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Macroeconomic Factors influencing foreign Direct investment in Some Selected Countries in Africa

Richard Essel Mensah
z1906473@students.niu.edu

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ABSTRACT

MACROECONOMIC FACTORS INFLUENCING FOREIGN DIRECT INVESTMENT IN SOME SELECTED COUNTRIES IN AFRICA

Richard Mensah, MS
Department of Statistics and Actuarial Science
Northern Illinois University, 2023
Dr. Chaoxio, Director

This paper investigates the possible factors that influence foreign direct investment inflow rate to Africa after controlling other macroeconomic factors. Using the heterogenous Toeplitz mixed method on a sample of 23 countries from 1998 – 2020, we find evidence of the statistical significance of a relationship between the amount of trade done in Africa and the FDI inflow rate in Africa. We also find a statistical relationship between the labor force participation rate and the FDI inflow rate to Africa. Although the Fixed effect and GLM method did not find the relationship between LFP rate and FDI inflow to Africa significant, the heterogenous Toeplitz mixed method was selected because it has the smallest Bayesian Information Criteria (BIC) value.

Keywords: heterogenous Toeplitz, FDI, LFP, GLM, Mixed method.

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**MACROECONOMIC FACTORS INFLUENCING FOREIGN DIRECT INVESTMENT
IN SOME SELECTED COUNTRIES IN AFRICA**

BY
RICHARD MENSAH

A THESIS SUBMITTED TO THE GRADUATE SCHOOL
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Dr. Chaoxio

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My utmost gratitude goes to God for His mercies.

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DEDICATION

To my children

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CHAPTER 1

INTRODUCTION

Foreign direct investment plays an integral role in Africa's development, just as it is essential in Asia and elsewhere in the world as can be seen in the work of Caroline Kariuki, 2015. The significance of FDI in contemporary Africa must be considered, supported by Elizabeth Asiedu, 2002. According to UNCTAD, \$83 billion investment was made in Africa in the year 2021 alone compared to \$50.04 billion investment made in 2012, which is a significant change within a 9-year period. Caroline Kariuki, 2015 believes that FDI is increasing in Africa, which is good news for the continent considering its development agenda. Billington, 1999 further asserted that FDI is more important in emerging economies due to insufficient reserves, technology, and the capital needed to stimulate economic growth. This claim can stand the test of time because foreign reserves are high in the market economy, abundance of technology and capital for economic growth and development but the situation is quite different in Africa.

According to (Investopedia): FDI is any form of investment an investor makes in a different country with the idea of expanding, creating jobs for foreign workers, and for diversification purposes not losing all investment in one industry. FDI has the potential of bringing peace and harmony between countries, increase solidarity among countries, giving foreign workers hope by discouraging isolation, promoting supply chain ideologies, and encouraging human movement from one country to the other. Between the period 1998 to 2020, there have been significant economic occurrences in Africa that have attracted investors to the continent. That is, Ghana

discovered, extracted, and exported oil to the international market as claimed by Elizabeth Asiedu (2002) that many investors are in Africa due to the availability of natural resources, the continent has experienced relatively stable governance in most countries, intracontinental trade (trade among countries in the continent) is on the rise just as intercontinental trade (trade between the continent and the rest of the world) is on the rise too.

The improvements in infrastructure development in recent years are supported by Elizabeth Asiedu's work (2002) and Jeong et al. (2002). According to the World Bank, Africa has a vast population of young people who could work to eradicate poverty in the region by 2050. Africa is the largest free trade destination in the world. Given these reasons, FDI has become an integral part of Africa's development and growth because investors believe in the above reasons stated, and investment in this region has become very conducive.

Considering what FDI can do in Africa's growth and development, a critical look at certain macroeconomic factors that affect FDI on the continent is worth observing. Also, since it has become clear that the continent can realize its developmental potential by inviting more FDI, these macroeconomic factors that impact FDI need careful examination. The subsequent chapters are arranged as follows: 2. Literature Review, 3. Model Analysis, 4. Interpretation of Results, and 5. Conclusion.

1.1 The Objective of this Paper

This paper investigates macroeconomic factors influencing Foreign Direct Investment in some selected African countries.

1.2 Research Questions:

- What effect does Trade Rate have on FDI inflow to Africa after adjusting for other macroeconomic factors?
- What influence does Labor Force Participation Rate have on FDI rate inflow to Africa after adjusting for other macroeconomic factors?

1.3 The Hypothesis of this paper

H_0 : There is no relationship between Trade Rate and FDI rate in Africa.

H_1 : There is a relationship between Trade Rate and FDI rate in Africa.

H_0 : There is no relationship between Labor Force Participation Rate and FDI rate in Africa.

H_2 : There is a relationship between Labor Force Participation Rate and FDI rate in Africa.

CHAPTER 2

LITERATURE REVIEW

Numerous studies have investigated the factors that affect FDI in developing countries, as seen in the work of Nunes, Oscategui & Peschiera (2006) in Latin America. However, this paper looks at macroeconomic factors affecting FDI in randomly selected African countries before and during covid 19 pandemic. Nunes, Oscategui & Peschiera (2006), found that the size of the economy in Latin America matters in attracting FDI into the region, and the story is similar in the case of Africa. Larger economies in Africa attract more FDI than smaller economies in Africa. Alfred P. Montero, (2008) believes that FDI is sensitive to different costs, opportunities, and risk levels. The claim above is valid because an investor wants to invest in a country with lower risk levels, is politically stable, has an effective and reliable transportation system, and has abundant natural resources.

Asiedu (2002) claims, "First, on the subject of FDI, Africa remains under-researched." This assertion informed the research idea of how macroeconomic variables influence foreign direct investment in some selected African countries. Elizabeth Asiedu (2002) concludes that openness to trade impacts FDI in sub-Saharan Africa. However, this paper looks at trade as a percentage of GDP in Africa and whether it attracts FDI inflow to the continent. Hence, this research paper differs from previous work on FDI and trade openness. Another factor differentiating this paper from previous work is the Labor Force Participation Rate (LFPR) influencing FDI in Africa.

Thorough research has occurred, and it realized that previous literature in the past had not paid attention to how LFPR affects FDI, hence this paper comes to fill in the gap in the literature.

The theoretical framework of this paper is based on the work of Dunning (1973): “Firm invests abroad to look for three types of advantages: Ownership (O), Location (L) and Internalization (I) advantage.” Pravin Jadhav (2012) believes that the more trade goes on, the higher the country’s FDI inflow. Countries that are into more trade become attractive destinations for more investment. Caroline Kariuki (2015) believes the exchange rate significantly explains FDI inflow to African countries. This paper supports the argument because if the local currency consistently performs poorly against the US dollar, it may not be a better destination for investment than a country with a strong currency against the US dollar. As Caroline Kariuki (2015) suggested, a high inflation rate will likely tie investment down for an extended period in the local economy. In that sense, a high inflation rate plays to the advantage of the host nation. Nnadozie and Osili (2004) discovered an inverse relationship between the inflation rate (economic instability) and FDI inflow, supporting the above claim.

All the literature read gives insight relevant to this research, factors affecting foreign direct investment in Africa after controlling for other macroeconomic factors. Only a few papers elaborate on how the amount of trading in Africa impacts FDI inflow rate and the Labor force participation rate affecting FDI inflow rate in Africa. Hence, this paper supports the ideas elaborated above and examines the FDI inflow rate during covid 19 pandemic era.

CHAPTER 3

MODEL ANALYSIS

3.1 Data

The data for this work is longitudinal. This paper used multiple countries and multiple years for this analysis. The number of countries used in this paper is 17 from 1998 to 2020. 1998 to 2019 would represent before covid 19 pandemic, and 2020 will signify during the pandemic. This paper shall also employ mixed-effect regression for the analysis to remove all biases by controlling for individual characteristics, as explained by (Jacqueline et al., 2018) in the research paper.

