KEY DETERMINANTS OF INVESTMENT IN NIGERIA

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Abstract

This paper analyzes the key determinants of investment in Nigeria by adopting a co-integration and error correction mechanism. The model captures the dependent variable, investment with the values of gross fixed capital formation in the economy, while performance, profitability, capital performance, economic growth, political stability, macroeconomic stability, international financial risk and infrastructural development were independent variables in the model. These variables reveal relative levels of statistical significance. Results of the long-run and short-run estimates show that industrial performance, capital performance, and low levels of economic growth discourage investment in Nigeria. While profitability encourages investments, financial risk captured by exchange rate volatility strongly opposes them. Infrastructural development represented by government expenditure spending and macroeconomic stability disclose mix, show result, which implies uncertainty in policies associated with increase in investment.

1 Introduction

Economic empirical literatures on investment and related theories are often not conclusive in analyzing the determinants of investment in an economy. This is basically due to the fact that there are numerous determinants of investment and this depends on the perspective of the analyst decision to follow any related economic theory (Blonigen, 2005).

It is the purpose of this paper to consider uncertainties in accordance with the real economic variables linked to investment, in order to enhance the relevance of factors that go beyond the standard assumptions of neoclassical theory and to consider their associated impact on the levels of domestic investment in the Nigeria economy.

This paper attempts to specify the determinants of gross fixed capital formation in the Nigerian economy in order to understand the key determinants of investment in Nigeria and how crucial this is to understanding the main sources of fluctuations in aggregate demand in the economy.

2. Literature

Investment theory stipulates that the decision to invest is most likely a rational decision in an attempt to maximize the present value of the difference between revenue and costs in order to make and increase profit. The investor should collect substantial information and by prospecting a discount rate from the expected inflation, the desired rate of return and the present associated risk, he can calculate a net present value for the investment being proposed

in line with the level of growth in the proposed sector of the economy where the investor wishes to invest. This view reveals that the decision to invest is founded on the investors' expectations about the value of these variables for the various alternatives available.

Therefore, to invest the rational investor considers his expected revenue and cost. Thus one can consider the main variables for rational investors' investment decision as prospecting anticipated profit outcomes. It is necessary to recall that investors decision within imperfect markets, seeks to improve their revenue streams in several ways. They consider specific advantages in the market to have an edge over other competitors in the market, and to compensate for the additional cost of investing in the market. This includes innovation in technology, scale economies, marketing and improved sales skills, better and cheaper access to capital and other forms of government induced distortions (Ietto-Gillies, 2005).

Empirically, Abu (2009) evaluates the long-run determinants of private investment in Nigeria with the use of the error technique and found that growth of real income, increase in public investment, exchange rate and openness of the economy and higher savings have a positive effect on private investment. But credit to private sector, rising inflation, high lending rate impede private investment in Nigeria.

Benoit, Frank and Philip (2009) find out that those changes in users cost of capital, which in turn are affected by interest rates have both statistical and economical significant effect on investment, and that average interest rate on debt is generally higher for small firms than for large firms. These disclosures imply little evidence that the effects of monetary policies on small firms are enormous.

3.1 Theoretical Framework

In order to provide a quantitative assessment of the key determinants of investments in Nigeria in the short-run and long-run, we considered a simple theoretical framework that states the neoclassical theory of investment which proposes that on the long-run, it is necessary that a stable relationship exist between an economy's capital stock, the level of real output and the real user cost of capital performance. In this light, we consider real growth in the economy as economic performance and capital stock performance in order to analyze the view that these relationships exist among the levels of investment and market size amidst high levels of economic risk represented in the model by exchange rate volatility and the levels of uncertainty captured by political stability and macroeconomic stability in the model (Ghura and Barry, 2000; Akkina and Mehmet, 2002; Naqvl, 2002; Pelgrim and Sevastian, 2002).

