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RESEARCH ARTICLE

Evaluation of port state control inspections in Türkiye

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ABSTRACT

With technological developments, transportation has become easier and maritime trade between countries has reached very important dimensions, but this situation has led to the emergence of various risks in terms of both environment and maritime safety due to accidents or other reasons. The most important factor threatening the environment and maritime safety is the continued operation of substandard ships. There are various inspection mechanisms to prevent the operation of these ships and one of these mechanisms is port state control inspections. In this context, in this study, Port State Control inspections carried out in Türkiye between 2018 and 2022 were statistically examined and frequency analysis was performed and Pearson Chi-Square Independence test was utilized to analyse the hypotheses and the degree of relationship between the hypotheses was analysed by Phi- Cramer's V test. The study contributes to the literature in terms of statistical analysis of PSC Inspections in Turkish Ports within the scope of Black Sea Memorandum and Mediterranean Memorandum.

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Introduction

Maritime transportation is one of the foundations of globalisation, where most of the world trade takes place, and many ships call at ports in various countries of the world (Öztürk et al., 2016; Akpınar & Şahin, 2020; Bolat & Alpaslan, 2021; Prieto et al., 2021). However, since it is a type of transport that involves various risks for the marine environment and people (Emecen Kara, 2022), the lack of safety, security and/or pollution protection on ships causes marine accidents (Demirci & Çiçek, 2023). The majority of these accidents are caused by substandard ships (Demirci & Çiçek, 2023). Substandard ships can pose serious hazards to both personnel safety and marine life (Karahalios, 2021) and have a negative effect on both the maritime security and sustainability of international trade (Chuah et al., 2023). In this context, to decrease the risks posed by maritime transportation in the world seas and to preserve both environment of marine and human life, there are many legal regulations and sanctions for ships to navigate in

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compliance with international standards and these are implemented by international organisation, port state and flag state (Öztürk & Gökdemir Işık, 2016; Öztürk et al., 2016; Akpınar & Şahin, 2020).

"The International Maritime Organization (IMO)" and the "International Labour Organization (ILO)", which are fundamental rule makers in maritime sector, are the determinants of important environmental, security and safety conventions (Bang & Jang, 2012; Öztürk et al., 2016; Akpınar & Şahin, 2020; Emecen Kara et al., 2020; Kostović et al., 2022; Maşalacı & Çakır, 2023). Apart from IMO and ILO, stakeholders such as, insurance companies, ship owners, cargo owners, classification societies, port states and flag states also have responsibilities in the proper enforcement and supervision of all these rules and conventions (Demirci & Çiçek, 2023; Nwokedi et al., 2023).

The first control mechanism that can prevent substandard ships from circulating in the world seas is the flag state (Farag, 2016). However, since this inspection mechanism is not sufficiently operated in some flag states, ships that endanger maritime safety may continue to carry out their international activities (Farag, 2016). Classification societies are the organisations secondarily responsible for safety inspections of ships periodically (Farag, 2016; Emecen Kara, 2018); they provide technical surveys as well as annual, interim and additional surveys (Demirci & Çiçek, 2023). Ship owners, management companies, masters and crew are also responsible for substandard ships (Farag, 2016). The other control mechanism is insurance companies and P&I clubs (Farag, 2016). Since these inspection mechanisms mentioned above are insufficient to prevent substandard ships, it has become necessary to establish a new inspection mechanism as Port State Control in order to prevent these substandard ships (Farag, 2016).

Port states continue to inspect foreign flag ships arriving at the ports in line with the regional agreements they have established. (Bang & Jang, 2012; Öztürk & Gökdemir Işık, 2016). Port State Control, which was established after the tanker accidents in the 1960s and 1970s (Torrey Canyon-1967, Amoco Cadiz-1978, etc.), has its roots in the "1978 Hague Memorandum" (Nooramin & Sadjadi Parsa, 2010; Arslan & Eyigün, 2016; Şanlıer, 2020, 2021; Uygur & Bolat, 2021; Wang et al., 2021; Chuah et al., 2023). Later, the "Memorandum of Understanding on Port State Control" was signed between Western states at the "Balkans Conference" held in Paris in 1982 and "the Paris Memorandum of Understanding (Paris MoU)" was established (Knapp & Franses, 2007; Şanlıer, 2021; Bolat & Alpaslan, 2021; Demirci et al., 2022). Paris MoU is the first PSC system to be implemented (Bang & Jang, 2012; Bolat & Alpaslan, 2021; Chuah et al., 2023). There are currently nine main regional MoUs (Paris, Vine Del Mar, Tokyo, Caribbean, Mediterranean, Indian Ocean, Abuja, Black Sea, Riyadh) in the world (MedMoU, 2023a). Moreover, "the United States Coast Guard (USCG)" also conducts inspections of PSC on its shores (Bang & Jang, 2012; Emecen Kara, 2018, 2022; Uygur & Bolat, 2021; Demirci et al., 2022; Kostović et al., 2022).

