CHAPTER 9

PORT STATE CONTROL INSPECTION AND VESSEL DETENTION

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1. INTRODUCTION

The regime of port state control (PSC) was created more than 30 years ago (Kasoulides, 1993)[2] and is defined by the International Maritime Organisation as 'the inspection of foreign ships in national ports to verify that the condition of the ship and its equipment comply with the requirements of international regulations and that the ship is manned and operated in compliance with these rules'.[3] These regulations are under the provisions of the International Convention for the Safety of Life at Sea, 1974, as amended (SOLAS), the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended (STCW), the International Convention for the Prevention of Pollution from Ships, 1973, as amended (MARPOL), the International Convention on Load Lines, 1966 (Load Lines), and the International Convention on Tonnage Measurement of Ships, 1969 (Tonnage 69).

PSCs are mainly justified by the limited resources available for some flags of registry and the necessity, at the same time and for most sovereign states, to have a better control over foreign vessels calling at their port and sailing through their territorial waters. This necessity is even higher nowadays when maritime safety and security issues are under the scrutiny of public opinion. Sovereign states, with limited control over these issues, are the first ones usually blamed by public opinion when accidents, incidents or marine pollution occur.

Within this general framework, detention rates and records from PSC for vessels, shipowner, and flag of registry . . . are under the scrutiny of regulators and of the industry. This chapter deals with this issue. It presents in the next section elements relative to the use of detention records to determine which vessels to inspect during a PSC (section 2). The third section offers a methodology in order to identify vessels that could be subject to detention as well as

1. The authors wish to express their gratitude to the Indian Ocean MoU Secretary Mr. Ganguli who allowed us to have access to the data used in this study.

2. The present regime of PSC traces its origins from a memorandum of understanding signed in The Hague between eight North Sea states in 1978.

3. www.imo.org/

an application on 26,515 inspections that took place within the Indian Ocean PSC region from 2002 to 2006. The last section offers some conclusions.

2. PSC INSPECTION AND DETENTION RECORDS

Most PSC MoUs (Memoranda of Understanding on Port State Control also called 'MoU')[4] consider their effectiveness through their ability to target vessels that might be detained, meaning vessels for which inspections will lead to the identification of deficiencies that are 'clearly hazardous to safety, health and environment'. However, this pragmatic approach is mainly justified by the limited number of inspectors and the need to avoid unnecessary inspections but is subject to interrogations for several reasons.

The first interrogation is related to the use of different targeting systems when one would expect that the factors to consider should be similar. Depending on the priorities of the various authorities, each state has developed its own criteria, criteria that may be compatible or not. The same remark holds within the nine regional agreements on port state control that cover virtually all of the world's seas and aim at coordinating the controls within a region.

The second interrogation is on the focus on vessels that might be detained. This makes sense as long as the implicit assumption that vessels detained are substandard ships that represent a risk in terms of safety holds. Unfortunately, the causal relationship between casualties and detentions is not so direct and was for instance challenged in a working paper[5] submitted by Turkey during the Maritime Safety Committee 82/10/9 and then completed during the last Flag State Implementation sub-committee of IMO (2007). The paper stresses for instance that using data from Paris MoU and Tokyo MoU (1998 to 2002), no clear significant relationship exists between the detention rate for a particular flag of registry and its respective weighted casualty ratio.[6] It would be particularly true within the Paris MOU area where a negative relationship is even found.[7]

4. These different MoUs are: Paris MoU—Europe and the North Atlantic; Tokyo MoU—Asia and the Pacific; Acuerdo de Viña del Mar—Latin America; Caribbean MoU—Caribbean Sea region; Abuja MoU—West and Central Africa; Black Sea MoU—Black Sea region; Mediterranean MoU—Mediterranean Sea region; Indian Ocean MoU—Indian Ocean region; Gulf Cooperation Council (GCC) MoU—Arab States of the Gulf.

5. The document was initially motivated by the use by some MoUs such as Paris and Tokyo MoUs of Black/Grey/White list of flags to define unsafe ships.

