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THE ECONOMICS OF VIOLATION BEHAVIOUR OF FISHERS IN INDONESIA, MALAYSIA AND THE PHILIPPINES*)

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ABSTRACT

This paper examines the behaviour of the fishers violating a zoning regulation under a condition of limited enforcement in the fisheries of Indonesia, Malaysia and the Philippines. Rational utility theory is used as a framework for explaining compliance behaviour. Samples of 304 violators from the study area were used in the analysis. Tobit model is employed in the analysis. The results indicate that economic, morality and social influence factors determine the overall violation decision of individual violators fishing in the prohibited area. In general the findings of the study were consistent with the theoretical model of compliance behaviour tested by previous researchers. Enforcement is costly, thus to improve fishers' compliance in the study area there is a need to use other determinants of compliance such as morality and social influence factors. Fisheries management authorities should also explore alternative approaches for managing fisheries such as participatory or community-based management approaches. Such approaches may incur lower monitoring and enforcement costs.

Keywords: Violation, non-compliance, fishers, zoning regulation, enforcement, Tobit, regulation, policy.

I. INTRODUCTION

Most governments regulate the fisheries through licensing, area and gear restriction schemes. One such area restriction schemes is the zoning regulation. The paper focuses on zoning regulation, which is used to manage the fisheries in Indonesia, Malaysia and the Philippines. This regulation prohibits large-scale fishers from operating in the inshore areas. There are four main zones for Indonesia (zone 1 to 4) and Malaysia (zone A to D), respectively. The waters of Philippines are divided into two zones, national and municipal. The alleged rationale for the zoning regulation is an attempt at a fair allocation of fishing ground and resources between the highly efficient trawlers and the less efficient traditional gears. This is expected to reduce competition and conflict between the operators of the two different gears (Jahara, 1988). The regulation is also aimed at reducing overfishing in the inshore waters.

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The problem examined here is the high incidence of non compliance with zoning regulations by the fishers under a condition of limited enforcement in the fisheries of Indonesia, Malaysia and the Philippines as affirmed by Gatra (1996); Forum (1996); Department of Fisheries of Malaysia (1996) and Sutinen et al. (1988).

Although the zoning regulations have been imposed to manage fishers, in practice the non-compliance and incidence of encroachment by the large-scale gears and even by foreign vessels into the prohibited fishing area is common. The outcome of non-compliance with the zoning regulation is over-fishing and conflicts in resource utilisation. Non compliance with the zoning regulation is a serious problem and undermines the effectiveness of fisheries management. From a management perspective it is worth while to investigate the causes of non-compliance and explore policies for encouraging or securing compliance. In this study the behaviour of the violators of regulation is examined.

II. MATERIALS AND METHODS

2.1. Previous Studies

There are relatively few studies of violation behaviour in the fisheries of Asia with the exception of the work of Kuperan (1993) and Susilowati (1998). They found that economic, morality, environment or social-standing and legitimacy factors influence compliance behaviour. Other empirical studies of regulatory enforcement were undertaken by Blewett et. al. (1987); Sutinen and Gauvin (1989); Blewett et. al. (1987); Blewett et al.(1985); Lepiz and Sutinen (1985); Bean (1990); Sutinen, Raiser and Gauvin (1990); Furlong (1991).

The economics of fisheries law enforcement assessed by Sutinen and Andersen (1985) concluded that enforcement costs are a major determinant of regulatory policy for non-exclusive resources. They also brought forward the idea that enforcement of fisheries law is imperfect and costly and it affects the behaviour of fishing firms and optimal fisheries management policy. Sutinen and Hennessey (1985) also exposed enforcement as the neglected element in fishery management. They questioned the assumption in most of the literature on fisheries management and regulation; i.e. laws can be perfectly enforced without cost.

Sutinen (1996) outlined a comprehensive guideline for evaluating the performance of fisheries compliance and management. The compliance decision of individuals generally involve four factors: (1) the amount of illegal gain or benefit; (2) the expected penalty; (3) moral obligation; and (4) social influence. Under incomplete enforcement, patrolling activities of the authorities does not deter flagrant violators. Frequent violator may not be driven by economic factors solely, but rather than by multidimensional motives. Individual fishers mostly are influenced by their peers, related people or relatives when deciding whether to comply. However, under certain circumstances fishers persist complying when illegal gains are much larger than the expected penalties because they fell the need "to do the right thing". These multidimensional motives are taken into account in this study.

