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**FISCAL POLICY AND MACROECONOMIC  
PERFORMANCE IN NIGERIA,  
1970 - 2007**

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By

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**Abstract**

*This paper is on fiscal policy and macroeconomic performance in Nigeria for the period of 1970 to 2007. The purpose of the study is to investigate the causal relationship between government expenditure (GE) representing our independent variable and Gross Domestic Product (GDP), Inflation Rate (IFR), Private Investment (PI) and Capital Inflow (CIF) are proxies for our dependent variables. To carry out this study, the GDP model was built. The explanatory power was determined. The econometric views (E-views) software was used for the analysis of the data. The statistical tools employed include augmented dickey fuller test (ADF), stationarity test, Johananen's co-integration test, ordinary least squares (OLS) multiple regression analysis and granger causality test. The time series data were found to be stationary in the short run and a number of co-integrating equations were found to establish long-*

*run relationship among the variables under study. The result shows that the explanatory power of the GDP model is high because of variation in government spending accounts for 94% (0.9428) of changes in macroeconomic variables. The implication is that government expenditure had a strong effect on determining the macroeconomic performance of the Nigerian economy within the period understudy. Therefore, we conclude that there is a significant relationship between GDP and macroeconomic performance indicators. We recommended for appropriate policy mix, increase in government expenditure so as to enhance infrastructural development and formulations of policy that would encourage selective capital goods. Finally, fiscal policy instruct should be used to achieve fiscal control*

## **Introduction**

Over the years, the Nigeria government under different administrations has no doubt initiated several economic policies, programmes and reforms with the aim of ensuring improvement in the lives of Nigerian people (citizens). One of such key areas that is well stipulated is the fiscal polices and the general impact on the macroeconomic performance in Nigeria. Available evidence shows that a lot revenue accrued to government in the past years. However, fiscal policies and fiscal priorities seemed to have been misplaced and mismatched resulting to mismanagement / misappropriation, upward movement of inflation rate, low standard of living, youth unrest, militancy in the Nigerian's Niger Delta region, over dependence on foreign institution, low gross domestic product index (GDP) infrastructural facilities and epileptic power supply just to mention but a few. To put it another way, fiscal policies were not properly channeled to areas where they would have been of the most benefit to the Nigerian people. Therefore, the fiscal policy is expected to lead to increased macroeconomic objectives such as economic growth, price stability, full employment and balance of payments equilibrium. These cannot be achieved without proper regulation, improving inter-government fiscal coordination, promoting macroeconomic stability of some variables, including the control of fiscal policy aggregates. The federal government uses fiscal policy instruments to alter the economy prior to the adoption of the structural adjustment programme (SAP) in 1986. Nigeria like most other developing countries in sub-Sahara Africa, have witnessed crises associated with unsustainable and balance of payments deficits as well as high rates of inflation. Direct control of fiscal policies which involved the fixing of a quantitative ceiling on commercial bank credit expansion and /or increase in government spending, taxation and borrowing, depending on prevailing economic circumstance. Others are; sectoral allocations and the pegging of nominal interest rate as implemented by CBN to ensure compliance by banks. Indirect approach to fiscal operations was also used. This involved the use of market-based instrument to bring about variations in the aggregate demand and supply in the economy. The banks were equipped with policy tools used to influence money supply through government spending, taxation and borrowing policy.

Thus, fiscal policy could be expansionary or contractionary / restrictive. Expansionary fiscal policy occurs when government spending is increased or taxes are decreased or a combination of both. It is a measure taken when an economy is in a recession. The aim of the government therefore will be to stimulate the economy (or spend it out of recession).

However, the extent to which these desired results could be achieved depends on the nature of the economy. On the other hand, contractionary fiscal policy is applied to dampen the level of aggregate demand for goods and services particularly when it appears to be over heating the economy by mounting pressures on the price level to take its usually form of reduction in government spending or an increase in taxes or a combination of both. Any of these measures will reduce the money in the hands of households and business, spending power and the level of aggregate demand. Also, contractionary fiscal policy is known as deflationary fiscal policy since the aim is to deflate the economy. This is in the belief that deflation of the economy will counteract inflation. Government borrowing is another aspect of fiscal policy; it is resorted to when government expenditure exceeds its revenue. The results is that if government strictly ties its spending to revenue, it may not be able to spend the economy out of recession especially when income levels of households and businesses are already low. When such borrowing becomes a necessity, the government can source the fund from domestic residents and institutions or from external sources. This involves selling of gilt-edged securities, selling government securities to the banking sector or by printing of new money (High powered money). Significant government borrowing from domestic residents and banks will increase aggregate demand for loans and raise interest rate and therefore "crowd out" private investment spending may emerged. In other words, government borrowing tends to reduce the total spending by the private sector which now finds it more costly and perhaps more difficult to borrow. It is for this reason that the monetarists argue that net effect of fiscal measure aimed at expanding demand in the economy may be insignificant because the financing of the budget deficit will have adverse effects on private spending whatever choice of the policy is adopted at any particular time will depend on the priority of the policy makers/analyst.