6. The Weight Casualty Rate considers different degrees of severity (1 for very serious, 0.5 for serious and 0.25 for less serious casualties) and is calculated as:

$$\text{Weight Casualty Rate} = \frac{\sum \text{Weight Coef} \times \text{Number of casualties over 5 years}}{\text{Number of ship years}}$$

7. Their findings are in line with previous studies focusing on casualties such as Alderton and Winchester (2002), Li and Wonham (1999) and Li (1999).

This conclusion was, however, challenged by two documents submitted respectively by New Zealand (FSI 15/3/1) and by Australia/New Zealand (FSI 15/3/2). In the first document, although New Zealand recognised the interest of introducing casualty data within existing targeting systems, it stresses that a wide range of factors might determine a ship to be substandard and that casualties are very often explained by factors outside the scope of PSC inspections (human element for instance).[8] Furthermore, and conversely to the Turkish study, New Zealand joint document with Australia (FSI 15/3/2), based on former studies by Knapp (2007) stresses that the probability of very serious casualties would decrease by 5% for vessels that have been inspected previously and that, for black listed flag States, the probability of a very serious casualty is higher than for those who are not. In the same vein, Degré (2008) advocates for a multivariate approach to consider casualties instead of detentions in order to establish a Black Grey White (BGW) list which will be applied to category of vessels instead of flag of registry as done presently.

However, and apart from problem with the compatibility of PSC and casualties datasets, two main issues still remain. First, the initial objective of PSC is not to avoid casualties, but to prevent nonconformity with international regulations. It would therefore mean that the definition of PSC should be enlarged. Secondly, earlier approaches ignore the ability for PSCs to reduce the consequences from casualties. For instance, compliance for life boats equipment aboard a vessel will not avoid the accident to happen, but limits its foreseen consequences.

A third main interrogation related to the use of detention records in PSC and target system is on the methodology used to identify vessels that might be detained. If a relative consensus exists on the main factors to consider, a disparity still exists on the weight that should be given to these various factors.[9] Usually, three main categories of information are considered:

- first, related to the vessel's characteristics such as the type of vessels and their age;
- secondly, to the performance of the flag of registry, the classification society, and the shipowner;
- and thirdly, to records from previous inspections for a specific vessel.

For instance, the Paris MoU (2007)[10] calculates at the end of each day generic and historical factors for a specific ship to reach an overall target factor (see Appendix 1).[11] Generic factors are based on the past performances of the ship's flag of registry, vessel type, age at inspection, and the performance of its

8. A correspondence group was set up by IMO during last FSI 15 to examine these issues.
9. See Knapp (2007) for an overview of the various target systems.
10. See http://www.parismou.org/ for additional information.
11. If the overall target factor is more than 50 points, the inspection becomes mandatory.

class society. Historical factors are related to whether the vessel is entering the region for the first time, has been inspected during the last 6 months, has been detained, the number of deficiencies recorded during last inspection, and actions taken to correct outstanding deficiencies.[12]

The target system used by the Indian MoU[13] created in 1998 is representative of practices used by more recent MoUs that cannot rely on a comprehensive dataset such as the Paris MoU. Its secretariat[14] states that members of the Indian MoU should inspect 10% of foreign vessels calling at their ports and that focus should be given to ships that enter for the first time or that have not entered during the last 12 months in the region; ships with deficiencies noted during former inspections that still need to be rectified; ships that have been reported by pilots or port authorities as having deficiencies which may prejudice their safe navigation; ships whose statutory certificates on the ship's construction and equipment have not been issued in accordance with the relevant instruments; ships carrying dangerous goods or pollutants which have failed to report to the competent authority of the port and coastal State all relevant information concerning the ship's particulars, the ship's movements, and details concerning the dangerous goods cargo being carried; and ships which have been suspended from their class for safety reasons in the last six months. Finally, the Indian MoU stresses that in selecting vessels to inspect, authorities should seek to avoid inspecting ships that have been inspected by other authorities within the previous six months, unless clear grounds for inspection exist.

