Decoupling in the Shipping Industry: The effect of the US-Chinese trade war on the Seaborne Trade

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Disclaimer

I hereby declare that this dissertation is my own original work and has not been submitted before to any institution for assessment purposes. Further, I have acknowledged all sources used and have cited these in the reference section.

Abstract

The economic decoupling between USA and China, the two largest economies of the world, as the result of the deterioration of the two counties' foreign affairs, is expected to have a short-term effect on the seaborne trade. Not only China is the second largest economy but is also a major shipping player, including shipbuilding and ship-financing services. The economic decoupling adds more uncertainty to an already shaken global environment of the last decade, shaped by several disruptions, such as Covid-19 pandemic, BREXIT, the Russo-Ukrainian War, along with the Trump Tariffs in 2018, create uncertainties that affect the shipping industry, representing more than 90% of global trade. This dissertation aims to provide answers by studying the disruption of US and China trade-war on Seaborne Trade. In the following dissertation it is proved that the interaction between the two economies and seaborne trade is decreased after 2018.

Keywords: decoupling, China, USA, maritime, geopolitical, disruption, supply chain, global economy, seaborne trade volume, containers, dry bulk commodities, iron ore, containers

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1. Introduction

The United States of America and China are the two largest economies of the world, with China joining the top-two in 2010[1]. The two countries are in trade war which culminated with the tariffs imposed by Trump Administration in 2018. The effect of *decoupling* on the shipping industry refers to the disruption stemming from the trade war between US and China in the economic activities through sea, which will cause alterations to the Seaborne Trade since the supply chain between them will be partially or completely disrupted. The decoupling will disrupt the supply chain of the two countries and lead to the formation of new ones, separate for the US and China.

China is a major shipping player, amongst the top-three[2] of the world, and a provider of shipbuilding and ship-financing services. The country also absorbs enormous quantities of dry bulk commodities[3], such as iron ore and coal, and at the same time is the largest provider of manufactured goods, covering almost 30% of the global supply. The US, the strongest economy of the world and a traditional maritime power, is a major importer of services and goods in order to cover the needs of its population. The US present trade deficit regarding their trading with China, referring mostly to manufactured goods.

The purpose of this dissertation is to highlight the importance of the bilateral affairs of USA and China for the smooth operation of maritime industry and global economy, as USA and China. The possibility of decoupling, the subject of this dissertation, is questioned by discussing bibliographic references and analyzing the shipping cycles based on the macroeconomic events occurring from the financial crisis of 2008 until 2022. The most important sub-sectors of the bilateral trade, Dry Bulkers and Containers, are briefly mentioned in order to demonstrate the codependence of the two maritime nations. The quantitative effect of decoupling in the Seaborne Trade Totals, as a whole and per two sectors (i.e., Dry Bulkers and Containers), is estimated through linear regression analysis and a hypothesis test regarding

[1] *China becomes the world's second largest economic power (by GDP, in current dollar terms)*. 10000 years of economy. (2010). https://www.citeco.fr/10000-years-history-economics/contemporary-world/china-becomes-the-world-s-second-largest-economic-power-by-gdp-in-current-dollar-terms

2 *Galanopoulos, R. (2022, December 1). Top 10 ship owning nations - vesselsvalue.* Marine Insight. https://www.marineinsight.com/shipping-news/vesselsvalue-data-gives-a-look-into-the-top-10-ship-owning-nations/

[3] Chambers, S. (2023, April 20). *Chinese commodity demand soars back*. Splash247. https://splash247.com/chinese-commodity-demand-soars-back/

the US imports from China. The topic under investigation is of high importance, as the disruptions in the shipping industry cause anomalies not only to the economies involved (high prices, lack of goods) but also to the global economy. It is worth mentioning that supply chain disruption and the importance of the bilateral affairs between US and China have been widely discussed in World Economic Forum 2023[4] in Davos.

The empirical study is separated in two main periods, one from 2008 to 2017 and one from 2018-2022. The reason is the imposition of the 2018 Trump tariffs[5] which decreased the USA imports from China for specific goods. The additional analysis of the macroeconomic environment and the shipping cycles assists in understanding the fluctuations and volatility of the shipping industry and thereof highlight the importance of the economic decoupling's impact on seaborne trade.

In the first part of the dissertation, the macroeconomic environment and the shipping market cycles along with historic data for the bilateral affairs of two counties are analyzed. The seaborne trade and the major trading routes of dry bulk commodities, and especially iron ore, and the manufactured goods provided by China to the West are examined in order to highlight the importance and significance of the exposure of China and the West to their bilateral trade. Even though this study focuses on dry bulk and container segments, it is necessary to briefly refer to the oil market in the business cycles analysis, due to the fact that oil prices are highly related to the cost of transportation (bunkers).

The second part includes the Quantitative Analysis. Initially, the Dependent Variables and the Independent Variables are analyzed, and will be used in a later stage to the Regression Models. The Total Volume of Global Seaborne Trade is analyzed based on several indicators that are important for both the USA-China trade but also the international trading activities. Control variables such as, the China and US GDP, Chinese Imports from USA and USA Imports from China, are chosen in terms of the perception of the industry of how the seaborne trade grows or shrinks. Firstly, one hypothesis test is used to confirm the deducted bilateral trade, by separating the Imports of USA from China into two groups, the last 3 years before decoupling

[4] *Davos 2023: Special address by Liu he, vice-premier of the People's Republic of China*. World Economic Forum. (2023, January 17). https://www.weforum.org/agenda/2023/01/davos-2023-special-address-by-liu-he-vice-premier-of-the-peoples-republic-of-china/

[5] Bown, C. P. (2022, December 20). *Four years into the Trade War, are the US and China decoupling?*. Peterson Institute for International Economics. https://www.piie.com/blogs/realtime-economics/four-years-trade-war-are-us-and-china-decoupling

2015-2017, and the 2 years after 2018 and 2019. On a second basis, there is one main linear regression for the Total Volume of Seaborne Trade, and then two for Dry Bulkers and Containers each. The economic decoupling is empirically measured through a dummy variable that separates the data into two groups, taking the price of D=0 for the period before 2018, and the price D=1 for the time period after the imposition of tariffs.

The two significant limitations of this paper are the data scarcity that would enable a more thorough empirical analysis, and the second one is the highly disrupted global environment that makes is difficult to identify the effect the tariffs have on seaborne trade.

2. *Literature Review*

The literature retrieved, does not cover in a great extend the West – China Decoupling effect in Shipping industry and the academic resources are limited to superficial discussion. The additional review of the main components of this dissertation offers useful tools in terms of definition of decoupling, macroeconomic indicators that affect shipping industry and seaborne trade volume, and analysis of empirical quantitative data that will assist in the statistical models used to prove the relation between seaborne trade volume and Chinese market.

In the *Global Trends Report 2040* (National Intelligence Council, 2021[6]) the rivalry of US and China has central role forecasting that the bipolar global order will extinct and the world will face a multi-polar international system where no power dominate as "No single state is likely to dominate all regions or domains, and a broader range of actors will compete to advance their ideologies, goals, and interests". The global system will be characterized by traditional powers trying to maintain their international and regulatory character, and developing countries such as China will try to expand their international influence. In addition, the report presents alternative scenarios, e.g., "Separate Silos" or "decoupling" regarding the formation of several power blocks around powers such as China, Russia, EU and US. The news events could originate from different fields, but empirical evidence points to political and economic events having large impacts on financial markets (Chan et al. 2001[7]).

Concerning the term of decoupling and its macroeconomic implications, the publication of the *American Chamber of Commerce in France* (Benabdallah et al., 2021[8]) provides a well-rounded presentation regarding the term of economic "decoupling". It addresses the possibility of the US and China to adopt different supply chains permanently, causing disruption to global trade and businesses. The paper identifies the decoupling in 5 sectors: supply chains, business models, geographic expansion, talent attraction and services. A very important part of the paper is the Executives' opinions about decoupling, identifying it as a disruption to the globalization,

[6] Global Trends 2040 - A more contested world, National Intelligence Council (2021). 7th edition, ISSB: 978-1-929667-33–8. https://www.dni.gov/files/ODNI/documents/assessments/GlobalTrends_2040.pdf

[7] Chan, Y., Chui, A. C. W., & Kwok, C. C. Y. (2001). The impact of salient political and economic news on the trading activity. *Pacific-Basin Finance Journal*, *9*(3), 195–217. https://doi.org/10.1016/s0927-538x(01)00015-4

[8] BENABDALLAH, Z., PASCAUD, Z., & GHEZ, J. (n.d.). *Economic Decoupling, Our new reality?*. American Chamber of Commerce in France. https://amchamfrance.org/wp-content/uploads/2021/12/Economic-Decoupling-Our-New-Reality.pdf

driven by technology and a coincidence of politicization of trade and protectionism policies, questioning the sustainability of this scenario. Andre Chieng rejects the decoupling theory as he believes that China will remain the "workshop of the world". Concluding, the need for companies to be aware of and prepared for the scenario is highlighted. Additionally, many papers of various industries and analysts refer to the word "decoupling" to separate demand from supply or describe two different markets that move separately (LNG and Oil).

The paper *Biden's World: Views from the United States, China, Russia and the European Union* (Biscop and Gromyko, 2020[9]) underlines the importance of the rise of China and how it impacts on the US and EU strategy planning, treating the EU and US as two separate players. The new american administration seems to follow the same pattern as the Trump Administration regarding the policy against China and it is mentioned that US will have to find ways to contain China in trade and technology. The trend of de-globalization has been seen since 2008 as mentioned in *Deglobalization in the context of United States-China Decoupling* (Garcia-Herrero and Tan, 2020[10]) with the US trying to contain China's rising power by decreasing the bilateral trade and leading to the form smaller supply chains started to form. It is worth mentioning that the Covid-19 is a factor that increased deglobalization. The implications caused in the global economy by Covid-19 and the damages on the West-China affairs are highlighted in the paper *US-China Economic Relations Under Pressure from COVID-19* (McNally, 2020[11]), and connected with the uncertainty of the consumption patterns and the supply chain changes. It is underlined that China is the only country that can produce manufactured goods so efficiently due to the low costs and cheap labor. Another report of the Atlantic Council, *Smart Partnerships amid Great Power Competition: AI, China, and the Global Quest for Digital Sovereignty* (Burrows and Mueller -Kaler, 2021[12]) indicates factors that are leading to decoupling, which could be summarized in the US attempt to restrain China's power and the Chinese frustration because of their will to be rule-makers and not rule-takers.

[9] Biscop, S., Mattelaer, A., Brender, R., Biscop, S., Bladel, J. V., & Coelmont, J. (2020, December). *Biden's world? Views from the United States, China, Russia and the European Union*. No.132. Egmont Institute. https://www.egmontinstitute.be/bidens-world-views-from-the-united-states-china-russia-and-the-european-union

[10] García-Herrero, A., & Tan, J. (2020). *Deglobalisation in the Context of United States- China Decoupling*. No.21. Bruegel. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3754740

[11] McNally, C. A. (2020, June). *US-China Economic Relations Under Pressure From COVID-19*. East West Center. https://www.jstor.org/stable/resrep25006?seq=2

[12] Burrows, M., & Mueller-Kaler, J., Smart Partnerships amid Great Power Competition: AI, China, and the Global Quest for Digital Sovereignty (2021). Atlantic Council - Geotech Centre. https://www.atlanticcouncil.org/wp-content/uploads/2021/01/Smart-Partnerships-2021-Report-1.pdf.

Chinese officials do not welcome decoupling but will try to make the most out of it. The briefing *Decoupling, deglobalization and democracy (*Shipping Strategy[13]*)* addresses the macroeconomic and political factors that could have as a result the decoupling in trading between China and West. It is suggested decoupling started after the global economic crisis of 2008 to protect the internal economies, as a protectionism attempt. Despite that, the US was the largest importer of Chinese products in 2021. It is worth mentioning the paradigm used to justify the broadening of US-China decoupling to other stakeholders such as the ER. Michael Shoebridge[14] in a recent interview stated that the US-China decoupling is a reality, and it is broadening geographically and per sector, predicting that EU - China decoupling will be next. The paper *US-China: The Great Decoupling* (Michal Meidan, 2020[15]) concludes that decoupling is unlikely to happen in all sectors and more probably, in case it happens, it will be focused on one sector, such as energy.

Referring to the shipping literature review, the book *Maritime Economics (Stopford, 2013[16])* analyzes the shipping cycles theory, where each shipping cycle has four periods with different characteristics and high volatility to macroeconomic events, causing changes to freight rates and asset prices. Stopford identifies three big shipping cycles from 1820 to 2008. In *Analyzing Shipping Cycles of Dry Bulk Shipping Market over the past 50 years* (Wang, 2017), Wang connects the shipping cycles with the world economy and considers them as the baseline of every shipping related analysis, as it assists in business decisions through forecasting.

The importance of the global supply chain (Levy, 1995) in shipping is highlighted and any disruption in the supply chain will lead to disruption of demand and will increase the cost of transport. In the paper of the *Asean Macroeconomic Research Office* (2022) useful information and analysis are provided for the disruption caused in the supply chains due to Covid-19 and to the Russia – Ukraine war, focusing on container trading. The disruption in the global trading is emerging from the changes in the behavior of the states involved in trading or the macroeconomic events occurring around the globe.

[13] *Decoupling, deglobalization and democracy*. Shipping Strategy. (n.d.).
[14] Barrett, E. (2020, September 28). *China is inching toward another trade war*. Fortune. https://fortune.com/2020/09/27/china-australia-trade-war-us/
[15] Meidan, M. (2019a, July). *US-China: The Great Decoupling*. The Oxford Institute for Energy Studies. https://www.jstor.org/stable/resrep33982
[16] Stopford, M. (2013). *Maritime economics* (3rd ed.). London: Routledge

Concerning the supply chain literature, the *Conceptual Aspects of Global Value Chains* (Antras, 2020[17]) concludes that global supply chains allow countries to benefit from the comparative advantage of other countries not only at the sectoral level but also at the stage level within sectors", highlighting the interconnection of them, leading to the induction that the globalized supply chains are vulnerable to macroeconomic changes and shocks, such as Covid-19. The supply chain disruptions may be located in the logistics sector, product and labor shortages and restrictions to the economic activity according to Supply chain disruptions and the effects on the global economy (Attinasi et. Al, 2021[18]). It is worth mentioning supply chain disruptions are accountable for 1/3 of the production disruptions and negative impact on inflation. In the article *How Are Shipping Industry Problems Hurting Economies Around the World?* (Newton, 2023[19]) the importance of the relocation of global trade is highlighted as a result of the disruption of the latest years. The opinion-based analysis *The global supply chain consequences of the Russia-Ukraine war* (Hamilton, 2023) discusses the disruptions caused by the Russo-Ukrainian war mostly in the dry bulk and energy sector with food and fertilizer shortages and delays, raising the inflation and energy prices. This situation leaded countries with economic ties with Russia and Ukraine to investigate alternatives to cover their needs. Most of the papers referring to supply chain disruptions approach the problem with the case study of Covid-19.

A decade ago, the US was the greatest importer of East-Asian products (Rajan, 2019[20]), but today China is the leading final demand market in the region. This creates a regional supply chain in which China is the greatest importer- making the region less vulnerable to international trade. The findings are supported by Kim in *An Analysis of the Dynamic Relationship between*

[17] Antràs, P. (2020, January). *Conceptual Aspects of Global Value Chains - Word Development Report 2020*. World Bank Group. https://openknowledge.worldbank.org/server/api/core/bitstreams/f93942dc-f943-586f-96dc-3bd8a8cec7ac/content

[18] Attinasi, M. G., Balatti, M., Mancini, M., & Metelli, L. (2022, January 13). *Supply chain disruptions and the effects on the global economy*. European Central Bank. No. 8/2021. https://www.ecb.europa.eu/pub/economic-bulletin/focus/2022/html/ecb.ebbox202108_01~e8ceebe51f.en.html

[19] Newton, E. (2023, April). *How Are Shipping Industry Problems Hurting Economies Around the World?*. Supply Chain Connect. https://www.supplychainconnect.com/news-trends/article/21263710/how-are-shipping-industry-problems-hurting-economies-around-the-world

[20] RAJAN , R. (2019, June). *Global cooperation is needed to reap the benefits and avoid the pitfalls of cross-border capital flows/Rising Tide*. International Monetary Fund. https://www.imf.org/en/Publications/fandd/issues/2019/06/crossborder-capital-flows-rajan

the Global Macroeconomy and Shipping and Shipbuilding Industries (Kim, 2011[21]) who supports that part of freight rates is determined by the fluctuations of the Chinese economy. It is worth mentioning that the iron ore as a major dry commodity is highly affected by the Chinese demand, which affects the BDI (Gu, Chen and Lien, 2019[22]). The paper *The relation between the international and China shipping markets* (Yi Miao, Xiao Xu and Zhen Xi, 2020[23]) questions the influence of the Chinese Market on international trade by examining the relationship between BDI, TSI and FFAs. After quantifying the data, it is proved that the three indicators are related. In the paper *World Economic Growth and Seaborne trade volume* (Nektarios Michail, 2020[24]) it is proved that the volume of seaborne trade is affected by the changes in the world economic and macroeconomic environment. The world is divided in three categories of countries, low, middle, and high income, an indicator affecting shipping demand. China is allocated to the middle-income category, even though it is the second biggest economic power in terms of nominal GDP[25].In *Quantifying the relationship between seaborne trade and shipping* (*Michail and Melas,* 2020[26]) attempted to quantify the relationship among seaborne trade, world economy and freight rates, through BVAR[27], resulting in the strong relation that exists between them not only in theory, but also practically.

Based on the above literature review, it is identified a gap in the academic literature regarding the effect of the Western – Chinese Decoupling on the Shipping Industry, and more specifically on seaborne trade. This dissertation study aspires to contribute to the awareness and provide evidence effect of decoupling on seaborne trade at this early stage of the trade war. The macroeconomic indicators and the bibliography mentioned above suggest that decoupling

[21] Park, S., Kwon, J., & Kim, T. (2021). An analysis of the dynamic relationship between the global macroeconomy and Shipping and Shipbuilding Industries. *Sustainability,* No. *13*24. https://doi.org/10.3390/su132413982

[22] Gu, Y., Chen, Z., & Lien D. (2019). Baltic Dry Index and iron ore spot market: dynamics and interactions. Applied Economics, Taylor & Francis Journals, vol. 51(35), pages 3855-3863. https://ideas.repec.org/a/taf/applec/v51y2019i35p3855-3863.html

[23] Gu, Y., Dong, X., & Chen, Z. (2020). The relation between the International and china shipping markets. *Research in Transportation Business and Management*, ELSEVIER, No. *34*, 100427. https://doi.org/10.1016/j.rtbm.2020.100427

[24] Michail, N. A. (2020). World Economic Growth and Seaborne Trade Volume: Quantifying the relationship. *Transportation Research Interdisciplinary Perspectives*, ELSEVIER, No. *4*, 100108. https://doi.org/10.1016/j.trip.2020.100108

[25] *The 50 largest economies in the world*. Worlddata.info. (n.d.-a). https://www.worlddata.info/largest-economies.php

[26] Michail, N. A., & Melas, K. D. (2020). Quantifying the relationship between Seaborne Trade and shipping freight rates: A Bayesian vector autoregressive approach. *Maritime Transport Research*, ELSEVIER, No.*1*, 100001. https://doi.org/10.1016/j.martra.2020.100001

[27] Bayesian Vector Autoregression

between Western shipping supply chain and Chinese is likely to partially occur and it is taking broader dimensions in think-tanks and policy maker cycles. Having said that, it is of utmost importance to attempt to quantify the relationship of Seaborne Trade and Chinese Market and analyze the macroeconomic indicators that will have a severe effect in the world's largest industry, shipping.

3. Data Resources

The annual reports of the United Nations Conference on Trade and Development provided a well-rounded image of the shipping industry and the trade development for the latest years. The statistical and informative value of these reports is high, as it describes in detail the annual trends and gives valuable information for the Seaborne Trade Volume and how it interacted with the various macroeconomic disruptions.

Clarksons Shipping Intelligence Network is widely used for retrieving not only the quantitative data (Seaborne Trade Volume, Freight Rates, Chinese Iron Ore Imports, etc.) but also for various market reports regarding the overall shipping market (Shipping Intelligence Weekly, Monthly and Quarterly Outlooks per Commodity, China Intelligence Monthly). The Clarksons platform is commonly utilized in the shipping industry due to the credibility and the accuracy of the data posted. As an additional platform United States Census Bureau was used to retrieve quantitative market data related to the trade balance between the two countries.

The correlations in between the indicators retrieved have been analyzed and constructed into models that assisted in understanding the trends and the current effect of the Chinese trading activities to global shipping. Regression analysis (Brooks, 2020) has been used to analyze the correlation and the effect of various independent variables to the dependent ones, with the use of dummy "decoupling" variable.

4. Part A: Analysis of the Macroeconomic and Geopolitical Environment

From 2008, the macroeconomic environment suffered from several disruptions, affecting the global economy and the seaborne trade volume. The shipping cycles, used to predict the values of assets and freight rates, have been highly correlated with these events, due to the international character and the high cyclicality of the shipping industry. Any event occurring around the globe, but especially the ones that involve the traditional economic or military powers, USA, Russia, China, EU, or states with popular shipping passages (Suez Canal, Kerch Strait, Panama) may disrupt the shipping cycle permanently or temporary, by creating another cycle, or a completely different supply chain. In the first part of this dissertation are discussed the geopolitical events that shaped the shipping industry and the basic elements of seaborne trade of containers and dry bulkers. In this section is provided a well-rounded understanding of the macroeconomic events and their relationship to the shipping industry. Last but not least, the bilateral affairs of US and China will be discussed, to underline their importance in the seaborne trade volume.

i) The macroeconomic and geopolitical environment from 2008 to 2017

During summer of 2008, the economic markets were characterized by uncertainty and it was expected by various stakeholders acting outside of the shipping industry that the economic prosperity of 2003-2007 had come to an end[28]. However, the shipping community had a more optimistic view which was reflected in an increased orderbook and a proliferation the shipping investments.

