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The U.S. Coast Guard Vessel Inspection Program: A Probability Analysis

by

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Abstract

This study investigates the probabilities of vessel safety and pollution inspections by type of vessel by the U.S. Coast Guard based upon individual vessel inspections for the years 1992-2001. Probit estimates of vessel safety (versus pollution) inspection equations suggest that fishing, passenger, recreation and tug boats are less (more) likely to be inspected for safety (pollution), whereas tank barges and U.S. flag vessels are more (less) likely to be inspected for safety (pollution). Also, vessel safety and pollution inspection probabilities by vessel type vary by Coast Guard district and time. The probability of a U.S. flag vessel being inspected for safety has increased over the time period of the study. The results bring into question the effectiveness of the Coast Guard in reducing the oil-spill pollution of tank barges and improving the safety of fishing boats.

I. Introduction

The U.S. Coast Guard has jurisdictional authority over the U.S. maritime sector. It has five missions: maritime safety (e.g., search and rescue and vessel safety inspection); maritime mobility (e.g., aids to navigation and vessel traffic/waterway management); maritime security (e.g., drug interdiction, alien migrant interdiction and general maritime law enforcement); national defense (e.g., homeland security and port and waterways security); and protection of natural resources (e.g., marine pollution education, prevention, response and enforcement).

Coast Guard authority over vessels begins with conceptual vessel design and continues through the active service life of the vessel. Vessels are inspected for adherence to domestic vessel regulations and standards. Federal regulations and standards are found in the U.S. Code of Federal Regulations. Vessel regulations and standards also exist at the state level. Further, the Coast Guard inspects vessels for adherence to international vessel regulations and standards found in conventions of the International Maritime Organization (IMO) to which the U.S. is a signatory.

The IMO is an United Nations (UN) agency that is responsible for improving the safety of international shipping and preventing pollution from ships.[1] The first IMO safety convention to be adopted was the 1960 International Convention on Safety of Life at Sea (SOLAS) which was designed to improve the safety of shipping -- having provisions that cover navigational safety, ship design and stability, electrical and machinery installations, fire protection, radio communications, life-saving appliances and the transport of dangerous goods.[2] In 1969 the first two IMO pollution conventions were adopted: the International Convention relating to Intervention on the High Seas in Case of Oil Pollution Casualties (establishing the right of coastal states to intervene in incidents on the high seas[3] which are likely to result in oil pollution) and the International Convention on Civil Liability for Oil Pollution Damage (establishing the civil liability of the owner of a ship or cargo for damage suffered as a result of

an oil pollution incident).[4] This study investigates vessel safety and pollution inspections by the U.S. Coast Guard. Specifically, the study investigates whether the Coast Guard inspection of a given type of vessel is more likely to be a safety as opposed to a pollution inspection, i.e., it investigates the probabilities of safety and pollution inspections. Whether the probabilities of Coast Guard vessel safety and pollution inspections by type of vessel vary by Coast Guard district and time (year and month) are also investigated. This study is the first, to the knowledge of the authors, to investigate the vessel inspection probabilities by type of vessel of a country's vessel safety and pollution inspection program. These probabilities, in turn, can be used by policy makers to evaluate the U.S. Coast Guard vessel safety and pollution inspection program with respect to its effectiveness in improving vessel safety and reducing vessel pollution.

The study is structured as follows: A model of Coast Guard safety/pollution vessel inspections is presented in Section II, followed by a discussion of the data in Section III. Estimation results are detailed in Section IV and estimated marginal probabilities are discussed in Section V. Conclusions are set forth in Section VI.

II. The Model

The safety/pollution vessel inspection (SAFEi) by Coast Guard personnel of the ith vessel is posited to be a function of the type of vessel, vessel characteristics and the Coast Guard safety/pollution vessel inspection program for the ith vessel, i.e.,

$$\text{SAFEi} = f(\text{type of vessel, vessel characteristics, Coast Guard safety/pollution vessel inspection program}) \quad (1)$$

where SAFEi is a binary variable equal to 1 for a vessel safety inspection and 0 for a vessel pollution inspection.

Type of vessel includes: fishing boat (FISHBOAT), dry-bulk freight ship (FRTSHIP), passenger boat (PASSENGR), recreation boat (RECREATN), tank barge (TANKBARG), tank ship (TANKSHIP) and

tug boat (TUGBOAT). Vessel characteristics include whether the vessel flies the U.S. flag (USFLAG) or a foreign flag.

The Coast Guard safety/pollution vessel inspection program for the ith vessel (PROGRAMi), in turn, is posited to vary with the Coast Guard district (DISTRICT) where inspected, the year (YEAR) inspected and the month (MONTH) inspected, i.e.,

$$PROGRAMi = g(DISTRICTi, YEARi, MONTHi) \qquad (2)$$

DISTRICT is represented by the binary variables DIST1, DIST2, DIST5, DIST7, DIST8, DIST9, DIST11, DIST13, DIST14 and DIST17 which represent the ten Coast Guard districts (see Figure 1).[5] Since our data are for the years 1992 through 2001, YEAR is represented by the ten yearly binary variables Y92 through Y01. The twelve months are represented by the twelve monthly binary variables M1 through M12.