Türkiye carries out port state control under "Black Sea MoU" and "Mediterranean MoU". Port State Controls are carried out in Turkish ports on Black Sea coast under the "Black Sea MoU" agreement (BSMoU, 2023) and other Turkish ports under Mediterranean MoU agreement. The geographical scope of the "Black Sea MoU", signed in 2000 by six Black Sea countries, includes ports on Black Sea coast, namely Bulgaria, Georgia, Romania, the Russian Federation, Türkiye and Ukraine (Eyigün, 2013). The observers of "the Black Sea MoU" are "IMO", "ILO", "Commission on the protection of the Black Sea against pollution", "USCG", "Mediterranean MoU", "Paris MoU", "Riyadh MoU" and "Republic of Azerbaijan". "Black Sea MoU" is an observer in "Paris MoU", "Viña del Mar", "Tokyo MoU", "Mediterranean MoU", "Indian Ocean MoU", "Abuja MoU" and "Riyadh MoU" (MedMoU, 2023a). In addition, "The Mediterranean Memorandum of Understanding on Port State Control" was signed by Algeria, Tunisia, Cyprus, Türkiye, Israel, Egypt, Morocco and Malta in 1997. At the end of 1997, Lebanon and Jordan ratified the agreement in 1999 (Eyigün, 2013). The observers of the Mediterranean MoU are "IMO", "ILO", "EC", "Paris MoU", "Black Sea MoU" and "USCG" and "Mediterranean MoU" is an observer in "Paris MoU", "Black Sea MoU", "Abuja MoU" and "Riyadh MoU" (MedMoU, 2023a).

Purpose of the article is to investigate the port state controls in Türkiye. It is aimed to provide a holistic perspective by considering "Mediterranean MoU" and "Black Sea MoU" together in Turkish Port State controls. In this context, statistical analysis of the inspections carried out in Turkish Ports in the Mediterranean and Black Sea Memorandums between 2018 and 2022 has been carried out. In this context, firstly, frequency analyses were made and it was defined whether there was an important relationship between the two independent groups with "Pearson Chi-Square test". Then, "Phi/ Cramer's V test" was utilized to define the degree of relationship between the accepted hypotheses.

Literature Review

With the increase in technology and ships' size, the risks in terms of safety and environment in maritime transportation have increased and maritime safety has become an important issue to be solved with major marine accidents occurring over time. One of the most important reasons for the occurrence of maritime accidents has been substandard ships. The primary responsibility for ensuring maritime safety belongs to flag states and flag state inspections have been insufficient due to the fact that some flag states have not acted responsibly enough over time. Although marine stakeholders are also responsible, all these organizations have been insufficient over time and the concept of port state control has occurred (Nwokedi et al., 2023). Many academic papers have been conducted on port state controls, which have a major influence on maritime safety.

Looking at the academic research on port state control, it can be seen that the research is mainly on risk and performance analysis (Emecen Kara, 2018; Akpınar & Şahin, 2020; Karahalios, 2021). Studies on risk and performance analysis include "Failure Mode and Effects Analysis (FMEA)" (Akyüz et al., 2016) "Fuzzy Cluster Analysis (FCA)" (Demirci et al., 2022), "Fault Tree Analysis (FTA)" (Akpınar & Şahin, 2020), "Bayesian" (Yang et al., 2018, 2020; Wang et al., 2021; Chuah et al., 2023), "Grey Relation Analysis (GRA)" (Lai et al., 2023), "Entropy Based Gray Relationship Analysis (GRA)" (Maşalacı & Çakır, 2023), "Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS)" (Emecen Kara, 2022; Lai et al., 2023), Excess Factor (EF) (Emecen Kara, 2016; Yılmaz, 2020). Akyüz et al. (2016) analysed the maritime safety of the Black Sea MoU, focusing on the compliance of certain aspects of "SOLAS Chapter II-2" regarding fire protection, detection and extinguishing regulations in ships using the FMEA method. Demirci et al. (2022) focused on the estimation of the risk level of ships for inspections of port state using an analytical method that integrates a fuzzy rule-based system with a machine learning method with the parameters of ship's type, flag and age, number of deficiencies and detention. Wang et al. (2021) found that the biggest deficiencies in ship detentions during Tokyo MoU PSC inspections were caused by fire safety and navigational safety, using a Bayesian network model. Yang et al. (2018) examined Paris MoU PSC inspections to calculate the cargo taking rate of bulk carriers using a real-time Bayesian network model and found that the main risk factors are recognised organisation (RO) and ship age. Furthermore, Yang et al. (2020) used Key Performance Indicators and Bayesian Network to examine PSC inspections before and after NIR under Paris MoU and found that NIR improved maritime safety and ship quality.

