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Economic Analysis of Petroleum Taxes in Pollution Control and Prevention in Ghana

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Abstract

Petroleum taxes are increasingly being used all over the world for pollution control and prevention, oil resource management and for revenue purposes. For sustainable development, countries are expected to use petroleum products in such a way that, it does not comprise the ability of future generation to improve their lives and the environment. In line with this, several countries have introduced various taxes on petroleum products to discourage their excessive use to conserve oil resources for sustainable development. In Ghana, petroleum taxes have become important excise taxes in terms of revenue and environmental and resource management. Petroleum taxes were first introduced in 1986, but were redesigned as part of the petroleum price build-up concept in 1989 to raise additional public revenue and cause users of the petroleum products to face the external costs related to traffic congestion and emissions. However, despite the prospects and potential of the taxes in environmental and oil resource management in Ghana, little research has been carried out to ascertain the extent to which the taxes achieve their environmental goals. Thus, the purpose of the study is to analyse the petroleum taxes in terms of goal attainment to determine to what extent the taxes achieve their environmental goals.

To do this, the qualitative research methodology was adopted where semi-structured interviews were conducted with relevant stakeholders who were selected using purposive sampling technique. In addition, existing statistics, institutional statements and reports, newspaper articles and studies of relevant institutions and individuals were used. The interviews were analyzed qualitatively with the use of the transcription software f4. Additionally, Time series and Stata 9 software were employed along with descriptive statistics to assess the goal attainment of the taxes. The analysis revealed the taxes have failed to reduce consumption of fuel products, urban congestion and air pollution for the attainment of the tax goal due to inelastic demand of fuel products, limited use of sustainable fuel product alternatives (e.g. biofuels) and transport options (such as bicycle and train systems), surge in private car ownership (drive alone road users) and general increase in demand for vehicular transport in Ghana. It is against this backdrop that, the paper recommends the design of the petroleum taxes in ways that would help stimulate abatement technologies for the attainment of the tax goals.

Keywords: Economic analysis, pollution control, sustainable development, petroleum taxes, Ghana

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1. Introduction

Environmental taxes are increasingly being used all over the world for pollution control and prevention, natural resource management and for revenue purposes (Eurostat, 2013). Organization for Economic Co-operation and Development (OECD) and European Environment Agency (EEA) define environmental taxes as compulsory, unrequited payments to general government levied on tax-bases deemed to be of particular environmental relevance. Environmental taxes use price signals, to change the behaviour of consumers and producers towards environmental and resource management and help raise additional revenue for general government expenditures including environmental programmes (OECD, 2006). The most common form of environmental taxes and the ones that are most fiscally important in the EU, OECD and non-OECD countries are petroleum taxes (OECD, 2013).

Generally, petroleum taxes are used to shape production and consumption of petroleum products, and associated environmental problems by putting prices on environmentally damaging behaviour so that every unit of pollutant emitted or the product consumed becomes a cost to the polluter (Stilwell, 2012; Endres, 2011). The cost to the polluter involves imposing a charge on the emitted quantity of a pollutant, the quantity of the final product consumed, or the like (Endres, 2011). It is expected that, an increase in the prices of the petroleum products through the taxes would encourage consumers to shift their consumption patterns in a more sustainable manner and induce them to adopt more environmentally friendly technologies (Field and Field, 2013; Endres, 2011).

However, despite the importance of the taxes in pollution control and oil resource management, only a few countries in Africa have designed the taxes in environmental context (BMZ, 2013). As a front-runner in this respect, Ghana has reformed its petroleum taxes in environmental context to improve its environmental quality and raise additional revenue to support the national budget. This involves gradual removal of subsidies on certain petroleum products (e.g. gasoline and gas oil and Liquefied petroleum Products) used in Ghana to ensure consumers pay the real price or full cost of the products (BMZ, 2013; Joy Business News, 2013, June 18; Metschies, 2003) which has the tendency of reducing excessive fuel use which leads to vehicular emissions.

Although the petroleum taxes were first introduced in Ghana in 1986 (Terkper, 2001), they were re-designed as part of the petroleum price build-up concept in 1989 to raise additional public revenue and cause users of fuel products to face the external costs related to traffic congestion and emissions (Kombat, 2013; Terkper, 2001; World Bank, 1989). Vehicular air pollution pose health and environmental threat to the people of Ghana (Adu-Kumi, 2012; Agyemang-Bonsu et al., 2010; Agyemang-Bonsu et al., 2007). Additionally, many Ghanaians contract cardiovascular and other diseases daily which are partly attributed to air pollution (Graphic Online Health News, 2013, January 2). Furthermore, vehicular emissions contribute to the phenomenon of climate change, which has impact on Ghana regarding changes in weather and climate patterns, rising sea level and weather related disasters which affect agriculture production and water supplies (Business and Financial Times, 2014, October 26; Techie-Obeng et al., 2013; De Pinto et. al., 2013). Besides, petroleum taxes, help conserve oil resources for sustainable development. Therefore, it is expected that petroleum products are used in such a way that, it does not comprise the ability of future Ghanaian generation to improve their lives and the environment. The introduction of the petroleum taxes were seen as policy tools for solving the environmental and health risks associated with air pollution and helping conserve financial and oil resources.

As in many countries, the Ghanaian petroleum taxes are not Pigouvian, there is no attempt to identify the marginal external cost and optimum level of the tax (see, Pigou, 1932). Instead, the government's intention is to set the tax rates that would help change the behaviour of consumers towards pollution control and oil resource management in order to improve

environmental quality using market incentives and help the country generate additional revenue (see, Goodstein, 2008; Baumol and Oats, 1971, 1988).

