



RESEARCH ARTICLE

Temporal volatility of Brent oil prices and interrelation with maritime traffic density in the Turkish Straits during COVID-19 crisis

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ARTICLE INFO

Article History:
Received: 12.07.2024
Received in revised form: 14.09.2024
Accepted: 17.09.2024
Available online: 30.09.2024

Keywords:
Brent petrol
Economic crisis
Marine transport
Pandemic
Shipping industry
Turkish straits

ABSTRACT

This research evaluated variations in Brent oil prices and the interrelation with maritime traffic density in the Turkish Straits during the COVID-19 pandemic. The number of commercial ships that made non-stop over passage through the Turkish Straits in the last 5 years, covering the COVID-19 -and post-pandemic periods with economic instabilities was investigated along with variables of vessel characteristics such as; gross tonnage, size and type of vessel loads. Results of the present study reveal that the maritime traffic density between 2019 and 2023, was influenced by the pandemic crisis, when harsh quarantine measures of lockdown and curfews in the first shock wave. In the aftermath, conflicts between Ukraine and Russia led to economic recession or upheaval with instabilities in Brent oil prices. For the period examined in this study, the number of non-stop over passage vessels and gross tonnages used the Turkish Straits were affected by the pandemic outbreak and Brent oil price variations. The number of vessels decreased by 5.22% from 84,871 to 80,440 during the epidemic in 2020, and by 5.38% from 43.342 to 42.340 during the global recession in 2022. Overall, the number of non-stop over passage vessels using the Turkish Straits between 2019 and 2023 declined by 1.15%, while the gross tonnage and ship length increased by 3.44% and 13.24%, respectively. In total, the number of non-specific tankers (TTA) and those carrying chemicals (TCH) increased by 2.92% and 10.97%, respectively, but a 13.25% decrease was noted for the liquefied petroleum gas (LPG) tankers over the 5 years. Considering that the world trade network is largely dependent on maritime transportation, identifying the changes in maritime transportation with the interrelation of Brent oil during global crises may provide important data for strategy building of best trade management with foresights to world economic crises.

Please cite this paper as follows:

Yiğit, Ü. (2024). Temporal volatility of Brent oil prices and interrelation with maritime traffic density in the Turkish Straits during COVID-19 crisis. *Marine Science and Technology Bulletin*, 13(3), 225-233. <https://doi.org/10.33714/masteb.1515193>

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Introduction

Shipping, which forms the backbone of the world trade network, accounts for 80% of total commercial shipments. The capacity of the merchant fleet operating worldwide increased by approximately 43% between 2013 and 2021, reaching approximately 2.1 million deadweight tons in 2021 (Statista, 2024a). It has been seen that global crises affected maritime transportation. Especially during the lockdown period right after the start of the recent COVID-19 pandemic, the disruption of port operations due to the decrease in manpower has also negatively affected the shipping industry. The Covid pandemic, which emerged in early 2020, caused a decrease by approximately 4% in the world maritime trade (UNCTAD, 2021). Ports, which play an important role in maritime transport, connect the trade network between production centers and consumer markets at an international level. Any change in the maritime transport network, such as the closure of ports, the reduction of border crossings, etc., can cause trade disruptions in many countries, thus causing economic shocks. Interruptions in supply chains can cause economic bottlenecks not only regionally but also globally (Verschuur et al., 2022). This has been the case in 2020, when the countries closed borders and reduced human mobility to prevent the spread of the COVID-19 pandemic, that eventually went into a rapid global crisis with economic aftershocks and damage worldwide (March et al., 2021). The Turkish Straits, consisting of Istanbul Strait and the Çanakkale Strait, are important sea passages for international maritime traffic and have an important geo-strategic position. According to 2023 figures, the number of ships passing through the Turkish Straits was recorded at approximately 84,000 (MTI, 2024). In contrast, it is reported that 14,000 ships passed through the Panama Canal (Statista, 2024b) and 22,000 ships through the Suez Canals (Statista, 2024c) in 2022. While the Suez Canal, one of the important sea passage points in the world, is a junction point between Europe and Asia, the Turkish Straits system forms the borders connecting Europe and Asia with the Istanbul and Çanakkale Straits. As oil prices increase, transportation costs will also increase, leading to significant changes in the maritime transportation industry. Contrary to the stable course or even downward trend in oil prices in the 1980s and 1990s, oil prices have reached very high levels today. Until 2004, Brent oil prices were relatively stable at an average of \$40 per barrel and did not show sharp fluctuations. After 2004, however, prices began to increase sharply, rising above \$120 per barrel following the global credit and economic crises that emerged in mid-2008