[28] Haralambides, H., & Thanopoulou, H. (n.d.). The Economic Crisis of 2008 and World Shipping: Unheeded Warnings. *SPOUDAI Journal of Economics and Business*, No.*64*(2), 5–13.

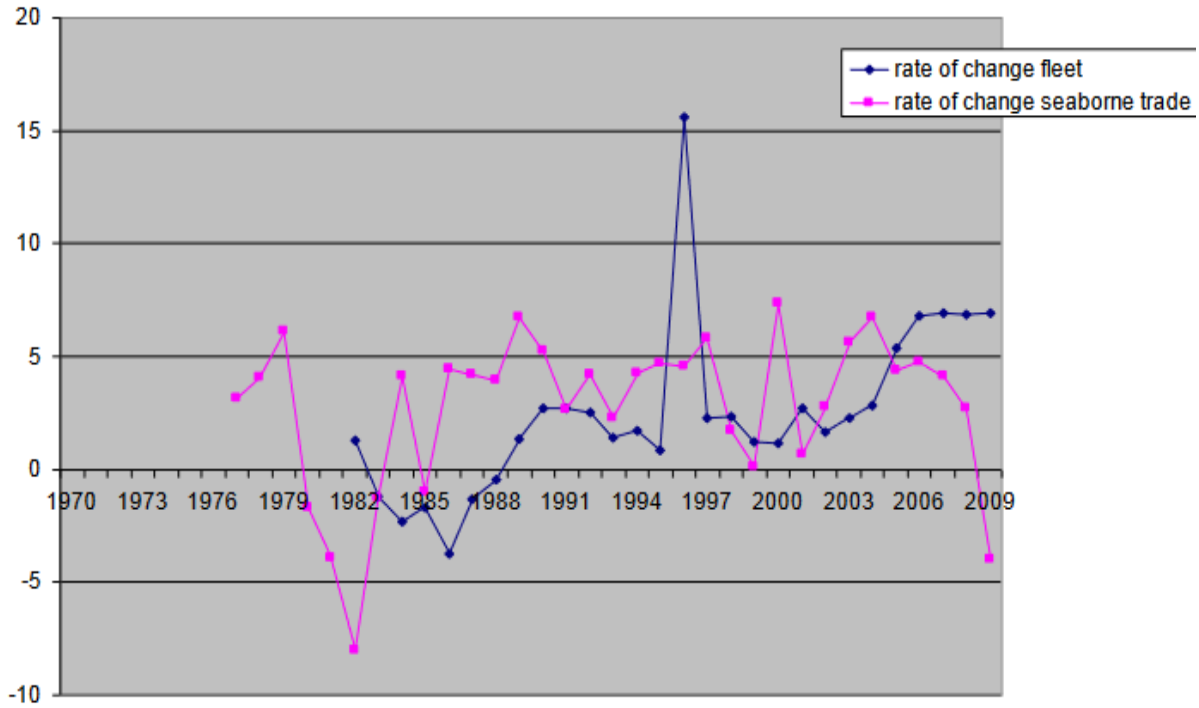


Figure 1: Annual rate of change of world seaborne trade and of world tonnage[29]

After the Lehman Brothers collapse[30] panic conquered the markets, as the liquidity problems begun, stock exchange prices fell and several banks declared bankruptcy. The shipping industry was not left intact, as the freight rates and the demand dropped for all of the segments[31]. At the same time, the assets kept soaring as a result of the increased orderbook. The following years the economy was trying to recover, with unemployment rates[32] being steadily increased and demand and supply trying to balance. Factors such as subprime mortgage lending, excessive leverage, and inadequate regulation played critical roles in its onset and diffusion[33]. Following the 2008 global financial crisis, central banks around the world implemented monetary policies

[29] Haralambides, H., & Thanopoulou, H. (n.d.). The Economic Crisis of 2008 and World Shipping: Unheeded Warnings. *SPOUDAI Journal of Economics and Business*, No.*64*(2), 5–13.
[30] Jeffrey Cheng, D. W., Dews, F., Lauren Bauer, S. Y. W., Glencora Haskins, J. P., & Wessel, D. (2022, March 9). *History credits Lehman Brothers' collapse for the 2008 financial crisis. here's why that narrative is wrong*. Brookings. https://www.brookings.edu/articles/history-credits-lehman-brothers-collapse-for-the-2008-financial-crisis-heres-why-that-narrative-is-wrong/
[31] Shipping Intelligence Network. (n.d.). https://sin.clarksons.net/
[32]Impact of the economic crisis on employment and unemployment in the OECD countries - oecd.org - OECD. (n.d.). https://www.oecd.org/els/emp/impactoftheeconomiccrisisonemploymentandunemploymentintheoecdcountries.htm
[33] Baily, M. N., Litan, R. E., & Matthew S., J. (n.d.). (publication). *The Origins of the Financial Crisis*. Initiative on Business and Public Policy at Brookings. Retrieved from https://www.brookings.edu/wp-content/uploads/2016/06/11_origins_crisis_baily_litan.pdf

to combat the economic downturn[34]. These measures included quantitative easing, forward guidance, and negative interest rates.

In early 2011 the Arab Spring began in Tunisia and then spread to the Arabic world, as a response to the economic uncertainty and difficulties[35]. The political unrest, expostulating to the existing political system[36] provoked uncertainty regarding the energy supplies, as MENA region is the greatest provider of oil and gas, raising at the same time questions for the eligibility of Suez Canal for the commercial activities[37].

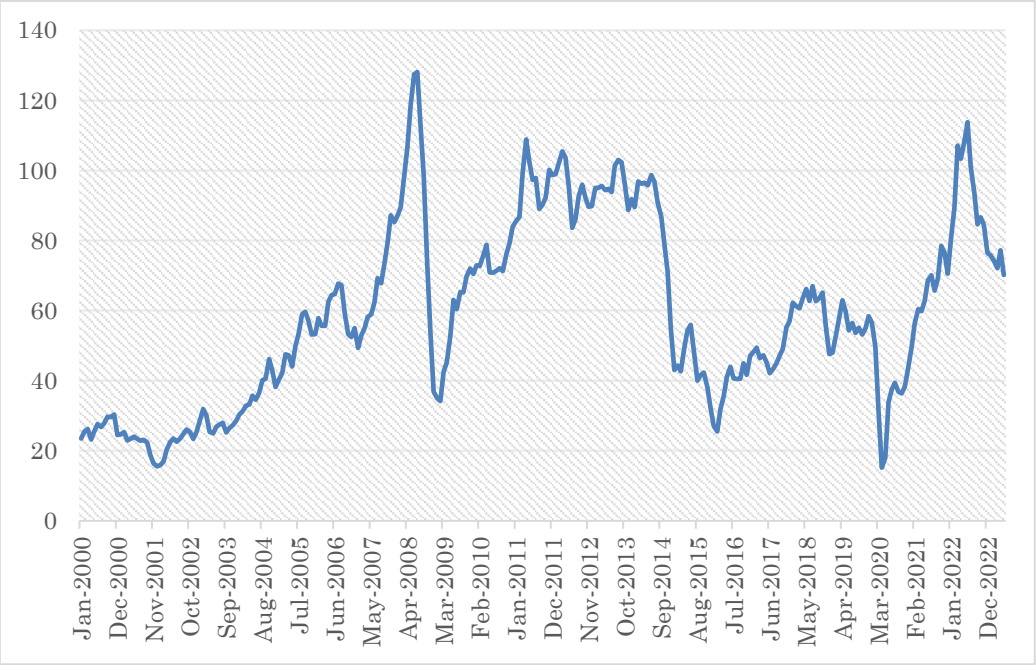


Figure 2: Oil Prices (US$ per Barrel)[38]

[34] Weinberg, J. (2013, November 12). *The great recession and its aftermath*. Federal Reserve History. https://www.federalreservehistory.org/essays/great-recession-and-its-aftermath

[35] Zeidan, A. (2023, August 20). *Arab spring, pro-democracy protests*. Encyclopædia Britannica. https://www.britannica.com/event/Arab-Spring

[36] Darbouche, H., & Fattouh, B. (2011, September). (publication). *The implications of the Arab Uprisings for Oil and Gas Markets*. Oxford Institute for Energy Studies. https://www.oxfordenergy.org/wpcms/wp-content/uploads/2011/09/MEP_2.pdf

[37] *Petroleum and Other Liquids - U.S. Crude Oil First Purchase Price*. EIA - U.S. Energy Information Administration. (n.d.). https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=f000000__3&f=m

[38] *Petroleum and Other Liquids - U.S. Crude Oil First Purchase Price*. EIA - U.S. Energy Information Administration. (n.d.). https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=f000000__3&f=m

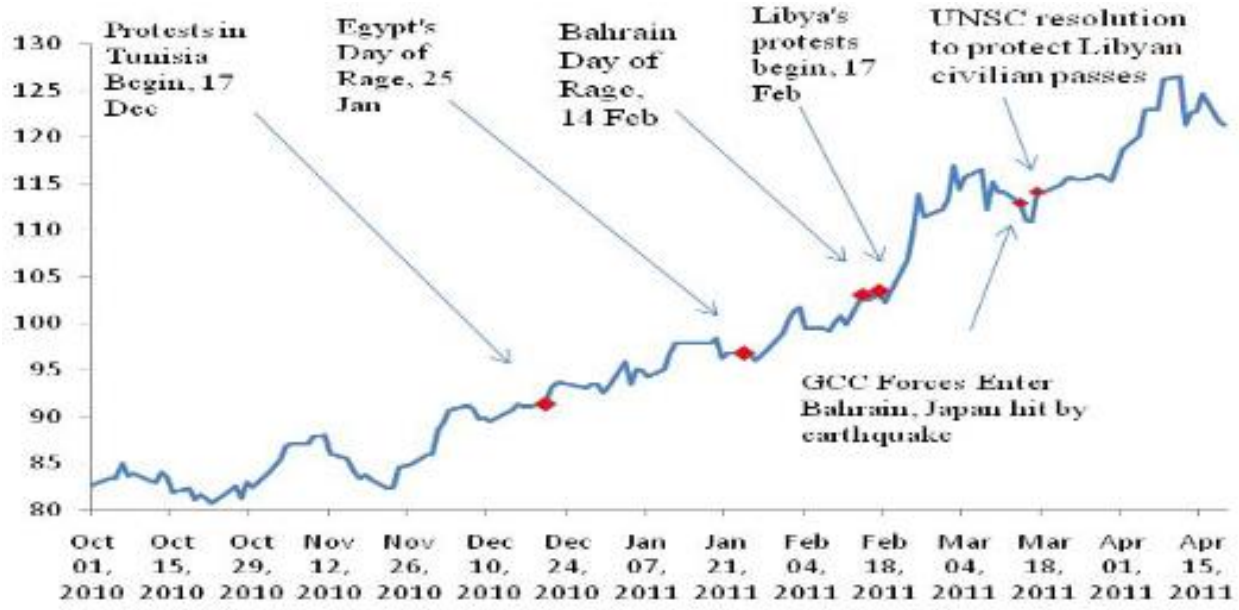


Figure 3: Key Middle East Events and the Oil Price October 2010–April 2011[39]

The disruption and the shock in oil prices caused by the Arab Spring is one of the numerous disruptions caused by political unrest or wars in the MENA region, causing independency requests from the importing nations.

In March of 2011, the earthquake tsunami in Japan[40] disrupted temporary the shipping routes in the region and the Syrian Civil War started. As, Syria never had a central role in shipping activities in the region, the various economic sanctions did not affect the global economy nor the seaborne trade activities. After the first months of the civil war Syria lost its place in the global trading and become irrelevant to shipping activities[41], losing all of its competitiveness.

In 2014, Russia invaded in Crimea[42] causing a wave of reactions, political unrest and disapproval from the West. The annexation of Crimea in late March, triggered several economic sanctions to be imposed to Russia and Russian entities, including restrictions on companies and individuals related to the government, as well as sector-wide measures that restrained the

[39] Darbouche, H., & Fattouh, B. (2011, September). (publication). *The implications of the Arab Uprisings for Oil and Gas Markets*. Oxford Institute for Energy Studies. https://www.oxfordenergy.org/wpcms/wp-content/uploads/2011/09/MEP_2.pdf

[40] Oskin, B. (2022, February 25). *Japan earthquake & tsunami of 2011: Facts and information*. LiveScience. https://www.livescience.com/39110-japan-2011-earthquake-tsunami-facts.html

[41] Cohen, E. (2016). From Arab Spring to economic winter – examination of the relationship between politics and economics as evident in the Syrian Civil War during 2011-2015. *Journal of International Studies*, *9*(1), 9–26. https://doi.org/10.14254/2071-8330.2016/9-1/1

[42] Pifer, S. (2020, March 17). *Crimea: Six years after illegal annexation*. Brookings. https://www.brookings.edu/articles/crimea-six-years-after-illegal-annexation/

trading of goods related to the energy and defense[43] sectors. The sanctions aimed to demonstrate opposition to Russia's actions and to discourage further aggressive behavior. In response, Russia imposed countersanctions on American and European food imports, and other countries joining the sanctions against Russia[44]. The Russian sanctions were wider than West's and limited imports, costing 10.3 billion dollars.

The port of Crimea and the Kerch Strait are ones of most significant for commercial "spots" in the Black Sea Region. Back in the time of Soviet Union, Ukraine was characterized as "maritime maturity"[45] due to the fact that many shipping activities were taking place in the country, contributing to its economy. Crimea's ports were subject to sanctions and the shipowning community was questioning the safety of trading in this area[46], deducting the trade in the region (mostly grain, oil and LNG exports[47]). It is worth mentioning that 260 commercial vessels ignored the sanctions and traded with Russia from 2014 to mid-August of 2016. The dry bulk seaborne trade and the freight rates for dry bulk commodities slightly fell in 2014 and 2015, affected by the disruption caused by the Crimean issue. It is worth mentioning that before the annexation, Russia had imposed sanctions to Ukrainian goods in July and August of 2013.

In June of 2016, UK held a referendum with regards to whether the country should continue being a part of EU or if it should go separate ways. The result was 52%[48] of the voters to choose to leave the EU. The process was complete almost 4 years later in January 2020, after negotiations for the framework of their future relationship. The UK was a member of the EU for 47 years and was the first country to ever leave the union. As UK was one of the most significant countries for the seaborne trade of EU, the departure caused disruptions to the EU

[43] Klymenko, A. (2016, October 7). *The effectiveness of the international maritime sanctions against Russia over the occupation of Crimea*. Maidan of Foreign Affairs. https://www.mfaua.org/en/projects/the-effectiveness-of-the-international-maritime-sanctions-against-russia-over-the-occupation-of-crimea

[44] Hanousek, J., & Bělín, M. (2019, April 29). *Making sanctions bite: The EU–Russian sanctions of 2014*. CEPR. https://cepr.org/voxeu/columns/making-sanctions-bite-eu-russian-sanctions-2014

[45] Venneri, M. (2020, November 4). *The significance of Ukraine's maritime industry for the Black Sea, and beyond*. Middle East Institute. https://www.mei.edu/publications/significance-ukraines-maritime-industry-black-sea-and-beyond

[46] *Maritime Legal Issues arising out of trading to Ukraine/Crimea*. Steamship Mutual. (2014, July 1). https://www.steamshipmutual.com/publications/articles/legalissuesarisingoutoftradingtoukrainecrimea0714

[47] Klymenko, A. (2016, October 7). *The effectiveness of the international maritime sanctions against Russia over the occupation of Crimea*. Maidan of Foreign Affairs. https://www.mfaua.org/en/projects/the-effectiveness-of-the-international-maritime-sanctions-against-russia-over-the-occupation-of-crimea

[48] BBC. (n.d.). *EU referendum results*. BBC News. https://www.bbc.co.uk/news/politics/eu_referendum/results

supply chain, mostly due to trade tariffs and additional paperwork[49], raising questions on whether UK will remain a financial and shipping center.

ii) The macroeconomic and geopolitical environment from 2018 to today

The Covid-19 pandemic shacked the world order and trading activities. The pandemic emerged in late 2019 and had severe macroeconomic consequences, especially in years 2020-2021. The freight markets and seaborne trade fell on y-o-y comparing to 2019[50], but the second year of the pandemic the same rates recovered and 2021 was a profitable year. The Covid impacts pertaining to seaborne trade volume and freight rates were the crew changes, the safety Covid measures that had to be taken on board and the imbalance of global demand and supply[51]. The COVID-19 pandemic has had a significant effect on the shipping industry, causing disruption to global trade and maritime transportation, undoubtedly disrupting the market[52].

The latest massive disruption, causing inflation rates rocket high and prices for transportation to increase especially in EU and Black Sea Region, is the Russia-Ukraine conflict. The Russian forces invaded the East Ukraine, targeting ports and critical state infrastructure, causing problems to the trading activities and blocking shipping passages and ports Mariupol, Berdiansk, Skadovsk, and Kherson). Ukraine was accountable for 90% of global supply if grain and oilseeds, creating shortages and rise of prices. The shipping industry and the whole world kept track of Russia's moves in East Ukraine, in order to predict the outcome and adapt to the changes. The answer to Russia's actions from the West was immediate, imposing sanctions to Russia, in order to deescalate the situation. The EU and USA and other international organizations, imposed sanctions to Russian politicians, banks, LNG and oil companies[53]. Russia did not stop the warships in Ukraine due to the sanctions but also managed to impose

[49]Goodlogdetype. (n.d.). *Brexit - what does it mean for the shipping industry?*. Good Logistics. https://goodlogisticsgroup.com/brexit-shipping-industry/

[50] *Maritime trade weathers covid-19 storm but faces far-reaching knock-on effects*. UNCTAD. (2021, November 18). https://unctad.org/news/maritime-trade-weathers-covid-19-storm-faces-far-reaching-knock-effects

[51] Millefiori, L. M., Braca, P., Zissis, D., Spiliopoulos, G., Marano, S., Willett, P. K., & Carniel, S. (2021). Covid-19 impact on Global Maritime Mobility. *Scientific Reports*, *11*(1). https://doi.org/10.1038/s41598-021-97461-7

[52]Lin, M. (2020, March 24). *Quarantine measures threaten global seaborne trade*. TradeWinds. https://www.tradewindsnews.com/regulation/quarantine-measures-threaten-global-seaborne-trade/2-1-780695

[53] *EU sanctions against Russia explained - consilium*. European Council - Council of the European Union. (n.d.). https://www.consilium.europa.eu/en/policies/sanctions/restrictive-measures-against-russia-over-ukraine/sanctions-against-russia-explained/

reprisal sanctions back to the West. The war itself along with the sanctions completely disrupted the shipping market, shrinked the seaborne trade and pushed the freight rates for dry commodities for ships transferring Russian cargo. Tankers, as Russian oil is part of the sanctions, its transportation only got more expensive, reaching 90,000$/day in mid-November[54].

Figure 4: Rising shipping prices (daily vessel earnings, in US$/day)[55]

Due to the dependance on Russian raw materials, the prices of basic good and energy consumption reached the highest y-o-y change since 1971 in OECD and G-7[56], creating inflation rate problems in the member states. The food prices increased more than in 2008 crisis[57],[58]. Maritime transportation was challenged to find new ports that can ease the situation and minimize the disruption effects. The Black Sea Grain Initiative managed a slight recovery of dry bulk commodities in the area, securing safe passage and supporting meeting the global

[54] Clarksons research. (n.d.). https://www.clarksons.net/n/#/portal

[55] Jacobs, K. (2022, July). *Russia's war on ukraine: Maritime Logistics and connectivity*. European Parliamentary Research Service. https://www.europarl.europa.eu/RegData/etudes/ATAG/2022/733603/EPRS_ATA(2022)733603_EN.pdf

[56] Thomson, F. (2023, February 20). *One Year on: Impact of the Ukraine War on Global Energy Prices*. Open Access Government. https://www.openaccessgovernment.org/one-year-impact-of-ukraine-war-global-energy-prices-input-output-analysis/152599/

[57] Elliott, L. (2022, April 26). *Ukraine war "will mean high food and energy prices for three years."* The Guardian. https://www.theguardian.com/business/2022/apr/26/ukraine-war-food-energy-prices-world-bank

[58] Guénette, J.-D., Kenworthy, P., & Wheeler, C. (2022, April). *Implications of the War in Ukraine for the Global Economy, EFI Policy Note 3*. World Bank Group, Equitable Growth, Finance and Institutions. https://thedocs.worldbank.org/en/doc/5d903e848db1d1b83e0ec8f744e55570-0350012021/related/Implications-of-the-War-in-Ukraine-for-the-Global-Economy.pdf

demand[59]. The initiative specifically allows grains and fertilizers, including ammonia, to be exported from three key Ukrainian ports in the Black Sea - Odesa, Illi and Chornomorsk. The initiative was extended several times.

From the 2008 financial crisis to the Russo-Ukrainian war the period from 2008 to 2023 has witnessed numerous macroeconomic events that have shaped the global economic landscape.

5. The USA – China bilateral affairs

The diplomatic ties of the two countries are going back to 1979[60], when the two countries officially commenced diplomatic ties, characterized by periods of tension and collaboration[61]. The challenges of their relationship ranges, from cybersecurity, military and human rights abuse issues. For the purposes of this dissertation the timeline from 2008 to 2023 of the bilateral affairs will be mentioned and analyzed.

Beginning from September 2008, after the collapse of Lehman Brothers, China became the largest holder of the USA debt (US$60 billion)[62], and in 2010 China becomes the second world's largest economy, worth US$1.33 billion, threatening the USA. Today, China holds the second position in holding US debt[63]. During 2011, the USA tried to be close to the Asian Power. More specifically, in a "Foreign Policy" [64]essay, the USA stated that they pivot to Asia, willing to increase the cooperation, investments in the area and diplomatic ties, in an early attempt to counter China's power. Later the same year, in the Asian Pacific Economic Forum the "Trans-Pacific Partnership" related to free trade, was established, but as USA employed 2,500 mariners from Australia, China expressed its frustration.

