

**ECONOMIC AND
SOCIAL STUDIES**

Volume 56, No. 1

March 2014

CONTENTS**ARTICLES**

Pages

- Institutional Requirement on Price Limit and Stock Market Volatility in Nigeria
— *Afolabi E. Olowookere* 1
- Institutions and Road Traffic Offences in Nigeria: A game theoretic approach ✓
— *A.T. Yakubu, A.A. Kilishi, H.I. Mobolaji and M.A. Yaru* 21
- Institutional Reforms, Credit Incentives and Agricultural Sector Performance in Nigeria
— *Fidelis O. Ogunmike and Uche M. Ozughalu* 37
- Oil Wealth and Democracy in Africa: Cross-country evidence and lessons for Nigeria
— *John C. Anyanwu and Andrew E.O. Erhujakpor* 61
- Towards a Second-best Framework for Petroleum Products Pricing in Nigeria
— *Emmanuel Ojameruaye* 99
- Performance of Agricultural Credit in Africa (1990-2011)
— *Adeleke Salami and Damilola Felix Arawomo* 125

[PUBLISHED BY THE NIGERIAN ECONOMIC SOCIETY]

THE NIGERIAN JOURNAL OF ECONOMIC AND SOCIAL STUDIES

Editor
Ndubisi Nwokoma

Associate Editors
Shehu Usman Rano Aliyu

Business Manager
Omo Aregbeyen

Abiodun S. Bankole

Petterson Ekeocha

Volume 56, No.1

March 2014

CONTENTS

ARTICLES	Pages
Institutional Requirement on Price Limit and Stock Market Volatility in Nigeria — <i>Afolabi E. Olowookere</i>	1
Institutions and Road Traffic Offences in Nigeria: A game theoretic approach — <i>A.T. Yakubu, A.A. Kilishi, H.I. Mobolaji and M.A. Yaru</i>	21
Institutional Reforms, Credit Incentives and Agricultural Sector Performance in Nigeria — <i>Fidelis O. Ogwumike and Uche M. Ozughalu</i>	37
Oil Wealth and Democracy in Africa: Cross-country evidence and lessons for Nigeria — <i>John C. Anyanwu and Andrew E.O. Erhijakpor</i>	61
Towards a Second-best Framework for Petroleum Products Pricing in Nigeria — <i>Emmanuel Ojameruaye</i>	99
Performance of Agricultural Credit in Africa (1990-2011) — <i>Adeleke Salami and Damilola Felix Arawomo</i>	125

[PUBLISHED BY THE NIGERIAN ECONOMIC SOCIETY]

© The Nigerian Economic Society, 2014

Secretariat

9 Paul Hendrickse Road

Bodija, Ibadan

U.I. P.O. Box 22044

Ibadan, Nigeria

Telephone: 02-8700395

Website: www.nigerianeconomicsociety.org

E-mail: nesibadan@gmail.com

ISSN: 0029-0092

Edited and formatted in Nigeria by

Crafted and Bound

1436A Customs, UI-Secretariat Road

Opposite former NITEL office

Ibadan, Oyo State

mobile: 0805 338 1432 • 0809 829 0700

email: craftedandbound@gmail.com

INSTITUTIONS AND ROAD TRAFFIC OFFENCES IN NIGERIA: A Game Theoretic Approach

A. T. Yakubu, A.A. Kilishi, H.I. Mobolaji and M.A. Yaru

Department of Economics, University of Ilorin, Ilorin Nigeria

ABSTRACT

Road traffic offences and their negative consequences are rampant in Nigeria. A number of institutions have been put in place to check this menace, but it persists. This paper therefore examined the relationship between traffic offences and traffic institutions. An inspection game of enforcement of road traffic rules is constructed using a simple two-person game between road traffic police and road users. The results show that there was no pure strategy Nash equilibrium. However, the mixed strategy Nash equilibrium showed that the probability of obeying traffic rules increased as the cost of monitoring decreased, while it declined with increase in the cost of monitoring. Also, as the cost of breaking rules increased relative to gains of breaking them, the probability of breaking rules reduced. It was thus recommended that the cost of breaking rules be increased by either increasing the fines or increasing the probability of punishing road traffic offenders.