Generally, the target of both fiscal and monetary polices is the attainment of relative macroeconomic performance. Economic activities do not evolve in a vacuum but are stimulated by endogenous macroeconomic polices formulated in the Nigeria domestic frontiers of a country (Onoh 2007). An issue which occupied the minds of government for decades is the effectiveness and efficacy of fiscal policy to influence economic variables/ aggregates. Therefore, there is the need for an effective fiscal policy that will stabilize the macroeconomic performance of the country. This paper is aimed at determining whether there is any causal relationship between fiscal policy and macroeconomic performance under regulation and deregulation in the Nigerian economy. It will also examine the relationship between fiscal policy and macroeconomic variables in the Nigerian economy within 1990 to 2007.

### **Conceptual Framework**

The concept of macroeconomics has to do with broad aggregate, which includes major issues as unemployment, economic growth, inflation and international payments, among others. It involves the conscious manipulations of a number of policy instruments – fiscal, monetary, exchange rates and income policy measures to achieve a set of stated objective / macroeconomic performance which includes full employment of productive resources, reasonable price stability, an acceptable rate of economic growth, an equitable distribution of income, stability in external trade relations and



balance of payment equilibrium. Realization of these goals is challenging and this is because some of these objectives may be inherently conflicting.

Despite disagreement among scholars, decision and policy makers on how fiscal policy actually works and on the magnitude of its effects on the economy, there is a remarkably strong agreement that fiscal policy has some impact on the economy. A view held by scholars of the monetarist school of thought. The monetarists are very skeptical about the ability of government to effectively manage the economy. They believe that, even when the discretionary policies of government have achieved the desired objectives, it is usually associated with high costs. Infact, they opine that, rather than really correcting cyclical fluctuations, government policies generate them. They also argue that irregular growth in money supply is largely responsible for fluctuations in economic activities (Kpoha, 2003, as cited by Gbosi 2004).

Government spending plays a major role in the economy; therefore, it is important to analyze the relationship of government spending to general economic activities. Fiscal policy deals with the deliberate change of the levels of government expenditures, taxes and government borrowing with the view to influencing macroeconomic variables in a desired direction. This involves the formation of policies that would influence the behaviour of economic agents. Therefore, fiscal policy is a practice actively used to stabilize the economy as increases in government spending or a reduction in taxes are used to stimulate the economy out of a recession, otherwise, reduction in government spending and/or increase in taxes are used to slow down a boom (Dornbusch and Fisher, 1990).

According to Gbosi (2005), attempts by economists to explain fiscal policy as a major tool of macroeconomic management originated from the view of two schools of economists, that of the classical and Keynesians respectively. Having built their faith on the so-called say's law of markets, the classical economist argued that the market economy was self adjusting. Therefore, there was no need for the government to tamper with the economy. However, the alternation of the first and second world wars disproved the classical theory. Keynes recognized that there was a potential instability in the economy which cannot be corrected by the forces of market mechanism. He argued that through public works programmes, the government could stimulate aggregate demand through changes in savings and investment which are responsible for changes in economic activities and employment in an economy.

The sequence of events that occur in the process and the theoretical relationship between fiscal policy and macroeconomic performance measures are shown below:

$\uparrow GE \rightarrow GDP \uparrow \rightarrow IFR \uparrow \rightarrow UER \downarrow \rightarrow BOP \downarrow$

Where;

$\uparrow GE$  = Increase in Government expenditure

$\uparrow GD$  = Increase in Gross Domestic

$\uparrow IFR$  = Increase in Inflation Rate

$\downarrow UER$  = Decrease in unemployment rate

$\downarrow Bop$  = Decrease in balance of payment

The above transmission process in relation to how the empirical results rhyme with prior expectations of the relationship between the variable under study which

implies that a single policy action initiated in the economy either through government agencies will have repercussions on various sectors of the economy.

