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Evaluating the Economic Impact of Fiscal Provisions in the Draft Petroleum Industry Bill on Offshore Marginal Oil Field Development

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Abstract- Petroleum Fiscal System (PFS) is a key determinant of investment decision in the exploration and production (E&P) of oil and gas. It describes the relationship between: the host governments, the investors, and community with respect to how costs are recovered and profits are shared equitably. The Fiscal Provisions of the Petroleum Industry Bill (PIB) gives government a greater access to gross revenue and this consequently has an impact on the economics and profitability of oil and gas investments especially for marginal oil field development which is already very capital intensive. This paper reviews the economics of offshore marginal field development within the context of the ensuing petroleum industry institutional restructuring and reforms in Nigeria. It provides a review of the fiscal terms, instruments in the draft petroleum industry bill (PIB), the effects on the economics measure and government take statistics of a marginal oil field development in offshore Nigeria. Offshore PSC model for marginal oil field was developed using Excel spreadsheet and the result was compared to that of Monte-Carlo simulation. The model results of revenue Takes for each stake holders were impressive and calculated as Government Take being $659,424,516.52, Farmor Take at $539,529,149.89 and Farmee Take at $513,837,285.60 respectively as to compare with the result obtained by Monte Carlo simulation. Monte Carlo simulation process was incorporated to account for risk and uncertainties.

Keywords- *fiscal regime, petroleum industry bill, economic model , marginal field development.*

I. INTRODUCTION

Petroleum is the backbone of the Nigerian economy, contributing over 30-40% GDP, 85 % of government revenues and over 95% foreign exchange earnings. The oil and gas sector remains critical to the government's Vision 2020 [1]. This sector will remain the critical sector of the national economy and the primary source of government's revenue for the foreseeable future. A broad range of structural, regulatory, fiscal and financial issues have made the Nigeria oil and gas sector largely inefficient and ineffective. As petroleum remains the main driver of global economy and would still continue to be for a very long time to come, it has made it pertinent to restructure the Nigerian Oil and Gas Industry in order to be able to compete effectively and efficiently on the global stage. Therefore, the government is embarking on reforms – through the Petroleum Industry Bill (PIB) which is geared towards transforming the sector. This transformation is expected to re-position the oil and gas sector for better performance [2].

The PIB is a product of the Oil and Gas Implementation Committee (OGIC) report in August 2008. The bill which seeks to establish the legal and regulatory framework, institutions and regulatory authorities for the Nigerian Petroleum Industry, to establish guidelines for the operation of the upstream, midstream and downstream sectors, and for purposes connected with the same. The PIB also includes the fiscal provisions upon which the petroleum industry shall operate. The fiscal provisions in the PIB are quite different from the provisions of the present Petroleum sharing contract (PSC) [2].

The petroleum fiscal system (PFS) can be described as the legislative, tax, contractual and fiscal elements underlying exploration and production operations in a petroleum province, region or country. The primary purpose of the PFS is to determine equitably how COSTS are recovered and profits are shared between the firm and the government. The current Petroleum Fiscal System (PFS) for oil and gas as laid down in the 2005-PSC and 2012 as presented on Table 1 and 2.

TABLE I. 2005 PSC FISCAL TERM FOR OIL AND GAS

Petroleum Fiscal System (PFS) -Conventional Fields	
Oil Production	Rate %
PPT	85% for JV companies, 65.75 for PSC companies
PFS-Marginal Fields	
PPT	50% for PSC companies
ETF	2.5%
NDDC	3.0%
Investment Tax Credit	10.0%
Royalty (R_Y)	18.% (88ft water depth)
Fiscal Term for Gas	
Gas Production	Rate %
PPT	40
Investment Tax Credit	5
Royalty (Ry)	0

TABLE II. PSC FISCAL TERM FOR OIL

PIB Terms	**Rate**
PPT	50%
ETF	2.0%
NDDC	3.0%
Investment Tax Credit	10%
Royalty (Ry, PIB)	12.5% (shallow water, oil volume (5-20mb/d)

(PIB, 2012)