JEL classification: P37, R41, C70

1. Introduction

ROAD TRANSPORT in Nigeria is dominated by the informal sector. The negative effect of informal transport operators is frequent violation of traffic rules, leading to road accidents (Ojekunle, 1998; Cevero, 2000; Alexander et al., 2012). Road traffic offences range from driving without using seatbelts, through having no valid driver's licence, non-use of safety helmets (for cyclists), excessive speed and double-parking, to wrong overtaking. Various institutions, such as the police, the Federal Road Safety Commission, and the

Vehicle Inspection Office are charged with the responsibility of ensuring compliance with road safety rules, as well as the prosecution of traffic offenders. Despite the existence of these institutions, road traffic offences are common features on Nigerian roads due to the attitude of road users and corruption on the part of law enforcement agents (Ogunrinola, 2011; Arosanyin et al., 2012). A large proportion of road traffic accidents are as a result of road-users' attitude. Specifically, accidents occur because of decisions taken by road users to disobey or break road traffic rules; these decisions are commonly referred to as human error.

Studies have shown that accident rates and compliance with traffic rules are inversely related. In recent years, there has been an increase in the presence of law enforcement agencies which enforce traffic rules and ensure compliance (Aparicio et al., 2011). Previous studies on informal operators in Nigeria's transport sector considered issues relating to road traffic offences and road accidents from the standpoint of road users, with little attention to the role of relevant road traffic institutions (Oluwadiya et al., 2004; Ngim and Udosen, 2007; and Oni et al., 2011). The objective of this paper is to examine the kinds of incentives that make road traffic institutions more efficient. The game theory was used as a tool of analysis in the study. As an outcome, the study would provide a useful theoretical framework for traffic law enforcement agents in the area of enforcing compliance with safety rules and, hence, a reduction in road accidents. The review is divided into five sections. Following this introductory section is the literature review as section 2; section 3 presents conceptual and theoretical frameworks; section 4 applies the game theory to road traffic offences, while section 5 contains the conclusion and recommendations.

2. Literature Review

A study of Lagos Island traffic was carried out by Lea and Delu (1973) with the aim of providing short-term traffic management solutions to road users. Grava (1974) also conducted a study on Lagos with the aim of providing concrete solutions to the movement problems within the metropolis. The two studies used descriptive statistics to analyse their data and found that both formal and informal transport systems contribute significantly to traffic congestion and road accidents in Lagos; and that traffic rules were frequently violated by road users. The conclusion was that an effective traffic management policy will help

solve the problem of road congestion caused by both formal and informal transport operators. The findings of Kimani et al. (2004), Kissalita (2007) and Adesanya (1998) support those of Grava (1973) on congestion and regulation of informal transport operation. However, Lea et al. (1973) and Grava (1974) did not assess the role of relevant institutions in combating road traffic offences.

An investigation on motorcycle limb injuries in Nigeria was carried out by Oluwadiya et al. (2004). It was a hospital-based study of limb injuries resulting from motorcycle accidents between June 1998 and May 1999 among patients at the emergency unit of Obafemi Awolowo University Teaching Hospital, Ile-Ife. The study, which used simple percentages for data analysis, found that 79.3 per cent of the 145 respondents had limb injuries from motorcycle accidents. The use of protective/ safety devices was practically non-existent, which was a violation of traffic rules. They concluded that motorcycle accidents are a significant source of limb injuries in the developing world, and that motorcycle operators should be encouraged to use protective/safety devices.

Furthermore, a comparative study on motorcycle traffic development in Taiwan, Malaysia and Vietnam was conducted by Dao et al. (2005). The study adopted a cross-country analysis of the motorcycle traffic situation in each country. The results showed that traffic regulation and management in Malaysia and Vietnam did not make any distinction between motorcycles and other traffic at intersections, but in Taiwan, the motorcycle was seen as a different mode and had its own regulations. Motorcyclists wore safety helmets in Malaysia and Taiwan, but there was no such regulation in Vietnam. Motorcycles were driven with headlight at all times in Malaysia, unlike in Taiwan and Vietnam. The study concluded that traffic regulation in these countries had become a necessity, as registered motorcycles outnumbered registered cars, and also because traffic offences were being committed with impunity, especially by the informal transport operators. This finding is corroborated by Kimani et al. (2004), Arosanyin et al. (2011) and Ogunrinola (2011).