The model adopted in this study is a co-integration equations model. We designed models that express investment as gross fixed capital formation (GFCF^I) as a function of GDP growth (U^G), Market size (MZ^R), Political stability (N^G), exchange rate volatility (EX^V), profitability (O^x), macroeconomic stability (ME^S), Labour efficiency (LE^I) and capital performance (C^w).

$$G\text{FCF} = \alpha_o + \partial_j U^G + \beta_j N^G + \vartheta_j EX^V + \chi_j O^X MZ^R + \gamma_j ME^S + \mu_j LE^I$$
$$+ \pi_j C^W + U_{1t} \quad - \quad - \quad \text{Equ 3.1}$$

Where:

α_o = Intercept

$\partial, \beta, \varphi, \chi, \gamma, \mu, \pi, \nu, \eta,$ and λ = Various slope coefficients

U_{1t} and U_{2t} = Impulses

The presumptive (a priori) signs are:

$\partial > / < 0, \beta > 0, \vartheta < 0, \chi < 0, \gamma > 0, \mu > / < 0,$ and $\pi > 0$

A predicted consequence of the model is that firms invest more when there is less uncertainty. This is why the model introduces variables such as political stability, exchange rate volatility and macroeconomic stability. If this is confirmed, it indicates the relevance of uncertainty in investing and the need to rethink a new theory to complement the neoclassical ideology of investment. Then, the possible impact of investors' analysis on the improved value of the investment must establish a risk and financial analysis undertaken to evaluate human resource inputs in the light of labour efficiency.

This co-integration equation model is built on a prototype macroeconomic model with a specific insight into investment and associated economic uncertainties prevalent in the Nigeria economy in order to analyze the major determinants of investment in Nigeria.

The model is unique since it gives the value of relative investment movements as a function of exogenous variables that include macroeconomic stability and exchange rate volatility which represents a set of policy instruments used in the country over the observation. Further, it allows for the direct estimation of the effect of these basic policy instruments on aggregate domestic investment, measured by gross fixed capital formation. This means, that the model avoids the danger of attributing too much influence to any variable which may limit the desired component of investment and it simply disperses uncontrollable channeled funds within the domestic economy such that they no longer have effect on total capital movements.

3.2 Model Specification

The formulation of a reliable investment equation taking into consideration the level of economic activities in Nigeria is an enormous process, since very little could be found in theoretical literature in line with the contemporary relationship between investment, market size, labour efficiency and other key macro economical variables.

The co-integration equation model adopted in this study seeks to explain investment in relation to its key determinants such as exchange rate volatility, macroeconomic stability, credit performance, GDP growth, macroeconomic stability, market size, profitability etc. This is so because for this model to explain the apparent perpetuation of disequilibria in investment in Nigeria, it has to include endogenous reaction functions of the monetary sector. Also, this model took into consideration the structural economic, policy changes and economic reforms in Nigeria through the periods of the research.

In functional forms this can be represented as:

$$\text{GFCF} = \delta_o + \delta_1\beta_1\text{INDP} + \delta_2\beta_2\text{PRFT} + \delta_3\beta_3\text{GEXP} + \delta_4\beta_4\text{CAPF} + \delta_5\beta_5\text{POLS} + \delta_6\beta_6\text{MACSB}$$
$$+ \delta_7\beta_7\text{GDPG} + \delta_8\beta_8\text{EXRVL} + U_{1t} \quad - - - - - - \quad \text{Equ 3.2}$$

WHERE:

GFCF = Gross Fixed Capital Formation, INDP = Industrial Performance, PRFT = Profitability,

GEXP = Government Expenditure, CAPF = Capital Performance, POLS = Political Stability, MACRSB = Macroeconomic Stability, GDPG = Gross Domestic Product Growth rate, EXRVL = Exchange Rate Volatility, δ_o = Intercept, $\delta_1, \delta_2, \delta_3, \delta_4, \delta_5, \delta_6, \delta_7$ and δ_8 = Various slope coefficients, U_{1t} and U_{2t} = Impulses

The presumptive (a priori) signs are:

$\beta_1 > 0, \beta_2 > 0, \beta_3 > 0, \beta_4 > / < 0, \beta_5 > 0, \beta_6 >, \beta_7 > 0,$ and $\beta_8 > / < 0$

4 Empirical Results

The data used in this study were extracted form the Annual Report and Statement of Accounts of the Central Bank of Nigeria (CBN), for the period 1970 to 2008.

4.1 Unit Root Test for the Variables

To test for the presence of the co-integrating relationships among the variables specified in the model, we begin by considering the characteristics of the time series data employed in the study. This is achieved by considering the order of integration of each series using the Dickey Fuller (DF) and Augmented Dick Fuller set of unit root test.

