The Impact of Gas Flaring and Power Plant Emission on the Socio Economic Environment of Niger Delta Region in Nigeria

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ABSTRACT: *Nigeria flares 17.3 billion m^3 annually from the crude oil exploration in the Niger Delta. This gas flaring expends huge amount of energy and causes environmental degradation and disease. The links between oil exploration and exploitation processes and attendant environmental, health and social problems in oil producing communities are not well known.*

This study examines how gas flaring during oil exploration has caused hardship to the local communities in the Niger Delta region of Nigeria. Nigeria which is known to be the sixth largest producer of crude oil among the organization of petroleum exporting countries (OPEC) and the largest in the African continent.

Despite this enormous wealth coming from the Niger Delta, There is a pervasive poverty and despicable environmental damage as a result of crude oil mining activities going on in the region. The neglect of the oil communities by the government and the oil companies in terms of infrastructural development and youth empowerment has led to bunkering, restiveness and hostage taking in the area. This study made of primary and secondary data to analyse the discussion contained in the study. It identifies the constraints to effective implementations of Nigeria's environmental laws and especially the Environmental Impact Assessment (EIA) as it concerns oil prospecting which hindered environmental sustainability. It also Unveils critical issues concerning the region deplorable state of the economy of the local people of the Niger Delta in Nigeria, which has the stigma of being the world's highest gas flare of the gas associated with crude oil production. Apart from being wastage of valuable resources, it runs contrary to Nigeria's obligations to reduce green house gas (GHG) emission.

This paper also reviews the trend of gas flaring over the years (ii) reviews the Nigerians national response and its commitment to end flares by 2008 and the prospects of the Nigeria's Liquefied Natural Gas (LNG) projects.

The results show that the reduction of gas flaring will improve human health and the environment. This paper concludes that the livelihood of the people in the Niger Delta can be improved by promoting a shift from flaring the associated gas to utilization as a gaseous fuel for electricity generation.

Keywords: *Gas flaring, degradation, sustainability, environment.*

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1.0 INTRODUCTION

Nigeria is richly endowed with energy resources; these include coal, tar sand, oil, natural gas, hydroelectricity, solar and so on**.** The commercial energy sector is, however, dominated by oil and gas, both of which jointly account for 71 per cent of commercial domestic energy resources (Iwayemi and Adenikinju, 2001). Thus, oil and gas play significant role in the development of the Nigerian Economy.

The discovery and extraction of natural resources has brought different consequences to countries that are endowed with such resources. While some of these nations have become economically strong and self sustaining, others have been drawn into serious economic hardships and conflicts. Empirical evidence has revealed that oil and gas abundant economies are among the least growing economies (Ayres & Kneece (1990), Barnes 2005; DEckor, 2002. This Phenomenon of often conceived within the prisms of the "resource curse" and "Dutch disease" but both are manifestatives of the inefficient utilization of resources rather than inevitable out come of the availability of oil gas resources. United Nations Development Programme (UNDP, 2006) the proponents of the resource curse, project have it that the citizens of these countries rather suffer from abject poverty, environmental damages, pollutions, diseases, illiteracy and score very low on the United Nations Human Development Index.

It is established that economic advancement and industrialization are contingent on continuous availability and prudent utilization of energy resources, still Nigeria's energy planning and management system leaves much to be desired. Nigeria despite its widely acknowledged status as an energy rich nation still saddled with the problem of adequate and unreliable energy supply for domestic and industrial use (NCEMA, 1999).

The Niger Delta region, where Nigeria Current Large Oil and Gas resources are located, to with the Niger Delta as the unifying feature has remained a source of global interest. With openness to the Atlantic Ocean and watercourses with access to the sea and rivers such as the Benue and Niger Rivers, the Niger Delta embodies some of the major coastal upwelling sub-ecosystems of the world and is an important center of marine biodiversity and marine food production ranked among the most productive coastal and offshore waters in the world. However, pollution from domestic and industry sources, over-exploitation of Oil and Gas resources and poorly planned and managed communities and coastal developments and near-shore activities are resulting in a rapid degradation of vulnerable land, coastal and offshore habitats and shared living marine resources of the region putting the economies and health of the populace at risk.

The deterioration in water and air quality (chronic and catastrophic) from land and sea-based activities (especially industrial,(flaring/power plants), agricultural, urban and domestic sewage run-off, eutrophication and gas flaring have been identified as a major Tran boundary environmental problem by communities in the region.