2.2. Theory of Violation

Becker (1968) introduced the basic theory of deterrence. He claimed that violation might be induced by several

motives, such as: (1) basically individuals attempt to maximise utility subject to a budget constraint; and (2) a rational individuals will commit a crime if the expected utility gained from committing the crime is greater than the utility to be gained from engaging in the alternative legitimate activity. This theory of basic deterrence has been extended by including psychological and social factors (Tyler, 1990; Pyle, 1983; Kohlberg, 1984 and Sutinen, 1996) as shown in Figure 1.

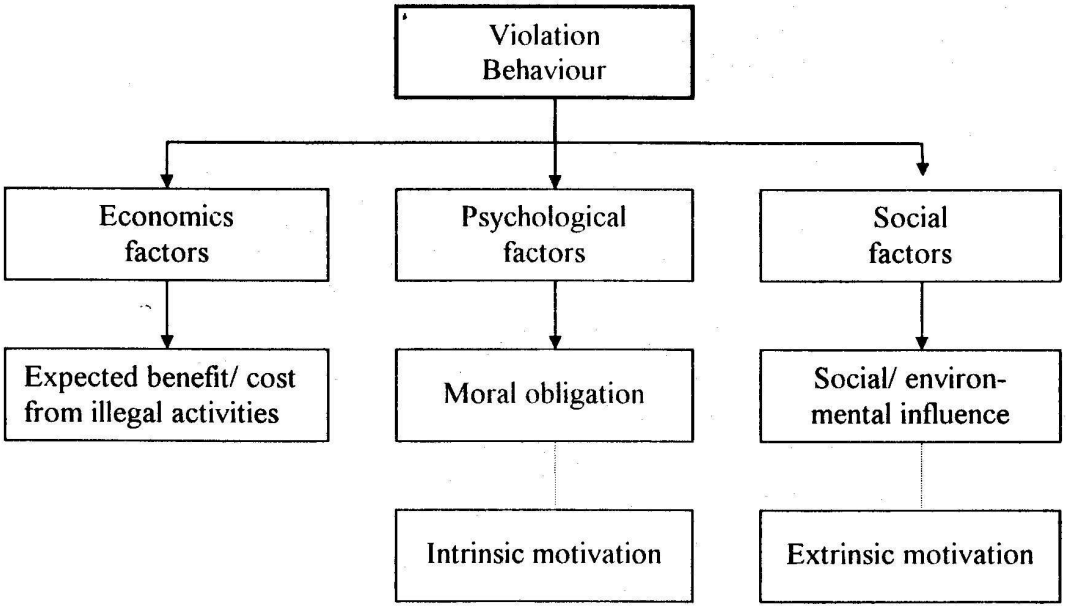

Figure 1: Factors affecting Violator Behaviour

Source: figure is framed from several compliance concepts compiled by the author, 1998.

2.3. Estimation Technique

The behaviour of violators can be modelled using a censored regression or Tobit model (Gujarati, 1995 and Maddala, 1992). For simplicity, the Tobit model can be formulated as follows:

$Y^*_i = \beta X_i + \mu_i$ if RHS, e.g. NFINS > 0

$Y^*_i = 0,$ otherwise.

where Y^*i is observed if $Y^* > 0$ and not observed if $Y^*i \leq 0$. The observed Y_i is defined as:

$$Yi = \begin{cases} Y^*_i = \beta X_i + \mu_i, & \text{if } Y^*_i > 0 \\ 0 & \text{if } Y^*_i \leq 0 \end{cases}$$

