OPTIMAL CONTRACT AND INCENTIVE COMPATIBILITY CONSTRAINT (ICC): SOME EVIDENCE FROM NIGERIA'S HAULAGE MARKET

C. Chris Ofonyelu

Adekunle Ajasin University, Akungba-Akoko, Ondo State, Nigeria

Correspondence: C. Chris Ofonyelu, Department of Economics, Adekunle Ajasin University, Akungba-Akoko, Ondo State, Nigeria, E-mail: ofonyelu1@gmail.com

ABSTRACT

The purpose of this paper is to show that covenants and legal agreements are useful exercise in enhancing equilibrium relationships between commercial drivers and their vehicle owners. Haulage business is one of such economic activity that is prone to principal-agency problems. In view of this, haulage firms and commercial vehicle owners do covenant their drivers as a precondition for employment. This study employed Chiappori-Salanie (C-S) test statistics to examine the effect of such covenants in mitigating information asymmetry problems among 50 commercial truck drivers operating under Akoko North West Local Government Scheme (ANWLGS) of Ondo state. Based on the findings, covenanted drivers were observed to demonstrate lower default likelihood than the non-covenanted. Drivers on fixed agreements showed lesser default tendency than those whose terms of engagement was unfixed. The finding from the study joins with Akerlof (1982) to suggest that effort commitment relates positively with compensation and that fixed covenant enhances performance.

Keywords: Incentive compatibility constraint, optimal contract, information asymmetry

INTRODUCTION

Haulage is a very profitable business activity. However, it is open to large scale moral hazard and adverse selection problems because of the existence of information asymmetry. The asymmetry exists between vehicle owners and their drivers. The problems become more pronounced when the business is operated through a third party. That this, when the vehicle is not self driven by the owner or the owner does not directly manage the vehicle but through line managers. Haulage business essentially implies a bilateral contract existing between the owner of the vehicle and the driver concerning delivery of goods. In majority of the situations, truck owners do require their drivers to deliver specific amount of money periodically (which in most instance may be daily, weekly or at fixed intervals). The driver is on the field and as a result has more information than the owner with respect to the situations on the road and state of the vehicle as well as any expenses that may arise at any point in time. It is for this that the drivers are considered the informationally advantaged. A major challenge with the business is the problem of finding safe drivers as an average driver is high risk. A risky driver seeks to maximize his private gains against that of the owner of the vehicle. This may include inflating cost of expenses made on the vehicle, embarking on unauthorized journeys and/or totally absconding with the vehicle. Because of these problems, vehicle

owners impose some constraints upon the adverse incentives of their drivers by making them sign a covenant or agreement before they are employed. This motivation is the basis for the incentive compatibility constraint (ICC) that is being discussed in this study. ICC ensures that actions of participating agents in a game situation are consistent with the rules established by the players (Ledyard, 2008). It majorly serves to commit the driver to persistently act in a way that is compatible with the owner's interest while assuming the owner will be faithful to the terms of the engagement. The imposition of an incentive constraint in a contractual relationship helps to commit the parties in a contract into the underlying rules such that the relationship can last into the long run. The motivation for this study is to discover the extent to which imposition of credible rules and covenants can mitigate adverse selection and moral hazard in transportation and haulage businesses. The rest of this study is structured as follows. Section II discussed the link between imposition of incentive constraint and effort commitment. Section III illustrated a model of optimal effort commitment for constrained and unconstrained haulage contracts. Section IV concludes the study.