Table 4.1

Ratios from ADF unit root test on the time series in the model in equation 3.1

Regressors	Test	DF/ADF Tests including an intercept and not a trend		DF/ADF Tests including intercepts and a trend	
		Levels	1st Diff.	Levels	1st Diff.
GFCF	DF	1.6877	-3.5242	-1.2317	-3.9168
	ADF	0.56744	-4.2385	-1.5667	-5.2107
INDP	DF	-3.1177	-23519.5	-29772.4	-22252.4
	ADF	-22030.0	-10335.4	-20025.9	-9427.1
PRFT	DF	-2.7889	-9.6981	-5.0173	-9.5647
	ADF	-1.7816	-6.9138	-3.4894	-6.8219
GEXP	DF	6.3006	-3.1116	3.6292	-5.2334
	ADF	8.1583	-1.0762	5.9051	-0.49972
CAPF	DF	-7.6921	-7.6221	-7.8755	-7.8755
	ADF	-5.8717	-5.8717	-6.1085	-6.1085
POLS	DF	-3.3853	-3.3853	-3.3271	-3.3271
	ADF	-2.4383	-2.4383	-2.3669	-2.3669
MACSB	DF	-4.0921	-4.0921	-4.0918	-4.0918
	ADF	-4.1710	-4.1710	-4.2161	-4.2161
GDPG	DF	-5.5556	-5.5556	-5.5704	-5.5704
	ADF	-3.7755	-3.7755	-3.8175	-3.8175
EXRVL	DF	0.36007	-6.1615	-1.6565	-6.1654
	ADF	0.35917	-4.3101	-1.6230	-4.3483
Critical value		-2.9422	-2.9422	-3.5348	-3.5348

Source: Microfit 4.1, March 2010.

*Critical values for the Dickey Fuller Test is at 95% confidence interval.

It can be inferred from the results that all the variables were virtually non-stationary at their levels. Only the GDPG, MACSB, CAPF and the GEXP variables were noticed to be stationary. This means that they are of the I(1) series. Differentiating the variables once shows that most of all the variables are stationary, which means they are mostly of the I(0) series. This is because the computed statistics are greater than the critical values of -3.5348 and -2.9422 respectively.

Table 4.2
The unit root tests of the residuals of DGFCF on the Regressors

Variables	Dickey Fuller Test	Augmented Dickey Fuller Test	Augmented Dickey Fuller Test	Critical Value	Co-integration
DGFCF(-1), DGFCF(-2), DGFCF(-3), DINDP, DPRFT, DGEXP(-1), DGEXP(-2), DGEXP(-3), DPOLS, DPOLS(-1), DPOLS(-2), DPOLS(-3), DEXRVL, DCAPF, DMACSB, DMACSB(-1), DMACSB(-2), DMACSB(-3) GDPG	-6.2123	-3.8495	-3.3071		Accept

Table 4.3 presents the result of the unit root test for the residuals. The Dickey Fuller Test (DF) and the Augmented Dickey Fuller Test (ADF) shows that there is a long-term equilibrium relationship between changes in DGFCF and its arguments i.e. DINDP, DPRFT, DGEXP, DPOLS, DEXRVL, DCAPF, DMACSB and DGDPG with there associated lags at their first difference. Consequently, an error correction representation for the selected ARDL model was specified and estimated.

Table 4.3
The unit root tests of the residuals of GFCF on the Regressors

Regressors	ARDL(3) Schwarz Bayesian Criterion			Error Correction Representation of the ARDL (3)			Estimated Long-run Coefficient of the ARDL(3)		
	Coeff.	t-ratio	p-value	Coeff.	t-ratio	p-value	Coeff.	t-ratio	p-value
DGFCF(-1)	1.4217	3.8144	0.002	0.7819	0.7819	4.2560			
DGFCF(-2)	-0.65456	-1.6378	0.122	-0.3820	-0.3820	-2.1394			
DGFCF(-3)	0.52174	2.3562	0.032						
DINDP	-466.011	-1.2787	0.220	-206.69	-0.5039	0.619	35383.1	0.0590	0.953
DPRFT	300.0222	1.5640	0.139	106.309	0.4956	0.639	-18199.0	-0.059	0.954
DGEXP	0.14627	3.4244	0.004	0.0052	0.3349	0.741	-0.8847	-0.0531	0.958
DGEXP(-1)	-0.1097	2.0673	0.056						
DGEXP(-2)	-0.0099	-0.1716	0.866						
DGEXP(-3)	-0.2193	-2.565	0.022						
DPOLS	1567.7	0.2166	0.831	4313.4	0.5524	0.586	38403.2	-0.0591	0.953
DPOLS(-1)	9788.4	1.1044	0.237						
DPOLS(-2)	-1866.3	-0.2252	0.825						
DPOLS(-3)	-13134.2	-1.5769	0.136						
DEXRVL	-	-	0.123	-	-	0.827	7277.9	0.0712	0.944