Before Xi Jinping election in November of 2012, the trade deficit of the USA increased from US$273 billion to US$295.5 billion. At the same time, China stopped exporting raw materials used in the production of manufactured goods, having as a result many multinational companies to move their plants in China. In order to improve the deteriorated affairs, the US

[59] https://www.un.org/en/black-sea-grain-initiative
[60] Council on Foreign Relations. (n.d.). *Timeline: U.s.-china relations*. Council on Foreign Relations. https://www.cfr.org/timeline/us-china-relations
[61] U.S. Department of State. (n.d.). *Chronology of U.S.-China Relations, 1784-2000*. U.S. Department of State. https://history.state.gov/countries/issues/china-us-relations
[62] Council on Foreign Relations. (n.d.). *Timeline: U.s.-china relations*. Council on Foreign Relations. https://www.cfr.org/timeline/us-china-relations
[63] USAFacts. (2023, July 3). *Which countries own the most US debt?* https://usafacts.org/articles/which-countries-own-the-most-us-debt/
[64] Clinton, H. (2011, October 11). *America's Pacific Century*. Foreign Policy. https://foreignpolicy.com/2011/10/11/americas-pacific-century/

President Obama met Xi in the US where they extensively discussed collaboration on climate change[65] and North Korea.

Unfortunately, the bilateral affairs soon deteriorated when the US administration accused Chinese hackers of stealing American trade technologies. The Chinese showed their disappointment by leaving the cybersecurity group, only to meet again during the same year to make joint statements about climate policies[66]. During 2015, the US government opened a dialogue disputing the territory of the South China Sea, accusing Beijing of militarization [67]of the artificial islands in the region.

After Trump's presidential election, the bilateral affairs of the two states seemed to reach new historical high levels[68] and both sides showed understanding and cooperation willingness, revealing a ten-part agreement[69] for extending their cooperation.

Before 2018 tariffs, on 2016, the US imposed restrictions to the Chinese telecommunication equipment manufacturer ZTE[70], obliging any american company that wants to purchase supplies to getting a license. After negotiations a year after the restriction is removed, ubder the condition that China does not share technologies with North Korea and Iran, which got denied a year after. Trump Administration restored the relations with ZTE, with exchange US$1 billion fine and compliance to US audits for 10 years[71]. Huawei[72], accused of fraud and

[65] Council on Foreign Relations. (n.d.). *Timeline: U.s.-china relations*. Council on Foreign Relations. https://www.cfr.org/timeline/us-china-relations

[66] *U.S.-China joint announcement on Climate Change*. The White House - President Barach Obama. (2014, November 11). https://obamawhitehouse.archives.gov/the-press-office/2014/11/11/us-china-joint-announcement-climate-change

[67] Council on Foreign Relations. (n.d.). *Timeline: China's maritime disputes*. Council on Foreign Relations. https://www.cfr.org/timeline/chinas-maritime-disputes#!/?cid=otr-marketing_use-china_sea_InfoGuide

[68] National Archives and Records Administration. (n.d.). *Remarks by President Trump After Meeting with President Xi of China*. Trump White House. https://trumpwhitehouse.archives.gov/briefings-statements/remarks-president-trump-meeting-president-xi-china/

[69] Eckert, P. (2017, April). *Xi, Trump emerge upbeat after get-acquainted talks in Florida*. Radio Free Asia. https://www.rfa.org/english/news/china/trump-xi-04072017191036.html

[70] *The Federal Register, Additions to the Entity List*. Federal Register . (2016, August 3). https://www.federalregister.gov/documents/2016/03/08/2016-05104/additions-to-the-entity-list

[71] Lynch, D. J., Denyer, S., & Long, H. (2018, June 7). *U.S. reaches deal with China's ZTE that includes $1 billion fine, Commerce secretary says*. The Washington Post. https://www.washingtonpost.com/business/economy/us-reaches-deal-with-chinas-zte-that-includes-1-billion-fine-commerce-secretary-says/2018/06/07/ccffa4b0-6a52-11e8-9e38-24e693b38637_story.html

[72] *Department of Commerce announces the addition of Huawei Technologies Co. Ltd. to the entity list*. U.S. Department of Commerce. (2019, August 2). https://2017-2021.commerce.gov/news/press-releases/2019/05/department-commerce-announces-addition-huawei-technologies-co-ltd.html

conspiracy against the US, was added along with the affiliates of the company to the entity list. Due to external threats, the US Department of Commerce proposed trade restrictions linked to technologically advanced products by limited the exports in China, Russia and Venezuela[73]. These exports controls are still in effect and expanded under Biden's Administration[74].

The trade war began in the March of 2018, when Trump announced trade restrictions against China, worth US$ 50 billion[75]. The *tariffs'* main goal was to protect the American economy, by reducing imports. The trade tariffs spread through 4 sectors, solar panels and washing machines, steel and aluminum products, technology and intellectual property. It is worth mentioning that China was not the only country subject to tariffs, indicating the beginning of a protectionism area for the US.

The most significant restrictions for the bilateral trade are located in the steel and aluminum sector due to the fact that the imports allegedly hurt the US economy. The tariffs were 25% on steel and 10% on aluminum, covering US$ 48 billion imports of which China was accountable for 6% due to previous restrictions[76]. During the same month, EU, Australia, Canada and other Western countries were exempted from the tariffs. In April, China imposes tariffs of US$ 2.8 billion on scrap, pork, fruits and other US products while in the following months tariffs exemptions expired and the US files dispute to WTO[77] for the counter-tariffs of China and other states. It is important to mention that six months after the tariffs, the US GDP growth was 2.2%, while smaller exporting countries suffered from 15.5% less revenue[78]. A PIIE research

[73] *Department of Commerce announces the addition of Huawei Technologies Co. Ltd. to the entity list*. U.S. Department of Commerce. (2019, August 2). https://2017-2021.commerce.gov/news/press-releases/2019/05/department-commerce-announces-addition-huawei-technologies-co-ltd.html

[74] Flinch, A. (2022, September 1). *Nvidia warns of sales hit from new U.S. chip licensing requirements for China*. The Wall Street Journal. https://www.wsj.com/articles/nvidia-warns-of-sales-hit-from-new-u-s-chip-licensing-requirements-for-china-11661984074

[75] AP News. (2021, April 22). *Trump orders huge tariffs on China, raises trade war worries*. AP News. https://apnews.com/article/73e5e5aa7be2408892e9904d642d2137

[76] Bown, C. P. (2020, March 2). *Trump's long-awaited steel and aluminum tariffs are just the beginning*. Peterson Institute for International Economics PIIE. https://www.piie.com/blogs/trade-and-investment-policy-watch/trumps-long-awaited-steel-and-aluminum-tariffs-are-just

[77] *United States challenges five WTO members imposing illegal tariffs against U.S. products*. United States Trade Representative. (n.d.). https://ustr.gov/about-us/policy-offices/press-office/press-releases/2018/july/united-states-challenges-five-wto

[78] Bown, C. P., Jung, E., & Zhang, E. (Yiwen). (2018, November 15). *Trump's steel tariffs have hit smaller and poorer countries the hardest*. Peterson Institute for International Economics PIIE. https://www.piie.com/blogs/trade-and-investment-policy-watch/trumps-steel-tariffs-have-hit-smaller-and-poorer-countries

indicates that the prices of steel products rose 9%[79] due to tariffs. New tariffs imposed on January 2020 targeted almost US$45 billion[80] aluminum and steel products, hitting China, among other countries. Until 2022, some countries were exempt, and the UK[81] tariffs rolled back for a specific amount of the products with the exception of Chinese entities that had to be audited prior.

The second most important sector subject to tariffs were the technology and intellectual property. The battle started when, a US investigation[82], concluded that the Chinese unfair trade practices are harming the american trade development, resulting tariffs worth US$ 50 billion of 1,333 Chinese products[83] and WTO dispute. In response China imposes tariffs that target US$ 45 billion american agriculture products. In the following months both countries are exchanging threats for additional tariffs and sanctions. After the Phase 1 tariffs, the US introduced tariffs worth US$200 billion targeting manufactured goods such as computers and electronics (47% of the list[84]). Following Trump's threats to impose more tariffs, China threatens to impose additional tariffs worth US$ 60 billion on american goods. On the Phase 2[85], US and China imposed US$16 billion additional tariffs on their products. In December, after the G-8 summit, both country leaders stated the two countries will start having better

[79] Hufbauer, G. C., & Jung, E. (2018, December 20). *Steel profits gain, but steel users pay, under Trump's protectionism*. Peterson Institute for International Economics PIIE. https://www.piie.com/blogs/trade-and-investment-policy-watch/steel-profits-gain-steel-users-pay-under-trumps

[80] Bown, C. P. (2020a, February 4). *Trump's steel and aluminum tariffs are cascading out of Control*. Peterson Institute for International Economics PIIE. https://www.piie.com/blogs/trade-and-investment-policy-watch/trumps-steel-and-aluminum-tariffs-are-cascading-out-control

[81] *Raimondo, Tai statements on 232 tariff agreement with United Kingdom*. U.S. Department of Commerce. (2022, March 22). https://www.commerce.gov/news/press-releases/2022/03/raimondo-tai-statements-232-tariff-agreement-united-kingdom

[82] *Findings of the investigation into China's acts, policies, and practices related to technology transfer, intellectual property, and innovation under section 301 of the trade act of 1974.* (2018, March 22). office of the United States trade representative executive office of the president. https://ustr.gov/sites/default/files/Section%20301%20FINAL.PDF

[83] *Notice of Determination and Request for Public Comment Concerning Proposed Determination of Action Pursuant to Section 301: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*. OFFICE OF THE UNITED STATES TRADE REPRESENTATIVE. (2018). https://ustr.gov/sites/default/files/files/Press/Releases/301FRN.pdf

[84] Bown, C. P., Jung, E., & Lu, Z. (Lucy). (2020, August 4). *Trump's latest $200 billion tariffs on China threaten a big blow to American consumers*. Peterson Institute for International Economics PIIE. https://www.piie.com/blogs/trade-and-investment-policy-watch/trumps-latest-200-billion-tariffs-china-threaten-big-blow

[85] Bown, C. P., Jung, E., & Lu, Z. (Lucy). (2020, June 9). *Trump, China, and tariffs: From soybeans to semiconductors*. Peterson Institute for International Economics PIIE. https://www.piie.com/blogs/trade-and-investment-policy-watch/trump-china-and-tariffs-soybeans-semiconductors

affairs and discuss their trading activities with the note that if they do not reach any agreement by March 2019, then the tariffs will rise[86]. Until May 2019 the climate seemed to improve, but then Trump "tweeted" a thread that the tariffs will rise to 25% rate[87], and China replied with additional tariffs that would cover US$36 billion out of the US$60. The following months both countries threatened each other with additional tariffs, only to announce that there is a deal to take place in January 2020[88]. The agreement was that China will import additional US$200 billion from US, with the majority of tariffs remaining active, in a much higher level than the trade's restriction before the beginning of trade war. Due to the Covid-19 disruption, China missed the goal, activating tariffs on 352 products[89].

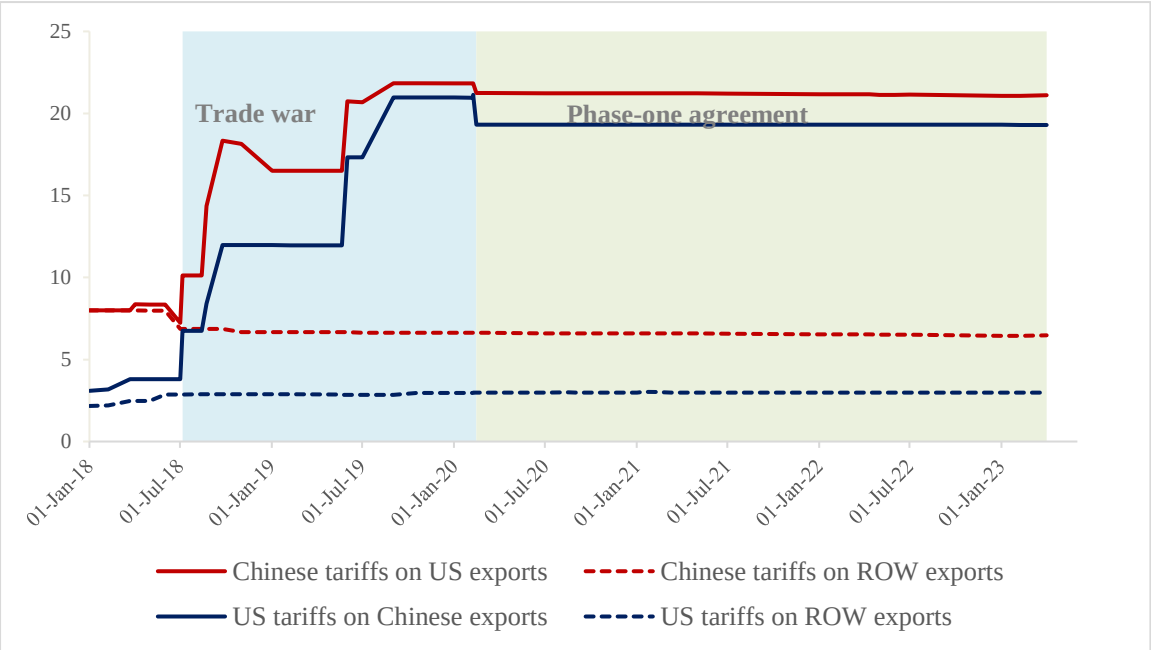
In the following graph the above short-length review of the trade war is summarized.

[86] Bown, C. P. (2020, December 18). *Why the US needs allies in a trade war against China*. Peterson Institute for International Economics PIIE. https://www.piie.com/commentary/op-eds/why-us-needs-allies-trade-war-against-china

[87] *Notice of Modification of Section 301 Action: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*. Federal Register, National Archives. (2019, September). https://www.federalregister.gov/documents/2019/05/09/2019-09681/notice-of-modification-of-section-301-action-chinas-acts-policies-and-practices-related-to

[88] Bown, C. P. (2023, April 6). *US-china trade war tariffs: An up-to-date chart*. Peterson Institute for International Economics PIIE. https://www.piie.com/research/piie-charts/us-china-trade-war-tariffs-date-chart

[89] *Notice of Modification of Section 301 Action: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*. Federal Register, National Archives. (2019, September). https://www.federalregister.gov/documents/2019/05/09/2019-09681/notice-of-modification-of-section-301-action-chinas-acts-policies-and-practices-related-to



[90]

Figure 5: US-China tariff rates toward each other and rest of world (percent) (y-axis= tariffs %)

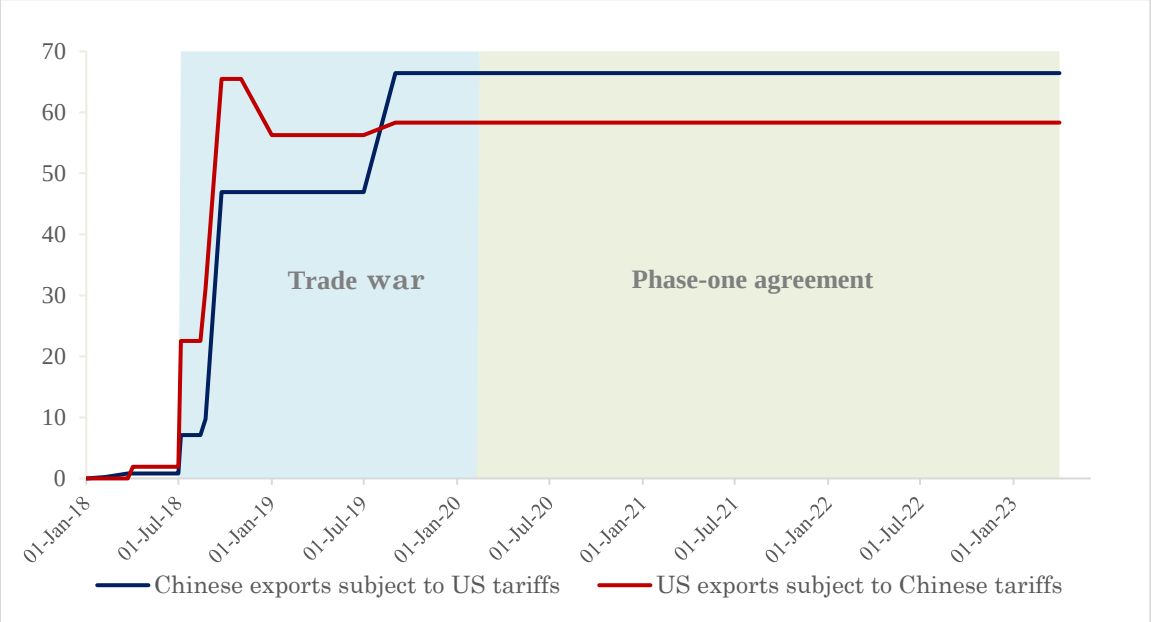


Figure 6: Percent of US-China trade subject to tariffs91 (y-axis= tariffs %)

[90] Bown, C. P. (2023, April 6). *US-china trade war tariffs: An up-to-date chart*. Peterson Institute for International Economics PIIE. https://www.piie.com/research/piie-charts/us-china-trade-war-tariffs-date-chart

[91] Bown, C. P. (2023, April 6). *US-china trade war tariffs: An up-to-date chart*. Peterson Institute for International Economics PIIE. https://www.piie.com/research/piie-charts/us-china-trade-war-tariffs-date-chart

The below graphs summarize that China was the country most affected by the tariffs, as an indication that the goal of Trump, and later Biden, Administration was to contain China.

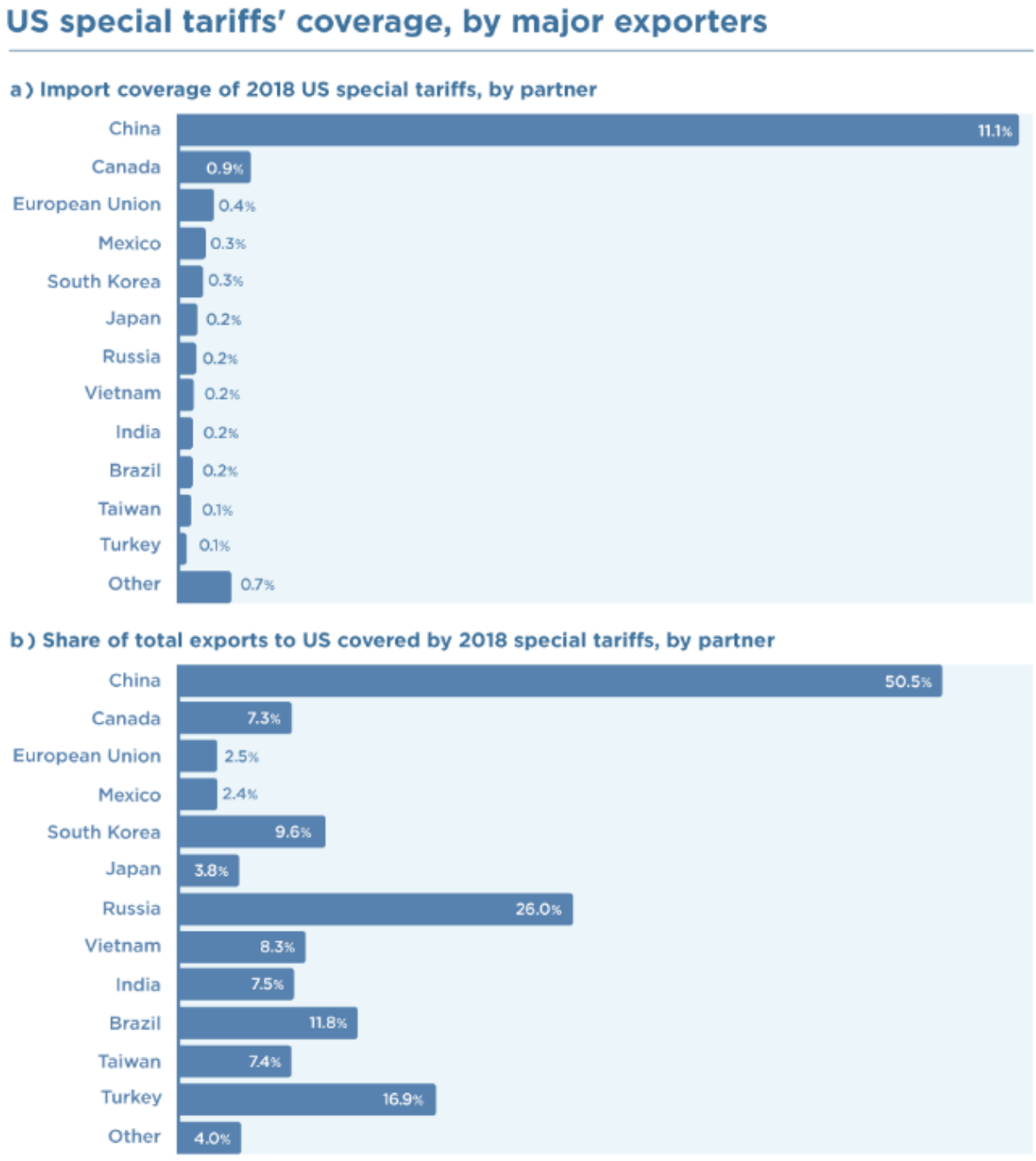


Figure 7: US Tariffs Coverage[92]

[92] Bown, C. P., & Zhang, E. (Yiwen). (2019, February 15). *Measuring trump's 2018 trade protection: Five takeaways*. PIIE. https://www.piie.com/blogs/trade-and-investment-policy-watch/measuring-trumps-2018-trade-protection-five-takeaways

6. Seaborne Trade

The term *Seaborne trade* refers to the transportation of goods through the sea trading routes by vessels[93] and it is measured in ton – miles[94], meaning how many miles a tone of commodity was transported. The total volume of Seaborne Trade includes the transportation of dry cargo (commodities such as coal, iron ore, grain), liquid cargo (oil, LNG, LPG – refines products), and finally manufactured, or containerisable goods. Being an essential part of the global economy by representing 80%[95] of transportation of goods, allowing businesses to transport goods efficiently and cost-effectively across the world, the volume of the seaborne trade is highly volatile and cyclical due to the international character and the multinationalism of the stakeholders. The seaborne trade balance (or trading balance, as it will be analyzed in the USA – China trade significance) measures the difference between the volumes of loaded and discharged goods per nation.