Literature Review and Hypothesis Development

The literature on the relationship between incentive constraint and effort commitment in mutually beneficial relations have grown in the last three decades (Akerlof (1982), Katz (1986), Mosca, Musella and Pastore (2007), Hannan, Kagel and Moser (2001)). In fact, optimality in contractual relationships is the central issue of discussions in Information Economics. A major suggestion from these studies is that working agents would provide more effort when been adequately compensated. When an additional effort is made, both parties tend to be benefitted. The implication of these thinking implies that an average driver would put in higher effort if the returns to him are higher than for a lower return. A driver putting higher efforts imply that he will be willing to make as more trips as possible to maximize the owner's profit or deliver higher profits to the owner per every trips that is made. On the side of the owner, he will be willing to pay the driver higher wage than could be paid elsewhere. Higher wages imply that the commission that a driver is paid on every trip must have been high. The net between the wage a driver is paid and the competitive wage that is paid other drivers in the market represent a sort of commission to the driver. For the owner, the owner, the additional earning as a result of extra effort input from the driver also represents a sort of commission. This commission, viewed from both side is strictly positive and signify the participation constraint for both players, and it is expected that drivers will want to make more trips per month as the owner seek to maximize the commission. Agency theory has been widely used in recent decades to qualitatively predict how economic agents will differ vary in their behaviors when face with differing degrees of uncertainty (Hoppe & Schmitz, 2013). This paper deviate from the predominant view in the literature suggesting that in most analyses of the principal-agent problem, the principal chooses tend to act first by choosing an incentive scheme to maximize expected utility subject to the agent's utility being at a stationary point (Grossman & Hart, 1983; Mirrless, 1975). Either of the agent could play first to signal the beginning of the mutual contract. A driver cannot be thing of driving a truck if it has not already been provided by an owner in the

same way he could motivate an owner to purchase one. A haulage contract on the other side cannot be said to have commence if the owner does not get a driver to drive his truck.

The haulage market is a subsector in the Nigerian transport industry. Its operation requires no strict regulation as to the minimum number of vehicles that should form the fleet and capital, specific type of goods to carry or any special registration before joining the market[1]. Overly, the capacity of individuals joining the market is dependent on the market demand and the capacity of to adapt to the demands of the market. Over 50% of the haulage companies in the country have at least five vehicles in their fleets. The market is large because of the growing consumer markets and lack of alternative well developed competitive means to transport goods across the country. For instance, over 80% of goods transported through the country are moved by the road. There are three major factors in determining the viability of a haulage business: cost of fuel (diesel), quality of the roads and the driver factor. Of the three, the latter is considered the most pervasive as a very good driver would maximize profit in the face of rising fuel costs and bad roads. For most vehicle owners, the decision to go into the transport business is made once a safe driver is found. The quality of the driver determines the viability of the investment. Despite the crucial role of the driver factor in determining the viability of the business, haulage business still remains one of the most dependable businesses in Nigeria because it offers very short period to recoup the investments. The saying that there is no bad vehicles but bad driver holds true because the quality of the driver is the defining factor in the profitability of the business. To reduce the risks involved, truck owners are used to devising strategies to constrain adverse incentive of the drivers and commit them to mutually beneficial goals.

Table 1: Size of the Nigerian haulage subsector in the transportation industry of Nigeria (%)

Transport Sector	1960	1970	1980	1990	2000	2010	2015	2020*
Haulage by road Transport	0.59	0.59	0.95	0.86	0.85	0.9	0.89	0.84
Haulage by rail Transport	0.23	0.14	0.01	0.01	0	0	0.01	0.02
Transport by Water	0.15	0.22	0.03	0.05	0.04	0.02	0.02	0.05
Transport by Air	0.03	0.05	0.01	0.05	0.03	0.02	0.02	0.02
Other Transport Services		--	--	0.03	0.08	0.05	0.06	0.07
Total	1	1	1	1	1	1	1	1

Source: Central bank of Nigeria Statistical Bulletin (2013)
* Estimated

Constraining individual's incentive is important in asymmetric interactions. Problems arise when the party with more information (the driver as in this case) has an incentive to use that information to maximize personal benefit at the expense of the

---

[1] The main form of registration required is that with the local unions where one will be loading and offloading goods.

principal by telling lies[2]. An optimal transportation contracts need be structured so that the participant with more information is motivated to act in the interest of the other's party (or has less incentive to exploit an informational advantage). When a driver knows that there will be penalties as a result of deviation from agreed terms, it becomes most likely that the driver will want to consistently act in the interest of the principal. Information asymmetry has been known to precipitate adverse selection and moral hazards in business relations (Ofonyelu, 2014). The truck owner does not know perfectly what the driver knows or does once the vehicle leaves his vicinity. Problems therefore arise as it is in the interest of the driver (who is the informationally advantaged) to want to use the information advantage for personal benefit at the expense of the owner. One may therefore want to hypothesize that a covenanted driver will take less risky behaviors than the uncovenanted.