Caroline Kariuki (2015) finds that FDI a year ago had a contributing effect on the current inflow of FDI into Africa, but compared to this paper, the one-year lag FDI did not have any significant effect on the current FDI inflow to Africa; hence, this paper did not include lag FDI_1 in the model. Also, GDP per capita was not included in this model because previous research by Nnadozie and Osili (2004) showed that GDP per capita could not be robust in explaining FDI inflow to Africa.

TABLE 3.1 Definition of variables

VARIABLES	DEFINITIONS
FDIRATE	Foreign direct investment net inflow (% of GDP)
gdpRATE	GDP Growth (Annual %)
LFPRATE	Total (% of total population ages 15+ years)
TradRATE	Trade rate (% of GDP)
InflatRATE	Consumer Prices (Annual %)
EXCRATE	Real effective exchange rate index (2010=100)
INTRATE	Interest rate
unempRATE	Total (% of total labor force participating rate)

Source: World bank

Table 3.2 is a descriptive statistics table showing the means, standard deviation, minimum, and maximum values of each variable in the model. The total number of observations under consideration is 391. The mean of the FDI rate is 3.01474, and the corresponding standard deviation is 3.08221. The mean is between a minimum of -2.5445 and a maximum of 32.30120, while that of the labor force participation rate is 62.13430 and sandwiches between a minimum of 44.78 and a maximum of 83.53 with its corresponding standard deviation at 10.1898. The mean of the GDP rate that represents the size of the economy is 3.70685, between a minimum of -36.39 and a maximum of 26.417; the corresponding standard deviation is 4.45801. Furthermore, the mean amount of trade on the continent is 64.998, and its standard deviation is 24.592.

Table 3.2 Descriptive Statistics

The CORR Procedure						
9 Variables: FDIRATE InflatRATE gdpRATE EXCRATE INTRATE LFPRATE TradRATE unempRATE year						
Simple Statistics						
Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
FDIRATE	391	3.01474	3.08221	1179	-2.54454	32.30120
InflatRATE	391	15.89886	134.88983	6216	-18.07454	2630
gdpRATE	391	3.70685	4.45801	1449	-36.39198	26.41732
EXCRATE	391	103.54430	32.60157	40486	58.13464	511.06014
INTRATE	391	13.02916	17.94325	5094	0.0004131	84.12036
LFPRATE	391	62.13430	10.18961	24295	44.78000	83.53000
TradRATE	391	64.99626	24.59203	25414	20.72252	131.23652
unempRATE	391	8.91657	7.08751	3486	1.90000	33.29000
year	391	2009	6.64175	785519	1998	2020

Source: Estimated by Author

Table 3.3 is a matrix table that shows the magnitude and direction of the variables' relationships. The association of each variable against other variables can be seen in table 3.3, with the diagonal values showing 1.0 signifying the correlation of each variable against itself. In contrast, the off-diagonal values show the degree of the association between itself and other variables. The correlation between the FDI rate and labor force participating rate was 0.105, and its p-value was $0.03 < 0.05$ alpha level. Also, the association between the FDI and trade rates was 0.148, and its p-value was $0.0037 < 0.05$ alpha level. The relationship between the FDI rate and GDP rate was not different from the table.

Nevertheless, the story is different when we look at interest rates against FDI; its p-value was larger than the 0.05 alpha level. The association between the FDI rate and the exchange rate was not significant. In both cases, some significant level is observed, and an extensive discussion is in the results below.

Table 3.3 Correlation Matrix

Pearson Correlation Coefficients, N = 391 Prob > r under H0: Rho=0									
	FDIRATE	InflatRATE	gdpRATE	EXCRATE	INTRATE	LFPRATE	TradRATE	unempRATE	year
FDIRATE	1.00000	-0.03952 0.4358	0.20281 <.0001	-0.07090 0.1617	-0.04764 0.3475	0.10517 0.0376	0.14631 0.0037	-0.05719 0.2593	0.06720 0.1848
InflatRATE	-0.03952 0.4358	1.00000	-0.13321 0.0084	0.69175 <.0001	-0.06008 0.2359	0.07459 0.1410	-0.08532 0.0920	-0.05764 0.2555	-0.09410 0.0630
gdpRATE	0.20281 <.0001	-0.13321 0.0084	1.00000	-0.12452 0.0137	-0.17380 0.0006	0.09709 0.0551	0.01350 0.7902	-0.14944 0.0031	-0.03511 0.4888
EXCRATE	-0.07090 0.1617	0.69175 <.0001	-0.12452 0.0137	1.00000	-0.17974 0.0004	-0.03343 0.5098	-0.11000 0.0296	-0.12310 0.0149	-0.18126 0.0003
INTRATE	-0.04764 0.3475	-0.06008 0.2359	-0.17380 0.0006	-0.17974 0.0004	1.00000	-0.38138 <.0001	0.07425 0.1428	0.32900 <.0001	0.65034 <.0001
LFPRATE	0.10517 0.0376	0.07459 0.1410	0.09709 0.0551	-0.03343 0.5098	-0.38138 <.0001	1.00000	-0.35222 <.0001	-0.37985 <.0001	-0.14528 0.0040
TradRATE	0.14631 0.0037	-0.08532 0.0920	0.01350 0.7902	-0.11000 0.0296	0.07425 0.1428	-0.35222 <.0001	1.00000	0.03678 0.4683	0.05498 0.2781
unempRATE	-0.05719 0.2593	-0.05764 0.2555	-0.14944 0.0031	-0.12310 0.0149	0.32900 <.0001	-0.37985 <.0001	0.03678 0.4683	1.00000	-0.06981 0.1683
year	0.06720 0.1848	-0.09410 0.0630	-0.03511 0.4888	-0.18126 0.0003	0.65034 <.0001	-0.14528 0.0040	0.05498 0.2781	-0.06981 0.1683	1.00000

Source: Estimated by Author

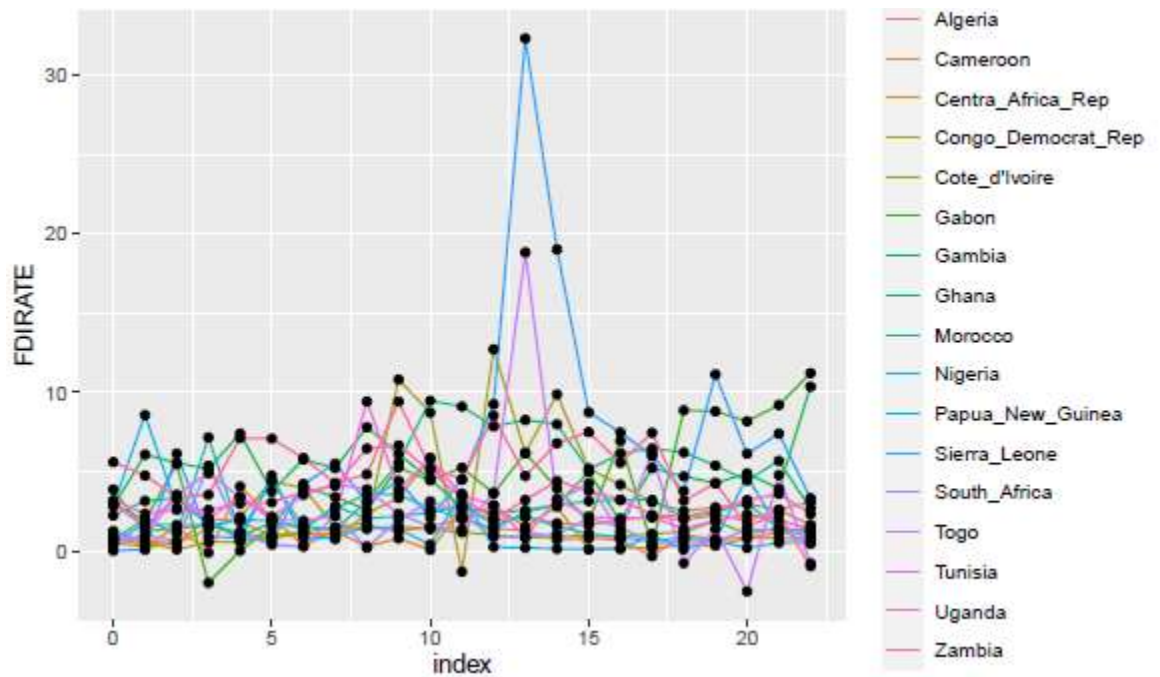


Figure 3.1 FDI rate in Africa

The graph above is consistent with this model. The regression analysis shows that Sierra Leone has a positive relationship with the FDI rate. Its corresponding estimate is positive, meaning Sierra Leone contributes positively to the overall FDI rate in Africa.

