USER CHARGES AND ILLEGAL WASTES DUMPING: A STUDY OF LAGOS STATE NIGERIA

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Abstract

User fees has been hailed or embraced as a means of diverting solid wastes away from the landfill or dumpsites thereby prolonging the lifespan of the dumpsites. Various studies have been conducted to evaluate the impact of user fees on the 3Rs (reduce, re-use and recycling) of waste management while little has been done in analyzing the impact of user fees on illegal wastes. This study is justified in view of the fact that illegal dumping of wastes is more devastating to the society due to its higher cost than quick depletion of dumpsites' spaces.The study utilized stepwise regression as well as F-statistics. The study found most user fees as directly related to illegal dumping but not significantly. However, the combined effects of those user charges significantly increase illegal dumping. The study recommendsthat there is a great need to strengthen the Institutions or Agencies put in place to monitor dumping. The appropriate Environmental Laws must be enacted and enforced.There must be proper coordination of waste management Agencies.Lastly, the Private Sector and the Community must be fully integrated into solid waste management in Lagos among others.

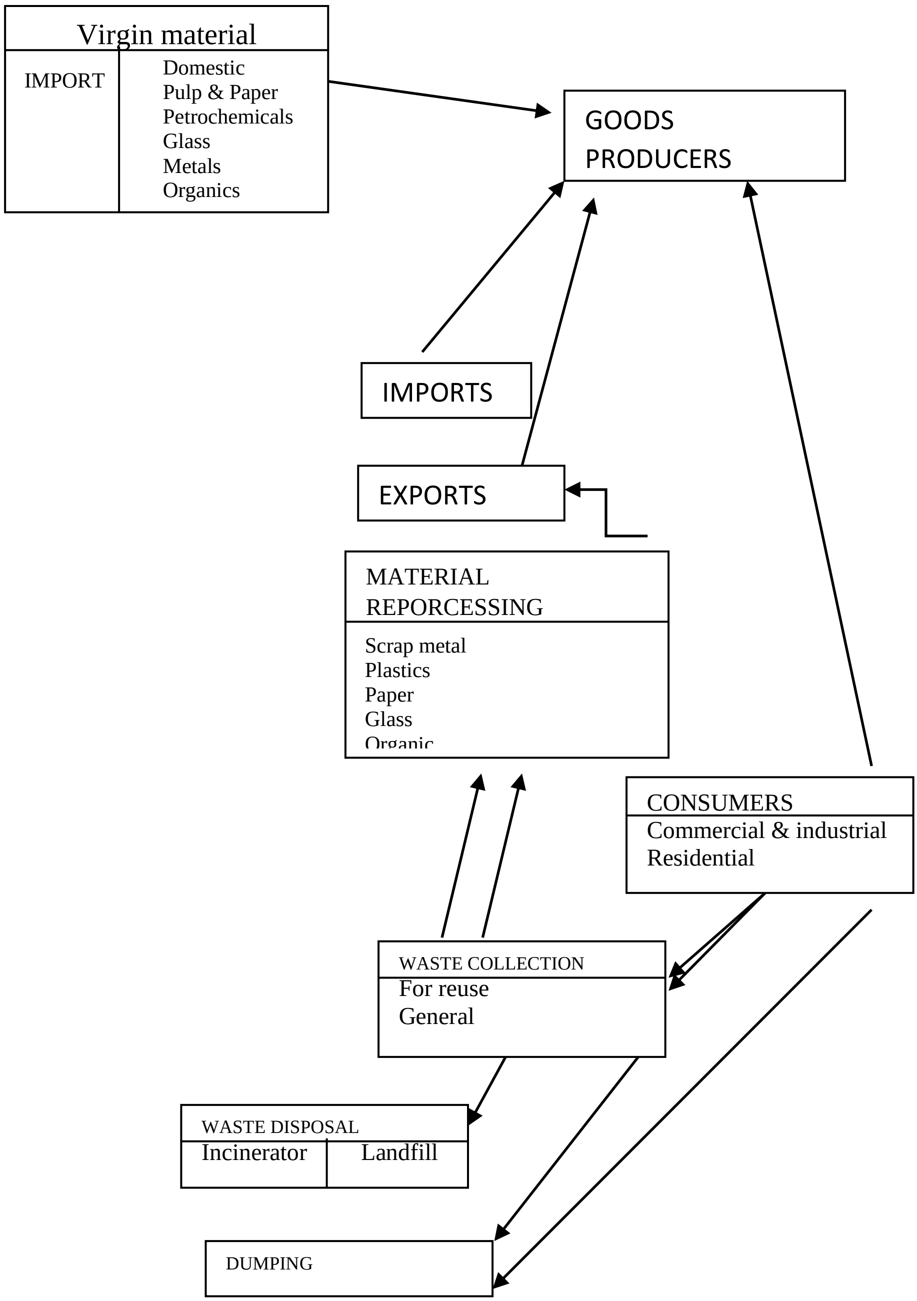
Keywords*:* Solid wastes, recycling reuse, reduction, illegal dumping.

