HOUSEHOLD WOOD FUEL CONSUMPTION AND EFFECT ON CLIMATE CHANGE IN TARABA STATE, NIGERIA

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Abstract

This study examined the effects of woodfuel consumption as a source of household cooking choice on climate change in Taraba State, Nigeria. The study was a survey research. A total of two hundred and forty respondents from four wards in Jalingo metropolis were randomly selected and data collected was analyzed using E-view17.0.The study also used the Environmental Kuznets Curve (EKC) which explains the relationship between environmental quality and income. The EKC hypothesis states that there is an inverted U-shaped relationship between environmental degradation and the level of income.The study showed that households consume more of woodfuel for cooking and heating needs than other energy substitutes like kerosene, liquefied gas (LPG) and electricity due to higher cost, unavailability of the substitutes and other major determinants like income, population of the household, usage and equipment. The study revealed that climate change is a serious problem that affects health, agriculture and water, rainfall, biodiversity, air quality etc. The study recommended more availability of substitute energy to households by the Federal Government at cheaper costs which will in-turn cut household's dependence on wood fuel and reduce environmental and socio- economic problems not only in Taraba State but Nigeria at large.

Introduction

Household woodfuel consumption has mainly been studied in developing countries. These studies include(Hosier,1987;Leach,1992;Smithetal.,1994; Masera et al.,2000;Ouedrago,2006;Gupta and Kohlin,2006) as reported by Fatihi Elrahman Eldirdiri, Yahia Omar Adam Guma and Mohammed Hamid (2012).Analysis of wood fuel over the decades has revealed certain trends in the woodfuel consumption. Woodfuel is the predominant fuel used in the rural areas of developing countries whereas charcoal is the preferred fuel in urban centers replacing woodfuel as income rises (Arnold et al.,2006;Kituyi,2003) as cited byZaku,Kabir,Tukur and Jiment(2003).This is why many studies like Blackwood and Lynch(1994) and Doessel,(1994) follow the conventional view

of identifying the poor using the criteria of consumption and expenditure. Woodfuel can indeed be considered as an inferior and more polluting energy source(Anold et al, 2003).At the household level the potential problem of woodfuel consumption concerns the health of people who are exposed to indoor air pollution stemming from incomplete combustion of wood due to using inefficient-stoves. The consequences of this are respiratory diseases and lung cancer which culminate into unwarranted deaths (Smith, 2003), hence causing social and economic problems. Woodfuel consumption has adverse effects on the environment as reflected by deforestation, which leads to extinction of species, habitat destruction, ecosystem simplification and climate change.

Climatic change is an important issue that has been in global spotlight because of its attendant problems threatening the sustenance of man and his immediate environment. Climate change has been defined as any change in climate over time, whether due to natural variability or as a result of human activity. Current global concern is focused on climate change resulting from human activity, and specifically from the release of carbon dioxide and other greenhouse gases to the atmosphere. The burning of fossil fuels, clearing of forests, and certain other human activities are major sources of greenhouse gas emissions. These problems are more prominent in developing countries. Nigeria is one of the densely populated countries with a population of about 180 million people, half of which are estimated to live in abject poverty.

Problem Statement

Climate change is already having significant impacts in Nigeria, and these impacts are expected to increase in the future. According to Africa Development Bank Group,(2013), recent estimates suggest that, in the absence of adaptation, climate change could result in a loss of between 2% and 11% of Nigeria's GDP by 2020, rising to between 6% and 30% by the year 2050. This loss is equivalent to between N15 trillion (US$100 billion) and N69 trillion (US$460 billion). Also, according to Babanyara and Saleh (2010), between 1990 and 2000, Nigeria lost an average of 409,700 hectares of forest, equal to an average annual deforestation rate of 2.38%. Against this backdrop, this paper examines the effects of household woodfuel consumption on climate change in Taraba State. The study also among other things provides answers to the following questions.

Research Questions

-What is the effect of woodfuel consumption on climate change in the study area?
- Is there any significant relationship between income and climate change?
- What are the major determinants of woodfuel consumption?