3.2 SPECIFIED EMPIRICAL MODEL

$$Y_{it} = X_{it}'\beta_i + K_i\delta_i + \epsilon_{it} \dots\dots\dots (3.2.2)$$

($\epsilon_{i1} \dots \dots \epsilon_{in}$) is normally distributed with mean zero and variance-covariance matrix Σ

Y_{it} represents the country i at time t of the dependent variables. X_{it} represents the vector of independent variables. β_i is the vector representing the coefficients of the independent variables. K_i represents a matrix of random effect, and ϵ_{it} represents the vector form of the errors in the model.

$$FDI_{it} = \beta_0 + \beta_1 gdpRATE_{it} + \beta_2 unempRATE_{it} + \beta_3 TradRATE_{it} + \beta_4 InflatRATE_{it} + \beta_5 LFPRATE_{it} + \beta_6 EXCRATE_{it} + \beta_7 INTRATE_{it} + \beta_8 Unemp_{it} + \gamma t + \epsilon_{it} \dots \dots \dots (3.2.1)$$

Where $i=1, \dots, n$ for countries and $t=1, \dots, n$ for the number of years.

3.3 RESEARCH DESIGN

The design of the study is a cross-country design. The data in this research was obtained from world bank development indicators. This research period is from 1998-2020 and 17 countries were used.

The method used for this study is the mixed effect method. This method contains both fixed and random effects. The Akaike Information Criteria (AIC) was used as the selection for method selection.

3.4 Analyzing Diagnostic Test

From figure 3.1, the leverage graph shows a change of 0.5 which is not a significant change in the coefficients of the graph if a couple of the observations are eliminated from the graph, that is a good sign that the model is performing well though few of the observations show a further

distance away from the zero point. A good number of observations lie on either side of the zero point, signifying even distribution around the zero point. The normality observed from the graphs helps to know whether it is appropriate to transform the data. Critically observing the residual graphs below shows that the data is normally distributed, thus, does not require any transformation for the analysis. Also, considering that the Q-Q plot below shows the data aligning well on a straight line, the residuals are normally distributed and meet the normality assumption required for the model to be a good model. The scale location plot must show a constant variance for us to use the probability values obtained in this analysis reliably. Considering the scale location plot below, it is observed that the constant variance assumption has been satisfied. Therefore, the probability values obtained in the analysis are reliable.

From the residual plots of FDI above, the graph looks bell shape meaning it is normally distributed and is centered around the zero mean. Also, the quantile plot lies on the straight line and stays within the straight line, and looking at the Cook's distance graph, one observation has a Cook distance of 0.7 which does not affect the results too much. Plotting t -student against predicted values is sandwiched between -2.5 and +2.5 and is consistent with the results of the FDI rate against predicted values.