JEL Classification: D:62, H:23, Q:53, Q:57, Q:58.

1. Introduction

Waste management is a part of system of material utilization in the overall economy. In order to fully appreciate and understand the connection between waste management and the economy, it is necessary to see the interconnection between the functioning of the economy and waste management because the viability of any activity such as recycling affects and is affected by, arrangements upstream in the supply of virgin materials from primary sectors and imports, and downstream in the options for disposing or on-selling materials once they are discarded.

The materials cycle is an open one because of the presence of international trade. New materials may enter the cycle as raw materials imported from other economies or as materials embedded in imported goods. At the other end, materials may move out of an economy as exports because the returns from doing so exceed the alternative local markets. The figure that follows therefore showed the overview of this cycle and the associated role of waste management and recycling, re-use, waste disposal and dumping.



SOURCE: New Zealand Institute of Economic Research (INC.) – 1999.With slight modification by Ayadi (2020)

Figure 1. Material Use Cycle

In the above diagram, developing Countries of the World obtain virgin materials needed for productive purposes either locally or as imported virgin materials of various components. They also obtain secondary materials as substantial part of their inputs in addition to some semi-processed and fully processed materials obtained through import for local production. These producers transform these materials and turn them out to consumers as commercial/industrial goods as well as individual consumables. The consumption activities of these sectors therefore creates some refuse/residues which are either stored for onward collection by the waste service providers, recycled/reuse (which is hardly the case in Nigeria) or dumped in the streets. The waste service providers therefore process the waste and transport to the disposal sites (incinerators and/or landfill) or sort the waste for material recovery where it finds its way back to the local producers.

The major import of the material cycle in LDCs is that dumping and disposal is always the final destination of waste in an open-loop system of material cycle and in such a system, the logic of economic growth implies that the more the level of consumption (both at domestic and commercial levels), the more will be thrown away as waste except there is a re-orientation towards closing up the loop in material cycle. A viable alternative for developing nation like Nigeria is the adoption of a natural model of “closed-loop” system of materials cycle characterized by circular flow of materials and multiple use of materials.

Practically, a hundred percent closed-loop is not achievable, but economic growth and environmental well-being are maintained in the balance where resource conservation in waste management revolves around embracing the ‘3Rs’ (reduce, reuse, and recycling) which approximates to an ideal practicable closed-loop system with the sole objective of diverting as much as possible waste from landfill to productive uses and waste minimization which is the main concern of this study.

Lagos state has a landmass of 3,577 Square Kilometres which represent 0.4 percent of Nigeria’s territorial landmass and is the smallest state in the Federation. The physical environment of LagosState is composed of about 83% of landmass and 17% of water bodies. Natural factors such as flat topography of the state, its high water table, the swampy nature and its intensive rainfall contribute to the problems of the environment and the location of the state made it possible to receive pollution loads from rivers and streams from hinterland states.

The state also has between 60-70% of Nigeria’s total industries. The high population and large concentration of industrial, commercial, and trade activities in the state exposed it to various environmental pollution and ecological problems leading to environmental degradation such as those associated with industrial activities of our water and land, generation and insanitary disposal of solid wastes (some of which are toxic or hazardous) leading to deterioration of the human environment.

The sheer quantity of waste generation in Lagos metropolis is a huge problem because waste represents an enormous loss of resources both in terms of materials and energy. For example, quantity of waste is a problem because it is a product of inefficient production processes, low durability of goods and unsustainable consumption patterns.Waste generation is increasing in Lagos State and an amount of about 3 million tonnes of solid waste is being turned out by households, manufacturing, commercial premises, construction and demolition etc (Adeogba 2000). In addition, waste management exerts pressures on the environment in the following ways:

a.Increased transport and the environmental impact of such land transport can be enormous and are usually in the form of significant energy consumption and air pollution since the transport distances from points of waste generation to landfill/dumpsites is much.

b.Air and water pollution and secondary waste streams from recycling plants.

c.Great demands for land in the creation of landfills/dumpsites and the landfills/dumpsites represent a permanent loss of resources. Moreover, the need to control the pollution impacts of landfills/dumpsites lead to increasing public expenditure for monitoring and clean-up operations.

d.Leaching of nutrients, heavy metals and other toxic compounds from landfills/dumpsites are not only dangerous to the present generation but has significant consequences on future generations.

e.Emission of greenhouse gases from landfills/dumpsites andtreatment of organic waste has a daring consequence on the life support ecosystem.