Replacing the explanatory variables in equation (2) with the heretofore mentioned binary variables and then substituting into equation (1) as well as substituting the heretofore mentioned type-of-vessel and vessel characteristics variables and rewriting, one obtains the reduced-form equation:

$$\begin{aligned} SAFEi=F(&FISHBOATi,FRTSHIPi,PASSENGRi,RECREATNi,\\ &TANKBARGi,TANKSHIPi,,TUGBOATi,USFLAGi,DIST1i,DIST2i,\\ &DIST5i,DIST7i,DIST8i,DIST9i,DIST11i,DIST13i,DIST14i,DIST17i,\\ &Y92i,Y93i,Y94i,Y95i,Y96i,Y97i,Y98i,Y99i,Y00i,Y01i,M1i,M2i,\\ &M3i,M4i,M5i,M6i,M7i,M8i,M9i,M10i,M11i,M12i) \qquad (3) \end{aligned}$$

III. DATA

Data used in the estimations of equation (3) consist of 388,061 individual vessel inspections by the U.S. Coast Guard for the years 1992-2001. The purpose of a given inspection was to detect whether a vessel was in violation of Coast Guard vessel safety or pollution regulations. Security vessel inspections, e.g., for drug interdiction, alien migrant interdiction and general maritime law enforcement, are not considered. Data for all variables were extracted from the U.S. Coast Guard Marine Safety Management System (MSMS) database.[6]

Variables used in the estimations and their specific measurements as well as their descriptive statistics (mean and standard deviation) appear in Table 1. The mean statistic for SAFE reveals that 76.1% of the inspections were safety inspections and by deduction 23.9% were pollution inspections. Safety inspection activities in the Coast Guard's port safety activity reports include, for example, annual vessel inspections, vessel inspections for fire protection and navigational safety, cargo inspections and document checking. Pollution vessel inspections include various MARPOL-related and other pollution prevention inspections (both equipment and operational requirements). The mean statistics for type of vessel reveal that 1.1, 63.8, 1.9, 0.1, 6.9, 20.2 and 4.5% of the inspected vessels were fishing boats, freight ships, passenger boats, recreation boats, tank barges, tank ships and tug boats, respectively. Further, 16.1% of the vessels inspected were U.S. flag. Among Coast Guard districts, the largest percentage of inspections (30.8%) occurred in the 8th district, followed by 15.7, 13.4 and 10.2% in the 7th, 5th and the 1st districts. For the period 1992-2001, the largest percentage of inspections (12.5%) occurred in 1995, followed by 11.8, 11.4, 11.3 and 11.0% in 1996, 1994, 1997 and 1998, respectively. Among months, the percentage of inspections range between 7.2 and 9.4%.

IV. Empirical Results

Equation (3) is estimated using probit analysis rather than ordinary least squares (OLS). Unlike OLS, probit analysis restricts the predictions of SAFE to lie in the interval between zero and one. The probability of observing SAFE = 1 in the probit model may be expressed as:

$$\text{Prob (SAFE = 1)} = \Phi(\beta' x) \qquad (4)$$

where Φ is the standard normal distribution function; β is a vector of parameters; and x is a vector of explanatory variables as found in equation (3). The marginal probabilities in the probit model for the x explanatory variables are:[7]

$$\partial E[SAFE|x]/\partial x = \psi(\beta' x)\beta \qquad (5)$$

where ψ is the standard normal density function. In addition to being determinants of PROGRAM, yearly and monthly binary variables are also included in the estimation of equation (3) in order to address possible estimation bias from omission of relevant explanatory variables, i.e., any omitted relevant explanatory variables are assumed to be correlated with the yearly and monthly binary variables.

Table 2 reports the estimate of equation (3) using the entire sample of 388,061 vessel inspections. In order to avoid the problem of perfect multicollinearity, the binary variables DIST1, Y92 and M1 are arbitrarily dropped from the estimation. It can be seen that equation (3) fits the data well. The chi-square statistic is 5,166.4, exceeding the chi-square critical value necessary for significance at the .01 level for 37 degrees of freedom. The statistically significant coefficients for the type-of-vessel variables suggest that fishing, passenger, recreation and tug boats are less (more) likely to be inspected for safety (pollution) than other types of vessels. Conversely, tank barges and U.S. flag vessels are more (less) likely to be inspected for safety (pollution). Among Coast Guard districts, a vessel is less (more) likely to be inspected for safety (pollution) in districts eight, eleven, thirteen and fourteen than in district one; a safety (pollution) inspection is more (less) likely in districts seven and nine. In 1993 and 1994 vessel safety inspections were less likely than vessel pollution inspections. Among months, a vessel safety (pollution) inspection is more (less) likely in August than during other months.