In addition, data mining (Tsou, 2019; Xiao et al., 2021; Sevgili & Töz, 2022) and statistical analysis studies (Arslan & Eyigün, 2016; Farag, 2016; Bolat, 2019; Ukić Boljat et al., 2020; Mantoju, 2021; Prieto et al., 2021; Şanlıer, 2020, 2021; Kostović, et al., 2022, Turna & Öztürk, 2023; Uçar & Boran, 2023) have also been carried out. Tsou (2019) used "big data analysis" to investigate the implicit relationships related to detention shortages and determined that there is an implicit relationship between Fire Training and ISM resources and manpower. Xiao et al. (2021) reached that ship's type, age, flag state performance and number of deficiencies considered significant by NIRs are important criteria for calculating ship risk. Kostović et al. (2022) compared the inspections' number and detained container ships for each area and for the same timeframe, the inspection statistics (overall) and the proportion of ships detained. Mantoju (2021) made a statistical study of MARPOL deficiencies in PSC inspections in all the MoUs and found that the most significant deficiencies were related to Annex I and Annex V. Ukić Boljat et al. (2020), using chi-square test and correlation analysis, explained that the highest number of deficiencies were found in Marpol Annex I, followed by Annex V, IV and VI, respectively. Prieto et al. (2021) found that a direct relationship between age of ship and deficiencies' number and ship size, and substandard ships are smaller and older ships. Şanlıer (2021) analysed the Paris MoU inspections and stated that the deficiency areas that affect the detentions most are ISM, fire doors - openings in fire-resistant compartments, emergency fire pumps/pipes, fire drills and the most difficult conventions are STCW, SOLAS and ILO conventions.

There are also studies on the legal dimension of port state control (Keselj, 1999; Stoyanov & Terlemesian, 2004; Bang & Jang, 2012; Öztürk et al., 2016) and studies on stakeholders (Piniella et al., 2020; Nwokedi et al., 2023). Keselj (1999) examined the notion of port State jurisdiction under UNCLOS and the development of the MoU on Ports. Stoyanov & Terlemesian (2004) provide an overview of Bulgarian and international law on management of environmental in port regions. Nwokedi et al. (2023) analysed the classification society performance of ships inspected and arrested under the Abuja PSC and found that ships classed by Germanisher Lloyds (GL) had fewer safety defects and deficiencies in inspections, while shipowners preferred NipponKaiji Kyokai the most.

There have been studies on the analysis of the status of the Turkish flag in the MoUs (Bolat, 2019; Yılmaz, 2020; Uygur &

Bolat, 2021; Sevgili & Töz, 2022; Kan, 2023), and some studies on the Black Sea and Mediterranean MoUs (Emecen Kara, 2016; Öztürk & Gökdemir Işık, 2016; Öztürk et al., 2016; Şanlıer, 2020; Akpınar & Şahin, 2020; Maşalacı & Çakır, 2023; Uçar & Boran, 2023). Looking at studies on Turkish flag ships, Bolat (2019) deficiencies were identified especially in the areas of navigational safety, fire safety and life-saving equipment of Turkish flagged ships, throughout the inspections of Tokyo MoU. Kan (2023) aimed to identify and address the deficiencies of Turkish flag ships under the "MLC Convention" in the Paris MoU and concluded that a sustainable and conscious management approach should be adopted, working and seafarers' living conditions should be improved, trade union rights should be developed and grievance mechanisms should be established. Sevgili & Töz (2022) found that the main deficiencies causing the arrest of Turkish flagged ships in PSC inspections are navigation safety, documentation and documentation and emergency systems. Uygur & Bolat (2021) aimed to analyse the performance of Turkish flag ships in Paris MoU inspections and concluded that deficiencies have an impact on the detention decision of the ship, but the age of the ship has no effect on the detention decision. Yılmaz (2020) used the excess factor and arrest rate indicators to measure merchant vessels of Turkish flagged in the Paris MoU inspections. Looking at the studies on the Mediterranean and Black Sea MoUs, Akpınar & Şahin (2020) aimed to calculate the probability of a ship being detained during Black Sea MoU PSC inspections and evaluated it using "Fault Tree Analysis (FTA)". Emecen Kara (2016) analysed the risks related to the ships passing through the Bosporus Strait by utilizing the "Black Sea MoU" inspection data and concluded that the highest risk flags are Sierra Leone, Tanzania, Cambodia, Turkey, Georgia, Togo and Moldova. Maşalacı & Çakır (2023) found that the most important deficiency type in ship detentions during PSC inspections in the Black Sea was Fire Safety and Emergency Systems. Şanlıer (2020) resulted that the root cause for detentions in Black Sea MoU PSC inspections is the age of the ship and the flag, ship type, inspection authority and recognised organisation are other reasons. Uçar & Boran (2023) analysed that there is a meaningful relationship between the cause for detention based lack of machinery within the scope of Black Sea PSC inspections and classification society, ship's age, flag, gross tonnage, and inspection country; however, there is no meaningful relationship between the ship type and the causes for detention statistically. In a study conducted by Öztürk & Gökdemir Işık (2016) for port state officers conducting port state inspections in Türkiye, the aim was to determine the operations of the ship that should be considered before the ship to be inspected. Öztürk et al. (2016) stated that the greatest problem of the Turkish PSC system in the implementation of 1982 UNCLOS is the lack of branching, while the problem of inter-departmental supervision is not a significant problem.