	355.0700	1.6350		42.514	0.2204				
DCAPF	-0.0074	-2.1861	0.045	-0.638	-1.7706	0.861	0.1092	0.05401	0.957
DMACSB	-298.808	-2.1443	0.049	-311.195	-3.7269	0.001	53273.1	0.0612	0.952
DMACSB(-1)	-98.287	-0.4934	0.629 0.554						
DMACSB(-2)	-82.228	0.6057	0.526						
DMACSB(-3)	-115.601	-0.6486							
DGDPG	-121.739	-0.6194	0.556	-16.29	-0.0713	0.944	2788.4	0.0532	0.955
INTR	-9367.1	-1.2984	0.214	Ecm(-1) 0.0054	0.0612	0.952			
R-Square R-Bar-Square F-Statistics D.W	0.88 0.71 5.25 2.18		0.001	0.60 0.43 3.56 D.W	0.0005 2.4				

Source: Micofit 4.1 March 2010
Note:*Critical values for the Dickey Fuller Test is at 95% confidence interval.

Based on the ARDL (3), which was selected on the basis of Schwarz Bayesian criterion, the result of the long-run equation, and the short-run parsimonious DGFCF model estimate are reported in Table 4.3.

In order to obtain a better result the researcher probe further by seeking to find the 'equilibrium error' by tying the short-run behaviour of capital formation to its long-run value and relating the changes in capital formation to changes in the DINDP, DPRFT, DGEXP, DPOLS, DEXRVL, DCAPF, DMACSB and DGDPG 'equilibrating error' in the previous periods.

Therefore, the result shows that the short-run changes in DGFCF has a significant positive effect on the variables in the model and about 0.054 of the discrepancy between the actual and long-run or equilibrium value of investment is eliminated and corrected each year.

4.3 Empirical Analysis

We use the DGFCF (Gross capital formation) variable to represent the levels of investment in the Nigeria economy. The DGFCF lag one and the DGFCF lag three periods were noticed to have a positive impact on the present levels of Investment. These variables passed the test of statistical significance at the one percent level. But the second lag has a negative effect on the levels of investment; this means that past levels of DGFCF distorts present levels of DGFCF in the opposite direction, suggesting that previous levels of investment have misleading effects on present investment activities in the economy.

The impact of DINDP (industrial performance) variable on the levels of investment measured by the changes in the economy shows a negative effect on the present levels of investment in the economy, but passes the test of individual statistical significance at the ten percent level of statistical significance. This implies that uncertainties in industrial performance influence the level of progress in investment in an economy negatively.

Profitability in investment in the economy has positive impact on the levels of investment in Nigeria. This variable was individually statistically significant at the 10 percent level, suggesting that as much as firms in investing in the Nigeria economy make increasing levels of profit, investors will be encouraged to invest in such sectors of the economy.

Relatively, the DGEXP variable used to capture the levels of infrastructural development in the economy has misleading result. The DGEXP at its present value has positive impact on the levels of investment in Nigeria but previous levels of infrastructural development has negative effects on the levels of investment in the economy and this was worse at the second lag. Revealing that previous levels of infrastructural development in did not encourage the levels of investment in the economy. It is necessary to note that these variables pass the test of individual statistical significance at the one and five percent levels, exposing the fact that previous levels of infrastructural development and formally guided policies discourage the investors' prospecting intentions in Nigeria, but present policies are in focus and have the tendencies to encourage investments.

The DPOLS variable which captures political stability reveals a positive effect on its present and one period lag levels, but negative impacts at the second and third lags on the levels of investment during the period under review. The DPOLS variables pass the test of individual statistical significance at the 5 percent level. This suggests that to a reasonable degree, in the case of Nigeria, as revealed empirically, DPOLS is an impediment to the progress of investment.

