which similarly expanded their fleet during increasing demand and then after, they adopted a more prudent approach during weak market. However, the effort of maintaining their fleet size during economic slowdowns is also a common approach, emphasizing the important of an intact global share, as a strong positioning.

New Investments

As mentioned in the theoretical section, it is also observed that some shipping companies proceed towards capital allocation and expansionary policies during trough phases. This approach enables them to built-up their resources, strongly position their presence in the market and expand affordably. At the FrontLine example, we note that new investments stand at \$991.90 million which is a remarkable expansionary approach, especially considering the weakened market. This approach is a reflection of a forward-thinking approach to prepare for the upcoming market's recovery. As the market finally starts to recover, the new investments slightly fell to \$878.45 million, indicating that the company prioritized its fleet optimization and operational efficiency. Despite that the year of 2021 was marked by a remarkable demand for tankers, the company focused on profitability rather than expansion.

The new investments stood at \$411.66 million, noticeably less than the previous years. In 2020, there were significant investments such as the acquisition of 10 Suezmax tankers from Trafigura, as noted in Frontline's 2021 20. Such major acquisitions reduced the need for additional fleet expansion or investments in 2021, as those purchases would have already increased capacity to meet demand during the peak period. The approach followed is very effective, if the years of recovery can be predicted based on complete, real and thorough records and data. The expansion during trough stage increase the capital outlay and debt during a very fragile period of time decreasing liquidity which is substantial for the sustainability. However, the expansion cost is significantly less than the cost during peak times. At the example given, FrontLine assessed and predicted successfully the market, enabling to actively participate in the booming demand. Same strategy ensures and support the position for future growth and participation in the booming demand.

Retained Earnings

Retained earnings reflect the ability of the company to generate profit and fortify its

financial position. At this example, FrontLine reported a negative retained earnings account at the end of the year 2017. It can be justified due to the weak market condition but also due to the remarkable expansionary policy followed. Despite the challenges encountered and the company's high investments, the year of 2020 was characterized by an economic rebound as the account rose to \$8.24 million, underlying the recovery and profitability. However, the next year was marked by an unexpected negative retained earnings of \$3,349.10 million which was attributed to a combination of significant voyage, ship operating expenses, higher administrative costs, depreciation, and finance expenses and mostly due to the significant dividend payouts.

In particular, Frontline's financial statements showed that a total of \$249.7 million in cash dividends with a reported net income of \$412.9 million led to the reduction of retained earnings, turning it into a deficit. However, by the year 2023, retained earnings turned to a positive balance reflecting the company's ability to recover and improve its managerial system. It is obvious that the company demonstrated its strengthened position and its ability to successfully deal with market's unfavorable conditions.

Conclusion

The analysis of different shipping phases confirms that the cyclical financial strategies reveal a clear alignment with liner, dry and wet shipping sector. The approaches in different market conditions demonstrate common policy in the main financial Accounts, such as PP&E, New Investments and Retained Earnings. The differences are mainly dependent on the company's policy in dealing with volatility and not on the shipping sector they operate in. For instance, FrontLine proceeded to an expansionary policy during weak market in order to strengthen its position for the upcoming recovery, whereas ZIM demonstrated a more prudent policy in order to preserve liquidity waiting for the recovery.

Despite differences in cargo types and market dynamics, companies in both sectors share common financial strategies to address market cycles, focusing on growth during recoveries, maintaining financial stability during downturns, and accumulating reserves during profitable periods. As mentioned in previous sections, the ability in investing during weak times can give the competitive advantage to lead in the shipping industry. This necessitates thorough and strong system that provides countless opportunities, facilitates to seamless operations and ensures sustained success.

8. CONCLUSIONS

This thesis aimed to provide a comprehensive analysis of the shipping cycles and their effects on the operating cost behavior, cost structure and strategic decisions of shipping firms. This research has illustrated the importance of resilience and profitability during the shipping cycles, mainly through the adaption of robust financial planning and flexible management strategies that enable rapid changes. After a thorough analysis of the characteristics of shipping cycles, financial reports of shipping companies across the years and application of accounting principles, the study has concluded to some important insights. As clarified, global socioeconomic conditions, geopolitical events and trade patterns are closely linked to shipping cycles. Those cycles range from seasonal (Dead Cat Bounce), short-term to long-term and they mostly depend on the global macroeconomic trends.

The shipping phases are categorized as following: Trough, Recovery, Peak and Collapse. Each of the shipping cycles provide different opportunities and threats. The Trough stage represents the most challenging phase for the shipping firms. Oversupply of vessels, weak demand for shipping services lead to historically low freights rates and severe financial distress. Companies with large scope of operations that are dependent on freight rates have particularly high fixed costs. As mentioned, high fixed costs are constant costs regardless of the intensity of operation. Companies, such as Maersk, with high fixed costs are vulnerable during weak periods. However, in the analysis provided Maersk and Hapag-Lloyd responded to the trough phase by reducing unnecessary costs and focusing on liquidity preservation. The strategic decision of postponing capital-intensive projects and cautiously spending methods enabled them to preserve their share power in the market. It is also observed that shipping companies with unstable and poor cash inflow are the most susceptible to market's fluctuation. As a result, they often resort to laying up or scrapping vessels to sustain their operations. On the other hand, Trough stage can be an opportunity for expansion.