An examination of the cost of road traffic accidents in Vietnam using human capital methodology was done by Vuchic (2005). It is noteworthy that the motorcycle is the main transport mode in Vietnam. The result of the study shows that apart from traffic congestion, most (70%) of the accidents were caused by commercial motorcycle operators. This finding was supported by Tangphaisankun et al. (2009), Anne et al. (2011), and Ngim and Udosen

(2007). Vuchic (2005) further revealed that speed, illegal passing, and poor awareness of traffic safety regulations caused the most road accidents. However, the role of traffic law enforcement agents in reducing road traffic offences in Vietnam was not studied.

A cross-sectional community-based study was carried out by Ngim and Udosen (2007). The study examined the attitude of informal commercial motorcycle operators to road safety regulations and practices in Calabar, Nigeria. Randomly selected motorcycle operators who agreed to participate in the study were interviewed. Information regarding certain aspects of road safety was obtained from two hundred and forty-seven of them using a structured questionnaire, and the data were analysed using descriptive statistics. The average age of the respondents was 34 years. The results showed that only 41.3 per cent of them had formal training on motorcycle riding; 35.7 per cent had a motorcycle rider's licence; and 43.7 per cent had a vehicle insurance policy. Further, only 16.2 per cent of them carried the recommended one passenger at a time, while 83.4 per cent of them agreed that the use of a crash helmet is good; 34.8 per cent of them take alcohol to enhance their performance while working. The study concluded that the attitude of commercial motorcyclists in Calabar to road safety was poor and thus recommended, among others, that road safety education should be ensured, as well as strict enforcement of traffic regulations. The study further recommended that the use of three-wheelers should be introduced.

Ojugbana et al. (2010) studied how to reduce harm associated with women using commercial motorcycle transport in a developing country. The study used primary data generated through a structured questionnaire and interview administered on 1,200 commercial motorcyclists in Asaba, Nigeria. The study used descriptive statistics for data analysis and found that 75 per cent of the respondents agreed that motorcycle transport at night is unsafe. Many of the respondents (68%) affirmed that women who used commercial motorcycles for transportation at night are often targets of rape and abuse. About 72 per cent of the women had stopped using commercial motorcycles for transportation at night; the police confirmed harassment and attack on women using this mode of transport; and 90 per cent of the victims were unable to give descriptions of their attackers. The study concluded that the actions of commercial motorcyclists at night often resulted in severe consequences for women; that

informal transport operators have become perpetual road traffic offenders; and that there is the need to establish a reliable database for the activities of commercial motorcyclists between 7pm and 6am and this should include verifiable personal information. Oni et al. (2011) studied motorcyclists' crash characteristics in Lagos. They examined the perception of 1,400 riders and 1,550 passengers regarding the use of commercial motorcycles, using a questionnaire for data collection. The study used descriptive statistics to analyse the data. A large percentage of the riders were male, graduates, married, and earned above five hundred naira a day. Their transport activities were characterized by overloading, excessive speed, and non-use of crash helmets. The passengers used the transport mode purposely to beat traffic congestion, save time, and enhance accessibility. The findings also showed that the motorcyclists did not care about safety but constantly violated traffic rules and regulations, such as driving without a licence and not wearing safety helmets.

The issue of safety and motorcycling in the United States of America was examined in a national telephone survey (Anne et al., 2011) using descriptive statistics. The study revealed that 25 per cent of the over 1,600 respondents did not wear safety helmets; 57 per cent of this group said a law requiring helmet use would persuade them to do so. The study further found that riders aged 18–29 years and those who engaged in sport-touring and super-sport motorcycle riding were always more likely to wear helmets for safety. Forty-three per cent of the respondents said they had had an accident at least once. Motorcyclists were frequently breaking traffic rules and 62 per cent of recent crashes in the US involved motorcycles. The study concluded that universal helmet-use laws should be enacted and enforced in order to increase the effective use of safety helmets. The age bracket of motorcycle riders and the view on accidents in the study concurred with other studies (see Ogunsanya and Galtima, 1993; Ojekunle, 1998; Adesanya, 1998).

The challenges of informal motorcycle transport in Liberia were examined by Alexander et al. (2012). About half of all Liberians live in rural areas where roads are usually not gravelled or paved. Thus, the commercial motorcycle, popularly called 'phen-phen', offers the only possible access to villages. Furthermore, phen-phen transports goods and farmers to local markets. The study used primary data generated through a questionnaire and analysed using descriptive statistics. The results showed that the average daily earnings of a

'phen-phen' driver is about US\$20 (which is equivalent to ₦3,000). The study also found that most of the drivers could not afford motorcycles, but instead rented from those with enough financial resources. The hiring operators pay owners of motorcycles about US\$7 per day and they are left with about US\$8 after deducting other cost of operation such as the cost of fuel.