(UNCTAD, 2010). According to various forecast models made in previous years, it has been predicted that oil prices may vary from \$60 per barrel to \$160 by the 2020s (TEMS, 2008). It is stated that the high increase in oil prices may have a two-way effect on global economies: The first of these effects is that higher oil prices will reduce consumption and therefore reduce the economic growth rate. This will lead to a slowdown in economies around the world. On the other hand, as the increase in demand for goods and services slows down, the growth in demand for trade and transportation services will also slow down and the momentum of economic flow will decrease (TEMS, 2008).

Considering that the world trade network is largely dependent on maritime transportation, identifying the changes in maritime transportation during global crises may provide important data for maritime trade and management in times of possible future crises. Hence, this study investigated the impacts of Brent oil price changes during COVID-19 pandemic period and the global economic recession followed thereafter.

Material and Methods

Study Area

The study covers the Istanbul and Çanakkale Straits, two internationally important waterways in the northwest of Türkiye. The Aegean and Mediterranean are connected to the Black Sea via the Straits. The Marmara Sea, located between the two straits, opens to the Aegean and Mediterranean through the Çanakkale Strait, and to the Black Sea via the Istanbul Strait, which are the borders between the European and Asian continents (Figure 1).



Figure 1. Study area with arrows pointing on locations of Istanbul and Çanakkale Straits

Maritime chokepoints are narrow water passages where the marine traffic is dense. Therefore, these chokepoints provide effective study locations for monitoring specific conditional variations in traffic densities. Among the World's important maritime chokepoints, the two straits of Istanbul and

Çanakkale were used for the monitoring of maritime traffic activities during and after the COVID-19 pandemic, along with possible interrelation of brent oil price variations.

Data Definition and Analyses

The interrelations between variables such as; number of ships, length, total gross tonnage and type of vessels with brent oil price variations were evaluated for the sample period from 2019 to 2023, covering the pandemic crisis, that triggered collapsing global economies in the aftermath with recession and upheaval.

The data evaluated for the variables for ship traffic density with variables of number, length, and total gross tonnage of non-stop over passage vessels through the Turkish Straits over the pandemic years, including the aftermath, have been collected from online statistical panels provided by the Turkish Ministry of Transport and Infrastructure (MTI, 2024). Percent variations for the investigated variables between 2019 and 2023 have been estimated using the following equations (Equations 1-4) as earlier described by Yiğit & Kusku (2022), and Yiğit (2024):

$$\%PVsn = \frac{(sn(t)-sn(t-1))}{sn(t-1)} \times 100 \quad (1)$$

where $\%PVsn$: percent variation in the number of ships transited; $sn(t)$ and $sn(t-1)$ are the number of ships transited at time t and $t-1$, respectively.

$$\%PVtgt = \frac{(tgt(t)-tgt(t-1))}{tgt(t-1)} \times 100 \quad (2)$$

where $\%PVtgt$: percent variation in total gross tonnage of ships transited; $tgt(t)$ and $tgt(t-1)$ are the total gross tonnages of ships transited at time t and $t-1$, respectively (*Note: besides total gross tonnage, vessels lower than 500 GT (gross tonnage, LOA) transited have been assessed in a separate group, using the same equation above*).

$$\%PVloa = \frac{(loa(t)-loa(t-1))}{loa(t-1)} \times 100 \quad (3)$$

where $\%PVloa$: percent variation in the LOA of ships transited; $loa(t)$ and $loa(t-1)$ are the LOA of ships transited at time t and $t-1$, respectively; LOA: length over all, vessels longer than 200 m have been assessed.

$$\%PVtt = \frac{(tt(t)-tt(t-1))}{tt(t-1)} \times 100 \quad (4)$$

where $\%PVtt$: percent variation in the number of total Tankers transited; $tt(t)$ and $tt(t-1)$ are total tankers transited at time t and $t-1$, respectively.