In other words, unfavorable economic conditions put pressure on asset's value allowing companies with strong liquidity to acquire assets at distressed prices. The following phase is the years of recovery. The demand for shipping services has started to increase and shipping companies cautiously reactivate their laid-up vessels. As indicated, the

recovery stage is marked by a clear increase of freight rates that financially allow the shipping companies to have a positive balance. At this stage, it is observed that most of the companies prioritize the optimization of their operations through efficiency and cautious expansion. As proved, Maersk and Hapag-Lloyd employed different strategies to capitalize on the improving market. Maersk focused on the fleet expansion through lease contracts while Hapag-Lloyd invested in new acquisitions and infrastructure. Both companies increased their spending, through a different approach, aiming to actively participate in the booming demand.

Additionally, the alignment of fleet capacity and market demand can be efficiently managed through the application of Break-Even Analysis which determines the good management of freight rates, fixed and variable costs. If the recovery is supported by strong macroeconomic foundation, then the market continues to increase until it reaches the highest point. This point is characterized as the Peak stage and it is marked by remarkable rising demand, full fleet utilization and high freight rates. The shipping companies with high operating leverage, such as Maersk, are able to distribute more effectively the fixed costs across larger number of operations, resulting in higher operations. Despite the flourishing economic conditions, this stage of shipping cycles carries the risk of overexpansion that drastically results to inevitable oversupply of vessels in the market. As analyzed, a more conservative approach in expansion is new lease contracts that can provide a more prudent approach, as a way to avoid the pitfalls of over-investment.

However, despite the prudence of some shipping companies to overexpansion, the combined elements of over-confidence and a global economic slowdown mark the commencement of the collapse stage. As the market experiences declining demand and oversupply of vessel, shipping companies seek strategies to scale down expenses, as a way to preserve their liquidity. For instance, Maersk followed a careful expansionary strategy during the peak time, prioritizing lease contacts instead of acquiring new vessels. This approach was essential to mitigate the effects of the upcoming collapse stage, by immediately adjust their fleet utilization to the demand. This research showed how different strategic decisions and financial management can support and strengthen the company's presence in the market.

In addition to the shipping cycles characteristics and companies' responses, this thesis provided insights of the methods that shipping companies employed in order to mitigate the detrimental consequences of the volatility of shipping industry. One of the most effective strategy to hedge against the volatility of the freight rates is the fleet diversification. Shipping companies with a more diversified scope of operations are less susceptible to changes, as stronger-performing segments can financially counterbalance others in underperformance. For instance, Maersk's operations involve in more diversified activities that make them less vulnerable in volatility. Conversely, Hapag-Lloyd is more focused on the liner shipping that makes it more susceptible to market's changes. As highlighted, correlation coefficients revealed that Maersk's diverse activities mitigates the effect of associated risk during fluctuations. Another key strategic tool to alleviate the risk is connected to operating lease liabilities. As observed and analyzed, Maersk expanded its fleet capacity during economic opportunities involving in lease contracts.

The uncertainty of the market's growth sustainability makes shipping companies to commit in lease contracts, instead of expanding their owned fleet. This technique avoids large amounts of cash outflow while it facilitates the immediate increase of fleet capacity. Lease contracts allow shipping firms to perfectly align their fleet capacity with the market's demand. Another variable that shipping companies employ in order to calculate the minimum numbers of voyages needed and freights rates earned to cover their fixed expenses is Break-Even Analysis. This is also a valuable tool that indicates a specific quantitative point of operations and profits that must be exceed in order to cover fixed and variable costs. As analyzed, Maersk due to its larger scale possesses a higher Break-Even Analysis than Hapag-Lloyd, as a small operator. This tool enables shipping companies to decide the prices and cost management based also in the associated risk.

Another important variables that must be taken into consideration is the depreciation. Depreciation is an inevitable fixed cost that decreases the value of assets with the passage of time. Especially, during downturns, companies must address the decrease of their assets' value effectively. As noted, Maersk, Hapag-Lloyd, ZIM, Pacific and FrontLine followed strategies that involved scrapping old vessels during trough stage and reinvest during recovery and peak stages. This is an effective way to address

depreciation and soften the negative effect on the assets' value which is depicted in the financial statements.

All the aforementioned strategies are mainly followed in order to assure a healthy and sustainable financial position, ensuring long-term resilience against market fluctuations, and the ability to seize growth opportunities. Strong cash reserves depict the resilience and capability in rapid adjustments. Those strategies are mainly employed in order to earn, preserve and spend capital effectively, facilitating the long-term growth. Hence, liquidity during periods of low demand allows shipping companies to deliver financial obligations and continue operations despite challenging market conditions.

The methodology utilized for the development of this thesis is to provide thorough financial data from different shipping companies that operate in different shipping sectors. The analysis was based on key financial accounts, such as Property, Plant and Equipment (PP&E), new investments in PP&E, lease contracts and retained earnings, aiming to identify critical decision in every stage. Even though the different approaches among the shipping companies mainly due to their policy and size, we observed their common approaches that applied for all shipping sectors. All shipping companies prioritized flexible management strategies, robust financial planning and cost structure in order to increase their liquidity and address the challenges of cyclical volatility.

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