Safety was perceived as the biggest concern in commercial motorcycle operation in Liberia. Moreover, phen-phen riders were found to be more vulnerable to dangers associated with road insecurity than users of other transport modes. It was thus concluded that to improve the overall safety of commercial motorcyclists in the country, the police should be empowered to enforce the existing laws and regulations of the ministry of transport with regard to commercial motorcycling.

Arosanyin et al. (2012) executed a study on compliance with road safety regulations among 334 commercial motorcyclists at the main campus of Ahmadu Bello University, Samaru, Zaria, using a questionnaire for data collection. The study used descriptive statistics and phi-coefficient to analyse the data collected. It found that the compliance rate with regulations, such as minimum age limit, number plate registration, and motorcycle engine capacity, was 100 per cent. However, compliance with regulations regarding driver's licence, number of passengers per ride, and crash helmet usage was found to be 64, 45 and 16 per cent, respectively. The study further found a negative attitude on the part of the riders towards safety regulations, and recommended that there is the need for total restructuring of the driver's licensing scheme, as well as enhanced enforcement strategies by the agencies concerned.

An in-depth study of bicyclists injured in road crashes in South Australia was carried out by Lindsay (2013). The study explored the circumstances surrounding road crashes for a group of 61 bicycle riders, who had collided with motorized vehicles and were admitted to Royal Adelaide Hospital, Australia, between 1 January 2008 and 31 December 2010. The results showed that pedal cycle crashes constituted around 17.4 per cent of all traffic crashes which resulted in hospital admission in 2010, a rise from the 12 per cent recorded for 2001. The study further revealed that there was renewed interest in cycling in the study area, perhaps due to an increase in the awareness level of people with regard to the benefits of maintaining good health and

environment. The study concluded that cyclists do not generally obey traffic rules and regulations in the study area.

3. Conceptual and Theoretical Framework

The game theory has grown over the years to become a powerful tool in studying multi-person interaction. The key feature of this kind of interaction is strategic interdependence, as each individual agent recognizes that the payoff of his actions depends not only on his actions but also on those of others. For instance, the payoff a road user receives for breaking traffic rules depends on his actions, as well as those of the traffic police. Hence, the actions any agent may take will have consequences for others. Thus, the concept of game theory is the systematic study of how rational agents behave in strategic situations, where the best decision for an individual is taken after accounting for the decisions others have taken or will take. Thus, in a strategic interaction the best action for an individual may depend on what he expects other players to do.

Nevertheless, each player is out to maximize his own payoff/welfare and each player knows that this is the goal of other players. The expectation of each player therefore needs to be consistent with the actual action the other takes. The expectations that are consistent with actual actions are called rational expectations. The solution that satisfies this is known as the rational expectation equilibrium. One concept of solution (that is, a consistent prediction of the rational expectation equilibrium) is the Nash equilibrium. The Nash equilibrium is a pair of strategy such that each player's choice maximizes his expected utility/welfare/payoff, given the strategy of the other player. Hence, if any solution exists in a game theoretic problem, it is a Nash equilibrium.

One of the classical types of game commonly used in the inspection game is the matching pennies game. The matching pennies game is a zero-sum game in which the interests of the players are diametrically opposed to each other. Each player would want a play strategy that cannot be easily predicted by other players. Hence, it is natural for each player to randomize by playing his strategy with some probability. Thus, the inspection game does not usually have a pure strategy Nash equilibrium but a mixed strategy Nash equilibrium.

This paper applied the inspection game to a road traffic offence game. The outcomes of pure strategy equilibrium, as well as those of mixed strategy equilibrium are considered.