Therefore, fiscal policy instrument through an indirect approach to fiscal management helps to address the conflicting interest with the help of a trade-off analysis. In our analysis, fiscal policy (FP), Measures such as government expenditure (GE), Private Investment (PI) Export (x), Capital outflow (COF), are proxies for fiscal policy instrument serving as (our independent variables) while macroeconomic variables such as Gross Domestic Product (GDP), inflation rate (IFR), unemployment rate (UER) balance of payment (BOP) are proxies for macroeconomic performances (our dependent variable).

### **Fiscal Policy in Nigeria Under Regulation**

The primary objectives of fiscal policy are the maintenance of price stability, full employment, sustained economic growth and maintenance of balance of payment equilibrium. According to the Central Bank of Nigeria (2003), the economic environment which guided fiscal policy in Nigeria in the pre-SAP era could be termed as the period of boom and burst. Prior to the deregulation of the financial sector in 1987, fiscal policy in Nigeria depended mainly on the direct control or instruments. Prominent among these instruments were direct ceiling, selective credit controls through taxes, government expenditure and borrowings. (i.e. internal and external). Therefore, reasons are advanced for government's dependence on the direct approach of fiscal control prior to the deregulation of the Nigerian economy in 1986. The first is the narrowness and undeveloped nature of the financial system/markets. The second is the inadequate demand and supply of relevant debt instruments and the deliberate restraint on interest rates. Thus, the objectives of fiscal policy then were maintenance of relative price, stability, reduction in unemployment rates and a healthy balance payment position.

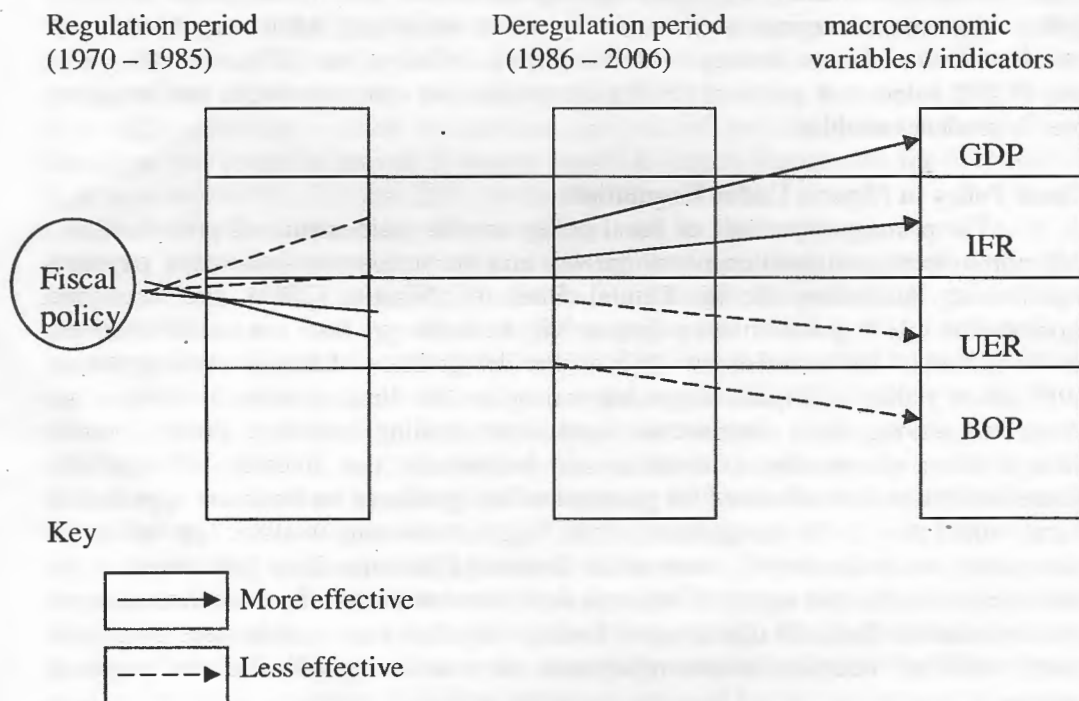
In Nigeria, the regulation period is divided into three phrases namely; pre and post-independence 1959 – 1969, the oil boom era, 1970 – 1980 (Udoji award era) the fall of the oil boom, 1981 – 1985 and pre SAP era, 1985 – 1986 and post SAP era, 1987 and beyond.