Also, the DEXRVL variable which captures the relative levels of external financial risk as opposed to the levels of investment in the economy, reveals negative impacts on the level of investment in the Nigeria, but this variable was statistically significant at the 10 percent level. Suggesting that present rates of exchange do not encourage investment in Nigeria.

The DMASB variable shows that there is a strong negative relationship between macroeconomic stability and level of investment in the economy. The first and second lags values and its associated lags show misleading results. This variable was only statistically significant at its present level and at the first lag but its second and third lag was not statistically significant. Suggesting that the macro-economy is highly unstable and macro-economy policies put in place in the period of this study do not encourage the level of investment in the economy. This implies that some elements of positive effect were noticed despite distortions in the existing and previous macro-economic policies that made the levels of DMASB exert negative effects on investment during the period under review. This shows that previous macro-economic policies put in place to redirect DMASB performance and improve investment growth fundamentals, although reacts slowly, were in the right direction while present values are most likely worse of.

The DCAPF variable was noticed to have a negative impact on investment at its present levels. This variable pass the test of individual statistical significance at the one percent level, it reveals that capital performance influence distortions in the processes put in place to improve the levels of investment in the economy.

Subsequently, economic growth (DGDPG) shows a negative impact on the levels of investment. This reveal that the effect of pervious fiscal policies in line with the levels of growth in the economy put in place by government had a reasonable minimal control on investment to improve its present margin. This fact remains unassertive since the variable did not pass the statistical test of individual significance at either the one or five percent level

The Error Correction Mechanism (ecm) coefficient had the expected negative sign and this shows that the model easily passed the test of statistical significance at the 10 percent level. Therefore, the error correction mechanism in the economy as shown by the ecm coefficient is quite fast, taking about 54 months. This implies that it is likely that investment reverts back to its long-run equilibrium path quickly.

It is necessary to note that the coefficient of the ecm captures the short-run impact which is tied to the long-run relationship between co-integrating variables through the feedback mechanism.

The result of the summary statistic shows that the model has a perfect fit. The R^2 value of 0.88 shows that over 88 percent systematic variation in investment can be explained by the model, leaving out only 12 percent to the error term.

In support of the R^2 value is the F-statistics value of 5.25 which easily passed the test at the 1 percent level of statistical significance. This shows that all the slope coefficients are simultaneously significantly different from zero.

The D.W statistic value of 2.18 which is approximately 2 shows the model is free from the presence of first order serial correlation. Overall, the model has a very good fit and can be used to draw serious conclusions on the effect of DGFCF on other key macroeconomic variables in the Nigeria economy, taking into consideration the DINDP, DPRFT, DGEXP, DPOLS, DEXRVL, DMACSB and DGDPG in the economy in the period under investigation.

5   Recommendations and Conclusions

5.1 Recommendations

Government should integrate financial policies and investment policies such that both can interact freely and the stated outlined financial policies can determine the credit quality of the firms. This should also create an avenue for alternative finance mechanism such as a properly developed equity market, better deals to obtain straight debt and hybrid debt, all of which should be determined by the investing firms value and growth possibilities (Erwan and Clifford, 2002). Although this act will require government to monitor firms operations closely, it will reduce investment associated risk and the magnitude of distortions in investment policy associated with its financing possibilities.

Government should put innovation policies in place to study and develop "innovation strategy" in order to enhance the prospects of different types of investments. This may involve some levels of training and monitoring of small innovation projects. On this view, Eurria (2007) states that "macroeconomic stability is not enough to achieve vigorous growth with development", and suggests other social economic challenges that will improve human capital; curtail poverty and enhance the well fair of the poor, monitoring economic and social performance.

Government can compensate for the impact of political and policy inconsistencies on all forms of investment that endangers economic growth by setting up mechanisms that will closely monitor and subsidize all forms of investment in the economy. This should correct all forms of policy inconsistency shocks by allowing the investment rate of return depend on the output prices while the existing level of subsidy should be maintained under high output prices (Hassett and Gilbert, 1999; Cherian and Enrico, 1999).

Also, Abu (2009) declares that government should adopt policies that will facilitate the growth of national income, increase public investment, saving and enhance foreign trade and investment. Employ policies to check rising inflation, lending rates, strengthen democratic institutions in order to sustain the current political stability and strengthen the mechanisms and increase funding for the anticorruption agencies to check corrupt practices.