Our study discusses port state control in Turkish ports in "Black Sea MoU" and "Mediterranean MoU", and this study contributes to the literature since there are not enough studies in the literature in terms of statistical analysis of Turkish port state control in both MoUs.

Material and Method

The paper's aim is to analysis the inspections carried out in Turkish Ports in the Mediterranean and Black Sea Memorandums between 2018 and 2022. Firstly, frequency analyses were performed and Pearson Chi-Square independence test is utilized to assign whether there is a relationship of significant between two independent groups. Then, Cramer's V test is used to determine the degree of relationship between the accepted hypotheses.

Chi-Square independence analysis is one of the most useful statistics used to test hypotheses when variables are nominal (Bayar & Akan, 2022). Chi-Square independence analysis is a statistical analysis used to perform independence analyses on categorical data (Turhan, 2020; Bayar & Akan, 2022). In cases where the p value is less than 0.05, it is accepted to be significant and there is a relationship between variables (Baradan et al., 2016).

The Pearson Chi-square independence test compares the observed values with the values that will be expected if there is no relationship between the two variables, and in order to apply the Pearson Chi-square independence test that each case must be included in a cell in the cross-tabulation for the test to be meaningful (Baradan et al., 2016). In addition, the cross-tabulation can have at most 20% cells with an expected frequency below 5, and expected frequencies below 1 are unacceptable (Baradan et al., 2016).

Phi Cramer's V test is performed to identify the level of relationship between variables that have relationship of significant with chi-squared test; Phi coefficient is used for 2×2 dimensional tables and Cramer's V coefficient for tables larger than 2×2 (Bölükbaşı & Yıldırtan, 2009; Çolak & Ergün, 2020; Akan et al., 2022). The relationship levels of Phi Cramer's V values are as follows (Rea & Parker, 1992; Kotrlik et al., 2011; Akan et al., 2022):

- "Negligible association" (0.00 and under 0.10)

- "Weak association" (0.10 and under 0.20)
- "Moderate association" (0.20 and under 0.40)
- "Relatively strong association" (0.40 and under 0.60)
- "Strong association" (0.60 and under 0.80) and
- "Very strong association" (0.80 and under 1.0).

Application

In the study, 11080 inspections with Türkiye as the Port State between 2018 and 2022 were analysed and the data were taken from "Black Sea MoU" and Thetis-Med (for Mediterranean MoU) websites (BSMoU, 2023; EMSA, 2023). SPSS programme was used for data analysis. As can be seen in Table 1; 80.3% of the data belong to the inspections in the "Mediterranean MoU" and 19.7% in the Black Sea MoU". In terms of year, the most inspections were carried out in 2022 (f: 3249, 29.3%) and the least in 2020 (f: 1530, 3.8%).

Moreover, the most detailed inspection (f:7758, 70,00%) and the least expanded inspection (f:232,2,1%) were carried out. Of the inspected vessels, 52,5% were without deficiencies, 3,1% with deficiencies were detained, 44,32% had only deficiencies but no detention. Most of the inspections took place in Mersin (f:1571, 14.2%) and the least in Other Mediterranean and Aegean Ports (f:373, 3.4%). (Table 1).

In the study, a total of 34 hypotheses were established to evaluate the existence of a relationship between them (Table 2). Pearson's chi-square independence test was utilized to measure the accuracy of these hypotheses, and Cramer's V test was used to identify the effect rate of the hypotheses that were accepted to have a relationship of significant according to the results of the chi-square test (Table 3). In this context, hypotheses H_{10} and H_{27} were rejected and no significant relationship was found between "result" and "month" and between "flag" and "month". In order to identify the relationship level between the hypotheses accepted as a result of Pearson Chi-Square Independence test, Cramer's V coefficient was examined in Phi Cramer's V test. H_1 ("type of inspection" and "year") (v:0.236), H_{11} ("result" and "flag") (v:0.220), H_{12} ("result" and "ship type") (v:0.243), H_{13} ("result" and "port") (v:0.230), H_{15} ("result" and "ship's age") (v:0.263), H_{18} ("MOU" and "flag") (v: 0.228), H_{19} ("MOU" and "ship type") (v:0.301), H_{25} ("port" and "deficiency") (v:0.201), H_{28} ("flag" and "ship type") (v:0.332), H_{30} ("flag" and "ship's age") (v:0.205), H_{33} ("ship type" and "deficiency") (v: 0.207) and H_{34} ("ship type" and "ship's age") (v:0.322) are "moderate association". Finally; H_6 ("type of inspection" and "port") (v: 0.456), H_8 ("type of inspection" and "MOU") (v: 0.579) and H_{24} ("port" and "ship type") (v: 0.403) are "relatively strong association" (Table 3).

