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Investigating non-compliance behavior with fisheries regulations in the Persian Gulf

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Abstract: Non-compliance with fishing regulations by Iranian fishermen in three provinces of Khuzestan, Bushehr, and Hormozgan along the Persian Gulf was investigated. Using a questionnaire and a stratified random sample method, a total of 566 fishermen were interviewed. The legitimacy variables (outcome and process) that can explain the observed noncompliance with zoning regulations for the shrimp fishery were examined. A Tobit econometric technique was used to estimate the violation decision by Iranian fishermen in the study area. The model was classified into two types: the basic model and the extended model. The key results indicate that one of the factors influencing fishermen to violate the regulation is the differential in the potential income between shrimp fishing zone and other areas. The results also indicate that the moral judgment variable (MCODE) and exogenous variables of probability of detection and conviction play a key role in the violation decision of fishermen. In general, the extended model using an exogenous determinant of probability of detection and conviction in the Tobit estimation technique gave better results than the enriched model using raw probabilities.

Keywords: Fisheries management, Regulation, Legitimacy, Persian Gulf, Iran

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Introduction

The property right over fishery resources in Iran is with the government. The government attempts to manage fisheries activities by imposing regulations on fishing gears and fishing time. The Iranian fisheries organization as a part of government is responsible for regulating and managing the fisheries resources of Iran and is also concerned with enhancing the social and economic conditions of the fishing communities.

In spite of government efforts, in practice, the noncompliance with the regulation by a large number of fishermen exists. The fishery managers believe that the noncompliance with fishery regulations is a serious problem and has a negative effect on the fishery management programs. Therefore, there is a need to investigate the causes of noncompliance behavior of fishermen.

There are several studies on the economics of violation of regulations. The main assumption in an economic analysis of a criminal behavior is that individuals are rational decision makers who respond to the costs and benefits of participation in illegal activities (Furlong, 1991).

The economic rationale for regulating the fishery is very clear. Economic policies to remedy these problems should, thus, 1) find methods of rationing the amount of effort in the fishery, 2) find methods of regulating the harvest to maintain efficient stocks of fish, and 3) recognize that any policy implemented may affect the distribution of income through the reduction of effort and by generating rents (Hartwick & Olewiler, 1986). Scott (1979) gave the following reasons for the importance of fisheries regulations: 1) the declining trend in catches, 2) the decline in fishermen's profits, and 3) the increasing problems of overfishing.

The fundamental point of departure is that people are rational maximizing beings. Therefore, we should find that 1) crime rates respond to the costs and benefits of committing crimes, and 2) people respond to deterring incentives. It follows that devoting resources to detection and conviction should influence the level of crime (Jackson & Jones, 1985). Becker (1968) emphasized that people need not be rational all the time, but it is enough that varying the expected penalty influences the criminal behavior at the margin for deterrence to work. Various economic models have been influential in directing thinking about, and analyzing criminal behavior. The recent literature focused on the role of legal actions, informal sanctions, normative perception and also the rewards and losses of criminal activities. Studies on compliance behavior (outside fishery economics), which have dealt with illegal activities include Becker, 1968; Ehrlich, 1973; Brown & Reynolds, 1973; Block & Heineke, 1975; Heineke, 1978; Clark, 1980; Lee, 1984; Sherman, 1993; Hegtvedt & Johnson, 2000; Tyler, 2002; Sunshine & Tyler, 2003.

The objective of the present study is to examine and identify factors that lead to noncompliance with the fisheries regulations in the Iranian port of the Persian Gulf.

Materials and methods

This study is built on deterrence theory and criminal behavior. The individual behavior model presupposes that people are rational maximizing beings and their violation rates respond to the cost and benefits of committing crimes. The violation activities will increase the cost side of the cost-benefit calculus for the offenders. This essentially is the deterrence theory. Deterrence through enforcement activities can influence individuals to reduce their criminal activities and therefore individual's assessment of his interest by taking into account the cost factors involved in violating the regulations. Becker (1968) argues that comparing the costs and benefits of clearing up a particular crime allows us to find an optimal level of crime prevention. There are a numbers of studies being carried out in some Asian countries (Kuperan, 1992; Susilowati, 1998; Kuperan & Sutinen, 1998).