However, despite the prospects and potential of the taxes in environmental and oil resource management in Ghana, little research has been carried out to ascertain to what extent the taxes achieve their environmental goals. Thus, the aim of the paper is, therefore, to analyze the taxes using the criterion of goal attainment (for details of this economic criterion see section three). To achieve this aim, the paper looks at the extent to which fuel users respond to the fuel prices resulting from the taxes. The paper is expected to bring to fore the extent to which the environmental goals of the taxes are achieved with respect to fuel consumption, emission reduction and traffic congestion.

The rest of the paper is structured as follows: section two looks at the methodological issues regarding data gathering and analytical procedures. In the third section, the theoretical or analytical framework used for the analysis of the Ghanaian petroleum taxes are discussed. The fourth section provides an overview of petroleum taxes in Ghana. Here the petroleum taxes are discussed in terms of their mechanisms, scope, rates, goals and revenue as it is important to understand these mechanisms in order to analyze the goal attainment. In the fifth section, results are presented. Discussion and conclusion are given in the last section.

2. Research methodology

The qualitative research methodology was deemed appropriate and adopted for this study. In order to achieve the study objectives, extensive literature research about design and mechanisms of petroleum taxes in Ghana was consulted. The information helped to get an overview about the petroleum tax policies in Ghana. But these policies had not been explored in terms of goal attainment. Therefore, the author decided to conduct face-to-face in-depth semi-structured stakeholder interviews with representatives of all relevant downstream petroleum industrial actors in Ghana using purposive sampling technique. The purposive sampling technique was used because the information required could only be provided by certain experts, top management and other key personnel from the relevant stakeholder institutions who possessed the requisite knowledge that could help assess the taxes in terms of goal attainment.

The face-to-face interviews ensured prompt responds. It also help collect relevant additional existing materials (e.g. statistics, institutional statements and reports, newspaper articles, parliamentary reports and studies from relevant institutions) on the taxes from relevant institutions to help analyse the taxes in terms of goal attainment. These published and unpublished materials were crucial in the analysis. In all, 25 senior officials and chief directors from the relevant stakeholder organizations, namely: Ghana Revenue Authority; National Petroleum Authority; Environmental Protection Agency; Ministry of Energy; Ministry of Finance and Economic Planning; Ministry of Environment Science and Technology; and Association of Oil Marketing Companies were interviewed between February and April 2014 with an average interview length of 1.26 hours.

Semi-structured in-depth open-ended and closed-ended interview questions were designed and used for the collection of the primary data. The interview questions were developed based on the objective of the study and review of literature on goal attainment. The 32 interview questions were divided into three sections. Section one asked questions pertaining to the respondents and their institutions. Questions included the status of the respondents in their organizations and their knowledge on petroleum taxes. Section two asked questions on the environmental problems that emanate from petroleum usage. The last section asked respondents about the role of the petroleum taxes in pollution control and prevention as well as oil resource management. In the last section, respondents were asked follow-up questions.

The digital voice recording device was used to capture the interviews. Additionally, the author had field notebook to take additional notes during the interviews. The Transcription

software f4 combined with a foot pedal were used to transcribe the interviews captured on the digital voice recorder and analyzed qualitatively. Additionally, certain factors and indicators related to the tax goals (e.g. emissions per vehicle) were used to assess the implementation of the taxes according to the economic criterion (i.e. goal attainment). Also, descriptive statistical analysis with the aid of Stata 9 software was used to evaluate the extent to which the tax goals are attained in terms of targets, status and progress.

3. Theoretical framework

The idea of internalization of externalities using market incentives like a tax dates back to Pigou (Pigou, 1932). However, estimating the external cost and external damage to set the Pigouvian tax has been difficult due to insufficient information in this respect (see, Hanley et al., 2013; Endres, 2011; Pigou, 1932). For these reasons a "correct" internalization of externalities with a Pigouvian tax is not possible. Therefore, environmental economists have adopted the standard-price approach suggested by Baumol and Oates (1971) as an alternative complementary method of analysis. The idea here is that, the regulator provides the policy goal and it is the economists' job to design policies to implement the goal and to analyze these policies according to certain criteria. In recent years, several of the criteria have been developed and used in literature (see, e.g. Field and Field, 2013; Hanley et al., 2013; Endres, 2011). Although every environmental policy has specific features that make it to succeed when any of the evaluation criteria is/are applied, Endres (2011) sees goal attainment as an important criterion that could be used to assess any environmental policy instrument to determine to what extent the policy achieves it goals. Thus, the paper adopts this economic criterion to assess the Ghanaian petroleum taxes.

Goal attainment is the capacity of an environmental policy to accurately reach its set goals (Endres, 2011). With respect to information asymmetry and flexibility of environmental policy decision makers, it needs to be said that normally a divergence between the target and actual values achieved occur (Endres, 2011). An environmental policy is effective if the goal it pursues is reached. Usually goal attainment involves turning goals into measurable objectives and determining how far they have been realized in practice (Verdung, 2000). Generally, environmental tax goal (s) should be measurable, attainable, specific, time-based and relevant (State of Washington, 2012). However, the quantitative goals should not dominate qualitative goals, as not every goal might be quantified (Stavins, 2012). Skjærseth (2004) states that lower goal ambitions have greater probability of attainment by a tax policy than higher goal ambitions. Since goals are statements of desire outcomes for any activity, when all of the objectives of an environmental tax are achieved the goals are considered to be achieved (State of Washington, 2012).