Model of Optimal Effort Commitment

The basis of analysis in this section begins from a simple restatement of model of gift exchange in labour markets as suggested by Akerlof (1982, 1984).

$\pi(w,N)=f(e(w-z)N)-wN$ (1)

Based on equation (1), a haulage firm hires N identical drivers to drive a fleet of trucks, each of the drivers supplies effort level $e(w-z)$. The effort level, $e(.)$ is increasing and concave, w is the wage (that is, the commission paid the driver for each journey made), and z is the benchmark wage paid by other competing firms. Over time, transport firms have arrived at a market wage that drivers are paid once a successful trip is made. A firm may be said to be generous when it pays above the benchmark wage such that $w>z$, and conversely when $w<z$. The firm's revenue is an increasing and concave function $f(eN)$ of the total amount of effort supplied by the N drivers such that the net profit to the owner is as given by equation (1). A typical haulage firm is one where once a vehicle is purchased; the returns from the drivers' effort will be recouped as if he pays profit to the owner. This is a converse case[3], as the cost of the vehicle as well as profits therefore is now being recouped by the employer (hereafter referred to as the owner) from every trips made by the driver. For each of these trips, the driver makes his own profit. A safe driver will choose effort levels τ and ϯ to maximize profits, such that

$$\frac{de}{d\tau} = \frac{e}{\tau}$$ (2)

A driver has two choices to make with respect to maximizing own and owner's profit. He could choose to deliver a fixed amount of money for every trip made or remit proceeds from every trip based on the expenses that are encountered in the course of the journey. A driver who agrees to deliver a fixed amount on every trips made will be liable for any repair or expenses that may arise on the vehicle until it returns from the journey. For the driver who remits account based on all the expenses encountered on the journey, his commission will depend on how profitable each trip was. The closest

---

[2]Experience has shown that no truck driver will want to tell the owner the truth about the exact amount they make per trips, or the exact expenses they make on the trips. Since verifying the claims on this by the driver may not be always possible, it is always better to structure the haulage contract such that the driver's incentives to tell lies are mitigated.
[3]As the employer is now to be paid commission while the driver makes profits

generalization is that he will be paid a fixed percentage of the profit per trip[4]. It is assumed that a driver in this kind of category will receive 25% of the profit made per trip made. Where a journey results in a total loss, a driver in this category will be paid a discretionary fee. τ represent the amount paid as returns to the owner if the driver delivers a fixed amount for every trips made. If the driver is to account to the owner based on expenses made per trip, the owner will be paid ϯ from the trips rather than a fixed τ. By writing the equilibrium returns τ*, equilibrium effort e^* and profit π* as a function of ϯ, it can be shown that

$$\frac{de^*}{d\text{ϯ}} > 0; \ \frac{d\pi^*}{d\text{ϯ}} < 0; \ \frac{d\tau^*}{d\text{ϯ}} > 1 \qquad\qquad (3)$$

The foregoing implies that both the owner and the drivers would be better off engaging in the contract than without participation. Based on experience, risk loving drivers will always opt to deliver a fixed amount per trip while the risk averse group will want to remit their account after every journey. Risk loving drivers, by compelling themselves to a fixed deliver a indirectly precondition to become safe. The participation constraint ensures that both parties would want to participate, in that they are at least as well off by participating as they would be by not participating, and the ICC ensures that people are motivated to behave in a manner consistent with the optimal solution. Usually, the optimal solution will suggest that the compensation people receive when the desired outcome is achieved will at least be as high as the compensation they would earn when some other outcome occurs. A driver who is committed will give its company a crucial competitive advantage through higher productivity and lower employee turnover (Vance, 2006) by paying the owner ϯ. A possible likelihood between the driver and the owner is that the driver would want to inflate expenses if the owner requires that he delivers based on the expenses made per trip. Within such a contractual relationship, the strategy will be dominant if, regardless of whatever action the driver takes, the owner earns a larger payoff than for any at other instance. To deliver a specific amount per trip implies that the driver bears all costs that may arise once the vehicle leaves for a journey. To account, means that the owner is subjected to a variable income such that without much expenses, the owner earns more but less when expenses rise. This nature of contrasting situation between the driver and owner is essentially a screening problem as the owner (uninformed party) attempts to structure the contract in a way that screens away the different behaviors that are undesirable of the driver. The position of the game changes to a signaling game in a situation where it is the driver (informed party). If we assume that **w** is the amount a driver will be paid if he delivers and **z** is the earning when the driver accounts. The optimal solution will be to find if it is **w** or **z** that maximizes the owners' profit given the total possible number of trips that can be made in each instance and over the useful life of the vehicle. A major concern of this study is to determine by how much the driver's effort will increase if his incentive is made right. Ordinarily, a driver will be interested in delivering to the owner a fixed negotiated amount per every trip than being made to account on the trips. A fixed