A last example is the target system used by the Australian Maritime Safety Authority (AMSA).[15] AMSA has developed its own targeting system since 2001[16] using a generalised additive modelling to identify factors to consider and to offer a hierarchy amongst the various factors. It relies on a dataset of 29,500 inspections that took place in Australia from 1996 to 2005 to identify the factors that explain the probability for a vessel to be detained and to rank

12. Within the Paris MoU, a new inspection regime (NIR) is expected to replace the current system to consider two main issues. First, the targeting system does not set criteria on the total percentage of vessels to be inspected within the Paris MoU region (only 25% of foreign vessels calling for each member). Consequently and secondly, multiple inspections exist for vessels having fairly good records. The NIR sets a goal for 100% of vessels entering the region to be inspected and a hierarchy to be developed amongst High Risk Ships (HRS) inspected every 5–6 months, standard/Medium Risk Ships (MRS—every 10–12 months) and Low Risk Ships (LRS—every 24–36 months).

13. The members of the Indian MoU in 2007 are: Australia, Bangladesh, Djibouti, Eritrea, Ethiopia (observer), India, Iran, Kenya, Maldives, Mauritius, Mozambique, Myanmar, Oman, Seychelles, South Africa, Sri Lanka, Sudan, Tanzania, and Yemen.

14. See http://www.iomou.org/ for additional information.

15. Although Australia is part of two distinct MoUs (Indian MoU and Tokyo MoU), it still uses its own criteria to select vessels to inspect. See http://www.amsa.gov.au/Shipping_Safety/Port_State_Control/ for additional information.

16. The system was implemented in cooperation with the Commonwealth Scientific and Industrial Research Organisation (CSIRO).

them according to their relative influence (from important 1 to marginal 4, see Appendix 2). Results suggest that for bulk carriers (around 60% of foreign vessels calling at Australian ports), the age of the vessel is the most important factor, followed by the number of deficiencies at the previous inspection and the time elapsed since the previous inspection, and the recognised organisation and the flag the vessel is flying. On the other hand, the fact that the ship is undergoing its first inspection plays only a marginal role. For the other ship types, age still represents the most important factor, followed by the type of ship and the gross tonnage, the number of deficiencies at previous inspection, the time since previous inspection and the flag of registry, while the recognised organisation and the fact that the ship is undergoing its first inspection play significant, but marginal, roles.

To conclude, it appears that the current PSC system leads to issues related to their harmonisation, to their focus on detention and not on casualties, and to the identification and weight of factors explaining detention. For the latter which is the focus of the next section, while the factors retained by various MoUs to target vessels are fairly similar (age at inspection, vessel type, previous records, etc.), the weight that should be given (none in the Indian MoU for instance) or the reasons for the weight that has been given (Paris MoU for instance) to the various factors is still unclear. AMSA represents here a notable exception. The next section offers a methodology to estimate such factors and their respective weight using 26,515 inspection results carried out by countries belonging to the Indian Ocean MoU.

3. AN ESTIMATION OF FACTORS INFLUENCING THE DETENTION RATE

As stated in the previous section, if a relative consensus exists amongst various MoUs on the factors to be considered to select vessels for inspection (Knapp, 2007; Knapp and Franses, 2007), few studies (AMSA 2001; Cariou et al., 2007, 2008) have offered a methodology to estimate the weight that should be given to these various factors. This second section contributes to this issue using a sample from 26,515 PSC inspections carried out within the Indian MoU region from January 1, 2002 to December 31, 2006. The 26,515 inspections correspond to 10,236 vessels as a vessel can be inspected several times.

Every PSC boarding generates a detailed inspection report containing the following information: ship's name, International Maritime Organisation (IMO) vessel number, flag of registry, recognised organisation, vessel type, gross tonnage, deadweight tonnage, year built, type of inspection, date of inspection, date of detention, date of release from detention, place of inspection, inspecting authority, and nature of deficiencies. In this section, we will focus on detention records (Table 9.1).