Goal attainment of environmental tax involves performance measures put in place to achieve the policy goals and determining the status and progress as well as the trend of the policy goals (Endres, 2011). Theoretically, in order to estimate a tax which precisely reaches its goal the regulator needs to know the aggregated regional marginal abatement cost curve for all pollutants. It is unlikely that this information would be available. Therefore a pragmatic approach would be to roughly estimate the abatement cost curve and set a tax rate based on this estimation for the attainment of the tax goal (Hanley et al., 2013). Then, however, it is most likely pollution reductions would be either higher or lower than expected. In this respect, a permanent adjustment of the tax to fine-tune it to be able to reach the goal is unrealistic given high administrative costs, political resistance, and the understandable interest of firms for long-term price security to plan their investments.

The Ghanaian petroleum taxes are established to set incentives toward changing consumer behaviour for the petroleum products considered environmentally unfriendly. Their

ecological goals would be to reduce air pollution arising from petroleum products. Therefore as a step in this direction, Ministry of Finance and Economic Planning in consultation with other government ministries, department and agencies developed the tax goals. Although, the tax goal was mainly to raise revenue, it could also help achieve environmental goals. The environmental goal of the tax is 35% reduction in air emissions. In terms of travel time the tax is expected to achieve reduction in annual travel time by 8 hours on urban roads and arterials. Additionally, they were to help reduce excessive petroleum consumption in Ghana.

4. Petroleum taxes in Ghana

Several taxes have been introduced into the petroleum price build-up to help Ghana raise revenue and conserve fuel for environmental purposes. These include: specific tax, ad valorem excise tax, levies (e.g. liquefied petroleum gas levy, Tema Oil Refinery debt recovery levy, road fund levy, energy fund levy, exploration levy and cross subsidy levy) and margins (e.g. primary distribution margin, Bulk Oil Storage and Transport margin, fuel marking margin, unified petroleum products fund, marketers margin, dealers margin, liquefied petroleum gas filling plant fund, distribution compensation margin and promotion margin) (NPA, 2015). These taxes and quasi taxes are imposed on petroleum products refined in Ghana or finished petroleum products imported by oil marketing companies into the country. The taxes are charged on the volume of the petroleum products purchased at the filling stations or pumps and collected by the oil marketing companies on behalf of the Ghana Revenue Authority. In addition, oil companies pay import excise duty on petroleum products imported into Ghana.

The taxes aim at helping Ghana raise additional revenue to support the national budget. In addition, the taxes provide a major incentive to achieve greater efficiency in transport sector, since fuel taxes and pricing act as an incentive to conserve fuel to reduce fuel imports. Petroleum taxes and pricing do not only help save valuable oil resources and foreign currency, but help cut emissions at both local and global level. The taxes are the appropriate instruments to capture the externalities and cause users to face the external costs related to traffic congestion and emissions. Furthermore, the taxes are to cause fuel users to shift to more environmentally friendly modes of transport such as non-motorized transport (walking and cycling) as well as the use of public transport to help conserve fuel and its related financial resources. It is also a way of motivating consumers to develop own technologies to conserve fuel by developing and using alternative green fuels. Petroleum tax differentials in Ghana target directly at consumers by changing relative prices, which may induce alternative behaviour including lower demand for fuel products[2]. It is expected that the tax would cause an increase in prices of fuel products which reduces quantity demanded of the products. This is expected to invariably reduce vehicular emissions for the improvement in air quality. However given the inelastic demand[3] of fuel products in Ghana (see, Ackah and Adu, 2014; Cynthia and Prince, 2013) this bring up the question of the taxes' ability to achieve their objectives of causing reduction in fuel consumption, emissions and traffic congestion.

However, given that demand for the products falls insignificantly, the tax could be raised to give an incentive effect to reduce congestion and pollution but this brings about social equity and social exclusion issues where economic welfare is reduced by over taxing some groups (Ackah and Adu, 2014). As Ackah and Adu put it, petroleum excise tax tend to be regressive

[2] Tax differentiation in this context as applied in Ghana is the difference in tax rates based on differences in fuel products and not differentiation based on fuel content as applied in other countries including Germany and Austria.

[3] Demand of a product is inelastic when a percent change in the price of the product results in a less than proportionate percentage change in the quantity demanded of the product (Baumol and Blinder, 2012)

which have negative influences on the distribution of income within a society and consumption patterns of lower-or fixed income earners. In such a situation according to Speck et al. (2001) additional measures would be needed to offset these, such as consumer awareness campaigns, regulations or tax revenue recycling or incentives to make the tax more attractive and successful. Generally OECD (2006) classifies the taxes as energy or product taxes.

With respect to revenue, the taxes have become the most important commodity taxes in Ghana outstripping most of the excises from the non-petroleum products. Between 1994 and 2013, a total of GH₵ 4,667.92 million have been realized from the taxes (GRA, 2014). The tax revenue increased from GH₵20.17 million in 1994 to GH₵ 37.66 in 1998, GH₵ 110.59 in 2002, GH₵415.17 in 2006 but fell to GH₵ 275.2 in 2010. It however rose to GH₵ 583.90 in 2013. It averaged about 10% of total tax revenue between 1994 and 2013 but exceeded 2% of GDP for the same period (GRA, 2014). Its contribution to total taxes however, declined from 15.87% in 1994 to 4.44% in 2013 mainly due to expansion of the Ghanaian tax net to capture other tax types which hitherto did not exist.

All petroleum products imported into Ghana are under the control of the Ghana Energy Commission Act 1997 (Act 541). Therefore it is the commission that determines the import excise tax rate. Although petroleum products do no attract excise duty, aviation fuel and marine gas oil do attract excise duty of 2.00 US cents per litre each (NPA, 2015). Also, hydrocarbon oils (e.g. aviation, turbine, kerosene and gas oil) attract export duty of 25% of cost, insurance freight value of the products. The petroleum excise taxes are derived as the difference between the pump prices and the refinery-cum-marketing costs and margins for converting the imported crude into the refined products (GRA, 2013; Terkper, 2001). The tax is administered under an Act of Parliament of Ghana, i.e. Act 544 amended by Act 577, Act 593, Act 781 and Act 867. The specific tax levels of the locally refined products and the imported finished products as at 1st January, 2015 are summarized in Table 1.