Objectives of the Study

The main objective of this study is to examine the effect of household's woodfuel consumption on climate change in Taraba State while the specific objectives are to:

-examine the relationship between woodfuel consumption and the effects on climate change;
- examine the relationship between income and climate change;
-examine the determinants of woodfuel consumption in the study area

Literature Review

Woodfuel is a major source of household energy especially in developing countries. This demand for energy is found to have adverse effect to the economy and environment. Igugu (2003) and Ebe (2006) noted that woodfuel demand in Nigeria is specifically determined by the factors reported by Anthony and Ojechenemi (2012). According to Zakeriah, Ampadu and Asante (2000), as reported by Anthony and Ojochenemi, (2012), local people, particularly the resource poor farmers in the rural areas, contribute most to environmental resource degradation. Hansen (1992), as cited by Anthony and Ojochenemi, (2012) holds that environmental degradation itself can result to poor agricultural productivity. Desai (1992) establishes that population has linkages with poverty and environmental resource degradation. Thus household size can affect woodfuel consumption and scarcity. The Indicator theory given by Dewees (1989) considers other factors besides population explained by indices (factors) such as labor, time, consumption of less preferred bio fuels, cutting of live wood and people's perception of woodfuel, as determinants of woodfuel crisis.

Energy is one the critical inputs for economic growth of any country. Per capita income is strongly correlated with the per capita consumption of energy in both developing and industrialized countries (Devendra,2007). Low-income and poverty are closely linked, while energy consumption level and income are highly correlated (Dewees ,1989). The energy ladder model portrays a three- stage fuel switching process. The first stage is manifested by universal reliance on biomass. In the second stage households move to "transition" fuels such as kerosene, coal, and charcoal in response to higher incomes and other factors such as deforestation and urbanization. In the third phase, households switch to LPG, natural gas or electricity. The main driver affecting the movement up the ladder is hypothesized to income and relative fuel prices (Barnes et al.,2002) as cited by(Helen,20060). In Nigeria, government policy through subsidy on energy substitutes like kerosene, gas and electricity which are meant to reduce the demand for wood fuel consumption by household have failed because of unavailability and high prices of these substitute products, hence, making it impossible for cleaner and safer energy consumption by low income earners to meet their cooking and heating needs. Environment plays a major role. In 1987 the Brundtland Commission, also known as the World Commission on Environment and Development (WCED) issued its first report on poverty and environment. Subsequently, theories and analyses have been deepening the understanding of the phenomenon. Among them the energy ladder hypothesis (Arnold, Köhlin, & Persson, 2006), the poverty-environment hypothesis (Duraiappah, 1998; Wunder, 2001), the environmental Kuznets curve (Foster &Rosenzweig, 2003) and the village computable general equilibrium (CGE) models (Shi, Heerink, & QU, 2009).

.Climate change refers to some observable wastes and fossil fuels in industrial and agricultural variations in the climate system that is attributable to activities, bush burning, and deforestation. All these human (anthropogenic) activities contribute to alter the atmospheric composition of the earth and balance of the equilibrium between the natural Green House Gases (GHS) and ultimately lead to global warming. Climate change refers to some observable wastes and fossil fuels in industrial and agricultural variations in the

climate system that are attributable to activities; bush burning; and deforestation. Global warming is (water vapour, carbon dioxide, methane and nitrous oxide) closely associated with climate change especially as they are man-made GHGs (sulfur hexane fluoride-SF).Though there are many studies on the effects of woodfuel in Nigeria, this study looks at woodfuel consumption by households in relation to the environmental and economic effects in the study are in other to add to the existing literature on the effects of woodfuel consumption.

Theoretical Framework

This study is anchored on the environmental Kuznet Curve (EKC).The EKC hypothesizes that the relationship between per capita income and the use of natural resources and or the emission of wastes has an inverted U-shape. According to the specification, at relatively low levels of income the use of natural resources and or the emission of wastes increase with income. Beyond some turning point, the use of the natural resources and or the emission of wastes decline with income. Reasons for this inverted U-shaped relationship are hypothesized to include income-driven changes in: (1) the composition of production or consumption ;(2) the preference for environmental quality; (3) institutions that are needed to internalize externalities and / or (4) increasing returns to scale associated with pollution abatement (Amy and Eric, 2007). Grossman and Krueger (1995), among others, found that for a number of environment variables, the relationship between per capita income and the environmental degradation takes an inverted U- shaped form that is, environmental quality initially worsens but ultimately improves with an increase in income. Economic theory relates that an array of factors influence how much will be demanded of any given commodity at any given price: average levels of income, the size of the population (e.g household size), the prices of and availability of related goods (in this case, kerosene, cooking gas and coal), individual and social tastes, special influences (e.g. distance of household to common forests and region), and season (Samuelson & Nordhaus , 2005; Reddy, Ram, Sastry & Devi, 2008), as reported by Anthony and Ojochenemi, (2012).