### **Fiscal Policy in Nigeria Under Deregulation**

Fiscal policy took a new dimension in Nigeria with the deregulation of the financial system in 1987. In an attempt to further deregulate the financial sector, the federal government in 1992 re-emphasized its intention to shift from the use of direct controls to the use of indirect market orientation – approach to fiscal measures/aggregates. This move was to vigorously pursue as soon as possible an economic environment that is very conducive for private investors and competitive environment. The general belief was that the indirect approach/controls will help to strength the effectiveness of fiscal policy and the overall efficiency of the financial market. Since 1992, fiscal policy instruments have been the major instrument of fiscal control in Nigeria. Under the SAP, the objectives of fiscal policy were the stimulation of output, employment and maintenance of domestic and external stability, (Agundu, 2008).

Figure 1: Illustrates the effectiveness of fiscal policy under regulation and deregulation periods of the Nigerian economy (1970 – 2006).

**Figure 1: Analysis of Fiscal Policy (FP) Effectiveness Under Regulation and Deregulation Period of the Nigerian Economy**



Others are:

- GDP = Gross, domestic product
- IFR = Inflation rate
- UER = Unemployment rate
- Bop = balance of payment

From the above analysis, fiscal policy is built around Keynesian theory of government intervention in the market economy using government spending to stimulate economic growth, raise unemployment level and control inflation. According to Nordhaus (2005) as cited in Saunder (2006), the US, President J.F. Kennedy adopted the principles of Keynesian economic in 1961 and successfully fought economic recession and inflation President Ronald Reagan used it to pull the America economy out of deep recession in 1980 – 1982. In 1993 President William Clinto used fiscal measures that lowered America’s federal deficit by about 150billion dollars (or 2% of GDP) over a period of five years to produce a budget surplus in 1998. Despite these resounding victories of fiscal policy, empirical studies carried out on the US economy by Anderson, and Jordan (1968), Hafar (1982), Collier (2003); on the UK economy by



Saunders (2006) did not give empirical support to the effectiveness of fiscal policy on economic stabilization, according to Agiobenebo (2003).

### Model Specification

Multiple regression analysis is used in this study to investigate the extent to which the various fiscal policies have impacted or caused performance on the economy. The following fiscal policy instruments were used: Fiscal Policy Measures: Government Expenditures (GE), private investment (PI), inflow (GE), export (x), capital outflow (COF), import (m), and gross domestic product (GDP), inflation rates, unemployment rates (UER) and balance of payment (BOP). This research seeks to investigate measure and /or find out the causes of the degree of relationship between independent variables and one dependent variable at a time. Data used were generated from secondary sources, namely; the Central Bank of Nigeria (CBN) statistical bulletins, journals, books and newspapers.

The following functional relation was formulated.

### GDP MODEL

$$\begin{aligned} \text{GDP} &= f(\text{GE}, \text{PI}, \text{IFR}, \text{CIF}, \text{x}) \\ \text{GDP} &= a_0 + a_1 \text{GE} + a_2 \text{PI} + a_3 \text{IFR} + a_4 \text{CIF} + a_5 \text{x} + a_6 \text{DUM} + \text{UI} \quad \text{-- (1)} \end{aligned}$$

The log – log form is:

$$\begin{aligned} \text{Log GD} &= a_0 + a_1 \log \text{GE} + a_2 \log \text{PI} + a_3 \log \text{IFR} + \\ &a_4 \log \text{CIF} + a_5 \log \text{x} + a_6 \text{Dum} + a_2 \quad \quad \quad - \quad \quad \quad - \quad \quad \quad - \quad \quad \quad \text{-- (2)} \end{aligned}$$

Where;

- GE = Government expenditure
- IFR = Inflation rate
- CIF = Capital inflow
- X = Export
- PI = Private investment
- DUM = Dummy variables
- U = Random error term.