In Table 3 estimates of equation (3) are presented, where each estimate is for a given district. Only the estimated coefficients of the type-of-vessel variables and USFLAG are presented. A comparison of these coefficients reveals the extent to which the likelihood of vessel safety and pollution inspections varies by type of vessel and U.S. flag across districts. The statistically significant estimated coefficients suggest that : (1) a fishing boat is more likely to be inspected for pollution in districts 7, 11, 13, 14 and 17; (2) a freight ship is more likely to be inspected for safety in districts 2 and 14 and for pollution in districts 9, 11 and 13; (3) a

passenger boat is more likely to be inspected for safety in districts 8 and 9 and for pollution in districts 1, 7, 11, 14 and 17; (4) a recreation boat is more likely to be inspected for safety in district 1 and for pollution in districts 2, 7, 11 and 14; (5) a tank barge is more likely to be inspected for safety in districts 2, 8 and 14 and for pollution in district 5; (6) a tank ship is more likely to be inspected for safety in district 14 and for pollution in districts 9, 11 and 17; (7) a tug boat is more likely to be inspected for pollution in districts 1, 5, 7, 8, 11 and 14; and (8) a U. S. flag vessel is more likely to be inspected for safety in districts 1, 5, 7, 8, 9, 11 and 17 and for pollution in district in 14.

In Table 4 estimates of equation (3) are presented, where each estimate is for a given year of the data set. The estimation results suggest that fishing and tug boats were likely to be inspected for pollution. Also, U.S. flag vessels were likely to be inspected for safety over the 1992-2001 period. This is likely due to the fact that U.S. vessels are subject to annual inspections and other regulatory compliance inspections by the Coast Guard. The statistically significant estimated coefficients suggest that: (1) a freight ship was more likely to be inspected for pollution in the years 1992 and 1993 and for safety in the years 1994 and 1995; (2) a passenger boat was more likely to be inspected for pollution in the years 1992-94; (3) a recreation boat was more likely to be inspected for pollution in the years 1994-96; (4) a tank barge was more likely to be inspected for pollution in the year 1992 and for safety in the years 1994-95 and 1999; and (5) a tank ship was more likely to be inspected for pollution in 1992-93. The increased probability of tank-ship pollution inspections in the early 1990s could be the result of growing concerns of marine pollution after the Exxon Valdez spill in 1989 and the passage of the Oil Pollution Act of 1990.

In Table 5, estimates of equation (3) are presented, where each estimate is for a given month. The estimation results suggest that, irrespective of the month, fishing and tug boats are likely to be inspected for pollution and U.S. flag vessels are likely to be inspected for safety.

However, freight and tanker ships, irrespective of the month, are neither more or less likely to be inspected for pollution and safety. Further, the results suggest that: (1) a passenger boat is more likely to be inspected for pollution in the months of January, February and September through December; (2) a recreation boat is more likely to be inspected for pollution in the months of February, March, May and October through December; and (3) a tank barge is more likely to be inspected for safety in the months of February, March, April, June, July and November.

The above vessel inspection results bring into question the effectiveness of the U.S. Coast Guard vessel inspection program in reducing pollution from vessel oil spills. A study by Talley, Jin and Kite-Powell (2001) of vessel-accident oil spillages investigated by the U.S. Coast Guard found that tank barge accidents incurred greater in-water and out-of-water oil spillage than accidents of tanker ships and non-oil-cargo vessels. Talley, Jin and Kite-Powell (forthcoming) also found that the out-of-water oil transfer spills of tank barges were greater than those of tanker ships and non-oil-cargo vessels. The policy implication of these studies for reducing pollution from vessel oil spills is that greater attention, say more vessel pollution inspections, needs to be given to reducing the vessel-accident and transfer oil spills of tank barges. However, this study found that the U.S. Coast Guard is more likely to inspect tank barges for safety than for pollution.

In addition, the study's empirical results suggest that fishing boats are less (more) likely to be inspected for safety (pollution). However, commercial fishing is one of the least safe occupations. In 1996 the U.S. commercial fishing fatality rate was 16 deaths per 10,000 workers, a rate that is 16 times higher than that for fire and police protective service occupations. Between 1984 and 1998, 2,074 U.S. commercial fishing vessel accidents resulted in the total lost of the vessel (U.S. Coast Guard, 1999).

V. Marginal Probabilities

The estimated probit marginal probabilities with respect to the explanatory variables found in Tables 2 through 5 are presented in Table 2 and Tables 6 through 8, respectively. The marginal probability estimates indicate the extent to which the change in a given explanatory variable changes the probability of a vessel safety inspection. From the third column of Table 2, one notes that when the vessel is a recreation and fishing boat, the probability of the vessel being inspected for safety decreases (pollution increases) by .158 and .142, respectively and when the vessel is a tank barge and a U.S. flag vessel, the probability of a safety (pollution) inspection increases (decreases) by .049 and .065, respectively.

The district marginal probabilities found in Table 6 suggest that a freight ship, passenger boat and a tank ship are the least likely to be inspected for safety in district 11 (the probability decreases by .192 .162 and .178, respectively), a fishing boat in district 13 (the probability decreases by .201), a recreation boat and tug boat in district 14 (the probability decreases by .249 and .154, respectively) and a tank barge in district 5 (the probability decreases by .134). A tank barge and a tank ship are the most likely to be inspected for safety in district 14 (the probability increases by .129 and .056, respectively), a freight ship in district 2 (the probability increases by .201), a passenger boat in district 9 (the probability increases by .145) and a recreation boat in district 1 (the probability increases by .249).

