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CULTURE EFFECTS ON VESSEL DETENTION

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ABSTRACT

This paper applies Hofstede's cultural dimensions into the shipping industry and analyzes the culture effects on vessel detention. All ships have their own nationality but the flag control is manageably sophisticated. Substandard ships are aware of high risks, and quality control of ships is critical to the maritime safety and security. It has been proved that the detention rate depends on the flag of registry together with ship age, inspecting authority, type of ship, and recognized organization influencing. Previous research has focused on the performance of individual flag of registry in terms of casualty and detention rate. This study considers the collective characteristics of flags according to culture effects and their influences on ship quality. Based on Hofstede's five-dimension culture theory, we map the flag states on culture dimensions. From 12,635 detention records of the Tokyo MOU region from 2000 to 2009, we determine the effect of culture dimensions against the vessel detention. The findings can be summarised in two aspects. First, the power distance index has little influences on the detention rate. Second, more importantly, the individualism, uncertainty avoidance index and long-term orientation have positively impacts on the number of detentions. Our findings show that culture indeed has an effect on the vessel detention taken by different Port State Controls. A further look on the flag of registry is that the performance of individual flags may be better illustrated if individual flags are classified according to culture dimensions. This paper is organised as follows: Section 1 introduces the background; Section 2 discusses related literature; Section 3 considers the data collection and methodology; Section 4 concerns the findings; and Section 5 addresses conclusions and further research.

Keywords: flag of registry, culture theory, vessel detention, Hofstede's five dimensions

1. INTRODUCTION

Since the Second World War, barriers to international trade have been considerably lowered through different agreements and globalization is the trend over the whole world. Shipping is the derivative industry of trade and continues to play a vital role in support of world economy which is currently responsible for the carriage of 90% of world trade in terms of cargo volume. Ships are especially manageable sophisticated and the quality control of ships is to a great extent related to the maritime safety. According to the statistic of Lloyd's Register Fairplay 2008, the 99,741 ships trading internationally in 2008, totally 830.7 million gross tonnages and an average of 22 years are registered in more than 150 Flag States, with the 20 largest Flag States accounting for 82% of this total world tonnage.

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The culture theory has already been applied to the military, medicine, science, psychology and business areas. With regard to shipping industry, ship detention is a preventive measure of safety to find the substandard ships before the 'accidents', it mainly focuses on the hardware implementation but neglects the importance of software. The technology innovation about the engine solution only partially improves the efficiency, and the culture with human behaviour may fundamentally influence the maritime safety and security. The concept of Flag State and Port State Control elaborates the responsibility of ship quality management, and this paper will apply the culture theory to the shipping industry for the first time and aim to interpret that culture effects on the vessel detention.

The flying of the flag is a symbol of a ship's nationality. After the registration, the Flag State represents as the authority to undertake national and international responsibility over ships. The Flag States have overall duty for the implementation and enforcement of international maritime regulations for all ships flying its flag.

Although Flag State is responsible for the ships complying with international standards, there is a possibility that a ship rarely visits its port of registry during its service life and limited resources of some maritime administrations hampered their ability to inspect every vessel flying their flags. Due to these factors, Flag States are unable or unwilling to adequately perform their mandated duties of ensuring ships flying their flag fully comply with international safety standards.

As such, Port State Control (PSC) is created as a complement, not a substitute to Flag State Controls. International Maritime Organization (IMO) defined the PSC 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.*" If foreign ships entering in the ocean territory and inspected with the results which achieve the several deficiencies and beyond the international regulations level, then PSC has the right to detain these substandard ships. The detained ships will be released until they meet the requirements after maintenance. These regulations serve as the bases on the regime of PSC which has been instituted and under the provisions of *United Nations Convention on Law of the Sea* (UNCLOS 1982), the *International Convention for the Safety of Life at Sea 1974, as amended* (SOLAS 74/78), *International Convention on Standards of Training, Certification and Watch-keeping for Seafarers 1978, as amended* (STCW 78/95), *International Convention for the Prevention of Pollution from Ships 1973, as amended* (MARPOL 73/78) and other international Conventions.

PSC was originally intended as an interim measure to Flag State implementation, but trends and developments in recent years show that PSC is extremely effective to monitor foreign ships calling at their ports and sailing through their territorial waters, especially if organized on a regional basis. Therefore IMO encourages PSC to establish the regional PSC organizations or agreements, and Memorandum of Understanding (MOU) is formed. These MOUs cover all of the world's oceans and put a safety net to catch the substandard ships. They require each port authority to consult, cooperate and exchange information with others and fulfil their commitments. This action prevents the potential possibility that ship-owners and charterers would avoid the ports where substandard ships are more likely to be subject to inspection and detention.

Culture can be found everywhere. So far as we know, globalization is not merely an economic phenomenon but recognized as a combination with other factors, and culture is one of these factors contributed to the globalization. There is a sense that the culture of a society cannot be pictured of itself, but only by comparison with other societies. The differing cultures of societies around the world play a part, together with the other influences, in shaping how industry in different country are set up and run.

Ships are the most important part in the shipping industry and all of them have their own single "*nationality*". The framework of culture in that certain nation – Flag State has the

impact on the performance of the ship quality standard because of the different authority hierarchy, laws and legal systems, relationship management aspect, education system, political system, religious beliefs and others. Meanwhile, ship quality is obviously related to the vessel which maybe detained by PSC inspection. Consequently, there may be a relative link between culture effects and vessel detention.

This paper aims to investigate the potential relationship between the culture dimension and vessel detention. The main objectives are to find out what are the relationships between each culture dimension and vessel detention, and how does culture affect the vessel detention. We believe that the culture is the underpinning reason to explain the variations of detention rates and numbers across Flag States.

Section 1 introduces the background about the culture and vessel detention. Section 2 critically reviews the relevant literatures on theories of culture and ship quality management. Section 3 proposes the data collection and the methodologies to be used. Section 4 discusses the results and findings about the culture influences on the vessel detention. The last section addresses the conclusions and points out the directions for further research.

2. LITERATURE REVIEW

2.1. Controlling of Substandard Ships

Shipping industry is developing fast with the sustainable growth of world trade. Maritime safety and security are the major concentrations in the shipping industry and have significant impacts on the international trade. Ships are the main body of this industry and how to manage and operate ships becomes the primary issue. Flag State has the principal responsibility to make sure that ships flying its flag fully comply with the international regulations. But there are some limitations that Flag State cannot inspect the ships and guarantee its ships meeting the requirements all the time. Then PSC has been developed as the supplement of Flag State and effectively carries out the obligations to ensure ships following the rules. Both Flag State and PSC have made some efforts to eliminate many ships which fall below the international standards. Therefore, there is a need to identify substandard ships and look deeply about the performance of Flag State and PSC inspection.

