Distributional Effects of Transport Fuel Taxes in Kenya

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Abstract

The choices of transport that households make are important in determining the type of fuel taxes. Many countries in the developing world have in the recent past witnessed an increasing vehicular population due to increased preference for private transport as a result of improved incomes and resultant wealth effect among the middle and upper class strata of the population. The public transport system is in most cases disorderly and many of those individuals and households who could otherwise be using public transport system end up buying private cars, which do not only lead to high traffic congestions in the cities but also pollution due to increased consumption of gasoline. Therefore, these countries need to come up with policies that promote public transport and mass transit and discourage private ownership of vehicles. This paper estimates distributional effects of fuel taxes by use of the gini coefficient and Suit Index and comments on fuel tax regime for developing countries that are currently experiencing unprecedented vehicular growth. From the distributional effects analysis it is shown clearly that the burden from fuel taxes impacts more on the high income households who spend a higher proportion of their income on transport fuel compared to the low income households. This study therefore concludes that transport fuel taxes in Kenya are progressive and not regressive as is widely argued.

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Abbreviations and Acronyms

AGO	Automotive Gas Oil
CBD	Central Business District
CO_2	Carbon Dioxide
ECM	Error Correction Model
EEU	Environnemental Economics Unit
ERC	Energy Regulatory Commission
IEA	International Energy Agency
KIPPRA	Kenya Institute for Public Policy Research and Analysis (KIPPRA)
KNBS	Kenya National Bureau of Statistics
KRB	Kenya Roads Board
KM	Kilometres
MNL	Multinomial Logit
MSP	Motor Spirit Premium
N_2O	Dinitrogen Oxide
NO_x	Nitrous Oxides
PIEA	Petroleum Institute of East Africa
PM	Particulate Matter
ROSCAS	Rotating Savings and Credit Associations
SO_2	Sulphur Dioxide
UNEP	United Nations Environmental Programme
VMT	Vehicle-Miles Travelled
VOCs	Volatile Organic compounds

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1. Introduction

Energy is a key to economic growth and development as well as improvement of quality of life, and the world energy demand increases tremendously. The major source of energy is currently fossil fuels, which account for about 81% of the World total primary energy supply, but also hydro power, nuclear and biomass are significant sources. Oil use accounted for 43.1% of fuel shares of total final consumption (IEA, 2006). Most of the oil was used in the transport sector. In order to limit the environmental damage of the transport sector, as well as generate income to state budgets, fuel taxation is a widely used measure. Which level of fuel taxation that is appropriate is, however, a debatable issue and the taxes vary dramatically across countries. The gasoline tax in Great Britain of 50 pence/litre in 2000 (about US$ 2.80/US gallon) is the highest amongst industrial countries while the tax level in the United States of about 40 cents/gallon is the lowest(Parry a and Small, 2005).

In Kenya, petroleum accounts for 22% of the total primary energy supply, 67% of which is consumed in the transport sector while the rest is consumed mainly in industrial processing and power generation (Aligula, 2006). In recent years, 2003-2007, Kenya has recorded a substantially increased demand for transport fuels (both diesel and gasoline). The total consumption of petroleum products is currently about 3.73 billion litres and is projected to increase by more than three times in line with vision 2030, which is the blue print document for economic and investment policy. Gasoline and diesel consumption currently stands at about 890 million and 1.4 billion litres, respectively. The gasoline tax is about 40, 43 and 28 US cents/litre for motor gasoline super, motor gasoline regular and automotive gas oil (diesel), respectively.

The steady increase of motor vehicles in the rapidly growing Kenyan cities makes transport emerge as a key contributor to regional air pollution. By end of 2006, over 700, 000 vehicles were already licensed to ply Kenyan roads and the number is increasing by an average of 30,000 units per annum. Emissions of pollutants, mainly carbon dioxide (CO_2), nitrous oxides (NO_x), dinitrogen oxide (N_2O), sulphur dioxide (SO_2), volatile organic compounds (VOCs), lead and particulate matter (PM) are a result of the diesel and gasoline combustion by motor vehicles. Similarly, ambient lead concentrations in urban centres in Kenya in 2004 was recorded in the range of 0.4 – 1.3 $\mu g/m^3$. The lead content in gasoline in Kenya is 0.4g/litre, and only 4% of the gasoline consumed in the country by April 2004 was unleaded. The proportion has since increased to 30% in 2005. This implies that about 245 million litres of leaded gasoline were consumed in 2004 releasing about 98.1 tonnes of lead, 75% of which ends up in air, soils and plants, while the rest remains in engine block and lubrication oil (UNEP, 2006).

Kenya has one of the best regulatory regimes in the petroleum sector in Africa. Regulatory functions in the sector have previously been shared among various players including the Ministry of Energy, Ministry of Finance, Provincial Administration and Local Authorities. The Petroleum Institute of East Africa (PIEA) is a voluntary membership institution patronized by major oil companies, plays a key role in capacity building and awareness creation. For many years Kenya did not have a clear policy governing all the energy sectors. The challenges posed by this policy vacuum led to a new policy; the Sessional Paper on Energy No. 4 of 2004 and the energy Act 2006 through which the Energy Regulatory Commission (ERC) is now regulating all energy sectors (petroleum, electricity, renewable energy and biomass). The policy aims to achieve sustainable energy supply.