Tankers transited through the straits have been grouped under 3 classes: (a) TTA (Non-Specific Tankers, indicating tankers of unspecified type), (b) TCH (tanker carrying chemical cargo), (c) LPG (liquefied petroleum gas), and the traffic density has been estimated by using the following equations (Equations 5-7):

$$\%PVtta = \frac{(tta(t)-tta(t-1))}{tta(t-1)} \times 100 \quad (5)$$

where $\%PVtta$: percent variation in Non-Specific Tankers (TTA) transited; $tta(t)$ and $tta(t-1)$ are TTA tankers transited at time t and $t-1$, respectively.

$$\%PVtch = \frac{(tch(t)-tch(t-1))}{tch(t-1)} \times 100 \quad (6)$$

where $\%PVtch$: percent variation in tankers carrying chemical cargo (TCH) transited; $tch(t)$ and $tch(t-1)$ are TCH tankers transited at time t and $t-1$, respectively.

$$\%PVlpg = \frac{(lpg(t)-lpg(t-1))}{lpg(t-1)} \times 100 \quad (7)$$

where $\%PVlpg$: percent variation in Liquefied Petroleum Gas Tankers (LPG) transited; $lpg(t)$ and $lpg(t-1)$ are LPG tankers transited at time t and $t-1$, respectively.

Results

Findings of this study reveal that the maritime traffic density in the Turkish Straits was affected by the pandemic and economic trends of global recession or upheaval periods after the pandemic outbreak, with variations in brent oil prices. With the outbreak of COVID-19 pandemic early 2020, brent oil prices dropped from \$64.30 to \$41.96 per barrel with a collapse of 34.74% compared to the pre-pandemic year of 2019 (Figure 2). The total number of non-stop over passage vessels used the Turkish Straits also dropped from 84,871 to 80,440, showing a decline by 5.22% with the outbreak of the pandemic (Figure 3). This was also noted for the total gross tonnages, which was reduced from 1,511,206,284 to 1,478,603,748, representing a drop by 2.16% (Figure 4). The total number of non-stop over passage tankers used the Turkish Straits also dropped from 18.800 to 17.807, with a decline by 5,28% (Figure 5).

The transition of Non-Specific Tankers (TTA) and those carrying Liquefied Petroleum Gas (LPG) declined by 10.04% and 2.36%, respectively, whereas tankers carrying chemicals (TCH) however, increased transition through the Straits by 4.62% over the previous non-pandemic year of 2019 (Figures 6-8).

In the post-pandemic year of 2021, brent oil price increased from \$41.96 to \$70.86 per barrel, that was an increase by 68.88% (Figure 2). This was also a year of recovery period for the Maritime transportation density in the Turkish Straits when the number of non-stop over passage vessels increased from 80.440 to 81.893 (1.81% increase), with total gross tonnages from 1,478,603,748 to 1,530,393,894 (3.50% increase) in 2021 over the previous year (Figure 3, Figure 4).

produced by statistical data provided by Statista (2024d) and MTI (2024).

The drop in the transition volume of TTA and LPG tankers continued their decreasing trend by 5.64% and 9.33%, respectively, during the post-pandemic year of 2021, with only increase of TCH tankers by 6.58% (Figures 6-8). However, the total non-stop over passage tankers used the Straits remained in a declining trend of 1.97% over the previous year (Figure 5).