Results and Discussion

Port State control is carried out in order to determine whether the port state meets the safety and pollution prevention requirements of foreign flagged ships entering their ports or coastal facilities and whether they are suitable for the related international conventions, whether there are appropriate people who they are working on board (Bang & Jang, 2012; Farag, 2016; Öztürk et al., 2016; Akyüz et al., 2016; Akpınar & Şahin, 2020; Yılmaz, 2020; Uygur & Bolat, 2021; Kostovic et al., 2022).

Turkish port state control inspections are performed within the scope of "Black Sea MOU" and "Mediterranean MOU"; Black Sea Region ports within the borders of Türkiye are inspected under "Black Sea MOU" and ports on the other coasts are inspected under "Mediterranean MOU". In this context, in 2022, a total of 4972 PSC inspections were conducted on 3501 individual ships in "Black Sea MoU" and deficiencies were found in 2981 of these inspections. The inspection rate was 74.25%. 162 individual ships were detained total 174 times in the inspections. The detention rate was 4.63% (BSMoU, 2022). Within the scope of the "Black Sea MoU", 523 individual ships were inspected with 568 inspections totally in Turkish ports and deficiencies were found in 340 of these inspections. The inspection rate was 40.39%. 8 individual ships were detained total 9 times in the inspections. The detention rate was 1.53% (BSMoU, 2022). However, the countries with the greatest PSC inspection rate were Russia, Ukraine and Georgia, while the countries with the greatest rate of detention were Romania, Russia and Bulgaria, respectively (BSMoU, 2022). Also, in 2022, 6132 PSC inspections were conducted in the "Mediterranean MoU". In these inspections, inspection with deficiencies was 2909, with a deficiency rate of 47.44%. As a result of these inspections, 921 detentions were made and the detention rate is 15.02%. However, the country with the biggest inspections number in 2022 is Türkiye; in 2021, 2711 inspections were conducted in Turkish Ports and the inspection rate is 37.30%. In Türkiye, inspection with deficiencies was 1290 and the deficiency rate is 47.58%. However, 89 detentions were carried out and the detention rate was 3.28%. The countries with the greatest inspection rate are Jordan (79.86%), Lebanon (38.88%), Egypt (31%) and Türkiye (37.3%). The countries with the greatest rate of detention were Israel (4.43%), Cyprus (3.94%), Türkiye (3.28%) and Jordan (3.00%) (MedMoU, 2023b).

Table 1. Frequency table for port state inspections in Türkiye

	Frequency	Percent		Frequency	Percent
MOU			**Flag**		
Mediterranean	8897	80.3	Liberia	1094	9.9
Black Sea	2183	19.7	Malta	1043	9.4
Year			Marshall Islands	1050	9.5
2018	1841	16.6	Panama	1930	17.4
2019	1979	17.9	Russia Federation	1130	10.2
2020	1530	13.8	China/Hong Kong /Singapore	786	7.1
2021	2481	22.4	Other	4047	36.5
2022	3249	29.3	**Port**		
Month			Ceyhan	564	5.1
January	1006	9.1	Mersin	1571	14.2
February	972	8.8	Aliağa	1498	13.5
March	944	8.5	Kocaeli	1357	12.2
April	734	6.6	Iskenderun	1267	11.4
May	560	5.1	Izmir	699	6.3
June	834	7.5	Samsun	690	6.2
July	732	6.6	Istanbul/Ambarlı/Tuzla	626	5.6
August	793	7.2	Trabzon	422	3.8
September	1010	9.1	Other Black Sea Ports	1071	9.7
October	1193	10.8	Other Marmara Ports	942	8.5
November	1178	10.6	Other Mediterranean and Aegean Ports	373	3.4
December	1124	10.1	**Deficiency Area in Detentions**		
Week Day			Certificate and Documentation	232	66.9
Monday	2426	21.9	Structural Conditions	115	33.1
Tuesday	2364	21.3	Water/Weathertight Conditions	117	33.7
Wednesday	2272	20.5	Emergency Systems	182	52.4
Thursday	2042	18.4	Radio Communication	115	33.1
Friday	1864	16.8	Cargo Operation including Equipment	15	4.3
Saturday	75	0.7	Fire Safety	229	65.7
Sunday	37	0.3	Alarms	51	14.7
Type of Inspection			Living and Working Conditions	189	54.5
Initial Inspection	3090	27.9	Safety of Navigation	223	64.3
Detailed Inspection	7758	70.0	Life Saving Applications	212	61.1
Expanded Inspection	232	2.1	Dangerous Goods	6	1.7
Result			Propulsion and auxiliary machinery	124	35.7
Detention	347	3.1	Pollution prevention	127	36.6
Only Deficiencies	4913	44.3	ISM	125	36.0
Without Deficiency	5820	52.5	ISPS	67	19.3
Ship Type			Labour Conditions	57	16.4
Bulk Carrier	3415	30.8	Others	17	4.9
Tanker	1172	10.6	**Ship's Age**		
General Cargo /multi purposes	4859	43.9	0-5	839	7.6
Other	1634	14.7	6-10	2064	18.6
Deficiency			11-15	2199	19.8
0	5820	52.5	16-20	1234	11.1
1-5	3632	32.8	21 and up	2561	23.1
6-10	1108	10.0	n/a	2183	19.7
11 and up	520	4.7			