As an essential component of the global economy[96], the transportation of goods by sea provides a cost-effective and a fast way to transport goods across the world. This efficiency translates into lower prices for consumers, which can stimulate economic growth and improve living standards. It allows to the countries involved to grow their economy through shipping activities and access markets for product purchasing from all over the world. The trading activities amongst countries will either promote their diplomatic ties with other states or create alliances, either deteriorate them in case of competitive products. It supports all of the industries, such as agriculture, manufacturing and energy. Last but not least, shipping is a job provider, as this industry employees anything from the range of logistics offices, lawyers, chefs, or seafarers.

Seaborne Trade is also a big part of the environmental agenda[97], especially as the world moves towards 2030, and the goals of IMO for emissions deduction. While shipping is not emission-free, it is a relatively efficient and environmentally friendly way to transport goods compared

[93] *World Seaborne Trade - UNCTAD Handbook of Statistics 2022*. UNCTADstat. (2022). https://hbs.unctad.org/world-seaborne-trade/
[94] Brand, A. E. (2007). *Elements of shipping*. Routledge.
[95] *Review of Maritime Transport 2022*. UNCTAD. (n.d.). https://unctad.org/rmt2022
[96] Hoffmann, J. (2018, March 23). *Seaborne trade has brought prosperity. how to ensure its sustainability*. Global Maritime Forum. https://www.globalmaritimeforum.org/news/prosperity-for-all-the-contribution-of-seaborne-trade
[97] Hermundsgård , H. (n.d.). *Emissions connect - ADVANCE from raw data to sustainable operations*. DNV. https://www.dnv.com/services/emissions-connect-237579?gclid=EAIaIQobChMIgrPS6J3mgAMVEweLCh3HOw4wEAAYBCAAEgK33_D_BwE

to other modes of transportation, such as air freight or road transport[98]. The industry has made significant progress in reducing its environmental impact in recent years and continues to seek ways to become more sustainable. Innovative companies, such as Maersk[99] or Shell[100], are investing in Research and Development projects in order to find sustainable alternative fuels.

In short, seaborne trade plays a crucial role in the global economy, connecting people and businesses from around the world while providing jobs and economic growth.

Figure 8: Trading Routes

a) The trade of Dry Bulk Commodities[101]

The dry bulk commodities are the oldest trade of all, as these commodities are used as raw materials in manufacturing and day to day life. As mentioned in the Clarksons Glossary "*The term 'dry bulk cargo' can be used to describe a number of different raw materials, yet all share*

[98] Kennemer, J. (2020, May 12). *Air Freight vs. Sea Freight Carbon Footprint // Environmental Impact of Shipping*. Sourcing Hub. https://www.sourcinghub.io/air-freight-vs-sea-freight-carbon-footprint/
[99] Silverstein, K. (2023, February 27). *Decarbonizing the shipping sector is a long trip but within reach*. Forbes. https://www.forbes.com/sites/kensilverstein/2023/02/27/decarbonizing-the-shipping-sector-is-a-long-trip-but-within-reach/?sh=19f3d0a960b2
[100] Bullard, N. (2023, April 3). *Solar and Wind Are Growing Faster Than Fledgling Nuclear and LNG Once Did*. Bloomberg. https://www.bloomberg.com/news/articles/2023-04-03/solar-and-wind-energy-leave-the-past-growth-of-nuclear-in-the-dust?srnd=green&sref=iln6Reat
[101] *Ship operations and management*. (2017). Institute of Chartered Shipbrokers.

some key characteristics. A dry bulk cargo is usually: a solid material (either a combination of particles, granules or large pieces), shipped in large quantities, measured in deadweight tonnage (dwt), loaded and shipped unpackaged, in lose form, an unprocessed commodity which will later be used for the manufacturing or production of goods"[102]. The most important index for measuring the changes in cost of transportation is the BDI[103]. It can also be used for forecasting the true demand in the market, due to the fact that dry bulk commodities are used as raw materials.

Dry Bulk trading is divided into two categories, the minor bulks and the major bulks. Major bulks are accountable for 2/3 of dry bulk trading and includes iron ore, used for industrial production and daily manufactured goods, and coal, used for electricity production. For the purpose of this dissertation, the iron ore commodity is considered to be of utmost importance because of the dependence of Chinese economy to West providers[104].

The below map shows the most important trading ports for iron ore trading. It can be observed that several arrows starting from Brazil and Australia end up in major Chinese ports. More specifically:

- Brazil (Tubarao) to China (all ports),
- India (Kakinada) to China (all ports),
- Rotterdam to China (all ports),
- Chile to China (all ports),
- Brazil to China (all ports).

[102] Chen, J. (2022, July 24). *Dry bulk commodity: Definition, examples, index, vs. Container*. Investopedia. https://www.investopedia.com/terms/d/dry-bulk-commodity.asp
[103] Chen, J. (2022, July 24). *Dry bulk commodity: Definition, examples, index, vs. Container*. Investopedia. https://www.investopedia.com/terms/d/dry-bulk-commodity.asp
[104] *Import value of iron ore to China in 2021, by country of origin (in million U.S. dollars)*. Statista. (n.d.). https://www.statista.com/statistics/1070171/china-iron-ore-import-share-by-country

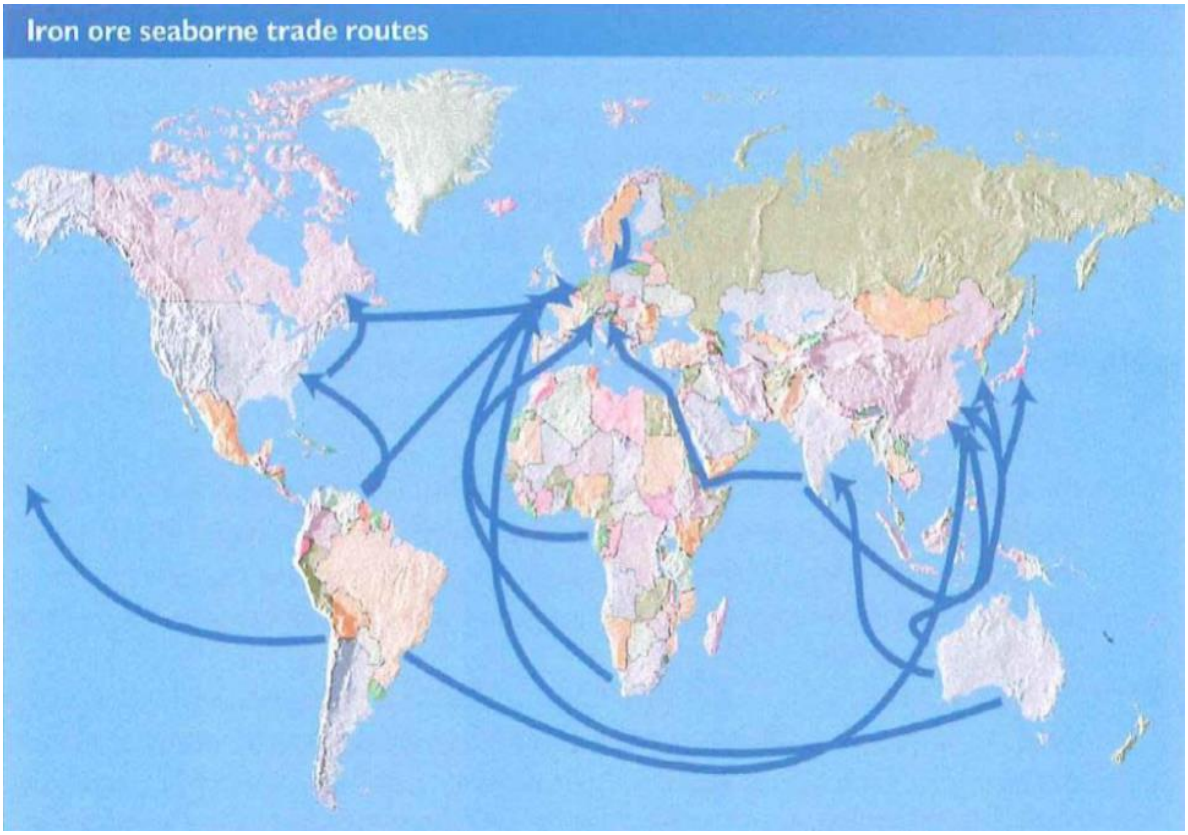


Figure 9: Iron Ore Trade Map[105]

[105] *Ship operations and management*. (2017). Institute of Chartered Shipbrokers

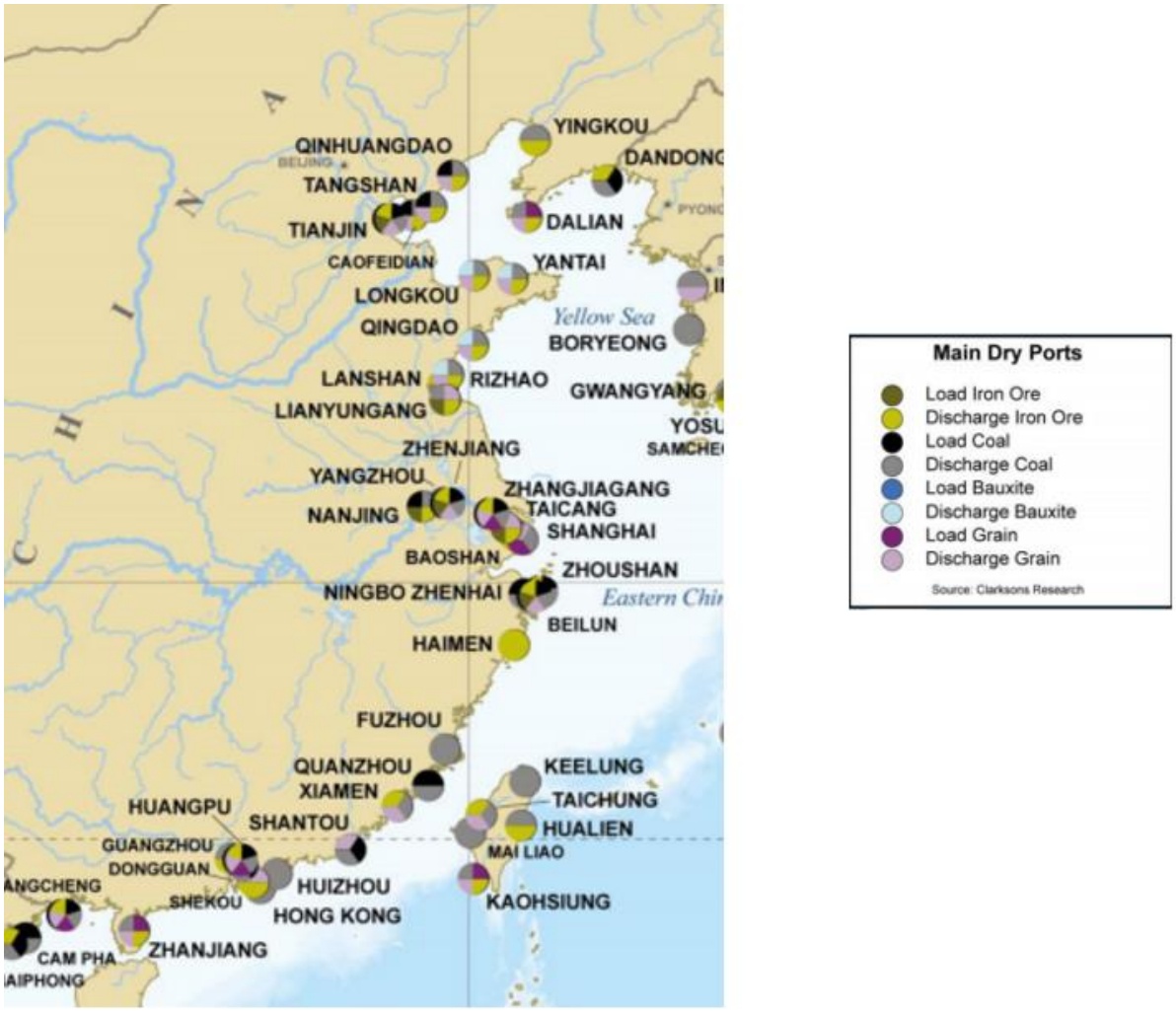


Figure 10: Chinese Iron Ore Importing Ports

[106]

b) The Manufactured Goods trade

Container trade has a significant role in the global trade due to its standardized and cost-efficient nature[107], earning 50-60% of the total shipping revenue[108]. The liner trade, standardized by using uniform boxes – easily transported by trucks, trains, and ships, has enabled the efficient handling and movement of goods worldwide. Manufactured goods vary, from electronics, clothes, house equipment of any other material used in daily life. Their introduction was first made in 1950s and its use is growing steadily and at this moment the

[106] Shipping Intelligence Network. (n.d.). https://sin.clarksons.net/

[107] *Containerships – the engines of globalization and trade, Misuse of Containerized Maritime Shipping in the Global Trade of Counterfeits*. OECD iLibrary. (n.d.). https://www.oecd-ilibrary.org/sites/508bfb5b-en/index.html?itemId=%2Fcontent%2Fcomponent%2F508bfb5b-en

[108] Goulielmos, A. M. (2017). *"containership markets": A comparison with bulk shipping and a proposed oligopoly model*. SPOUDAI Journal of Economics and Business. https://spoudai.org/index.php/journal/article/view/159

majority of international seaborne trade being carried by container ships. Liner trading has fixed costs based on the size of the vessel and the container boxes and combining with the cost minimizing character of the overall shipping industry, containerships are one of the cheapest and fastest ways of transportation.

China is the greatest manufacturer and exporter of containerisable goods, continuingly leading maritime connectivity. The cheap labor and low-cost production in most of the products makes China attractive for financial investments in factories of any kind[109]. The significance of the Chinese factor for the manufactured goods trading is of high importance and it can easily be observed as the top-10 container ports list contains 7 ports located in China.

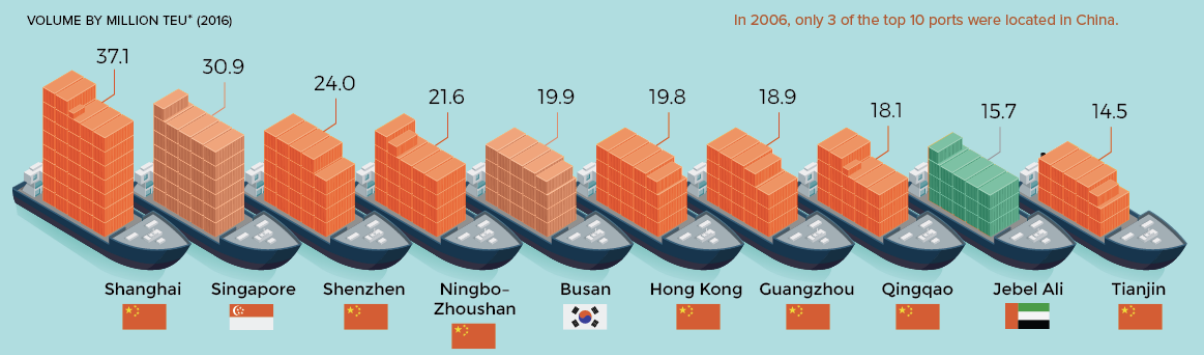


Figure 11: Top 10 Container Exporting Ports [110]

Also, according to the below graph, Asia, in generic terms, is accountable for 71.3% of the most crucial ports, with China covering 40.3%.

[109] *How is china influencing global maritime connectivity?*. ChinaPower Project. (2021, May 12). https://chinapower.csis.org/china-ports-connectivity/

[110] Routley, N. (2019, March 12). *Visualizing the world's busiest ports*. Visual Capitalist. https://www.visualcapitalist.com/worlds-busiest-ports/

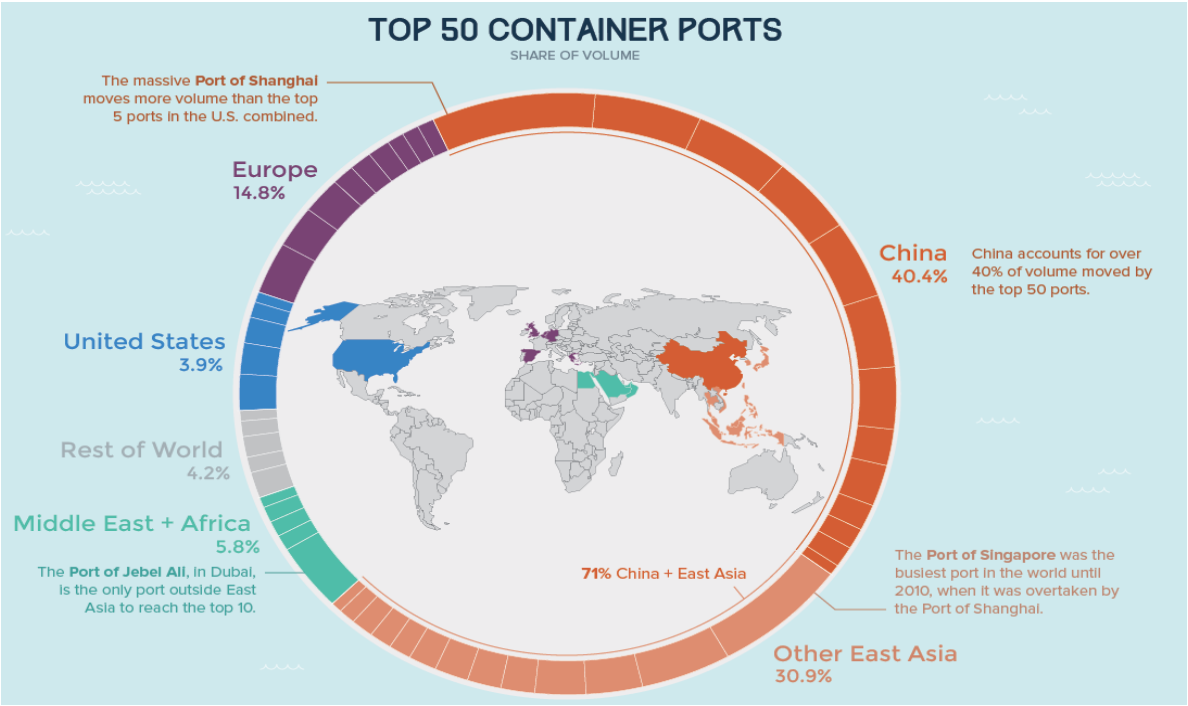


Figure 12: Top 50 Container Ports[111]

However, there have been some concerns in recent years related to the impact on human rights and the wide plastic consumption for this shipping segment. Additionally, a growing concern is the impact of global trade tensions, with most important for this trade, the U.S.-China trade war, which allegedly officially begun in 2018, after the Trump Tariffs. As a result, the transportation and import costs from China to the U.S. have almost double increased. It is worth mentioning that the disruption of Covid benefited the Chinese economy, and on the contrary to the Dry and Oil markets, the containership freight rates reached historical high levels until the first half of 2022, significantly falling but staying above 20,00$/day.

7. The significance of the Seaborne Trade between China and USA

The trade affairs of the two largest economies of the world present high interest, due to the complexity of their bilateral affairs. China is the third exporting country[112] for US products supporting more than 1 million jobs. Historically, the trading balance with China is negative,

[111] Routley, N. (2019, March 12). *Visualizing the world's busiest ports*. Visual Capitalist. https://www.visualcapitalist.com/worlds-busiest-ports/

[112] *US Exports to China Goods and Services Exports to China and the Jobs They Support, by State and Congressional District*. US-China Business Council 2023. (2023). https://www.uschina.org/sites/default/files/us_exports_to_china_2023_0.pdf

as the US import larger qualities of Chinese products. Focusing on year 2020 trade balance is the following:

Imports from China By Sector	China Commodity Trade 2022	US Exports to China by Sector
$536,754,091,696	Total Value All Commodities	$153,837,091,085
1.2%	Agriculture Products (Chapters 01-24)	23.1%
0.1%	Oils, Minerals, Lime, Cement (Chapters 25-27)	9.7%
12.0%	Chemicals, Plastics, Rubber, Leather Goods (Chapters 28-43)	19.5%
1.6%	Wood, Cork, Paper, Printed Books (Chapters 44-49)	2.9%
10.0%	Textiles, Footwear, Headgear (Chapters 50-67)	2.4%
1.7%	Stone, Glass, Metals, Pearls (Chapters 68-71)	2.3%
5.8%	Base Metals, Iron, Steel, Tools (Chapters 72-83)	3.0%
46.4%	Machinery & Mechanical Appliances (Chapters 84-85)	20.1%
3.7%	Transportation Equipment (Chapters 86-89)	8.4%
2.7%	Optical, Measuring, Medical, Other Instruments (Chapters 90-92)	7.1%
0.0%	Arms & Ammunition (Chapter 93)	0.0%
12.9%	Miscellaneous Manufactured Items (Chapters 94-96)	0.2%
0.0%	Art, Collectors' Pieces, Antiques (Chapter 97)	0.1%
1.0%	Special Classification Items (Chapter 98)	1.1%
0.8%	Temporary Legislation (Chapter 99)	0.0%
Source: U.S. Census Bureau USA Trade Portal April 24, 2023		

Figure 13: Trade Balance[113]

During 2022, the growth of US exports to China slightly decreased with several analysts underlining that the steady increase of the latest years might be the result of inflation[114]. The y-o-y change in growth was 1.2%, while the average inflation for 2022 was 8%[115]. As it is observed in the below graph, the exports of US goods to China have small fluctuations through the years. The exports fell in 2018 and 2019, due to the tariffs. These two years are the only two years that the actual effect of tariffs, and economic decoupling, can be identified. For years 2020 to 2022 the US exports reached record high, due to the Covid-19 and Russo-Ukrainian war disruption.