A safe disposal of solid waste is a must in effective waste management, the existing methods in use in Lagos State depicts some defects as residents discharge off their refuse in unauthorized places, open spaces, gutters and streams. Others burn their refuse openly while some dump in open illegal dumpsites.Dumpsites are usually disused pits, valley or ditch where wastes are dumped without treatment, grading or placement of a layer of inert materials to prevent the breeding of flies, mosquitoes and disease carrying vectors. Lagos has 32 approved dumpsites as observed by the UDBN Survey (1997).

Presently, there are no sanitary landfills in Lagos state, but there are three major dumpsites in Lagos State with average depth of 18 metres each and sizes of 42.0, 10.5 and 9.3 hectares respectively. Incineration is another disposal method which involves waste processing technique by which solid, liquid and gaseous combustible matter is converted to a residue and to gasses by refuse burning and the residue in form of ashes is left as an end product. The main incineration plant in Lagos State is the Oshodi Incineration Plant which has been converted to a transfer station because of the releases of obnoxious gases such as carbonmonoxide, nitrogen oxides, acid gases etc as end-products as against the modern incinerators which are safer with by-products used as a source of energy.Other method of disposal is the composting which is a biological decomposition of wastes of organic origin under controlled circumstances to a condition sufficiently stable for nuisance-free storage and for use in agriculture.

Initially, Lagos State, waste management is regarded as a municipal function and as such are expected to be borne by the Governments. The bulk of their revenue comes from state subvention, Local Government deductions, other source of finance is through property tax, which is based on the value of the property. This is usually revalued every 5 years. A percentage of the property value is determined (2½% to 10%) as property tax, from which a determined percentage is passed on for waste management.With the commercialization of LAWMA Services, the Board derives additional funding from internally generated revenue from industrial waste collection (user charges). As at mid 2001, a total of about 260 industrial premises were serviced by LAWMA and revenue accruing from such is put at an average of N10 million per month.

In December 1999, the private sector participation (PSP) programme was set up in a bid to effectively manage the large volume of municipal waste generated daily in the state. This programme was made in the area of domestic waste management in which consumers (domestic households) pay varying agreed user's fee per given service levels so as to enjoy the services of the PSP under each Local Government of operation.

User fees has been hailed or embraced as a means of diverting solid wastes away from the landfill or dumpsites thereby prolonging the lifespan of the dumpsites. Various studies have been conducted to evaluate the impact of user fees on the 3Rs (reduce, re-use and recycling) of waste management while little has been done in analyzing the impact of illegal wastes dumping on the user fees. This study therefore assesses the impact of user charges (residential and commercial) on refuse dumping in Lagos State. This study is justified in view of the fact that illegal dumping of wastes is more devastating to the society due to its higher cost than quick depletion of dumpsites' spaces.

2. Review of RelatedLiterature

In an attempt to find the relationship between waste discarded and users' fee, Wertz made use of two data points of discarded waste per capita (699 Pounds) in a volume-based user fee in the city of San Francisco in 1970, and the quantity of waste discarded per capita (937 Pounds) in all urban areas of the US in the same year. All urban areas in the US were paying property taxes to finance waste services in which case the marginal cost of disposal above the required level is zero or simply put, the price of disposing additional pound of refuse is zero. With these figures, Wertz (1976;263-272) calculated the arc elasticity of waste with respect to the price of solid waste services (SWS) as –0.15 meaning that a

100 percent rise in user fee will bring about a 15 percent fall in the quantity of waste discarded.

The above result suggests that user fee is potent in reducing waste disposal, but Wertz's(1976;263-272) distinctive oversight is the area of waste generation and waste discarded. His theory analyzed waste generated while his empirical work focused on waste discarded. The importance of this distinction has a great impact on the harmonization of his theory and empirical work (Jenkins 1993).

Also related to the above is his failure to address the difference between waste generated and waste discarded. For instance, he failed to analyze the impact of user fee on refuse dumping so as to find out the net benefit of such fee. This is a major flaw of his work. For instance, is the difference in waste generated and waste discarded caused by more composting, recycling, illegal dumping of refuse or refuse burning?

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Jenkins (1993;32-52) developed a utility maximization model which relates utility positively to the quantity of goods consumed and negatively to the amount of recycling subject to a number of constraints.He also in his utility maximization model of household decisions on solid waste services viewed the impact of an increase in user fee on time devoted to recycling. He then concluded that as the user fee on solid waste services is raised, individuals will devote more time to recycling. The import of this is that as user fee is raised, more recycling will be done by the household. In the like manner, the firm will commit more labour to recycling as the commercial user fee for solid waste services is raised. He also failed to analyze the dumping effects of raising the user fees.