Table 1: Specific tax levels on petroleum products in Ghana

No	Petroleum product	Tax level (GHp)
1	Premium gasoline	6.40 per litre
2	Gas oil	5.42 per litre
3	Residual fuel oil	5.97 per litre
4	Kerosene	3. 41 per litre
5	Liquefied Petroleum Gas (LPG)	2. 21per kg

US$ 1= GH3.19, €1=3.96 as of 8th December 2014

Source: NPA, 2015

Although Act 867 of 2013 provided a change from the specific rates of duty to an ad valorem excise duty rates of 5.97% on premium gasoline, 3.53% on Gas oil, 3.05% on residual fuel oil, 0.85% on kerosene and 0.33% on liquefied petroleum gas effective February 2014, government reversed the excise tax on the products from ad valorem to specific due to the implementation challenges and political considerations (see, Government of Ghana budget, 2015). In addition, petroleum products especially gasoline, gas oil, liquefied petroleum gas and kerosene attract 17.5% VAT under a special petroleum tax Act 2014 (Act 879) (Daily Graphic 2014, November 20; Daily Guide Newspaper, November 20).

5. Results

The main goal of the Ghanaian petroleum taxes is to generate additional revenue from consumers and contribute towards capturing negative externalities (pollution) that emanate from fuel use (World Bank, 1989; Terkper 2001). In line with this, certain specific objectives of the environmental goal of the tax were to be achieved: (1) reduction in domestic consumption of fuel products, (2) reduction in pollution that emanate from road transport, and (3) reduction in congestion on urban highways and arterials. To determine how far the tax environmental goal has been achieved, the tax objectives are analyzed.

Reduction in domestic consumption of fuel products through fuel prices to reduce vehicular emissions has been the major environmental objective of the petroleum excise tax. From an environmental point of view one would like to see the size of the tax base i.e. petroleum products diminish once a tax is imposed on the products (OECD, 2006). Basically the more fuel consumed the more emissions, depending on the energy efficiency of the vehicles and quality of the fuel. If less fuel is used per kilometre, the less the CO_2 emissions per kilometre, and indirectly the less emissions of other pollutants like N_2O, CH_4, PM, CO, NO_X, SO_2 (GEPA report, 2013; Agyemang-Bonsu et al., 2007). Therefore reducing fuel consumption was seen as one of the measures that could be adopted to achieve the tax environmental goal. However, despite the taxes, gasoline and gas oil consumption increased from 1,499 billion litres in 2000 to 3,114 billion litres in 2013 and liquefied petroleum gas from 45 million kilogramme in 2000 to 269 million kilogramme in 2013 (NPA, 2015). During the same period, vehicle population increased from 511,063 to 1,641,512. Also, the per capita gasoline and diesel consumption (litres) increased from 15 in 1990 to about 35 in 2013. Figure 1 shows the consumption trend of the traditional gasoline and gas oil as well as liquefied petroleum gas in Ghana.