An indepth study of the Natural gas in Nigeria becomes imperative because of its pervasive impact on the development of any area in the world that is measured by per capita energy consumption on the contribution of the energy sector to the gross domestic product. This study, however, add to the existing literature on the evaluation of the impact of gas flaring on socio-economic and environment in Nigeria using Niger Delta as case study.

In this paper which is divided into four sections, section one is the introduction, section two is the review of existing literature, section 3 is concerned with the methodology of the study and interpretation of the analysis while section 4 is ts concern with the policy implication of findings, recommendations and conclusion.

2.0 A Review of Existing Literatures

The exploration for oil over the years since discovery of first commercial quantity oil in Oloibiri has pose several environmental challenges**.** Oni and Oyewo (2011) posited that over time, extensive exploration for oil has had a huge negative impact on human health, the local culture and the self aspirations of the people of this region. One of such practice associated with the exploration for crude oil is the flaring of gas into the atmosphere. Wikipedia (2011) describe gas flaring as a process, involves the use of an elevated vertical stack or chimney as a channel through which undesired gas or combustible gas and liquids are burnt as they exit the flare stacks on oil wells or oil rigs.

The origins of gas flaring can be traced to the activities of Shell-BP with the epoch- making discovery of crude oil in commercial quantity at Oloibiri (Bayelsa State) in August 1906 (Jimoh and Aghalino 2000). As Osuoka and Roderick (2005) assert, "the first field was found in 1956 and the first export was made in 1958. Flaring of gas mixed up with crude oil began right at the start, and so did a recognition of its unacceptability" (p.6).

Gas Flaring in Nigeria

At the onset of oil exploration in Nigeria, practice of gas flaring became institutionalized as natural gas was deemed to be a waste product that resulted from the process of exploring crude oil from the ground and the practice became institutionalized throughout the industry (Oni and Oyewo; 2011).

Over the years government after government has formulated policies and measures to try and capture the flared gas through the setting up of the Bonny LNG project in 1989 together with other gas gathering projects, these measures have been largely adequate to take care of the volume of natural gas been produced.

Apart from operational and bureaucratic and its attendant losses to the economy (Adebayo 2010), gas flaring has constitutes environmental nuisance in Niger Delta region of Nigeria.

Nigeria is endowed with a huge gas reserve, in fact, petroleum experts regard Nigeria "as a gas province with little oil in it" (Gaius-Obaseki, 1996). Nigerian gas reserve is estimated to be about 124 trillion cubic feet (TCF) of gas in 2005 which in term of energy it is said to be twice as much as the nation's crude oil reserves. Natural gas in Nigeria is obtainable in two main forms-Associated natural gas (AG) and as Non-associated natural gas (Non-AG). Approximately 75 percent of the total gas output are flared in 2000. This may be broken down into 8 percent of non-associated gas and 92 percent of the associated gas output (NNPC, 2008). Gas flaring has, thus, become a dominant feature of upstream activity in the petroleum industry of the Nigerian economy (Okoh, 2001).

Gas flaring in Nigeria could be blamed on the unsustainable exploration practices coupled with the lack of gas utilization infrastructure in the country. However, Ojinnaka (2008) believes that energy, such as gas, has a pervasive impact on the economy and environment such that the progress or development of any area in the world is measured by per capita energy consumption or the contribution of the energy sector to the gross domestic product of that area.

As a result of this perception that associated gas was deemed to be a by-product, no facilities were put in place to capture and store the gas.

This was indeed evident at the dawn of exploration in Nigeria when British officials cited economics and a lack of markets for the continued flaring of gas.

Thus, it was cheaper then to flare the gas as against storage. It was felt that the laying of pipelines and the creation of storage tanks was too expensive an undertaking at the time; and coupled with this was the perceived lack of a viable market for the gas. This was, to say the least, double standards on the part of the British in that they took a contrary position in relation to oil exploration and the attendant associated gas flaring in the North Sea, as the practice was totally discouraged from the onset. Thus Nigeria, it seems, was bequeath with an oil industry that institutionalized the flaring of gas, with the total disregard for the attendant impact on the environment and the huge waste of an energy resource (Osuoka and Roderick 2005). It, thus, becomes inevitable that challenges would exist while trying to re-organize the petroleum sector. These challenges