4. The Game of Road Traffic Offences

This paper considered the impact of institutions and road traffic offences. Institutions as defined by North (1990) are the rules of the game in a society or, more formally, the humanly-devised constraints that shape human interactions. In consequence, they structure incentives in human exchange, whether political, social or economic. They consist of formal rules (for example, constitutions, laws and property rights), and informal constraints (for example, sanctions, taboos, traditions, customs, norms of behaviour, conventions and codes of behaviour), as well as their enforcement characteristics. In other words, they consist of the structure that humans impose on their dealings with each other and the extent to which rules are enforced. Institutions often establish the constraints that determine the costs and benefits under which individuals take decisions. The extent of constraints and the choices individuals make in different institutional settings depend on the effectiveness of their enforcement. However, in this paper the enforcement of road traffic rules are considered as institutions. Therefore, the paper constructs a simple two-person game between road user and traffic police. The outcome of the game is generalized to n person case.

4.1 Assumptions of the game

- Road users have two strategies, to either obey or break traffic rules.
- There are gains that accrue to road users (particularly commercial road users) who break traffic rules, such as meeting up with contract, making more money.
- Traffic police can monitor road users or decide not to monitor them.
- There are costs for monitoring and these include costs of employing traffic police, buying equipment, and other costs of policing road users.
- Normal revenue made by road users without breaking traffic rules is R , while the additional benefits that accrue to them for breaking traffic rules is r .
- A road user is made to pay a fine f if he is caught breaking the rules.
- The probability of being caught and convicted is P .
- Thus, the payoff function of a road user could either be R (if he obeys traffic rules) or $R + r - Pf$ (if he breaks traffic rules).
- As long as $r > Pf$ there is incentive for a road user to break traffic rules.

- The cost of breaking traffic rules is Pf , and P is an increasing function of expenditure on traffic policing.

There are benefits for monitoring road users; for instance, if road users are monitored, those who break traffic rules will be caught and safety of other road users is ensured. This will mean less accidents, less accident-related medical expenses and less loss of lives and properties. Let all these benefits be represented by S . Additional benefits in the form of revenue could accrue to the government if road traffic offenders are caught and are made to pay fine f .

There is a cost attached to monitoring, which is assumed to be cM . The function cM is a differentiable, positive and increasing function of M . As cM increases, P also increases and the function Pf equally increases. On the other hand, if road users are not monitored, cM and P are assumed to be zero and, hence, function Pf will be zero. There is, however, a cost related to not monitoring, because there will be incentive for road users to break traffic rules; and this makes the road unsafe both to those who break the rules and every other road user. This cost includes an increase in the incidences of accidents, accident-related medical expenses, and loss of lives and property. These costs are represented with $-S$.

4.2 Outcome of the game

The payoff matrix of this game is presented in table 1. The road user is a row player, while the traffic police is a column player. The road user has two strategies: obey traffic rules or break traffic rules. The traffic police also has two strategies: monitor road user or not monitor road user. The payoff of the road user is written first before that of the traffic police.

Table 1. Payoff matrix of traffic offence game

Road User	Traffic Police			
	Monitor		Do Not Monitor	
Obey Traffic Rules	R	$S - cM$	R	S
Break Traffic Rules	$R + r - pf$	$S + f - cM$	$R + r$	$-S$

In this game, if road users obey traffic rules, the incentive of the traffic police is not to monitor road users, because $S > (S - cM)$. However, if road users usually break traffic rules, the traffic police would monitor road users. On the

other hand, if road users know for sure that the traffic police will monitor them, they will obey traffic rules. If the traffic police chooses not to monitor road users, the response of road users will be to break traffic rules. Thus, there is no pure strategy Nash equilibrium in this game. This implies that if the traffic police chooses and keeps to a strategy, for instance, not to monitor, road traffic offenders will not be caught and road traffic offences will remain. Though there is no pure strategy Nash equilibrium, there could be a mixed strategy Nash equilibrium (Gibbons, 1992; Osborne, 2004).

Let us assume that the traffic police and road user randomize their pure strategies by assigning probability to each strategy—that is, each strategy is chosen with a probability: the road user chooses to obey traffic rules with probability π and break the rules with probability $(1 - \pi)$, while the traffic police chooses to monitor with probability μ and not to monitor with probability $(1 - \mu)$. The payoffs of the two players are as follows: the road user gets R with probability μ and R with probability $(1 - \mu)$ for choosing to obey traffic rules. The expected utility for choosing to obey is:

$$E(U_O) = \mu R + (1 - \mu)R \quad (1)$$

where U_O is the utility the road user derives for obeying traffic laws.