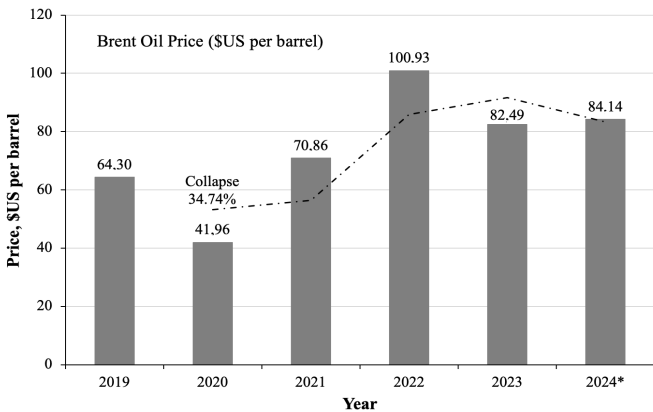


Figure 2. Variations of brent oil prices prior to and over the pandemic crisis and the aftermath from 2019 to 2024. Data for 2024*, as of May; dashed line: Moving average, 2 periods. 2019: pre-pandemic; 2020: pandemic year, 2021: post-pandemic; 2022-2023: global recession and upheaval.

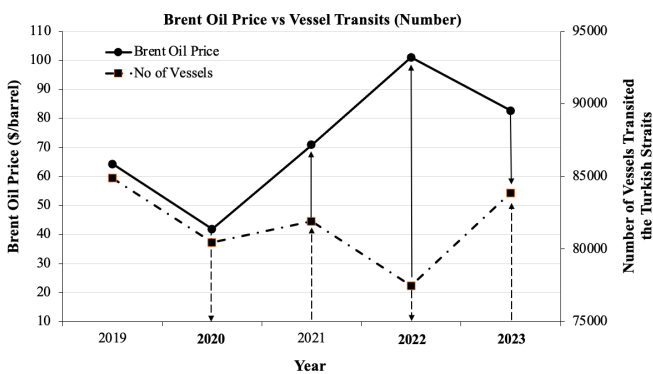


Figure 3. Superimposed figure for the interrelation of brent crude oil price versus number of non-stop over passage vessels used the Turkish Straits prior to and over the pandemic crisis and the aftermath from 2019 to 2023. Vertical arrow lines present drops and increases for brent oil prices (straight line) and non-stop over passage vessel (dashed line). Figure

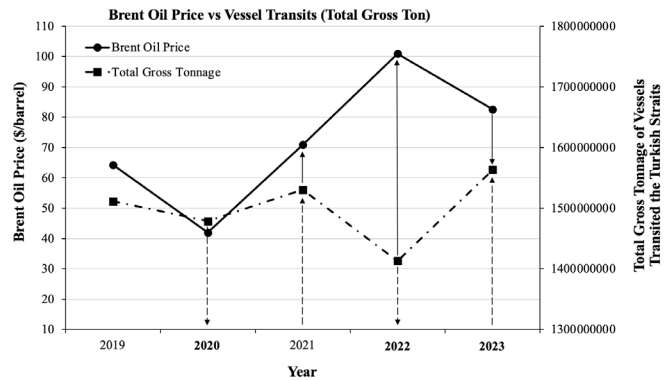


Figure 4. Explanatory overlay for the interrelation of brent crude oil price versus total gross tonnage of non-stop over passage vessels used the Turkish Straits prior to and over the pandemic crisis and the aftermath from 2019 to 2023. Vertical arrow lines present drops and increases for brent oil prices (straight line) and non-stop over passage vessel (dashed line). Figure produced by statistical data provided by Statista (2024d) and MTI (2024).

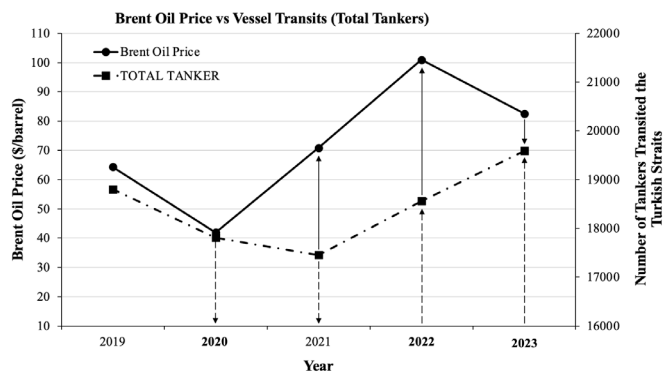


Figure 5. Explanatory overlay for the interrelation of brent crude oil price versus the number of non-stop over passage tankers used the Turkish straits prior to and over the pandemic crisis and the aftermath from 2019 to 2023. Vertical arrow lines present drops and increases for brent oil prices (straight line) and number of non-stop over passage tanker (dashed line). Figure produced by statistical data provided by Statista (2024d) and MTI (2024).