Various instruments have been applied in the case of Kenya to achieve certain fiscal policy objectives as well as environmental sustainability objectives. Kenya uses fiscal instruments to pursue environmental objectives albeit in a limited way; subsidies are more prevalent; fees and royalties are too low to induce behaviour change; taxes and levies are rare. Some of the instruments previously used include increase in excise duty on petroleum products for gasoline and for gas oil; levy of Kshs.1 per litre of Kerosene to raise revenue for use in water harvesting and other projects; surcharge on imported second hand vehicles and increase in excise duty on motor vehicles to decongest roads. Others include reduction of import duty, excise duty, VAT on diesel and residual fuels; LPG; Kerosene; imported timber and other wood products to reduce deforestation. The most common taxes in fuel taxation and especially that related to transport are the excise duty and road maintenance levy fund which finances activities of the Kenya Roads Board (KRB). Studies have shown that there is seemingly inelastic demand for gasoline in the transport sector coupled with pressure to address urban traffic congestion (Mutua et al, 2008).

The current trend of emissions from gasoline and diesel fuels is a threat to the well being of citizens as well as global warming and climate change. The fact that public transport system in Kenya has performed poorly over the years has further deteriorated the pollution from the transport sector. With the high levels of fuel consumption and the thereof high emissions levels, there is a great need to discourage consumption. Since Kenya is also a signatory to many climate change and environment related programs, such as the Kyoto protocol, revising the fuel tax regime is an issue to consider. Environmentally related fiscal policies also have the potential to raise more revenue for the state and possibly lower the domestic debt, while at the same time reducing environmental damage.

A background on the economic theory for employing taxation as a tool for environmental policy is given in Barthold (2004) in which essentially three rationales for this are identified. There is the benefit principle taxation, in which taxes are assessed as user fees to fund specific direct expenditure programs. For instance, the purpose of the federal motor fuel taxation expansion in the United States in 1956 was to fund highway construction. Taxes can also be assessed as insurance premia in a mandated scheme of risk pooling. The tax is then used to fund an insurance pool against possible environmental risks that arise from the taxed product. Furthermore, developed countries have used the tax code to deliver pigouvian subsidies or impose pigouvian taxes on polluters. According to Pigou, a tax equal to the difference between marginal social cost and private marginal cost would lead the market to an efficient outcome since it internalises the externality into private costs (Barthold, 2004).

A common argument against transport fuel taxes is that fuel demand is inelastic and, therefore, the environmental benefit of the fuel taxes is small. Sterner(2007), however, concludes that the long run price elasticity of gasoline is high, but in the short run it may be quite inelastic and this has implications for policy makers, who often depend on observable short run progress. The complicated political economy of fuel taxation is addressed in Hammar et al (2004). Their study on political economy obstacles to fuel taxation observes that overall economic and political situation, structure of transport system as well as characteristics of fuel markets play a key role in gasoline taxes. The study points out that basis for the correlation between fuel taxes and fuel consumption is twofold; not only do low taxes encourage high consumption, but high consumption also makes it politically complicated to raise taxes 2004 (Hammer et al, 2004).

Another important factor regarding taxation of transport fuels is the distributional effects. It is commonly argued that gasoline taxes are regressive and therefore not justifiable on grounds. This belief is however questioned in (West, 2004). The paper investigates distributional effects of alternative vehicle pollution control policies for the case of USA, and estimate a model of discrete vehicles choice, including vintage and size choice, and the continuous choice of vehicle-miles travelled(west, 2004). The study indicates that a tax on miles or gasoline is progressive over the bottom half of the income distribution but regressive over the wealthiest part. This is because many of the lower income households do not own any vehicles and a price increase would make poorer households reduce their driving distance more than wealthy households. The study states that greater price responsiveness among low-income households enhances the degree of progressivity in the lower-income groups while mitigating the degree of regressivity in the upper-income groups. Furthermore, it concludes that gas or mile taxes are significantly less regressive than other possible policy choices for vehicle emission control such as newness subsidies or engine size taxes (West, 2004). The study also reviews distributional aspects of fuel taxes in South Africa (Ziramba, 2008). The study shows that gasoline taxes in South Africa are clearly progressive.

Suits (1977) use gini coefficient and Suit Index to examine progressivity and regressivity of taxes in the US. The study asserts that its widely accepted knowledge that some taxes are progressive while others are regressive and that the degree of each varies. However Suits (1977) notes that there is no generally accepted index on how regressive or progressive a particular tax is. The ndex was inspired by the gini coefficient. The gini coefficient varies from +1 at the extreme progressivity where the entire tax burden is borne by members of the highest income bracket, through zero for a proportional tax, to -1 at the extreme of regressivity at which the entire tax burden is borne by members of lowest income brackets. The index of tax progressivity is related to the Lorenz curve and the gini concentration ratio. Usually, accumulated percent of total family income is plotted vertically against accumulated percent of families on the horizontal axis.

Mutua et al (2008) in analysing transport choice, elasticity and distributional effects of fuels taxes in Kenya find that improved income among households creates a wealth effect which encourages households to own cars. High ownership of private cars leads to high vehicular population, congestion, high gas consumption and pollution. The study notes that the choice of transport households make therefore has an impact on the consumption of transport fuels and thereof pollution. Their analysis of demand elasticity established that the long run coefficients are two times higher that of the short run elasticity coefficients.

The debate in Kenya today with regard to fuel taxation has mainly focused on the arguments that the current taxes such as the fuel levy and excise duty are too high. This has been intensified by the oil price volatility which led to high prices of gasoline of up to Kshs. 110 or US$ 1.37 in November 2008 following high prices of crude petroleum in the international market which increased to US$147 per barrel. The price has since dropped to about Kshs. 75 or US$ 0.94 in March 2009. The government has moved in to reduce taxes on oil used in power generation but transport fuel taxes have not been affected. Motorists, generally argue that the tax burden is too high and also once it has been collected, is not used well to finance road development and rehabilitation works. While their arguments may be valid to some degree, issues of pollution abatement and climate change are overly ignored in such arguments. Are fuel taxes too high?, are they progressive or regressive?