[113] *2022 U.S. trade with China*. US Department of Commerce - Bureau of Industry and Security, Office of Technology Evaluation. (2022). https://www.bis.doc.gov/index.php/country-papers/3268-2022-statistical-analysis-of-u-s-trade-with-china/file

[114] *US Exports to China Goods and Services Exports to China and the Jobs They Support, by State and Congressional District*. US-China Business Council 2023. (2023). https://www.uschina.org/sites/default/files/us_exports_to_china_2023_0.pdf

[115] *Annual inflation rate in the United States from 1990 to 2022*. Statista. (n.d.). https://www.statista.com/statistics/191077/inflation-rate-in-the-usa-since-1990/?gclid=EAIaIQobChMIzJn26cz3gAMVDZmDBx2_OQ2aEAAYASAAEgLaY_D_BwE

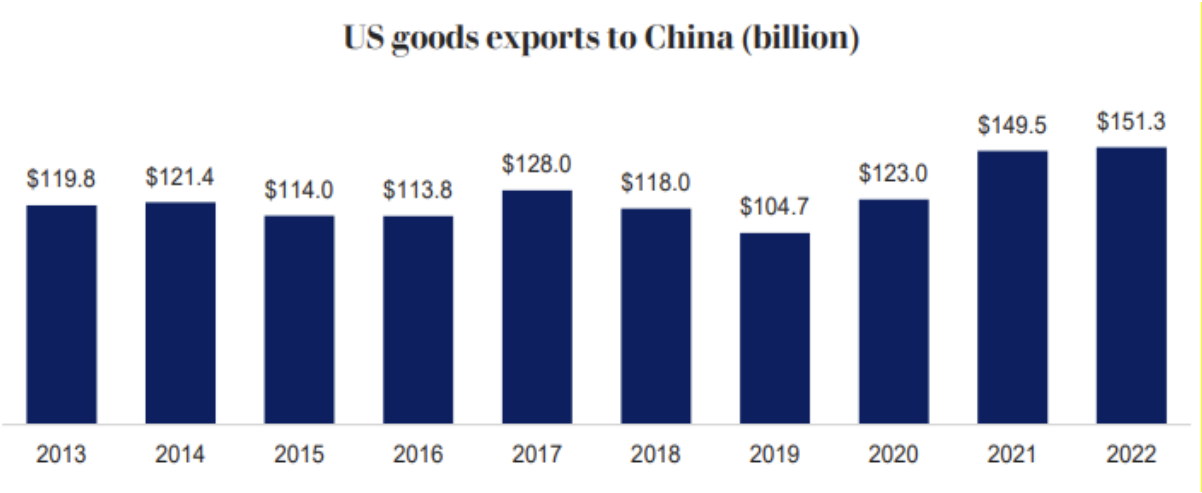


Figure 14: US goods exports to China (billion)[116]

As long as it concerns the US imports from China, it is observed that in general terms the quantities have an upward trend. It seems, complying with the time gap between the imposition of the tariffs on Chinese products and on American products, 2018 was at a historical high level. The actual effect of decoupling can be found in years 2019-2020, but once again, the figures are altered for the following years due to the Covid-19 pandemic.

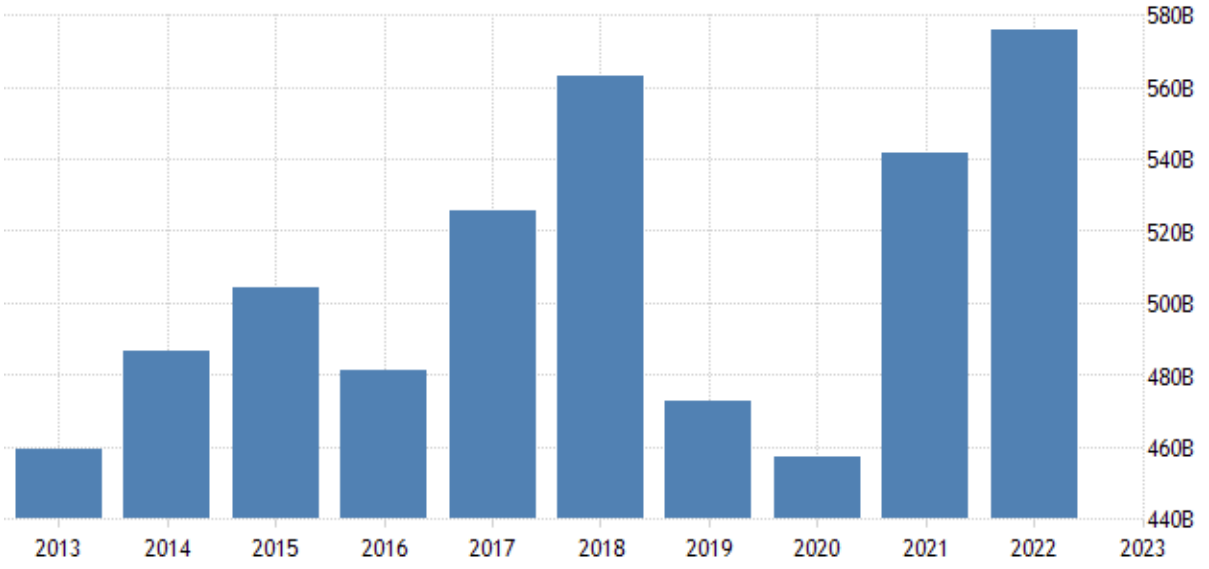


Figure 15: US Imports from China[117]

[116] *US Exports to China Goods and Services Exports to China and the Jobs They Support, by State and Congressional District*. US-China Business Council 2023. (2023). https://www.uschina.org/sites/default/files/us_exports_to_china_2023_0.pdf

[117] *United States imports from CHINA - 2023 data 2024 forecast 1991-2022 historical*. United States Imports from China - 2023 Data 2024 Forecast 1991-2022 Historical. (n.d.). https://tradingeconomics.com/united-states/imports/china

The limitations of the growth, at least for the period 2018-2020, of the bilateral trade could be identified in tariffs, deterioration of US-Chinese affairs and the dispute for semiconductors. The researchers of the National Bureau of Economic Research[118](Gorman, 2020) suggest that while the trade war was growing strong between US and China, the products that tariffs were imposed provoked growth in other countries, proving that the supply chain changed.

Last but not least, Chinese economy is expected to grow by 5.2% in 2023, while the rate for the rest of the world is 2.9%[119], indicating that in order for another economy to be competitive, it has to keep friendly trading affairs with China[120], providing at the same time a justification and a possible reason why the US want to contain China.

8. The Shipping Market Cycles

The Shipping Market Cycles refer to the "waving" of the segments in the shipping market. The cycles have specific characteristics for each phase and are related to the international economy and subject to macroeconomic and geopolitical events that may occur. Analysts use the cycle fluctuations to predict the shipping market and make business decisions.

Martin Stopford (Maritime Economics, 2013) separates the Shipping Market Cycles to two basic categories[121]: the *long-term trend* lasting ~ 60 years and the *short-term* – or *business – cycle* lasting ~ 5-10 years. The *long-term trend* is difficult to be identified and is usually connected to a major global event. The analysts Kondratieff and Schumpeter evolved the long-term trend theory, as they attempted to detect the long-lasting shipping cycles and explain their phases using macroeconomic events.

The business cycle is the most common approach for predictions and business decisions and will be used for the analysis in this dissertation. The short cycles last 5-10 years and present four stages. The first stage is the Trough, where there are many available vessels from the

[118] Gorman, L. (2022, April 4). *How the US-china trade war affected the rest of the world*. National Bureau of Economic Research. https://www.nber.org/digest/202204/how-us-china-trade-war-affected-rest-world

[119] *World economic outlook update*. International Monetary Fund. (2023, January 31). https://www.imf.org/en/News/Articles/2023/01/31/tr-13123-world-economic-outlook-update#:~:text=With%20China's%20economy%20now%20reopening,account%20for%2010%20percent%20only.

[120] Gorman, L. (2022, April 4). *How the US-china trade war affected the rest of the world*. National Bureau of Economic Research. https://www.nber.org/digest/202204/how-us-china-trade-war-affected-rest-world

[121] Stopford, M. (2013). Maritime economics (3rd ed.). London: Routledge

previous phase of the cycle, the freight rates are below the break even and the banks are very hesitant in lending money, due to the negative cashflows. Many shipowners decide to sell their less operative vessels for scrap to increase liquidity, and the ship supply is decreasing. The second phase, Recovery, is where the demand and supply come to balance. The freight rates recover above the OPEX providing greater liquidity. The second-hand prices are increasing and the confidence in the market is restored. Peak, the third phase of the cycle, has as main characteristic the excess demand. In this phase of the cycle the available vessels are operating in full speed to meet the needs of the demanding market and overcome the lack of vessels. The freight rates skyrocket, with some periods being ten times more than the average freight rate. The cashflows are positive and the liquidity increases, as the prices in the new buildings do. The confidence is completely restored, and the banks are open in investing in new projects, increasing the orderbook. It is worth mentioning that the shipping stock markets are very profitable during this time of the cycle. The more this period lasts, the more the expectations and exposure grow. The last phase of the cycle is the Collapse. Due to the excessive orderbook, the supply of vessels now is greater than the demand, having as a result the less commercial ships to be idle and the operating one not operating on full speed. The ports are congested and there are many vessel deliveries occurring as a result of the excessive orderbook. The freight rates are rapidly falling so as the asset prices. Despite all of this, there is still liquidity, as a consequence of the previous stage of the cycle.

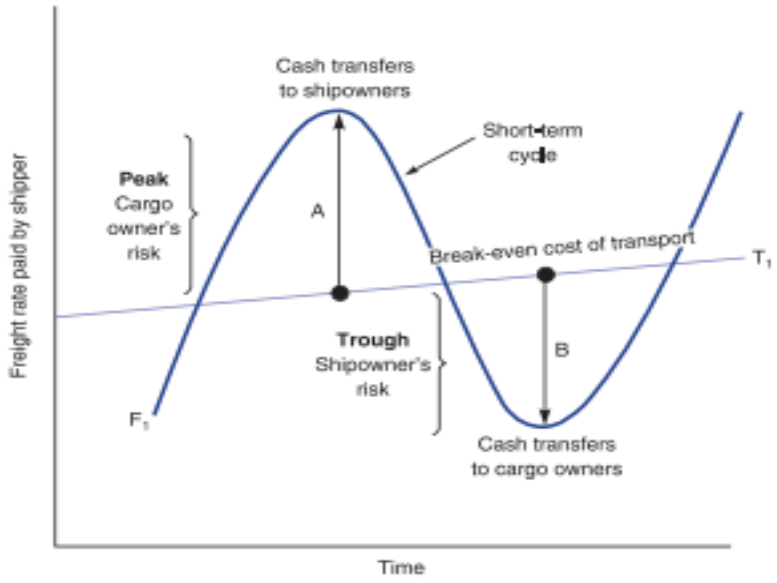


Figure 16: Shipping Cycle Four Stages [122]

[122] Koldemir, B., Ceyhun, G., & Kayimer, G. (2016, October). *A STUDY ON FINANCIAL RISK MANAGEMENT IN TURKISH MARITIME SECTOR*. Global Conference On Innovation in Marine

Except of the two types of cycles, there is also the seasonal shipping cycle, occurring within one year and is related to the seasonality of specific commodities, such as grains. The seasonal patterns can be easily identified every year.

Nowadays, the shipping cycles may have different characteristics and smaller duration due to the fast pace of events. The patterns remain but there is no regularity and can be any definition. The observation of the segment of interest in relation to the other segments provide a round up analysis of the overall market and may assist the analyst predict the future trend of the "waving".

In the below graph, providing the freight rates for the dry bulk carriers for the last 30 years, the shipping business cycles can be identified.

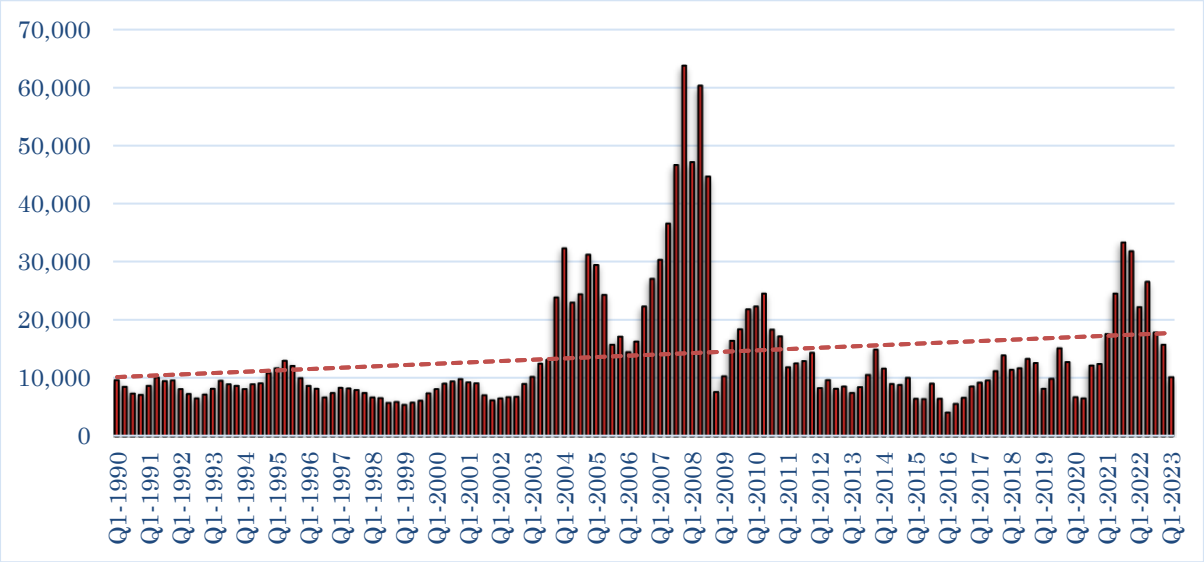


Figure 17: Bulkers Earnings

From 1990 to early 2003, the markets went through the *Through phase*, recovering from the collapse caused by wars all around the globe in the second half of the century. The market showed *recovery* in the years 2003 to 2007, only to *reach its peak* with historical high levels of freight rates for all the shipping segments in the very profitable year 2007 and the first three quarters of 2008. The Chinese factor in the dry bulk trade and the demand for Australian Iron Ore[123] pushed the freight rates higher. The orderbook was also highly increased, providing an

Technology and the Future of Maritime Transportation. https://www.researchgate.net/figure/Key-Risk-Features-of-the-Shipping-Cycle-Source-Compiled-by-Martin-Stopford-from-various_fig1_316087451

[123] Wang, C. (2017, August 27). *Analyzing shipping cycles of dry bulk shipping market over the past 50 yearspast 50 years*. World Maritime University Dissertations. https://commons.wmu.se/cgi/viewcontent.cgi?article=2531&context=all_dissertations

idea that there would be excessive vessel supply in the following years. Following the Lehman Brothers Collapse in September 2008, the market collapsed in Q4.2008, with freight rated deducted by 82.9% compared to Q3.2008[124]. Many analysts consider that from 2008 to 2018 is one shipping cycle, lasting on average 10 years[125]. The below breakdown to different periods, is according to macroeconomic events and the general situation of the global economy.

The above analysis according to the shipping cycles theory will help to in obtain a better understanding of the freight rates behavior in case of the Decoupling disruption.

a) The shipping market during economic crisis 2008 – 2012

After a remarkable profitable 2007, the year 2008 started with strong freight rates – representing the *peak* of the cycle. However, the economic growth and consumption in USA and EU was slowing down. Emerging markets, such as China and India, continued growing and benefited from the high prices.

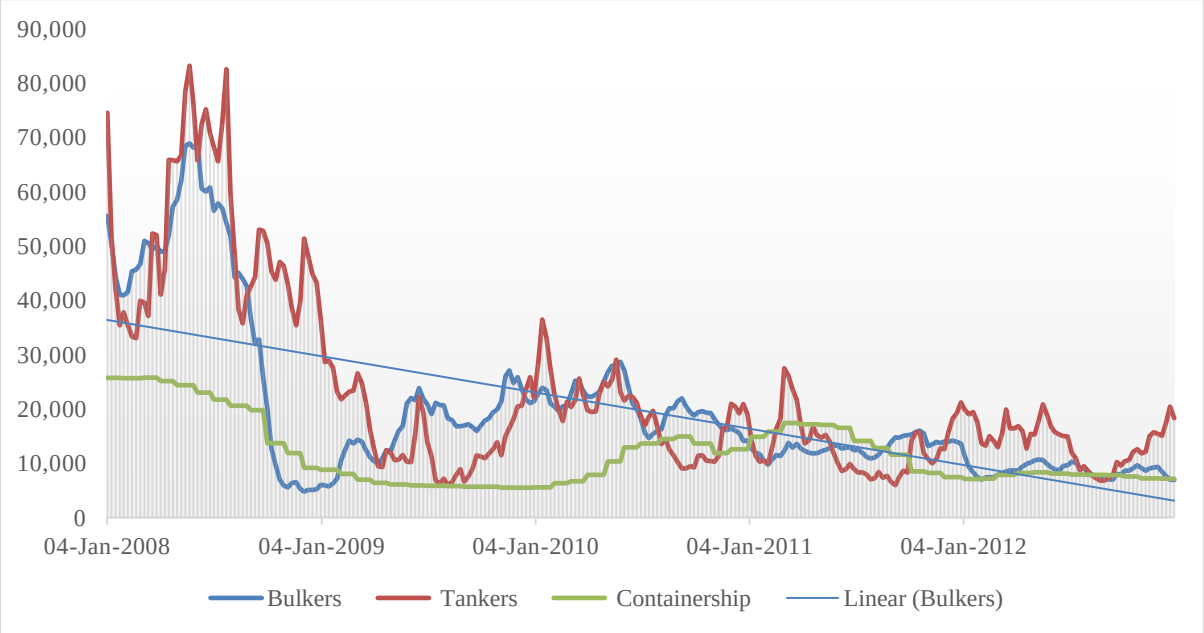


Figure 18: Earnings 2008-2012[126]

Having a closer look to 2008 freight rates it could be observed that from April to early August the market was profitable, especially for the dry and oil segments. Due to the high inflation and

[124] Shipping Intelligence Network. (n.d.). https://sin.clarksons.net/
[125] Wang, C. (2017, August 27). *Analyzing shipping cycles of dry bulk shipping market over the past 50 yearspast 50 years*. World Maritime University Dissertations. https://commons.wmu.se/cgi/viewcontent.cgi?article=2531&context=all_dissertations
[126]Shipping Intelligence Network. (n.d.). https://sin.clarksons.net/

deducted economic growth, the containership earnings were steadily falling. Before the Lehman Brothers collapse in September 2008, the freight rate market for the oil collapsed. The dry bulk market was in free fall from early September 2008 until the end of 2008. The oil freight rates even though they were deducted did not follow the free fall and continued to average levels, following the high prices and supply of oil, along with containers that kept moving steadily downwards until 2009. At this time, the inflation rates for both USA and China were at a very high level, but the growth level in China remains above the trendline[127].

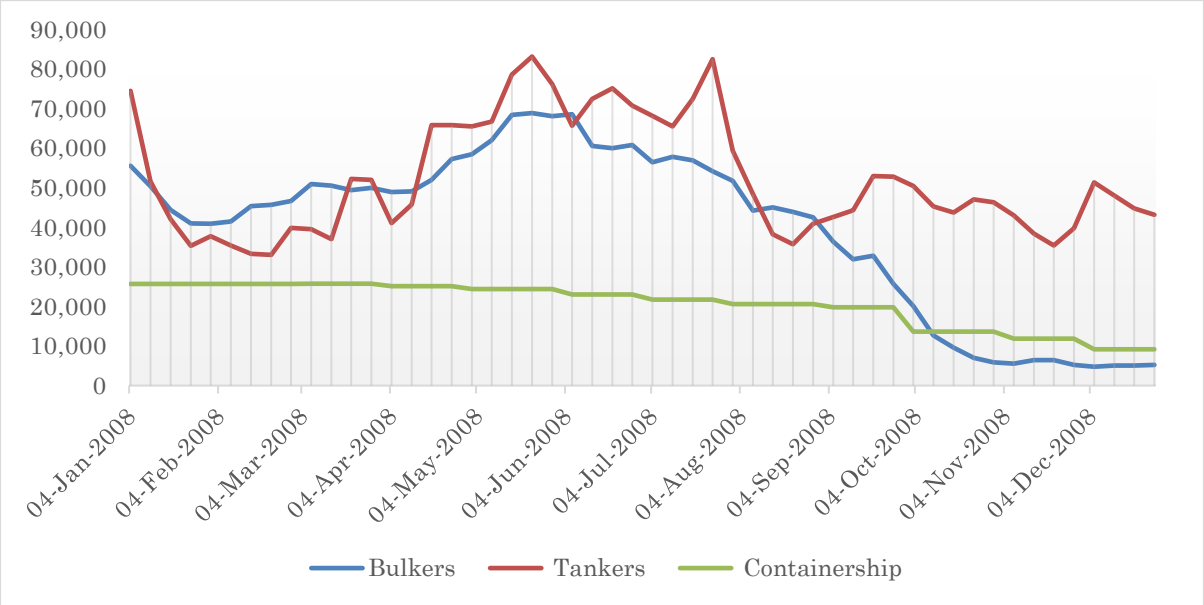


Figure 19: Closer look to 2008 Earnings

Following the collapse of 2008, the freight market was weak in the first half of 2009, and in general terms stayed low until the end of 2012, following the general economic conditions. Developing countries, as China, faced less problems, due to more introvert economic policies and less exposure to international trade at the time, and benefited[128] from the low asset and commodity prices. It is worth mentioning that when the world struggled to finance new projects

[127] *IMF World Economic Outlook (WEO) update - Global Slowdown and Rising Inflation, July 2008*. International Monetary Fund. (2008, July). https://www.imf.org/en/Publications/WEO/Issues/2016/12/31/Global-slowdown-and-rising-inflation

[128] *IMF World Economic Outlook (WEO) update - Rapidly Weakening Prospects Call for New Policy Stimulus- November 2008*. International Monetary Fund. (2008, November 6). https://www.imf.org/en/Publications/WEO/Issues/2016/12/31/Rapidly-Weakening-Prospects-Call-for-New-Policy-Stimulus

in 2009-2011, China was the only country across the globe that did not face such problems. The domestic demand kept being robust due to the macroeconomic policy support[129].

From years 2010 to 2013 the cycle goes through the *Through* and *Recovery* Phases. As the USA and the Western economies faced severe struggles, of economic and social aspect, and had to confront a decline in the demand, China, due to a more introverted economic model and state financial aids, managed to keep growing and benefit from the low prices in metal trading[130].