Table 9.1 Vessel inspection sample

Variables (in %)		*Distribution of characteristics*			
		No detention	*Detention*	*All*	*Rate of detention*
Age of ship at PSC inspection	0–4	16.4	3.2	15.4	1.6
	5–9	21.7	7.5	20.6	2.8
	10–14	15.7	10.4	15.3	5.2
	15–19	15.7	15.6	15.7	7.6
	20–24	18.8	28.3	19.5	11.1
	25+	11.6	35.0	13.4	20.0
Inspecting authority	Australia	58.0	40.6	56.6	5.5
	Iran	11.5	25.6	12.6	15.6
	India	17.3	29.7	18.2	12.5
	South Africa	9.5	1.7	8.9	1.5
	Others	3.8	2.4	3.7	4.9
Flag of registry	Panama	26.8	25.5	26.7	7.3
	Liberia	6.8	4.1	6.6	4.7
	Hong Kong, China	6.2	2.6	5.9	3.4
	Bahamas	5.1	3.2	4.9	5.0
	Cyprus	4.6	5.3	4.7	8.7
	Singapore	4.6	4.0	4.6	6.8
	Russian Federation	4.6	2.7	4.4	4.7
	Malta	4.4	4.2	4.4	7.4
	Greece	3.5	2.0	3.3	4.5
	Others	33.5	46.4	34.5	10.3
Type of ship	Bulk carrier	47.1	36.7	46.3	6.1
	General cargo/multi-purpose ship	17.3	32.1	18.4	13.3
	Oil tanker	10.2	11.1	10.3	8.3
	Containership	8.4	5.9	8.2	5.5
	Chemical tanker	3.1	4.3	3.2	10.2
	Vehicle carrier	3.1	1.1	2.9	2.8
	Woodchip carrier	1.6	0.8	1.5	3.9
	Refrigerated cargo carrier	1.3	0.9	1.3	5.7
	Ro-ro cargo ship	1.3	1.0	1.3	6.3
	Gas carrier	11.3	5.9	11.0	2.2
	Others	22.5	23.4	22.6	8.3
Classification society	Nippon Kaiji Kyokai	31.0	17.1	30.0	4.4
	Lloyd's Register	15.0	14.4	14.9	7.4
	Det Norske Veritas	9.9	6.4	9.7	5.0
	American Bureau of Shipping	8.8	7.7	8.7	6.8
	Germanischer Lloyd	8.0	7.2	7.9	7.0
	Bureau Veritas	7.6	10.2	7.8	10.0
	Russian Maritime Register of Shipping	6.0	7.1	6.1	9.0
	China Classification Society	3.8	2.2	3.7	4.5
	Korean Register of Shipping	3.6	2.6	3.6	5.6
	Others	6.3	25.1	7.7	25.0
Number of observations – Mean		24,484	2,031	26,515	7.7

Source: Indian MOU (2007).

The sample concerns 10,236 vessels, the average number of inspections by vessel being equal to 4.1. The average age of vessels subject to inspection is 14.43 years old with a fairly equal distribution amongst various age categories (15.4% of vessels are between 0 and 4 years old, 20.6% between 5 and 9, 15.3% between 10 and 14, 15.7% between 15 and 19, 19.5% between 20 and 24 and 13.4% are more than 25 years). Australia carried out the majority of controls (56.6%) followed by India (18.2%) and Iran (12.6%). Panama is the

first flag of registry subject to inspection (26.7%) followed by Liberia (6.6%) and Hong Kong China (5.9%). Bulk carriers represent 46.3% of vessels inspected followed by general cargo/multi-purpose ships (18.4%) and oil tankers (10.3%). Finally, the Nippon Kaiji Kyokai classification society is the first recognised organisation inspected (30%) followed by Lloyd's Register (14.9%) and Det Norske Veritas (9.7%).

We construct a dependent binary variable which takes the value of one when the vessel is detained and 0 otherwise. The number of controls leading to detention is 7.7%, ranging from 5.6% in 2002 to a maximum of 9.1% in 2003. In Columns (2) and (3) of Table 9.1, we describe the occurrence of detention by vessel's characteristics.

Turning first to age at inspection (last column in Table 9.1), statistics show as expected a constant increase in the average number of detentions with vessel's age (from 1.6% of controls leading to detention for vessels less than 5 years old to 20.0% for vessels older than 25 years old). Regarding the inspecting authority, Iran is the country for which the average number of detentions is the highest (15.6% deficiencies on average) followed by India (12.5%) and Australia (5.5%). Concerning the flag of registry, a high number of detentions is detected for Cyprus (8.7%) and Singapore (6.8%), the highest proportion being for flags belonging to the 'other flag' category[17] (10.3% of controls). Turning to the type of vessels, general cargo/multi-purpose ships are the most subject to detentions (13.3%) followed by chemical carriers (10.2%) and oil tankers (8.3%). Finally, regarding recognised organisations, the other category[18] contains the highest proportion of vessels detained (25% of