---

[4]Most drivers will settle for between 20-30% of the profit made per trip.

payment suggests that the driver becomes the precursor of any expenses that may arise in the course of the journey and as a result will be very careful to minimize the occurrence of unnecessary expenses. When the driver is asked to deliver a fixed amount, he earns an attractive w, and is able to increase the number of possible trips that can be made per month.

The increase in the number of trips by λ ($\lambda>1$) implies increasing the owner's profit such that we can rewrite equation (1) as

$$\pi(w,N)=f(e(w-z)N\lambda)-wN\lambda \qquad (4)$$

$$\pi(w,N)=f(e(.)-\lambda \qquad (5)$$

The extent to which the profit will increase depends on the effort commitment of the driver (4) while the owner is concerned with maximizing the difference between $w-\lambda$. Incentive compatibility constraint relate positively with effort commitment for both agents. For instance, if both the driver and owner could settle for a mutually acceptable fee as to be delivered after every trip, it will then be in the interest of both parties to want to step up the number of deliveries over time since each of the deliveries relates positively to individual profit function. The owner will be indifferent with the number of times that each vehicle travels per month if the monthly deliver is made higher as a result of more trips than if the driver makes lesser trips because of lower motivation. Suppose that a driver will make Ϥ trips if the owner pays w but γ trips if *z is paid as the wage rate.* We suppose that Ϥ > γ. The optimal profit choice for the owner would be whether

$$\pi(w,N)= (f(\unicode{x04E9}(w-z)N\lambda)-wN\lambda \ ) \ \ > (f(\gamma(w-z)N\lambda)-wN\lambda \qquad (6)$$

Equation (6) implies that the driver will be better off being paid w to make (Ϥ) trips than when paid z to earn γ. When a driver is sure of a stable contract with adequate payment of w, it is most likely that the likelihood of default, which may imply termination of contract or loss of job as the case may be, will be a very big penalty for the driver. When an interaction is structured so that the driver will want to act in the interest of the principal (or at least have less incentive to exploit an informational advantage), the contract has to be incentive compatible. An incentive-compatible solution would ensure that people who engage in high-risk behaviors identify themselves as such and would want to tame such incentive. To secure a long term contract with a vehicle owner, a driver will be willing receiving w than any higher pay but that will be short termed. What is most realistic in the two contracts is that the owner will earn more if it stipulates maximum expenses that can be made on trips such that drivers are required to deliver the remnant of the money they make per trip after accounting for those expenses that is approved by the principal. On the average, experiences have shown that the cost of maintenance and other expenses that are common in haulage businesses could be minimized if drivers drive carefully. A driver will tend to be more careful when he is required to deliver a fixed amount per trips and will be more motivated than otherwise. In Ofonyelu (2017), using Chiappori-Salanie (C-S) statistics, attempt was made to estimate the cross correlations between driver's perception about covenant and their risk characteristics. C-S statistics suggests that in

the presence of information asymmetry, default variables and adverse risk characteristics will be positively correlated. The result as contained in table 2 can be shown below.

Table 2: Cross correlations on perception about covenant and some risk variables

Default Risk Variables	All Drivers	Covenanted Drivers	Non Covenanted Drivers
Surrendered Collateral	*0.0473	-0.0322	*0.1126
Presented a guarantor	-0.1161	-0.0673	0.0104*
Hailed from the immediate environment	*0.2816	-0.0699	-0.1572
Married	*0.0223	-0.0718	0.0821*
Spouse from localized environment	*0.2599	-0.0969	-0.0204
Had many children	*0.2600	0.0658*	0.066*
At least one of the parents is alive	-0.0624	-0.0056	-0.0893
Bread winner of the family	-0.0194	-0.0071	-0.007
Came from monogamous family	-0.1418	-0.0203	-0.020