On the other hand, if the road user chooses to break traffic rules, he gets $R + r - Pf$ with probability μ and $R + r$ with probability $(1 - \mu)$, such that the expected utility for choosing to break traffic rules is:

$$E(U_B) = \mu(R + r - Pf) + (1 - \mu)(R + r) \quad (2)$$

where U_B is the utility derived from breaking traffic rules. But the road user will prefer to obey rules if:

$$[\mu R + (1 - \mu)R] > [\mu(R + r - Pf) + (1 - \mu)(R + r)],$$

that is, $E(U_O) > E(U_B)$

However, he will prefer to break traffic rules if:

$[\mu R + (1 - \mu)R] < [\mu(R + r - Pf) + (1 + \mu)(R + r)]$, that is, $E(U_O) < E(U_B)$ but mixed the strategies only if:

$$[\mu R + (1 - \mu)R] = [\mu(R + r - Pf) + (1 + \mu)(R + r)] \quad (3)$$

From equation (3):

$$\mu = r/Pf \quad (4)$$

On the other hand, the traffic police gets $S - cM$ with probability π and gets $S + f - cM$ with probability $(1 - \pi)$ for choosing to monitor the road user. He gets S with probability π and $-S$ with probability $(1 - \pi)$. Thus, the expected utilities for choosing to monitor and not to monitor are given in equations (5) and (6) respectively:

$$E(U_M) = \pi(S - cM) + (1 - \pi)(S + f - cM) \quad (5)$$

$$E(U_N) = \pi(S) + (1 - \pi)(-S) \quad (6)$$

The traffic police will choose to monitor the road user if:

$$\pi(S - cM) + (1 - \pi)(S + f - cM) > \pi(S) + (1 - \pi)(-S)$$

and will prefer not to monitor if:

$$\pi(S - cM) + (1 - \pi)(S + f - cM) < \pi(S) + (1 - \pi)(-S)$$

He will mix the strategies if the expected utilities of the two strategies are equal, that is:

$$\pi(S - cM) + (1 - \pi)(S + f - cM) = \pi(S) + (1 - \pi)(-S) \quad (7)$$

From equation (7):

$$\pi = -cM \quad (8)$$

Equations (4) and (8) are important in this game. Equation (4) states that the probability of monitoring the road user equals the ratio of gains of breaking traffic rules to cost of doing so. While equation (8) states that the probability of obeying traffic rules by road users equals the negative of cost of monitoring. The mixed strategy Nash equilibrium can, therefore, be written as: road user will choose to obey traffic rules with probability $\pi = -cM$ and choose to break the rules with probability $\pi = 1 + cM$. The optimal choice of the road user is shown in figure 1.

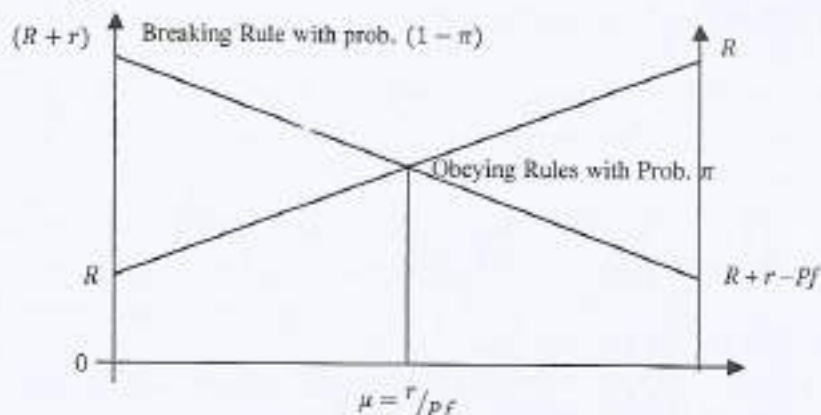


Figure 1. Road user's success rate in mixing obedience to rules and breaking of rules.

The traffic police will choose to monitor the road user with probability $\mu = r/Pf$ and choose not to monitor the road user with probability $1 - \mu = (Pf - r)/Pf$.

But the optimal choice of the traffic police is shown in figure 2.