Table 2. Research hypotheses

Hypothesis	Statement
H_1	"Type of inspection" and "year" have a relationship of significant
H_2	"Type of inspection" and "month" have a relationship of significant
H_3	"Type of inspection" and "result" have a relationship of significant
H_4	"Type of inspection" and "flag" have a relationship of significant
H_5	"Type of inspection" and "ship type" have a relationship of significant
H_6	"Type of inspection" and "port" have a relationship of significant
H_7	"Type of inspection" and "deficiency" have a relationship of significant
H_8	"Type of inspection" and "MOU" have a relationship of significant
H_9	"Result" and "year" have a relationship of significant
H_{10}	"Result" and "month" have a relationship of significant
H_{11}	"Result" and "flag" have a relationship of significant
H_{12}	"Result" and "ship type" have a relationship of significant
H_{13}	"Result" and "port" have a relationship of significant
H_{14}	"Result" and "MOU" have a relationship of significant
H_{15}	"Result" and "ship's age" have a relationship of significant
H_{16}	"MOU" and "year" have a relationship of significant
H_{17}	"MOU" and "month" have a relationship of significant
H_{18}	"MOU" and "flag" have a relationship of significant
H_{19}	"MOU" and "ship type" have a relationship of significant
H_{20}	"MOU" and "deficiency" have a relationship of significant
H_{21}	"Port" and "year" have a relationship of significant
H_{22}	"Port" and "month" have a relationship of significant
H_{23}	"Port" and "flag" have a relationship of significant
H_{24}	"Port" and "ship type" have a relationship of significant
H_{25}	"Port" and "deficiency" have a relationship of significant
H_{26}	"Flag" and "year" have a relationship of significant
H_{27}	"Flag" and "month" have a relationship of significant
H_{28}	"Flag" and "ship type" have a relationship of significant
H_{29}	"Flag" and "deficiency" have a relationship of significant
H_{30}	"Flag" and "ship's age" have a relationship of significant
H_{31}	"Ship type" and "year" have a relationship of significant
H_{32}	"Ship type" and "month" have a relationship of significant
H_{33}	"Ship type" and "deficiency" have a relationship of significant
H_{34}	"Ship type" and "ship's age" have a relationship of significant

In the study, it was observed that the total number of Turkish Ports' inspections affiliated to the Black Sea MoU and Mediterranean MoU in 2018 (f:1841, 16.6%) and 2019 (1979, 17.9%), while it decreased in 2020 (f:1530, 13.8%). The reason for this decrease was that the Covid pandemic started to spread around the world. After this pandemic process, it was observed that Port State Controls in Türkiye increased more and more compared to the previous years, in 2021 (f: 2481, 22.4%) and 2022 (f: 3249, 29.3%), However; in terms of days, 63.7% of the inspections took place in the first three days of the week (Monday, Tuesday, Wednesday), while only 1% of the inspections took place at the weekend.

In the study, 34 hypotheses related to inspections have been established and only H_{10} (""result" and "month" have a significant relationship") and H_{27} (""flag" and "month" have a significant relationship") hypotheses have been rejected, while the degree of association between H_2 ("type of inspection and "month"), H_{17} ("MoU" and "month"), H_{22} ("port" and