It is not simple to define which ships are below the international standards. Usually the meaning of substandard ship is identified by various authorities and surveyors. In the 2001 report of OECD Maritime Transport Committee, the substandard ship can be regarded as "*a vessel that, through its physical condition, its operation or the activities of its crews fail to meet basic standards of seaworthiness and thereby pose a threat to life and/or the environment.*" (OECD, 2001)

Basically, several factors such as poor shipbuilding quality, poor maintenance and under qualified crew contributed to the quality of substandard ships. The inspector will take these criteria as the professional judgment and determine whether to detain ships until the deficiencies are corrected, or allow them to sail with certain deficiencies which are not vital to the maritime safety.

OECD 2001 also pointed out one reason why substandard ships persistent exist. Different players only pursue the economic interest and neglect the technical safety of ships. From ship-owner's point of view, irresponsible ship-owners tend to achieve the economic advantage from non-observation of international standards. From the charterer and cargo owner's point of view, they are attracted by the inexpensive freight costs, and this leads them to care little about the quality of ships.

Another reason can be drawn as the lack of safety culture. On one hand, workers do not have proper attitude to operate the ships at the high safety level. On the other hand, many authority administrations include Flag States do not apply the international regulations

strictly. Some of them are lack of the capacity to undertake this obligation and some aim to maximize the numbers under their register to get more benefits. Thus, the concept of "*Flag of Convenience*" (FOC) register appears and spreads widely.

Substandard ships always cause more accidents at sea and have critical impacts on the environmental safety. It is important for different players in the shipping industry paying more attention to control the quality of ships.

Flag State is the first line authority to enforce the ships flying its flag comply with the international regulations and convert these rules into national law which individual ships can meet the requirements. The degree of maritime safety mainly depends on whether Flag States fulfil their sufficient responsibilities.

Goss (1994) stated that because of the lack of essential infrastructure or necessary political willingness, the Flag State with open register used to sign international agreements but failed to comply with the totality of the resulting obligations by obtaining the cost advantages.

According to Alderton and Winchester (2002), there are observable differences between casualty rates for FOC, second / international register and national flagged vessels. The Lloyd's casualty database for the year 1997-1999 shows that FOCs indeed have a worse record than either second / international registers or national flags. But there are also variations within the FOC group itself. The newer entrants to the FOC market are much more likely to have poorer safety records than their more established competitors, and it is suggested that this is mainly due to market forces.

Corres and Pallis (2008) used a quantitative assessment to draw more specific conclusions on the Flag State performance. The findings emphasized the exceptionally good performance of the EU registries, and the particularly good performance of several more "*traditional*" maritime nations. Most significantly, there was a clear sign that the bad traditional image of commercial registries is changing fast. The best commercial flags are lagging behind the best national flags, while the worst commercial flags are no worse than their national counterparts. Therefore, the commercial flags should be examined for quality on the case by case basis.

The political attitude by a national administration does not necessarily cause a better result, and PSC inspection is a strong element to improve the performance for both commercial and national flags. Under the MOU, each port authority must achieve an average annual total of inspections, corresponding to a certain percentage of the number of foreign merchant ships entering its ports, and the inspection percentage is determined by various MOU. Although different MOUs adopt different targeting system to inspect the foreign ships calling at their ports, every PSC inspection generates a common inspection report contains the detailed information on the deficiencies noted (including 0 for no deficiencies) together with relevant vessel particulars such as the flag of registry, inspection place, IMO vessel number, vessel type, year of built, and date of inspection.

Hare (1997) analyzed that regional MOU has greatly diminished the potentials for substandard ships to participate in international commerce. Odeke (1997) stated that PSC enhances maritime safety and pollution prevention, and slowly eliminates the unfair advantages associated with operating cheaper and substandard ships.

Cariou, Mejia and Wolff (2008a) tested vessel's characteristics against the length of time between two PSC and the number of deficiencies detected during PSC. Poisson models estimated the vessel age, ship type and flag of registry appear to be the significant predictors in the 63% reduction of total deficiencies detected during the next PSC inspection.

The PSC Black Gray White (BGW) list was established to classify the substandard ships and those on the black list experience a higher risk to be detained. According to the latest analysis of Cariou, Mejia and Wolff (2008b; 2009), the age of ship at PSC inspection, inspecting authority, flag of registry, type of ship and recognized organization proved to be the key factors influencing the vessel detention. The results show ship age (40.4%) ranking the

primary importance of the probability to be detained, followed by classification society (31.1%), inspecting authority (16.6%), type of ship (5.9%) and flag of registry (4.2%).

Substandard ships are aware of the high risks in the shipping industry. The International Conventions are devoting to ensuring the ships safely constructed, well maintained and properly manned with the relevant regulations. Flag States have the primary responsibility to keep the ships in accordance with the standards and PSC turned out as a complement of Flag State controlling better of the ships' quality.

The Flag State is the first line of authority. Previous research has focused on the performance of individual flag of registry in terms of casualty and detention rate. The culture effect is missing all the time. This paper considers the collective characteristics of flags according to culture effects and their influences on ship quality instead of the individual flag of registry.

2.2. Culture Theory

The world is full of confrontations between people and nations who think, feel and act differently. Youngdahl, Kellogg, Nie and Bowen (2003) described that the factors include values, language, history, geography combine together to influence the behaviours and approaches to communication, family, work and every aspect of life. Culture is not a homogeneous trait within geographic region, and understanding of culture should begin with the realization that individual is affected by country, region, family, religious, and corporate cultures to various degrees.

According to Bird (2000), "although culture is widely used to describe variations among people from different nations or of different ethnicities, there is no single accepted definition." Therefore, a commonly-used set of characteristics to help identifying culture: first, culture includes a collective system of values; second, culture is learned, not innate; third, culture distinguishes one group from another; fourth, culture influences beliefs, attitudes, perceptions and behaviours in somewhat uniform and predictable ways.

With the in-depth knowledge of culture, we list some definitions of culture following the time sequence. Linton (1945) defined that "A culture is a configuration of learned behaviours and results of behaviour whose component elements are shared and transmitted by the members of a particular society."

Kroeber and Kluckhohn (1952) stated that "Culture consists of patterns, explicit and implicit, of and for behaviour acquired and transmitted by symbols, constituting the distinctive achievements of human groups, including their embodiments in artefacts; the essential core of culture consists of traditional (i.e. historically derived and selected) ideas and especially their attached values; culture systems may, on the one hand, be considered as products of action, and on the other as conditioning elements of further action."