Therefore, from our log-log form is;

Log GDP =

$$\begin{aligned} &a_0 + a_1 \log \text{GE} + a_2 \log \text{PI} + a_3 \log \text{IFR} + a_4 \log \text{CIF} + a_5 \log \text{x} + a_6 \text{Dum} + \text{U}_1 \\ &3.92 \quad 0.13 \quad -0.13 \quad -0.020 \quad -0.01 \quad -0.12 \quad 0.14 \\ &(0.00) \quad (0.079) \quad (0.016) \quad (0.385) \quad (0.655) \quad (0.010) \quad (0.067) \end{aligned}$$

$$R^2 = 0.94; \text{ Adjust } R^2 = 0.89; \text{ Prob (F – statistic) = 0.00}$$

The result of the stationarity test on GDP showed better values for  $R^2$  and adjusted  $R^2$  (see appendix 1). The result shows a strong explanatory power of the model

as  $R^2$  (0.9428) shows that approximately 94 percent of changes on GDP are explain by changes or variations in explanatory variables, that is, 94% of variation in GDP causes changed on macroeconomic performance. The overall model is also significant with the probability, value (p-value) (0.00) of the F-statistic being less than  $\alpha = 0.05$ . Also, the granger causality test on the GDP model shows that the relationship between GDP and its explanatory variables within the periods under review is that of "independence" (Appendix 2). Note that we are interested in rows 1-5 of the result in because it deals with the relationship between GDP and its explanatory variables. The decision rule is that if the probability value (p-value) is greater than our chosen alpha ( $\alpha=0.05$ ), we reject the null hypothesis ( $H_0$ ) of "does not granger cause..." if it is less than alpha, ( $\alpha$ ) then we fail to reject  $H_0$ . From the result shown in rows 1-5 (appendix 2), on the P-values are greater than  $\alpha$ , so we fail to reject  $H_0$ . This means that there is no causal relationship between GDP and its explanatory variables (macroeconomic performance). In the other words, there is neither unidirectional nor bidirectional causality. Therefore, the GDP model is not a simultaneous equation model and used ordinary least squares (OLS) method for its estimation. Also for inflation (IFR) model, it was observed that there is no relationship "independence" (Appendix 3) as in the GDP model and OLS was also used for its estimation as well.

### **Discussion of Results**

The results of the multiple regression analysis for the GDP model are in Appendix 1, the effects/causes of government expenditure (GE) on Gross domestic product (GDP) is not statistically significant as indicated by a p-value (0.079) which is greater than our level of significance ( $\alpha=0.05$ ). This could be attributed to misappropriation of public funds and corruption that have resulted in diversion of public funds to non-productive areas rather than investing in productive areas such as infrastructure and other growth promotion activities.

Also, the coefficient is positive (0.13) which aggress with our apriori expectation. Also, the effect /cause of private investment (P1) on Gross Domestic Product (GDP) it significant with a p-value (0.016), which is less than alpha ( $\alpha=0.05$ ) but with a negative sign of coefficient (-0.13) which does not agree with our apriori expectation. This could be attributed to erratic power supply in the country, inadequate roads and other relevant social amenities. It could also mean that government expenditure (GE) had a crowding-out effect on private investment.

The effect/cause of inflation rate (IFR) on GDP is not statistically significant because a p-value (0.3852) is greater than  $\alpha=0.05$ . This may be due to the mono-cultured nature of the Nigerian economy. That is, Nigeria is not a producer nation as she relies more on imported goods. The negative coefficient of (-0.020) of IFR agrees with our apriori expectation as inflation beyond certain limits adversely affects productive as in the Nigerian situation. Capital inflow (CIF) exerted a non-significant (p-value, 0.655279) and negative (-0.01) effects. It is not significant due to insufficient foreign capital investment rather, the economy is mainly characterized with capital out-flow (capital flight) as a result of political and socio-economic instability. The negative is contrary to our apriori expectation as Cif is expected to boast (positive relationship) GDP growth. Also, export (x) exerts a significant (p-value, 0.0096 Ca) and positive (0.12) effect on GDP. This agrees with our apriori expectation. However, this marginal



improvement can be enhanced by formulating policies that encourage export promotion. This also shows that revisiting of non-oil exports would no doubt enhance our gross domestic product (GDP). The dummy variable included on the GDP model captures the relative effect/cause of regulation and deregulation on GDP through their impacts on fiscal policy indices/measures. The positive coefficient (0.14) indicates a relatively marginal increase in GDP in the period of regulation, but this difference is not significant (p-value, 0.0670 > α). Thus fiscal policy has only been marginally more effective in the deregulation than regulation as shown in figure 1 but the difference in effectiveness is not positive, as captured in table (1) below.