Fullerton and Kinnaman (1992) explored the effects of using economic incentive in the form of unit pricing programme on the weight of garbage, number of containers, the weight per can and the amount of recycling in Charlottesville, Virginia a University town with a population of 40,341 in USA following the introduction of a unit charge of $0.80 sticker per 32-gallon bag or can of residential garbage collected as from July 1, 1992. Fullerton and Kinnaman concluded that households' response to unit's pricing was in the form of reduction in the number of bags but not on the actual weight of their garbage. Household therefore stomped on their garbage to reduce their costs. There was also an increase in recycling weight. Though, refuse weight declined by 14 percent at the curb, after accounting for dumping (using the lower estimate) the actual reduction in garbage is only 10 percent.

According to Donald (2002) there are two main components of direct costs associated with solid wastes disposal. The first is the price paid by households for their wastes to be picked up and the second is the price paid by households for their wastes to be picked up and the second is the price paid by getting the wastes disposed off in the landfill or dumpsites called tipping fee. Although some industrial sectors may provide their own waste management services, but household wastes management are usually done by the municipal governments or the private contractor employed to do it on their behalf.

When waste collection is financed from the tax revenues of the government, It means that price per unit of wastes discarded is zero. This is in opposition to economic logic as zero price is not equal to the marginal cost of waste disposal. At the other hand, zero price implies that individuals and firms may generate more wastes than when they pay the appropriate price (Marginal costs)of wastes disposal. To overcome the above problem, user-pay programme which is approximately equal to the marginal cost pricing is the one that can guarantee efficient waste management.

User pay in wastes management entails the waste generators to pay for wastes services based on the volume, weight or service level as opposed to financing via general tax levies and\or tenement which are not directly connected with household wastes generation. The most interesting properties of user fee is that it is an economic instrument that provides incentives to reduce waste disposal through reuse, reduction and recycling.

According to FCS group (2017), the substitute for solid wastes collection service can either be self haul transportation to the dumpsites or illegal dumping. However, self hauling can only be considered as an alternative to collection service in low density areas given that the competing cost of solid wastes and risks assumed by someone engaged in illegal dumping is too low to serve as deterrent to illegal dumping. According to FCS group (2012) illegal dumping of waste might be a significant matter and an upward rise of solid waste collection charges can spike off illegal dumping of wastes.
Abrashkin (2015) outlined the benefit of (VBWF) as more equitable cost distribution, provision of incentives for waste reduction and consequently generation of environmental benefits for the society at large. Creation of awareness on the need to reduce waste and embrace the 3Rs of waste management among offers, He also outlined the drawbacks as having the potential to place financial burdens on the low-income residents or large families. It provides uncertain and volatile revenue for supporting waste and recycling, Political hurdles. More importantly, (VBWF) creates incentives to illegal dumping of wastes among others. Abrashkin (2015) examined the economic, political and behavioral uses of applying the volume-based waste fee for promoting recycling municipal solid wastes in various diverse sample of United state's cities. The "pay as you throw" (PAYT). Volume based waste fee (VBWF) place a unit price on wastes generation and providing market mechanism to encourage waste reduction by recycling. The results indicate that the implementation of (VBWF)led to an average of 17% reduction in municipal solid waste volume sent to landfills and waste to energy facilities. In other words it leads to greater diversion of organic waste (composting)increased recycling and top-line reduction in waste generation. The major shortcoming of the study is that it failed to account for the illegal dumping associated with volume-based waste fee.
Palatnik,Broody,Ayahon and shechter (2014)surveyed some OECD countries implementing VBWF programmes across at least five percent of its population .The countries include Netherlands, Korea, Japan, Sweden, Canada and Switzerland. They found that household charging for waste collection through pay as you throw system produces between 16 to 20 percent less waste than similar household who pays for waste through other means like flat service fee and others taxes. In the study, the authors controlled for factors that affects waste generation and recycling such as demographic factor as well as attitudinal factors. They concluded that VBWF charges worked by diverting recyclables away from landfill and recycling is the second most important factor affecting waste prevention. They however failed to find the impact of VBWF charges on

illegal waste dumping.

Kim, Chang and Kelleher (2008)analyzed the effect of unit pricing on the urge to dump wastes illegally in16 provinces in Korea from 2001 to 2003 using the fixed effects panel regression model. The study found that a one percentage increase in the unit price of wastes led to a three percentage increase in the illegal dumping. The policy implication is that imposition of unit pricing for recouping waste disposal cost may not be as effective as recycling incentives in curbing illegal dumping of wastes.

Mangizvo(2010)employed questionnaires, and interviews to unravel the causes of illegal dumping of solid waste in the alleys in the central business district of Gweru city of Zimbabwe. He found the lack of receptacles in the centre of the city, lack of environmental awareness and inadequate human and financial resources as the major cause of waste dumping.

Abdulai (2011) analyzed the cause and effects of indiscriminate dumping in Tema metropolis of cape coast using descriptive survey based on a sample of 403 samples. The quota, Systematic as well as convenience sampling techniques were employed. The study found inadequate dumping site, irregular removal of waste and inadequate funds and equipment as factors fuelling indiscriminate dumping.