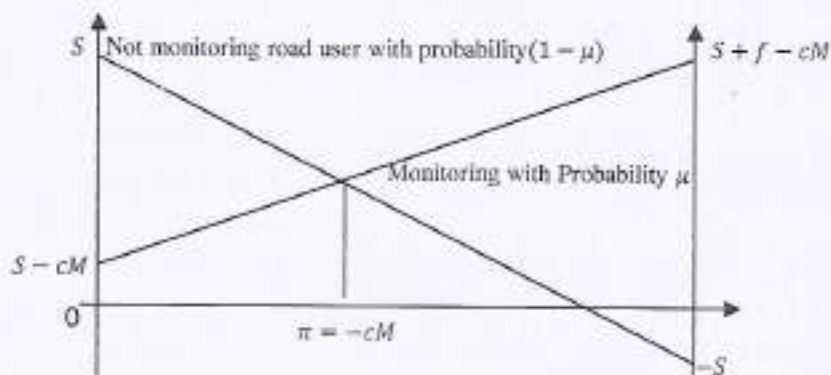


Figure 2. Traffic police's success rate from mixing monitoring and not monitoring.

Figures 1 and 2 show that the road user is made indifferent if the traffic police chooses $\mu = r/pf$, and that the traffic police is indifferent if the road user chooses $\pi = -cM$.

5. Kickback and Outcome of the Game

Supposing it is possible for the road user to bribe the traffic police, how does this affect the outcome of the game? That is, the road user can give the traffic police a bribe so that if he is caught breaking traffic rules, the full penalty is averted. Let the kickback be k ; as long as k is less than f there is incentive to give a bribe. The difference is that k benefits the traffic police directly, while f goes to the government as revenue. However, if the road user's bribe is $f=0$, hence function $pf=0$, there would be a zero penalty for those who give a bribe. The outcome of the kickback game is presented in table 2.

Table 2. Payoff matrix of kickback game

Road User	Traffic Police			
	Monitor		Do Not Monitor	
Obey Traffic Rules	R_i	$S - cM$	R_i	S
Break Traffic Rules	$R + r - k_i$	$-S + k - cM$	$R + r_i$	$-S$

The presence of kickback changes the incentive structure of the game. Thus, as long as $r > k$ the incentive for road users would be to break traffic rules; and as long as $k \neq 0$ the incentive of the traffic police would be to monitor road users. Hence, the Nash equilibrium of the kickback game is to monitor and break traffic rules with payoffs $-S + k - cM$ and $R + r - k$ respectively. This equilibrium will always hold except when there is cost associated with taking bribes, which must be greater than k . The implication of this includes: (i) traffic police will always be on the road without reduction in road traffic offences; and (ii) traffic institutions will become weak and inefficient. This equilibrium is Pareto inefficient because the individual road user and individual traffic police officer would gain at the expense of the general society. The society spends cM to monitor road users, but still faces the consequences of breaking traffic rules $-S$.

6. Conclusion and Recommendations

A number of implications can be drawn from the outcome of the game. First, if road traffic rules are ensured by close monitoring of road users, there will be less violation of traffic rules. This can be achieved by either increasing the fines for those caught or improving surveillance so as to increase the probability of catching road traffic offenders. Second, if the traffic police keeps to a particular action, road users will not be caught breaking traffic rules. Therefore, it is better for the traffic police to randomize their actions. Third, the probability of obeying traffic rules is a decreasing function of the cost of monitoring. This implies that, as the cost of monitoring increases, the probability that road users will obey traffic rules decreases. This could be due to the fact that monitoring will decrease as the cost of monitoring increases, and the incentive to break rules by road users will rise. However, if the traffic police receive kickbacks from road users, traffic offences will persist and traffic institutions will become weak and inefficient. It is therefore recommended that:

1. Traffic police should always randomize their actions;
2. Traffic police should be equipped to maintain efficient and effective surveillance;
3. Penalty for traffic offences should be made severe and noninvertible; and
4. The remuneration of traffic police should be made attractive enough such that they will not be tempted to take bribes. In addition, taking and giving of bribes or kickback should attract punishment.

References

- Adesanya, A.O. 1998. The use of motorcycles for public transport: The situation in Ibadan. *NISER Monograph Series No.6*. Ibadan: Nigerian Institute of Social and Economic Research (NISER).
- Alexander, C., S.K. Adams, M. Marco and N. Siaka. 2012. Challenges of informal motorcycle transport in Liberia. Accessed from www.ecobank.com on 7th February 2012.
- Anne, T.M., L. Blana, E.R. Teo and L.M. Strous. 2011. Overview of motorcycling in the United States: A national telephone survey. *Journal of Safety Research* 42(3):177-184.
- Aparicio, L. F., R.B. Arenas, J.M. Mira and A.J. Paez. 2011. The endurance effects of the penalty point system in Spain three years after. Main influencing factors. *Accident Analysis and Prevention* 43(3): 911-922.