come in the form of expanding the network of pipelines and increasing the number of gas storage tanks. This coupled with the need to find markets for the gas within and outside the country has resulted in bureaucratic bottlenecks in the form of delays in executing market oriented projects like the West African Gas Pipeline project and the continued somersaults on the part of past and present Nigerian governments as to when to enforce the gas flare-out date on the multinational oil companies. This inaction, on the part of the government and the multinational oil companies can be traced to the fact that the Nigerian oil industry is steeped in corruption; which has been to the benefit of the ruling local elite. As a result, policies of best practice
that should underpin the activities within the industry are non-existent, thus accountability and transparency are words rarely used in the industry and this has had a lasting impact on the continued flaring of gas or indeed any other negative practice within the industry.

Detailed and historical studies have provided empirical validation of the views that the discovery and extraction of natural resources has brought different consequences to countries that are endowed with such resources, while some of these nations have been economically strong, others have been facing serious economic hardships and conflicts.

The studies by Cedigas (2000), Nigeria is by far the number one flarer of natural gas on the planet both absolutely and proportionally - about 46 percent of Africa's total and the most gas flared per tone of oil produced. The data also indicates that Nigeria accounted for 19.79 percent of the global figure.
Orubu (2002b) who undertook a comparism of concentrations of ambient air pollutants in the region and Lagos State concludes that pollutant concentrations are highest in the Niger Delta and argues that some of the green house gases (such as methane and carbon dioxide) emitted at flare sites contributes to global warming.

This suggests therefore that Nigeria oil fields contribute more to global warming through flaring of associated gas than the rest of the world.
The largest proportion of these flare sites are located in the Niger Delta.
An impact assessment of the 1983 Oshika oil spill by powell and White (1985) confirmed the dearth of floating and submerged aquatic vegetations especially water Lettuce, fish, crabs and birds.

Otukunefor and Biukwu (2005) have all shown the pollution Levels of aquatic ecosystems observed in the region are as a result of unregulated effluent discharges and unsustainable methods of petroleum extraction.
Amakiri (2005) laments the loss of biodiversity, alternation of habitats and deforestation that is associated with petroleum exploitation related canalization. This canalization which is quite extensive in the region.
The canalization which is quite extensive in the region opens up previously pristine and inaccessible ecosystem to illegal logging activities.

Ndiokwere and Ezele (1990) also report high levels of heavy metals in soils and plants near the Warri refinery.
Enoyan et al (2006a, 2006b) have also confirmed high levels of heavy metal contamination of River Ijana and efficient receiving – steam that flows by the same refinery.
Braide et al, (2004) observed high concentrations of heavy metals in the Niger Delta. Furthermore, Spiff and Horsefall, (2004) reported trace metal contamination of the intertidal flats of the upper New calabar River in the Niger Delta.

Gill et al, (1992) and Agbogidi et al, (2006) conducted an independent studies, that documented adverse effects of crude oil, engine oil and spent lubricating oil on soils and the suppression of germination of seeds as well as stomata abnormities in diverse food crops.
The major sources of degradation of forest land and water in the region include oil spills, gas leaks, blow outs canalization and discharge of wastes and effluent from oil and gas operations directly into the surface water bodies and the low surface, oil spills in Nigeria was due to a number of causes that include corrosion of pipelines and storage tanks, sabotage and accidents in oil operation.

A world bank survey (Grey, 1995) estimated that about 2.3 million cubic metres of crude oil is split in about 300 separate incidents in the region each year and noted that oil companies normally understate the incidents of spillage and that the total volume of the oil spilt might be as much as ten times the official figure.
The official figure of SPDC (2004) show that between 1976 and 2001, 6,187 incidents in which 3 millions barrels used spilled. Greater than 70 percent of the volume went increased (UNDP, 2006).
Leaks and spills also affect ground water quality. Preliminary results of on going ground water quality evaluation around the CORPC show elevated levels of BTEX in shallow boreholes and dugwell water (Akpoburie et al 2008)
An earlier study by Douglas et al (2005) on the effect of deforestation on tropical basic hydrology has also associated for instance of 1 percent basic yielded for every 3 percent forget loss thereby increasing the probability of flooding.
Efforts at developing the region through various intervention schemes and agencies have been dismal failures and a result of insincerity, dishonesty and lack of commitment on the part of the federal government that initiated the scheme.