The present study investigates the case of Kenya, and seeks to establish distributional effects of fuel taxes. The paper basically seeks to establish the distributional effects of transport fuel taxes and comes up with policy recommendations on fiscal and environmental policy for developing countries that are currently experiencing unprecedented vehicular growth.

2. Methodology

The methodology of this study is in three parts. First, it computes budget shares of transport in household expenditures for each category of population classified by household income deciles. Secondly, it develops Lorenz curves/Gini coefficients and lastly, computes Suit Indices following Suits (1977) to determine whether transport fuel taxes are progressive or regressive. . It is important to take into account both those directly paying for fuel, i.e. those who own cars, and those that pay indirectly for fuel in the public transport system.

2.1 Distributional effects

2.1.1 Budget Shares

The budget share for each income decile is calculated according to the following formula following Ziramba et al. (2008):

$$E_{id} = \left[\frac{TE}{THE} \right] \qquad (1)$$

Where;

E_{id} =expenditure share of each decile

TE =household transport expenditure for each decile

THE =total household expenditure for each decile

2.1.2 Gini Coefficient and Suits Index

Following Suits (1977), this paper as argued earlier, analyses whether transport fuels in Kenya are progressive or regressive. These are mainly gasoline, popularly known as motor spirit super which is mainly consumed in private transport and diesel which is consumed mainly in public transport.

To measure the progressivity of a tax, a figure similar to Lorenzo curve, but one in which the accumulated percent of tax burden is plotted vertically against the accumulated percent of income on the horizontal axis.

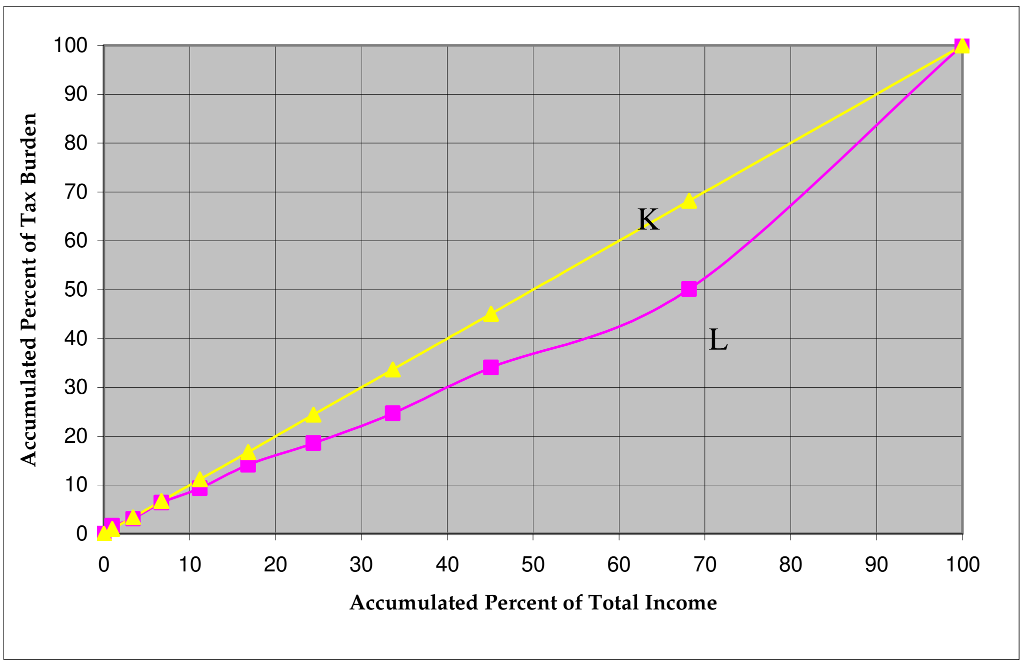

Figure 1: Lorenz Curve of Household income and accumulated tax burden

Y

Analogously to the Gini coefficient ratio, this paper defines the index of progressivity S for Kenya in terns of K, the area under the triangle and the L, the area between the Lorenz curve and the horizontal axis. The equation to estimate the Suit index is specified as follows:

$$S = (K - L)/K = 1 - (L/K) \text{ .... (2)}$$

Z

2.1.3 Properties of the Suit(S) Index

X

The Suit index exhibits certain properties which makes it unique in policy analysis and particularly when it comes to scenario building on expected outcomes of various tax rates in fiscal policy making. According to Suits (1977), it facilitates exposition to represent the accumulated percent income, measured on horizontal axis as a variable y that ranges from 0 to 100.

The ordinate of the Lorenz curve representing the corresponding accumulated percent of total tax burden for a given tax x, then becomes $T_x(y)$. In this case, the area under the curve corresponding to tax x is given by

$$L_x = \int_0^{100} T_x(y)dy \quad \text{……………………………………………………………. (3)}$$

Recalling that the area of the triangle has been designated K, it therefore follows that the index of progressivity of the tax is given by

$$S_x = 1 - (L_x / K) \quad \text{………………………………………………………….… (4)}$$

The above formula is applied to calculate the area under the curve as stated in equation 5 below.

2.1.3.2 Calculation of the Index

In practice, the value of $T_x(y)$ is known for only a few discrete values of y. The values are given for only 11 values of y: for y y1, y2….y10, corresponding to the population deciles and for y=0. According to Suits (1977), this information is adequate to provide a close approximation to the value of the integral as:

$$L_x = \int_0^{100} T_x(y)dy \quad \text{…………………………………………………………... (5)}$$

2.2. Data

In our analysis, we use data from the KIPPRA 2004/2005 urban household travel survey. The survey interviewed a representative sample of about 2,200 households in Nairobi. It interviewed the low, middle and upper income households.