Source: Authors' computation

Evidence from Table 2 showed that covenanting drivers have strong impact in reducing adverse outcome among the different categories of drivers examined. Specifically, covenanted drivers showed the least positive correlation among the default variables. Among the covenanted drivers, the family size was a major factor in mitigating asymmetries. A driver with many children to feed will likely be committed and honest with the owner than those with little or no family responsibility. The number of children was positively correlated across the three cases considered. The implication of this is that child bearing and family size is a major factor in determining the riskiness of the truck drivers. Without having surrendered collateral, drivers will very likely to be risky as only the covenanted drivers was not positively correlated. This will be supporting the hypothesis that covenanting does minimize default risks. The involvement of guarantors, having knowledge about the parent and family were also among the variables that are not positively correlated with the default variables. A positively correlated default risk variable will imply that such variable is strongly causative of information asymmetry. For all of the three scenarios considered, covenanted drivers were the least asymmetric while the non-covenanted were the most. The major insight from the table is that covenanting of drivers helps to mitigate information asymmetry and adverse outcomes in haulage business.

CONCLUSION

This study situate the contractual relationship in a haulage business as a principal-agent problem whereby drivers have the option of remitting a fixed amount per trips or give account according to the expenses they make after every trips. Results from both scenarios showed that the optimal solution was reached when drivers were required to remit a fixed amount per trips made on the journey than otherwise. The finding from the study joins with Akerlof (1982) to suggest that effort commitment

relates positively with compensation. Imposing an ICC could lead to more efficient outcome.

REFERENCES

Abrahamson, M., & Anderson, W. P. (1984). People's commitments to institutions. *Social Psychology Quarterly*, 47, 371-381.

Akerlof, G.A. (1982). Labor contracts as partial gift exchange. *The Quarterly Journal of Economics,* 97(4), 543-569.

Akerlof, G.A. (1984). Gift exchange and efficiency-wage theory: Four views. *American Economic Review (American Economic Association)*, 74(2), 79-83.

Cohen, A. (2003). Multiple commitments in the workplace: An integrative approach. Mahwah, NJ: Lawrence Erlbaum Associates.

Grossman, S.J., & Hart, O.D. (1983). An analysis of the principal-agent problem. *Econometrica*, 51(1):7- 45.

Hannan, R.L., Kagel, J.H., & Moser, D.V. (2001). Partial gift exchange in an experimental labor market: Impact of subject population differences, productivity differences and effort requests on behavior. Retrieved on 18/12/2018 from http://www.econ.ohio-state.edu/kagel/Giftexch.hkm.pdf.

Hoppe, E.I., & Schmitz, P. W. (2013). Contracting under incomplete information and social preferences: An experimental study. *Review of Economic Studies,* 80 *(4), 1516-1544.*

Latz, L.F. (1986). Efficiency wage theories: A partial evaluation. *MIT Press*. Retrieved from http://www.nber.org/chapters/c4248.pdf.

Ledyard, J.O. (2008). *Incentive compatibility. The New Palgrave Dictionary of Economics* (2nd Edition. Eds). Steven N. Durlauf and Lawrence E. Blume. Palgrave Macmillan.

Mirrlees, J.A. (1975). *The theory of moral hazard and unobservable behavior-Part I*, NuffieldCollege, Oxford, Mimeo.

Mosca, M., Musella, M., & Pastore, F. (2007). Relational goods, monitoring and non-pecuniary compensations in the nonprofit sector: The case of the Italian social services. *Annals of Public and Cooperative Economics,*

Ofonyelu, C.C., & Eguabor, R.E. (2014). Metered and unmetered billing: How asymmetrics are the PHCN bills? *Journal of Social Economics Research*, 1(5), 97-107.

Ofonyelu, C.C., & Eguabor, R.E. (2017). Mitigating information asymmetry in Nigeria' haulage business: The role of incentive covenants in Akinbobola, T.O and Fasoranti, M. M. (eds), *Contemporary Issues in Nigeria, Essays in Honour of Professor Sola Olorunfemi* (p. 143-155), Nigeria, Emerald Printcorp.

Vance, R.J. (2006). Employee rngagement and commitment: A guide to understanding, measuring and increasing engagement in your organization. *SHRM Foundation*.