From Table 7, a fishing boat, freight ship, passenger boat, recreation boat, tank barge, tank ship and tug boat were the least (most) likely to be inspected for safety (pollution) in 1994, 1993, 1993, 1994, 1992, 1993 and 1992, respectively. A freight ship, tank barge and a U.S. flag vessel were the most (least) likely to be inspected for safety (pollution) in 1994, 1994 and 2001, respectively. The marginal probabilities for safety inspections of U.S. flag vessels suggest a rising trend over the time in the likelihood that a U.S. flag vessel will be inspected for safety.

From Table 8, a fishing boat, passenger boat, recreation boat and tug boat are the least (most) likely to be inspected for safety (pollution) in February, September, September and July, respectively. A tank barge and a U.S. flag vessel are the most (least) likely to be inspected for safety (pollution) in March and May, respectively.

VI. Conclusion

This study has investigated the probability of a vessel being inspected for safety and pollution by the U.S. Coast Guard. Is a given type of vessel more likely to be inspected for safety than for pollution? Do the vessel safety and pollution inspection probabilities for a given type of vessel vary by geographic location (Coast Guard district) and time (year and month)? These questions were investigated by probit estimations of vessel safety (versus pollution) inspection equations based by individual vessel inspections by the U.S. Coast Guard for the years 1992-2001.

The estimation results suggest that fishing, passenger, recreation and tug boats are less (more) likely to be inspected for safety (pollution), whereas tank barges and U.S. flag vessels are more (less) likely to be inspected for safety (pollution) by the U.S. Coast Guard. Also, vessel inspection probabilities by vessel type vary by Coast Guard district. In district 11, a freight ship, a passenger boat, a recreation boat and a tank ship are more likely to be inspected for pollution, but are more likely to be inspected for safety in districts 2 and 14, districts 8 and 9, district 1 and district 14, respectively. Further, vessel inspection probabilities by vessel type vary by time. A freight ship was more likely to be inspected for pollution (safety) in the years 1992 and 1993 (1994 and 1995); a tank barge was more likely to be inspected for pollution (safety) in 1992 (1994-95 and 1999). Irrespective of the month, fishing and tug boats are more likely to be inspected for pollution and U.S. flag vessels are more likely to be inspected for safety.

When the vessel is a tank barge and a U.S. flag vessel, the probability of the vessel being inspected for safety increases (pollution decreases) by .049 and .065, respectively. Tank

ships are the least likely to be inspected for safety in district 11 (the probability decreases by .178), but the most likely to be inspected for safety in district 14 (the probability increases by .056). The estimated marginal probabilities for safety inspections of U.S. flag vessels suggest a rising trend over the time in the likelihood that a U.S. flag vessel will be inspected for safety. U.S. flag vessels are the most likely to be inspected for safety in May.

Endnotes

1. The IMO was established in 1948 and today has 158 member countries. IMO conventions develop when a draft instrument is submitted at an IMO conference. The final text adopted by the conference, i.e., the convention, is then submitted to member governments for their ratification. The convention is ratified (or comes into force) when a specified number of countries are signatories to the convention. Each ratifying country is obligated to enact the convention into national law (i.e., implementation is mandatory), thus standardizing the law among the ratifying countries.
2. Subsequently adopted safety conventions address the overloading of ships, ship traffic separation schemes, the use of space satellites to aid ship operation and its safety, the training of crews to promote ship safety, minimum certification standards for crews, and search and rescue operations.
3. The 1982 United Nations Convention on the Law of the Sea (UNCLOS) defines high seas as "all parts of the sea that are not included in the exclusive economic zone, in the territorial sea or in the internal waters of a state."
4. The 1973 International Convention for the Prevention of Pollution from Ships (MARPOL) addressed oil pollution as well as pollution from chemicals, other harmful substances, garbage and sewage. It requires the issuance of ship pollution inspection certificates, the adherence of ships to specific anti-pollution rules, and the reporting of incidents involving harmful substances. The 1990 Convention on Oil Pollution Preparedness, Response and Cooperation enhanced the ability of countries to cope with sudden oil pollution emergencies such as those from tanker accidents. For further discussion of IMO pollution and safety conventions, see Talley (forthcoming). For a general discussion of maritime safety, see Talley (2002).
5. The Coast Guard 1st District covers the New England and New York Atlantic coast; the 2nd District covers the Midwest; the 5th District, the Mid-Atlantic coast (southern New Jersey to North Carolina); the 7th District, the southern Atlantic coast (South Carolina to Florida); the 8th District, the Gulf coast; the 9th District, the Great Lakes; the 11th District, the California coast; the 13th District, the Pacific northwest coast; the 14th District, Hawaii; and the 17th District, Alaska.
6. Three MSMS data tables were merged to obtain the data set for this study. The three data tables are the: Port Safety Resource Supplement Table (brst), Boarding Report Identification Table (brit) and Marine Casualty and Pollution Master Table (cirt).
7. For further discussion, see Greene (1997).