3. Empirical Analysis

This section of the paper presents summary statistics and results of distributional effects of transport fuel taxes where expenditure deciles, gini coefficient/Lorenz curve, tax burden and suits index which are calculated..

3.1 Summary Statistics

Table 1 summarizes the statistics used in the analysis. Notable is that the average monthly income is Kshs. 15,662 while the average household expenditure is Kshs. 18,200. This shows that households spend more than they earn. The extra income could be from transfers and gifts from relatives as well as initiatives in cooperatives and rotating savings and credit associations (ROSCAS). The mean monthly expenditure on transport is Kshs. 3,603 and that of leisure Kshs. 1,859. The mean distance from the central business district (CBD) is about six kilometres while the maximum is 20km. The mean household size is four (4) persons while the average age of the household head is about 36 years. For households that own car, the average number of cars per household is approximately 1.17 and the maximum number is four (4).

Table 1: Summary statistics

Variable	*Observations*	*Mean*	*STD*	*Minimum*	Maximum
Average income (Kshs)	2,105.00	15,662.03	15,350.93	1,500.00	50,000.00
Distance to CBD (KM)	2,071.00	5.84	4.46	0	20.16
Household Expenditure on Transport (Kshs)	2,054.00	3,602.93	4,473.59	0	50,000.00
Household Size	2,105.00	3.54	1.96	1	14
Expenditure on leisure (Kshs)	2,105.00	1,858.71	4,597.04	0	70,833
Household Monthly Expenditure(Kshs)	2,105.00	18,200.10	21,261.35	700	287,850.00
Age(years)	2,104.00	35.8	9.79	6	55
Number of cars	304	1.17	0.46	1	4

Source: Authors computation from UPTS Data, KIPPRA, 2004/2005

3.2. Distributional effects of transport fuel taxes

3.2.1 Expenditure Shares

In order to analyse the distributional effect of fuel taxes, data achieved from the household survey is allocated in income deciles and the budget share spent on transportation calculated. It is here argued that the well-being of individuals often depends on the income of the entire household rather than on the income of the individual and, therefore, the income deciles are arranged according to household incomes (see also Ziramba et al., 2008). The transport modes of interest in this part of the study are public as well private transport, since these transport modes account for use of fuel and consequently are affected by fuel taxes, while non-motorized transport is here left out.

Fig. 2 below shows the distribution of household income per month and number of households in the survey. It can be noted that about 50% of the households earn Kshs. 10,000 per month or less, while less then 15% of the households have incomes of Kshs. 50,000 per month or higher.

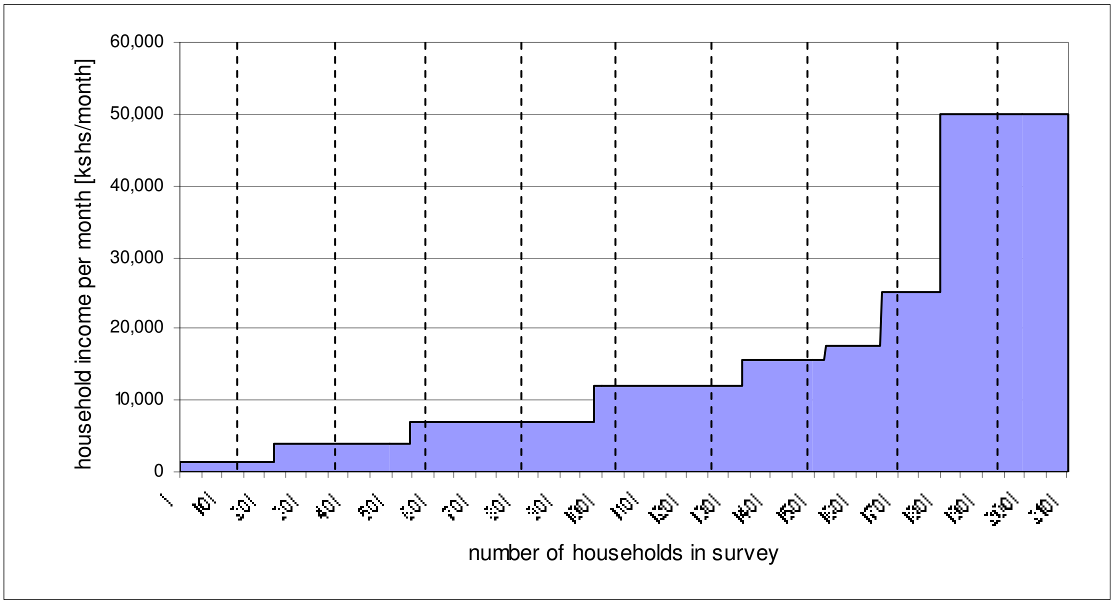

Fig 2: Household Income Distribution

In Fig. 3, the resulting public transport expenditures as shares of total expenditures for households for each income decile are presented. As can be seen, the lowest income household deciles spend somewhat less than 10% of their total household expenditures on public transport. In the middle income households the share is higher and near 14% for several of the middle income household deciles. For the income deciles with the highest household incomes, the public transport expenditure share of total expenditures drops considerable, and the highest income decile spend only about 3.5% of the total household expenditures on public transport.

For private transport the distribution of expenditures is completely different than for public transport. Fig. 4 gives the private transport expenditures as shares of total expenditures for households for each income decile. For the dominating part of the households, the share of the total expenditures spent on private transport is very low; the 7 lowest income deciles have all private transport expenditures that are lower than 2% of the total expenditures. However, the two income deciles with the highest incomes the share is significantly higher. For the second highest income decile the share is 9% and for the highest income decile the share is 12%.