The draft PIB presumable offers solutions to petroleum fiscal problems and community issues affecting oil and gas operations in Nigeria, and ensuring international best practices in order to facilitate good governance and transparency in the industry. In the PIB, every Petroleum Exploration License (PEL) shall be subject to a rent of US\$10/km^2 upon the grant of the PEL at the end of every year. Petroleum Prospecting License (PPL) shall be subject to a rent of US\$100/km^2 upon the grant of the PPL, at the end of the first and second year, US\$300/km^2 at the end of the third and fourth year, US\$500/km^2 at the end of the fifth and subsequent years. Also in the event of a significant gas discovery, a rent of US\$10,000/km^2 shall be paid on the declaration of such discovery and any anniversary thereof. The petroleum mining license (PML) shall be subject to a rent of US\$10/100/km^2 upon the grant of the PML and any anniversary thereof [3].

The PIB has been before the Nigeria National Assembly since 2008 and there have been several debates and attempts by the various stakeholders in the oil and gas industry to influence the texts and provisions of the Bill. The bill is expected to become an act soon and this paper seeks to look at the impact of the fiscal provisions in the bill on the economics of offshore marginal oil field development projects in Nigeria.

Marginal field comprise the small and abandoned fields, which have remained undeveloped by the joint venture operators (multinational oil companies) in Nigeria. Such fields contain reserves that are uneconomic when produced by the multinationals but might be profitable if operated by Nigeria (indigenous) entrepreneurs due to their low overhead and operating cost. A total number of 116 of such fields have been identified in Nigeria. They contain collective reserves of about 1.3 billion barrels, and another 20 fields contain between 15 to 20 million barrels each [4].

A number of papers have been published addressing the issue of Nigerian fiscal regime ([5]; [6]; [2]; [7]; [1]). [5] presented a paper on Comparative Performance Analysis of Petroleum Sharing Contracts in Angola, Equatorial Guinea, Gabon and Nigeria". The authors evaluated the structure, conduct and performance of PFS in Gabon, Equatorial Guinea, Angola and Nigeria in the Gulf of Guinea (GOG). Comparison of the effects of production delay, front loaded government take and taxation shows that petroleum sharing contract fiscal terms and instruments in Gabon, Equatorial Guinea, Angola and Nigeria are relatively competitive. They found that as the risk in deep water investment increases with water depth , return on investment rises in these GOG countries. The Monte Carlo Simulation analysis showed early discounted payout for investors in these GOG countries with significant degree of ceteris paribus.

[6] developed a fiscal model using an Excel spreadsheet. The model generates a cash flow and profitability indices (PIs) for both investor and government with the investment profile and expected production profile. Results from the model showed that royalty rate and the Nigerian Hydrocarbon Tax (NHT) have great impact on company's profitability. However, the sliding scale royalty system of the PIB ensures profitability for both the marginal producer and giant producer. It was also discovered that government surrenders part of its take increases with increase in the price of oil.

[2] reviewed the economics of offshore petroleum exploration and production (E&P) operations within the context of the ensuing petroleum industry institutional restricting and reforms in Nigeria. Deterministic and probabilistic modeling of the impact of the fiscal provisions in the draft PIB on offshore E&P economics, show that the government take statistic is a high of 91 percent in deterministic sense and our stochastic modeling suggest that at P50 confidence, host government take ranges from 89% to 92% and the most likely estimates of HGT is 90% under this circumstance. He concluded that for the PIB to be dynamic and a stable fiscal arrangement, it must now include contract terms and instruments that will willingly give up an appropriate proportion of economic rents to investors to guarantee sustainable capital investment flow for resource development.

[8] presented a paper on Comparative Evaluation of Models for Joint Venture Agreement and Production Sharing Contract fiscal system in Nigeria. In their study, models were developed and compared for joint venture agreement (JVA) and

Producing sharing contract (PSC) for the Nigeria fiscal systems. The results showed that the government has more take and a higher NPV under the JVA than the PSC. Sensitivities were carried out for the NPV and other parameters, the results showed that NPV was most sensitive to oil price.