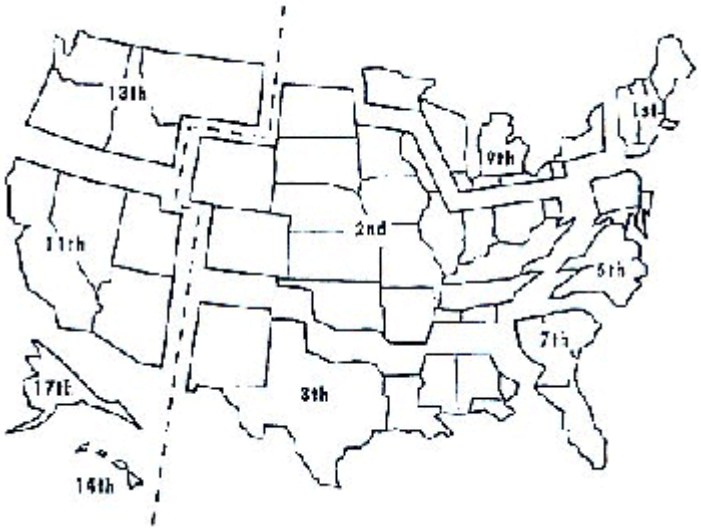

Figure 1: U.S. Coast Guard Districts
Source: http://www.boattalk.com/safety/districts.htm

References

Greene, W. H., 1997, *Econometric Analysis*, 3rd edn (Upper Saddle River, NJ: Prentice Hall).

Talley, W. K., 2002. "Maritime Safety and Accident Analysis." *The Handbook of Maritime Economics and Business*, Editor, C. Grammenos, London: Lloyds of London Press, 426-442.

Talley, W. K., forthcoming. "Regulatory Issues: The Role of International Maritime Institutions."*Handbook of Transport Strategy, Policy and Institutions*, Editors, D. A. Hensher and K. J. Button, Oxford: Pergamon.

Talley, W. K, D. Jin and H. Kite-Powell, 2001. "Vessel Accident Oil-Spillage: Post U.S. OPA-90." *Transportation Research Part D* 6:405-415.

Talley, W. K., D. Jin and H. Kite-Powell, forthcoming. "Post OPA-90 Vessel Oil Transfer Spill Prevention: The Effectiveness of Coast Guard Enforcement." *Environmental and Resource Economics*.

U.S. Coast Guard, 1999. *Dying to Fish, Living to Fish: Fishing Vessel Casualty Task Force Report*. Washington, D.C.: U.S. Government Printing Office.

Table 1 - Variable Definition and Descriptive Statistics

Dependent variable	**Measurement**	**Mean (S.D.)**
SAFE	1 if a Coast Guard safety vessel inspection, 0 if a pollution vessel inspection	.761 (.427)
Explanatory variables		
*Type of vessel**		
FISHBOAT	1 if a fishing boat, 0 otherwise	.011 (.106)
FRTSHIP	1 if a freight ship, 0 otherwise	.638 (.481)
PASSENGR	1 if a passenger boat, 0 otherwise	.019 (.136)
RECREATN	1 if a recreation boat, 0 otherwise	.001 (.037)
TANKBARG	1 if a tank barge, 0 otherwise	.069 (.254)
TANKSHIP	1 if a tank ship, 0 otherwise	.202 (.401)
TUGBOAT	1 if a tug boat, 0 otherwise	.045 (.208)
Vessel characteristics		
USFLAG	1 if U.S. Flag, 0 otherwise	.161 (.368)
Coast Guard District		
DIST1	1 if district 1, 0 otherwise	.102 (.302)
DIST2	1 if district 2, 0 otherwise	.052 (.222)
DIST5	1 if district 5, 0 otherwise	.134 (.341)
DIST7	1 if district 7, 0 otherwise	.157 (.364)
DIST8	1 if district 8, 0 otherwise	.308 (.462)
DIST9	1 if district 9, 0 otherwise	.035 (.184)
DIST11	1 if district 11, 0 otherwise	.097 (.295)
DIST13	1 if district 13, 0 otherwise	.060 (.238)
DIST14	1 if district 14, 0 otherwise	.034 (.181)
DIST17	1 if district 17, 0 otherwise	.022 (.146)
Year		

Y92	1 if 1992, 0 otherwise	.085 (.280)
Y93	1 if 1993, 0 otherwise	.101 (.301)
Y94	1 if 1994, 0 otherwise	.114 (.318)
Y95	1 if 1995, 0 otherwise	.125 (.331)
Y96	1 if 1996, 0 otherwise	.118 (.322)
Y97	1 if 1997, 0 otherwise	.113 (.317)
Y98	1 if 1998, 0 otherwise	.110 (.312)
Y99	1 if 1999, 0 otherwise	.105 (.306)
Y00	1 if 2000, 0 otherwise	.104 (.306)
Y01	1 if 2001, 0 otherwise	.025 (.156)
Month		
M1	1 if January, 0 otherwise	.081 (.272)
M2	1 if February, 0 otherwise	.084 (.277)
M3	1 if March, 0 otherwise	.094 (.291)
M4	1 if April, 0 otherwise	.086 (.280)
M5	1 if May, 0 otherwise	.085 (.280)
M6	1 if June, 0 otherwise	.083 (.276)
M7	1 if July, 0 otherwise	.086 (.280)
M8	1 if August, 0 otherwise	.087 (.282)
M9	1 if September, 0 otherwise	.081 (.274)
M10	1 if October, 0 otherwise	.082 (.274)
M11	1 if November, 0 otherwise	.079 (.270)
M12	1 if December, 0 otherwise	.072 (.259)

* In addition to the seven vessel types listed below, there are also a number of other vessel types listed in the data, e.g., industrial, offshore supply, oil recovery and research vessels.