μ_i IN $(0,\tau)$

where $Y^*_i > 0$ for those with a positive violation rate (NFINS) and $Y^*_i = 0$ for those with a zero violation rate. The likelihood function for Tobit model as given in Maddala (1992) is:

$$L = \pi_{Y_i > 0} 1 / \tau f[(yi-\beta X_i) / \tau] \pi_{Y_{i\leq 0}} F[-(\beta X_i / \tau])]$$

where the density function of the standard normal is denoted by f(.) and the cumulative distribution function by F(.) is:

$$f(t) = 1 (2\pi)^{1/2} \exp(-t^2/2)$$

and

$$f(z) = \int_{-\infty}^{z} f(t)\, dt$$

is the cumulative distribution function of the standard normal distribution

Maximising the likelihood function with respect to β and τ will give the maximum likelihood (ML) estimates of β and τ. The method of maximum likelihood can be used to estimate the parameters of such models. The SHAZAM computer package is employed to estimate the models. The econometric model, which will be tested in this paper, is:

$$\begin{aligned} NFINS = {} & \beta_0 + \beta_1 \textit{PROBABILITY} + \beta_2 \text{ ICPUEO} \\ & + \beta_3 \text{ ICPUEI} + \beta_4 \text{ MCODE} + \beta_5 \\ & \text{PERTVIOL} + \beta_6 \text{ CONSERVE} + \beta_7 \\ & \text{JUST} + \beta_8 \text{ CONFLICT} + \beta_9 \\ & \text{EVERYONE} + \beta_{10} \text{ INSHORE} + \beta_{11} \\ & \text{OFFSHORE} + \beta_{12} \text{ RIGHT} + \beta_{13} \\ & \text{VIEWS} + \beta_{14} \text{ NONCONST} + \beta_{15} \\ & \text{NODETECT} + \beta_{16} \text{ PENALFIT} + \beta_{17} \\ & \text{ENFORADQ} + \mu \end{aligned}$$

The definitions of these variables are given in Table 1.

Table 1. Code, Definitions and Measurement of Variables Used in the Models

Code	Definition
Dependent/Endogenous Variables:	
NFINS	Number of day's respondent has fished in the prohibited zone for the last one year (in days). Only respondent with NFINS ≥1 is taken as the sample (violator).
Independent Variables:	
OPROB	Overall probability of detection and conviction (in %).
ICPUEO	Index of catch per unit effort from fishing offshore
ICPUEI	Index of catch per unit effort from fishing inshore
MCODE	Moral development stage of individual fisher (using Kohlberg's scale, 1=preconventionalist; 2=conventionalist; 3=postconventionalist).
PERTVIOL	Subjective assessment of the percentage of fishers violating the regulation as perceived by the individual fisher (in %)
CONSERVE	Outcome variable, a ranking (in scale, range 1 to 5) variable on whether the fisher believes the regulation helps to conserve the fishery.
CONFLICT	Outcome variable, a ranking (in scale, range 1 to 5) variable on whether the fisher believes the regulation helps to reduce conflicts.

JUST	Outcome variable, a ranking (in scale, range 1 to 5) variable on whether the fisher believes the regulation is fairly imposed.
EVERYONE	Outcome variable, a ranking (in scale, range 1 to 5) variable on whether the fisher believes the regulation improves the long term well being of everyone (fish producers and consumers).
INSHORE	Outcome variable, a ranking (in scale, range 1 to 5) variable on whether the fisher believes the regulation improves the long term well being of inshore fishers.
OFFSHORE	Outcome variable, a ranking (in scale, range 1 to 5) variable on whether the fisher believes the regulation improves the long term well being of offshore fishers.
RIGHT	Process variable, a ranking (in scale, range 1 to 5) variable on whether the fisher believes the regulation has been rightly imposed.
VIEWS	Process variable, a ranking (in scale, range 1 to 5) variable on whether the fisher believes their views have been taken into account in formulating the regulation.
NONCONST	Process variable, a ranking (in scale, range 1 to 5) variable on whether the fisher believes the regulation is not consistently enforced.
NODETECT	Process variable, a ranking (in scale, range 1 to 5) variable on whether the fisher believes violators of the regulation are getting away without being detected by enforcement officers.
PENALFIT	Process variable, a ranking (in scale, range 1 to 5) variable on whether the fisher believes the penalties given to the fishers who are caught commensurate with the offence.
ENFORADQ	Process variable, a ranking (in scale, range 1 to 5) variable on whether the fisher believes the enforcement activities is adequate.
NPBOATS	Number of patrol boats operating in fishing areas as seen by the fisher over the last 12 months (in number of boats).
NENFOR	Frequency of enforcement activities perceived by the fisher at the sea (in number of times fisher have seen enforcement personnel)
HP	Horse power of engines in the boats used by fisher (in HP)
TON	Tonnage capacity of fishing boat (in tons)

Note: Outcome and process variables represent legitimacy accorded by the individual fisher to the regulation and regulatory agency with code 1=completely agree; 2=agree; 3=not sure; 4=disagree; 5=completely disagree.