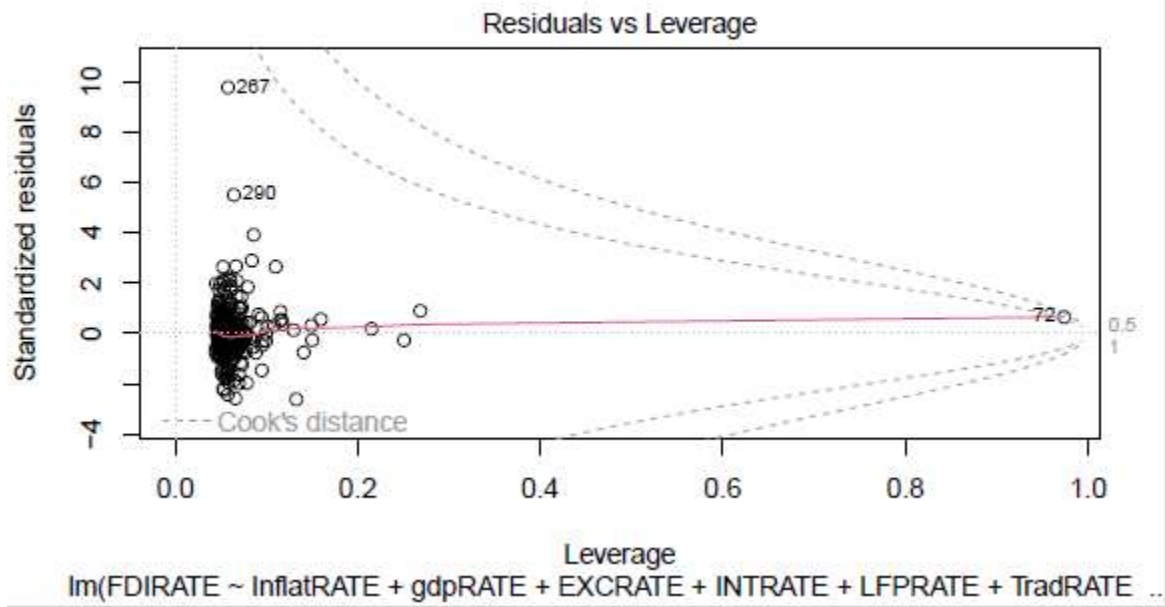


Figure 3.2 Residual plots against Leverage

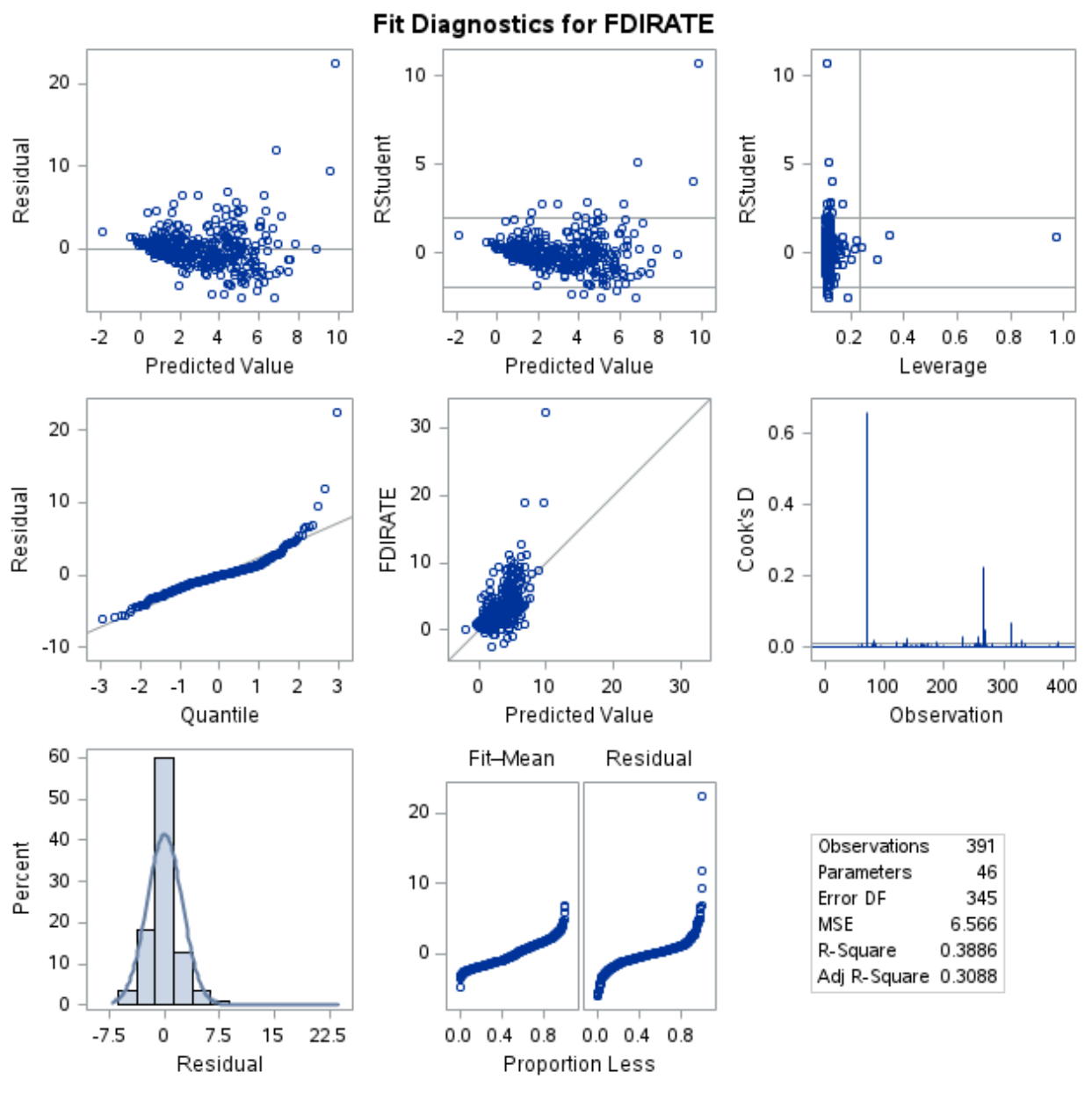


Figure 3.3 Fit Diagnostic for FDI Rate

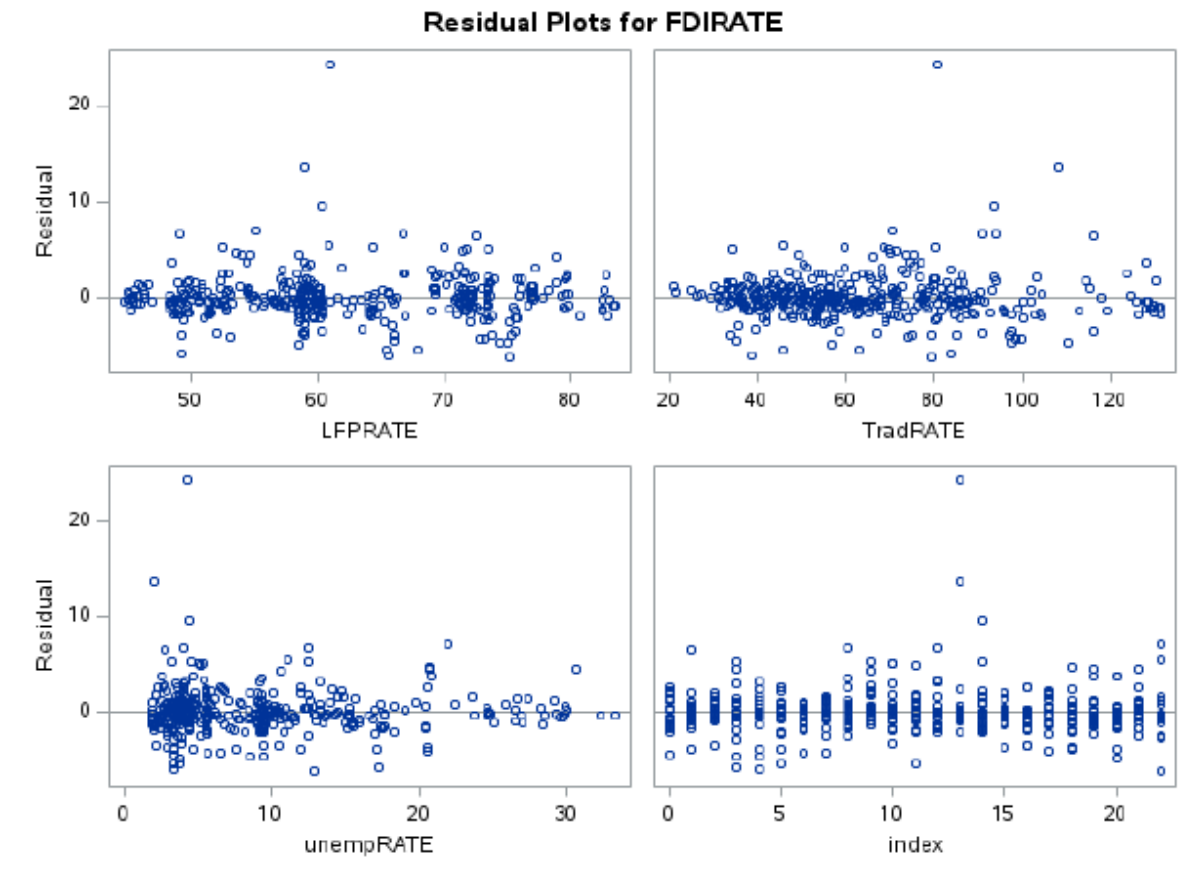


Figure 3.4 Residuals plot of FDI against independent variables

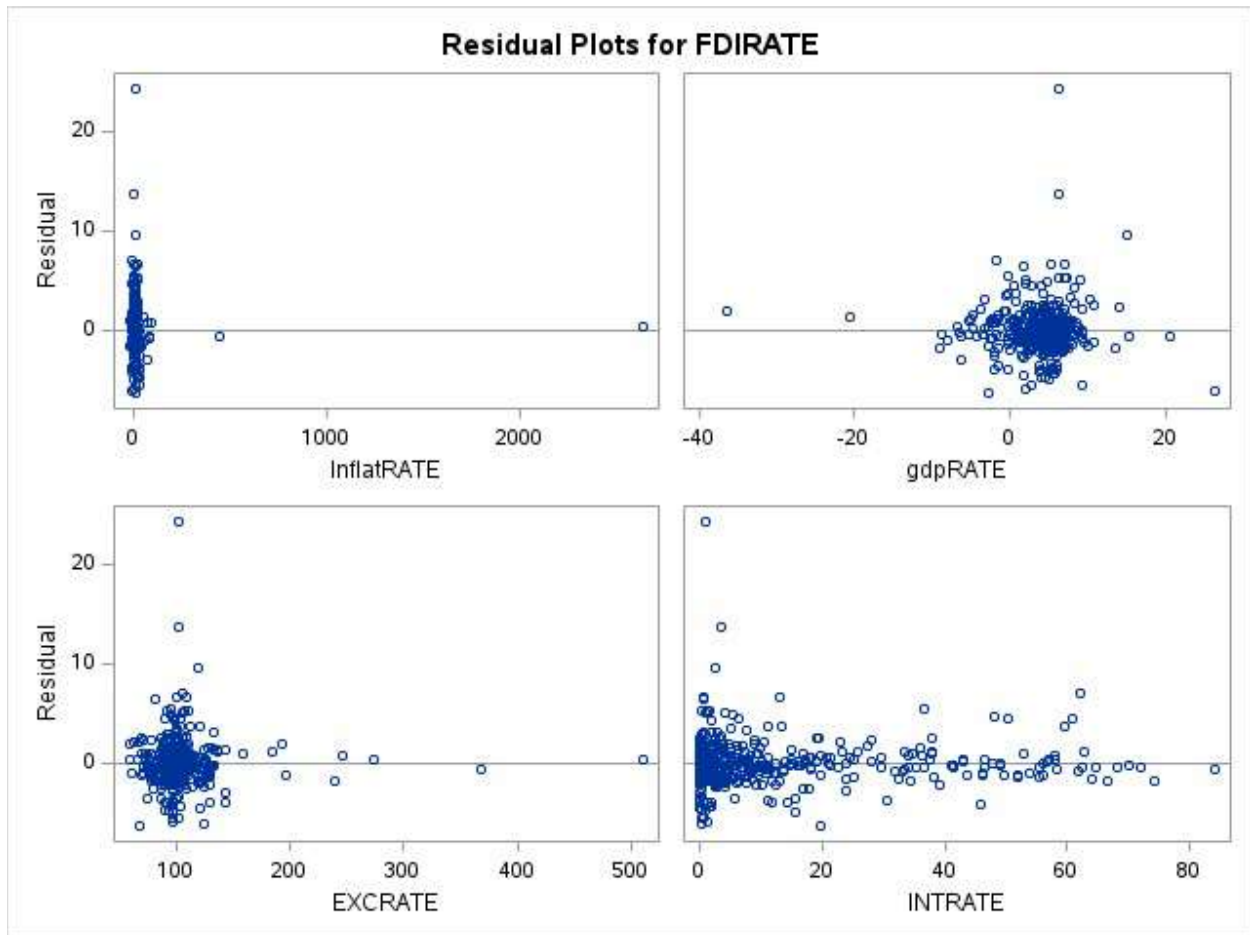


Figure 3.5 Residuals plots against other independent variables

CHAPTER 4

INTERPRETATIONS OF RESULTS

This study focuses on randomly selected 17 countries in Africa over a period of 23 years including before covid pandemic and during covid pandemic era. A mixed-effect model is used in this study. 9 different mixed effect method was used in the study, but it turns out that only the heterogenous Toeplitz method has the lowest AIC, BIC, and Log-likelihood values compared with the other 8 methods, hence, Heterogenous Toeplitz method was used for the study. Among the three criteria above BIC (Bayesian Information Criteria) was used because BIC puts into consideration the sample size of the data that makes the method selection more reliable, though AIC (Akaike Information Criteria) method is also good in model selection, it does not consider the sample size of the data as its basis, hence BIC is preferred over AIC.

Table 4.1 GLM regression analysis

The GLM Procedure

Class Level Information		
Class	Levels	Values
country	17	Algeria Cameroon Centra_Africa_Rep Congo_Democrat_Re Cote_d'Ivoire Gabon Gambia Ghana Morocco Nigeria Papua_New_Guinea Sierra_Leone South_Africa Togo Tunisia Uganda Zambia
year	23	1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020

Number of Observations Read	391
Number of Observations Used	391

The GLM Procedure

Dependent Variable: FDIRATE

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	24	1301.724402	54.238517	8.28	<.0001
Error	366	2403.280996	6.566342		
Corrected Total	390	3705.005398			

R-Square	Coeff Var	Root MSE	FDIRATE Mean
0.351342	84.96873	2.562487	3.014738

Source	DF	Type I SS	Mean Square	F Value	Pr > F
InflatRATE	1	5.7875020	5.7875020	0.88	0.3494
gdpRATE	1	147.1948620	147.1948620	22.42	<.0001
EXCRATE	1	9.7738360	9.7738360	1.49	0.2232
INTRATE	1	2.2575046	2.2575046	0.34	0.5580
LFPRATE	1	22.9734778	22.9734778	3.50	0.0622
TradRATE	1	124.8809487	124.8809487	19.02	<.0001
unempRATE	1	1.0690071	1.0690071	0.17	0.6827
index	1	36.7370824	36.7370824	5.59	0.0185
country	16	951.0201812	59.4387613	9.05	<.0001

Continued on following page.

Table 4.1 continued

Parameter	Estimate		Standard Error	t Value	Pr > t
Intercept	-7.597817695	B	4.73719555	-1.80	0.1098
InflatRATE	0.000547434		0.00141019	0.39	0.6981
gdpRATE	0.085979726		0.03181605	2.70	0.0072
EXCRATE	-0.005492121		0.00632276	-0.87	0.3856
INTRATE	-0.007772466		0.01555307	-0.50	0.6176
LFPRATE	0.100007331		0.05316098	1.88	0.0607