Example of user fee is the Belgium's case. Local authorities have two ways of financing municipal wastes management in which 'household waste tax ' or 'Environmental tax' and via payments for waste bags and wastes containers or the frequency of waste collection. In 1999, a study was done for OVAM(1999) to ascertain the impact to variable disposal fee on residual waste offered by household and it was found that Euro 0.50(BEF20)per grey waste bag brought would lead to approximately 30Kg weight per inhabitant. There were 2 channels through which the reduction occurred. First, the charges encouraged sources separation by households. This is called the separation effect and is responsible for 30% or 9kg reduction per inhabitant.Secondly, there is a reduction in waste either through genuine preventive behavior or through evasionwhich account for 70% or 21 kg of waste per inhabitant. The above results suggests that reduction may not be as a result of genuine preventive behavior (3Rs of waste management)alone but through evasion which is illegal wastes dumping suggesting that variable users fee could lead to dumping of wastes.

3. Theoretical Framework and Methodology

According to Asian Development bank (2014) user charges are volume-based fees generators (households and firms) pay for the service of solid waste management based on the principle of "polluter pays" also coined as "pay as you throw". This principle ensures that generators of wastes must bear the full costs of wastes collection, treatment and disposal. User charges include collection as well as the tipping fees. A tipping fee is levied on waste quantity received at a collection or processing facility like landfill.

The marginal cost pricing approach is also relevant in the determination of quantity of solid wastes discarded. The vertical line captured the price of solid wastes services while the horizontal captured the quantity of wastes disposed off. There is an inverse relationship between quantity of wastes set out for disposal and the price of waste disposal. The higher the price of SWS, the lower will be the quantity of wastes set out for disposal vice versa. Generally, in various countries, households finance wastes collection through tax or tenement which is a flat fee for SWS. That means that there is a zero incremental or marginal cost and this does not guarantee efficient wastes management. Households will continue to pay the same fee even as they throw garbage.

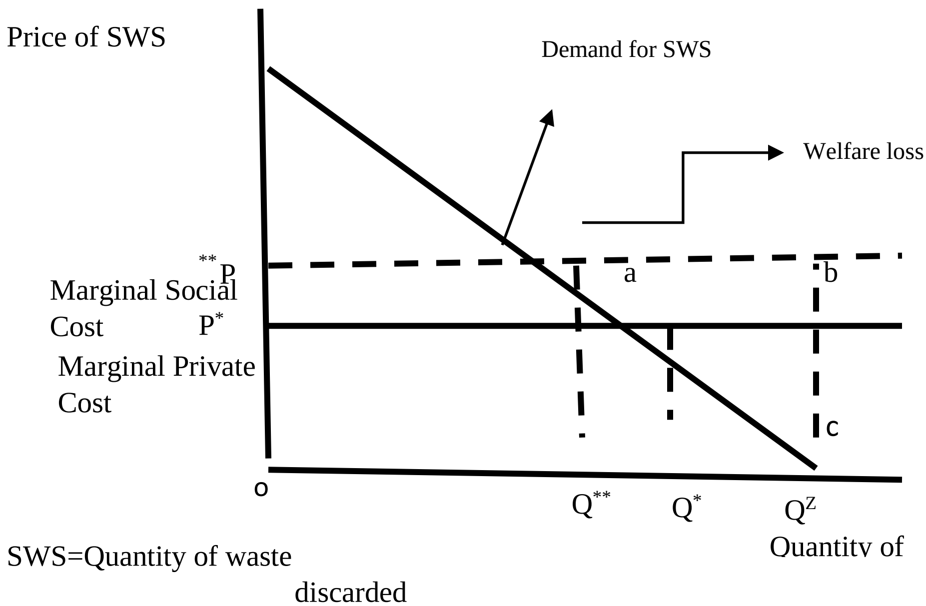

Figure II: The demand for solid wastes services (SWS)

Suppose that there is a marginal or incremental pricing of wastes and households are charged says P^{*}. With a higher price or user fee, household will now generate less wastes at Q^{x}. There is therefore a decline in the quantity of wastes set out for disposal due to a rise in user fee. Although there is a divergence between the marginal private cost and the marginal social cost of solid waste disposal, this study will not concentrate on that. Paying a user fee of P^{*} actually brought about a reduction in quantity of wastes discarded from Q^{Z} to Q^{*}. Quantity $Q^{*}Q^{Z}$ is therefore accounted for by embracing reduction strategies (re-use, recycle and reduction) and illegal dumping of wastes. What proportion of quantity Q^*Q^Z is accounted for by dumping is the subject matter of this paper.

Most studies on waste reduction strategies concentrate on the impact of the user fees on 3Rs ignoring the dumping behavior of household due to the imposition of user fee. This is the focus of this study.