The empirical model estimated to test the relationships between the dependent and independent variables is specified in this section. In this study the independent variable is the violation rate (VR), over a period of time in the shrimp fishing zone (SFZ).

There are three important factors hypothesized to affect the violation decision, namely biological, deterrence, and social factors. The biological factors in the fishery are reflected by stock conditions. The differences in the level of stocks in SFZ and other fisheries will motivate fishermen to fish in the prohibited zone. This factor is accounted by the value of catch per unit effort in the SFZ (CPUES) and the value of catch per unit of effort in the areas outside SFZ (CPUEF). The CPUE in each area is obtained by dividing the landings per fishing days by the total fishing hours per day.

The deterrence factors which include enforcement inputs and social factors as reflected by the moral obligation of individuals are important for obtaining compliance with the regulations. The deterrence factor is measured by the probability of detection and sanction (OVEPROP). The probability is a subjective probability of detection and sanction and includes four measures of the probability in this study:

1) Probability of being detected while fishing in the SFZ (RECOG1),

2) Probability of being arrested given detection (AFTRECOG2),

3) Probability of being brought to court given arrest (COURT3),

4) Probability of being found guilty given the fishermen is brought to court (PUNISH4).

The psychological and social variables in the model are measured by the level of moral development stage of the individual fisher (MCODE), while the social environment effect such as social norms is captured by the subjective assessment of the percentage of fishermen's violating the regulation as perceived by the individual fisher (PERTVIOL), and the perceived moral obligation to comply with the directives of an authority is measured by the (LEGITIMACY) variables. Therefore, the econometric model in this study can be summarized as follows:

Basic deterrence model is:

$$VR = f\,(OVEPROB, CPUES, CPUEF) \quad (1)$$

And the enriched model is:

$$VR = f\,(OVEPROB, CPUES, CPUEF, MCODE, PERTVIOL, LEGITIMACY) \quad (2)$$

Where, VR is the violation decision to fish in the SFZ and takes a value of one if the respondent is a violator and zero otherwise.

OVEPROB is overall probability of detection and conviction which is a subjective probability obtained directly from fishermen through a face-to-face interviews and is estimated as explained in equation (3).

VCPUEF is an index of value of catch per unit of fishing effort outside the SFZ. This variable is measured in terms of value of fish landings outside the SFZ divided by the number of fishing hours.

VCPUES is an index of value of catch per unit fishing effort in the SFZ. This variable is measured in terms of value of shrimp landings in SFZ during the shrimp fishing season divided by the number of fishing hours.

MCODE is the Moral development stage of individual fisherman in Kohlberg's scale: 1) pre-conventionalist, 2) conventionalist, 3) post-conventionalist. He stated in his theory of moral development that the pre-conventionalist and conventionalist were more likely to violate a regulation than post-conventionalist.

PERTVIOL is a subjective assessment of the percentage of fishermen's violating the regulation as perceived by the individual fishermen. This variable reflects the influence of other people's actions on the individual's behavior.

LEGITIMACY is measured by using a number of variables, which are identified as the outcome or process variables. LEGITIMACY in this study is a normative assessment of individuals on the appropriateness or right of enforcing agencies to restrict their behavior. Compliance will be higher when individuals accord a higher level of legitimacy to the enforcing agencies because they believe that the authority enforcing the law has the right to dictate behavior (Tyler, 1990).
Since the probability is a subjective probability of detection and conviction, the overall probability (OVEPROB) is a series of the conditional probabilities mentioned above and is estimated as follows:

OVEPROB = RECOG1*AFTRECOG2*COURT3*PUNISH4 (3)