Useem (1963) presented that "Culture has been defined in a number of ways, but most simply, as the learned and shared behaviour of a community of interacting human beings."

Lederach (1995) defined that "Culture is the shared knowledge and schemes created by a set of people for perceiving, interpreting, expressing, and responding to the social realities around them."

The scholars on culture research are dedicating themselves to qualify the application to other areas rather than shipping industry all the time. After Hofstede's (1984) IBM research, the culture theory experienced the revolution that culture can be quantified as each target country or region obtains the culture score. This is a huge progress that Hofstede has contributed to the culture theory.

Competing with the other culture theories, Hofstede's culture dimension theory is the most appropriate theory related to our empirical research. We will use Hofstede's (1984) culture definition that "Culture is the collective programming of the mind which distinguishes the members of one category of people from another" to start our research. This paper mainly

focuses on the culture application to the entire society, mostly a country which is known as "National Culture". It is made up of the societal values and belief system of a country and influenced by several factors, including its languages, religions, and gender roles, age profiles of its population, socio-economic groups and government policies.

Hofstede (1984) conducted the well-known research into IBM database and developed the Value Survey Module (VSM). He firstly put forward the four-dimension theory which has a profound impact on cultural studies. Based on this culture theory, national cultures are distinguished by four cultural value dimensions, including: (1) Power Distance Index, (2) Individualism and Collectivism, (3) Masculinity and Femininity, and (4) Uncertainty Avoidance. At that time, just a few countries and regions are scored by the research group. First of all, we would like to interpret the four-dimension culture theory and then advance the fifth dimension with time orientation.

Power Distance Index (PDI) is the "extent to which the less powerful members of institution and organization within a country expect and accept that power is distributed unequally". Institutions are the basic elements of society and organizations are the places where people work. PDI is to show how removed subordinates feel from superiors in a social meaning of distance and inform the dependence relationships in a country. In a high power-distance culture, inequity is accepted and there is considerable dependence of subordinates on superiors. Subordinates prefer managers who take decisions and do not offload the responsibility on to them. In a low power-distance culture, inequality and over status symbols are minimized and there is limited dependence of subordinates on bosses. Subordinates expect to be consulted and share decisions with approachable managers.

Individualism (IDV) pertains to "societies in which the ties between individuals are loose and everyone is expected to look after himself or herself and his or her immediate family." As its opposite side, collectivism pertains to "societies in which people from birth onward are integrated into strong, cohesive in groups which throughout people's lifetimes continue to protect in exchange for unquestioning loyalty." IDV refers to the relationship among people and the degree to which individuals are integrated into groups. Individualistic cultures reflect in a strong desire for challenging work and freedom in doing it, yet having sufficient time left for personal life. Collectivist cultures reflected in a relatively stronger value given to the provision for everyone of training and good physical conditions.

Masculinity (MAS) is the society when emotional gender roles are clearly distinct: "men are supposed to be assertive, tough, and focused on material success, whereas women are supposed to be more modest, tender and concerned with the quality of life. Feminine is the society when emotional gender roles overlap: both men and women are supposed to be modest, tender and concerned with quality of life." MAS relates to the division of emotional roles between men and women. The importance of earnings, recognition, advancement and work challenge corresponds to the masculine culture which represents the assertive and competitive role. The importance of relations with managers and colleagues corresponds to the caring and social environmental-oriented feminine role.

Uncertainty Avoidance Index (UAI) is the "extent to which the members of a culture feel threatened by ambiguous or unstructured situations." Among other things, the feeling is expressed through nervous stress and in a need for predictability which include both written and unwritten rules. Unstructured situations are novel, unknown, surprising and different from usual. UAI indicates a society's tolerance for uncertainty and ambiguity which turned out to be related to the control of aggression and the expression of emotions. In a high uncertainty avoidance culture, people are more nervous about what may happen and try to minimize the possibility of uncertainty situations by following strict laws and rules, safety and security measures, and on the philosophical and religious level by a belief in absolute truth. In a low uncertainty avoidance culture, people treat uncertainty more casually and value the freedom not to be closely regulated in their behaviour. They try to have as few rules as possible, and on

the philosophical and religious level they are relativist and allow many currents to flow side by side.

In late 1980s, Michael Harris Bond and a number of his colleagues from the Asia-Pacific region undertook a study of 21 cultures called the Chinese Values Survey (CVS). Three dimensions of the CVS replicated dimensions earlier found in the IBM survey, but the fourth dimension – Uncertainty Avoidance had no equivalent in the CVS. The fourth CVS dimension combined the values of orientation on the future or on the past and present. Greet Hofstede (1988) then labelled the Long-Term and Short-Term Orientation and we treated it as the fifth dimension.

Long-Term Orientation (LTO) stands for "the fostering of virtues oriented toward future rewards, in particular, perseverance and thrift." Its opposite side, Short-Term Orientation stands for "the fostering of virtues related to the past and present, in particular, respect for tradition, preservation of 'face', and fulfilling social obligations." LTO is the fifth dimension which was added by Hofstede after the original four to try to distinguish the difference in thinking between the East and the West. In a long-term orientation culture, there is a positive view which expresses a dynamic orientation toward the future. In a short-term orientation culture, there is a negative aspect for a static orientation toward past and present. Overall, most Asian countries scored long-term and the others medium or short-term.

Hofstede's five-dimension theory provides a basic framework on the national culture and describes the characteristic of different countries. This culture theory reflects the macro environment of the society. Based on Hofstede's remarkable findings, the scores on each dimension into different countries give us an inspiration to practically apply the culture theory into the shipping industry, and investigate the collective culture effects on vessel detention.

3. METHODOLOGIES

3.1. Data Collection
The whole dataset is combined from several sources: culture scores from the books "*Management Worldwide: Distinctive Styles amid Globalization*" and "*Cultures and Organizations: Software of the Mind*"; detention list of 104 months from Tokyo MOU from 1st January 2000 to 31st August 2009; selected flag inspection records in accordance with the culture scoring countries and regions from PSC database of Tokyo MOU from 1st January 2000 to 31st August 2009.

There are some difficulties of data collection: first, the detention list is in the form of month, we should integrate all the lists together which is time consuming; second, the data are collected from month to month and the original data are not ready for analysis, we need to redefine the ship type, ship flag and classification society as numbers; third, flag inspection collection is a huge workload, and we should separately search the record for each country and region. Fourth, the amount of data is huge and diversifying, and we take a long time to arrange and apply.