Public transport includes transport by e.g. bus, trains while private transport is mainly by cars and motorcycles. It should be noted that only a part of the transport expenditures can be considered to be fuel costs. For European conditions, it has been estimated that about 17% of the operating costs for urban buses stem from fuel costs, and the corresponding share for line-haul buses has been estimated to 28%. The largest shares of the operating costs are the driver costs (salary etc.), which are 46% and 31% for urban and line-haul buses respectively (Jobson, 2007). . Since salaries are generally lower in developing countries like Kenya than in European countries, it could be argued that the corresponding fuel share of the total public transport costs should be somewhat higher. Indeed, a study done in Kenya (Aligula et al., 2005) shows that about 30% of public transport expenditures and 80% of private transport expenditures originate from fuel related costs. Considering that no driver salaries or administrative costs etc. are included in the expenditures for private transport, the fuel share of the private transport expenditures should be considerable higher than for the public transport expenditures.

In Fig. 5 it is assumed that 30% of the public transport expenditures and 80% of the private transport expenditures stem from fuel costs, and the figure shows the fuel expenditures from both public and private transport as shares of total expenditures for each income decile.

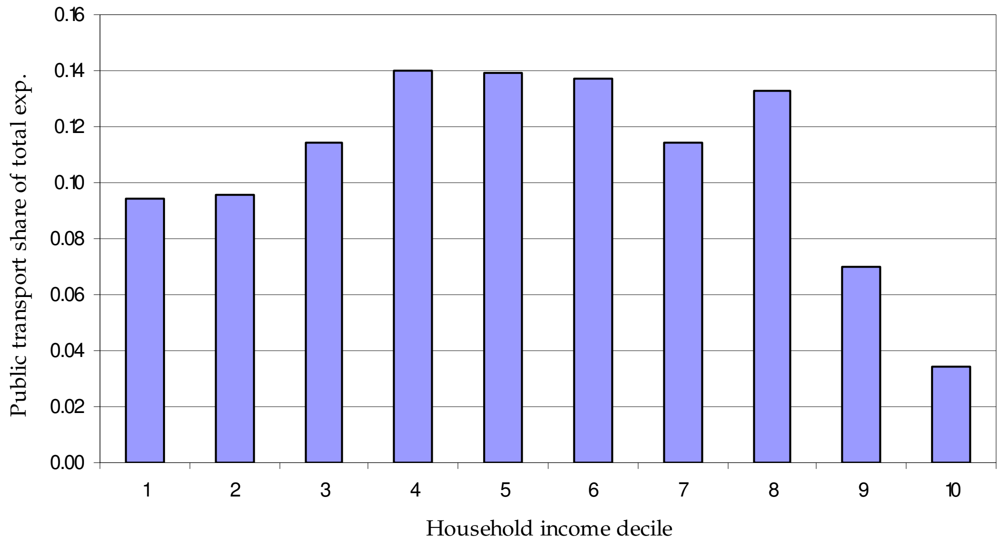

Fig. 3: Share of total household expenditures spent on public transport per household income decile (1=lowest income, 10=highest income).

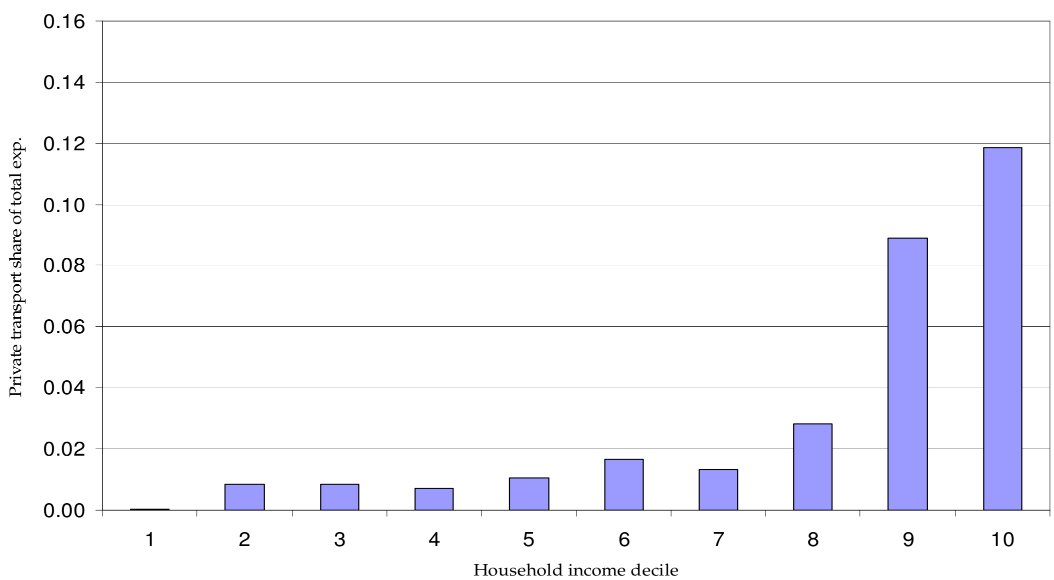

Fig. 4: Share of total household expenditures spent on private transport per household income decile (1=lowest income, 10=highest income).