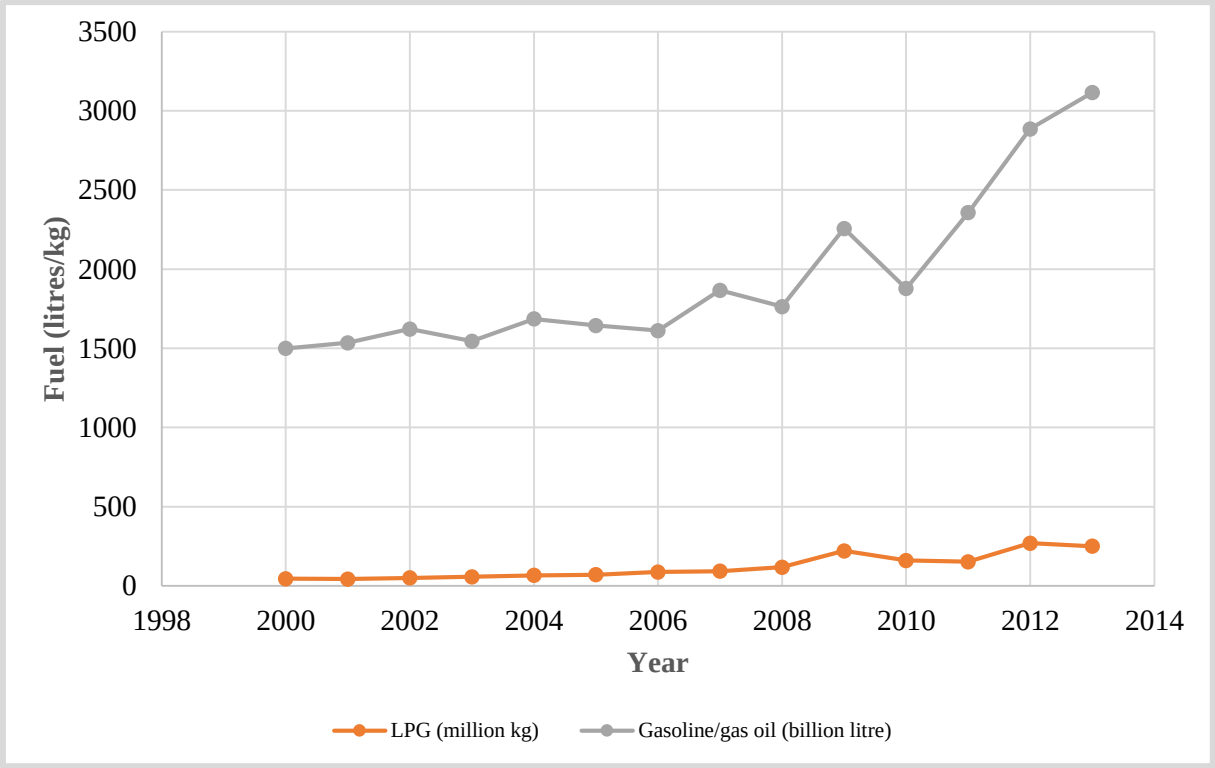

Figure 1: Trends in fuel consumption in Ghana
Source: NPA, 2015

The increase in the gasoline and gas oil consumption is due to (1) unreliable nature of public transport as alternatives to many cars on the roads, (2) increase demand for vehicles due to wage and salary increments and access of workers to car loans, and (3) inelastic demand of the motor fuel products. Dahl (2012) for instance estimates price and income elasticity of -0.26 and 1.27 respectively for the Ghanaian fuel products while Ackah and Adu (2014) determine the short and long-run income elasticity of the products at 0.71 and 5.13 respectively. This means that, in the short-run, demand for gasoline and gas oil are necessitates since substitutes are not available. However, in the long-run, consumers find alternatives such as using bicycles and walking when income reduces, but travel and drive more when income increases.

Reduction of vehicular emissions to improve on air quality and related health risks in Ghana has been one of the main environmental objectives of the petroleum excise tax. A drop of 35% in emission levels with associated improvement in public health by 2015 is the target of the taxes (GEPA report, 2013). This target is however to be achieved by emissions reduction from all sectors of the economy including the road transport sector which contributes significantly to both total greenhouse gases (GHG) and non-GHG (Adu-Kumi, 2012; Agyemang-Bonsu et al., 2010) and account for over 95% of all transport services in Ghana (NPA report, 2012).

Although reduction in emissions from the transport sector is seen as critical in achieving the emission reduction target, vehicular emissions have been increasing over the years. Adu-Kumi (2012) estimates that vehicular emission levels increased steadily from 2000-2011 as vehicle population and fuel consumption increased correspondingly. Figure 2 depicts the total vehicular emissions in Ghana from 2000 to 2013.

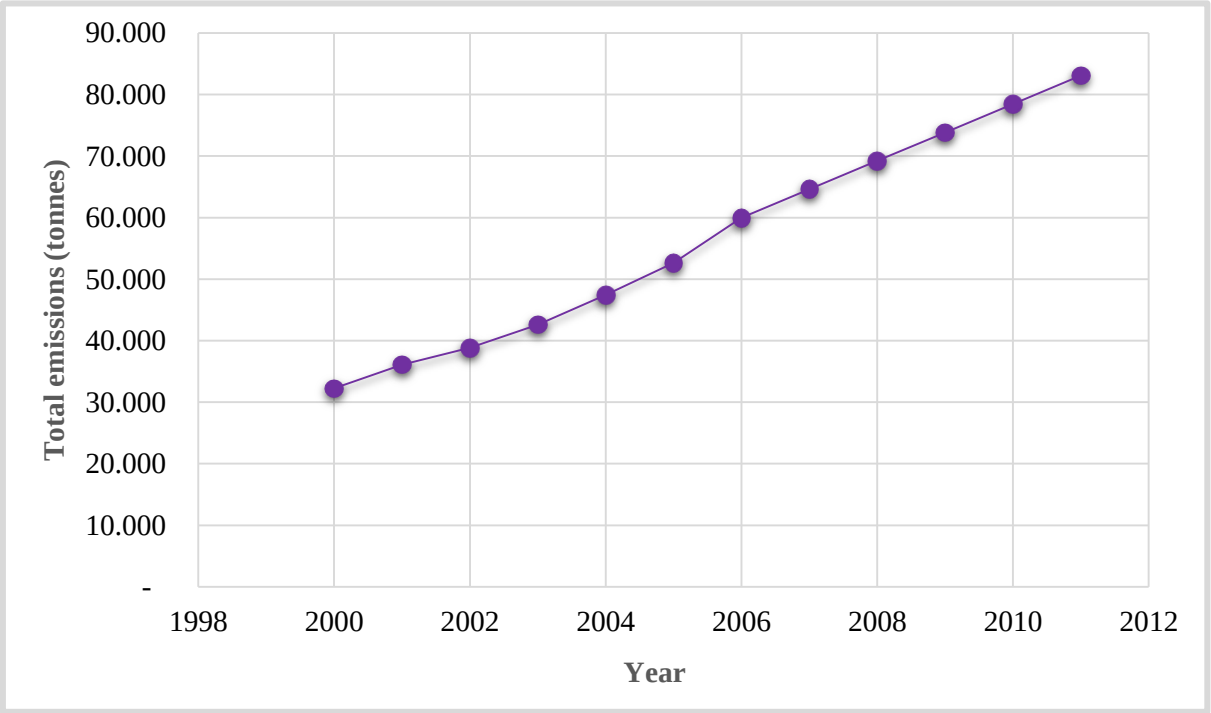

Figure 2: Total vehicular emissions in Ghana (2000-2011)

Source: Adu-Kumi, 2012

Figure 2 shows total vehicular emission levels increased linearly from 32,223 tonnes in 2000 to 83,087tonnes in 2011 representing about 9% increase per annum. The emission to vehicle ratio (i.e. emissions per vehicle) in Ghana has also increased from 0.063 tonnes in 2000 to 0.066 tonnes in 2011. Therefore there is no doubt the emission reduction target of 35% would not be achieved by 2020. Adu-Kumi, (2012) estimates vehicular emissions will reach 126,527.8 tonnes by 2020 if all conditions remain the same.