The data about culture scoring of different countries come from Hofstede's (2005) research results (See Appendix). The findings listed the score for 74 countries and regions in previous four dimensions and in addition 39 countries and regions in the fifth dimension.

Tokyo MOU represents Memorandum of Understanding on Port State Control in the Asia-Pacific Region, and Hong Kong is a member of Tokyo MOU. We adopt PSC database published on the official site of Tokyo MOU. Using the vessel inspection database from 1st January 2000 to 31st August 2009, we find total 12,635 detention records in the period. Related to the countries with culture score, 152,262 inspection results containing 6,390 detention results are counted as vessel may be inspected several times.

3.2. Overview of Statistical Methods

Linear regression is widely used in research and practical applications and attempts to model the complicated relationship between several variables which fitting a linear regression equation to observed data. Variables are known as independent variables and one is dependent variable. The model depends linearly on the unknown parameters to be estimated from the data and focuses on the conditional probability distribution of dependent variable given by independent variables.

The ordinary linear regression model is described by the equation:

$$\mathbf{y} = \mathbf{x}\,\beta + u, \ u \sim (0, \sigma^2 I n),$$

Where
(ⅰ) $\mathbf{x}$ is a non-stochastic n × p matrix with p < n;
(ⅱ) the elements of the n × 1 vector $\mathbf{y}$ are observable random vectors;
(ⅲ) the elements of the n × 1 vector u are non-observable random variables such that $E(u)$ = 0 and Cov $(u) = \sigma^2 I n$ with $\sigma^2 > 0$

Factor analysis can be viewed as a multivariate method of data reduction since it reduce the number of overlapping measured variables to a smaller set of factors. The underlying factors contain the essential information about the correlations among the measures.

Wong, Yan and Bamford (2008) summarized three stages in factor analysis. Firstly, a correlation matrix is generated for all the variables; secondly, according to the correlation coefficients of the variables, factors are extracted from the correlation matrix; thirdly, factors are rotated to maximize the relationship between the variables which makes it possible to identify the meaningful factor descriptions. The final formation of factors is acquired by setting the sampling adequacy above 0.5 after the calculation.

Overall, Statistical Package for the Social Sciences (SPSS) V.17 is used to handle the data and conduct the statistical tests such as linear regression, and factor analysis.

3.3. Factor Analysis

Assuming the factors such as ship flag, gross tonnage, ship type, classification society and ship age contributing to the vessel detention, we give the numeric labels to the factors of ship flag, ship type and classification while gross tonnage and ship age are expressed in terms of number.

The factor analysis is used to analyze the common feature component in a number of observed variables. Table 1 explains the five variances which can be divided into two components according to the detention number.

Table 1 Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared			Rotation Sums of Squared		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.463	29.265	29.265	1.463	29.265	29.265	1.462	29.239	29.239
2	1.211	24.211	53.476	1.211	24.211	53.476	1.212	24.237	53.476
3	.875	17.498	70.974						
4	.815	16.299	87.273						
5	.636	12.727	100.000						

Based on the rotated component matrix in Table 2, ship type and ship age show the maximum relationship in component 1, ship flag and classification society have the strong signs in component 2, and gross tonnage is not related to any of two components. Therefore,

we classify ship type and ship age into one component, ship flag and classification society into another component.

Table 2 Rotated Component Matrix

Variable	Component	
	1	2
Ship Flag	-.242	.745
Gross Tonnage	-.784	.022
Ship Type	.682	.206
Classification society	.254	.730
Ship age	.508	-.287

Observing the characteristics of two components, ship type and ship age can be defined as the internal factors, and ship flag and classification society are named as the external factors.
- 🚢 Internal factors:
  - o ship type
  - o ship age
- 🚢 External factors:
  - o ship flag
  - o classification society

The internal factors concentrate on the elements which are determined by the ship specification. The external factors refer to those selections controlled by the decision makers such as ship-owner and charterer. Both internal and external factors greatly affect the vessel detention. Referring to the gross tonnage, the assumption that it relates to the vessel detention is denied, the possibility is that ships are built much larger because of the technology innovation.

4. CULTURE EFFECTS ON VESSEL DETENTION

4.1. Culture Effects on Detention Rate
Hofstede's five-dimension theory has quantified culture scoring on 76 countries and regions, thus culture effects are expressed by culture dimensions. All these selected countries and regions get the culture score for each dimension such as (1) Power Distance Index (PDI), (2) Individualism Index (IDV), (3) Masculinity Index (MAS), (4) Uncertainty Avoidance Index (UAI) and (5) Long-Term Orientation Index (LTO). Together with the inspection information from Tokyo MoU from 1st January 2000 to 31st August 2009, we use linear regression to test the correlation between the culture effects and vessel detention. The culture dimensions are the independent variables while detention number and detention rate are considered as two dependent variables, we will separately analyze the relationship.

The detention number is the number of detentions under the flag of registry. The Flag State detention ratio can be calculated as the following formula:

$$\text{Flag State detention ratio} = \frac{\text{Number of detentions under a Flag State}}{\text{Number of inspections under its registry}}$$

The results can be summarized as two aspects, first is the culture effects on detention rate, and the second is the culture effects on detention number.

Looking at the culture effects on detention rate, the predictors are PDI, IDV, MAS, UAI, and LTO while dependent variable is the detention rate. The linear regression function is described as below:

Detention Rate = F (PDI, IDV, MAS, UAI, LTO)

$$= \beta_1 \text{PDI} + \beta_2 \text{IDV} + \beta_3 \text{MAS} + \beta_4 \text{UAI} + \beta_5 \text{LTO} + u$$

where, β stands for the coefficients

In Table 3, the R Square 0.289 indicates that the relationship between predictors and dependent variable is weak, which means the detention rate is not tight related to the culture effects.

Table 3 Model Summary for Detention Rate

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.538	.289	.178	.0519	.289	2.607	5	32	.044**

Significance level: P < 0.01 (***), P < 0.05 (**) and P < 0.10 (*)

The coefficients in Table 4 show more details that the power distance has little influence on the detention rate as its significance is 0.08. Based on the un-standardized coefficient index Beta 0.001, we estimate the correlation between power distance and detention rate is positive. A higher power distance can increase the detention rate while lower power distance can reduce the detention rate.