- Arosanyin, G.T., A.T. Olowosulu and G.M. Oyeyemi. 2011. An examination of some safety issues among commercial motorcyclists in Nigeria: A case study. *International Journal of Injury Control and Safety Promotion* 2(2): 139 - 148.
- Arosanyin, G.T., A.T. Olowosulu and G.M. Oyeyemi. 2012. Compliance with road safety regulations among commercial motorcyclists in Nigeria. *Canadian Social Science* 8(1): 92-100.
- Cervero, R. 2000. *Informal Transport in Developing World*. United Nations Centre for Human Settlements (Habitat), Nairobi, Kenya.
- Dao, N.X., T.T. Anh and T.T. Anh. 2005. The cost of road traffic accident in Vietnam. *Proceedings of the Eastern Asia Society for Transportation Studies* 5: 1923-1933.
- Gibbons, R. 1992. *A Primer in Game Theory*. Prentice Hall, New York.
- Grava, M. 1974. Delhi on the Move 2005: Future traffic management scenarios. Prepared for Developing Countries by Tripp IIT, Delhi.
- Kimani, N.P., T. Kibua and M. Masinde. 2004. The Role of the Matatu Industry in Kenya: Economic Costs, Benefits and Public Concerns. IPAR Discussion Series, Discussion Paper no. 023/2004. Kenya Institute of Policy Analysis and Research, Kenya: Regal Press.
- Kisaalita, W.S. 2007. Delivery of urban transport in developing countries: The case of Boda-boda operators in Kampala, Uganda. *Development Southern Africa* 24(2): 23-30.
- Lea, J. and O. Delu. 1973. *Design and Appraisal of Rural Transport Infrastructure: Ensuring basic access for rural communities*. Washington D.C.: World Bank.
- Lindsay, V.L. 2013. Injured cyclists' profile: An in-depth study of a sample of cyclists injured in road crashes in South Australia. *Research in Transportation Economics* 38(1): 22-34.
- Ngim, N.E and A.M. Udosen. 2007. Commercial motorcyclists: Do they care about road safety? *Nigerian Medical Practitioner* 51(6): 111-113.
- North, D. 1990. *Institutions, Institutional Change and Economic Performance*. Cambridge: Cambridge University Press.
- Ogunrinola, I.O. 2011. Informal self-employment and poverty alleviation: Empirical evidence from motorcycle taxi riders in Nigeria. *International Journal of Economics and Finance* 3(2): 176-185.
- Ogunsanya, A. and M. Galtima. 1993. Motorcycle in public passenger transport service in Nigeria: A case study of Yola town. In: S. Ikya (ed.) *Urban Passenger Transportation in Nigeria*. Lagos: Heinemann Books.
- Ojekunle, J.A. 1998. Operations and use of motorcycles as a mode of public passenger transport. In: Dunge H., Chikolo I.V. and Ogunsanya A.A. (eds.) *Issues in Transport Planning and Management* (84-103). Zaria: NITT.
- Ojughana, D., K. Otebunne, C.C. Ojughana and A. Okonkwo. 2010. Reducing harm associated with women in using commercial motorcycle transport in a developing country. Accessed from www.group.fmg.com on 10 February 2010.
- Oni, S.L., O. Fashina and Y.K. Olagunju. 2011. The motorcycle crash characteristics in Lagos State, Nigeria. *Journal of Environmental Management and Safety* 2(1): 1-15.
- Oluwadiya, K.S, L.M. Ogimi and A.A. Olasinde. 2004. Motorcycle limb injuries in a developing country. *West African Journal of Medicine* 22(7): 17-31.
- Osborne, M. 2004. *An Introduction to Game Theory*. New York; Oxford University Press.

- Tangphaisankun, A., F. Nakamura and T. Okamura, 2009. Influences of paratransit as a feeder of mass transit system in developing countries based on commuter satisfaction. *Journal of the Asian Society for Transportation Studies* 8(4): 86-100.
- Vuchic, V.R. 2005. Urban transit: Operations, planning and economics. *Eastern Asian Society for Transport Studies* 6(3): 282-293.