Blasing, Hand and Kimberly (2007) worked on monthly carbon emissions from natural gas flaring and cement manufacture in

United State. They discovered that emissions amounted to 1 % of all fossil fuel and carbon emissions had no clear and persistent pattern annually. Akpan (2009) in his work noted that literature shows that vast amount of these gas are being used by few of our chemical industries. He posited further that the only way out for harnessing the nation's natural gas is to encourage the establishment of gas based petrochemical complexes that can consume large volume needed to eliminate gas flaring. He Abdul Kareem and Odigure (2011) worked on the Economic benefit of Natural Gas utilization in Nigeria based on a case study of the food processing industry their work focused on the measurement of heat radiation from gas flaring as one of the menaces of gas flaring fits of substituting conventional fuel and energy types, such as antomotue gas oil. Results obtained revealed that up to 69% are used, 29.85% on low poor fuel oil and million electricity with natural gas could be saved by the company, translated to millions of dollars in few years if conventional fuel and energy is substituted with natural gas.

4. GAS FLARING ISSUE: AN OVERVIEW

The flaring of gas in Nigeria has resulted to the release of associated gases which have been linked to climate change. The emission of greenhouse gases, in particular, methane and carbon dioxide during flaring continues to induce climate change and its impact on the environment. As Osuoka and Roderick (2005) noted, "The burning of Fossil fuel, mainly coal, oil and greenhouse gases has been inducing global warming and this may get worse during the course of 21st century.

Table 1:
Top 20 flaring countries

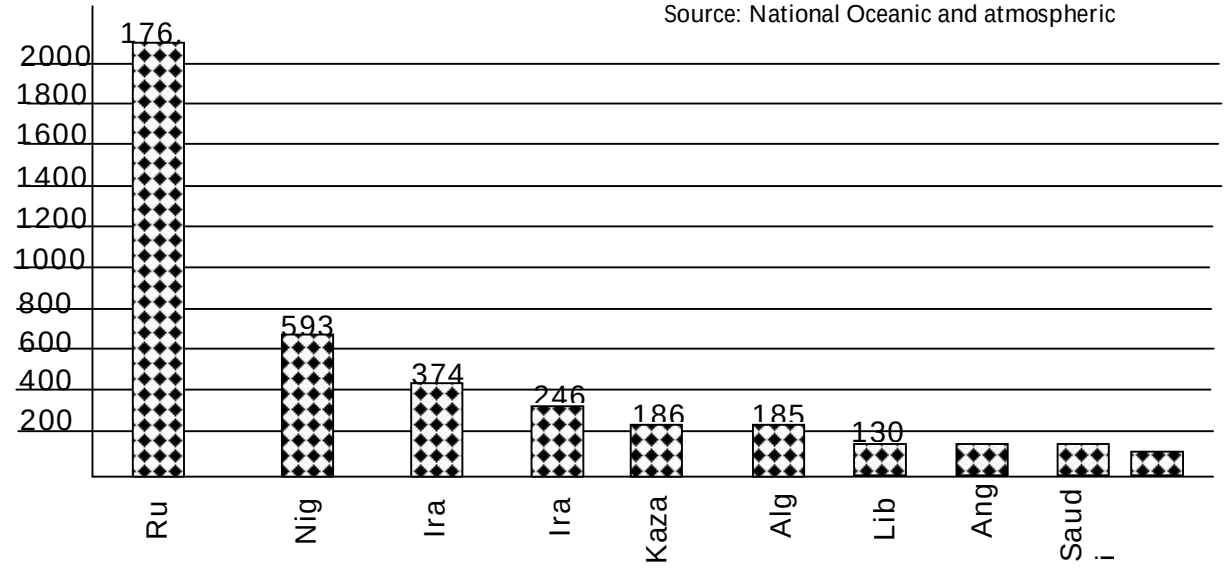
S/N	2004 Rank	Reputed….. country	
1.	Nigeria	24.1	
2.	Russia	14.7	
3.	Iran	13.3	
4.	Iraq	8.6	
5.	Angola	6.8	
6.	Qatar	4.5	
7.	Algeria	3.7	
8.	Venezuela	3.7	
9.	Equatorial Guinea	3.6	
10.	Indonesia	3.5	
11.	USA	2.8	
12.	Kazakhstan	2.7	
13.	Libya	2.5	
14.	Azerbaijan	2.5	
15.	Mexico	1.6	
16.	UK	1.6	
17.	Brazil	1.5	
18.	Garbon	1.4	
19.	Cameroon	1.1	
20.	Canada	1.0	
	Total Top = 20	107.5	
	Source: Garet B (2007)		