Table 4 Coefficients for Detention Rate

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.034	.057		.602	.552
	PDI	.001	.001	.352	1.809	.08*
	IDV	-.001	.000	-.246	-1.205	.237
	MAS	.000	.000	.108	.674	.505
	UAI	.000	.000	.084	.544	.590
	LTO	-.001	.000	-.258	-1.490	.146

Significance level: P < 0.01 (***), P < 0.05 (**) and P < 0.10 (*)

High PDI values concentrate on most Asian countries, Eastern European countries, Latin countries, Arab-speaking countries and African countries. Low power distance mainly appears in the German-speaking countries, Nordic countries, United States, Great Britain and the Netherlands.

Hofstede explained that a country's PDI score can be accurately predicted from the following factors. The first predictor is geographic latitude, an interesting measure to relate with power distance, and reflects a rough characteristic of climate that high latitudes are cold, with medium latitudes subtropical to moderate and low latitudes tropical. Although it is impossible to prove that people living in warm climates would make people lazy and cold ones industrious, the logic relationship commonly indicates that higher latitudes contributed

to lower PDI, along with other factors. Second is the size of population, people in populous countries have to depend more on authority and accept more distant political power and less accessible than those in small nations. Third is the national wealth, which means richer countries are associated with lower PDI in general.

PDI is positively correlated to the detention rate, as a high value of PDI almost shows high detention rate and low PDI presents low detention rate. Figure 1 shows the distribution of PDI effects.

Figure 1 PDI Distribution
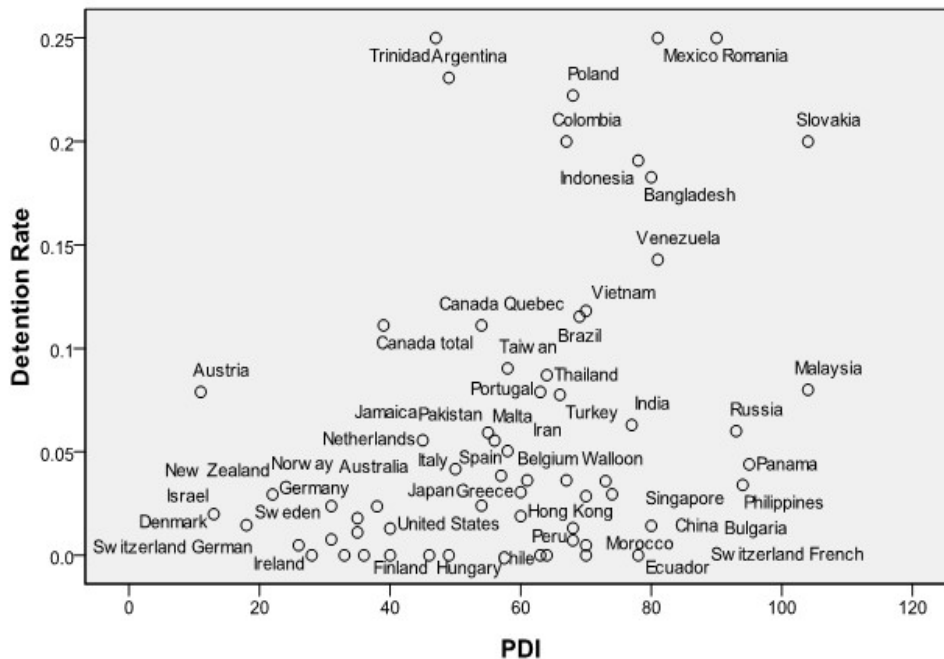
If a ship is registered in the flag with high power distance such as Slovakia or Romania, the relationship between subordinate and superior is emotional, and subordinates almost follow the formal rules and rely on the orders from superiors. The power is centralized on the top of organization, and a hierarchy of inequality exists to distinguish different levels.

Flying the flag with high PDI, the government in that Flag State has the oligarchic power to determine the level of the international safety standards, and when the decision-makers dedicate to attract more ships registered in their flags, the standard level may be compromised. They do not care subordinate's opinion and force subordinates to obey. Consequently, these flag states pay more attention to the benefits themselves and lead to the poor performance which affects the detention rate.

If a ship is registered in the flag with low power distance such as Denmark or Israel, the relationship between subordinate and superior is pragmatic, subordinates usually rely on their own experience and consulted by the superiors. The power is decentralized and hierarchy of inequity is not accepted.

Flying the flag with low PDI, the government in the Flag State liberates the power to legalize the international safety standards, and different levels share the ideas to maintain the ships to a certain safety degree. Therefore, the Flag States control the sub-standard ships and reduce the detention rate.

4.2. Culture Effects on Detention Number

Talking about the culture effects on detention number, the predictors are the same five culture dimensions and the dependent variable is detention number. The linear regression function is described as below:

Detention Number = F (PDI, IDV, MAS, UAI, LTO)

$$= \beta_1 \, PDI + \beta_2 \, IDV + \beta_3 \, MAS + \beta_4 \, UAI + \beta_5 \, LTO + u$$

where, β stands for the coefficients

The R Square 0.606 in Table 5 indicates the relationship between predictors and dependent variable is strong, which presents that culture effects to a great extent affect the detention number.

Table 5 Model Summary for Detention Number

Model	R	R Square	Adjusted R Square	Std. Error of the	R Square Change	F Change	df1	df2	Sig. F Change
					Change Statistics				
1	.779	.606	.545	57.180	.606	9.852	5	32	.000***

Significance level: P < 0.01 (***), P < 0.05 (**) and P < 0.10 (*)

More significantly, the coefficients in Table 6 show that the individualism, uncertainty avoidance index and long-term orientation have the considerable impacts on the detention number, with the significances of IDV 0.005, UAI 0.016 and LTO 0.046 respectively. In general, the un-standardized coefficients of IDV and UAI show the negative correlation with detention number while LTO is positively correlated to the detention number.

Table 6 Coefficients for Detention Number

| Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	167.412	62.573		2.675	.012***
	PDI	.309	.571	.078	.542	.592
	IDV	-1.582	.520	-.463	-3.044	.005***
	MAS	-.515	.451	-.136	-1.142	.262
	UAI	-1.061	.417	-.294	-2.547	.016***
	LTO	.967	.465	.268	2.079	.046**

Significance level: P < 0.01 (***), P < 0.05 (**) and P < 0.10 (*)

Nearly all wealthy countries are scored high on IDV, and poor countries are scored low. Hofstede (1981) concluded that a country's IDV score can be predicted from two aspects. First is the country's wealth, the higher IDV countries show less economic growth than the lower ones. Second is the country's geographic latitude, countries closer to the equator are associated with lower IDV.

IDV has the negative effects on detention number, which imply that high IDV causes a lower detention number and low IDV causes more detention number. Figure 2 states the distribution of IDV effects.