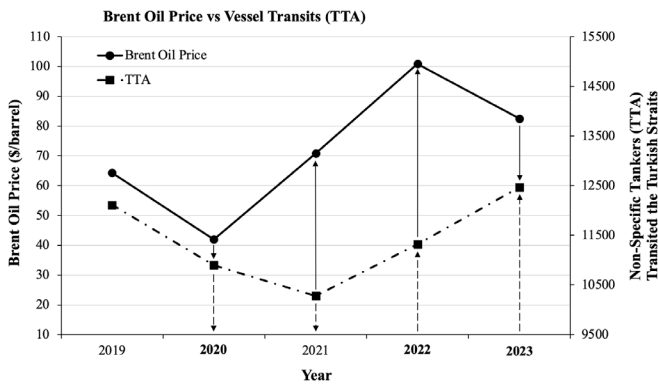


Figure 6. Explanatory overlay for the interrelation of brent crude oil price versus the number of Non-Specific Tankers (TTA) used the Turkish Straits prior to and over the pandemic crisis and the aftermath from 2019 to 2023. Vertical arrow lines present drops and increases for brent oil prices (straight line) and number of non-stop over passage TTA (dashed line). Figure produced by statistical data provided by Statista (2024d) and MTI (2024).

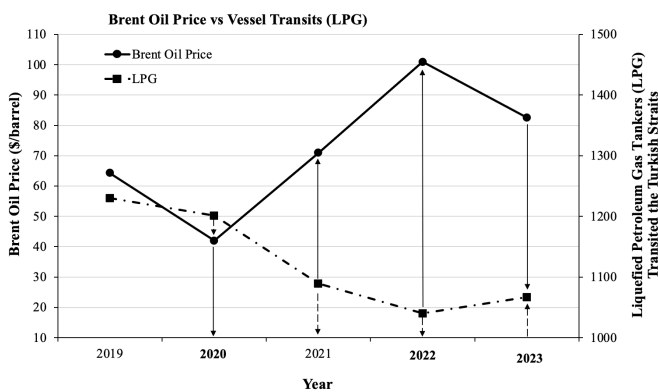


Figure 7. Explanatory overlay for the interrelation of brent crude oil price versus the number of tankers carrying Liquefied Petroleum Gas (LPG) used the Turkish straits prior to and over the pandemic crisis and the aftermath from 2019 to 2023. Vertical arrow lines present drops and increases for brent oil prices (straight line) and number of non-stop over passage LPG (dashed line). Figure produced by statistical data provided by Statista (2024d) and MTI (2024).

The aftermath of pandemic encountered a severe increase of brent oil price rate from \$70.86 to \$100.93 per barrel, that was an increase by 42.44% in the global recession year of 2022 compared to the previous year. The excessive price increases in brent oil resulted in another declining period for the vessel number from 81,893 to 77,486 (5.38% decline), and total gross tonnages from 1,530,393,894 to 1,413,066,367 (7.67% decline). The total number of non-stop over passage tankers used the Straits, however, increased from 17,456 to 18,557 (6.31%

increase), with only declining rate of 4.50% for the LPG carriers over the previous year.

In the global upheaval period of 2023, however, the brent oil price dropped by 18.21% from its highest rate of 100.92 in 2022 to \$82.55 per barrel in 2023, which was followed by a flurry of ship traffic density by 8.27% increase from 77,486 to 83,892 vessels, with an increase of total gross tonnages from 1,413,066,367 to 1,563,158,348, representing an increase of 10.62%. This was the year of highest volume for the tankers used the straits with a total number of 19,590, where both TTA and LPG tankers increased by 10.11% and 2.6%, respectively, with only decline for the TCH tankers by 2.24% over the previous year.