[9] analyzed the effects of fiscal terms and system parameters on the performance profile of exploration and production (E&P) ventures and the corresponding government take under different fiscal arrangements. He investigated how fiscal systems should be structured and designed to maximize government take from E&P ventures keeping in perspective the underlying economic objectives of the contractors/operators. Using a hypothetical field as a case study, the paper concluded that government participation in E&P ventures through joint venture arrangements does not optimize economic gains for the E&P firms, neither does government participation necessarily maximize the fair market value of petroleum resources received by the government. He also found a strong evidence to suggest that the petroleum sharing contract (PSC) arrangement can be more favorable to E&P firms in terms of economic returns than the joint venture arrangement (JVA) under the general and analogous specified fiscal parameters and terms.

The purpose of any business is to make profits. Marginal fields development projects are highly risky and capital intensive though the rewards are usually high too when successful. Because of the cost implication of marginal field development projects, the operator of a license usually goes into partnership with other IOCs and may need to convince its partners of the economic viability of the project. Besides, the fiscal provisions for marginal field development happen to be one of the contentious issues between the government and the IOCs.

The literature on petroleum fiscal arrangements will continue to grow as the Niger Delta matures as an oil province and as oil continues to be the fuel of choice for rapidly growing economies around the world with the attendant price levels witnessed in the last few years. The paper therefore, addresses the economics of offshore marginal oil field development within the context of the ensuing petroleum industry institutional restructuring and reforms in Nigeria.

II. TAX/TOYALTY SYSTEM, CONCEPT OF COMPANY TAKE, JV PARTNER TAKE AND GOVERNMENT TAKE

Taxes are one of the most important ways of rent and revenue collection in Nigeria. Petroleum Profit Tax is payable under the Joint Ventures (JV) and Production Sharing Contract (PSC). In many other jurisdictions, PSC contractors pay company income tax as they are seen as conducting petroleum operations on behalf of the state oil company which holds the concession area. Taxation is affected by the incentives given to the companies by the MOU and the contractual agreements.

Taxes are regulated by the Petroleum Tax Agency (PTA) and the MOU.

In a simple Tax/Royalty system, revenue sharing between Government and company is as follows:

$$\text{GovernmentTake} = \text{Royalty} + \text{Tax} \quad (1)$$

$$\text{Company Tax} = \text{Revenue} - (\text{Royalty} + \text{Tax}) \quad (2)$$

The revenue sharing formular on profit after tax (P.A.T) for 1991 MOU stated as follows:

$$\text{Government (NNPC) Take} = + (55\% \text{ of } 70\% \text{ P.A.T}) \quad (3)$$

$$\text{Field Operation (Farmee) Take} = (30\% \text{ of P.A.T}) \quad (4)$$

$$\text{JV Partner (Farmor) Take} = (45\% \text{ of } 70\% \text{ P.A.T}) \quad (5)$$

$$\text{Government Total Take} = \text{Royalty PPT} + \text{Education Tax} + \text{NDDC} + (55\% \text{ of } 70\% \text{ P.A.T.}) \quad (6)$$

The Memorandum of Understanding (MOU) is a contractual agreement between the Nigerian Government and the Joint Venture companies which first came into existence in 1986. This provide arrangement under which the Nigerian government ensures a certain level of profits to the oil company irrespective of fluctuating market prices, in return for continuity in exploration and exploitation work by the companies. The second and third MOU came into force in 1991 and 2000 respectively [10]. Furthermore, the draft PIB includes a new joint venture structure referred to as incorporated joint venture (IJV). It mandates the national oil company and its joint venture partners to enter into a shareholding agreement as an independent liability company. It is expected that the working interests in the current joint venture arrangements will convert to share in the IJV liability company. The bigger impediment to the implementation of the IJV structure is how to actually make the IJVs independent companies and how to overcome the perception of the IJVs as public corporations and not privates. Such perception, if allowed to take hold in the international communities, will affect the credit profiles of IJVs and possibly diminish the economic performance of the IJVs in the long run [2].

III. OFFSHORE MARGINAL PSC ECONOMIC MODEL

The principal petroleum fiscal arrangement stipulated in the draft PIB for offshore marginal oil and gas development in Nigeria is the PSC even though the PIB empowers the national oil company, at its discretion, to enter into other forms of contracts with any company. The basic fiscal elements described previously; corporate income tax, hydrocarbon tax, royalties etc. are incorporated in a spreadsheet based PSC economic indicators and government take profiles are generated using an excel program and Monte Carlos Software.