If a ship is registered in the flag with high IDV such as United States or Australia, management in an individualist society is management of individuals. In the individualist society, tasks are supposed to prevail over any personal relationships, and occupational mobility is higher. Management training teaches the honest sharing of feeling, and decisions are based on skills and rules only, and the treatment of everyone is universalism. Thus individuals are treated equally and show more legal responsibility to the whole society.

Figure 2 IDV Distribution
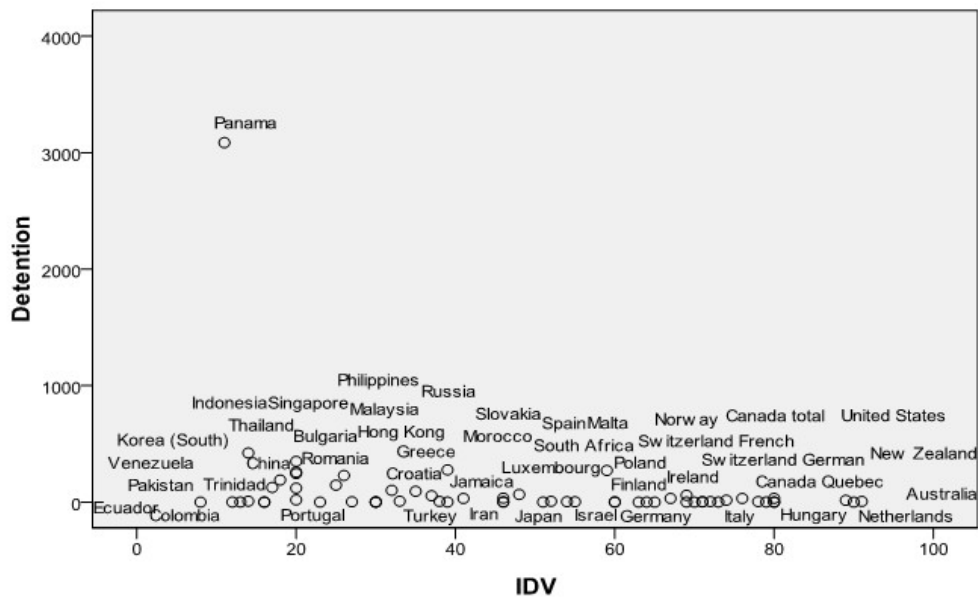
Flying the flag with high IDV, laws and rights are supposed for all parties and the Flag State apply the legal functions to the whole state. The individual Flag State is responsible to act legally and restrain substandard ships. The detention number can be reduced when the individual responsibility of Flag State is increased.

If a ship is registered in a flag with low IDV in terms of collectivism such as Panama or Malaysia, management of collectivism is management of groups. In the collectivism society, personal relationship prevails over the task, and occupational mobility is lower. Direct appraisal of subordinates will spoil the harmony and decisions take the in-group members into account which show the particular treatment to their members. The people in collectivism society feel emotionally integrated into the group and discriminate the out-group members, and the morality is more important than legal responsibility.

Flying the flag with low IDV, laws and rights are differed by groups and Flag State holds the dominant role to promote the economy. This collectivism phenomenon leads to the neglect of legal responsibility as Flag State devotes itself to keep the relationship with the outsiders. Therefore, detention number may be increased when flag state does not fully carry out the obligation to manage substandard ships.

The distribution of UAI shows a new grouping of countries, high UAI countries occur in Latin American, Latin European, and Mediterranean countries. Medium to high are the German-speaking countries, Australia, Germany, and Switzerland. Medium to low scores occur almost all of Asian countries which Japan and Korea are the exceptional examples to get the high score, African countries, Anglo Nordic countries plus Netherlands, United States and Great Britain. Hofstede (1984) pointed out that on average weak UAI countries are slightly wealthier than those with strong UAI.

There is a negative relationship between UAI and detention number, which shows that a high value of UAI causes a lower detention number and low UAI cause a higher detention number. Figure 3 lists the distribution of UAI effects.

If a ship is registered in the flag with high UAI such as Greece or Poland, more and more precise laws or written rules are tended to be formed. People are fear of the uncertainty situations, safety and security is likely to prevail over than other needs and it is better to implement the necessity laws.

Figure 3 UAI Distribution
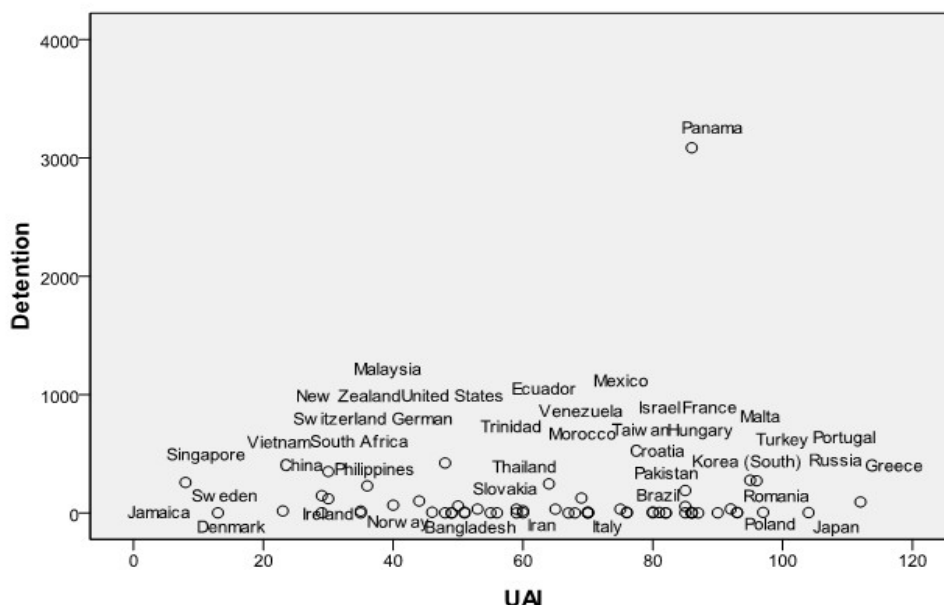
Flying the flag with high UAI, Flag State concerns more about the uncertainty and the substandard ships are intolerable. Flag state tries to avoid the uncertainties and sets up laws to maintain a high security level. The detention number appears less in the high UAI flags and will be reduced if strengthen the UAI effects.

If a ship is registered in the flag with low UAI such as Indonesia or Philippines, fewer general laws or unwritten rules are needed. People believe that problems can be solved without formal rules and show willingness to run unfamiliar risks.