Methodology

The model of the study is formulated based on the study of Kim, Chang and Kelleher (2008) and in agreement with FCS group (2017). In order to fully capture the net benefit of user fee, we estimated the contributions of those fees (the commercial charge, PSP charge and the cartpushers' charge) to dumping in the state. The following model was utilized to test the impact of user charges on wastes dumped daily in Lagos State based on their level of integration and the following model was produced.

The model

Incremental contribution and stepwise regression of dumping

Choc and Frazer (1999) in their theoretical analysis confirmed the roles of dumping when the solid waste service's charges are increased. This study is following up on this in this empirical investigation of dumping. Incremental contribution is an important one in this situation. In this empirical investigation, one is not completely sure which of the user charges (apart from cartpusher's charges) his worth adding as explanatory variables in the dumping model. Our intent is to exclude variables that contributes a very little towards error of sum of squares (ESS). In the same manner, we do not want to exclude explanatory variable (s) that's substantially increase ESS. To accomplish this, this study used the analysis of variance (ANOVA) or F- test. We utilized the latter tools.

In this method, one proceed either by introducing the Independent variables one at a time (stepwise forward regression) all by including all the independent variables in one multiple regression and rejecting them one at a time (stepwise backward regression). The decision to add or drop a variable is usually made on the basis of the contribution to that variables of the ESS as judged by the F-test. We adopted the stepwise forward regression procedure and the F-test utilize the following formula.

$$F= \frac{(R^2{}_{new} - R^2{}_{old} / df}{(1 - R^2{}_{new}) / df} \quad (1)$$

R^2_{old} is the R^2 of the old model (if the old model has one independent variable R^2 equal to R^2 of this model)

R^2_{new} equal to R^2 of the new odel (say new model with another independent variable added).

df numerator is the number of new regressor added

df denominator is (n-number of parameters in the new model)
Note that since the dependent variable (dumping) is the same under new and old model the above formula can be used, otherwise we have to use another version of F-test which we need not include here.
The models are analysed are:

$$\text{Dumpsm} = \alpha_0 + \alpha_1 \text{Rcarprsm} + \in \quad (2)$$

$$\text{Dumpsm} = \alpha_0 + \alpha_1 \text{Rusasm} + \in \quad (3)$$

$$\text{Dumpsm} = \alpha_0 + \alpha_1 \text{Rusfcosm} + \in \quad (4)$$

$$\text{Dumpsm} = \alpha_0 + \alpha_1 \text{Rcarprsm} + \alpha_2 \text{Rusasm} + \in \quad (5)$$

$$\text{Dumpsm} = \alpha_0 + \alpha_1 \text{Rcarprsm} + \alpha_2 \text{Rusfcosm} + \in \quad (6)$$

$$\text{Dumpsm} = \alpha_0 + \alpha_1 \text{Rcarprsm} + \alpha_2 \text{Rusasm} + \alpha_3 \text{Rusfcosm} + \in \quad (7)$$

Where:
Rusa= Average monthly residential user charges (deflated by CPI) corresponding to time t.
Rusfcom= Average monthly user charge for commercial/industrial waste (deflated by the CPI) corresponding to time t.
Dumping= Monthly quantity (in tonnes) of waste dumped in Lagos Streets in time t.
Carprice= Cart pusher's average charge in time t.
Dump= Quantity of waste dumped in Lagos in time t.
Rcarpr= Monthly real cart pusher's charge corresponding to time t.
SM added at the end of variables means that they have not been smoothed by the Holt- winters smoothing technique.
Since data for the study of time series, we conducted a unit root test so as to eliminate the possibility of a spurious regression by applying augmented dickey Fuller (ADF) test on all variables both (weekly and monthly).

In addition to this, we ran regression. on Holt- Winter's filtered data (the justification smoothing data and for adopting all Holt- Winter's procedure is provided in the next subsection). In order to obtain the best estimate of models, we equally ran Ordinary Least Square (OLS) regression and the Generalized Least Square (GLS) regression on models at level so as to obtain the best estimate of models. The justification for applying GLS when OLS shows autocorrelated disturbance were provided by Greene (1997), who stress the problem posed by autocorrelated disturbances and a way of dealing with them when he stated that the model with autocorrelated disturbances is a generalized regression model, and we should expect least Square to be in- efficient. This problem can be seen when we know the disturbance process and the process generating the independent variables. The efficiency of the least squares falls to less than 10% if the autoregressive root (ρ) is close to 1. Judge *et. al*. (1985) also agreed to the loss of efficiency but differ on the severity of the problem (see also, Hill, Griffith and Judge, 2001). Based on the foregoing, we applied the generalized least squares (GLS) on series at levels and Holt-winter's filtered data.