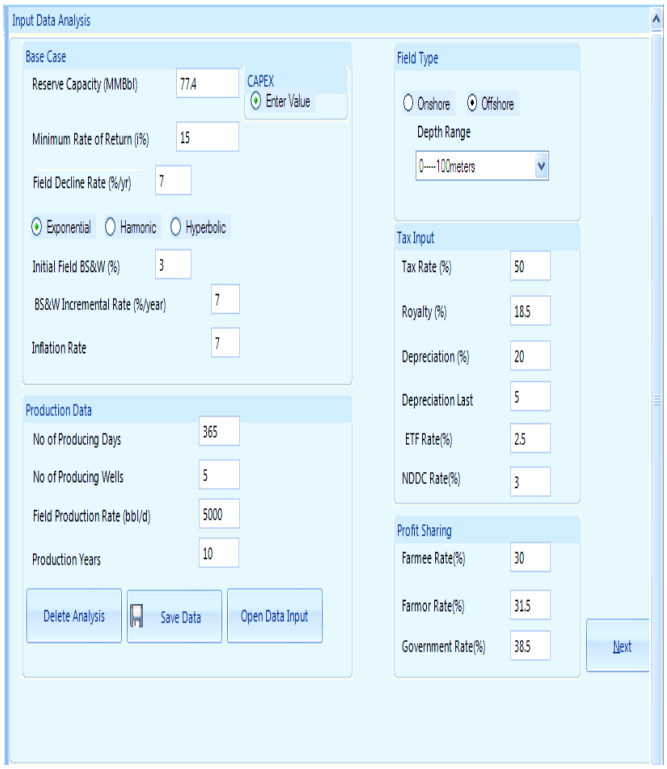

Figure 1. INPUT DATA SHEET

A. *PSC Model Specification*

The model framework adopted for this paper is the discounted cash flow analysis. The modeling framework defines the discounted net cash flow such that:

$$\text{NPV}(r,t) = \sum_{t=0}^{n} \left(\frac{V_t}{(1+i)^t} \right) \tag{7}$$

$$V_t = {}^{G}R_t = Capex_t - Opex_t - Ry_t - PIB_{term} \tag{8}$$

Where V_t is estimated net cash flow, r is the rate of discount such that internal rate of return is defined as r=r*, which makes NPV=0. The net cash flow of an investment is the cash received less the cash spent during a given period.

The NPV concept is used to compare Exploration and Production (E & P) Projects with alternative investment and can be represented as:

$$NPV = \sum_{t=0}^{n} \frac{Q_0^t P_0^t + Q_0^t P^t - CAPEX_t - OPEX_t - Ry_t - Tax_t - PIB_{term}}{(1+i)} \tag{9}$$

Let ,CAPEX = $C_W + C_F$ (10)

PIB_{term} = PIB tax schedule as shown on Table 2

$$opex(1) = Q_o^t C_{op}^t + Q_{wp}^t C_{wp}^t + Q_{w_i}^t C_{w_i}^t + Q_{g_{li}}^t C_{g_{li}}^t \tag{11}$$

OPEX (2) = R $(1 + r)^{t-1}$ (12)

OPEX= OPEX (1) + OPEX (2) (13)

Substituting Equations (10), (11), (12) and (13) into Equation (9) gives:

$$NPV = \sum_{t=0}^{n} \frac{Q_0^t P_0^t + Q_0^t P^t - Q_0^t C_{op}^t - Q_{wp}^t C_{wp}^t - Q_{gi}^t C_{gli}^t - (C_w + C_f)_t - R(1+r)_t^{t-1} - Ry_t^1 - Tax^1 - PIB_{term}}{(1+i)} \tag{14}$$

Where,

C_W = total cost for drilling and completing wells

C_f = cost for surface production facilities

V_t = Net income in year, t (= income – cost)

OPEX = Operating Expenditures

OPEX (1) =Operating Expenditures associated with water handling, gas injection and operational costs of producing each STB of oil regarding to payrol and maintenance.

OPEX (2) = Operating Expenditures associated to supplies and overhead costs.