With respect to gas-by-gas emissions from road transport in Ghana, CO_2 constitute about 96.2% of the total GHGs. The remaining 3.36% and 0.42 % are accounted for by CH_4 and N_2O CO_2 equivalent respectively (Agyemang-Bonsu et al., 2007). On the other hand CO accounted for about 50% of the non-direct GHGs increasing from 32.22 Gg in 2000 to 82.67 Gg in 2011 (Adu-Kumi, 2012). This was followed by NO_x with an average composition of 30% of the non-direct GHGs which also increased from 19.52 Gg in 2000 to 32.05 Gg in 2005 but was expected to reach 95 Gg by 2015 (Adu-Kumi, 2012). The remaining 20% represented the other non-direct GHGs namely, SO_2, NMVOC, Heavy metal and Pb. These pollutants among others had and continue to have varying degrees of damaging effects on both Ghana and global physical and human environments.

Also, reduction in traffic congestion on urban highways and arterial routes to reduce travel time has been one of the main objectives of the petroleum tax. Reduction in annual travel time by at least 8 hours per trip in the urban areas by 2015 is the target of the taxes (World Bank report, 2006). Using fuel taxes to discourage the use of private cars and rather encourage public transport was seen as solution to the urban traffic congestion. However, population growth (see, GSS, 2013) and increasing rates of demand for private car ownership and urban transport buses coupled with the narrow nature of the urban roads have compounded the urban traffic situation making it extremely difficult to achieve the tax goal.

According to NPA report (2012) the number of vehicles on Ghanaian roads may increase by 70% in the next 15-20 years leading to road congestion, inadequate arterial network capacity and reduction in air quality. The vehicles are inefficient in terms of the amount of space and traffic congestion caused to transport each passenger. Delay is the consequence as vehicles move at slow pace of less than 20 Kilometres/hour (World Bank report, 2006). An interview with Motor Transport and Traffic Unit (MTTU) indicates the annual average hours of delay per peak traveler have increased significantly over the past 2 decades making it impossible to achieve the tax goal. MTTU reports that between 2000 and 2013, the annual hours of delay during the morning and evening peak hours of 07:30-09:30 and 16:30 and 18:30 respectively per driver increased significantly in the urban areas. Figure 3 provides information on the annual average hours of delay per peak driver in urban areas of Ghana.

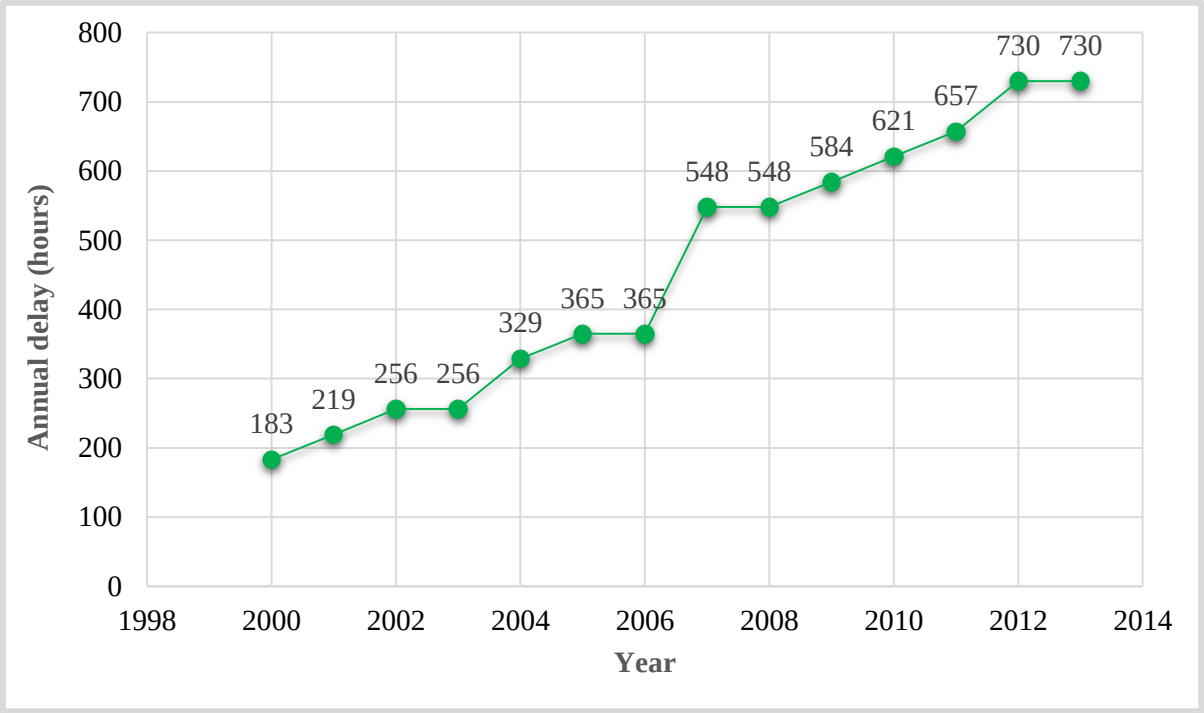

Figure 3: Average hour of delay per peak driver in urban areas of Ghana (2000-2013)

Source: Data obtained from Motor Transport and Traffic Unit-2014

It can be deduced from Figure 3 that the annual hours of delay increased by about 299% from 183 hours in 2000 to 730 hours in 2013. Without road and public transport investment, MTTU estimates drivers would have experienced an average of 77 hours of delay per annum between 2000 and 2013.