**Table 1: Granger Causality Test Result among Key Macroeconomic Performance Measures / Variables**

| S/NO | STATE OF THE VARIABLE                             | CAUSALITY TEST RESULT                     | DECISION |
|------|---|---|----------|
| 1.   | Causal relationship between GE and GDP in Nigeria | Independence (no causal flow GE-GDP)      | Accepted |
| 2.   | Causal relationship between GE and inflation      | Independence (No causal flow) (GE----IFR) | Accepted |
| 3.   | Causal relationship between GE and BOP            | Unidirectional GE ----BOP                 | rejected |

### **Findings and Conclusion**

Based on the empirical test and judging the variables as shown in the analysis above, there is an independent causal relationship between Government Expenditure (GE), Inflation Rate (FR) and Gross Domestic product (GDPs. Private investment, capital inflow is also insignificant. Also export to GDP exerts a marginal influence on the economy. (That is insignificant relations fiscal policy and macroeconomic variable). Therefore, the GDP model, GE is seen not to have significant influence on GDP model, GE is seen not to have significant influence on GDP. This is confirmed by our Granger causality test. It was discovered from our analysis that there is an insignificant relationship between fiscal policy and macroeconomic measures. Therefore fiscal policy is not a major cause(s) of growth rate of the Nigerian economy within the period understudy. Other factors not included in our model, exerted stronger influence on the Nigerian economy. These factors include, societal attitudinal change, deregulation of our economy, entrepreneurship development among others. We conclude that fiscal policy has both direct and indirect effects on the Nigerian economy and in the achievement of macroeconomic performance.

### **Recommendations**

Based on our conclusion, the results of the study show that there is the need to allow an appropriate interplay of the fiscal policy instruments/aggregates. (That is fiscal policy mix) The Central Bank of Nigeria and other regulatory authorities should intensify financial system deregulation, so as to promote effective and efficient macroeconomic performance

Government should direct its fiscal policy instruments such as government expenditure, taxes and borrowing towards achieving fiscal control and to enhance overall economic growth.

The government should also formulate policies and programmes to institute, reward and encourage attitudinal/societal positive change. Finally, the government should, through the Central Bank of Nigeria, diversify the economic base of the nation so as to promote the non-oil sector.

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## Appendix 1

### Stationarity Test on GDP

#### Augment Dickey-Fuller Unit Root Test on D(GDP)

| Null Hypothesis: D(GDP) has a unit root<br>Exogenous: Constant, Linear Trend<br>Lag Length: 9 (Automatic based on SIC, MAXLAG=9)  |                  |                       |             |        |
|---|------------------|-----------------------|-------------|--------|
|   | t-Statistic      | Prob.*                |             |        |
| <b>Augmented Dickey-Fuller test statistic</b>   | <b>-8.794874</b> | <b>0.0000</b>         |             |        |
| Test critical values:   |                  |                       |             |        |
| 1% level  | -4.356068        |                       |             |        |
| 5% level  | -3.585026        |                       |             |        |
| 10% level   | -3.233456        |                       |             |        |
| *MacKinnon (1996) one-sided p-values.   |                  |                       |             |        |
| Augmented Dickey-Fuller Test Equation<br>Dependent Variable: D(GDP,t)<br>Method: Least Squares<br>Date: 02/21/10 Time: 01:04<br>Sample (adjusted): 1981 2006<br>Included observations: 26 after adjusting endpoints |                  |                       |             |        |
| Variable  | Coefficient      | Std. Error            | t-Statistic | Prob.  |
| D(GDP(-1))  | -3.981706        | 0.452730              | -8.794874   | 0.0000 |
| D(GDP(-1),2)  | 2.427958         | 0.375256              | 6.470134    | 0.0000 |
| D(GDP(-2),2)  | 2.164355         | 0.312032              | 6.936331    | 0.0000 |
| D(GDP(-3),2)  | -2.009223        | 0.250727              | 8.013583    | 0.0000 |
| D(GDP(-4),2)  | 1.632851         | 0.240974              | 6.776042    | 0.0000 |
| D(GDP(-5),2)  | 1.303761         | 0.225693              | 5.776701    | 0.0000 |
| D(GDP(-6),2)  | 1.254300         | 0.200394              | 6.259182    | 0.0000 |
| D(GDP(-7),2)  | 1.059893         | 0.190235              | 5.571505    | 0.0001 |
| D(GDP(-8),2)  | 0.713409         | 0.150930              | 4.726748    | 0.0003 |
| D(GDP(-9),2)  | 0.238700         | 0.105111              | 2.270923    | 0.0395 |
| C   | -19.44328        | 2.670451              | -7.280898   | 0.0000 |
| @TREND(1970)  | 1.170185         | 0.139940              | 8.362074    | 0.0000 |
| R-squared   | 0.942806         | Mean dependent var    | 8.112692    |        |
| Adjusted R-squared  | 0.897867         | S.D. dependent var    | 8.598750    |        |
| S.E. of regression  | 2.748010         | Akaike info criterion | 5.163669    |        |
| Sum squared resid   | 105.7218         | Schwarz criterion     | 5.744329    |        |
| Log likelihood  | -55.12769        | F-statistic           | 20.97991    |        |
| Durbin-Watson stat  | 0.741681         | Prob(F-statistic)     | 0.000001    |        |