2.4. Data Collection

The study area for Malaysia covers Kuala Kedah in Kedah State. In Indonesia, the Central Java Province, i.e. Pekalongan and Juwana Regencies were chosen and four locations in the Philippines (Iloilo and Capiz Provinces were Roxas City, Conception, Iloilo City and Tigbauan) were selected as the study areas.

Multistage sampling method was applied to obtain the total sample of 658 fishers randomly for the three countries. However, only 304 respondents are identified as violators with distribution as follows:

Table 2. Sample distribution

Violator Grouping*	Malaysia	Indonesia	Philippines	Total
Light	28	32	100	160
Moderate	23	33	8	64
Flagrant	58	20	2	80
Total Sample (violator only)	109	85	110	304
Grand Total [1/]	126	187	255	568
% violator	86.5	45.5	43.1	53.5

Note:

* Light violator : if there are violation ranges from 1 to 20 times in the last one year
Moderate violator: if there are violation ranges from 21 to 100 times in the last one year
Flagrant violator : if there are violation ranges from 101 to 350 times in the last one year

[1/] Total sample comprises violators and non-violators

III. RESULTS AND DISCUSSION

The zoning regulation in Malaysia prohibits trawlers from fishing within five miles from the shoreline. For Indonesia, the zoning belt is within three miles and for the Philippines is within the municipal water, which is about 15 km from the shoreline. Fishers who had experience fishing in the prohibited area once in the last twelve months were considered as violators of the zoning regulation. The percentage of violator respondents in Malaysia is the highest (86.5%) and followed by Indonesia and the Philippines of 45.5% and 43.1%, respectively.

Two models of violation intensity will be discussed are the economic model and the enriched model.

3.1. The Economic Model

The economic model considers only deterrence and illegal gains as the main factor affecting violation behaviour. Deterrence is measured in term of the probability of detection and conviction (OPROB) while catch per unit effort in offshore, ICPUEO and catch per unit effort inshore (ICPUEI) are used to measure the economic gains. The violators are divided into three types, i.e. light, moderate and flagrant violators. For all violators, the probability of detection and the catch per unit effort offshore are significant at 5% level or lower and have the theoretically appropriate signs. This implies that enforcement does have an effect on the intensity of violation, and the condition of the fishery (in term of stock available lowers the need for illegal fishing).

The best results are however obtained for the light violators confirming the view that light or occasional violators can be brought to comply through increased enforcement. Also the condition of the fishery stock as reflected in the catch per unit effort index in the inshore and offshore is important in influencing the intensity of violation for the light violators. For moderate violators however the illegal gains appear not to be important while the probability of detection variable has the wrong sign. While for the flagrant violators, the probability of detection is not significant but the condition of the fishery as reflected by the catch per unit effort in the offshore is significant in determining the intensity of violation. The overall results suggest that moderate and flagrant violators are not likely to be deterred for violation pure by enforcement only. Other approaches may be required to reduce incidence of violation among flagrant violators. The results also imply that the motivation for violation may be different between light violators and flagrant violators. This has important implication for enforcement policy. The result of economic model is summarised in Table 3.

Table 3. Tobit Estimation of Intensity of Violation (Economic Model)

Variable	All Violator: Coefficient (t-ratio)	Light Violator: Coefficient (t-ratio)	Moderate Violator: Coefficient (t-ratio)	Flagrant Violator: Coefficient (t-ratio)
OPROB	-83.073 (-5.633****)	-8.401 (-4.627****)	20.112 (1.667#)	-18.275 (-0.600)
ICPUEO	-122.31 (-2.218**)	-60.214 (-3.107****)	-18.533 (-1.053)	190.44 (1.791*)
ICPUEI	18.832 (0.412)	37.597 (2.274**)	28.669 (0.740)	-60.504 (-0.570)
INTERCEPT	110.28 (2.109**)	25.209 (2.703***)	46.040 (1.190)	76.189 (0.751)
SIGMA	(23.080****)	12.640***	11.183****	12.403****
N	568	160	64	80
Log-likelihood function	-2008.177	-339.121	-288.786	-418.112