Woodfuel Consumption and its effects on Climate Change

According to Pearce & Atkinson (1993), as cited by Unekwu (2010), the sustainability of the Nigeria economy is negative. One of the key resources in Nigeria that is increasing fast in its non-sustainability status is the forest. The forest is important in view of its role in economic development and trapping of CO_2 to slow down the process of global warming. The rapid rate of deforestation has been linked with increases in prices of petroleum products, especially dual purpose kerosene.

A key sector of both economic and environmental concern is the forestry sector. Forest provides many social, economic, and environmental benefits. In addition to timber paper products, forests provide wildlife habitat and recreational opportunities, prevent soil erosion and flooding, help provide clean air and water, and contain tremendous biodiversity. Forest litters and soil microbes, together, constitute an important resource that makes forests fertile for arable farming in the tropics (Akachukwu, 2006), as reported by Unekwu, (2010). Also, the ecotourism value of the forest is a formidable tool for sustainable economic development in Nigeria (Adeyemo & Okosodo, 2005; Akachukwu,

2005), as reported by Unekwu, (2010). Again, forests are an important defense against the global climate change. Through the process of photosynthesis, forests produce life-giving oxygen and consume huge amounts of carbon dioxide, the atmospheric chemical most responsible for global warming. By decreasing the amount of carbon dioxide in the atmosphere, forests can reduce the effects of global warming (Mastrandrea & Schneider, 2009), as reported by Unekwu, (2010).

Degradation of the natural environment is an increasing concern to policy makers and researchers in recent times. Woodfuel or wood fuel consumption is one of many causes of ecological degradation as a result of increasing population, low- income(poverty), high cost of energy substitutes (kerosene, cooking gas and electricity). Human consumption of natural resources is generally identified as the key link between human behavior and degradation of the natural environment (Stern *et al*, 1997).In addition to the scarcity of woodfuel as a crisis per se, deforestation has numerous other harmful consequences such as loss of biodiversity and soil erosion (Heltberg et al. 2000).

Globally, the improvement in the carbon intensity of economies, a measure of carbon emissions per unit of gross domestic product, has stalled since 2005. While it was still technically possible to limit warming to below two degrees Celsius, emissions growth would have to rapidly come to a halt and then fall quickly which would require a rapid shift to greener energy and even net negative emissions in the future, where more $C0_2$ is taken out of the air than added.

Effect of woodfuel consumption on Emissions and Cycles (Air quality)

Even where traditional biomass is harvested sustainably, wood fuel use may not be carbon neutral due to incomplete combustion- the idealized fuel cycle in which all carbon is converted to carbon-dioxide is unrealistic. Instead, due to incomplete combustion, carbon is released in other forms, including methane, nitrous oxide, carbon monoxide and non-methane hydrocarbons. These compounds are referred to as products of incomplete combustion (PICs) and have much higher global warming potential than carbon dioxide. According to IPCC (2007), the 100- year global- warming potentials of methane and nitrous oxide are 25 and 298 times than of carbon, respectively. Because of the incomplete combustion of wood fuels, between 10 and 20 percent of carbon released is in the form of PICs. Alternative cooking fuels typically have much lower factors than wood fuel (Smith, et al 2009).

The potential to reduce carbon emissions in sub-Saharan Africa by shifting to clean cooking fuel is significant. Aside from low k- factor, fossil fuels have several other advantages over wood fuels; higher energy density, a higher nominal combustion efficiency, and a higher heat transfer efficiency. These factors offset their higher carbon density, as both Liquefied Petroleum Gas (LPG) and kerosene produce less carbon per unit of useful energy than wood fuel. At the same time, because the factor is lower, even less of the carbon is released as PICs (Smith ,*et al* 2000).

Notable potential impacts of wood fuel processing and energy production include emissions such as dust or fly ash that could affect sensitivity plant species such as lichens , and the emissions of dioxins and metals (depending on the combustibles used). Air- quality

regulations could be used to control a range of such emissions (Scottish Natural Heritage, 2007).

Effects of harvesting woodfuel on Water

Poorly conducted, woodfuel harvesting can have significant effects on water quality and quantity, leading, for example, to increased soil erosion and run-off. On the other hand, forest plantations can require fewer fertilizers and pesticides than annual agricultural crops, thus reducing the risk of water pollution. In addition, forest root systems help to filter pollutants in surface water (Woods *et al*., 2006).