Instead of overall probability (OVEPROB), several combinations of subjective probabilities were also tried in the model as a proxy probability variable. There is another approach using estimated probabilities as an instrument variable. In this approach, the overall probability of detection and conviction could be hypothesized as a function of the instrument variable of enforcement inputs and the capacity of fishing boat to escape from detection as estimated by the individual fishermen. Thus, the estimate of OVEPROB is generated as follows:

OVEPROB = f (SBOATNO, FBOATNO, POWER, DAY, TON) (4)

Where,

SBOATNO is the number of patrol boat that fisher believes are in operation in the fishing area.

FBOATNO is the number of times fisher has seen enforcement personnel at sea.

POWER is horsepower rating of the engine in the fisher's boat.

DAY is the number of fishing days over the study period of one year.

TON is the tonnage of fishermen's boat.

The analytical framework of violation model employed by Kuperan (1992) and Sutinen and Kuperan (1998) are used in this study with modification and refinement on the technique and procedure of estimation and specification of the operational variables.

There are two key dependent variables in this study, the violation rate variable (VR), and the number of days an individual fisher has fished in the SFZ (ILGDAY). The violation decision is estimated using a Probit and a Logit model, while the number of days fished in SFZ is estimated using an Ordinary Least Squares regressions (OLS) and a Tobit model.

Regression models in which the regressed evokes a yes or no response, are known as dummy dependent variable regression models. They are applicable in a wide variety of fields and are used extensively in survey or census-type data. In this study, the problem is one in which the dependent variable is a dummy variable (mix of zero and greater than zero values). The simplest way to handle this problem is to remove the observations with zero values from the dependent variable and estimate the remaining observations using OLS regression (Kuperan, 1992). There are specialized censored regression models that allow for the use of all the information in the sample. The model needed is the one that will enable the explanation of the two sources of violations in the dependent variable 1) resulting from the changes in the explanatory variables for observations where the dependent variable is positive, and 2) resulting from changes in the probability of being above the zero limit. The Tobit regression model enables the explanation of the two sources of violations mentioned above.

The study area covers three Iranian provinces on the coast of the Persian Gulf, namely Khuzestan, Bushehr and Hormozgan. These provinces are shrimp fishing areas in the south of Iran. The selected area for the study was arrived at after discussions with Shilat officers, the managers of fishermen's cooperatives, and from the Hormozgan Fishery Research Center researchers on the frequency of occurrence of violations by fishers in the respective provinces. The results of the research reports and publications on the issue led to three provinces being chosen for the study.

The data for this study was collected using a written questionnaire and face-to-face interviews. This work was carried out in several phases. The questionnaire was first shown to the fisheries company officers in the Headquarters and province's Fishery Director Generals and fishery enforcement officers, fisherman cooperatives' members and endorsed by most of them. It was then tested on a number of fishers in each province. Changes were made to sequences the questions and the wording used to enable smooth interviews by the enumerators. The face-to-face interviews to collect the primary data in three provinces were conducted by four research assistants from the Persian Gulf & Oman Sea Ecology Research Center located in Hormozgan province. In addition to each of the provinces, two local persons were chosen to help the enumerators. The interviewers were chosen because of their working experience in the study area, proficiency in the use of local language in the study area, and their background knowledge. They were given training for few days before they undertook the survey and during the fieldwork. During the training course they were exposed to the objectives of the study, characteristics of the respondents and the area of the study, and the questionnaire format. They were taught how to ask the questions and record the answers. In each of the provinces the survey was carried out over a period of fifteen to twenty days under the author's supervision. The average interview took about one hour to complete.

Based on the fishing communities and the fishing vessel type, the "stratified sampling technique" was used for selecting the samples among the fishing population. This method was chosen because stratification is useful when a population is characterized as heterogeneous but consists of a number of homogeneous strata (Nachmias & Nachmias, 1981).