Data filtering or smoothing

Filtering techniques provide a means of removing or at least reduce volatile short-term fluctuations in a time series. Filtering is a series product procedure, which may be used to generate new series that are based upon the data in the original series. Filtering enhances the generation of series with white noise. Smoothing may be done to make the time series easier to analyse and interpret. Smoothing also may be done to remove seasonal fluctuations. That is, to deseasonalize or seasonally adjust a time series. Lastly, filtering techniques do produce optimal forecasts in certain conditions, which turns out to be intimately related to the presence of unit root in the series before forecast. In addition other approaches produce optimal forecast only under certain conditions as well, such as correct specification of the forecasting model. We must stress here that all our models are approximations, any procedure with a successful track record in practice is worthy of serious consideration, and filtering techniques do have successful track record in the situations mentioned above.

Hodrick- Prescott Filter (HP)

Hp smoothing method is widely used for macroeconomic analysis to obtain a smooth estimate of the long-term trend components of a series.

(3) The Schwarz criterion (SC) is derieved as: -2 I/n + 2k (Log n)/n or log ($\Sigma e^2 / n$ +k log n/n). The AIC differs from the adjusted –R^2 in that it penalize the addition of the right hand side variables (which reduces the number of degrees of freedom) more heavily. The SC also penalizes the addition of the right hand side variables more heavily than does the corrected R^2

(4) The final prediction error (FPE) is computed using the formular below: FPE= ((n+k)/ (n-k) σ^2 is an unbiased estimate of the residual variance) FPE is based on forecast made using actual rather than estimated values of explanatory variables for forecast periods and using parameters estimates for the entire sample, inclusive of the forecast period. The model with the smallest ex-post prediction error is selected.

All the above criteria, as well as numerous modification are based on the principle of minimising the residual sum of squares as a guide for selecting the best model (Maddala, 1988; Charemza and Deadman, 1997).

The results of coefficient of determination, adjusted coefficient of determination, Akaike information and Schwarz criteria indicates that the FGLS or EGLS estimates on Holt Winter's filtered that is at the most robust. In addition, they are the most reliable for forecast and policy decision.

Data

User charge for Commercial wastes data was obtained through LAWMA landfill gate records as well as the quantity of waste dumped in Lagos. This is the sum of wastes removed by the LAWMA's Highway Managers Ltd. and the Local Governments. Lastly, some of our data were generated or transformed linearly to daily and weekly data for analyzing daily and weekly data respectively. Average PSP user charges as well as the cartpusher's charges were obtained through the primary instrument administered on households. The questionnaires were administered in a stratified random sampling process on the household sector. 1,000 questionnaires in all were given out, out of which 504 were returned. The stratified sampling technique was to give out 50 questionnaires each to the 20 former Lagos State Council areas. The major problem with this sampling technique is that respondents could not be tracked down at home and as such, questionnaires were administered on respondents mainly at their working places and in this case, there was no assurance that the strata stipulations was strictly followed as many people are not residing even close to where they work. Categorization of our data based on those Zones could not be accomplished because some respondents did not disclose their addresses. However, we feel that this sampling technique may not necessarily lead to high sampling error.

4. Results and Discussion of Findings

The result in table one shows that each of the user charge is not integrated of order zero but stationary of order one. The quantity of wastes dumped is however integrated of order zero.

TABLE I: The Augumented Dickey-Fuller result for Data

	PHILIP PERRON TEST STATS/ADF TEST STATISTIC		**MAKINNON CRITICAL**		**REMARK**
Variable	LEVEL	1ST DIFFERENCE	LEVEL	1ST DIFFERENCE	
Rusfcom	-1.6477	-14.731	-3.4391	-3.4391	I (1)
Rusa	-1.533	-14.72	-3.4391	-3.4391	I (1)
Carprice	-1.483	-14.75	-3.4391	-3.4391	I (1)
Dumping	-3.7657	NA	-3.4391	NA	I (0)

The success of user charges in reducing waste generation is not always a win-win result. That is, reduction in waste set out for disposal may not be as a result of embracing the 3 Rs of waste management, but may be as a result of illegal waste dumping. This the study tried to do this analysis by modeling dumping as linearly related to the three user charges utilized in Lagos State.The results of our model in which the waste dumped in Lagos State was related step wisely on the various user charges (residential–cartpusher, residential- PSP and commercial/industrial solid waste services – LAWMA) produced the following results:

***Result presentation of stepwise regression for dumping model**

(1) Dumpsm= $\alpha_0 + \alpha_1$ Rcarprsm $+ \in$ (8)

(2) Dumpsm= $\alpha_0 + \alpha_1$ Rusasm + $\in$ (9)

(3) Dumpsm= $\alpha_0 + \alpha_1$ Rusfcosm $+ \in$ (10)

(4) Dumpsm= $\alpha_0 + \alpha_1$ Rcarprsm + α_2 Rusasm+ $\in$ (11)