"month") and H_{32} ("ship type" and "month)" hypotheses related to "month" has been "negligible association". H_6 ("type of inspection" and "port") (v: 0.456), H_8 ("type of inspection" and "MOU") (v: 0.579) are "relatively strong association". In this context, although most of the inspections in Turkish ports within the scope of "Black Sea MoU" (Samsun (f: 599), Trabzon (f: 294), other Black Sea Ports (f: 723)) are "initial inspection"; in Turkish ports within the scope of "Mediterranean MoU" (Mersin (f: 1383), Aliağa (f: 1147), Kocaeli (f: 1070), İskenderun (f: 943), Izmir (f. 605), Ceyhan (f: 486, Istanbul/Ambarlı/Tuzla (f: 563), other Marmara Ports (f: 831) and other Aegean and Mediterranean Ports (f: 352) are detailed inspection. Despite being the same port state, different inspection types were preferred in MoUs. "Expanded inspection" was performed at very low rates in both MoU ports. In this context, although the texts of all MoUs are almost the same, the MoU parties in some areas shortage of the technology, financial capacity, infrastructure, action plans and policies required for an effective agreement (Bang & Jang, 2012). Furthermore, Piniella et al. (2020), using both stakeholder perceptions and information from the "European Maritime Safety Agency (EMSA)", "Paris Memorandum of Understanding (Paris)", concluded that PSC controls are not perceived consistently and vary by the same state operator, port, even port state control operator.

Table 3. Research hypotheses test results

Hypothesis	Value	P	Result of Hypothesis	Cramer's V Value	Degree of Relationship
H_1	1237.187	0.000	Accept	0.236	"Moderate association"
H_2	121.117	0.000	Accept	0.074	"Negligible association"
H_3	159.239	0.000	Accept	0.085	"Negligible association"
H_4	234.153	0.000	Accept	0.103	"Weak association"
H_5	143.097	0.000	Accept	0.080	"Negligible association"
H_6	4604.900	0.000	Accept	0.456	"Relatively strong association"
H_7	227.402	0.000	Accept	0.101	"Weak association"
H_8	3713.054	0.000	Accept	0.579	"Relatively strong association"
H_9	17.381	0.026	Accept	0.028	"Negligible association"
H_{10}	30.087	0.116	Reject	-	-
H_{11}	1075.122	0.000	Accept	0.220	"Moderate association"
H_{12}	1309.234	0.000	Accept	0.243	"Moderate association"
H_{13}	1171.549	0.000	Accept	0.230	"Moderate association"
H_{14}	201.361	0.000	Accept	0.135	"Weak association"
H_{15}	1536.090	0.000	Accept	0.263	"Moderate association"
H_{16}	31.118	0.000	Accept	0.053	"Negligible association"
H_{17}	34.543	0.000	Accept	0.056	"Negligible association"
H_{18}	574.165	0.000	Accept	0.228	"Moderate association"
H_{19}	1000.558	0.000	Accept	0.301	"Moderate association"
H_{20}	279.699	0.000	Accept	0.159	"Weak association"
H_{21}	805.636	0.000	Accept	0.135	"Weak association"
H_{22}	371.661	0.000	Accept	0.055	"Negligible association"
H_{23}	1525.174	0.000	Accept	0.151	"Weak association"
H_{24}	5396.020	0.000	Accept	0.403	"Relatively strong association"
H_{25}	1337.633	0.000	Accept	0.201	"Moderate association"
H_{26}	114.492	0.000	Accept	0.051	"Negligible association"
H_{27}	69.279	0.367	Reject	-	-
H_{28}	3665.830	0.000	Accept	0.332	"Moderate association"
H_{29}	1165.782	0.000	Accept	0.187	"Weak association"
H_{30}	2328.602	0.000	Accept	0.205	"Moderate association"
H_{31}	137.382	0.000	Accept	0.064	"Negligible association"
H_{32}	50.609	0,026	Accept	0.039	"Negligible association"
H_{33}	1425.553	0.000	Accept	0.207	"Moderate association"
H_{34}	3449.389	0.000	Accept	0.322	"Moderate association"

H_{24} ("port" and "ship type") (v: 0.403) are "relatively strong association". The most inspected vessels were general cargo/multi purposes (f:4859, 43.9%) and Bulk Carrier (f:3415, 30.8%), respectively. In the scope of the "Mediterranean MoU", the most inspected ship types in Turkish Ports were general cargo/multi purposes (f: 3283, 36.9%) and bulk carrier (f: 2916, 32.78%) respectively, while the most inspected ship types in Turkish Ports within the scope of the Black Sea MoU were general cargo/multi purposes (f: 1576, 72.19%) and bulk carrier (f: 499, 22.86%), respectively. This situation is due to the different proportions of ships arriving at the ports of these MoUs. Şanlıer (2020) analysed the inspection data of the Black Sea MoU between 2012 and 2017 and stated that while the rate of general cargo, which is the most inspected vessel, was 44.79% in 2012, it decreased over the years and decreased to 37.48% in 2017, and the rate of bulk carrier, which was the second, was 25.99% in 2012 and increased to 34.81% in 2017.