The worse culprits of the urban highways and arterials congestion is the drive alone commuters. With the number of urban commuters increased, the percentage of drive alone has also increased over the past decade. More than 1 million Ghanaian urban duelers chose to drive alone to work in 2013 on a daily basis (MTTU, 2013). Using public transportation on daily basis was about 3.9 million, choosing to get to work on motorcycle, taxi, bicycle or foot was about 5.1 million. MTTU predicts annual hours of delay will reach 1,076 by 2020 if all conditions remain the same making it difficult to achieve the tax objective of reducing the annual delay time by at least 8 hours per trip in the urban areas.

6. Discussion and conclusions

Reducing air emissions caused mainly by road use is one of the main objectives of the petroleum excise tax (see, Terkper, 2001; World Bank, 1989). The tax was meant to reduce excessive fuel use and discourage drive alone commuting to reduce air pollution. However, the analysis proved the tax has failed to reduce consumption of fuel products, urban congestion and air pollution for the attainment of the tax goal for the following reasons:

First, demand for fuel products in Ghana is inelastic. Meaning consumers hardly responds to changes in the prices of the products which support Ackah and Adu (2014) study that gasoline and gas oil have inelastic demand in Ghana. Also, the study substantiates OECD (2006) assertion that petroleum taxes have attraction for many governments because they have low price elasticity of demand. Second, limited use of sustainable fuel product alternatives (e.g. biofuel/ethanol) and transport options (such as bicycle and train systems). Third, the surge in

private car ownership (drive alone road users) and general increase in demand for vehicular transport due to increased population, increase access to workers to car loans, general rise in wages and salaries of workers as well as expansion of the Ghanaian economy. The petroleum excise tax receipts have increased from GH₵ 20.17 million in 1994 to GH₵ 583.90 million in 2013 an increase of about 2,795% which is a proxy indication of the failure of the tax to achieve its goal. From an environmental point of view, one would generally like to see the size of the tax base diminish through behavioural changes among consumers which cause the revenues to decline (OECD and EEA, 2013; OECD, 2006).

The analyses have shown that petroleum taxes as applied in Ghana contradict some of the traditional economists' views on environmental policy instruments' ability to achieve desire pollution reduction for attainment of the tax goals. This way, the study aim is achieved but remind us of the dangers of prejudiced generalizations when assessing policy instrument and of the need for detail analysis of each policy instruments before drawing conclusions.

Bibliography

Ackah, I. and Adu, F. (2014). Modelling Gasoline Demand in Ghana: A Structural Time Series Approach, *International Journal of Energy Economics and Policy*, 4(1), pp.76-82

Adu-Kumi, S. (2012). Vehicular Emission and Fuel Economy Standards and Enforcement in Ghana. Accra: Ghana Environmental Protection Agency, pp.1-40

Agyemang-Bonsu, K. W., Benefor, D. and Asiamah, H. (2007). *Vehicular Emission Inventory, Ghana.* Accra, Ghana Environmental Protection Agency, pp.1-169

Agyemang-Bonsu, K. W., Donttwi, I. K., Tutu-Benefoh, D., Benti, D. E., Boateng, O. G., Asuobonteng, K. and Agyemang, W. (2010). Traffic-Data Driven Modelling of Vehicular Emissions using COPERT III in Ghana: A Case Study of Kumasi. *American Journal of Scientific and Industrial Research*, 1 (1), pp.32-40

Baumol, W. J. and Blinder A. S. (2012). *Economic Principles and Policy* (12th Ed.). Boston/ Hampshire: South-Western, Cengage Learning, pp.1-851

Baumol, W. J. and Oats, W. E. (1971). The Use of Standards and Prices for the Protection of the Environment. *The Swedish Journal of Economics*, 73 (1), pp.42-54.

Baumol, W. J., and Oats, W. E. (1988). *The Theory of Environmental Policy* (2nd ed.). Cambridge: Cambridge University Press, pp.1-284

BMZ (Federal Ministry for Economic Cooperation and Development) (2013). Environmental Fiscal Reform: Case Studies. Bonn/Eschborn: Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ), pp.1-32

Business and Financial Times (2014). Ignoring Climate Change Now will Prove Costly in Future-GAWU (General Agricultural Workers Union), October 26, [Online], Available at: http://www. thebftonline.com/content/ignoring-climate-change-now-will -prove-costly-future-gawu [Accessed October 27, 2014].

Cynthia, C. Y. and Prince, L. (2013). Gasoline Price Volatility and the Elasticity of Demand for Gasoline. *Energy Economics*, (38), pp.111-117

Dahl, C. A. (2012). Measuring Global Gasoline and Diesel Price and Income elasticity. *Energy Policy,* (41), pp.2-13

Daily Graphic (2014). Government Imposes Tax on Petroleum Products. November 20, pp 1-80

Daily Guide Newspaper (2014). 17.5% VAT on Petrol. November 20, pp.1-24

De Pinto, A., Robertson., R. D. and Obiri, B. D. (2013). Adoption of Climate Change Mitigation by Risk-Averse Farmers in the Ashanti Region, Ghana. *Ecological Economics*, (86), pp. 47-54

Endres, A. (2011). *Environmental Economics, Theory and Policy*. Cambridge: Cambridge University Press, pp.1-375.

Eurostat (2013). Environmental Taxes-Detailed Analysis, [Online], Available at: http:// www. epp.eurostat.ec.europa.eu/statistics_explained/index.php/Environmental_taxes_-_detailed_analysis [Accessed August 31, 2013].

Field, C. D. and Field, M. K. (2013). *Environmental Economics and Introduction* (6th Ed.). New York: McGraw-Hill /Irwin, p.1-480.