Table 2: The impact of gas flaring on agriculture output

Distance of farm land	Percentage loss in
From flore site	Yield of crops
200 metres	100 percent
600 metres	45 percent
1 kilometre	10 percent
Source: Salau (1993: 19-23) (Opukri Co. Ibaba IS 2008	Adegemo 2000:69

Figure 1

Figure gas flaring 2007
Source: National Oceanic and atmospheric



• Gas Flared %gas flared	49.8	41.9	35

Source: Madueme 0 (2%)

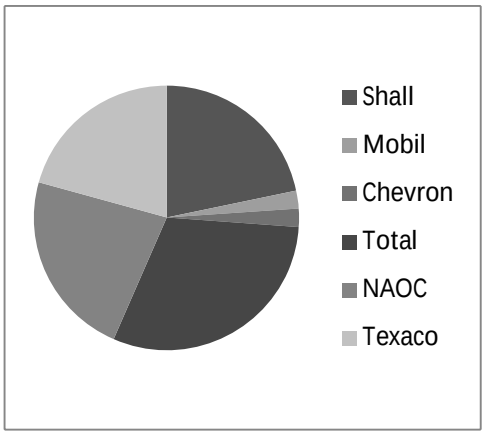
- Billion cubic feet (bef).

Administration in EIA (2009)

Figure:

Total percentage of gas fenced in Nigeria (200-2008)

Source: Madueme 0 (2010)



Source Author: Analysis based on data computing from table 4

Table 3: Major oil companies with data on natural gas produced and flared for the period (2000-2008)

Name of company	2000-2002	2003-2005	2006	2007	2008
Shell					
• Gas produced	1632857255	2114726414	735315476	783905871	800689882
• Gas flared	835756839	784786431	163405866	96967329	97879670
• Mobil					
• Gas produced	12323233154	1159585960	491140702	464537132	427115490
• Gas flared	383175395	535622854	210026022	183528046	130586764
Chevron					
• Gas Produced					
• Gas Flared	627587155	655500024	235249063	101186784	243040550
Total exp	455440050	389895189	192602299	162780356	156952278
• Gas Produced					
• Gas Flared	332525971	802855214	218868501	289817162	320032660
	123648616	265047485	64224402	33842081	86353534
NAOC					
• Gas Produced	1109643063	1244207143	423716209	320927714	293668636
Gas Flared	587136497	496718413	109926431	108696157	96353534
TEXACO					4803727
• Gas Produced	87486761	3702939	5941278	2479303	4746874
Gas Flared	87031562	36653106	5828277	2421920	
Pan Ocean					
• Gas Produced	62940758	74517198	3944139	0.00	21752432
• Gas Flared	59828073	70969973	3756324	0.00	21211546
Ground Totals	50855364117	6088397892	2114245718	2032853975	2111442905
• Gas Produced	2532017032	2549693811	740770521		542732471

5.0 METHODOLOGY AND EMPIRICAL ANALYSIS

Data were obtained from a community survey (2011) of information on gas flaring issues and its environmental impact on Nigeria Delta Community in Nigeria. The survey which include five communities in three local Governments of both Bayelsa and Delta State. The five communities are Oghulaha, Odimodi, Ogbotubo, Arotan and Sagara are used as case study.

Two hundred and fifty questionnaires were distributed randomly in the communities and collected back within (3) days out of the returned questionnaires two hundred questionnaires were verified fit for the analyses. The study was able to collect information on Air flaring, drinking water, health status, source of income culture, religion and Aesthetic from three local Governments of five communities in two states. Hundred percent of the final data used was obtained from the communities survey in both Bayelsa and Delta State.

The study adopted the model of Kareem and Odigare (2011).The data sourced from the Central Bank of Nigeria statistical bulletin were using ordinary least square technique while the information obtained from the community surveyed were analyzed with the use of chi-square technique. The dependent variable is economic growth measured as Gross Domestic Product and others are explanatory variables are volume of gas flared (VGF), crude oil production, gas flaring fines.