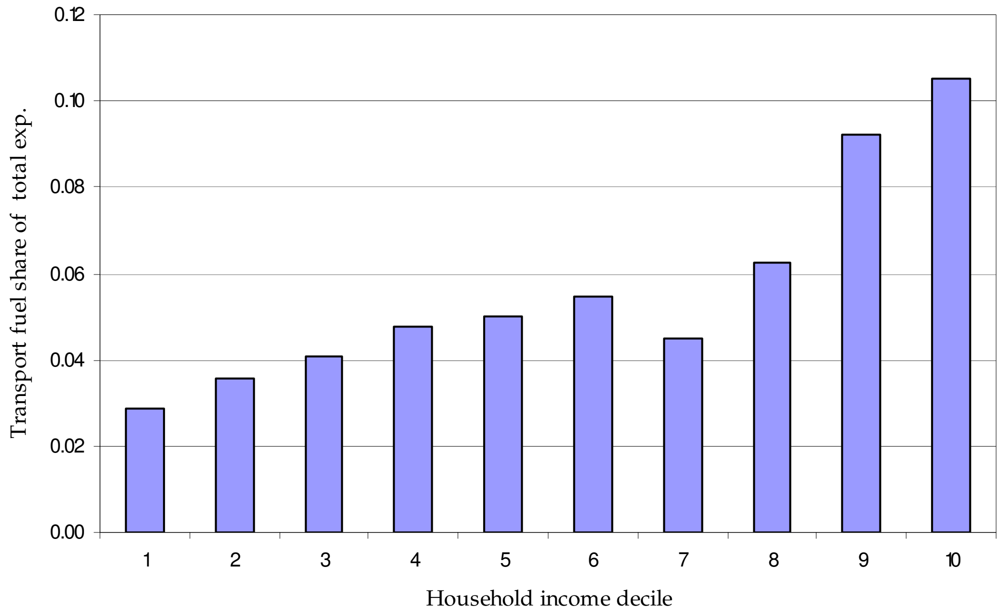

Fig. 5: Share of total household expenditures spent on transport fuel per household income decile if assuming that 30% of public transport expenditures and 80% of private transport expenditures are fuel costs (1=lowest income, 10=highest income).

3.2.2 Results of measurement of tax progressivity

In our analysis for the Suit index we begin by building a Lorenz curve of Kenya's household income. This is represented by figure 6 below. This figure is obtained by plotting vertically, the accumulated percent of total household income against accumulated percent of households on the horizontal axis. It is basically the familiar Gini coefficient in which if income were exactly equally distributed, the Lorenz curve would follow the diagonal line OY, but because the poorest 10% of households receive less than 10% of total income, the curve droops below the diagonal, following OXY. The greater the inequality of income, the further the Lorenz curve bows away from the diagonal. The Gini ratio estimates income concentration by the proportion of the area of triangle OXY that is contained in the sector bounded by the diagonal line OY. In this case, the Gini ratio can range between 0 for income equality to 1 for the extreme inequality in which all income is concentrated in a single household.

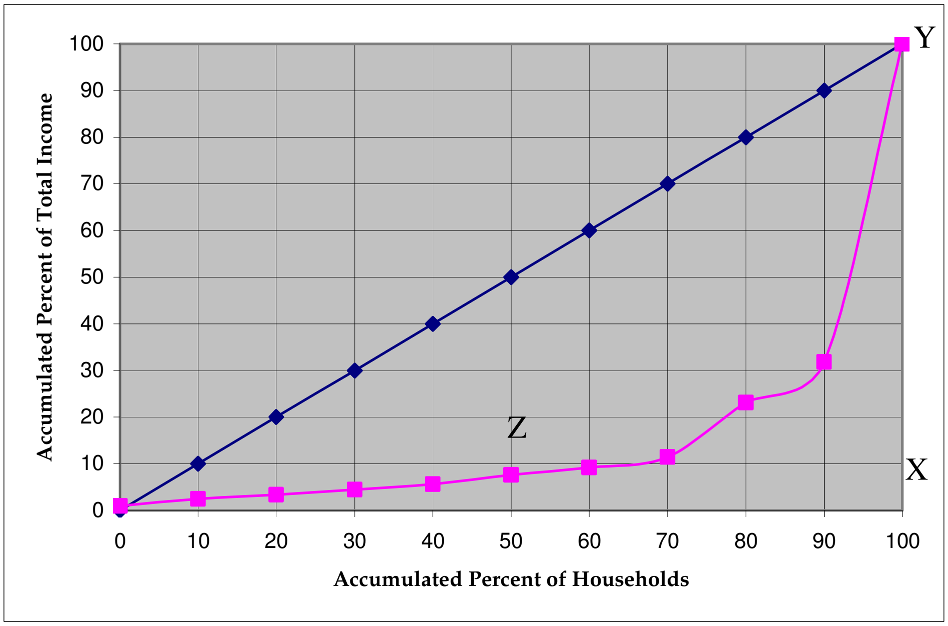

Figure 6: Lorenz Curve of Kenya Household income

From table 2 on tax burden from private transport fuel consumption, it is evident that the burden is lowest for low income households. Up to the 8th decile, the tax burden is actually about 4.7% of total burden and 11% for the cumulative sum. This is an indication that tax burden on petroleum products consumed by users of private transport is mainly born by the richest income deciles and exhibits progressivity in nature. On the other hand when both private and public transport tax burdens are combined, the lowest deciles once again experience low burden compared to the high income ones (see table 3).

Table 2: Tax Burden from Private Transport Fuel

Decile	Cumulated adjusted family income	Tax burden	as % of total	Cumulative sum
0	0	0.00	0.00	0%
1	1%	3.00	0.0%	0%
2	3%	0.00	0.0%	0%
3	7%	116.50	1.4%	1%
4	11%	25.20	0.3%	2%
5	17%	92.50	1.1%	3%
6	24%	44.70	0.5%	3%
7	34%	273.70	3.2%	7%
8	45%	400.00	4.7%	11%
9	68%	1,406.80	16.6%	28%
10	100%	6,121.70	72.2%	100%
Total		8,484.20		

Computation done from the KIPPRA Urban transport survey 2004/2005.