17. Other Flags of Registry are Saint Vincent and the Grenadines; China; Marshall Islands; Norway; Korea, Republic of; Philippines; Antigua and Barbuda; Malaysia; Isle of Man (UK); India; Netherlands; Japan; Thailand; United Kingdom (UK); Turkey; Korea, Democratic People's Republic; Denmark; Italy; Taiwan, China; Azerbaijan; Bermuda (UK); Vanuatu; Germany; Cayman Islands (UK); Iran; Cambodia; Indonesia; France; Sweden; Bangladesh; Belize; United Arab Emirates (UAE); Sri Lanka; Papua New Guinea; Saudi Arabia; Vietnam; Egypt; Croatia; Georgia; Switzerland; Myanmar; Comoros; Kuwait; Netherlands Antilles; Tonga; Jordan; Qatar; Belgium; Syrian Arab Republic; Gibraltar (UK); Turkmenistan; Mongolia; Ethiopia; Pakistan; Bolivia; Lebanon; United States of America; São Tomé and Príncipe; New Zealand; Bahrain; Ukraine; Dominica; Saint Kitts and Nevis; Honduras; Algeria; Sudan; Barbados; Luxembourg; Mauritius; Ireland; Portugal; Samoa; Seychelles; Ghana; Sierra Leone; Slovakia; Bulgaria; Maldives; Fiji; Eritrea; Brazil; Morocco; Tuvalu; Jamaica; South Africa; Tunisia; Spain; Lithuania; Chile; Colombia; Cook Islands; Tanzania; Dominican Republic; Kiribati; Namibia; Somalia; Costa Rica; and Nigeria. This category also includes vessels listed as being registered under unspecified 'other' flags.

18. Other Recognised Organisations are Registro Italiano Navale; Indian Register of Shipping; China Corporation Register of Shipping; International Register of Shipping; Korea Classification Society; International Naval Survey Bureau; Hellenic Register of Shipping; Polski Rejestr Statkow; Croatian Register of Shipping; Biro Klasifikasi Indonesia; Turkish Lloyd; Viet Nam Register of Shipping; Register of Shipping, Albania; Isthmus Bureau of Shipping; Honduras International Surveying and Inspection Bureau; Panama Register Corporation; Panama Maritime Documentation Services; Panama Shipping Registrar Inc.; Global Marine Bureau; Panama Maritime Surveyors Bureau Inc; RINAVE Portuguesa; Bulgarski Koraben Registar; Shipping Register of Ukraine; INCLAMAR; Honduras Maritime Inspection; Panama Bureau of Shipping; Belize Register Corporation; Ceskoslovensky Lodin Register; Seefartsaht Helsinki; Honduras Bureau of

detentions), followed by Bureau Veritas (10%) and the Russian Maritime Register of Shipping (9%).

We then seek to explain how the characteristics of the vessels influence the probability for a ship to be detained. As the dependent variable is binary, the appropriate specification is a Probit model. We choose to correct the standard errors using a clustering method at the vessel level, since a given ship may have recorded former detentions. Denoting by D the detention outcome, we thus estimate $Pr(D=1)=\Phi(\beta'X)$, where $\Phi(.)$ is the univariate distribution function, X is a set of explanatory variable and β is the vector of associated coefficients (see annex for results). In Table 9.2, we choose to report the marginal effects of the different explanatory variables, which are given by $\beta\phi(\beta'X)$, where ϕ is the normal density function.

Shipping; Russian River Register; Marconi International Marine Company Ltd; Registro Internacional Naval S.A.; Compania Nacional de Registro e Inspeccion de Naves. This category also includes vessels listed under 'Other', 'No Class', and 'Class Withdrawn'.