Table 2 - Coast Guard Vessel Safety Inspections: A Probit Estimate

VARIABLE	**COEFFICIENT (t statistic)**	**MARGINAL PROBABILITY**
Vessel type/flag		
FISHBOAT	-.460* (-16.45)	_0.142
FRTSHIP	.004 (.221)	0.001
PASSENGER	-.109* (-4.35)	_0.034
RECREATN	-.513* (-8.66)	_0.158
TANKBARG	.159* (7.06)	0.049
TANKSHIP	-.008 (-.404)	_0.003
TUGBOAT	-.314* (-13.61)	_0.097
USFLAG	.210* (18.14)	0.065
Coast Guard district		
DIST2	.009 (.564)	0.003
DIST5	-.003 (-.319)	_0.0009
DIST7	.030* (3.29)	0.009
DIST8	-.028* (-3.46)	_0.009
DIST9	.295* (19.45)	0.091

DIST11	-.220* (-22.18)	_0.068
DIST13	-.125* (-10.92)	_0.039
DIST14	-.255* (-18.15)	_0.079
DIST17	.008 (.459)	0.002
Year		
Y93	-.050* (-4.83)	_0.016
Y94	-.065* (-6.46)	_0.02
Y95	-.013 (-1.29)	_0.004
Y96	.016 (1.56)	0.005
Y97	.003 (.260)	0.0008
Y98	.009 (.839)	0.003
Y99	.010 (.977)	0.003
Y00	.011 (1.03)	0.003
Y01	.010 (.581)	0.003
Month		
M2	.004 (.396)	0.001
M3	.008 (.820)	0.003

M4	.003 (.272)	0.0009
M5	.009 (.793)	0.003
M6	.002 (.140)	0.0005
M7	.014 (1.28)	0.004
M8	.021*** (1.87)	0.006
M9	.010 (.924)	0.003
M10	.008 (.760)	0.003
M11	.011 (1.02)	0.004
M12	.011 (.958)	0.003
Constant	.724* (-30.57)	
# Observations	388061	
Chi-Square statistic	5166.4	

*,**,*** statistically significant at the 1,5, and 10 percent level.

Table 3 - Coast Guard District Vessel Safety Inspections: Probit Estimates

Variable	**DIST1**	**DIST2**	**DIST5**	**DIST7**	**DIST8**	**DIST9**	**DIST11**	**DIST13**	**DIST14**	**DIST17**
FISHBOAT	-.060 (-.374)	.223 (.495)	-.070 (-.325)	-.190*** (-1.73)	.005 (.046)	-.558 (-.845)	-.571* (-3.81)	-.610* (-6.19)	-.290* (-3.87)	-.458* (-3.49)
FRTSHIP	-.111 (-.647)	.755* (3.45)	.064 (.759)	-.061 (-1.06)	.026 (.786)	-.265*** (-1.79)	-.551* (-6.60)	-.141*** (-1.66)	.190* (2.59)	.130 (1.08)
PASSENGR	-.189*** (-1.94)	-.082 (-.552)	.051 (.301)	-.200* (-3.19)	.118** (2.41)	.664* (3.54)	-.464* (-4.65)	-.053 (-.301)	-.260* (-3.03)	-.480* (-3.33)
RECREATN	.831*** (1.90)	-.921* (-4.07)	.091 (.274)	-.335** (-2.22)	.050 (.302)	.360 (.777)	-.481** (-2.33)	-.213 (-.572)	-.676* (-5.02)	-------
TANKBARG	-.003 (-.040)	.446* (7.05)	-.439* (-4.57)	.052 (.641)	.231* (6.20)	,035 (.221)	-.172 (-1.25)	-.051 (-.503)	.351*** (1.75)	-.198 (-1.30)
TANKSHIP	-.093 (-1.24)	------	.058 (.689)	-.053 (-.900)	.001 (.041)	-.364** (-2.36)	-.512* (-6.01)	-.017 (-.184)	.153** (2.00)	-.599* (-4.92)
TUGBOAT	-.359* (-3.40)	-.076 (-1.23)	-.240** (-2.18)	-.240* (-2.67)	-.257* (-7.00)	-.222 (-1.31)	-.544* (4.16)	-.205 (-1.27)	-.419* (-3.38)	-.071 (-.390)
USFLAG	.247* (6.70)	-.313 (-1.56)	.551* (11.11)	.388* (11.54)	.165* (5.90)	.117*** (1.73)	.327* (9.87)	-.010 (-.203)	-.315* (-7.74)	.549* (14.56)
Constant	.776* (9.54)	1.189* (5.96)	.748* (8.33)	.749* (11.81)	.659* (17.00)	1.250* (6.06)	.826* (9.20)	1.132* (11.65)	.559* (5.92)	.729* (5.06)
# Observations	39458	20241	51991	60828	119558	13616	37475	23302	13085	8507
Chi-Ssquare statistic	244.6	814.5	213.5	343	769.1	361	518.1	473.8	1202.3	530.6)

*,**,*** statistically significant at the 1, 5 and 10 percent level.
Parameter estimates for the YEAR and MONTH variables are not reported.