As a result of our analyses, H_{11} ("result" and "flag"), H_{12} ("result" and "ship type"), H_{13} ("result" and "port") and H_{15} ("result" and "ship's age) have "moderate association". In this context, in our study, the flags of the ships that were most frequently detained in the inspections were found to be Panama, Marshall Islands and Liberia with approximately 16.71%, 4.61% and 3.46%, respectively. However, while the detention rate of Panama flag was 3.01%, Marshall Islands was 1.52% and Liberia was 1.11%. It was observed that these flags with the highest detention rate were easy flags. In addition, among the inspections, the most common type of vessels detained were "general cargo/multipurpose" (68.58%), "bulk carrier" (16.14%) and "tanker" (3.17%). The detention rate of "general cargo/multipurpose" was approximately 4.90 %, while that of "bulk carrier" was 1.64 % and that of "tanker" was 1.03 % according to our paper's result. In this context, the ports where the ships were detained the most in inspections were Iskenderun (approximately 13.54%), Mersin (approximately 12.97%), and Kocaeli (approximately 8.07%), respectively. In addition, Other Marmara Ports (approximately 14.12%), Other Black Sea Ports (approximately 12.10%) and Istanbul/Ambarlı/Tuzla (approximately 8.36%). However, while the rate of detention of vessels in Samsun Port was approximately 3.91%, it was 3.71% in Iskenderun Port and 3.55% in Ceyhan Port. Moreover; this rate was 7.24% in Other Aegean and Mediterranean Ports, 5.20% in Other Marmara Ports and 4.63% in Istanbul /Ambarlı/Tuzla. In addition, the age range of the most detained vessels in the inspections is 21 and up; this ratio covers approximately 67.90% of all detained vessels. This is followed by 16-20 with approximately 9.23%. In addition, approximately 8.43% of 21 and up and 1.95% of 16-20 vessels entered into detention. Only about 0.36% of the vessels in the 0-5 range were detained. In this context, Chuah et al. (2023) analysed the factors of risk for ship detention and found that the flag state is the biggest factor, followed by type of ship, recognized organization inspection authority and age of ship. In addition, Emecen Kara (2022) measured the flag states performance and stated that only 49% of the flag states have substandard performance and especially Panama and Indonesia are the countries with the lowest performance. Öztürk & Gökdemir Işık (2016) found that ship age, ship type, ship structure, cargo type, voyage intensity and ship flag also affect the inspection status of ships.

In PSC inspections, ships, the general condition of the ship; certificates and documents, preparedness for emergencies and the quality of the crew and familiarity with the task are examined (Demirci et al., 2022). When a PSC inspection is carried out, the first procedure after checking the external appearance of the ship under general conditions is to control the ship's certificates and documents, and if no obvious deficiencies are found as a result of the impression obtained, the inspection is terminated. If an obvious defect is found, control all levels of the deck and associated cabin area equipment etc. by visiting; a more comprehensive inspection is made (Tsou, 2019; Şanlıer, 2020; Prieto et al., 2021). If serious defects are found as a result of the detailed inspection, the ship is detained until all deficiencies are eliminated, and if the ship goes though the PSC inspection after the deficiency is eliminated, the detention of the ship is lifted (Tsou, 2019; Şanlıer, 2020; Chuah et al., 2023). In the inspections carried out in Turkish Ports between 2018 and 2022 the most common deficiency areas in the detentions were "Certificate and Documentation" (66.9%), "Fire Safety" (65.7%), "Safety of Navigation" (64.3%), and the least deficiency areas were "Dangerous Goods" (1.7%), "Cargo Operation including Equipment" (4.3 %), "Other" (4.9 %), respectively.

Conclusion

Evaluating the performance of the flag state are important to ensure the life, property and the environment safety for the coastal state in PSC inspections (Xiao et al., 2021; Uygur & Bolat, 2021). Therefore, the paper is examined PSC inspections in Türkiye between 2018 and 2022. The frequency and relationship analyses with the hypotheses were made. According to the results, it was observed that 98.99% of the inspections were carried out on weekdays and the vessels with

the highest detention rate were easy flag states. In addition, the month of inspection was either not correlated with other variables or the degree of association was "negligible association". The most correlation was observed between type of inspection and MoU between port and type of inspections and ship type. The study contributed to the literature in terms of statistically examining the inspections carried out in Turkish Ports between 2018 and 2022 within the scope of "Black Sea MoU" and "Mediterranean MoU". In future studies, a general risk analysis of PSC inspections and detentions in Turkish Ports can be carried out, as well as a risk analysis of any deficiency area that causes detention.

Compliance With Ethical Standards

Conflict of Interest

The author declares that there is no conflict of interest.

Ethical Approval

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

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Data Availability Statement

All data generated or analysed during this study are included in this published article and its supplementary information files.

Supplementary Materials

Supplementary data to this article can be found online at https://doi.org/10.33714/masteb.1402896

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