5.2 Conclusions

This study analyzes the key determinants of investment in Nigeria using a co-integration model of gross fixed capital formation, industrial performance, infrastructural development, profitability, political stability, exchange rate volatility, capital performance, macroeconomic stability and economic growth of the Nigeria economy, 1970-2008. Empirical test results suggest that the model achieved established standards of statistical adequacy. We estimate the model's error correction mechanism and examined the long and short run effect of the model in the period under study.

The results obtained reveal that industrial performance, profitability, capital performance, and economic growth discourage investment, while international financial risk is strongly opposed to investments, infrastructural development and macroeconomic stability with their associated lags gives misleading results. Although they are

basically statistically significant, their impacts have a number of implications for the Nigeria policy makers to formulate efficient policies. This suggests that so much has to be put in place as a matter of policy to enhance investment and encouraging growth in various sectors while prospecting for sustainable economic growth.

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Electronic Resource

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Appendix A1

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                    Autoregressive Distributed Lag Estimates
               ARDL(3) selected based on Schwarz Bayesian Criterion
*******************************************************************************
 Dependent variable is DGFCF
 36 observations used for estimation from 1973 to 2008
*******************************************************************************
 Regressor              Coefficient        Standard Error        T-Ratio[Prob]
 DGFCF(-1)                  1.4217               .37272           3.8144[.002]
 DGFCF(-2)                 -.65456               .39966          -1.6378[.122]
 DGFCF(-3)                  .52174               .22143           2.3562[.032]
 DINDP                  -466.0105              364.4485          -1.2787[.220]
 DPRFT                   330.0219              211.0139           1.5640[.139]
 DGEXP                     .14627               .042713          3.4244[.004]
 DGEXP(-1)                 .10968               .053054          2.0673[.056]
 DGEXP(-2)               -.0099262              .057854          -.17157[.866]
 DGEXP(-3)                -.21934               .085511         -2.5650[.022]
 DPOLS                   1567.7                7237.7             .21660[.831]
 DPOLS(-1)               9788.4                8863.0            1.1044[.287]
 DPOLS(-2)              -1866.3                8286.3            -.22522[.825]
 DPOLS(-3)             -13134.2                8329.0           -1.5769[.136]
 DEXRVL                 -355.0696              217.1656         -1.6350[.123]
 DCAPF                   -.0073699              .0033713        -2.1861[.045]
 DMACSB                 -298.8076              139.3478         -2.1443[.049]
 DMACSB(-1)              -98.2868              199.2220          -.49335[.629]
 DMACSB(-2)              -82.2279              135.7476          -.60574[.554]
 DMACSB(-3)             -115.6008              178.2236          -.64863[.526]
 DGDPG                  -121.7390              202.2435          -.60194[.556]
 INTP                   -9367.1                7214.2           -1.2984[.214]
*******************************************************************************
 R-Squared                     .87489    R-Bar-Squared                  .70807
 S.E. of Regression          14548.0     F-stat.   F( 20,  15)   5.2445[.001]
 Mean of Dependent Variable  14480.0     S.D. of Dependent Variable   26925.3
 Residual Sum of Squares     3.17E+09    Equation Log-likelihood     -380.3908
 Akaike Info. Criterion      -401.3908   Schwarz Bayesian Criterion  -418.0178
 DW-statistic                  2.1773
*******************************************************************************


                               Diagnostic Tests
*******************************************************************************
*      Test Statistics   *      LM Version       *        F Version         *
*******************************************************************************
*                        *                       *                          *
* A:Serial Correlation*CHSQ(  1)=  5.3886[.020]*F(  1,  14)=  2.4644[.139]*
*                        *                       *                          *
* B:Functional Form   *CHSQ(  1)=  8.4330[.004]*F(  1,  14)=  4.2827[.057]*
*                        *                       *                          *
* C:Normality         *CHSQ(  2)= 19.7371[.000]*     Not applicable       *
*                        *                       *                          *
* D:Heteroscedasticity*CHSQ(  1)=   .32678[.568]*F(  1,  34)=   .31146[.580]*
*******************************************************************************
   A:Lagrange multiplier test of residual serial correlation
   B:Ramsey's RESET test using the square of the fitted values
   C:Based on a test of skewness and kurtosis of residuals
   D:Based on the regression of squared residuals on squared fitted values
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Appendix A2