Table 4 - Coast Guard Yearly Vessel Safety Inspections: Probit Estimates

Variable	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
FISHBOAT	-.540*	-.433*	-.500*	-.431*	-.394*	-.322*	-.343*	-.107	-.503*	-.397**
	(-4.94)	(-4.53)	(-6.43)	(-6.03)	(-4.90)	(-3.40)	(-3.07)	(-.955)	(-5.70)	(-1.97)
FRTSHIP	-.180**	-.255*	.153**	.109***	-.003	.065	.038	-.029	-.034	.034
	(-2.05)	(-3.57)	(2.49)	(1.84)	(-.048)	(1.19)	(.695)	(-.456)	(-.565)	(.254)
PASSENGR	-.298*	-.489*	-.307*	-.048	-.084	.071	.083	-.005	-.095	-.057
	(-2.85)	(-5.59)	(-4.10)	(-.647)	(-1.14)	(.967)	(1.13)	(-.067)	(-1.21)	(-.337)
RECREATN	-.171	-.088	-1.126*	-.363**	-.709*	-.101	-.169	-.085	-.008	
	(-.652)	(-.271)	(-7.59)	(-2.36)	(-3.88)	(-.454)	(-.896)	(-.422)	(-.036)	------
TANKBARG	-.222**	.065	.506*	.304*	-.025	.015	-.029	.203*	.091	.130
	(-2.37)	(.849)	(7.53)	(4.73)	(-.385)	(.237)	(-.440)	(2.60)	(1.15)	(.757)
TANKSHIP	-.203**	-.259*	.075	.069	-.027	.048	.039	-.021	.006	.105
	(-2.28)	(-3.59)	(1.21)	(1.15)	(-.463)	(.856)	(.704)	(-.331)	(.090)	(.764)
TUGBOAT	-.520*	-.306*	-.255*	-.343*	-.382*	-.312*	-.306*	-.346*	-.381*	-.374**
	(-4.32)	(-3.62)	(-3.66)	(-5.24)	(-5.74)	(-5.15)	(-4.22)	(-4.67)	(-4.94)	(-2.32)
USFLAG	.206*	.220*	.095*	.208*	.243*	.289*	.375*	.352*	.356*	.405*
	(6.16)	(7.39)	(3.28)	(6.10)	(6.37)	(7.17)	(8.75)	(8.13)	(7.98)	(4.14)
Constant	1.008*	.848*	.540*	.571*	.703*	.758*	.745*	.745*	.779*	.661*
	(10.49)	(10.96)	(7.85)	(8.65)	(10.86)	(12.03)	(11.87)	(10.50)	(11.44)	(4.69)
# Observations	33173	39230	44206	48539	45722	43938	42513	40592	40474	9679
Chi-Ssquare statistic	828.1	840.3	1882.5	1023	487.1	539.5	567.1	526	512.1	130.1

*,**,*** statistically significant at the 1, 5 and 10 percent level.
Parameter estimates for the DIST and MONTH variables are not reported.