At the same time, shipbuilding yards were running in full capacity, foreshadowing the excess capacity of ships.

b) The shipping market in the Post Tariffs Period 2013 – 2017

The *recovery* phase continued in 2013, and freight rates reached the *peak* for the period in 2014. In mid-2014 the market dropped to 2012 levels for a small period of time, only to rebound in 2015 and first half of 2016.

From 2013 to the first half of 2017, the graph shows that the oil market followed a different trend than the dry and containers. With small fluctuations the freight rates of dry and containers continued in the *recovery* phase. On the contrary, the oil market reached its *peak* in early 2014, significantly dropped in 2014, and then followed a generally stable upward trend until September 2016, when it dropped in 2008 levels. These fluctuations are explained by the Russian invasion in Crimea and the sanctions on Russian raw materials. By the end of 2017, the three markets started to move towards the same trend again, being still in the recovery phase.

Generally, these years where not marked by any significant geopolitical event, global or important enough to disturb the market.

129 *IMF World Economic Outlook (WEO) - sustaining the recovery, October 2009*. International Monetary Fund. (2009, October 1). https://www.imf.org/en/Publications/WEO/Issues/2016/12/31/Sustaining-the-Recovery

130 *IMF World Economic Outlook (WEO) - sustaining the recovery, October 2009*. International Monetary Fund. (2009, October 1). https://www.imf.org/en/Publications/WEO/Issues/2016/12/31/Sustaining-the-Recovery

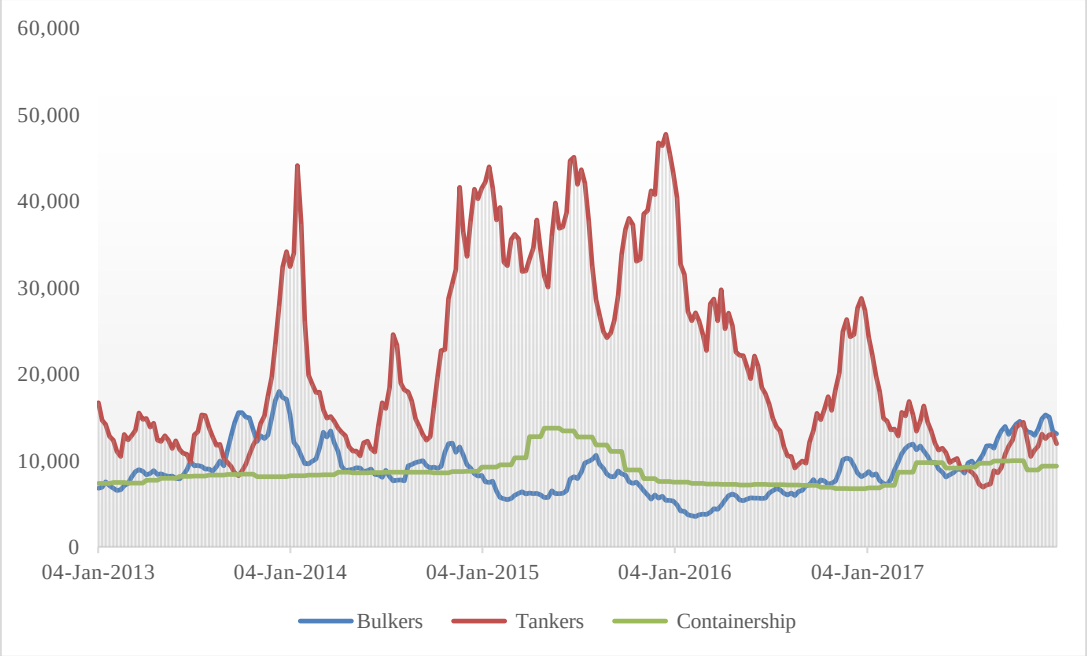


Figure 20: Earnings 2013-2017

c) The shipping market with Trump's Tariffs 2018 – 2019

At the time of tariffs announcement, the shipping markets were still in the recovery phase. The global economy was finally stabilized, and the freight market seemed to follow the same pattern. Containers had a slightly upward trend, while the dry market stayed low and the oil had several fluctuations, reaching the period high in early 2019.

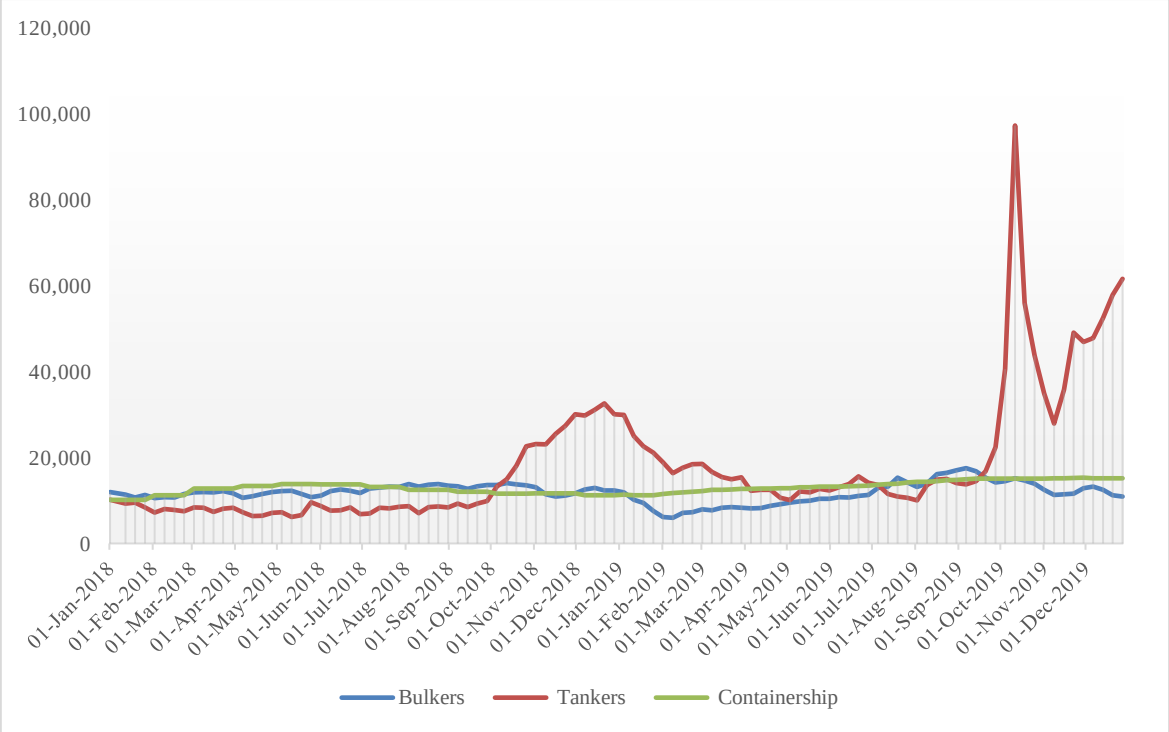


Figure 21: Earnings 2018-2019

More specifically, after the Tariffs imposition in January 2018, the dry and oil market dropped once again. The container market on the other hand, displayed a slight rise, possibly irrelevant to the tariffs.

d) The Covid-19 disrupted shipping market 2020 – 2021

The Covid-19 disrupted the shipping market, creating a (short) one and a half-year cycle, altering at the same time the Trump's Tariffs effect in the shipping market. The uncertainty dropped the dry and containers freight at the beginning of the pandemic, but by the end of 2021, when the trust was back in the markets and global economy the dry and container market reached high – pre 2008 crisis level[131]. The oil market seems to have its own reasons for fluctuations, as oil prices are subject to different geopolitical events.

[131] Khan, K., Su, C. W., Khurshid, A., & Umar, M. (2022). The dynamic interaction between COVID-19 and shipping freight rates: A quantile on quantile analysis. *European Transport Research Review*, *14*(1). https://doi.org/10.1186/s12544-022-00566-x

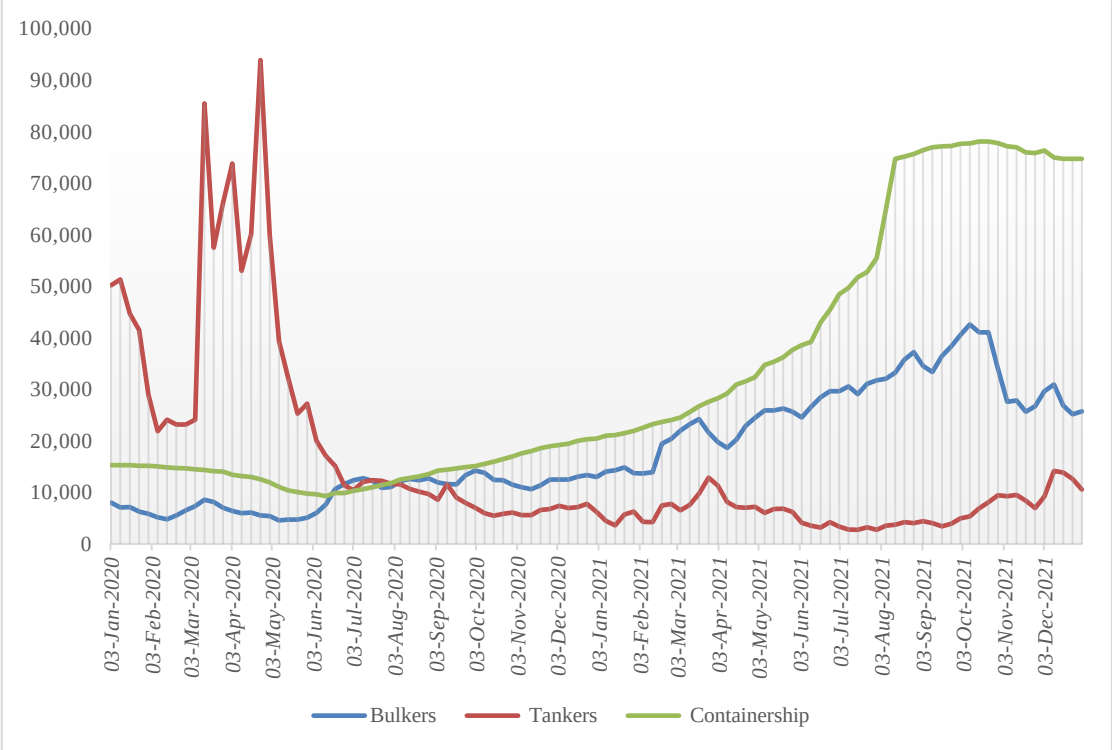


Figure 22: Earnings 2020-2021

The disruption caused by the pandemic and the high earnings the late 2021, leading the confidence to return to the markets. During late 2021 and early 2022, the liquidity coming from the prosperous market paved the way for new projects financing and new shipbuilding projects[132],[133].

e) The shipping market 2022 – today

By the end of lockdowns, the shipping market returned to the *recovery* phase, with the freight rates in 2009 levels for bulkers, but a definitely improved market for the containers and oil. The container freight rates increased comparing to the average earnings for the sector, but significantly dropped compared to the earnings during the pandemic. When the lockdowns got decreased, the demand for manufactured goods created during the lockdowns stepped down and the market corrected itself. Despite this, the above the average earnings could be partially explained by the high demand and the technological initiatives by container tycoons such as

[132] *Cash-rich shipowners double container ship order book in 2021*. BIMCO . (2021, August 26). https://www.bimco.org/news/market_analysis/2021/20210826-container_ship_orders_due_for_deli
[133] *2021 Newbuilding orders rise by 32.7%*. Hellenic Shipping News Worldwide. (2022, March 1). https://www.hellenicshippingnews.com/2021-newbuilding-orders-rise-by-32-7/

Maersk and MSC. The oil prices are explained by the disruption caused to energy sector by the Russo-Ukrainian War.

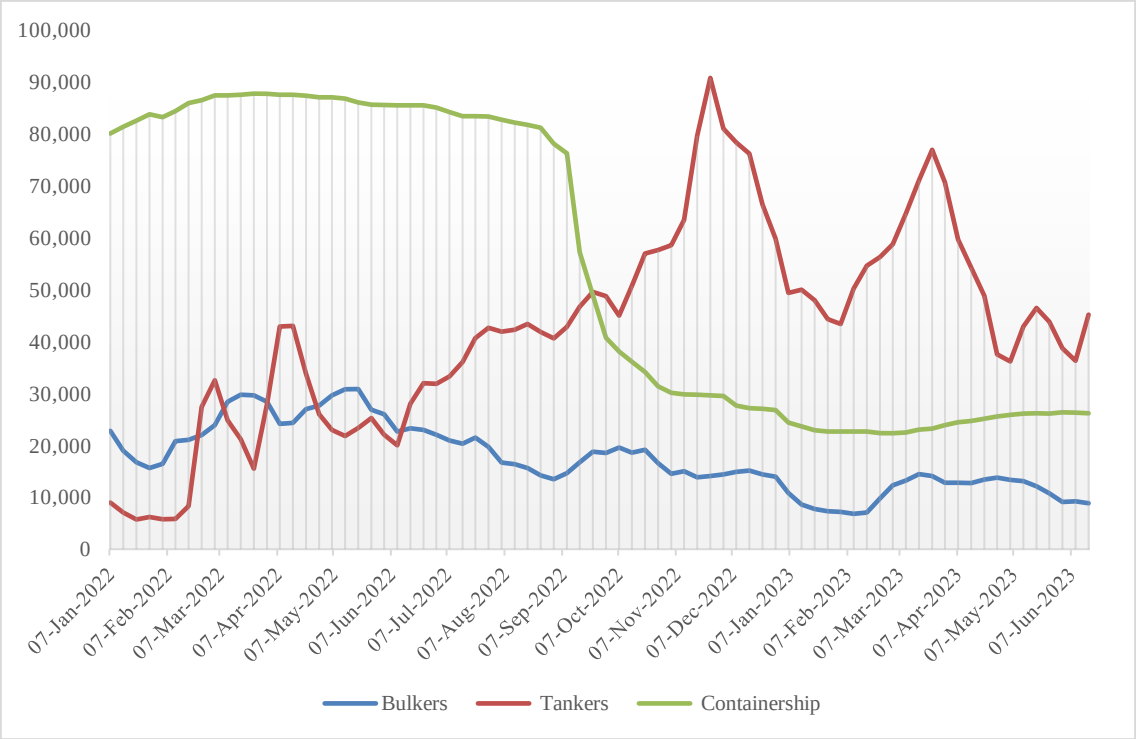


Figure 23: Earnings 2020-today

The above analysis of the bilateral affairs of the two counties, the geopolitical environment and, finally, the shipping market cycles provide a sufficient background examine the economic decoupling implication on seaborne trade. Specifically, the information presented so far along with the quantitative analysis of Part B, underline the relationship between the bilateral trade of the world's largest economies and the volatility of the shipping industry.

9. Part B: Quantitative Analysis

Motivated by the above macroeconomic and qualitative analysis in this section we explore empirically the impact of the imposition of Tariffs in 2018 the trade between USA and China on the seaborne trade. More specifically, the quantitative analysis explores the effect of the Chinese demand and supply to the dry and container shipping markets and the interaction of China with the Seaborne Trade.

The following sections discuss the dependent and independent variables and the reasons behind the selection of the specific variables. Secondly, the descriptive statistics along with the correlation table and the graphs will be presented. A hypothesis test is following, to test the significance of the bilateral trade, and finally, at the final part, the linear regression analysis models will be presented, and their results will be analyzed: The first regression analysis refers to the Total Seaborne Trade Volume for all the major shipping markets combined, focusing on the interaction and contribution of the GDP of the two countries, USA and China, to the seaborne trade. The following two regression analyses refer to the two mostly exposed to Chinese-USA decoupled markets, the ones of Dry Bulk and Containers. In the sector analyses, the Seaborne Trade Volume for Bulkers and Containers are the Dependent Variables.

i) Datasets and Variables Analysis

The dataset consists of 12 annual variables, covering the period 2008 to 2022. The time period of fifteen years allows to examine several macroeconomic periods and global events, analyzed in Part A, and in this way sets a more concrete basis for the analysis. The graphs and analysis are performed using Microsoft Excel. Despite the fact that semi-annually or quarterly data would provide a more detailed analysis, unfortunately several indicators such as World Seaborne Trade Volume, East-West Container Trade and GDP are only provided on annual basis. All of the data are obtained from the Clarkson's Research Services Ltd (CRLS) Database, with the exeption of US Imports and Exports to China which are downloaded from the US Census Bureau.

a) Dependent Variables

- ***World Seaborne Trade/ World Seaborne Trade Dry/ World Seaborne Trade Containers***

The Seaborne Trade is the backbone of the world's economy and the trading activity. It is measured in tone – miles, referring to the transportation of goods by sea. The effect of the imposed Tariffs in 2018 reduced the Seaborne Trade Volume in total and in the two shipping markets examined. The Dry and Container Shipping Markets are chosen as the dependent variables for the regression models due to the codependency of China to iron ore imports and to West's from the Chinese manufactured goods. It is worth mentioning that the nature of both markets provides historical data for profitable or crisis periods, analyzed in Part A, assisting in identifying the macroeconomic disruptions in the market.

The dependent variables are following the same trend during the years - completely correlated as is can be observed in the below graph and crosschecked in Figure 24. The World Seaborne Trade is correlated with Dry Bulkers by 99.18% and Containers by 98.53%.

As each sector of the shipping industry is divided to smaller sub-sectors, it is important to present not only the general effect of Decoupling to the Total Seaborne Trade Volume but also adjust the dependent variables to the sectors of Dry Bulkers and Containers. This will assist in obtaining a better understanding of the exposure of the shipping industry's demand and supply to the US-Chinese Politics.

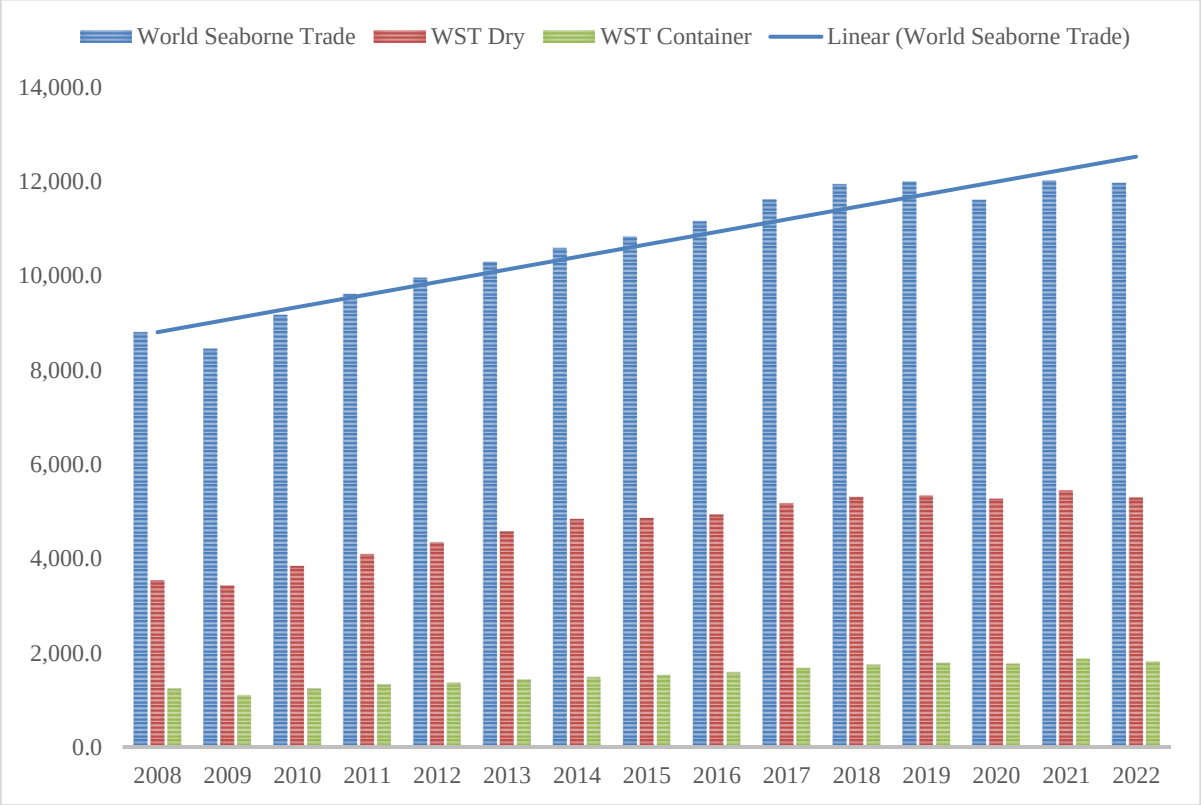


Figure 24: Seaborne Trade Volume and Trendline

As it is observed, in Figure 25, the general trend of the World Seaborne Trade is upward. In year 2020, the seaborne trade was deducted by -3.2% due to Covid-19 disruption, but a year after it was slightly above the 2018 volume. During Covid-19 the container market volumes stayed relatively stable, a situation explained[134] by the consumerist habits of the West during quarantine. According to Clarksons, the seaborne trade is expected to grow in 2023 and 2024.

Even though the seaborne trade is highly correlated to the Chinese - American trade, it has to be underlined, that even in the case of disrupted bilateral affairs, the two different supply chains will import goods from similar exporters aligned with their political preferences. The volume of seaborne trade allows to examine how the fluctuations in the bilateral trade affect the seaborne trade in total and per sector at this early stage of their trade war, where no other supply chains have the time to be formed for Dry and Container commodities.

b) Independent Variables

- ***USA Exports to China and USA Imports from China***

The bilateral trade of USA and China and the correlation to seaborne trade, is one of the main indicators for the regression analysis for the seaborne trade totals. More specifically, the bilateral trade is separated to two main categories, USA Exports to China and the USA Imports from China. Historically the USA present trade deficit, as the Imports from China overexceed the American exports, a situation also obvious from the above graph.