Table 3: Tax Burden from Private Transport Fuel

	Cumulated adjusted family income	Tax burden	as % of total	Cumulative sum
	0	0	0	0%
1	1%	213.10	1.6%	2%
2	3%	189.10	1.4%	3%
3	7%	440.50	3.3%	6%
4	11%	391.10	3.0%	9%
5	17%	631.30	4.8%	14%
6	24%	586.70	4.5%	19%
7	34%	807.50	6.1%	25%
8	45%	1,234.10	9.4%	34%
9	68%	2,117.10	16.1%	50%
10	100%	6,569.50	49.8%	100%
Total		13,180.00		

Computation done from the KIPPRA Urban transport survey 2004/2005.

In the analysis of tax burden for both private transport fuel, and combined burden for private and public fuels, one can argue that transport fuel taxes in Kenya are progressive and not regressive. This is affirmed by Figure 6(Lorenz curves for Public Transport and Private Transport Taxes), which summarise the accumulated percent of tax burden for both private and a combined burden for both private and public fuel taxes. The tax burden from private transport fuel taxes are higher than that of private and public transport combined. In both cases, the burden is more in the high income households. A tax increase in the transport sector will thus mainly impact/hurt the high income group because of their progressivity in nature. Diagonal lines OZ' and OZ represent private and combined burden of private and public transport fuel taxes respectively.

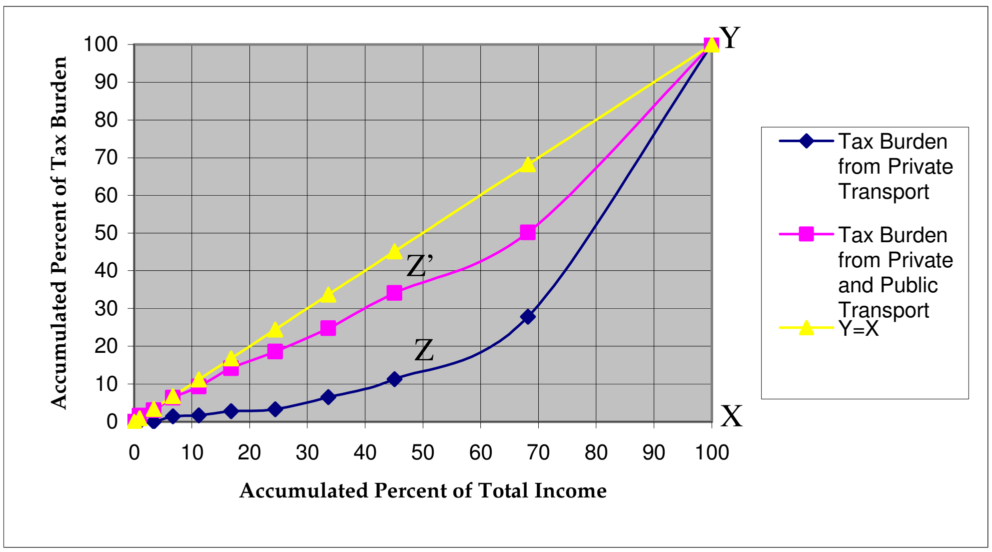

Figure 7: Lorenz curves for Public Transport and Private Transport Taxes

3.2.2.1 Suit Index(S)

According to Suits (1977), for a proportional tax, L=K, so S=0. The curve corresponding to a progress tax droops below the diagonal; the area L is smaller than K. As a result, the Suit index -S is positive for progressive taxes. These findings are similar to what we find in the case of Kenya. In the limiting case where the highest income bracket bears the entire burden of the tax burden, the Lorenz curve lies along the sides of OX and XY, so L=0, and S=+1. With a regressive tax, the Lorenz curve arches above the diagonal. This makes the area L larger than K, and therefore, S is negative. However this case was not evident in this study since both the private and combined private and public transport fuel taxes in Kenya are not regressive. In the extreme case of regressivity, Suits (1977) postulates that L=2K and S=-1. This is to say that the index of progressivity S varies between +1 in the limiting case of progressive tax, through 0 for proportional taxes, to -1 in the limiting case of regressivity.

This approximation is easily calculated like that of table 2 and has been used to compile table 4. The area of the triangle, K, is of course the same for all fuel taxes: Since the triangle has a base and altitude of 100, K=5,000 through out. From the analysis, the tax progressivity for private transport is 0.483 and 0.464 for tax calculated based on expenditure and income respectively. In the case of public transport fuel taxes, the index is 0.225 and 0.171 respectively. From the foregoing, we can conclude that fuel taxes in Kenya are progressive and that the degree of progressivity varies from fuel tax.

Table 4: Progressivity of Kenya's Private and Public Transport Fuel Taxes

(a). Tax progressivity Private Transport Taxes	
Type of Tax	Suit Index(S)
Tax calculated based on transport expenditures	0.483
Tax calculated based on transport income	0.464
(b) Tax progressivity for combined Private and Public transport fuel Taxes	
Tax calculated based on transport expenditures	0.225
Tax calculated based on transport income	0.171

Computation done from the KIPPRA Urban transport survey 2004/2005.