TradRATE	0.059820990		0.01250475	4.78	<.0001
unempRATE	0.022580614		0.06015859	0.38	0.7076
index	0.054823167		0.03899421	1.41	0.1605
country Algeria	-0.105705177	B	1.93126372	-0.05	0.9564
country Cameroon	-1.981422333	B	0.93239645	-2.13	0.0342
country Centra_Africa_Rep	-1.169237035	B	0.95376162	-1.23	0.2210
country Congo_Democrat_Re	0.780014517	B	1.04299852	0.75	0.4550
country Cote_d'Ivoire	-0.852783047	B	1.29149429	-0.66	0.5095
country Gabon	1.491623084	B	1.73891471	0.86	0.3916
country Gambia	3.020126389	B	1.26000555	2.40	0.0170
country Ghana	-0.221364622	B	0.90893081	-0.24	0.8077
country Morocco	0.337357428	B	1.74544870	0.19	0.8468
country Nigeria	0.540637090	B	1.42910595	0.38	0.7054
country Papua_New_Guinea	-4.260945579	B	1.53956253	-2.77	0.0059
country Sierra_Leone	3.905349837	B	1.19584415	3.27	0.0012
country South_Africa	-0.754922176	B	1.70572845	-0.44	0.6583
country Togo	-0.286358737	B	1.36227350	-0.21	0.8336
country Tunisia	-0.587005017	B	1.78803167	-0.33	0.7429
country Uganda	0.971874574	B	1.07143792	0.91	0.3650
country Zambia	0.000000000	B			

Source: Estimated by Author

Table 4.1 shows the effect of each of the countries in Africa's contribution towards the overall FDI rate in Africa. We observe that the amount of FDI inflow that comes into Cameroon is not enough to affect the overall FDI rate in Africa. The relationship between Cameroon and FDI rate is a negative one and has an estimated value of -1.9814 and is not statistically significant at 0.05 alpha level. Sierra Leone, on the other hand, is statistically significant at 0.05 alpha level with an estimated value of 3.9053 and has a positive effect on the overall FDI rate in Africa. Another

country that significantly contributed to the FDI rate in Africa is Gambia. Gambia has a positive effect on FDI in Africa and has an estimated value of 3.0201 and is statistically significant at 0.05.

Though Papua_New_Guinea showed statistical significance with an FDI rate at 0.05 alpha level, it has a negative effect of 4.2609 on the FDI rate in Africa. Also, from the table, Tunisia has a negative contribution to the overall FDI rate in Africa at an estimate of -0.5870 and statistically not significant with an FDI rate at 0.05 alpha level. From the model, the r-squared value equals 0.3513 meaning, 35% of the variation in the FDI rate in Africa can be explained by the predictor variables. The relationship between Ghana and FDI rate in Africa is negative at an estimated value of -0.2214 and statistically insignificant at an alpha level of 0.05 which is quite surprising because Ghana started extracting and exporting oil to the world market in 2010, one would have thought the newly oil exportation would attract more foreign direct investment but that was not the case.