In some cases, forest plantations use less water than annual agricultural crops, but this is highly dependent on the species used and management regime imposed. Fast- growing, short- rotation forest plantations use more water than plantations composed of slower-growing species. Because of their large leaf area, willow and poplar, for example, intercept more rainfall than agricultural crop reducing the amount of water reaching the soil and recharging aquifers or nearby surface water. In addition, they have high transpiration rates and deep root systems. As a result, willow and poplar short-rotation crops use more water than annual agricultural crops and can also tap into underground water in times of low rainfall (Woods *et al*, 2006).The effects of short-rotation forest plantations on hydrology should be evaluated through location-specific analysis that includes the species grown, soils, topography, and rainfall and management practices (RCEP, 2004; IEA, 2008).

The high water requirement of willow may constrain its use to areas where sufficient irrigation water is available (RCEP, 2004). Sewage or sewage sludge can be used to irrigate willow and will also provide additional nutrients (although the high heavy –metal content of sewage can potentially pollute the soil).Willow can be used to reduce soil contamination by absorbing heavy metals, but this, in turn, may affect the composition of the ash following the combustion of the wood.

On good land, short-rotation forest plantations are likely to increase water quality compared with land used for agriculture because of its lower agro-chemical requirements. There is some evidence that, in particular locations, the application of fertilizers and sewage sludge can cause nitrate leaching. However, it has also been suggested that mixtures of trees and grasses used as bio-energy crops could be cultivated along waterways to act as buffers, limiting nutrient turnoff from agricultural land (Woods *et al*, 2006).

Effect of wood fuel consumption on Soil nutrient, Agronomy and Topography

Forest plantations for woodfuel remain in place for a number of years, establish good root systems, and develop leaf litter layers, all of which helps to conserve or promote soil fertility and prevent soil erosion. When harvesting forest residues for bio-energy, site-specific considerations should take into account the unique qualities of both the soil and the topography to avoid soil-related damage, especially on low-fertility sites (Mead, 2005).

Harvesting should aim to minimize nutrient removal and physical damage to the soil. Ideally, most of the nutrient-rich foliage will be retained on the site. Minerals such as calcium, magnesium and, to a lesser extent, potassium and phosphorus, are contained in the bark of eucalypts and some other hardwoods.

According to Santana, Barros and Comerford (2000), leaving the bark on site is a good nutrient conservation practice for eucalypt plantations in Brazil. Another common practice is to return the ash generated by combustion to the site to help compensate for the loss of nutrients caused by biomass removal. Nevertheless, this is not fully achieved and some sites need additional fertilizers (Mead, 2005).

A set of ten principles has been developed for nutrient management in woodfuel production with the aim of assisting foresters to strike a balance between production, ecological services and carbon management(IEA, 2008).The principles include the idea of a strong commitment to adaptive forest management, which requires continual monitoring and adjustment (Raison, 2002).

Income (Poverty) and wood fuel Consumption

Low- Income and Poverty are closely linked while Energy consumption level and income level are highly correlated (Dewees 1989).Poverty may also arise from changes in average income or changes in the distribution of income (Doessel,1994).It is generally agreed that in conceptualizing poverty, low income (low consumption) is a symptom. This has been used in the construction of poverty lines (Obadan, 1997).

A positive approach to defining what is perceived as " low-income household" is to describe the most common or repeated characteristics: people living in places that do not provide healthful living conditions for its inhabitants, a place that lacks the minimum of amenities and infrastructure, people who can hardly sustain the harmonic development of the community, people whose inhabitants do not have resources to improve that condition themselves, or whose improvements demand efforts beyond the capacity of local or national agencies. For instance, Sagar (2005) reported an estimate of 2billion people worldwide suffering from energy poverty. Low income families are constrained in their consumption and so the opportunities for them to meet their consumption expenditures are very minimal. Low income earners with a large household size face more devastating experience in providing basic needs for their families, that is why pooling (in the financial sense) or wife management of finances is more common in low rather than high-income households(John & Adisa 2012). Household energy surveys have found income to be a major determinant of the energy transition (Alam,Rawat and Menaria,1998; Davis 1998; Campbell, Miles, Lysenko, Gibbs and Hughes, 2003; Ouedraogo 2006). For instance, Campbell *et al*, (2003) found that in the four largest cities in Zimbabwe higher income households were less likely to use wood as their primary cooking fuel, switching to kerosene and electricity. Ouedraogo (2006) found that household woodfuel utilization rate decreases with increasing household income in the capital city of Burkina Faso.