GEPA (Ghana Environmental Protection Agency) report (2013). Ghana-Road Map to Emission and Fuel Economy Standards, Drafted by van Doorn, W. J., checked and approved by Oosterdijk, H., Accra: GEPA/Royal Haskoning DHV, pp.1-41

Goodstein, E. S. (2008). *Economics and the Environment*. Hoboken: John Wiley and Sons Inc., pp.1-495

Government of Ghana budget (2015). *Budget Statement and Economic Policy of the Government of Ghana for the 2015 Financial Year.* Accra: Ghana Publishing Company/Assembly Press Ltd, pp.1-218

GRA (Ghana Revenue Authority) (2013). Tariff Interpretation Order,*Ghana Revenue Authority Magazine*. (5) pp. 2-31

GRA (Ghana Revenue Authority) (2014). Revenue Performance 2007-2013.Unpublished report, pp.1-7

Graphic Online Health News (2013). Traffic Fumes Increase Risks of Premature Deaths by 7%, December 9, [Online], Available from http://www.graphic.com.gh/news/health /13812-traffic-fumes-increase-risk-of-premature-death-by-7.html [Accessed January 2, 2014].

GSS (Ghana Statistical Service, (2013). 2010 Population and Housing Census Report: Millennium Development Goals in Ghana. Accra: GSS, pp.1-79.

Hanley, N., Shogren, J. F. and White, B. (2013). *Introduction to Environmental Economics,* (2nd ed.). Oxford: Oxford University Press, pp.1-285.

Joy Business News (2013). National Petroleum Authority (NPA) to push for total removal of subsidies on all petroleum Products, June 18, [Online], Available at: http://www. business.myjoyonline.com/pages/news/201306/108034.php [Accessed June 19, 2013].

Kombat, A. M. (2013). Economic Assessment of Environmental Taxes and Standards in Managing the Environmental Problems that Emanate from Oil and Gas Production on Ghana's Jubilee Field. *Journal of International Real Estate and Construction.* 3 (1), pp.33-50

Metschies, G. P. (2003). *International Fuel Prices* (3rd Ed.). Eschborn: German Technical Cooperation, pp. 3-114

MTTU (Motor Transport and Traffic Unit) (2013). Motor Accident Returns from 1991 to 2012 Nationwide. Unpublished report, pp. 1-5

NPA (National Petroleum Authority) (2015). Historical Trends in Petroleum Prices in Ghana and National Petroleum Consumption. [Online], Available at: http://www.npa.gov.gh/ npa_new/Downloads.php [Accessed January 23, 2015].

NPA (National Petroleum Authority) report (2012). Report on Two Day Workshop on Cleaner Fuel for Public Transport, September 13-14, ,Accra: NPA, pp.1-33

OECD (Organization for Economic Co-operation and Development) (2006). The Political Economy of Environmentally Related taxes. Paris: OECD, pp. 5-198

OECD (Organization for Economic Co-operation and Development) (2013). Database on Instruments used for Environmental Policy and Natural Resources Management. Paris: OECD, pp.1-4

OECD (Organization for Economic Co-operation and Development) and EEA (European Environment Agency) (2013). Database on Instruments used for Environmental Policy and Natural Resources Management, [Online]. Available at: http://www. 2. oecd. org /ecoinst/ queries /index.htm [Accessed 31 October, 2013].

Pigou, A.C. (1932). *The Economics of Welfare* (3rd Ed.). London: MacMillan

Skjærseth, J. B. (2004). 'Marine Pollution: International Ambition, Domestic Resistance', In: Skjærseth, J. B. (Ed.) *International Regimes and Norway's Environmental Policy-Crossfire and Coherence*. Adershot/Hampshire: Ashgate Publishing Ltd, pp. 254-262

Speck, S., McNicholas, J. and Markovic, M. (2001). Environmental Taxes in an Enlarged European Analysis and Database of Environmental Taxes and Charges in Central and Eastern Europe. Szentendre: The Regional Environmental Center for Central and Eastern Europe, pp.3-249.

State of Washington (2012). Biennial Transportation Attainment Report-Washington's Transportation System: Goals, Objectives and Performance Measures. Washington DC: Office of Financial Management, pp.1-65.

Stavins, R. N. (2012). *Economics of the Environment: Selected Readings,* (6th Ed.). New York: W.W. Norton and Company, Inc. pp.1-752

Stilwell, F. (2012) 'Marketising the Environment', *Journal of Australian Political Economy,* (68), pp.108–127.

Techie-Obeng, T., Akponikpe, P. B. I., and Adiku, S. (2013). Considering Effective Adaptation Options to Impacts of Climate Change for Maize Production in Ghana. *Environmental Development*, (5), pp.131-145

Terkper, S. E. (2001). The Role of Excise Taxes in Ghana: African Economic Policy Discussion Paper 74. Cambridge: Belfa Centre for Science and International Affairs pp.1-25.

Verdung, E. (2000). *Public Policy and Programme Evaluation*. New Brunswick/New Jersey: Transaction Publishers, pp.1-336

World Bank (1989). Report and Recommendation of the President of the International Development Association to the Executive Directors on a proposed credit of SDR 89.2 Million to the Republic of Ghana for a Second Phase of the Structural Adjustment Programme. Report No P-4915-GH. Washington DC: World Bank, pp.1-50

World Bank report (2006). Projected Brief on a Proposed Credit in the Amount of USD 29.0 Million Equivalent and a Proposed Grant from the Global Environment Facility Trusted Fund in the Amount of USD 7.0 Million Equivalent to the Government of Ghana for a Ghana Urban Transport Project. Washington DC: World Bank.