The number of samples was 556 respondents in the three provinces of Khuzestan, Bushehr, and Hormozgan. Fishermen were stratified based on the fishing communities and the fishing vessel type. It was nearly impossible to interview the fishermen in their homes as they were often away from home. Therefore, they were interviewed on their vessel's deck or at the landing places.

Table 1 shows the sample size and population of total and active vessels in the Persian Gulf chosen for the study. The sample used for analysis consisted of 151 in Khuzestan province, 283 in Bushehr and 132 in Hormozgan province. The sample also consisted of 221 small Boats and 341 wooden Dhows.

Table 1: Statistical population and sample size of fishing vessels

Province	Sample (No. of vessels)	Population (No. of vessels)		Sample percent of active vessels (No.)
		Total vessels	Active vessels	
Khuzestan	151	1950	1482	11%
Bushehr	283	2765	1736	18%
Hormozgan	132	2693	1489	9%
Total	566	7608	4707	12%

The secondary information were also collected from the various reports of SHILAT, IFRI, DRCD, FAO, ISC, and other related governmental departments and NGO's.

Results

1. Profiles

First, we present a brief description of the survey respondents, biological factors and surveillance activities in the study area. Tables 2 to 4 show the mean value of the key variables for the study area and for each of the provinces. Then, show the result of using exogenous variables in the econometric model (Table 6).

Based on the survey as Table 2 shows, on average the Iranian fishermen in the Persian Gulf were about 36 years old with no significant difference between provinces. On average, the fishermen in Khuzestan were older (37.9 years old) than the fishermen in Bushehr (33.9 years old) and Hormozgan (37.4 years old). However, the fishermen in Hormozgan had more experience in fishing (18.3 years) followed by fishermen of Khuzestan province (17 years) and the Bushehr's fishermen (16 years). In the term of literacy, on average, the educational level of all respondents among the Iranian fishermen in the Persian Gulf was found to be low with the number of years in school about 2.8 years in Khuzestan, 3.7 years in Bushehr, and 3.5 years in Hormozgan.

Number of fishing days by respondents was more than 272 days per year in the study area. Fishing days in Hormozgan (280 days) were higher than those in Bushehr (274 days) and Khuzestan (264 days).

Table 2: A profile of the study area, fishermen characteristics

Variable	Khuzestan	Bushehr	Hormozgan	Average
Age (years)	37.9	33.9	37.4	35.8
Experience (years of fishing)	16.9	15.9	18.3	16.8
Day (fishing days per year)	263.8	273.7	279.5	272.4
EDU*(years)	1.79	2.37	2.13	2.16

Note:

* = Code for educational level: 0 = no schooling; 1 = less than five years;

2 = between 6 – 9 years; 3 = between 10 – 12 years; 4 = more than 12 years.

On average, the amount of landings was 13282kg of fish per vessel per year and about 1440kg of shrimp per vessel. By province, the average fish landing in Hormozgan was 15887kg and shrimp landing was 1745kg per vessel, while in Bushehr it was 13404kg of fish and 1274kg of shrimp followed by Khuzestan (10777kg fish and 1482kg shrimp). The mean value of the CPUE was a very important variable in this study and it was shown that there was a significant difference between shrimp fishing zones (SFZ) and the other fishing grounds. It is seen that there is a significant difference in the value of catch per unit effort between the SFZ (VCPUES) and other fishing zones (VCPUEF), since on average the value of catch per unit of effort in SFZ was $US 230, while it was $US 79.7 in the other fishing zones. By provinces, the average value of catch per unit of effort in SFZ, in Khuzestan was $US 247, in Bushehr $US 213, and in Hormozgan $US 250. This was a considerable economic and biological factor that pushes fishermen to fish in the SFZ (Table 3).