R = Initial Opex =10% of CAPEX, incrementing at 2% per annum.

r = Rate of increase of OPEX per year (2%)

t = year

CAPEX = Capital Expenditures

GR_t = Gross Revenue at time, t

$$Q_o^t = Cummulative\,oil\ (STB)\ at\ time, t$$

$$Q_g^t = cumulative\ gas\ (MMSCF)\ at\ time, t$$

$$P_o^t = Average\,oil\ price\ (\$)\ at\ time, t$$

C_w = Total cost for drilling and completing wells.

C_f = Total cost for oil and gas processing facilities

$$Q_{wp}^t = cumulative\ \ water\ produced\ (STB)\ at\ time, t$$

$$Q_{wi}^t = cumulative\ \ wateri\ njection\ (STB)\ at\ time, t$$

$$Q_{gli}^t = cumulative\ gas\ lift\ inject\ (SCF)$$

$$Q_{wp}^t = \cos t\ \ for\ wateri\ njection\ at\ time, t$$

$$C_{gli}^t = \cos t\ \ for\ gas\ lift\ injection\ \ at\ time, t$$

Cost for gas lift injection at time, t

PIB = Petroleum Industry Bill

Equation (14) is subject to the following investment criteria:

NPV (r, n) > 0.0 profitable (15)

NPV (r, n) = 0.0 Breakeven (16)

NPV (r, n) <0.0 Unprofitable (17)

This model enable a general economic evaluation of a marginal oil field and consider all costs involved in evaluating

the life cycle of a marginal oilfield. The objectives of this economic model focus on economic analysis and evaluation using NPV together with other economic yardsticks for evaluation of marginal oilfield. The NPV simply provide a way to decide whether or not to invest in a project by looking at the projected cash inflows and outflows. It is used to compare E&P projects with alternative investments or is used as a comparison between projects. In addition NPV compares the value of a dollar today to the value of that same dollar in the future, taking inflation and returns into account. If the NPV of a prospective project is positive, then the project should be accepted. If the value of NPV is equal to zero, this mean breakeven and if it is negative, then the project isn't worth the risk and is a no-go. Therefore the project is rejected.

IV. RESULT AND DISCUSSION

The model converted the texts in the fiscal provisions of the PIB into Mathematics and coded on a spread sheet Excel. The model required the investor to supply data such as times of obtaining the different licenses (PEL, PPL and PML), expenditure forecast (CAPEX, OPEX), reserves and expected production profile during the life of the field. A price forecast for the products (oil and gas) was used with the model to generate cash flows for both the investor and host (Figure 1).

The model results of revenue takes for each stakeholders using 1991 MOU tariffs were impressive and calculated as Government Take being $623,221,158, Farmor (JV Partner) Take as $539,529,149 and Farmee Take (Field Operator) at $513,837,285 respectively with project IRR of 61% at 12.5% discount rate in comparison to the Monte Carlo simulation with most likely NPV at P_{50} modelling that Government Take, $3,005, 438,499, Farmee take as $ 513,405,516 and Farmor take as $ 540,131,638 (Table 3; Figs. 2, 3 and 4). The P_{10}, P_{50} and P_{90} probabilistic results confirmed the profitability of the marginal offshore oilfield. Although, it is wiser to invest in a venture with high profitability at P_{50} but it can be seen that the venture is also profitable at both P_{10} and P_{90}.

TABLE III. COMPARISON OF DETERMINISTIC AND PROBABILISTIC OUTPUT FORECAST

	Deterministic ($)	**P_{10} ($)**	**P_{50} ($)**	**P_{90} ($)**
Farmee take(30%) PAT	513,837,285	458,939,225	513,405, 516	573,619,680
($)Farmor Take (45% of 70% PAT)	539,529,149	481,475,507	540,131,638	602,765, 652
Government Take ($) (55% of 70% PAT)	623,221,158	2,801,466,196	3,005,438,499	3,205,479,821