Table 9.2 Econometric analysis of the probability of detention—marginal effects

Variables		*(1)*	*(2)*
		Marginal effects	Marginal effects
Age of ship at PSC inspection	0–4	Ref	Ref
	5–9	2.6%***	1.9%***
	10–14	7.4%***	5.8%***
	15–19	11.7%***	9.3%***
	20–24	14.4%***	11.2%***
	25+	22.3%***	17.9%***
Inspecting authority	Australia	7.8%***	8.2%***
	Iran	16.0%***	16.4%***
	India	14.9%***	20.9%***
	South Africa	−1.3%	−0.8%
	Others	Ref	Ref
Flag of registry	Panama	1.0%***	1.4%***
	Liberia	−0.5%	−0.2%
	Hong Kong, China	−1.7%***	−1.2%
	Bahamas	−1.2%*	−0.4%
	Cyprus	0.3%	0.3%
	Singapore	0.7%	0.1%
	Russian Federation	−4.8%***	−4.7%***
	Malta	−1.6%***	−1.4%*
	Greece	−1.3%*	−0.2%
	Others	Ref	Ref
Type of ship	Bulk carrier	2.1%***	3.0%***
	General cargo/multi-purpose ship	4.0%***	5.0%***
	Oil tanker	1.0%	2.7%**
	Containership	0.7%	2.7%**
	Chemical tanker	4.8%***	6.1%***
	Vehicle carrier	−2.1%**	−1.0%
	Woodchip carrier	1.1%	2.3%
	Refrigerated cargo carrier	0.7%	−0.9%
	Ro-ro cargo ship	0.2%	2.0%
	Gas carrier	−2.3%	−0.7%
	Others	Ref	Ref
Classification society	Nippon Kaiji Kyokai	−5.7%***	−5.0%***
	Lloyd's Register	−4.3%***	−3.8%***
	Det Norske Veritas	−4.5%***	−3.8%***
	American Bureau of Shipping	−3.6%***	−3.4%***
	Germanischer Lloyd	−3.2%***	−2.1%***
	Bureau Veritas	3.1%***	1.9%***
	Russian Maritime Register	−2.4%***	−1.9%**
	China Classification Society	−4.8%***	−4.3%***
	Korean Register of Shipping	−4.3%***	−4.1%***
	Others	Ref	Ref
Nb of deficiencies during previous inspection			+0.3%***
Number of observations		26,515	16,279

Source: Indian MOU (2007)
Marginal effects obtained from Probit models. Absolute values of t statistics are in parentheses. Significance levels are respectively 1% (***), 5% (**) and 10% (*). Standard errors are corrected for clustering at the vessel level.

As shown in column 1, results evidence the strong positive effect of age at inspection. The probability for a vessel to be detained increases by 14.4 points

of percentage when the vessel is between 20 and 24 years at inspection and even 22.3 points of percentage for vessels older than 25 years, the predicted probability of detention being equal to 4.9 points (at the mean of the sample). Iran, India, and Australia record higher detentions than other inspecting authorities. Furthermore, vessels flying the Russian Federation flag have relatively good records when it comes to detentions, while general cargo/multipurpose ships and chemical carriers are subject to more detentions. Finally, all recognised organisations have good records compared to the other category, a conclusion particularly true for Nippon Kaiji Kyokai, China Classification Society, Det Norske Veritas and Korean Register of Shipping.

In column 2 of Table 9.2, the number of deficiencies recorded during the previous inspection was taken into consideration. We find a positive coefficient for that covariate, meaning that vessels with many deficiencies recorded in the past are more likely to be detained. We have also attempted to account for the different types of deficiencies and use a grouping of the various deficiencies code in 8 categories (see Cariou et al., 2008).[19] Estimations (note reported here) suggest that deficiencies related to management, safety and fire appliances and certificates play a more influential role when explaining the probability of detention. Similar results are reported in Knapp and Franses (2007), who underline these last two elements (safety & fire appliances and certificates) as the first two contributors to the probability of detention.

An interesting feature is to estimate the contribution of the selected explanatory variables when explaining detentions. We choose to apply a decomposition method originally proposed in Fields (2003) in the case of a linear model. While it could be tempting to use changes in the value of the R^2 as a measure of the explanatory power of each covariate, the *ceteris paribus* condition is unfortunately not respected in that case so that we rely on the more complex procedure described in Fields.

A difficulty in our context is that our dependent variable is not continuous. As there is no decomposition method for a binary variable, we choose to proceed in the following way. First, we have re-estimated the probability for a vessel to be detained using an OLS regression. The coefficients then provide the marginal effects for each covariate. Then, as our results were very similar under both the Probit and the OLS estimations, we have decided to do as if the detention outcome was continuous and have applied the decomposition methodology described in Fields (2003).