4. Conclusion and Policy Recommendations

The choices of transport households make are important in determining the type of tax on gasoline. Many countries in the developing world have in the recent past witnessed an increasing vehicular population due to increased preference for private transport as a result of improved incomes and resultant wealth effect among the middle and upper class strata of their population. The public transport system is in most cases disorderly and many of those individuals who could be using public transport system end up buying private cars, which not only lead to high congestion in the cities but also pollution due to increased consumption of gasoline. Therefore, these countries need to come up with policies that promote public transport and mass transit and discourage private ownership of vehicles. This will help achieve better organised cities, reduced pollution and increased revenues through better tax regimes. A 'good' tax on gasoline will prohibit individual from driving and encourage a good system which has better welfare results for both the poor and the rich. In addition, many developing countries are faced by huge domestic debt and budget deficits and therefore, gasoline taxes have the potential to raise more revenue to bridge the financing gap.

This paper has estimated distributional effects of fuel taxes by expenditure and income deciles, presented a Lorenz curve of Kenya household income, calculated tax burdens and suit indices for both private transport fuel taxes and combined distributional effects of both private and public transport fuels.

The fuel expenditure includes both gasoline and diesel. Improved income among households creates a wealth effect which encourages households to own cars. High ownership of private cars leads to high vehicular population, congestion, high gas consumption and pollution. The choice of transport households make therefore has an impact on the consumption of transport fuels and thereof pollution. The analysis of demand elasticity has shown that the long run coefficients are two times higher that of the short run elasticity coefficients.

The analysis of distributional effects of gasoline taxes has shown that the lowest income household deciles spend somewhat less than 10% of their total household expenditures on public transport. In the middle income households the share is higher, nearly 14% for several of the middle income household deciles. For the income deciles with the highest household incomes, the public transport expenditure share of total expenditures drops considerable, and for the highest income decile only about 3.5% of the total household expenditures constitutes public transport expenditures. The low and middle income deciles spend very little of their total expenditure on private transport; the 70% lowest income households have all a budget share for private transport of less than 2%. This could be compared to the highest income decile, in which the share of private transport expenditures is 12%. When the impacts for public and private transport are combined, the study finds that the total share of transport fuel expenditures to total household expenditures are lower for low income households compared to the high income household.

The Lorenz curve for household income, and calculated burden and suit indices clearly show that the burden on fuel taxes impacts more on the high income households who spend a higher proportion of their income on transport fuel compared to the low income households. The study therefore can conclude that transport fuel taxes in Kenya are progressive and not regressive. Consequently, the study gives incentives to revise the fuel taxes in order to realise emission abatement as well as increasing revenue potential to the treasury.

From the foregoing analysis and conclusion, the following policy recommendations can be drawn from the study:

Firstly, there is need to improve the public transport system and encourage mass transit so as to reduce private ownership of vehicles and gasoline consumption. This could be through improvement in the railway system and public bus/metro system.

Secondly, there is need to revise taxes on high gasoline consumption vehicles which are not used for public transport. This will reduce per capita consumption of gasoline and hence achieve abatement.

Lastly, there is need to examine the revenue potential from gasoline taxes and evaluate how these taxes can be used to compensate citizens from welfare losses by improving service delivery in roads, transport and health sectors among others.

References

Aligula, E. M, Abiero-Gariy Z, Mutua, J.M, Owegi F, Osengo C and Olela R (2005) Urban Public Transport Patterns in Kenya: A case study of Nairobi City, Survey Report, Special Report Number 7, Nairobi Kenya.

Aligula, E. M (2006) Policy Options for Reducing the Impact of Energy Tariffs in Kenya, National Economic and Social Council, Final Draft.

Barthold, T.A (2004), Issues in the design of environmental taxes. *The Journal of Economic Perspective Vol. No.1* (winter, 2004), pp 133-151.

Government of Kenya (2004. Sessional Paper No. 4 on Energy. Ministry of Energy. Nairobi: Government Printer.

Hammar, H., Löfgren, Å., and Sterner, T. (2004), Political economy obstacles to fuel taxation. *The Energy Journal,* Vol. 25, No. 3, pp.

IEA (2006), World Energy Outlook 2006. International Energy Agency/OECD, Paris.

Jobson, E. (2007), Volvo Hybrid Technology. *Presentation 26/4-2007 at Chalmers University of Technology,* Gothenburg, Sweden.

Mutua, J.M, Borjesson, M. and Sterner, T (2008) Transport choice, elasticity and distributional effects of fuel taxes in Kenya, Paper Presented at the 9th Global Conference on Environmental Taxation, Singapore, 6-9th November, 2008.

UNEP (2006), *Integrated Assessment of the Energy Policy: with Focus on Transport and Household Energy Sectors:* in Sustainable Trade and Poverty Reduction, New Approaches to Integrated Policy Making at National Level, Country Report for Kenya , UNEP, ETB, Geneva.

Parry, I.W and Small, K.A (2005), does Britain or the United States have the right gasoline taxes? *The American economic review*, Vol. 95 No.4 (sep. 2005) pp. 1276-1289.

Sterner, T. (2003), Policy Instruments for Environmental and Natural Resource Management. Resources for the future (RFF) Press.

Sterner, T. (2007), Fuel Taxes: An important instrument for climate policy. *Energy Policy* 35(2007) 3194-3202.

Suits, D. B (1977), Measurement of Tax Progressivity, the American economic Review, Vol, 67. No.4 (Sep., 1977), pp. 747-752.

West, S.E. (2004), Distributional effects of alternative vehicle pollution control polices. *Journal of Public Economics* 88(2004) 735-757.

Ziramba, E., Kumo, W., and Akinboade, O.A (2008), Economic instruments for environmental regulation in Africa: an analysis of the efficacy of fuel taxes for pollution control in South Africa. Department of Economics, University of South Africa, Pretoria.

Appendix 1: Petroleum Products Prices in Kenya