Table 3: Identification of economic and biological factors in the study area

Variable (Kg per vessel)	Khuzestan	Bushehr	Hormozgan	Average
Fish	10777	13404	15887	13282
Shrimp	1482.4	1273.9	1754.5	1439.5
CPUEF	54	67	79.4	66.4
CPUES	49.4	42.6	50	46
VCPUEF ($)	64.8	80	95.3	79.7
VCPUES ($)	247	213	250	230

As Table 4 shows the fishing fleet's size was measured by the size of boat's tonnage and horsepower. The vessel tonnage employed by respondents in the area of study on average was about 29 tons which was not significantly different between the three provinces. The horsepower of the boats employed by fishermen in Hormozgan was found to be bigger, averaging 135.7 HP followed by Bushehr (121 HP) and Khuzestan (108.2 HP). The size of fishing fleet determines the number of fishing days per trip or per year, fishing hours, and the amount of catch. The total percentage of violation of the regulation in the southern fishery of Iran was about 43% of the country samples, while for the covered provinces, 47% of the respondent had violated the fishery regulation in Khuzestan, 39% in Bushehr, and 48% in Hormozgan province. The surveillance activities for shrimp zoning regulation in the study area could be gauged from the frequency of enforcement undertaken by the authorities (FBOATNO) and the number of patrol boats seen by fishers at sea (SBOATNO). In the respective provinces, the surveillance activities were extremely low and on average was only about two times a year. At the same time, only two or thee patrol boats were seen by fishers

Table 4: A profile of the study area, deterrence factors

Variable	Khuzestan	Bushehr	Hormozgan	Average
Ton (GRT)	28	28	32.2	29
POWER (Hp)	108.2	120.	135.7	121
PERTVIOL (%)	20	14	17	16.5
SBOATNO (no.)	3.1	2.2	1.6	2.3
FBOATNO (no.)	2.5	1.8	1.8	1.9

Four measurement of the probability of detection were used in this study. In the interviews conducted during the survey of fishers, the captains of the boat were asked their assessment of the probability of being detected while fishing in the prohibited area (RECOG) by enforcement authorities, probability of being arrested given detection (AFTRECOG), probability of being brought to court (COURTNO) given arrested, and the probability of being found guilty (PUNISH) given the fisher is brought to court. The results showed on average, fishers in the study area perceived that the probability of detection while fishing in the prohibited area (RECOG) by enforcement authorities was about 34 percent, probability of being arrested given detection (AFTRECOG) was 38 percent, probability of being brought to court (COURTNO) given arrested was 41 percent, and the probability of being found guilty (PUNISH) given the fisher brought to court was 20 percent (Table 5).

Table 5: A profile of the study area, variables of conditional probabilities

Variable (%)	Khuzestan	Bushehr	Hormozgan	Average
Recog	38	28	29	34
Aftrecog	46	34	38	38
Courtno	47	38	41	41
Punish	25	18	20	20

2. Econometric results

Using exogenous variables in the Tobit estimation model performs a number of significant explanatory variables with the expected sign. The result of estimating the ILGDAY using the raw probability is shown in Tables 6 and 7.

As Table 6 shows, in the basic deterrence model only one variable (OVEPROB) is significant at five percent level but had n negative sign. VCPUES and CPUES variables were not significant.

The extended model, meanwhile, contains deterrence, normative, social influence, and legitimacy variables. In this model, the number of significant explanatory variables at the 10 percent level with a correct signs was seven. The variables which are significant in determining the violation behavior of the fishers are CPUEF, CPUES, MCODE, GOVERN, ALL, INDUS, and ENFORC. The variables OVEPROB and FVEIW were significant with an unexpected signs. The MCODE variable became significant at 10 percent and the outcome variable (INDUS) became significant in the Tobit model, too. The variables RESOUR was not significant but, the variables ENFORC became significant at 5 percent in the Tobit model.

The Tobit model shows that moral development variable (MCODE), three outcome variable (GOVERN, ALL, and INDUS), and only one process variable (ENFORC) were significant. The variable of social standing (PERTVIOL) was not significant in the Tobit model.