Flying the flag with low UAI, Flag State allows the uncertainty and substandard ships are tolerable. Flag State is willing to face the chaotic risks, necessity laws are not fully implemented and the security level is relatively low. The detention occurs more frequently in the low UAI flags and will increase if weaken the UAI effects.

Based on CVS study, all other Asian countries except Philippines and Pakistan are in a higher LTO range, and highest scoring of non-Asian country is Brazil. Great Britain and its Anglo partners Australia, New Zealand, United States and Canada scored on the short term side, and African countries Zimbabwe and Nigeria scored extremely low.

LTO has a positive effect on the detention number, it indicates that high LTO causes more frequent detention and low LTO causes less frequent detention. Figure 4 presents the distribution of LTO effects.

If a ship is registered in a flag with high LTO such as Vietnam or South Korea, the behaviours are concerned on the future towards and the priority is given according to common sense.

Flying the flag with high LTO, Flag State only looks for the benefits in future according to the assumptions but ignores the historical conditions. The detention number is still high as the Flag State does not take account for the past performance, and long-term outcome has not turn up.

If a ship is registered in the flag with low LTO in terms of short-term orientation such as Pakistan or Nigeria, behaviours are following the past and present situations and the priority is given to abstract rationality.

Flying the flag with low LTO, Flag State establishes the policy based on the past and present data, it knows well about the past performance and changes the ineffective rules. The detention number will be obviously decreased when they pay more attention to the reality and do not want to lose face.

Figure 4 LTO Distribution
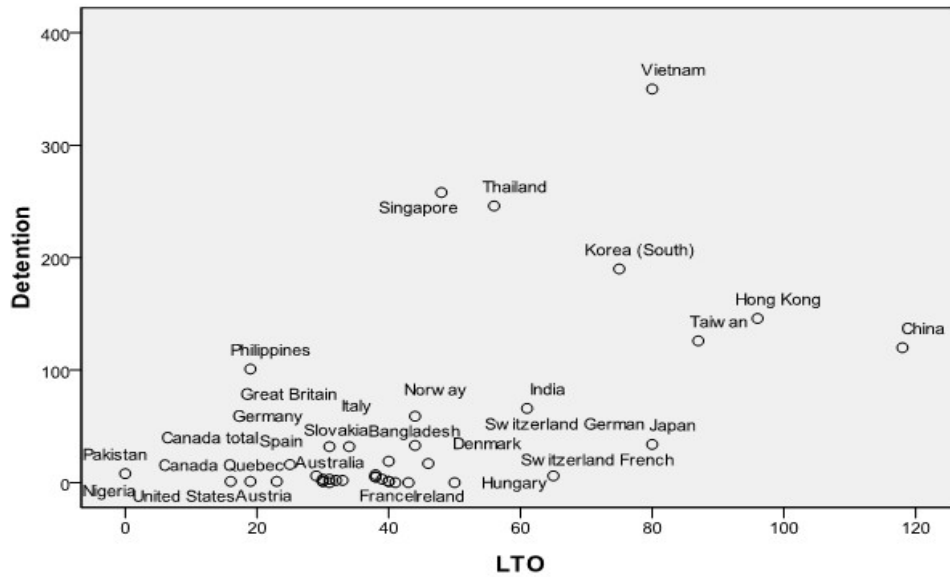
Referring to the personality, the correlation test shows that MAS affects neither the detention rate nor detention number. This is the good news for us to know that the gap of personality has been narrowed. The whole world is continuously advocating the sexual equality, and emphasizing the importance of the equal rights between male and female. At least, this personality problem is not revealed through this research.

To conclude, power distance has little influence on the detention rate. Moreover, the effects of collective culture dimensions including IDV, UAI and LTO on the detention number can be roughly drawn as the formula below:

Detention Number ~ – 1.5 IDV – UAI + LTO + 160

The most typical country is Belgium, with high IDV, UAI and low LTO. The collective culture effects on the detention number reveal that the performance of Belgium flag is good. To the opposite side, a typical country is Vietnam, as it stands for low IDV and UAI, but reflects a high LTO. Considering the high detention number, the culture effects on the vessel detention is apparent, seems that Vietnam culture is always leading to a higher vessel detention and ships flying Vietnam flag may at risk. Another typical country Panama has not yet scored by dimension LTO. Panama is one of the largest FOC registry countries, and from the culture dimension of IDV and UAI, Panama flag shows the similar characteristics with Vietnam, and the culture effect is even obvious with its extremely high detention number.

5. CONCLUSIONS

5.1. Summary of Findings and Contributions

This paper empirically examines the relationship between the culture effects and vessel detention. Firstly, Hofstede's five-dimension culture theory about the national culture behaviours is addressed to quantify the culture. The five dimensions are Power Distance Index, Individualism and Collectivism, Masculinity and Femininity, Uncertainty Avoidance and Long-Term and Short-Term Orientation. The culture dimension theory has already applied to various areas, and this is the first time to link with the shipping industry.

Secondly, safety and security issues turn into the major concentrations in the shipping industry. Ships are manageably sophisticated, especially substandard ships which are aware of high risks, thus the quality control is crucial to the shipping industry. International

regulations enforce that every ship should fly the flag to represent its status, and the differences of flag performance are obvious. The concepts of Flag State and Port State Control help us to know the responsibility to dominate the ship quality standards, and substandard ships usually experience relative higher probability to be detained. Flag of registry is proved to influence the vessel detention rate together with ship age, inspecting authority, type of ship, and recognized organization, but the impression of individual flags is not adequate to illustrate the relationship with vessel detention. In this paper, we propose that the collective culture effects on the vessel detention can present the individual flag performance.

Thirdly, Hofstede's five-dimension culture theory indicates the characteristic of flags in terms of collective culture effects. Total 76 countries and regions are scored by Hofstede, and from 12,635 detention records of the Tokyo MOU region from 2000 to 2009, we analyze the effect of culture dimensions against the vessel detention. The findings can be summarized in two aspects. One possible explanation is that only power distance has little influence on the detention rate and the relationship between power distance and detention rate is positive. Another important possible explanation is that individualism, uncertainty avoidance and long-term orientation have strong impacts on the detention number, and the correlation between individualism, uncertainty avoidance and detention number is negative while the long-term orientation effect is positive.