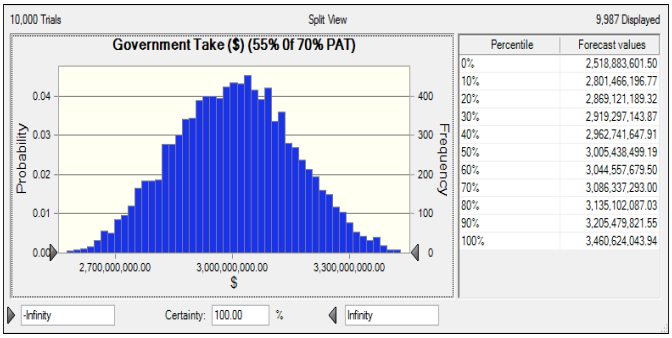

Figure 2. Stochastic Modelling of Government Take

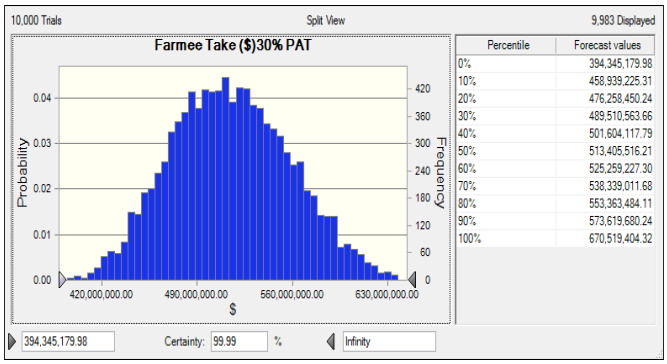

Figure 3. Stochastic Modelling of Farmee Take

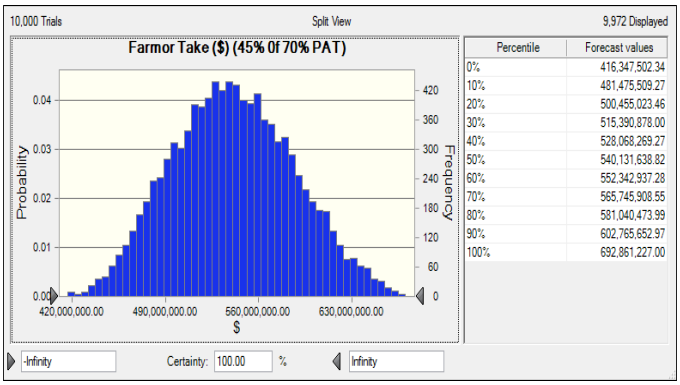

Figure 4. Stochastic Modelling of Farmor Take

Figs. 5 to 7 show the sensitivity analysis on Farmor Take, Government Take and Farmee Take respectively. It shows the various effects of changes in the value of oil price, tax Rate, Capex, Gas Price, Royalty rate, NDDC Rate and oil price. This would aid in decision making as the tax rate and oil price were discovered to be the most sensitive parameter for Farmee Take's whose slight changes will affect the profit earning of any field operators. For instance on Figures 5, the oil price have the highest impact on the Government Take follwed by tax rate, hence any drop in oil price will negatively affects the Government Take.