Note:

**** : significant at 1% level.
*** : significant at 2% level
** : Significant at 5% level
* : significant at 10% level
# : significant with unexpected sign

3.2. The Enriched Model

The non-economic factors of morality, environment influence and legitimacy were combined with the economic factors to form the enriched model. The normative approach considered that social and psychological bases to be important in securing compliance. These social and psychological variables are captured by moral, development (MCODE) and social standing (PERTVIOL) and legitimacy variables. The variables, which are significant in determining the intensity of violation of the overall fishers, are OPROB, ICPUEO, PERTVIOL, MCODE and some legitimacy variables like VIEWS, NONCONST and NODETECT. Hence, probability of detection and conviction and availability of fish stock in offshore remains significant and influence violation in the fisheries. The detailed results are shown in Table 4.

The social standing (PERTVIOL) and moral development (MCODE) were found not significant in all models (except for flagrant violators where MCODE came out significant). This situation can be interpreted that these factors which are suppose to be the normative guideline for the fishers, however when the individual fisher or party was observed solely they may expose their unique internal behaviour or role. The behaviour of intensity violation of the light violator in the enriched model is similar to its behaviour in the scenario of economic model. Enforcement and surveillance is considered as an important factor in deterring the light violator from engaging in illegal fishing activities.

Among the three types of violators (light, moderate and flagrant), the later one is considered as the main target of policy makers to outline the fisheries policies. They are the most frequent encroaches of the prohibited area and are driven by a good strategy as well as multidimensional motives.

The moderate violator behaves as a transition between light and flagrant violator. The results indicated that the moderate violator starts to ignore the probability of detection and convictions when they are fishing. They may perceive that their parties have capability to compete the enforcement launched by the authorities. The economic value of catch however is found to be the most universal factor in violation decision for all parties (light, moderate, flagrant). The non-economic motive such as moral development (MCODE) and social influence (PERTVIOL) factors fail to explain the intensity of violation of the light and moderate violators. However, the intrinsic and extrinsic motivation such as morality and some legitimacy variables were able to influence the intensity of violation of the flagrant violator. This implies that the flagrant violator know that norms and/ or morality are important factors in guiding their decisions to violate. However they do not rely on their internal emotions alone without considering the other motives such as economic returns. The severe violator tend to become indifferent and may disregard the comments or pressure from their environment or society in which they made violation decisions. This situation is indicated by the insignificance of the PERTVIOL variable in the flagrant violator's model.

The legitimacy perceived by the fishers towards the regulatory authorities and/ or institutions was measured by using 12 variables. The six variables including CONSERVE, CONFLICT, JUST, EVERYONE, INSHORE and OFFSHORE are used to capture the individual assessment of the regulation outcomes. These variables are concerned with the final result of a regulation. The other six variables (RIGHT, VIEWS, NONCONST, NODETECT, PENALFIT, ENFORADQ) represent the process by which the regulations are made and enforced and is viewed in terms of the

effectiveness or efficiency and procedural justice of the regulation. Only four out of twelve legitimacy variable were significant in the flagrant violator model such as CONSERVE, VIEWS, PENALFIT, and ENFORADQ and only one variable (VIEWS) was found consistently significant like in the overall model of violation (pool sample). This indicates that the legitimacy variables are unstable and none of the legitimacy variables can be claimed as universal factors in determining the intensity of violation of the different groups of violators.

The fishers expressed that the fisheries regulation has been formulated by accommodating their views as confirmed by the significance of the VIEWS variable at 1% level. The positive sign of ENFORADQ variable in flagrant violator model indicates that the flagrant violator perceived that when the authorities provide insufficient effort on enforcement and surveillance this will give an opportunity to the violators to undertake violation. In fact the enforcement resource and its activities to undertake surveillance in the fisheries especially for Indonesia and the Philippines are still lacking compared to Malaysia (Susilowati, 1998). This situation may provide a favourable condition for the flagrant violators in the study areas. In line with that the negative sign of PENALFIT variable may imply that the more the flagrant violator feels that penalty may not fit with the offences the lower will be his intensity of violation. This implies even the flagrant violator's respond to what is right. The negative sign of CONSERVE variable in the flagrant model can be interpreted that many flagrant respondents disagree with the statement that zoning regulation helps to conserve the fishery, however, this factor is not considered as the main motive for them to enter the inshore waters.