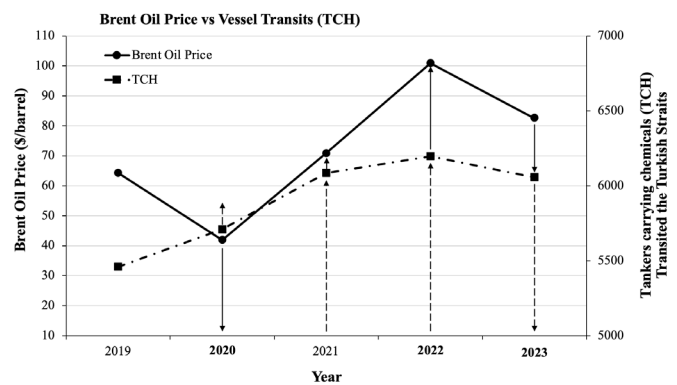


Figure 8. Explanatory overlay for the interrelation of brent crude oil price versus the number of tankers carrying chemicals (TCH) used the Turkish straits prior to and over the pandemic crisis and the aftermath from 2019 to 2023. Vertical arrow lines present drops and increases for brent oil prices (straight line) and number of non-stop over passage TCH (dashed line). Figure produced by statistical data provided by Statista (2024d) and MTI (2024).

In general, the number of non-stop over passage vessels used the Turkish Strait System declined by 1.15% between the investigated year span of 2019-2023, covering the global pandemic crisis with aftermath consequences. However, the total gross tonnage and ship length increased by 3.44% and 13.24%, respectively, since the outbreak of COVID-19 pandemic from 2019 to 2023. The total number of tankers also increased by 4.20% overall, with 2.92% and 10.97% increases for the TTA and TCH tankers, respectively, but 13.25% decline for the LPG tankers over the 5-years of investigation period that was initiated with the outbreak of the global pandemic crisis.

Variations in brent oil prices prior to and over the pandemic crisis with aftermath rates, along with the shipping traffic densities and characteristics of vessels used the Turkish Straits from 2019 to 2024 are given in Table 1.

Table 1. Average annual brent oil price (\$ per barrel), and non-stop over passage of vessels through the Turkish Straits between 2019 and 2023, with indications to vessel characteristics. Percent variations for all variables to the previous year have been given in parenthesis and italic. Minus (-) in front of percent rates indicate “percent decline”. (The year of pandemic outbreak with brent oil price dip in 2020, and the year of global recession with overshoot of brent oil price in 2022 have been highlighted in grey color)

Brent Oil*	Year				
	2019	2020	2021	2022	2023
\$/barrel	64.30 (-9.87%)	41.96 (-34.74%)	70.86 (68.88%)	100.93 (42.44%)	82.49 (-18.21%)
Σ-VN**	84,871	80,440 (-5.22%)	81,893 (1.81%)	77,486 (-5.38%)	83,892 (8.27%)
Σ-TGT**	1,511,206,284	1,478,603,748 (-2.16%)	1,530,393,894 (3.50)	1,413,066,367 (-7.67)	1,563,158,348 (10.62)
Σ-LOA**	11,410	12,382 (8.52)	13,161 (6.29)	11,302 (-14.13)	12,921 (14.32)
Σ-TT**	18,800	17,807 (-5.28)	17,456 (-1.97)	18,557 (6.31)	19,590 (5.57)
Σ-TTA**	12,112	10,896 (-10.04)	10,281 (-5.64)	11,321 (10.12)	12,466 (10.11)
Σ-LPG**	1,230	1,201 (-2.36)	1,089 (-9.33)	1,040 (-4.50)	1,067 (2.60)
Σ-TCH**	5,458	5,710 (4.62)	6,086 (6.58)	6,196 (1.81)	6,057 (-2.24)

Note: Σ-VN: Total number of non-stop over passage vessels; Σ-TGT: Total number of total gross tonnage; Σ-LOA: Total number of vessels lower than 500 Gross Tonnage (LOA); Σ-TT: Total number of tankers; Σ-TTA: Total number of non-specific tankers; Σ-LPG: Total number of Liquefied Petroleum Gas tankers; Σ-TCH: Total number of chemical cargo tankers; *Statista (2024d); **MTI (2024)