[134] Cranston, M. (2020, May 25). *Laptop imports from China Surge during shutdown*. Australian Financial Review. https://www.afr.com/policy/economy/laptop-imports-from-china-surge-during-shutdown-20200525-p54w59

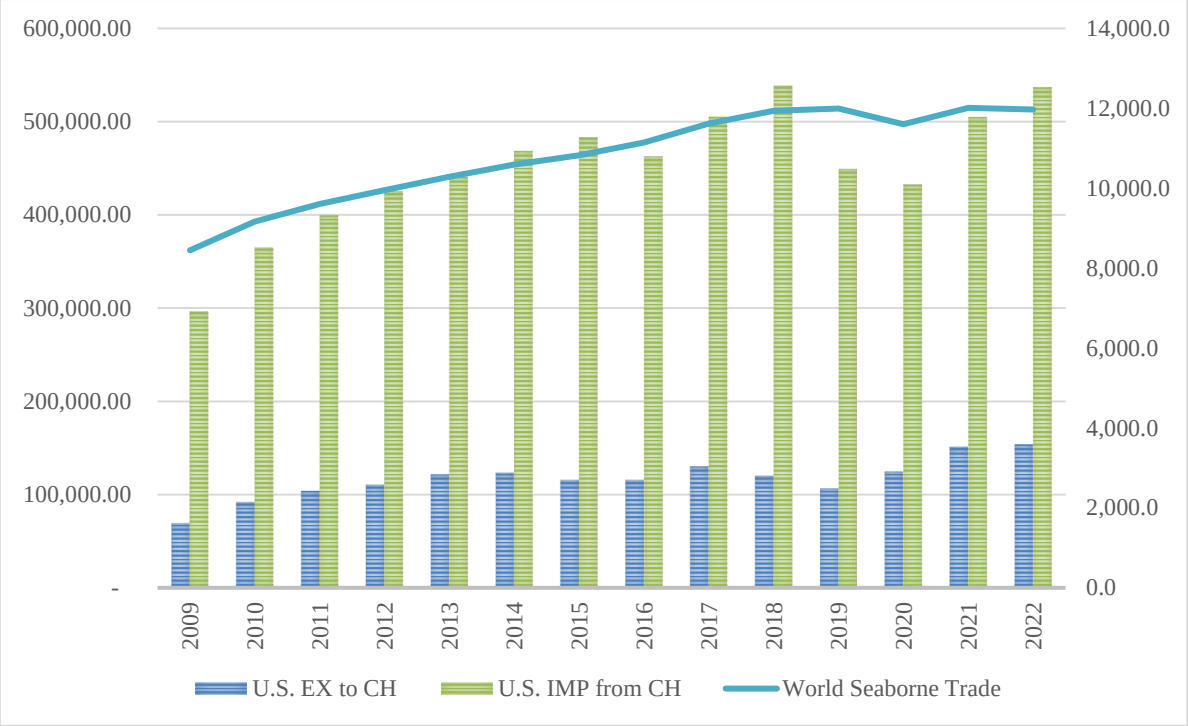


Figure 25: Bilateral Seaborne Trade Volume

As it can be observed in the graph, in generic terms, the Seaborne Trade follows the same trend as the USA Exports to China and the US Imports from China. According to Table x the correlation between these two variables is very strong, at 83.94% and 90.17% respectively.

During 2022, China was the third largest export market[135] of USA, but the trade balance of the two countries is negative for the US, indicating that the codependency of the two markets is not in the same level. The American exports to China steadily decreased in 2018 and 2019. On the contrary the Chinese Exports to USA reached historical high value in 2018 totals and followed a downward trend in 2019 and 2020. In 2021, when the market felt safer, the bilateral trading activities recovered to the pre-tariff levels of 2017. The trade deficit in the trade balance is static as it is observed from the graph.

Since all the value of the bilateral trade in measured in US$, the data are subject to inflation rates. The high levels of inflation rates after the Covid outbroke and the Russo-Ukrainian War, especially in 2021 and 2022 may slightly alter the results. Therefore, although at first glance the trend of US bilateral trade in Figure xxx seems to be upward, the high inflation rate in the US$, may slightly push the trade balance higher that it should have been.

[135] US exports to China 2023. The US-China business council. (2023, May 25). https://www.uschina.org/repo rts/us-exports-china-2023-0

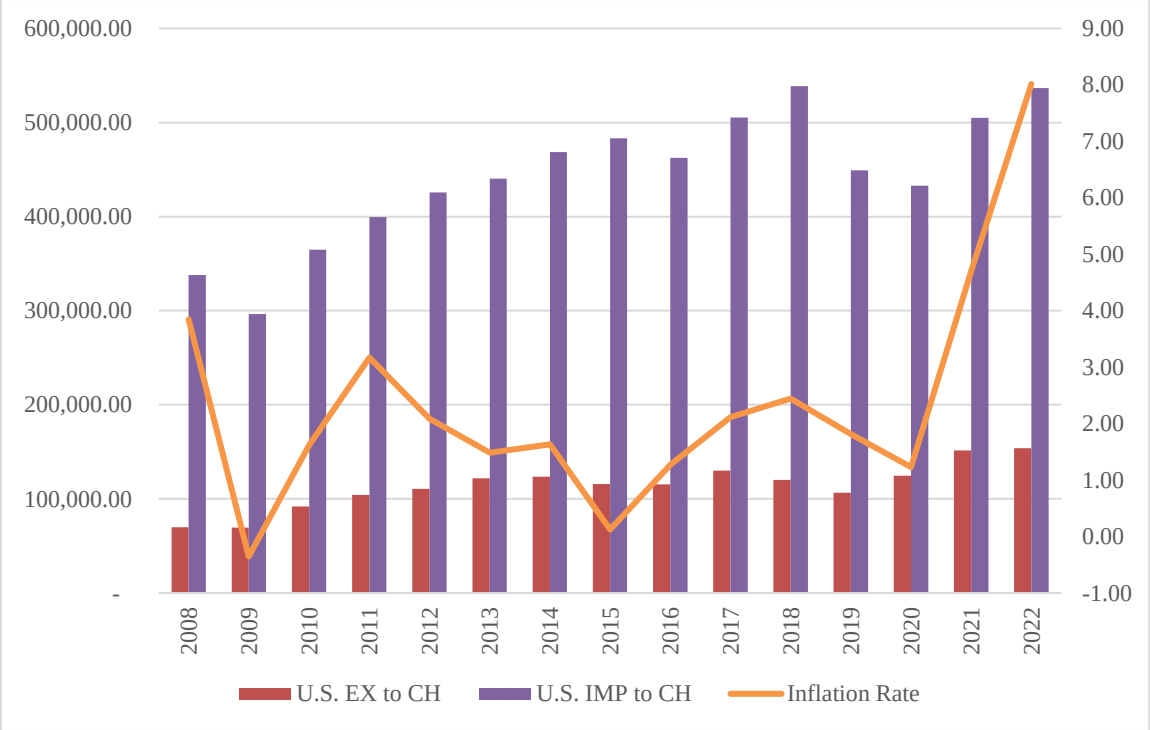


Figure 256: Bilateral Seaborne Trade Volume

- ***East West Container Trade***

China is the greatest producer worldwide and provider of manufacturing goods to the West. The exports to the USA are in the first place for May 2023, with value US$42,478,378[136], slightly less than the previous monthly measurement. This independent variable is of high importance for the linear regression models for the total Seaborne Trade and the Container Seaborne Trade.

Despite the trade tariffs, in 2018 the West container-goods imports rose by 2.3%, and followed the same trend until 2020, when the imports fell by 1.86.

[136] Trading Economics. (n.d.). China exports of manufactured Goods May 2023 data - 1993-2022 historical. China Exports of Manufactured Goods - May 2023 Data - 1993-2022 Historical. https://tradingeconomics.com/china/exports-of-manufactured-goods

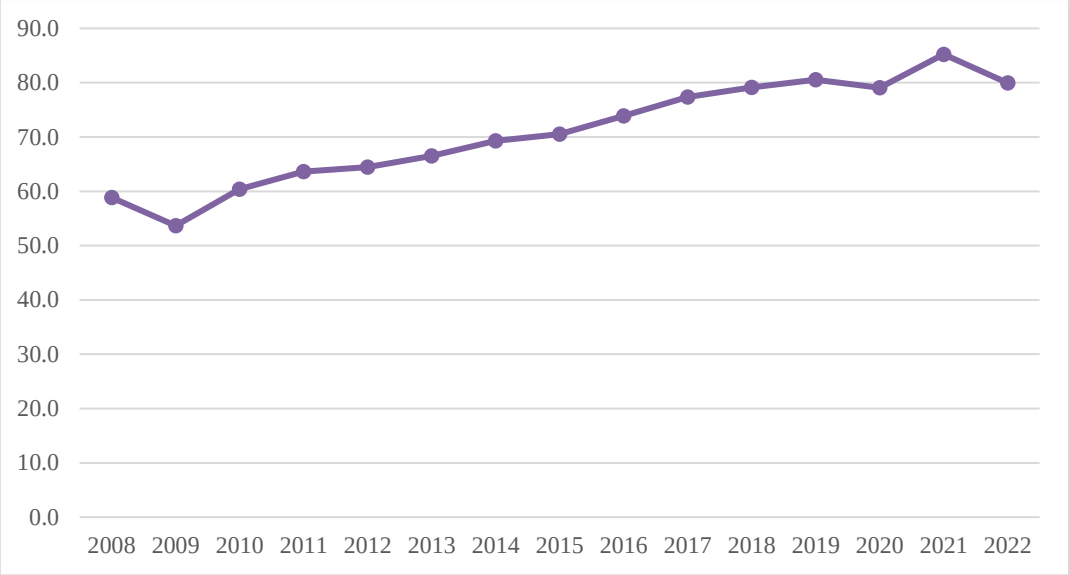


Figure 267: East West Container Trade

The container trade reached historical high levels in 2021 Covid disrupted year, when the world turned back to normality and a correction followed in year 2022 with the quantity of TEU dropping by 6.2%.

- ***Chinese Iron Ore Imports***

Iron Ore is the most significant independent variable in the Liner Regression Model of the Dry Seaborne Trade. China is the greatest importer of iron ore worldwide, accountable for 69%[137] of iron ore trade in 2022. The country absorbs huge amounts of iron ore from West suppliers, such as Australia. The commodity trade is highly related to the dry seaborne trade, at 96.89 - affected by the Chinese economy inflations. Iron Ore is used in the Chinese steel productions and exports.

The Chinese imports slowly receded [138]in 2020-2022, still remaining higher than the 2019 levels, due to the weak performance of the Chinese economy the latest years that affected the construction and steel industry, and the strict Covid-19 policies that caused delays in discharging iron ore in the Chinese ports.

[137] Hellenicshippingnews... (2023, January 31). China's iron ore imports market share reached 71.3% in 2022. Hellenic Shipping News Worldwide. https://www.hellenicshippingnews.com/chinas-iron-ore-imports-market-share-reached-71-3-in-2022/

[138] Kolisnichenko, V. (2023, January 13). *China cut iron ore imports by 1.5% y/y in 2022*. GMK Center. https://gmk.center/en/news/china-cut-iron-ore-imports-by-1-5-y-y-in-2022/

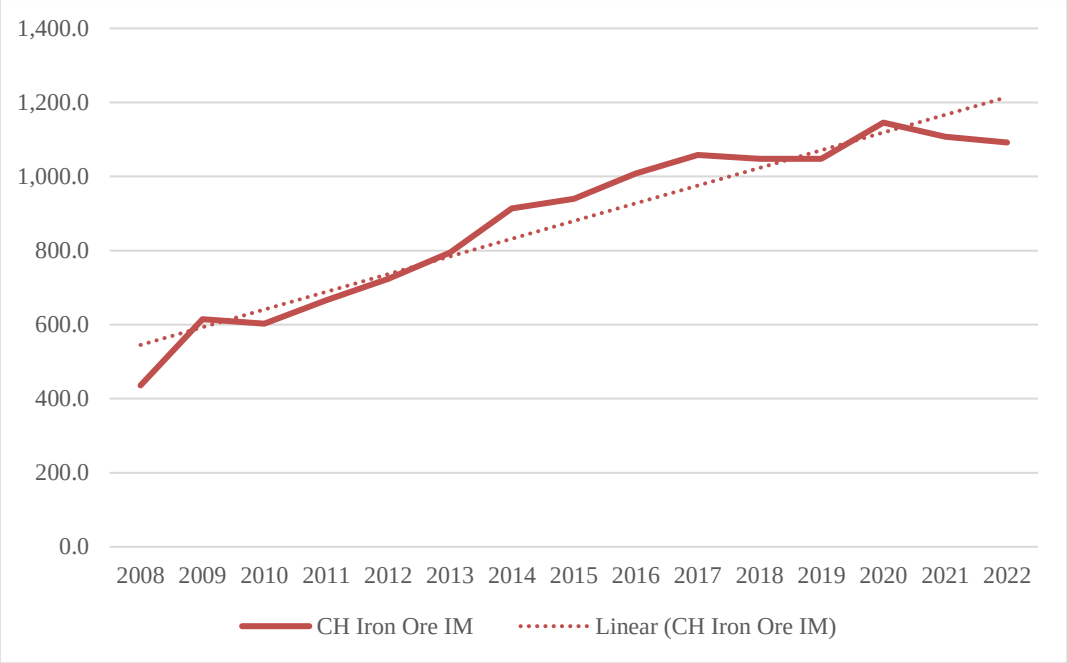


Figure 278: Chinese Iron Ore Imports

- ***GDP USA/China***

The GDP (Gross Domestic Product) of the main agents of decoupling (namely US and China), is important for the Seaborne Trade. GDP is the most important macroeconomic value a country produces, measuring the quantity of goods and services a country produces in a specific time period.

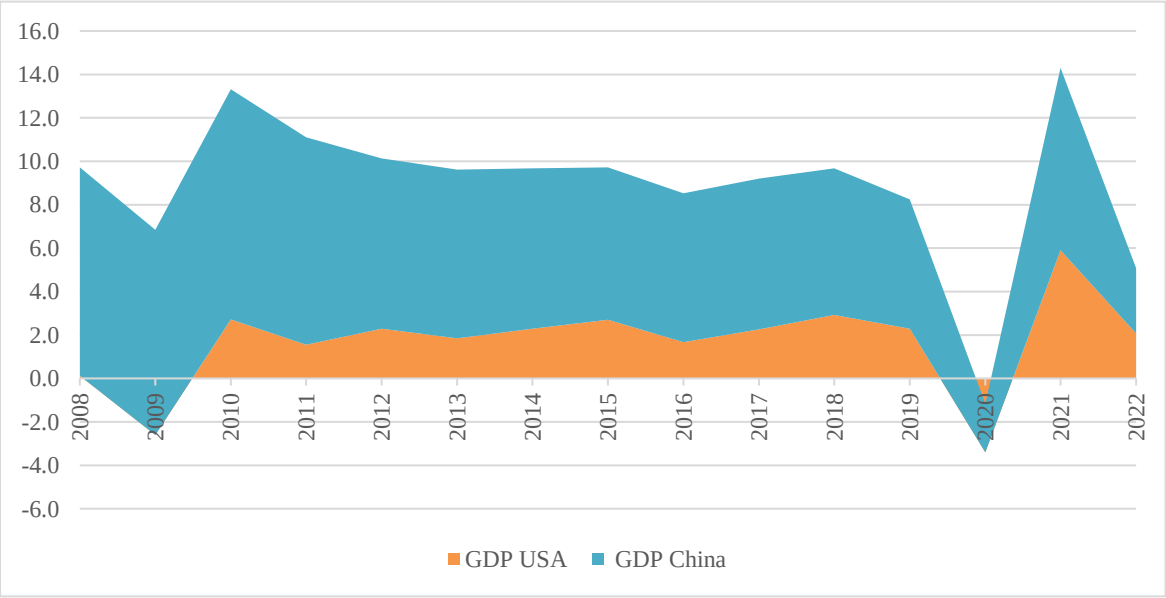


Figure 29: GDP

c) *"Decoupling" Dummy Variable*

Considering that the Donald Trump's trade tariffs against China were announced in January 2018, it is assumed that the decoupling era started at the moment the tariffs were imposed. Thereof the dummy "decoupling" variable takes the price of "0" for years 2000 – 2017, and the price "1" for years 2018 – 2022.

Dataset Synopsis Table	Variable Type	Regression Model (1,2,3,4)	Clarkson's Code (i.a.)[139]	Unit
World Seaborne Trade	Y	1	98793	Million Tonnes
Seaborne Trade Volume Dry	Y	2,3	534032	Million Tonnes
Seaborne Trade Volume Containers	Y	4,5	98805	Million Tonnes
Annual GDP USA	x	1, 2, 4	10653	% Yr/Yr
Annual GDP China	x	1, 2, 4	10661	% Yr/Yr
Total East-West Container Trade	x	5	541345	Million TEU
China Seaborne Iron Ore Imports	x	3	53276	Million Tonnes
U.S. Exports to China	x	Hypothesis test	US Census Bureau[140]	US$
Chinese Exports to U.S.	x	Hypothesis test	US Census Bureau	US$

Figure 30: Dataset Synopsis Table

ii) *Descriptive Statistics and Correlation Matrix*

[139] Shipping Intelligence Network. (n.d.). https://sin.clarksons.net/

[140] *Trade in Goods with China* . United States Census Bureau. (n.d.). https://www.census.gov/foreign-trade/balance/c5700.html

Descriptive Statistics provide a description of the basic features of this study. Mean, Standard Deviation, Minimum and Maximum price of the variable, aid in understanding the samples characteristics.

World Seaborne Trade		*WST Dry*	
Mean	10664.36	Mean	4686.553
Standard Error	318.9765	Standard Error	176.634
Median	10828.4	Median	4860.452
Mode	#N/A	Mode	#N/A
Standard Deviation	1235.391	Standard Deviation	684.1006
Sample Variance	1526190	Sample Variance	467993.7
Kurtosis	-1.10595	Kurtosis	-0.81755
Skewness	-0.5002	Skewness	-0.73315
Range	3564.488	Range	2018.225
Minimum	8447.084	Minimum	3427.239
Maximum	12011.57	Maximum	5445.464
Sum	159965.5	Sum	70298.3
Count	15	Count	15

WST Container		*East-West Cont. Trade*	
Mean	1524.123123	Mean	70.83175733
Standard Error	62.90325478	Standard Error	2.424875955
Median	1519.00408	Median	70.52683
Mode	#N/A	Mode	#N/A
Standard Deviation	243.6232582	Standard Deviation	9.391504192
Sample Variance	59352.29192	Sample Variance	88.20035098
Kurtosis	-1.196737074	Kurtosis	-1.026510972
Skewness	-0.212829187	Skewness	-0.252728125
Range	776.17433	Range	31.56755
Minimum	1092.7695	Minimum	53.66549
Maximum	1868.94383	Maximum	85.23304
Sum	22861.84685	Sum	1062.47636
Count	15	Count	15

GDP USA		*GDP China*	
Mean	1.639533333	Mean	7.291466667
Standard Error	0.575953535	Standard Error	0.594449356
Median	2.255	Median	7.391
Mode	#N/A	Mode	#N/A
Standard Deviation	2.230658451	Standard Deviation	2.302292456
Sample Variance	4.975837124	Sample Variance	5.300550552

Kurtosis	2.05124226	Kurtosis	0.886448949
Skewness	-0.928667889	Skewness	-0.934732637
Range	9.305	Range	8.367
Minimum	-3.405	Minimum	2.244
Maximum	5.9	Maximum	10.611
Sum	24.593	Sum	109.372
Count	15	Count	15

U.S. EX to CH		*U.S. IMP to CH*	
Mean	113948.8667	Mean	443051.9333
Standard Error	6229.324542	Standard Error	18162.5804
Median	115873	Median	449111
Mode	#N/A	Mode	#N/A
Standard Deviation	24126.07021	Standard Deviation	70343.37143
Sample Variance	582067263.7	Sample Variance	4948189904
Kurtosis	0.309714962	Kurtosis	-0.091159922
Skewness	-0.371160619	Skewness	-0.622924599
Range	84340	Range	242140
Minimum	69497	Minimum	296374
Maximum	153837	Maximum	538514
Sum	1709233	Sum	6645779
Count	15	Count	15

CH Iron Ore IM	
Mean	879.7944867
Standard Error	57.67110107
Median	939.72
Mode	#N/A
Standard Deviation	223.359214
Sample Variance	49889.33848
Kurtosis	-0.898103282
Skewness	-0.621926237
Range	709.75846
Minimum	435.87154
Maximum	1145.63
Sum	13196.9173
Count	15

Figure 31: Descriptive Statistics

As far as it concerns the correlation results between the variables examination, the above table should be considered:

Correlation Table Results Interpretation
R = number between -1 and 1,
If r > 0, then positive association,
If r < 0, then negative association,
If r = 1 or r = -1, then there is perfect linear regression,
If -0.5 < r < 0.5, then the relation is too weak and the values are no correlated, If 0.3 < r < 0.5 or - 0.3 > r > - 0.5, then there is moderate correlation,
If r > 0.7 or r < - 0.7, then the relation is too strong and the values are correlated.

Figure 282: Correlation Results

Figure 35 is the *correlation matrix* and it provides useful information about the correlation between the variables. These results were taken into account for the decision of which variables should be included in the linear regression models.

	World Seaborne Trade	*WST Dry*	*WST Container*	*East-West Container Trade*	*CH Iron Ore IM*	*GDP USA*	*GDP China*	*U.S. EX to CH*	*U.S. IMP to CH*
World Seaborne Trade	1								
WST Dry	0.991862	1							
WST Container	0.985346	0.970689	1						
East-West Container Trade	0.985850	0.973326	0.996304	1					
CH Iron Ore IM	0.960327	0.968986	0.939880	0.939185	1				
GDP USA	0.387955	0.391372	0.358198	0.405668	0.236022	1			
GDP China	-0.726278	-0.724139	-0.732447	-0.684108	-0.773895	0.243520	1		
U.S. EX to CH	0.839481	0.863789	0.832441	0.834672	0.830468	0.500570	-0.608697	1	
U.S. IMP to CH	0.901646	0.907284	0.855401	0.860558	0.839555	0.578390	-0.576191	0.893317	1

Figure 293: Correlation Matrix

Overall, almost all variables have significant correlations, except for GDP rate, that presents weak and negative correlations with the rest of the variables.