The model can be written as:

$$Y=\beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \mu_t \quad (1)$$

Where X_1 is the volume of gas flared, X_2 is the amount crude oil production, X_3 is the gas, flaring fines and X_4 is the volume of gas produced and μ_t is the stochastic error term.

Equation 1 was estimated using an ordinary least square (OLS) estimator. The OLS estimator has a large number of desirable properties. This actually makes it the best linear unbiased estimator.

Table 4 RESULT AND ANALYSIS

It was discovered that there is a relationship between economic growth (GDP) crude oil production (COP) and gas flaring (GF) hence it is concluded that natural gas flaring is positively related to the level of demand for petroleum product. It was also learnt that demand for crude oil international triggered production of natural gas as it is established that associated

Gas formed the bulk of Natural gas production in Nigeria. It was also discovered that there exist a relationship between volume of Gas flaring fine (GF), gas flaring fine (GFF) and volume of Gas produce it is established that fines impose on gas – flaring does not influence the level of gas flared in Niger Delta.

The hypothesis highlighted from the information obtained from the community survey is stated as :Ho: That the activities of the oil companies in Niger Delta region does not have any adverse effect on people of Niger Delta communities.

The chi-square formula is stated as X2=E(O-E)2 / E.

Where E is the summation,0 is the observed frequency and E is the expected frequency.X2 cal-refers to computation for the test statistics and X2 table value .The degree of freedom (df)=(R-1)(C-1)where n=5 is 4.

At 5% level of significance ,the degree of freedom is 4 and X2 cal=617.43 and X2 tab=9.49

The decision rule is that if X2 cal is greater than X2 tab at 0.05 level of significance, the null hypothesis is hereby rejected and concluded that the activities of the oil companies in the Niger Delta region have an adverse effect on people of Niger Delta.

6.0 CONCLUSION AND RECOMMENDATION

This study has examined the impact of gas flaring and power plant emission on the socio economic environment of the Niger Delta people in Nigeria. The results reveal that gas utilization has significant impact on the economy and it is also sustainable. It reveals further that since the imposition of fine on flared gas in 1984, no structural change has been observed.

Therefore, there is an urgent need for the government to provide environment that is conducive for investment in the gas industry as this will lead to additional income to both the people and the government of Nigeria.

These results also show that the imposition of fine on flared gas may not be a better policy option that the need to provide facilities that will enhance further utilization of Nigerian Natural gas.

Polices

Based on our results and their policy implications.

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ISSN 2229-5518

Appendix

E. View Results

Model I

Dependent Variable; GDP
Method; Least Square
Date: 09/02/22 Time: 17:43
Sample: 1982 2006
Included Observations: 25
GDP=C(1)+C(2)*VGF+C(3)*COP

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)		- 4000332.42		-0.001703
	14288505	137	3.57182961	20425169
		7939	036	
C(2)	- 66.3810550	-0.898827		
	8.5378902	148	0.12861938	405328
		6936	1953	
C(3)	26.411730	6.16259973	4.28580980	0.000300
	346	342	244	18007021
				7

R-squared	0.4803889 21425	Mean dependent var	3398346. 252
Adjusted R-square	0.4331515 50645	S.D depended var	4982461 16674
S.E of regression	3751262.0 5404	Akaike info criterion	33.22524 9473
Sum square resid	3.0958327 3958e+14	Schwarz criterion	33.37151 4572
Log likelihood	- 412.31561	Durbin- Watson stat	0.306951 8413

Model II

Dependent Variable; VGF
Method; Least Square
Date: 09/02/22 Time: 17:43
Sample: 1982 2006
Included Observations: 25
GDP=C(1)+C(2)*VGF+C(3)*COP

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	- 4552.1360	5421.41968	0.83965756	0.410132
	6359	438	7317	568023
C(2)	783.54106	5821.90298	0.13458504	0.894163
	5136	171	3344	665345
C3)	0.4835392	0.07889586	6.12882841	3.612307
	12168	38469	496	95893e-

R-squared	0.6591312 54836	Mean dependent var	23255.79 2
Adjusted R-square	0.6281431 87094	S.D dependent var	12257.90 14947
S.E of regression	7474.9126 8782	Akaike info criterion	20.78865 91302
Sum square resid.	122923503 3.19	Schwarz criterion	20.93492 42291
Log likelihood	- 256.85823 77258	Durbin-Watson stat	1.365962 8413 9127