Although Nigeria is the largest oil-producing country in Africa, its impact on the FDI rate is insignificant meaning not a lot of investments go on in Nigeria. It can also be shown from table 4.1, the GDP rate, Trade rate, and Labor force participating rate are statistically significant at 0.1 alpha level on FDI inflow into Africa. Their coefficients are positive meaning they have a positive effect on FDI inflow to Africa, however, at 0.05 alpha level, the GDP rate and Trade rate in Africa is statistically significant but not the Labor force participating rate.

From table 4.1, the GLM regression table above, the model has an F-value of 8.26 and a corresponding p-value of less than 0.05, meaning that the overall effect of the covariates on the

FDI is statistically significant. The impact of interest rates on FDI in Africa is not significant and its estimate is negligible. The situation was not different when it comes to the exchange rate, there was no reason to say that the exchange rate influences foreign direct investment in Africa partly because many countries in Africa have different currencies that perform badly against the US dollar at a given period.

It is very critical to select a model that has an appropriate mean and a covariance structure. From the above premise, this paper compared nine different mixed methods using their corresponding Akaike Information Criteria (AIC), Bayesian Information Criteria (BIC) and their log-likelihood as can be seen in the table above, I found that of all nine methods under consideration the Heterogeneous Toeplitz had the smallest AIC and BIC, as well as log-likelihood, hence, the heterogenous Toeplitz method, was used for this analysis. The corresponding table is reported below.

Table 4.2 Covariance Structures

COVARIANCE STRUCTURES	AIC	BIC	-2*RES LOG-LIKELIHOOD
1. Heterogeneous Toeplitz	1744.6	1782.1	1654.6
2. Toeplitz	1870.2	1889.4	1824.2
3. Heterogenous Autoregressive	1789.3	1809.3	1741.3
4. Variance Components	1935.8	1937.4	1931.8
5. Diagonal	1865.4	1869.3	1863.4
6. Compound Symmetry	1935.8	1937.4	1931.8
7. Heterogenous Compound Symmetry	1816.3	1836.3	1768.3
8. Autoregressive	1897.8	1899.5	1893.8
9. Autoregressive Moving Average	1871.4	1873.9	1865.4

Table 4.3 Mixed Effect - Heterogenous Toeplitz method

The Mixed Procedure

Model Information	
Data Set	WORK.FDIRATE
Dependent Variable	FDIRATE
Covariance Structure	Heterogeneous Toeplitz
Subject Effect	country
Estimation Method	REML
Residual Variance Method	None
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Between-Within

Class Level Information		
Class	Levels	Values
country	17	Algeria Cameroon Centra_Africa_Rep Congo_Democrat_Re Cote_d'Ivoire Gabon Gambia Ghana Morocco Nigeria Papua_New_Guinea Sierra_Leone South_Africa Togo Tunisia Uganda Zambia
year	23	1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020

Dimensions	
Covariance Parameters	45
Columns in X	9
Columns in Z	0
Subjects	17
Max Obs per Subject	23

Number of Observations	
Number of Observations Read	381
Number of Observations Used	381
Number of Observations Not Used	0

Iteration History			
Iteration	Evaluations	-2 Res Log Like	Criterion
0	1	2009.87851808	
1	2	1708.82885249	34.13639858
2	2	1699.15713484	31.99120268
3	1	1688.53551417	66.71258863
4	1	1670.80192245	0.05672972
5	1	1662.94114527	0.01264751
6	1	1655.88821536	0.00208839
7	1	1654.72551484	0.00028072
8	1	1654.58826276	0.00000930
9	1	1654.58371199	0.00000002
10	1	1654.58370397	0.00000000

Convergence criteria met.

Source: Estimated by Author

Table 4.4 Covariates Parameter Estimate

Var(1)	country	4.2979
Var(2)	country	4.6943
Var(3)	country	5.7734
Var(4)	country	9.6588
Var(5)	country	5.8952
Var(6)	country	3.2509
Var(7)	country	4.6953
Var(8)	country	5.8126
Var(9)	country	9.1375
Var(10)	country	15.7586
Var(11)	country	9.0259
Var(12)	country	8.6614
Var(13)	country	13.8876
Var(14)	country	63.6768
Var(15)	country	15.9058

Continues on the next page.

Table 4.1 continues

Var(16)	Country	4.7139
Var(17)	Country	4.6545
Var(18)	Country	6.3428
Var(19)	Country	4.8448
Var(20)	Country	8.5705
Var(21)	Country	3.8780
Var(22)	Country	5.3794
Var(23)	Country	14.6469
TOEPH(1)	country	0.6103
TOEPH(2)	country	0.6456
TOEPH(3)	country	0.4813
TOEPH(4)	country	0.5402
TOEPH(5)	country	0.4379
TOEPH(6)	country	0.4490

Continued on following page.

Table 4.1 continued.

Var(16)	Country	4.7139
Var(17)	Country	4.6545
Var(18)	Country	6.3428
Var(19)	Country	4.8448
Var(20)	Country	8.5705
Var(21)	Country	3.8780
Var(22)	Country	5.3794
Var(23)	Country	14.6469
TOEPH(1)	country	0.6103
TOEPH(2)	country	0.6456
TOEPH(3)	country	0.4813
TOEPH(4)	country	0.5402
TOEPH(5)	country	0.4379
TOEPH(6)	country	0.4490

Continued on following page.

Table 4.1 continued.

TOEPH(7)	country	0.3877
TOEPH(8)	country	0.3739
TOEPH(9)	country	0.3213
TOEPH(10)	country	0.3258
TOEPH(11)	country	0.2857
TOEPH(12)	country	0.2857
TOEPH(13)	country	0.1636
TOEPH(14)	country	0.1825
TOEPH(15)	country	0.06061
TOEPH(16)	country	0.1122
TOEPH(17)	country	0.1291
TOEPH(18)	country	0.2111
TOEPH(19)	country	0.3212
TOEPH(20)	country	0.1311
TOEPH(21)	country	0.1860
TOEPH(22)	country	0.01292

Table 4.5 Heterogenous Toeplitz Estimates

Fit Statistics	
-2 Res Log Likelihood	1654.6
AIC (Smaller is Better)	1744.6
AICC (Smaller is Better)	1756.9
BIC (Smaller is Better)	1782.1

Null Model Likelihood Ratio Test		
DF	Chi-Square	Pr > ChiSq
44	365.29	<.0001

Solution for Fixed Effects					
Effect	Estimate	Standard Error	DF	t Value	Pr > t
Intercept	-3.7943	2.2026	16	-1.72	0.1042
InflaRATE	0.000587	0.000659	366	0.89	0.3741
gdpRATE	0.02360	0.01828	366	1.24	0.2171
EXCRATE	-0.00619	0.003750	366	-1.65	0.0994
INTRATE	0.004982	0.01559	366	0.32	0.7491
LFPRATE	0.06374	0.02691	366	2.37	0.0184
TradRATE	0.03641	0.007863	366	4.63	<.0001
unempRATE	0.006697	0.03488	366	0.19	0.8483
Index	0.01143	0.03727	366	0.31	0.7592

Table 4.6 Type 3 tests of fixed effects

Effect	Number of	Den of	F-value	Pr>F
InflaRATE	1	366	0.79	0.3741
GdpRATE	1	366	1.53	0.2171
EXCRATE	1	366	2.73	0.0994
INTRATE	1	366	0.10	0.7491
LFPRRATE	1	366	5.51	0.0184
TradRATE	1	366	21.44	<0.0001
UNEMPRATE	1	366	0.04	0.8483
Index	1	366	0.09	0.7592

Many researchers have researched extensively on the openness of trade and how it affects the foreign direct investment rate in Africa, but little work has been done on the volume or the amount of trade in Africa that affects foreign direct investment. This paper supports the idea that more trade should take place on the continent to attract more investment into the continent. From the mixed method used, my result from the table shows that after controlling for other macroeconomic variables like GDP, inflation, interest rate, and exchange rate, the trade rate in Africa positively affects foreign direct investment. The p-value of the trade rate from the table is 0.0001 which is significantly less than the 0.05 alpha level, hence a large amount of trade in Africa

does affect FDI flow to Africa. Not only did the trade rate affect the FDI rate in Africa after controlling for other macroeconomic factors, but the Labor force participation rate also affects the FDI rate in Africa. Any continent that has many working men and women is more likely to attract FDI.