Access to electricity has been found to be another important determinant of the energy transition (Davis 1998; Campbell *et al*, 2003; Ouedraogo 2006). However, Madubansi and Shackleton (2007) found that the introduction of electricity into a rural region of South Africa had little impact on woodfuel consumption. Other factors associated with reduced consumption of woodfuel and instead use of alternative fuels are forest scarcity and increased woodfuel collection time (Heltberg, Arndt, and Sekhar, 2000) and household size (Alam *et al*, 1998; Ouedraogo2006).

Determinants of Woodfuel Consumption

According to Arntzen and Kgathi (1984),for the majority of the world population, woodfuel is the main energy source. Moss and Morgan quoted from a report by FAO (1974) stating that woodfuel contributes up to 58.4% of energy consumption in Africa .In many developing countries, woodfuel is depleting rapidly due to the rapid population growth. Below are the major and immediate determinants of wood for fuel.

Population: Generally, population growth is associated with an increase in the energy demand of households. In most developing countries, population growth rates are considerably high hence in reality, the households as the usual consumption unit of energy demands more energy. It would therefore be more accurate to link energy demand for domestic purposes to the number of households rather than to the overall population. Furthermore, population density results in high pressure on land and its related resources, including wood. Thus, an increase in energy needs by households depends heavily on the high population in a household.

Equipment: According to Arntzen and Kgathi (1984), Stoves are not frequently used among low income households. The cost of buying them may be an obstacle. People will be more inclined to use stoves if wood becomes scarce with accompanying greater efforts to collect wood. In rural and urban areas, wood fuel consumption is used for domestic purposes such as cooking, heating and lighting. It is also used for rural industrial activities like beer brewing and brick moulding. Wood fuel for cooking is still most popular because it is easy to handle wood and the fact that no special provisions are required. More so, open fires allow for more pots at the same time, which is more difficult with stoves. Finally it has to be realized that a change in habit of people usually takes time even when cheaper stoves and alternative lanterns are available.

Availability of Alternative Energy Sources: According to Arntzen and Kgathi (1984), access to energy sources has two different aspects; first, physical access and second, economic access (that is the prices of the energy sources available). Even if alternative energy sources are physically available, they may be too expensive for widespread utilization. This of course, depends on the income situation of individual households. Wood is usually collected locally and access to wood decreases if wood becomes scarce, given increase in physical and economic access to alternative energy sources. In Nigeria, the major alternative sources to household energy are liquefied petroleum gas (LPG), kerosene and electricity. Unfortunately, these alternatives are not physically available or economically viable to many households.

Income: income level is an important factor in household energy choice. Acquisition of cooking and lighting equipment and the convenience of using them depend largely on income. In developing countries, the percentage of low income earners is usually very high. Agriculture, the main source of income to households in developing countries does not provide adequate income to meet rising costs of living. Difference in socio-economic position between households will usually be reflected in different energy consumption patterns (Arntzen and Kgathi, 1984).

Marital Status: Marital status is whether you are married, single or divorced. The status of household members reflects an additional demand for energy consumption. Married members usually cook more meals than single members making them opt for cheaper and

available energy like woodfuel compared to single and divorce households whose demand for energy is usually low and its use sometimes frequent (FAO,1997).

Level of Education of household head: The level of education of the household head may determine the type of energy consumed because more educated members usually receive higher incomes than less or illiterate members. This implies that a higher level of educational qualification may enable a household to switch from one energy source to another and from a stressful energy like woodfuel to less stressful and expensive energy like gas and electricity.

Gender: Gender specific roles and responsibilities are often conditioned by household structure, access to resources, specific impacts of the global economy, and other locally relevant factors such as ecological conditions. Hence, gender plays a major role in determining woodfuel consumption as women do the cooking and heating in homes since household chores are done by women rather than men. This implies that gender composition can positively or negatively influence energy consumption (Bravo-Baumann,2000).

Methodology

The Study Area

Taraba state was created out of the defunct Gongola State on 27th August, 1991. Taraba State has total land mass covering 60, 291.82^2 kilometers. Based on the 2006 census figures the state has total population of two million three hundred thousand, seven hundred and thirty six people (2, 300,736).Taraba State has 16 Local Government Area and Jalingo is the state capital. Being an agrarian state, about 75% of the people in Taraba State engage in farming. Most workers are civil servants.Taraba State has sixteen (16) Local Government Areas. (Publication of Taraba State Ministry of Information, 2012). Though Jalingo Local Government has ten (10) wards, this study is restricted to four wards in Jalingo Metropolis namely; Kona 1 and Kona 2, Mayo-Gwoi and Sintalli ward.