Discussion

According to estimates made ten years ago, it was predicted that oil prices could range between \$60 and \$160 per barrel by 2020 (TEMS, 2008). It was probably not foreseen when these predictions were made that the COVID-19 pandemic would affect the whole world. Because, the lowest daily closing price of \$19.33 per barrel for brent oil was experienced on 21st April during the coronavirus outbreak early 2020 (Statista, 2024e). It has been stated that various factors may have caused the decline in crude oil prices with the emergence of the COVID-19 pandemic. Fan & Li (2015) reported that uncertainties can be triggered by supply and demand imbalances, unexpected shock waves, political changes and financial impacts, which in turn may potentially destabilize the economy and affect the volatility of crude oil prices. It is possible to attribute the sharp decline in oil prices in 2020, when the COVID-19 pandemic began to spread, to the sudden contraction in the trade network due to harsh measures such as lockdowns and border closures since the beginning of the outbreak, which also noted by Boldea et al. (2023).

Overall, our analyses evidence a decline of the ship traffic density in the Turkish Straits during the pandemic, which is in line with March et al. (2021), who reported a decline in global maritime traffic during the COVID-19 pandemic period. Based on the findings in the present study, the total number of vessels (-5.22%) and so the total gross tonnages (-2.16%) used the Turkish Straits reduced as did the prices for brent oil rates (-34.74%). In line with the findings, March et al. (2021) reported remarkable decreases in maritime traffic after March 2020, for Istanbul Strait, along with the Panama Canal, Strait of Gibraltar, Strait of Dover.

Essentially, there has been a gradual increasing trend in the shipping industry for a long time in all maritime activities, including shipping and tourism cruise lines before the pandemic outbreak (Jouffray et al., 2020; Vicente-Cera et al., 2020), with 92% of maritime transport of the Economic Exclusive Zones (Halpern et al., 2019), and the global shipping network was expected to increase between 240% and 1209% by 2050 according to estimates (Sardain et al., 2019). However, changes in maritime transport can be affected by many factors of legal regulations such as marine protected areas, speed restrictions, changes in separation lines, socio-economic

changes, pirate attacks, environmental changes or cultural and political conflicts (Tournadre, 2014; McCauley et al., 2016; Moore et al., 2018). The decline in oil prices at the beginning of 2020 may have triggered an increase in tanker transportation before the decrease in oil demand due to the COVID-19 pandemic (Michail & Melas, 2020; Jefferson, 2020), that was noted for the tanker transport activities in the Turkish Straits in the present study. The total number of non-stop over passage tankers used both the Istanbul and Çanakkale Straits declined from 18,800 to 17,807 with a drop by 5.28% after the outbreak of COVID-19 in 2020. The decline for the TTA tankers were sharper (-10.04%), but only 2.36% reduction was recorded for the LPG tankers used the Turkish Straits during the pandemic in 2020. However, it appears that tankers carrying chemical cargo (TCH) has not been affected by the spread of the COVID-19 pandemic. In contrast, the TCH tanker used the Turkish Straits increased by 4.62 % despite the outbreak of COVID-19 in 2020, compared to the pre-pandemic year of 2019. Hence the TCH tankers were in the front line compared to the others and the situation for the TCH carriers was not as bad as might have been expected, as also reported by UNCTAD (2022). With the outbreak of COVID-19 pandemic, the production of chemicals in China initially slowed down due to lowered demand as an aftershock, some facilities were closed, and some slowed down the production. However, it was stated that some enterprises continued production to meet the slow-motion demands from the world by increasing the amount of supply, hence, the impact on the chemical tanker sector was lower than expected, as there was no problem in the supply of chemical materials (UNCTAD, 2022).

According to UNCTAD (2022) reports, port calls by container vessels lowered by -2.8% over the pre-pandemic year of 2019. Dry bulk and wet bulk carriers slowed by -4.1 and -4.8%, respectively. The decline of dry breakbulk carriers was higher (-7.8%). This was also noted in the present study with larger declines observed among the TTA (-10.04%). Since liquified natural gas (LNG) and liquified petroleum gas (LPG) are utilized for the use in household energy supply or electric power plants, port calls by LNG (-0.2%) and LPG (-3.1%) have been reported to be less affected (UNCTAD, 2022). This was in line with the present study, where the number of LPG carriers transited the Turkish Straits during the pandemic year of 2020 declined only by 2.36%, in close agreement with UNCTAD (2022) reports for the world maritime transportation.