More specifically, very strong correlations can be identified in the following:

- World Seaborne Trade with WST Dry: 99.18%,
- World Seaborne Trade with WST Containers: 98.53%,
- World Seaborne Trade with East-West Container Trade: 98.58%,
- World Seaborne Trade with U.S. Exports to China: 83.94%,
- World Seaborne Trade with U.S. Imports to China: 90.16%.
- East-West Container Trade with Chinese Iron Ore Imports: 93.91%,
- East-West Container Trade with Exports to China: 83.47%,
- East-West Container Trade with U.S. Imports to China: 86.05%,
- Chinese Iron Ore Imports with U.S. Exports to China: 83.04%,
- Chinese Iron Ore Imports with U.S. Imports to China: 83.90%,
- U.S. Exports to China with U.S. Imports to China: 89.33%.

World Seaborne Trade Dry and Containers are following the same pattern as the Total Volume and have very strong correlations with the same variables. It is worth mentioning that the USA GDP presents weak correlations with all of the variables, except of the US imports from China that is 57.83%. The GDP of China is negatively correlated with all the variables except of the GDP of USA, in which no correlation exists.

iii) Hypothesis Testing for US Imports from China

The hypothesis test will be used in order to understand if the research question that US imports less form China after 2018 is true or false. By setting into two groups the data, different than in the following regression models, D=0 represents the period from 2015 to 2017, and D=1 represents 2018 to 2020.

t-Test: Two-Sample Assuming Unequal Variances		
	U.S. IMP from CH	***U.S. IMP from CH***
Mean	469,471.68	456,995.63
Variance	382,235,813.84	2,939,461,239.36
Observations	3	3
Hypothesized Mean Difference	0	
df	3	
t Stat	0.374936402	
P(T<=t) one-tail	0.366322409	
t Critical one-tail	2.353363435	

P(T<=t) two-tail	0.732644818
t Critical two-tail	3.182446305

Figure 304: Hypothesis Test

The above results, in terms of Mean and Variance, validate the statement that after the tariffs imposition the USA imports from China were decreased. Despite the drop, the t-Stat of the model is of low significance and indicates that the effects of the tariffs may be short-termed.

iv) Seaborne Trade Volume Regression Analysis

The Linear Regression Models are widely used to predict the value of the dependent variable, Y, by using independent variables, X, and explain the impact of changes in the below equation:

$$Y_i = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + \cdots + b_xX_x + \epsilon$$

More specifically,

- Y = dependent variable, the estimated Y value for I,
- b_0 = estimate of the regression intercept = the value of Y when X = 0,
- b_i = estimate of the regression slope = the estimated change in mean value of Y, for every one-unit change in X,
- X_i= independent variable, value of X for observation I,
- ϵ = residual/error.

Figure 315: Linear Regression Figures

The b_0 *and* b_i are calculated in Excel based on the dataset of Y and X inserted.

Due to the fact that the data have to be in sub-groups of the two different periods, the pre-decoupling and the decoupling, an interaction or "dummy" variable will be used in the equation:

$$Y_i = b_0 + b_1X_1 + b_2X_1 + b_3X_1X_2 + \cdots + b_xX_1X_2 + \epsilon$$

The results of the linear regression models shall be interpreted in the following manner:

R square *= coefficient of determination, indicates the percentage the Y variable is explained by X variables, ranging from 0 to 1,*
Adjusted R square *= is useful when more than two independent variables are used in the regression model,*

Standard Error *= determines the average distance of the observed values from the regression line,*
P>F *= indicates the significance of the model and should be as close to 0.00 as possible,*
t- statistic *= is the coefficient divided by the standard error, if |t| > 2, then the model is significant, if |t| < 2 then the value can be excluded because it has no effect,*
p- value *= measures the effect of X to Y, if p > 0.05 the independent variable has no predictive value, if p <0.05 the independent variable can predict the movement of Y.*

Figure 326: Linear Regression Results Interpretation

The regression models are run with a dummy "decoupling" variable that groups the data in two sub-groups: the pre-decoupling area 2008-2017 and the decoupling area 2018-2022.

The regression model in Figure 38, provides useful insights for the fluctuations of the seaborne trade volume growth in both periods.

Seaborne Trade Total Volume	GDP USA in D=0 and D=1
	GDP China in D=0 and D=1

Figure 337: Seaborne Trade Totals

Regression Statistics	
Multiple R	0.958917969
R Square	0.919523671
Adjusted R Square	0.88733314
Standard Error	414.6697518
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	19647145.93	4911786.483	28.56503536	1.8895E-05
Residual	10	1719510.031	171951.0031		
Total	14	21366655.96			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	12693.37508	549.4747533	23.10092502	5.22214E-10	11469.06903	13917.68112
GDP USA	317.3577613	84.3259974	3.763462883	0.003701048	129.4677302	505.2477923
GDP China	-379.349485	63.73294265	-5.952172768	0.000140831	-521.3553313	-237.34364
GDP USA, D=1	-152.424550	151.8144206	-1.004018919	0.33904524	-490.6881594	185.8390584
GDP China, D=1	179.8987155	83.98924486	2.141925621	0.057846866	-7.240984157	367.0384151

Figure 348: Regression Analysis Seaborne Trade Totals

The overall predictive value of the regression model is represented by the R Square = 91.95%, indicating that the independent variables can explain the Dependent Variable in great extent. It should also be highlighted that the Adjusted R Square, even though deducted as it is adjusted to the number of observations, is still high 88.73%. The low Standard Error is adding value to the predictive power of the model.

Moving to the ANOVA, the F and Significance F are the most important values as they indicate if the model is significant and if the results are worthy. Significance F should be the closest to 0 and below the price of 0.05. In this specific case, the Significance F is below this price and very close to 0.

As far as it concerns the second part of the table, t-stat and p-value will determine if the IVs of the equation have significant effect to the Seaborne Trade Total. As an overall comment both the IVs are significant in D=0, but their significance drops in D=1.

The GDP US in D=0 had significant effect on the Seaborne Trade, as the t-stat is $|3.76|>2$ and the p-value $0.003<0.05$, showing strong bonds with the DV. On the contrary, in D=1 this strong "bond" disappears with the t-stat $|1.004|<2$ and the p-value highly increased $0.33>0.05$. The same pattern is also followed by the Chinese GDP, that indicates even stronger connections with Seaborne Trade in D=0, t-stat is $|5.95|>2$ and p-value $0.00014<0.05$. In D=1, the relationship is weakened but still maintain a slight effect with p-stat being $|2.14|>2$ and p-value $0.05=0.05$. Surprisingly, US Imports from China an Chinese Iron ore imports do not have a significant effect on Seaborne Trade Totals, but it is worth mentioning that in D=1, after the tariffs imposition, the effect is even lower.

v) Dry Bulk Commodities Trade

Dry Bulk Trading consists of one of the cornerstones of sea trading activities. It is of highly importance to obtain a better understanding in the importance of both countries' GDP rate in the growth or decline of seaborne trade, and on a later stage, the iron ore commodity significance, as it is the most important commodity for the dry bulk trade between West and China, due to the Chinese codependence in West for its supply, thus it is the independent value with the highest significance in the second linear regressions.

Seaborne Trade Dry (GDP)	GDP USA in D=0 and D=1
	GDP China in D=0 and D=1

Figure 359: Seaborne Trade Dry (GDP)

Regression Statistics	
Multiple R	0.95428835
R Square	0.910666254
Adjusted R Square	0.874932756
Standard Error	241.9311499
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	5966604.87	1491651.217	25.4849454	3.15959E-05
Residual	10	585306.8131	58530.68131		
Total	14	6551911.683			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	5773.975401	320.5805544	18.01099699	5.96044E-09	5059.677412	6488.273389
GDP USA	203.0193531	49.19839325	4.126544378	0.002055497	93.3985016	312.6402045
GDP China	-208.5663406	37.18376862	-5.60906945	0.00022484	-291.4169401	-125.7157411
GDP USA, D=1	-126.1405649	88.57322532	-1.424138778	0.184854417	-323.4940095	71.21287967
GDP China, D=1	103.9874377	49.00192141	2.122109393	0.059810818	-5.19564724	213.1705226

Figure 40: Regression Analysis Seaborne Trade Dry (GDP)

As it is observed in Figure 41, the predictive value of the model for the Dry Bulkers is very high, as the R Square is at 91.06% and the Adjusted R Square is also very close to 1. The Significant F in ANOVA section is almost equal to zero, indicating that the chosen IVs explain the DV in a better way that a model with no predictor variables.

In the main section of the results table, it can be observed that almost every variable in D=0 both variables have significant effect to the seaborne trade dry. The GDP of USA presents t-stat |4.12|>2 and p-value 0.0020<0.05 meaning that the IV can predict movement in the DV and is significant for the overall predictability of the model, due to the fact that USA also import great quantities of dry bulk commodities to cover their needs for production and electricity and provide services, due to the increased population. The same happens with the Chinese GDP with t-stat |-5.60|>2 and p-value 0.00022<0.05.

As far as it concerns both the IVs in D=1, the overall predictability of the model significantly decreases, as the only variable with significant effect is the GDP of China. The USA GDP loses its significance and in turns negative with t-stat |-1.42|<2 and p-value 0.18>0.05. On the contrary, the GDP of China is barely significant with t-stat |2.12|>2 and p-value 0.059>0.05.

It can be assumed that both countries stopped contributing to the Seaborne Trade of Dry Bulkers after the imposition of tariffs.

For the iron ore commodity, the below linear regression provides information regarding its actual significance and contribution.

Seaborne Trade Dry (Iron ore)	Chinese Iron Ore Imports

Figure 4136: Seaborne Trade Dry (Iron Ore)

Regression Statistics	
Multiple R	0.969565299
R Square	0.940056868
Adjusted R Square	0.930066346
Standard Error	180.9102231
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	6159169.577	3079584.788	94.09487012	4.63913E-08
Residual	12	392742.106	32728.50884		
Total	14	6551911.683			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	2139.157295	237.6358086	9.001830607	1.10172E-06	1621.393347	2656.921244
CH Iron Ore IM	2.87099721	0.297535506	9.649259177	5.25995E-07	2.222723033	3.519271387
CH Iron Ore IM, D=1	0.059303632	0.12506343	0.474188436	0.643877297	-0.213186174	0.331793438

Figure 42: Regression Analysis Seaborne Trade Dry (Iron Ore)

The regression analysis of Figure 38 validates the significance of the iron ore commodity as the most important for the bilateral trade of West and China. The R Square is at 94.00% and the Adjusted R Square is also very close to 1 and with little difference from R Square at 93.00%. The Significant F is equal to zero, confirming the belief that the chosen IV explains the DV a great extent.

The results of the regression present, as expected, significant effect in D=0 with t-stat |9.64|>2 and p-value 0.0000<0.05. On the contrary, in D=1, the image is completely different, as the numbers (t-stat |0.47|<2 and p-value 0.6>0.05) indicate that the strong dependence of the DV with the IV does not exist after the tariffs got on effect.

vi) Manufactured Goods Trade

As explained n Part A, China is the biggest player in container industry and the largest provider of manufactured goods to the West, so it is of utmost importance to run another regression model regarding the Seaborne Trade of Containers. On a first basis, the effect of both the USA and China GDP on the Seaborne Trade of Containers will be calculated, and on a second basis, the effect of East – West Container Trade.

Seaborne Trade Containers (GDP)	GDP USA in D=0 and D=1
	GDP China in D=0 and D=1

Figure 373: Seaborne Trade Containers (GDP)

Regression Statistics	
Multiple R	0.967833201
R Square	0.936701104
Adjusted R Square	0.911381546
Standard Error	72.5238467
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	778335.0035	194583.7509	36.99515986	5.7756E-06
Residual	10	52597.0834	5259.70834		
Total	14	830932.0869			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	1904.003987	96.10062609	19.81260752	2.3529E-09	1689.878448	2118.129526
GDP USA	50.87670919	14.74823201	3.449681911	0.006229499	18.01560045	83.73781794
GDP China	-71.40094443	11.14660074	-6.405625006	7.77629E-05	-96.23711861	-46.56477026
GDP USA, D=1	-23.87559099	26.55164916	-0.899213109	0.389678407	-83.03635207	35.2851701
GDP China, D=1	41.4912559	14.68933553	2.824583577	0.018018503	8.761376692	74.2211351

Figure 44: Regression Analysis Seaborne Trade Containers (GDP)

The linear regression for the Containers presents quite interesting and significant results. As it can be observed in Figure 43, the seaborne trade for containers is explained at 93.65% by the GDP of USA and China. The Adjusted R Square is also high and has little difference with the R Square at 91.11%. The overall accuracy of the model is also evident due to the very low Significance F in the ANOVA section, which is very close to zero.

In D=0 the GDP of China seems to be of higher significance than the US GDP, with t-stat |-6.40|>2 and p-value 0.000077<0.05 and t-stat |3.44|>2 and p-value 0.00622<0.05 respectively.

In D=1, the results indicate a slightly different image. The GDP of China seems to be the only IV that still has predictive value for the DV, with t-stat |2.82|>2 and p-value 0.018<0, proving that even though the dependence of West decreased from D=0, China's GDP rate has still significant effect and contributes on Seaborne Trade for containers.

The following regression assesses the effect of the changes of East-West Container Trade to the Seaborne Trade Volume of Containers. As mentioned earlier, China, and more generally, Asia, is the "factory of the world" as the country presents the highest rates of manufacturing production. West, as more advanced economies on the other hand, rely on the trade of services, and thus the manufactured goods are almost exclusively imported by China.

Seaborne Trade Containers (East-West Container Trade)	East – West Container Trade

Figure 385: Seaborne Trade Containers (East-West Container Trade)

Regression Statistics	
Multiple R	0.997418921
R Square	0.994844505
Adjusted R Square	0.993985256
Standard Error	18.89414909
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	826648.2205	413324.1102	1157.806714	1.87768E-14
Residual	12	4283.866439	356.9888699		
Total	14	830932.0869			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	-210.9748952	56.90801802	-3.707296486	0.002995567	-334.966815
East-West Container Trade	24.31902542	0.859709395	28.28749524	2.36182E-12	22.44587956
East-West Container Trade, D=1	0.465634168	0.204701014	2.274703769	0.042079008	0.019628972

Figure 396: Regression Analysis Seaborne Trade Containers (East-West Container Trade)

The East West Container Trade Regression presents the highest R Square of all the above regressions at 99.48% with an almost identical Adjuster R Square at 99.39%. The Significance F is also significantly low, almost equal to zero.

In D=0, the East-West Container Trade presents high t-value, |28.50|>2 and p-value close to 0.00<0.05, indicating a high related independent variable, explained by the huge amounts of manufactured goods the West absorbs from Chinese suppliers. In D=1, the value remains significant but 14 times lower than in D=0, with t-stat |2.27|>2 and p-value 0.00<0.05, showing a change in the trend of the trading habits regarding the container industry. This number can be explained by the fact that China is still the number 1 provider of manufactured goods.

10. Findings Discussion

Taking into account the five linear regression models it is observed, as a generic comment, that the trading patterns slightly changed after 2018 and the tariffs announcement but kept moving on the same trend. All of them present significant results and not only provide a well-rounded perspective on the effect of both GDP of USA and China on the Seaborne Trade but also highlight the importance of two very important commodities of the bilateral trade, the iron ore and the manufactured goods.

The first regression model for the Seaborne Trade Total Volume indicates that both counties' economies, China and US, have less effect on the Seaborne Trade in the period after tariffs. After the economic decoupling, in D=1, the US GDP effect turns negative, indicating less codependency from the global markets in importing goods. On the contrary, before the economic decoupling, in D=0, the linear relationship between Seaborne Trade and US GDP shows a greater codependency in trade.

In the second linear regression regarding the Dry Bulkers the GDP of both countries behaves the same way as in the first regression model in D=0 and D=1. The third regression model that examines the codependence of the Chinese Iron Ore Imports with the Seaborne Trade Volume for Dry Bulkers validates the assumption that after tariffs the trade of the specific commodity between the two counties deducted, and even though before the tariffs the variable had significant effect, in D=1 this effect is completely insignificant. This could be explained by the tariff's limitations on steel and aluminum products combined with the decreased Chinese need for the commodity.

Chinese imports of Iron Ore from western suppliers, the most important independent variable of the model, it is observed that in D=0 the effect of the Chinese imports is of high significance, only to find out that in D=1 the variable stop affecting the volume of Seaborne Trade for Dry Bulk commodities.

The fourth and fifth linear regressions for Containers' Seaborne Trade, present the same image regarding the GDP and prove the high codependence of West to Chinese manufactured goods. The East-West container trade presents the utmost importance for the model in D=0. In D=1 not even the slightest interaction exists, indicating that the direct trading between the two countries is deducted at a very significant level.

In all of the Regression Models (Containers and Bulkers) the GDP of both countries follows the same pattern in both D=0 and D=1 as in the Total Seaborne Trade Volume.

11. Conclusions

Concluding, the trade war between the world's largest economies has significant effect on the seaborne trade volume. The volatility of the shipping industry is proved through macroeconomic and geopolitical events that not only shape the world and global economy but also affect the trading and diplomatic activities. The last two-year disruptions, Covid-19 pandemic and the Russo-Ukrainian war reminded the world and the shipping community that regional events may turn into global. Both disruptions started from a region and then spread to the rest of the world, causing disruptions to the shipping cycle. In the case of Covid-19 it had to do with a decease hard to identify and confront in the first place, causing problems to the supply chain with vessels delays, crew changes and product shortages. The Russo-Ukrainian altered the supply chain in the Black Sea Region, causing problems mostly to the dry bulk sector, as Ukraine is the greatest provider of wheat and in energy, as Russia was providing LNG in Europe. The inflation rates in both cases rocket high and created short-term shortages of products. The shipping cycles, one of the most powerful tools for making provisions in the shipping industry, that normally last 8-10 years, got shorter and presented small periods of great profits and then collapsed due to the macroeconomic environment.

The analysis' most important segments, the dry bulk and containers trade are briefly presented to make sufficiently clear that China is absorbing huge amounts of dry bulk commodities, and especially iron ore that imports almost exclusively from the West (i.e., Brazil, in order to handle its internal infrastructure needs. In the manufactured goods segment, for the West China is the

"world's factory", as the cheap labor and the massive production combined with the fact that most of manufacturing companies have factories located in China, gives a competitive advantage with regards to the price of the products. The advanced manufacturing in China, and the turn of advanced economies, such as the American, to the service sector creates a gap in the west for manufactured goods, that are imported in a great extend from East suppliers and China.

The US and China present periods of good cooperation and diplomatic ties, on the one hand, and tensions, on the other hand. After 2018, the beginning of the trade war or economic decoupling the decrease in the bilateral trade was evident. The tariffs targeted crucial trading pillars for the bilateral trade, such as the semiconductors, technology and aluminum and steel products. The regression model for the Seaborne Trade Volume provided useful insights for the contribution of both countries in the Seaborne Trade Volume, showing that their contribution deducted after the beginning of trade war and the imposition of trading tariffs. It is worth mentioning that the total amount of US$ of the bilateral trade is in historical high level at this point, a situation that it is considered to be an effect of Covid-19 and the Russo-Ukrainian war.

The five regression models and the discussion of both the dependent and independent variables provide insights and a round image of the parameters that have effect in seaborne trade volume. For years 2018 and 2019, the effect of the trade tariffs can be proven by the decreased in the bilateral trade, and the less interaction between the two economies' GDP rate and Seaborne Trade Volume. According to the regressions of Dry Bulkers and Containers, it is proved that in D=1 the effect of Chinese Iron Ore imports and East West Container trade is statistically insignificant. Unfortunately, the fact that in after two years of the trade tariffs the global environments was shocked by the two aforementioned disruptions do not let us prove the long-term effects of the tariffs to Seaborne Trade and the actual increase or decrease in the bilateral trade.

It is highly unlikely that the economic decoupling between the two economies will continue and disrupt the supply chain completely, and eventually the supply chain will adopt the new trading habits of US and China. The evidence so far indicate that the trade tariffs disrupted the supply chain and the markets in short-term, but as mentioned above, smaller counties involved in the trade of China and US benefit from the disruption as they became the mediators in their trade. After the short-term effect of the tariffs for 2018 and 2019, leaving out the disrupted of

the global events years, the supply chain will probably be re-arranged and find new balances by trading products from US to China through third countries.

The US, even after Joe Biden's presidential election, seem to keep following the same trend of limitation the trading and diplomatic ties with China. Due to the supremacy of the US, both as an economy and a center of technological innovation, it is assumed that the US will have the first say in initiating more tariffs or truce.

12. Paper's Limitations and Future Research

This paper, exploring a new subject that there are no concrete studies so far, macroeconomic, or quantitative, faces several limitations and paves the way for future research.

The first problem faced at the beginning of this dissertation was the lack of academic literature that covers and places the "decoupling" in the shipping industry. The peculiarities of the shipping industry made it impossible to identify common characteristics in the shipping industry and other sectors, such as the energy or in the manufacturing and purchasing patterns. The main sources of literature where newsletters that presented the market and papers that approached decoupling in other markets with different needs and characteristics than shipping. Another literature "problem" faced while conducting the research was that there are not many studies covering the effect of the macroeconomic events on seaborne trade.

The second limitation was the lack of extensive quantitative data on quarterly of monthly basis to run more detailed regression models that would provide this dissertation with more useful insights in the market and would present more accurately the fluctuations of the market. The annual data that were commonly available for all the indicators, even though they provide a generic image about how the seaborne trade behaved before the tariffs and after, it would be much more proper and useful for future research to discuss the fluctuations of the prices on monthly basis, focusing also on the macroeconomic events of each month.

The third and biggest problem is the Covid-19 disruption. The virus caused severe problems to the supply chain causing delays, crew and personnel deficiencies and supply shortages affecting the seaborne trade totals, the demand patterns and the trading routes. Without Covid-19 it would be much easier to explain and identify the real effect of tariffs to the Seaborne Trade Totals, as an indicator that is completely altered are the East-West Container Trades and the Chinese Iron Ore imports, the first from the alteration of trading habits of the West during

the quarantines and the second one because of how the economy of China got reshaped with the trade disruption.

The fact that there is not extensive research about the economic decoupling of the USA and China in the shipping industry creates space for future research with more case studies and scenarios of how specific shipping powers such as Greece or India will react to the scenario of the two biggest economies of the world to decouple.

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