Table 6: Tobit estimation of ILGDAY, basic and extended models using raw probabilities

	Basic Model	Enriched Model
Variable	Coefficient (t-ratio)	Coefficient (t-ratio)
CPUES	0.32105E-03 (1.3946)	0.37313E-03 (1.5771) *
CPUEF	-0.31463E-03 (-1.3682)	-0.36667E-03 (-1.5514)*
OVEPROB	0.50794 (2.7298)**	0.33174 (1.7207)* #
RESOUR ❶		0.18792E-01 (0.25190)
DIFFER❶		-0.58085E-01 (-1.0144)
GOVERN❶		0.34519 (3.7488)***
ALL❶		0.86895E-01 (1.4384) *
TRADI❶		0.20852E-01 (0.35384)
INDUS❶		0.14535 (2.1233)**
ENFORC❷		-0.12461 (-1.8895)**
FVIEW❷		-0.15989 (-2.6936) ***#
FINES❷		0.38477E-01 (0.46702)
IMPOSE❷		0.46265E-01 (0.86025)
ACTIVE❷		-0.85982E-02 (-0.15296)
AWAY❷		-0.58872E-01 (-0.74353)
MCODE		-0.25159 (-1.7175)*
PERTVOL		-0.18531 (-0.68572)
CONSTANT	-0.27528 (-4.7253)***	-0.30207 (-1.1636)
Log-likelihood Function	-1169.6439	-1150.6278
SIGMA	0.74550E-01 (20.389)***	0.76897E-01 (20.448)***

❶ = outcome variables *** = significant at%1 ** = significant at %5

❷ = process variables * = significant at %10 # = unexpected sign

Table 7: Tobit estimation of ILGDAY, basic and extended models using exogenous variables

	Basic Model	Enriched Model
Variable	Coefficient (t-ratio)	Coefficient (t-ratio)
CPUES	-0.13587E-02 (-2.5373) **	-0.11654E-02 (2.0844)**
CPUEF	-0.38574E-03 (-1.4915)*	-0.38763E-03 (-1.4829)*
MCODE		-0.24470 (-1.6508)*
PERTVIOL		-0.49577E-01 (-0.17660)
DAY	0.17458E-02 (3.5608)***	0.15547E-02 (3.0154)***
SBOATNO	-0.63488E-02 (-0.24873)	-0.18171E-01 (-0.67369)
FBOATNO	-0.97846E-01 (-3.4278) ***	-0.93917E-01 (-3.0937) ***
POWER	0.48862E-03 (0.60909)	0.67373E-03 (0.82983)
TON	-0.48342E-03 (-0.60202)	-0.66768E-03 (-0.82156)
RESOUR ❶		0.28987E-02 (0.38375E-01)
DIFFER❶		-0.92229E-01 (-1.5443) * #
GOVERN❶		0.30056 (3.2035) ***
ALL❶		0.87164E-01 (1.4210)*
TRADI❶		0.24493E-01 (0.41142)
INDUS❶		0.90982E-01 (1.2949)
ENFORC❷		-0.14117 (-2.1254)**
FVIEW❷		-0.17858 (-2.9669)***#
FINES❷		0.52902E-01 (0.63346)
IMPOSE❷		0.10527 (1.8891)**
ACTIVE❷		-0.34961E-01 (-0.61235)
AWAY❷		-0.12868 (-1.5728)*
CONSTANT	-0.48413 (-2.8631)**	-0.39726 (-1.3440)*
Log-likelihood	-1156.1899	-1137.5786
SIGMA	0.76099E-01 (20.485)***	0.78401E-01 (20.542)***

❶ = outcome variables *** = significant at %1 ** = significant at %5

❷ = process variables * = significant at %10 # = unexpected sign

As the second column of the Table 7 (Basic model) shows, CPUEF is significant at 5 percent level and CPUES is significant at 10 percent level, but both had negative signs. The FBOATNO and DAY were significant at one percent level of significance.