Table 5 - Coast Guard Monthly Vessel Safety Inspections: Probit Estimates

	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
FISHBOAT	-.575* (-5.94)	-.706* (-6.89)	-.371* (-4.57)	-.442* (-4.57)	-.422* (-4.39)	-.351* (-3.56)	-.404* (-4.17)	-.433* (-4.73)	-.609* (-6.19)	-.361* (-3.70)	-.425* (-4.28)	-.456* (-4.11)
FRTSHIP	-.044 (-.605)	-.057 (-.796)	.104 (1.60)	.012 (.169)	.017 (.232)	.027 (.425)	-.074 (-1.08)	-.049 (-.714)	.012 (.170)	.050 (.724)	.036 (.510)	-.007 (-.103)
PASSENGR	-.151*** (-1.64)	-.170*** (-1.85)	.030 (.383)	.013 (.139)	-.007 (.232)	-.083 (-1.02)	-.032 (-.357)	-.120 (-1.34)	-.234* (-2.69)	-.177** (-2.07)	-.170*** (-1.95)	-.161*** (-1.79)
RECREATN	-.338 (-1.19)	-.536*** (-1.63)	-.373*** (-1.93)	-.026 (-.101)	-.387** (-2.36)	.245 (1.02)	-.247 (-1.03)	.002 (.009)	-1.129* (-6.42)	-.725* (-4.37)	-1.101* (-4.86)	-.585** (-2.24)
TANKBARG	.087 (1.05)	.156** (1.95)	.364* (5.03)	.222* (2.85)	.114 (1.40)	.259* (3.47)	.137*** (1.78)	.020 (.261)	.099 (1.22)	.080 (1.02)	.160** (2.04)	.115 (1.39)
TANKSHIP	-.024 (-3.23)	-.046 (-.638)	.093 (1.40)	-.026 (-.358)	.008 (.113)	.007 (.114)	-.072 (-1.04)	-.060 (-.865)	-.015 (-.199)	.040 (.571)	.006 (.087)	-.033 (-.456)
TUGBOAT	-.296* (-3.45)	-.333* (-4.12)	-.156** (-2.12)	-.357* (-4.43)	-.365* (-4.41)	-.338* (-4.41)	-.388* (-4.93)	-.364* (-4.73)	-.312* (-3.74)	-.337* (-4.22)	-.340* (-4.30)	-.297* (-3.47)
USFLAG	.168* (3.93)	.187* (4.59)	.163* (4.41)	.223* (5.55)	.328* (8.31)	.216* (5.44)	.222* (5.59)	.235* (5.83)	.200* (4.91)	.237* (5.67)	.189* (4.61)	.184* (4.24)
Constant	.934* (11.20)	.871* (10.75)	.686* (9.27)	.742* (9.15)	.730* (9.12)	.678* (9.41)	.783* (10.30)	.761* (10.04)	.690* (8.74)	.636* (8.28)	.656* (8.43)	.736* (9.14)
# Observations	31319	32494	36363	33238	33156	32358	33391	33857	31376	31835	30635	28039
Chi-Square Statistic	360	446.2	541.1	488.7	527.2	520.2	443.5	440.5	575	526.1	527.3	268.7

*, **, *** statistically significant at the 1, 5, and 10 percent level.
Parameter estimates for district and year are not reported.

Table 6 - Coast Guard District Vessel Safety Inspections: Probit Marginal Probabilities

Variable	**DIST1**	**DIST2**	**DIST5**	**DIST7**	**DIST8**	**DIST9**	**DIST11**	**DIST13**	**DIST14**	**DIST17**
FISHBOAT	-.018	.059	-.027	-.057	.001	-.122	-.199	-.201	-.107	-.128
FRTSHIP	-.033	.201	.020	-.018	.008	-.058	-.192	-.046	.070	.036
PASSENGR	-.057	-.022	.016	.060	.036	.145	-.162	-.017	-.096	-.134
RECREATN	.249	-.247	.028	-.100	.015	.079	-.167	-.070	-.249	------
TANKBARG	-.001	.119	-.134	.015	.071	.008	-.060	-.017	.129	-.056
TANKSHIP	-.028	------	.018	.016	.0004	-.079	-.178	-.006	.056	-.168
TUGBOAT	-.108	-.020	-.073	-.071	-.079	-.048	-.189	-.067	-.154	-.020
USFLAG	.074	-.084	.168	.116	.051	.025	.114	-.003	-.116	-.154

Table 7 - Coast Guard Yearly Vessel Safety Inspections: Probit Marginal Probabilities

Variable	**Y92**	**Y93**	**Y94**	**Y95**	**Y96**	**Y97**	**Y98**	**Y99**	**Y00**	**Y01**
FISHBOAT	-.158	-.134	-.159	-.134	-.120	.-099	-.105	-.033	-.154	-.123
FRTSHIP	-.053	-.079	.048	.034	-.0008	.020	.012	-.009	-.011	.011
PASSENGR	-.088	-.152	-.097	-.015	-.026	.022	.025	-.002	-.029	-.018
RECREATN	-.050	-.027	-.358	-.113	-.216	-.031	-.052	-.026	-.002	------
TANKBARG	-.065	.020	.161	.095	-.008	.005	-.009	.062	.028	.040
TANKSHIP	-.060	-.080	.024	.021	-.008	.015	.012	-.007	.002	.033
TUGBOAT	-.153	-.095	-.081	-.107	-.116	-.096	-.094	-.106	-.117	-.116
USFLAG	.061	.068	.030	.065	.074	.089	.115	.108	.109	.126

Table 8 - Coast Guard Monthly Vessel Safety Inspections: Probit Marginal Probabilities

Variable	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
FISHBOAT	-.179	-.219	-.114	-.136	-.129	-.108	-.124	-.133	-.187	-.111	-.130	-.141
FRTSHIP	-.014	-.018	.032	.004	.005	.008	-.023	-.150	.004	.015	.011	-.002
PASSENGR	-.047	-.053	.009	.004	-.002	-.026	-.010	-.037	-.072	-.055	-.052	-.050
RECREATN	-.106	-.167	-.115	-.008	-.119	.076	-.076	.0007	-.349	-.223	-.310	-.181
TANKBARG	.027	.048	.112	.068	.035	.080	.042	.006	.030	.025	.049	.036
TANKSHIP	-.007	-.014	.029	-.008	.003	.002	-.022	-.018	-.004	.012	.002	-.010
TUGBOAT	-.092	-.104	-.048	-.110	-.112	-.104	-.119	-.112	-.096	-.104	-.104	-.092
USFLAG	.052	.058	.050	.069	.101	.067	.068	.072	.061	.073	.058	.057