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                   Test of Serial Correlation of Residuals (OLS case)
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 Dependent variable is DGFCF
 List of variables in OLS regression:
 DGFCF(-1)        DGFCF(-2)        DGFCF(-3)        DINDP          DPRFT
 DGEXP            DGEXP(-1)        DGEXP(-2)        DGEXP(-3)      DPOLS
 DPOLS(-1)        DPOLS(-2)        DPOLS(-3)        DEXRVL         DCAPF
 DMACSB           DMACSB(-1)       DMACSB(-2)       DMACSB(-3)     DGDPG
 INTP
 36 observations used for estimation from 1973 to 2008
****************************************************************************
 Regressor            Coefficient       Standard Error     T-Ratio[Prob]
 OLS RES(- 1)           -1.5210              1.1890          -1.2792[.209]
 OLS RES(- 2)           .076947              .79927          .096272[.924]
****************************************************************************
 Lagrange Multiplier Statistic    CHSQ( 2)=   5.4104[.067]
 F Statistic                      F(  2,  13)=  1.1497[.347]
****************************************************************************
```

Appendix A3

```
                          Unit root tests for residuals
****************************************************************************
 Based on ARDL regression of DGFCF on:
 DGFCF(-1)        DGFCF(-2)        DGFCF(-3)        DINDP          DPRFT
 DGEXP            DGEXP(-1)        DGEXP(-2)        DGEXP(-3)      DPOLS
 DPOLS(-1)        DPOLS(-2)        DPOLS(-3)        DEXRVL         DCAPF
 DMACSB           DMACSB(-1)       DMACSB(-2)       DMACSB(-3)     DGDPG
 INTP
 36 observations used for estimation from 1973 to 2008
****************************************************************************
        Test Statistic    LL          AIC          SBC           HQC
 DF        -6.2123     -349.9073    -350.9073    -351.6556     -351.1591
 ADF(1)    -3.8495     -349.8313    -351.8313    -353.3278     -352.3348
 ADF(2)    -3.3071     -349.7751    -352.7751    -355.0199     -353.5304
****************************************************************************
 95% critical value for the Dickey-Fuller statistic =   *NONE*
 Critical value not available for the number of regressors in the regression!
 LL  = Maximized log-likelihood     AIC = Akaike Information Criterion
 SBC = Schwarz Bayesian Criterion   HQC = Hannan-Quinn Criterion
```
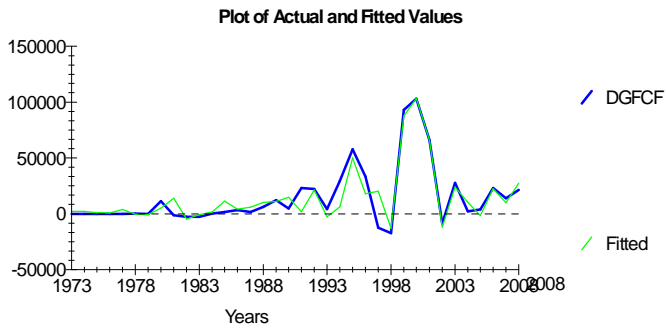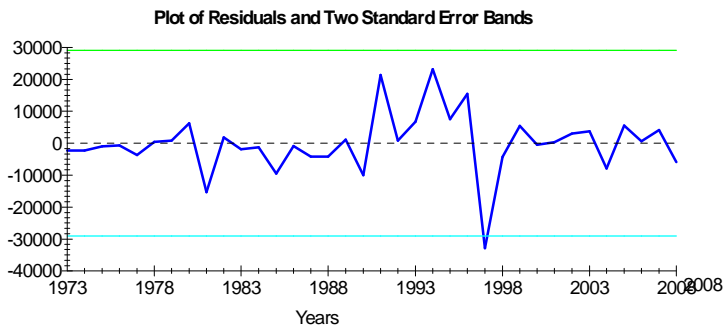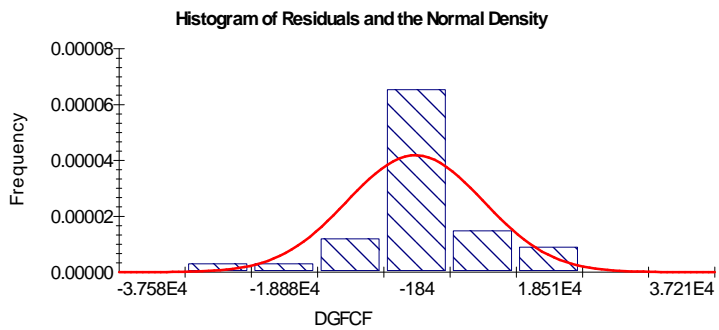
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Appendix B1

Figure 1

Plot of Actual and Fitted Values

Appendix B2

Figure 2

Plot of Residuals and Two Standard Error Bands

Appendix B3

Figure 3

Histogram of Residuals and the Normal Density

Appendix C1