19. The deficiencies related to safety and fire appliances are the first category of deficiencies recorded during inspections (29.3% of the cases), followed by deficiencies related to stability and structure (20.5%), navigation and communication (16.6%) and ship and cargo operations (11.5%). The four other categories (certificates, working and living conditions, equipment and machinery, and management) are less frequent. Cariou, P., Mejia, M.Q., Jr., Wolff, F.C. (2008) *Evidence on target factors used for Port State Control inspections, forthcoming.*

Table 9.3 Decomposition analysis of the factors contributing to detentions

Variables	*All*		*Inspecting authority*			
			Australia		*Other countries*	
	%	Rank	%	Rank	%	Rank
Age of ship at PSC inspection	40.4%	1	64.2%	1	42.5%	1
Inspecting authority	16.6%	3	–	–	–	–
Flag of registry	4.2%	5	3.5%	4	6.2%	4
Type of ship	5.9%	4	6.3%	2	8.1%	2
Classification society	31.1%	2	25.1%	3	39.1%	3
Year of inspection	1.8%	6	1.0%	5	4.1%	5
Total	100%		100%		100%	

Source: Indian MOU (2007).

As shown in Table 9.3, the first factor to explain the probability to be detained would be the age of the vessel at inspection (40.4%) followed by the recognised organisation (31.1%), the inspecting authority (16.6%) and the type of ship (5.9%). Although the variables retained by the Australian Maritime Safety Authority in their analysis are not exactly the same (see Appendix 2), the results similarly point out the age of vessel at inspection as the first factor to explain detentions.

That the inspecting authority plays a role in understanding both the number of deficiencies detected during an inspection and the probability for a vessel to be detained is striking from a policy viewpoint. Since PSC regimes aim at setting uniform or harmonised standards and procedures worldwide, this result could be used by shipowners to question the fairness of PSC inspections. This question was partially tackled by Knapp and Franses (2007), who identified the background of inspectors (engineer, nautical, naval architect or radio) as an element explaining the type of deficiencies detected, but did not conclude on discrepancy across various PSC regimes.

We then try to understand differences that can be found at a country level on detentions. For that purpose, we compare records from the Australian authority (56.6% of the inspections) to other inspecting authorities (43.4%). We then calculate the relative weights of the covariates for both groups (columns 2 and 3, Table 9.3).

Our results show first that age at inspection is by far the first factor to explain detentions records in Australia. Age at inspection explains 64.2% of the detention outcome, a result once again in line with the AMSA study. Age is still the first explanatory factor for the other group of countries, but with a lower weight (42.5%). Another major factor when explaining detentions is the type of ship (39.1% for other countries, but 25.1% for Australia). It therefore seems that the split done by AMSA between bulk carriers (60% of vessels calling at Australian ports) and other types of ships would make sense as different target factors should apply to the various types of vessels. Furthermore, the recognised organisation and the flag of registry matter less to understand the probability of detention.

Table 9.4: Additional findings from decomposition analysis

Variables	*Flag*		*Ship types*		*Classification societies*	
	Panama	*Others*	*Bulk carriers*	*Others*	*Lloyd's register*	*Other*
Age of ship at PSC inspection	40.5% (2)	43.2% (1)	61.1% (1)	33.9% (2)	57.2% (1)	58.8% (1)
Inspecting authority	9.6% (3)	19.7% (3)	14.4% (3)	23.0% (3)	24.1% (2)	22.2% (2)
Flag of registry	–	–	0.4% (5)	4.4% (4)	7.7% (3)	6.7% (4)
Type of ship	7.6% (4)	5.7% (4)	–	–	6.4% (4)	10.5% (3)
Classification society	40.7% (1)	29.5% (2)	22.7% (2)	36.6% (1)	–	–
Year of inspection	1.6% (5)	2.0% (5)	1.5% (4)	2.0% (5)	4.6% (5)	1.8% (5)
Total	100%	100%	100%	100%	100%	100%

Source: Indian MOU (2007)
Ranks are in parentheses under the percentage contribution.

Finally, using similar decomposition method, we investigated if the results are significantly different from former results for vessels flying the Panamanian flag, for Bulk Carriers and for vessels registered under Lloyd's Register (Table 9.4). Results suggest that the ranking in the main factors is fairly similar with age at inspection and ship type always remaining the two main contributors.