## Appendix 2

### Granger Causality Test on GDP Mode (Log Form)

| Pairwise Granger Causality Tests |     |             |             |
|----------------------------------|-----|-------------|-------------|
| Date: 04/08/10 Time: 21:45       |     |             |             |
| Sample: 1970 2005                |     |             |             |
| Lags: 2                          |     |             |             |
| Null Hypothesis:                 | Obs | F-Statistic | Probability |
| LGE does not Granger Cause LGDP  | 35  | 1.33694     | 0.27795     |
| LGDP does not Granger Cause LGE  |     | 2.25854     | 0.12199     |
| LPI does not Granger Cause LGDP  | 35  | 0.74525     | 0.48320     |
| LGDP does not Granger Cause LPI  |     | 2.54477     | 0.14706     |
| LIFR does not Granger Cause LGDP | 35  | 0.30397     | 0.74013     |
| LGDP does not Granger Cause LIFR |     | 0.25330     | 0.77788     |
| LCIF does not Granger Cause LGDP | 35  | 1.12004     | 0.33953     |
| LGDP does not Granger Cause LCIF |     | 0.18321     | 0.83352     |
| LX does not Granger Cause LGDP   | 35  | 1.48442     | 0.24261     |
| LGDP does not Granger Cause LX   |     | 0.19412     | 0.82488     |
| LPI does not Granger Cause LGE   | 35  | 0.59431     | 0.55831     |
| LGE does not Granger Cause LPI   |     | 1.40699     | 0.26065     |
| LIFR does not Granger Cause LGE  | 35  | 0.75689     | 0.47767     |
| LGE does not Granger Cause LIFR  |     | 0.59171     | 0.55971     |
| LCIF does not Granger Cause LGE  | 35  | 2.64050     | 0.08784     |
| LGE does not Granger Cause LCIF  |     | 0.61474     | 0.54745     |
| LX does not Granger Cause LGE    | 35  | 4.65030     | 0.01741     |
| LGE does not Granger Cause LX    |     | 0.96370     | 0.39297     |
| LIFR does not Granger Cause LPI  | 35  | 1.59072     | 0.20149     |
| LPI does not Granger Cause LIFR  |     | 0.89144     | 0.42065     |
| LCIF does not Granger Cause LPI  | 35  | 0.37999     | 0.69719     |
| LPI does not Granger Cause LCIF  |     | 1.57059     | 0.22452     |
| LX does not Granger Cause LPI    | 35  | 2.40311     | 0.10762     |
| LPI does not Granger Cause LX    |     | 1.13870     | 0.33369     |
| LCIF does not Granger Cause LIFR | 35  | 1.08299     | 0.35188     |
| LIFR does not Granger Cause LCIF |     | 0.39052     | 0.66070     |
| LX does not Granger Cause LIFR   | 35  | 0.31807     | 0.72969     |
| LIFR does not Granger Cause LX   |     | 0.46390     | 0.63949     |
| LX does not Granger Cause LCIF   | 35  | 0.63182     | 0.59297     |
| LCIF does not Granger Cause LX   |     | 3.58403     | 0.04020     |