Despite the 68.88% increase of brent oil prices in the post-pandemic period of 2021, there was a slight positive move in ship traffic density in the Turkish Straits. Although the total

number of ships and eventually total gross tonnage rate increased by 1.81% and 3.50%, respectively, 5.64% decline was recorded for the transition of TTA tankers and 9.33% for the LPG carriers through the Straits. In contrast however, there was a progressive increase in chemical cargo carriers by 6.58% in 2021 over the pandemic year of 2020. Although the sudden shock waves had eased in the second half of 2020, when the pandemic outbreak emerged, and the world trade network gradually entered a recovery process early 2021, the delays and congestion in the supply chain led to a significant increase in container freight charges, as the recovery process from the pandemic was prolonged and could not respond rapidly to the increasing world demand (UNCTAD, 2021). This may explain the continued decrease in the number of tankers used the Turkish Straits, even though the effects of the pandemic began to wane in 2021.

In the post-pandemic period of late 2021 and early 2022, increased energy prices likely lead to a market pressure, weakening the purchase power of people, as has been reported by TEMS (2008). A rise in oil prices may reduce consumption and economic growth of countries, thus slowing down the world economy. Further, a decline in consumer demand also slows down the demand for trade and transportation services (TEMS, 2008). The main result of the initial rise in energy prices might be attributed to the recovery in energy demand after the easing quarantine measures of lockdown and curfew after the first wave of the pandemic, the subsequent price increase during 2021 was probably influenced by the supply challenges (Kuik et al., 2022). This process has likely intervened an even greater chaos with the conflict arisen between Russia and Ukraine in early 2022. As has been reported earlier by McCauley et al. (2016), Tournadre (2014), and Moore et al. (2018), several factors such as legal regulations socio-economic changes, pirate attacks, cultural and political conflicts may influence maritime transportation activities. With the turn of regional conflict between Ukraine and Russia into a war with Russian invasion, was the second stage of the aftermath of pandemic epidemic with severe increase in brent oil price, reaching over \$100 per barrel in 2022. This shape increase of price per barrel was followed another declining period for the total non-stop over passage vessels through the Turkish straits. The tanker transits however, continued further increase by 6.31%, except the LPG carriers. When the brent oil price dropped (-18.21%) to \$82.55 per barrel in 2023, the ship traffic density increased further by 8.27%.

Overall, the maritime traffic density in the Turkish Straits declined by 1.15% between 2019 and 2023, covering the global

pandemic crisis with aftermath consequences. However, the total number of tankers increased by 4.20% over the 5-years span from 2019 to 2023. Consequently, it seems that COVID-19 pandemic has less explanatory power over time in explanation of the brent oil price fluctuations, however stronger in interpreting the impacts on maritime transportation density in the Turkish Straits. Further investigations are worth for the understanding the roles of regional conflicts such as the war in Ukraine that may have substituted for the COVID-19 pandemic to a larger extent over the aftermath, as also reported earlier by Amri Amamou & Aguir Bargaoui (2022), and Xing et al. (2023).

Conclusion

In conclusion, analyses in regional scale as in this study, provide important information for the assessment of variations in the blue economy on global scale. The findings of this study show that the COVID-19 outbreak has caused remarkable disruptions and volumetric contraction of the shipping traffic in the Turkish Straits, one of the important sea routes and maritime chokepoints in the World. Further investigations in long-term on temporal variability in the energy market and structural breaks in maritime traffic during world crises are encouraged with attention. Such research approaches may provide early insights into management strategies for the blue economy and marine industry during world crisis periods.

Compliance With Ethical Standards

Conflict of Interest

The authors declare that there is no conflict of interest.

Ethical Approval

For this type of study, formal consent is not required.

Funding

Not applicable.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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