The world bank reports that Africa has a large population of young men and women who could work to eliminate poverty from the continent come 2050. This claim by the world bank is consistent with my result. The labor force participation rate positively affects FDI inflow to Africa. The p-value of the LFP rate is found to be 0.01 which is less than an alpha value of 0.05, hence we reject the null hypothesis and suggest that the LFP rate does have an impact on the FDI rate in Africa.

From the table above, it can be clearly shown that the variance of the random term is significantly different from the value zero. Also, table 4.3 shows that a unit increase in trade rate in Africa increases the FDI rate by 0.036 units in Africa keeping everything else constant, and a unit increase in labor force participation rate in Africa, increases the FDI rate by 0.064 in the continent, all else constant. From the type III fixed effect table above too, both the trade rate and LFP rate in Africa are significant for the FDI rate in Africa. It can see that the residual error of the mixed effect is smaller than the residual error from the fixed effect model meaning that more variation was captured in the mixed effect model compared to the fixed effect model.

Table 4.7 Fixed effect method

Model Information		
Data Set	WORK.FDRATE	
Dependent Variable	FDRATE	
Covariance Structure	Diagonal	
Estimation Method	REML	
Residual Variance Method	Profile	
Fixed Effects SE Method	Model-Based	
Degrees of Freedom Method	Residual	

Class Level Information		
Class	Levels	Values
country	17	Algeria Cameroon Centra_Africa_Rep Congo_Democrati Re Cote_d'Ivoire Gabon Gambia Ghana Morocco Nigeria Papua_New_Guinea Sierra_Leone South_Africa Togo Tunisia Uganda Zambia
year	23	1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020

Dimensions	
Covariance Parameters	1
Columns in X	26
Columns in Z	0
Subjects	1
Max Obs per Subject	391

Number of Observations	
Number of Observations Read	391
Number of Observations Used	391
Number of Observations Not Used	0

Covariance Parameter Estimates	
Cov Parm	Estimate
Residual	6.5563

Fit Statistics	
-2 Res Log Likelihood	1863.4
AIC (Smaller is Better)	1865.4
AICC (Smaller is Better)	1865.4
BIC (Smaller is Better)	1869.3

Solution for Fixed Effects	
----------------------------	--

Table 4.8 Fixed effect Estimates

Covariance Parameter Estimates					
Cov Parm	Estimate				
Residual	6.5663				

Fit Statistics	
-2 Res Log Likelihood	1853.4
AIC (Smaller is Better)	1855.4
AICC (Smaller is Better)	1855.4
BIC (Smaller is Better)	1859.3

Solution for Fixed Effects						
Effect	country	Estimate	Standard Error	DF	t Value	Pr > t
Intercept		-7.5978	4.7372	366	-1.60	0.1096
lnflRATE		0.000547	0.001410	366	0.39	0.6981
gdpRATE		0.08598	0.03182	366	2.70	0.0072
EXCRATE		-0.00549	0.006323	366	-0.87	0.3856
INTRATE		-0.00777	0.01555	366	-0.50	0.6176
LFPRATE		0.1000	0.05316	366	1.88	0.0607
TradRATE		0.05962	0.01250	366	4.78	<.0001
unempRATE		0.02258	0.06016	366	0.38	0.7076
Index		0.05462	0.03896	366	1.41	0.1605
country	Algeria	-0.1057	1.9313	366	-0.05	0.9564
country	Cameroon	-1.9814	0.9324	366	-2.13	0.0342
country	Centra_Africa_Rep	-1.1692	0.9538	366	-1.23	0.2210
country	Congo_Democrat_Re	0.7800	1.0430	366	0.75	0.4550
country	Cote_d'Ivoire	-0.8528	1.2915	366	-0.66	0.5095
country	Gabon	1.4916	1.7389	366	0.86	0.3916
country	Gambia	3.0201	1.2600	366	2.40	0.0170
country	Ghana	-0.2214	0.9089	366	-0.24	0.8077
country	Morocco	0.3374	1.7454	366	0.19	0.8488
country	Nigeria	0.5406	1.4291	366	0.38	0.7054
country	Papua_New_Guinea	-4.2609	1.5396	366	-2.77	0.0059
country	Sierra_Leone	3.9053	1.1958	366	3.27	0.0012
country	South_Africa	-0.7549	1.7057	366	-0.44	0.6583
country	Togo	-0.2864	1.3623	366	-0.21	0.8336
country	Tunisia	-0.5870	1.7880	366	-0.33	0.7429
country	Uganda	0.9719	1.0714	366	0.91	0.3650

Source: Estimation by Author

From table 4.4, after controlling for macroeconomic variables in the model, trade rate and Labor force participation rate showed a significant impact on the FDI rate in Africa compared to

table 4.3, after controlling for macroeconomic variables Labor force participation rate was not significant on the FDI rate except for Trade rate but rather GDP rate which is one of the controlled covariates was found to be statistically significant. This comparison here further suggests that using Heterogenous Toeplitz for my method of analysis was a good choice. The p-value of the trade rate is less than 0.05 alpha level; hence, we reject the null hypothesis and suggest the high volume of trade in Africa does have a significant impact on the FDI rate in Africa. Using the fixed effect method for this analysis, the labor force participation rate did not have explanatory power in explaining the FDI rate inflow in Africa. Both the GLM method and the fixed effect method showed that there is an association between GDP and FDI rate inflow in Africa contrary to what the mixed effect model is saying.

CHAPTER 5

CONCLUSION

This paper looked at foreign direct investment inflow in Africa and the macroeconomic factors that influenced it after controlling for other macroeconomic variables that had the potential of influencing the FDI rate in Africa. Following the assertion by Pravin Jadhav (2012) that the more trade goes on in a country, the higher the country's FDI inflow informed the choice of trade as a percentage of GDP to be a factor that could potentially affect FDI inflow to Africa. Mixed method analysis was used to remove all biases by controlling for individual characteristics as depicted by (Jacqueline et al., 2018).

It manifested from the mixed method table that; the more trading is going on in Africa the more the FDI rate is also going up which is in line with the findings of Praven Jadhav (2012). This goes to suggest that governments in Africa may want to make trading-friendly policies so that more trading can take place in Africa. In a related paper, Jeong et al (2002) found that inflation in Africa does not spill over from country to country, due to trading in Africa being more intercontinental (countries in Africa trading with countries outside the continent) rather than intracontinental (countries in Africa trading among themselves). In as much as intercontinental trading in Africa is a good idea, governments in Africa can also encourage intracontinental trading in the continent as well to increase the FDI rate in Africa. Another factor that manifested a positive relationship with the FDI inflow rate in Africa is the LFP rate which agrees with the claims made by the world bank about Africa, that considering the young population of Africa, Africa is likely

to eradicate poverty from the continent in 2050. Having young and vibrant men and women in the continent willing to work is a recipe for more FDI to come into the continent and a possible poverty eradication strategy. If the volume of trading increases in Africa this paper found, Africa is likely to achieve its developmental goal.