Our findings show that culture indeed has an effect on the vessel detention taken by different Port State Controls, and the influence of the national culture dimensions is varied. The paper informs that the individual flag performance can be assessed by the culture effects, and the different Flag State should improve the compliance of international regulations. Meanwhile, it provides a new theoretical method to Port State Control to identify and inspect the risky ships. Overall, the contribution is that the players in the shipping industry including Flag State and Port State Control can implement the culture theory to the real-life situations, and enhances the maritime safety and security. More significantly, it is the first time to apply the culture dimension theory to the shipping industry, and offer a new research opportunity between culture and ship quality for the coming study.

5.2. Limitations and Future Research
The research limitations are produced from the difficulties of conducting the culture dimension scoring and inspection records. First, limited resources restrict the amount of ship inspection charged by Port State Control. A large number of foreign ships calling at the port at any one time, and the port authority cannot inspect all the ships due to the resource limitation, and further on-board inspections may do harm to port development with turnover rate and logistics system. Second, Hofstede's research only perform culture dimension scoring of total 76 countries and regions, and there are more than 150 Flag States for ship registering. The bottleneck is that our study may not absolutely reflect the culture effects as not all the Flag States culture scoring are available.

This paper has proved that flag of registry is one of the factors influencing the vessel detention rate, but matter less impacts. Further look on flag of registry is that the performance of individual flag may be better illustrated if flags are classified into clusters according to culture dimensions. As flags belong to various culture dimensions grouping, the in-depth recommendation is Hofstede's five-dimension culture theory should replace the flag of registry factor to analyze the relationship between the flag performance and vessel detention.

Further research is needed into the applicability of the cultural dimensions in ship detentions. It may be argued that given the hierarchical nature of ship social life, essential for efficient and safe operation, such command structures exist on every ship a priori, so the fact that the cultural dimensions may vary across different countries does not imply that the

cultural dimensions will be translated into the nationalities of the crew, since the hierarchical nature is defined by the command relations in every ship.

The shipping industry is highlighting the importance of the public maritime safety and security, and controlling the quality of substandard ships. Although a set of rules are established by different stakeholders, the issue of preventing the substandard ships is still exist. The culture concept in this project may draw the attention to enhance the culture education.

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APPENDIX

Table A1 Summary of Culture Dimensions and Ship Detentions

Country/Region	PDI	IDV	MAS	UAI	LTO	Inspection	Detention	Detention Rate
Arab countries	80	38	53	68				
Argentina	49	46	56	86		13	3	23.1%
Australia	36	90	61	51	31	90	0	0.0%
Austria	11	55	79	70	31	38	3	7.9%
Bangladesh	80	20	55	60	40	104	19	18.3%
Belgium Flemish	61	78	43	97	38	138	5	3.6%
Belgium Walloon	67	72	60	93	38	138	5	3.6%
Brazil	69	38	49	76	65	52	6	11.5%
Bulgaria	70	30	40	85		35	1	2.9%
Canada Quebec	54	73	45	60	30	9	1	11.1%
Canada total	39	80	52	48	23	9	1	11.1%
Chile	63	23	28	86		25	0	0.0%
China	80	20	66	30	118	8,425	120	1.4%
Colombia	67	13	64	80		5	1	20.0%
Costa Rica	35	15	21	86				
Croatia	73	33	40	80		223	8	3.6%
Czech Republic	57	58	57	74	13			
Denmark	18	74	16	23	46	1,166	17	1.5%
East Africa	64	27	41	52				
Ecuador	78	8	63	67		7	0	0.0%
Estonia	40	60	30	60				
Finland	33	63	26	59	41	3	0	0.0%
France	68	71	43	86	39	418	3	0.7%
Germany	35	67	66	65	31	1,785	32	1.8%
Great Britain	35	89	66	35	25	1,446	16	1.1%
Greece	60	35	57	112		3,052	93	3.0%
Guatemala	95	6	37	101				
Hong Kong	68	25	57	29	96	11,118	146	1.3%
Hungary	46	80	88	82	50	1	0	0.0%
India	77	48	56	40	61	1,048	66	6.3%
Indonesia	78	14	46	48		2,212	422	19.1%
Iran	58	41	43	59		635	32	5.0%
Ireland	28	70	68	35	43	4	0	0.0%
Israel	13	54	47	81		201	4	2.0%
Italy	50	76	70	75	34	768	32	4.2%
Jamaica	45	39	68	13		18	1	5.6%
Japan	54	46	95	92	80	1,417	34	2.4%
Korea (South)	60	18	39	85	75	10,039	190	1.9%
Luxembourg	40	60	50	70		72	0	0.0%
Malaysia	104	26	50	36		2,863	229	8.0%
Malta	56	59	47	96		4,903	272	5.5%
Mexico	81	30	69	82		4	1	25.0%
Morocco	70	46	53	68		6	0	0.0%
Netherlands	38	80	14	53	44	1,395	33	2.4%
New Zealand	22	79	58	49	30	34	1	2.9%
Nigeria					16	3	1	33.3%
Norway	31	69	8	50	44	2,480	59	2.4%
Pakistan	55	14	50	70	0	135	8	5.9%
Panama	95	11	44	86		70,227	3,086	4.4%
Peru	64	16	42	87		1	0	0.0%
Philippines	94	32	64	44	19	2,969	101	3.4%
Poland	68	60	64	93	32	9	2	22.2%
Portugal	63	27	31	104	30	38	3	7.9%
Romania	90	30	42	90		4	1	25.0%

Country/Region	PDI	IDV	MAS	UAI	LTO	Inspection	Detention	Detention Rate
Russia	93	39	36	95		4,614	277	6.0%
Salvador	66	19	40	94				
Serbia	86	25	43	92				
Singapore	74	20	48	8	48	8,749	258	2.9%
Slovakia	104	52	110	51	38	35	7	20.0%
Slovenia	71	27	19	88				
South Africa	49	65	63	49		12	0	0.0%
Spain	57	51	42	86	19	26	1	3.8%
Suriname	85	47	37	92				
Sweden	31	71	5	29	33	261	2	0.8%
Switzerland French	70	64	58	70	40	207	1	0.5%
Switzerland German	26	69	72	56	40	207	1	0.5%
Taiwan	58	17	45	69	87	1,395	126	9.0%
Thailand	64	20	34	64	56	2,825	246	8.7%
Trinidad	47	16	58	55		4	1	25.0%
Turkey	66	37	45	85		709	55	7.8%
United States	40	91	62	46	29	463	6	1.3%
Uruguay	61	36	38	100				
Venezuela	81	12	73	76		7	1	14.3%
Vietnam	70	20	40	30	80	2,963	350	11.8%
West Africa	77	20	46	54				
Zimbabwe					25			

Period: 1st January 2000 to 31st August 2009

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