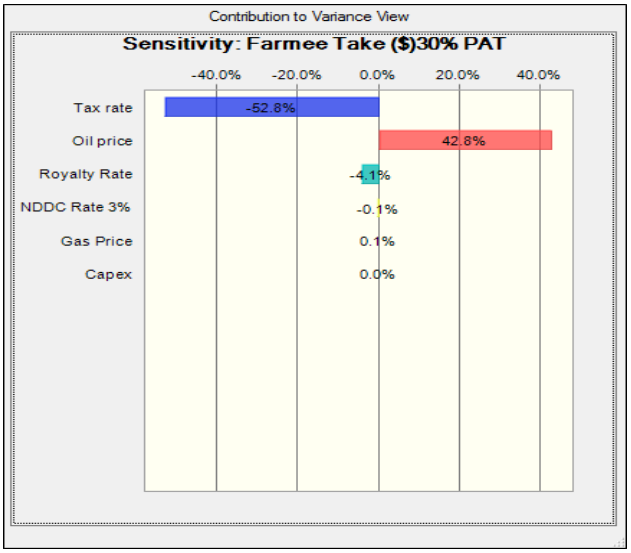

Figure 5. Farmee Take Sensitivity chart

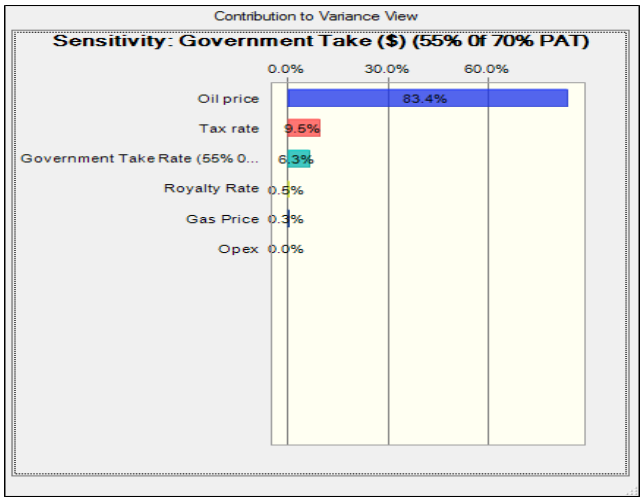

Figure 6. Government Take Sensitivity Chart

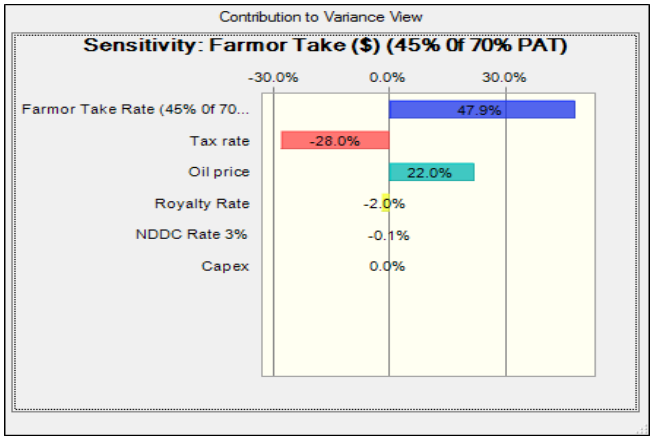

Figure 7. Farmor Take Sensitivity chart

The effect of fiscal terms on the economic system measures for marginal oilfield development in Nigeria within the contents of the draft PIB and Tax schedules shown on the Table 1 shows higher values of NPV of $969, 694, 556.17, profit to investment of 6.0429, PI of 3.55 and payout at 1.18 years compared to NPV of $480,516,098.11, profit to investment of 5.085, PI of 2.26 and payout at 1.86 years using 2005 PSC being current petroleum fiscal system (Table 4) The economic model was used to test and compare the draft PIB against the current PFS as shown on Table 5. The economic indices for the draft PIB are more positive and impressive compared to the current PFS , passing the draft PIB will be profitable to current PFS.

TABLE IV. ECONOMIC INDICES COMPARISON BETWEEN DRAFT PIB AND CURRENT PETROLEUM FISCAL SYSTEM (PFS)

Economic Indicators	Current PFS	Draft PIB
NPV	$480,516,098.11	$969,694,556.17
Profit to Investment	508.52%	604.29%
Productivity Index	2.26	3.55
Payout time	1.86yrs	1.18yrs

V. CONCLUSION

The structure and conduct of the global E&P industry have changed significantly over the years, to the extent that the search for and development of petroleum resources have become mostly driven by the attractiveness of fiscal regimes rather than geological prospectivity only. A dynamic and stable fiscal arrangement must now include contract terms and instruments that will willingly give up an appropriate proportion of economic rents to investors to guarantee sustainable capital investment flow for resource development. The result of the Offshore economics PSC model for marginal field was impressive and it takes into account PIB term. The drafted PIB should be adopted in Nigeria considering the result of economics analysis which is better than current PFS.

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NOMENCLATURE

CAPEX = Capital Expenditure
OPEX = Operating Expenditure
NPV = Net Present Value
PI = Profitability Index
IRR = Internal Rate of Return
ETF = Educational Tax Fund
NCF = Net Cash Flow
PBP = Payback Period
P_{10} = Probability at 10%
P_{50} = Probability at 50%
P_{90} = Probability at 90%
PPT = Petroleum Profit Tax
MOU = Memorandum of Understanding
JV = Joint Venture
PPTA = Petroleum Profit Tax Agency
PSC = Production Sharing Contract
PTA = Profit After Tax