Data Collection / Sampling Technique

This study was a survey research which adopted the primary source of data. The data was collected using a structured questionnaire from four wards in the study area.A total of three hundred and twenty (320) questionnaires were distributed among the four wards with each ward having sixty (60) questionnaires .The reason for the round figure or equal number of questionnaires is due to the fact that there is no significant difference in the population among the four wards and there is also similarity among household concentration due to their communal way of living. Furthermore, in other to have an even representation from the uneven number of questionnaires retrieved from the wards, a total of 240 questionnaires from the returned questionnaires were considered .The study used the multiple regression method with the help of E-view 17.0 econometrics software for analysis.

Model Specification

$$Yt = \beta_0 + GNDR\beta_1 + MRST\beta_2 + HSZ\beta_3 + NDT\beta_4 + EDU\beta_5 + AES\beta_6 + \mu i$$

Where;Y_t = Household income spent on woodfuel (household expenditure on woodfuel)

GNDR = Dummy for gender of household (0=female, 1= otherwise),
MRST = Dummy for marital Status, (0 = single, 1= otherwise),
HSZ = Household size,
NDP = Number of Dependants (member in family),
EDU = Dummy for educational Qualification (1= Secondary education or greater 0 = otherwise),
AES = Dummy for alternative energy sources (1= kerosene; 0 = otherwise),
Ui = Error term.

Results and Discussion

The regression result from individual wards showed that there is a significant relationship between income spent on woodfuel consumption and Household size in Kona 1 ward (0.000).This finding is consistent with a study by Arntzen and Kgathi, in 1984 which found that income level is an important factor in household energy choice while Desai (1992) established that population has linkages with environmental resource degradation. In Kona 2 ward, this study found determinants like Gender of household head (0.004) and level of Education of household head (0.000) to have positive and significant relationship on income spent on woodfuel consumption which is also consistent with Bravo-Baumann (2000) which agreed that gender can positively or negatively influence energy consumption. Results from Mayo-Gwoi ward also showed that Household Size (0.003)and Alternative source of energy (0.007) have significant relationship on income spent on woodfuel consumption. Furthermore, results from Sintalli ward showed that Household size (0.003) and Availability of Alternative source of energy (0.007) have significant relationship on income spent on woodfuel consumption. These findings are consistent with the work by Anold et al, (2003) which confirms that woodfuel can indeed be considered as an inferior and more polluting energy source.

Recommendation

Based on the findings of this study, the following recommendations are made:

- Massive campaign against indiscriminate felling of trees for woodfuel and charcoal production by households and the public. Also, environmental protection techniques be included in educational curriculum as this will increase and culture the need to protect our environment;
- Massive tree planting campaign and program should be introduced to reduce the already growing deforestation and desert encroachment in Nigeria.
- Efforts should be doubled by the Nigerian government to make available alternative source of cooking and heating energy like LPG, kerosene and electricity to households which will reduce dependence on woodfuel by households.

Conclusion

Woodfuel is the most available and cheapest source of energy among households especially those living in urban cities in Taraba State. This study concludes from its findings that woodfuel consumption is a problem affecting climate change in the study area.

Consumption of woodfuel by households in the study area contributes negatively to climate change thereby causing environmental, health and socio-economic problems not only to households but also loss of GDP to the Nigerian government.

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Appendix

regress yt gndr mrst hsz ndt edu aes

```
      Source |       SS       df       MS              Number of obs =     240
-------------+------------------------------           F(  6,   229) =    9.17
       Model |  6.8739e+09     6  1.1457e+09           Prob > F      =  0.0000
    Residual |  2.8617e+10   229   124965786           R-squared     =  0.1937
-------------+------------------------------           Adj R-squared =  0.1726
       Total |  3.5491e+10   235   151025968           Root MSE      =   11179

------------------------------------------------------------------------------
          yt |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        gndr |   3589.547    1538.68     2.33   0.021     557.7663    6621.327
        mrst |   945.1174   2373.978     0.40   0.691    -3732.515     5622.75
         hsz |   1103.645   309.5338     3.57   0.000     493.7464    1713.543
         ndt |   2478.369   531.4036     4.66   0.000     1431.303    3525.435
         edu |   2192.074   1908.296     1.15   0.252    -1567.99     5952.137
         aes |   3299.333   1632.667     2.02   0.044     82.36336    6516.303
       _cons |  -11374.83   3648.975    -3.12   0.002    -18564.69   -4184.972
------------------------------------------------------------------------------
```