4. CONCLUSION

This chapter aims at investigating the weights that should be given to factors explaining detention records within the target systems. It appears that most of our conclusions do not contradict the current targeting factors used by most of MoU or individual states. For instance, the age of vessel at inspection, records from previous inspections, the classification society, and type of vessel proved to be significant factors in predicting detention. In line with the study of AMSA, analysing the contribution of the various factors to detentions also stresses the major role played by the age of the vessel at inspection. Another interesting finding was to point out the inspecting authority as an important element to explain detentions. Keeping in mind that one of the objectives of PSC regimes is to apply uniform standards across various states, our conclusion that the ranking of the selected covariates is the same in our two groups of countries is in that sense a positive result.

Finally, a main issue concerning more specifically the Indian MoU region is the adoption of a more elaborate and harmonised targeting system instead of

the current list of criteria to consider.[20] It might do well to take the cue from recent developments within the Paris MoU that led its Secretariat to propose a New Inspection Regime system to increase the proportion of vessels controlled within the region. With multiple inspections at a regional level, the fact that each inspecting authority within the Indian MoU uses its own criteria might be counterproductive.

20. The objective set by the Indian MoU secretariat is for each authority to achieve a target inspection rate of 10% of the estimated number of individual foreign vessels entering ports under their national jurisdiction during the previous calendar year.

APPENDIX 1

Paris MoU(1) Target factor
Signed in 1982
Belgium, Bulgaria, Canada, Croatia, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Latvia, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Romania, Russian Federation, Slovenia, Spain, Sweden, United Kingdom
Number of inspections: 25% of vessel entering for each individual state
Total Target Factor = Generic Factor (GF) + Historical Factor (HF) If TF>50 points then the control is mandatory. The overall target factor is calculated at the end of each day.
GF-Flag. If detention during last 3 years is • More than 10% than TF = +4 • More than 13% than TF = +8 • More than 16% than TF = +14 • More than 18% than TF = +20
GF-Vessel type. TF = +5 • for Bulk carrier > 12 years old • for Gas carriers > 10 years old • for Chemical carriers > 10 years old • for Oil tanker GT > 3000 & > 15 years old • Passenger ship/ro-ro ferry > 15 years old (2)
GF-Non-EU RO. If Non-EU recognised classification society then TF =+3
GF=Age • 25 years old then TF = +3 • 21–24 years old then TF = +2 • 13–20 years old then TF = +1
GF=Flag state. TF = +1 if Flag has not ratified main conventions
GF=Targeted class. Class with a 3-yr average record of detentions above the average class detention value. A classification society with class related deficiencies in the last 3 years exceeds the average class detention rate by: • 0% then TF = 0 • 0–2% then TF = +1 • 2–4% then TF = +2 • >4% then TF = +3

HF-New. If entering a region port for the first time in the last 12 months then TF = +20
HF-Inspected. If not inspected in the last 6 months then TF = +10
HF-Detained. If detained in the previous 12 months then TF = +15
HF-Deficiencies If last control 0 then TF = –15 If last control 1–5 then TF = 0 If last control 6–10 then TF = +5 If last control 11–20 then TF = +10 If last control 21+ then TF = +15
HF-Outstanding deficiencies. For latest inspection if action taken "rectify deficiency at next port" or "Master instructed to rectify deficiency before departure" & for every two listed actions taken "rectify deficiency within 14 days" and/or other" then TF = +1 For latest inspection in case "all deficiencies rectified" then TF = –2

(1) Does not consider the new inspection regime that should replace the current system.
(2) Other than ro-ro ferries and HS passenger craft operating in regular service under the provision of Council Dir. 1999/35/EC

APPENDIX 2

Australian Maritime Safety Authority target factors (based on data from 2001–2005)

	Bulk carriers (17520 observations)	Other ships* (11658 observations)
Age of ship	1	1
Number of deficiencies at the previous inspection	2	3
Time since previous inspection	2	3
Recognised organisation	3	4
Flag	3	3
Ship is undergoing first inspection	4	4
Type of ship	–	2
Gross tonnage	–	2

* Passengers ships were excluded from their specific regime
Source: AMSA (2007)