### Appendix 3 Stationarity Test on GE Augment Dickey-Fuller Unit Root Test on D(GE)

| Null Hypothesis: D(GE) has a unit root<br>Exogenous: Constant, Linear Trend<br>Lag Length: 7 (Automatic based on SIC, MAXLAG=9)   |             |                       |             |        |
|---|-------------|-----------------------|-------------|--------|
|   |             |                       | t-Statistic | Prob.* |
| <b>Augmented Dickey-Fuller test statistic</b>   |             |                       | -5.621173   | 0.0005 |
| Test critical values:   |             |                       |             |        |
|   | 1% level    |                       | -4.323979   |        |
|   | 5% level    |                       | -3.580623   |        |
|   | 10% level   |                       | -3.225334   |        |
| *Mackinnon (1996) one-sided p-values.   |             |                       |             |        |
| Augmented Dickey-Fuller Test Equation<br>Dependent Variable: D(GE,2)<br>Method: Least Squares<br>Date: 02/21/10 Time: 01:36<br>Sample(adjusted): 1979 2006<br>Included observations: 28 after adjusting endpoints |             |                       |             |        |
| Variable  | Coefficient | Std. Error            | t-Statistic | Prob.  |
| D(GE(-1))   | -3.439898   | 0.611954              | -5.621173   | 0.0000 |
| D(GE(-1),2)   | 1.951477    | 0.660842              | 2.953014    | 0.0085 |
| D(GE(-2),2)   | 1.726858    | 0.676662              | 2.552026    | 0.0200 |
| D(GE(-3),2)   | 1.729414    | 0.661780              | 2.613277    | 0.0176 |
| D(GE(-4),2)   | 3.769748    | 0.874354              | 4.311467    | 0.0004 |
| D(GE(-5),2)   | 4.127456    | 0.909318              | 4.539068    | 0.0003 |
| D(GE(-6),2)   | 5.618496    | 1.093617              | 5.137537    | 0.0001 |
| D(GE(-7),2)   | 6.921690    | 1.171287              | 5.909474    | 0.0000 |
| C   | -69.92590   | 45.66477              | -1.531288   | 0.1431 |
| @TREND(1970)  | 5.317542    | 2.687270              | 1.978790    | 0.0633 |
| R-squared   | 0.962618    | Mean dependent var    | 7.146429    |        |
| Adjusted R-squared  | 0.943926    | S.D. dependent var    | 209.4409    |        |
| S.E. of regression  | 49.59530    | Akaike info criterion | 10.91812    |        |
| Sum squared resid   | 44274.49    | Schwarz criterion     | 11.39391    |        |
| Log likelihood  | -142.8537   | F-statistic           | 51.50110    |        |
| Durbin-Watson stat  | 2.201511    | Prob(F-statistic)     | 0.000000    |        |

### Appendix 4 Stationarity Test on IFR Augment Dickey-Fuller Unit Root Test on D(IFR)

| Null Hypothesis: D(IFR) has a unit root<br>Exogenous: Constant, Linear Trend<br>Lag Length: 1 (Automatic based on SIC, MAXLAG=9)   |             |                       |             |        |
|--|-------------|-----------------------|-------------|--------|
|  |             |                       | t-Statistic | Prob.* |
| <b>Augmented Dickey-Fuller test statistic</b>  |             |                       | -5.740390   | 0.0002 |
| Test critical values:  |             |                       |             |        |
|  | 1% level    |                       | -4.252879   |        |
|  | 5% level    |                       | -3.548490   |        |
|  | 10% level   |                       | -3.207094   |        |
| *Mackinnon (1996) one-sided p-values.  |             |                       |             |        |
| Augmented Dickey-Fuller Test Equation<br>Dependent Variable: D(IFR,2)<br>Method: Least Squares<br>Date: 02/21/10 Time: 02:02<br>Sample(adjusted): 1973 2006<br>Included observations: 34 after adjusting endpoints |             |                       |             |        |
| Variable   | Coefficient | Std. Error            | t-Statistic | Prob.  |
| D(IFR(-1))   | -1.380810   | 0.240543              | -5.740390   | 0.0000 |
| D(IFR(-1),2)   | 0.358867    | 0.168883              | 2.124942    | 0.0419 |
| C  | 3.770448    | 6.024605              | 0.625841    | 0.5362 |
| @TREND(1970)   | -0.185102   | 0.276039              | -0.670566   | 0.5076 |
| R-squared  | 0.577407    | Mean dependent var    | 0.091176    |        |
| Adjusted R-squared   | 0.535147    | S.D. dependent var    | 23.13277    |        |
| S.E. of regression   | 15.77195    | Akaike info criterion | 8.464474    |        |
| Sum squared resid  | 7462.632    | Schwarz criterion     | 8.644046    |        |
| Log likelihood   | -139.8961   | F-statistic           | 13.66340    |        |
| Durbin-Watson stat   | 2.072443    | Prob(F-statistic)     | 0.000009    |        |