The third column of Table 7 shows the results of the extended model for explaining ILGDAY. In Tobit model using exogenous variables, the number of significant explanatory variables at the 10 percent level was 10. The variables which are significant in determining the violation behavior of the fishers in Tobit model using exogenous variables are CPUEF (5%), CPUES (10%), MCODE (10%), DAY (1%), FBOATNO(1%), GOVERN(1%), ALL(10%), ENFORC(5%), AWAY(10%), and IMPOSE(5%). The catch per unit effort (CPUES and CPUEF) variables were significant and of the expected sign.

Discussion

In general, the extended model using exogenous determinant of probability of detection and conviction in the Tobit estimation technique gave better results than the enriched model using raw probabilities since the log-likelihood value and percentage of right prediction of the model and the number of significant explanatory variables at 10 percent level with the expected signs were higher.

Overall, in the extended model using exogenous determinant of probability of detection and conviction (as the selected model), the variables there were found to be significant with the expected signs were CPUEF, CPUES, MCODE, DAY, FBOATNO, POWER, TON, and six legitimacy variables. This result indicates most variables are significant in the extended model using exogenous variables. The key results from this study indicate that one of the factors influencing fishermen to violate the regulation is the differential in the potential income between shrimp fishing zone and other areas.

The results from this study also show that non-deterrence variables such as moral development and legitimacy variables in the fishing community do influence compliance behavior of fishermen in addition to the impact of enforcement inputs. The non-deterrence variables have great potential to be used in the regulatory policy arena for increasing compliance level in a more cost efficient way than using enforcement inputs alone. The moral judgment variable (MCODE) appears to be an important variable in explaining violation decision in the study area and supports the theory in the compliance literature while the influence of others are not significant and do not support the theory.

Theoretically, the role of legitimacy variables in securing compliance with regulation is important. Tyler (1990) emphasizes that compliance with a regulation is influenced by the extent to which individuals accord legitimacy to the enforcing agencies. Fishermen who agree with the distributive objective of the regulation are more likely to comply with the regulation than those who do not. Their agreement with the outcomes of the regulations increases the legitimacy of the enforcement agency thus increasing their compliance. The legitimacy variables also have considerable role in explaining compliance behavior by the Iranian fishermen in the Persian Gulf since six (three outcome and three process variables) of the legitimacy variables are significant in the model to explain the violation rate. Tyler (1990) concluded that the process variables are more important in explaining compliance behavior than the outcome and Kuperan and Sutinen (1998) found that the outcome variables are more important than the process variables in explaining compliance behavior. Results of this study show that both outcome and process variables have an important role in influencing legitimacy and then in explaining compliance behavior. The effect of what other fishers are doing has only a positive impact on the violation decision of Bushehr's fishermen.

The results also indicate that the exogenous variables of probability of detection and conviction play a key role in the violation decision of fishermen. These variables are the number of fishing days (DAY) that seems to play a key role in explaining the violation decision of fishermen in the study area. The other variables are the horsepower of fishermen boat's engines (POWER) and number of times that fishermen have seen the enforcement personnel at the sea (FBOATNO).

The larger catch per unit effort in SFZ is an important factor for explaining the number of days violated. Two of the exogenous variables of probability of detection and conviction FBOATNO and DAY were significant at one percent level. The number of fishing days (DAY) seems to play a key role in the violation decision of the fishermen in noncompliance behavior. This indicates that the higher fishing effort is an important factor for explaining the number of days violated. The positive sign for DAY could mean that the higher the number of days fishing at sea the higher is the probability of violating the regulation. The negative sign for FBOATNO implies that the more the fishermen see enforcement personnel in more number of times at sea the lower is the probability of violating the regulation. It can be concluded that the model using exogenous variables provides a better explanation of the compliance behavior by Iranian fishermen in the Persian Gulf.

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