```
                 Estimated Long Run Coefficients using the ARDL Approach
           ARDL(3) selected based on Schwarz Bayesian Criterion
*******************************************************************************
 Dependent variable is GFCF
 35 observations used for estimation from 1974 to 2008
*******************************************************************************
 Regressor            Coefficient         Standard Error        T-Ratio[Prob]
 INDP                    35383.1              599724.6            .058999[.953]
 PRFT                   -18199.0              309333.0           -.058833[.954]
 GEXP                    -.88474               16.6757           -.053055[.958]
 GDPG                     2788.4               48503.3            .057488[.955]
 MACSB                   53273.1              870893.6            .061171[.952]
 CAPF                     .10918                2.0217            .054006[.957]
 POLS                  -738403.2              1.25E+07           -.059048[.953]
 EXRVL                    7277.9              102221.5            .071198[.944]
*******************************************************************************
```

Appendix C2

```
                  Error Correction Representation for the Selected ARDL Model
                 ARDL(3) selected based on Schwarz Bayesian Criterion
*******************************************************************************
 Dependent variable is dGFCF
 35 observations used for estimation from 1974 to 2008
*******************************************************************************
 Regressor              Coefficient        Standard Error      T-Ratio[Prob]
 dGFCF1                      .78190                .18372        4.2560[.000]
 dGFCF2                     -.38998                .18228       -2.1394[.043]
 dINDP                   -206.6903              410.1849        -.50390[.619]
 dPRFT                    106.3093              223.5479         .47555[.639]
 dGEXP                    .0051682               .015434         .33486[.741]
 dGDPG                    -16.2882              228.4606        -.071295[.944]
 dMACSB                  -311.1949               83.4990       -3.7269[.001]
 dCAPF                    -.6378E-3              .0036023        -.17706[.861]
 dPOLS                      4313.4                7808.0         .55243[.586]
 dEXRVL                   -42.5141              192.8685        -.22043[.827]
 ecm(-1)                  .0058415               .095535         .061145[.952]
*******************************************************************************
 List of additional temporary variables created:
 dGFCF = GFCF-GFCF(-1)
 dGFCF1 = GFCF(-1)-GFCF(-2)
 dGFCF2 = GFCF(-2)-GFCF(-3)
 dINDP = INDP-INDP(-1)
 dPRFT = PRFT-PRFT(-1)
 dGEXP = GEXP-GEXP(-1)
 dGDPG = GDPG-GDPG(-1)
 dMACSB = MACSB-MACSB(-1)
 dCAPF = CAPF-CAPF(-1)
 dPOLS = POLS-POLS(-1)
 dEXRVL = EXRVL-EXRVL(-1)
 ecm = GFCF  -35383.1*INDP +  18199.0*PRFT +   .88474*GEXP  -2788.4*GDPG  -53
273.1*MACSB   -.10918*CAPF + 738403.2*POLS   -7277.9*EXRVL
*******************************************************************************
 R-Squared                   .59754   R-Bar-Squared                 .42985
 S.E. of Regression          20540.3   F-stat.    F( 10,  24)    3.5633[.005]
 Mean of Dependent Variable  14892.6   S.D. of Dependent Variable    27202.7
 Residual Sum of Squares    1.01E+10   Equation Log-likelihood     -390.6153
 Akaike Info. Criterion     -401.6153   Schwarz Bayesian Criterion  -410.1697
 DW-statistic                2.3920
*******************************************************************************
 R-Squared and R-Bar-Squared measures refer to the dependent variable
 dGFCF and in cases where the error correction model is highly
 restricted, these measures could become negative.
```