IV. RECOMMENDATIONS

Overall, the models for violators of fisheries regulations in Indonesia, Malaysia and the Philippines support the theory of compliance tested by previous researchers. The expansion of the basic deterrence model to include social and psychological variables indicates the ability of the model to explain intensity of violation. There is sufficient support to demonstrate that personal moral development plays a more important role than legitimacy variable in securing compliance.

It is found that probability of detection were low and violation rates were high especially for Indonesia and the Philippines given their limited resources for enforcement and a large geographical area to monitor. In theory, the level of compliance can be improved by increasing the probability of detection and conviction or by increasing penalties. This can be done by either improving the enforcement process and/ or its intensity. However, it is not very practical because of large financial requirements. To improve fishers' compliance in the study area there is a need to use other determinants of compliance such as morality and social influence factors. In Indonesia and the Philippines, enforcement institutions are not as well established as in Malaysia. Therefore, institutions of enforcement should be given priority in Indonesia and the Philippines. In Malaysia fairly well developed enforcement institutions exist, thus in this case there is a need to enhance the scheme and implement enforcement more effectively. To improve compliance, fisheries management authorities should also explore alternative approaches for managing fisheries such as participatory or community-based management approaches.

Table 4. Tobit Estimation of Intensity of Violation (Enriched Model)

Variable	All Violator: Coefficient (t-ratio)	Light Violator: Coefficient (t-ratio)	Moderate Violator: Coefficient (t-ratio)	Flagrant Violator: Coefficient (t-ratio)
OPROB	-49.077 (-3.649****)	-7.614 (-4.044****)	10.180 (0.761)	-2.806 (-0.110)
ICPUEO	-81.759 (-1.748*)	-51.063 (-2.430***)	-30.766 (-1.692*)	215.70 (2.204**)
ICPUEI	35.969 (0.864)	28.065 (1.517)	91.119 (2.287**)	-52.036 (-0.521)
PERTVIOL	52.776 (4.295****)	0.336 (0.207)	11.773 (1.294)	25.766 (1.571)
MCODE	-46.609 (-5.675****)	-1.081 (-1.081)	7.909 (0.939)	-34.974 (-1.933*)
CONSERVE	3.3394 (0.708)	0.382 (0.603)	6.110 (2.101**)	-8.9948 (-1.842#)
CONFLICT	4.700 (0.915)	-0.788 (-1.074)	-3.102 (-0.995)	6.284 (1.369)
JUST	2.920 (0.595)	0.671 (1.006)	-0.369 (-0.107)	-4.656 (-0.918)
EVERYONE	-0.842 (-0.154)	-0.831 (-1.254)	11.673 (2.331)	1.079 (0.178)
INSHORE	5.704 (1.121)	0.830 (1.201)	-1.917 (-0.648)	1.165 (0.234)
OFFSHORE	4.713 (0.936)	1.277 (1.934*)	3.398 (1.045)	-3.866 (-0.713)
RIGHT	4.819 (0.989)	-0.448 (-0.666)	-2.899 (-0.712)	-3.281 (-0.741)
VIEWS	12.185 (3.108****)	-0.057 (-0.122)	-2.395 (-0.744)	14.131 (2.859****)
NONCONST	-9.515 (-2.440***)	-0.034 (-0.065)	3.332 (1.279)	5.457 (1.150)
NODETECT	20.912 (5.112#)	-0.101 (-0.180)	2.384 (0.783)	5.065 (1.042)
PENALFIT	-2.743 (-0.688)	0.107 (0.178)	-1.780 (-0.651)	-9.080 (-1.813#)
ENFORADQ	-6.574 (-1.540)	-2.258 (-3.195#)	1.770 (0.659)	-19.271 (-3.777#)
INTERCEPT	107.21 (2.320**)	25.368 (2.625****)	-11.616 (-0.303)	49.104 (0.570)
SIGMA	(23.670****)	12.679****	11.178****	12.407****
N	568	160	64	80
Log-likelihood function	-1911.585	-329.337	-280.062	-399.072

Note:

**** : significant at 1% level.
*** : Significant at 2% level
** : Significant at 5% level
* : Significant at 10% level
# : significant with unexpected sign

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