(5) Dumpsm= $\alpha_0 + \alpha_1$ Rcarprsm $+ \alpha_2$ Rusfcosm+ $\in$ (12)

(6) Dumpsm= $\alpha_0 + \alpha_1$ Rcarprsm $+ \alpha_2$ Rusasm + α_3 Rusfcosm + $\in$ (13)

Results

1. Dumpsm= 173244.2- 933.949Rcarprsm + $\in$ (14)
   t- stats (2.823) (-1.920)
   R- squared= 0.098, adjusted R- squared= 0.071, F= 3.69

2. Dumpsm= 83208.64- 142.187 Rusasm+ $\in$
   (15)
   t- stats (1.852) (-0.617)

   R- squared= 0.0026, adjusted R- squared= -0.018, F= 3.88

3. Duspsm= 62044.19- 0.861 Rusfcom+ $\in$ (16)
   t- stats (2.84) (-0.299)
   R- squared= 0.003, adjusted R-squared= 0.027, F= 0.090

4. Dumpsm= 205954.8- 2395.605 Rcarprsm + 779.110 Rusasm + $\in$ (17)
   t- stats (3.357) (-0.703) (1.941)

   R- squared= 0.190, adjusted R- squared= 0.141, F= 3.88
   F- ratio due to addition of Rusasm= 3.67 (signf.)

5. Dumpsm= 179527.1- 1107.748 Rcarprsm+ 2.076 Rusfcosm + $\in$ (18)

t- stats (2.869) (-1.993) (0.664)

R- squared= 0.1097, adjusted R- squared = 0.0558, F= 2.03
F- ratio due to addition of Rusfcosm= 3.71 (signif).

6. Dumpsm= 211040.8- 2528.7 Rcarprsm+ 768.5 Rusasm + 1.8 Rusfcosm + ∈ (19)
   t- stats (3.376) (-2.745) (1.895) (0.606)

   R- squared= 0.200, adjusted R- squared= 0.125, F=2.66
   F- ratio due to the addition of Rusfcosm to (4)= 3.55 (signif.)

   The general conclusion one can draw from the above results is that all the three independent variables are justified for inclusion into the dumping model. The Generalized Least Squares (GLS) of equation 19 is provided below.

GLS estimate for dumping model

	FGLS monthly data		FGLS weekly data	
Variable	Coefficient	t- statistic	coefficient	t-statistics
Constant	-26116.80	-0.222	5805.271	0.762
Rcarprsm	49.062	0.096	34.019	0.464
Rusasm	71.062	0.286	-5.860	-0.187
Rusfcosm	2.770	1.053	0.221	0.556
AR(I)	0.976		0.982	
R- squared	0.892		0.955	
Adjusted – R^2	0.850		0.953	
DW	1.850		1.874	
F	62.011		800.260	
N	35		155	

The above result shows the GLS estimate of the dumping model. The import of this model is to account for the dumping that accompanies each user charge. The stepwise regression has enabled us to ascertain the regressors to include in the model. Of course individually,each user charge was positively related to dumping, none of the charges significantly explained waste dumping in Lagos state. However, the three user charges collectively exerted significant influence on dumping.

The GLS results suggest that a first-order autocorrelation has been cured and the dependent variables have explained between it 89% (for the monthly data) and 95% (for the weekly that data) variability in the dependent variables indicating that a good fit has been achieved. Autocorrelation has been cured and has been invited routes within a unit rocket is an indication of stationarity. From all these, one can only conclude that a good model for dumping has been achieved.

In other words, to reduce dumping in Lagos state, raising the PSP charges too might help. Interestingly too, the PSP's user charge which was negatively related to dumping might be due to the fact that there were simultaneous rise in charge and entry of new registered PSP who extended services to areas/sections that hitherto engaged in dumping.

Conclusion and Recommendation

This studywas set out to find the dumping impact of raising the user fees for the period wastes were financed using the user fees. The study was borne by the fact that what most studies are analyzing are the beneficial impacts of user fees in the form of encouraging recycling, re-use and reduction of wastes generation. Illegal dumping of wastes is more devastating to the society due to its higher cost than quick depletion of dumpsites' spaces. The study utilized stepwise regression. The study found most user fees as directly related to illegal dumping but not significantly. However, the combined effect of those user charges significantly increases illegal dumping.

Based on the above, user fees in place in Lagos, has, led to substantial dumping of refuse in the State. There is a great need to strengthen the Institutions or Agencies put in place to monitor dumping. The appropriate Environmental Laws must be enacted and enforced.Also related to the above point is the fact that there has been a duplication of duties of Agencies put in place to manage the environment and proper delineation of duties is essential for the reduction of illegal dumping. There must be proper coordination of waste management Agencies.Lastly, the Private Sector and the Community must be fully integrated into solid waste management in Lagos among others.

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