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APPENDIX A
VARIANCE-COVARIANCE METHOD

Model Information	
Data Set	WORK.FDRATE
Dependent Variable	FDRATE
Covariance Structure	Variance Components
Estimation Method	REML
Residual Variance Method	Profile
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Containment

Class Level Information		
Class	Levels	Values
country	17	Algeria Cameroon Centra_Africa_Rep Congo_Democrat_Re Cote_d'Ivoire Gabon Gambia Ghana Morocco Nigeria Papua_New_Guinea Sierra_Leone South_Africa Togo Tunisia Uganda Zambia

Dimensions	
Covariance Parameters	2
Columns in X	9
Columns in Z	17
Subjects	1
Max Obs per Subject	391

Number of Observations	
Number of Observations Read	391
Number of Observations Used	391
Number of Observations Not Used	0

Iteration History			
Iteration	Evaluations	-2 Res Log Like	Criterion
0	1	2009.97951906	
1	2	1931.78190015	0.00000007
2	1	1931.78185543	0.00000000

Convergence criteria met.

Covariance Parameter Estimates	
Cov Parm	Estimate
country	2.3371

Covariance Parameter Estimates	
Cov Parm	Estimate
Residual	6.5580

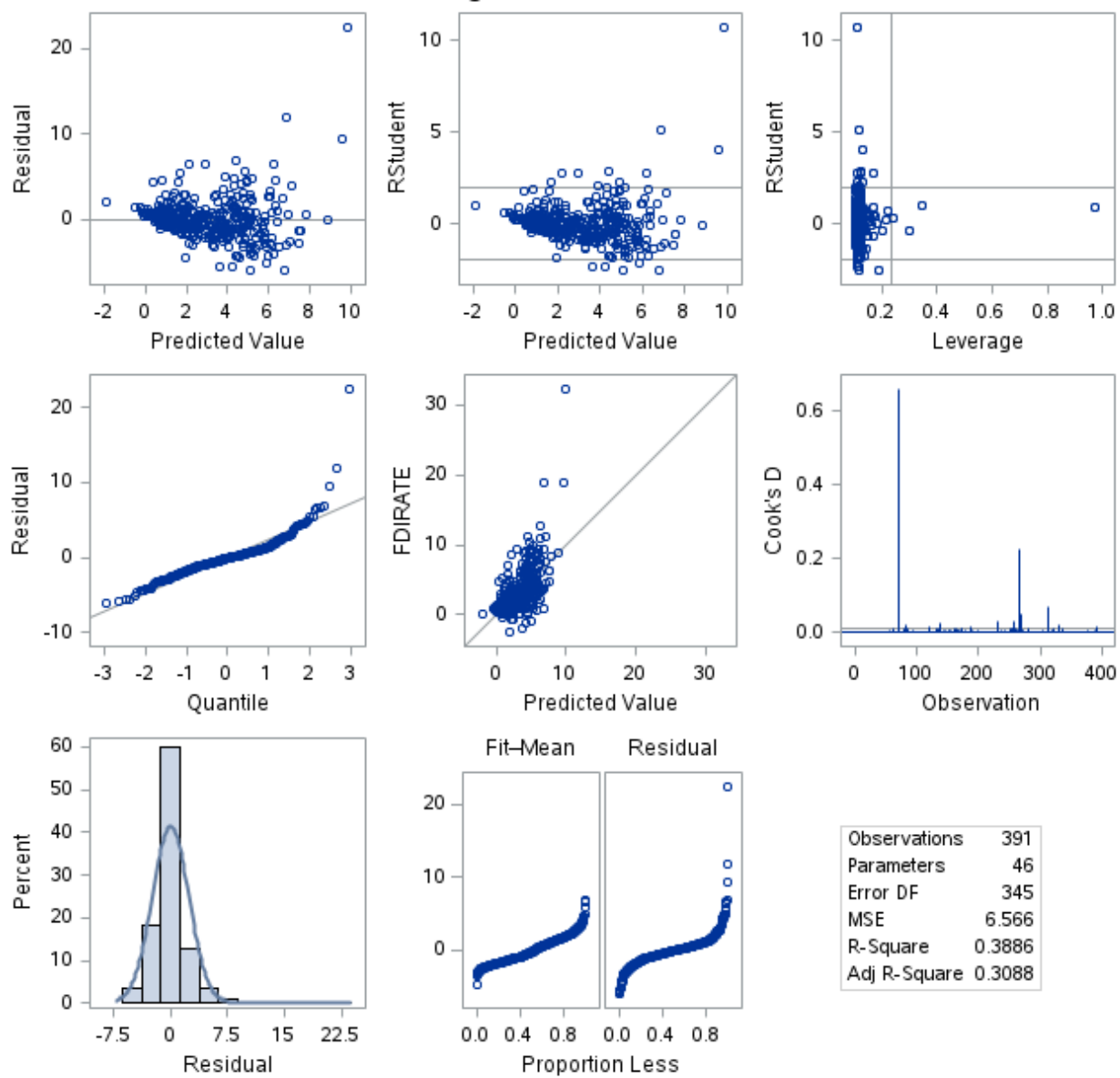
Fit Statistics	
-2 Res Log Likelihood	1931.8
AIC (Smaller is Better)	1935.8
AICC (Smaller is Better)	1935.8
BIC (Smaller is Better)	1937.4

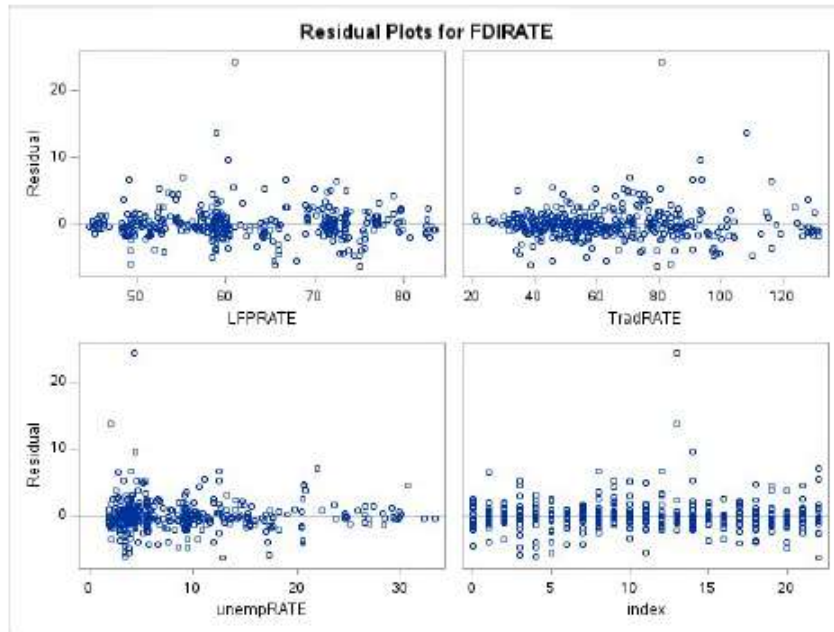
Solution for Fixed Effects					
Effect	Estimate	Standard Error	DF	t Value	Pr > t
Intercept	-5.9123	2.9421	16	-2.01	0.0617
InflatRATE	0.000463	0.001397	366	0.33	0.7402
gdpRATE	0.09140	0.03153	366	2.90	0.0040
EXCRATE	-0.00528	0.006219	366	-0.85	0.3961
INTRATE	-0.00846	0.01403	366	-0.60	0.5468
LFPRATE	0.08401	0.03544	366	2.37	0.0183
TradRATE	0.04897	0.01076	366	4.55	<.0001
unempRATE	0.02570	0.04567	366	0.56	0.5740
Index	0.05506	0.03367	366	1.64	0.1029

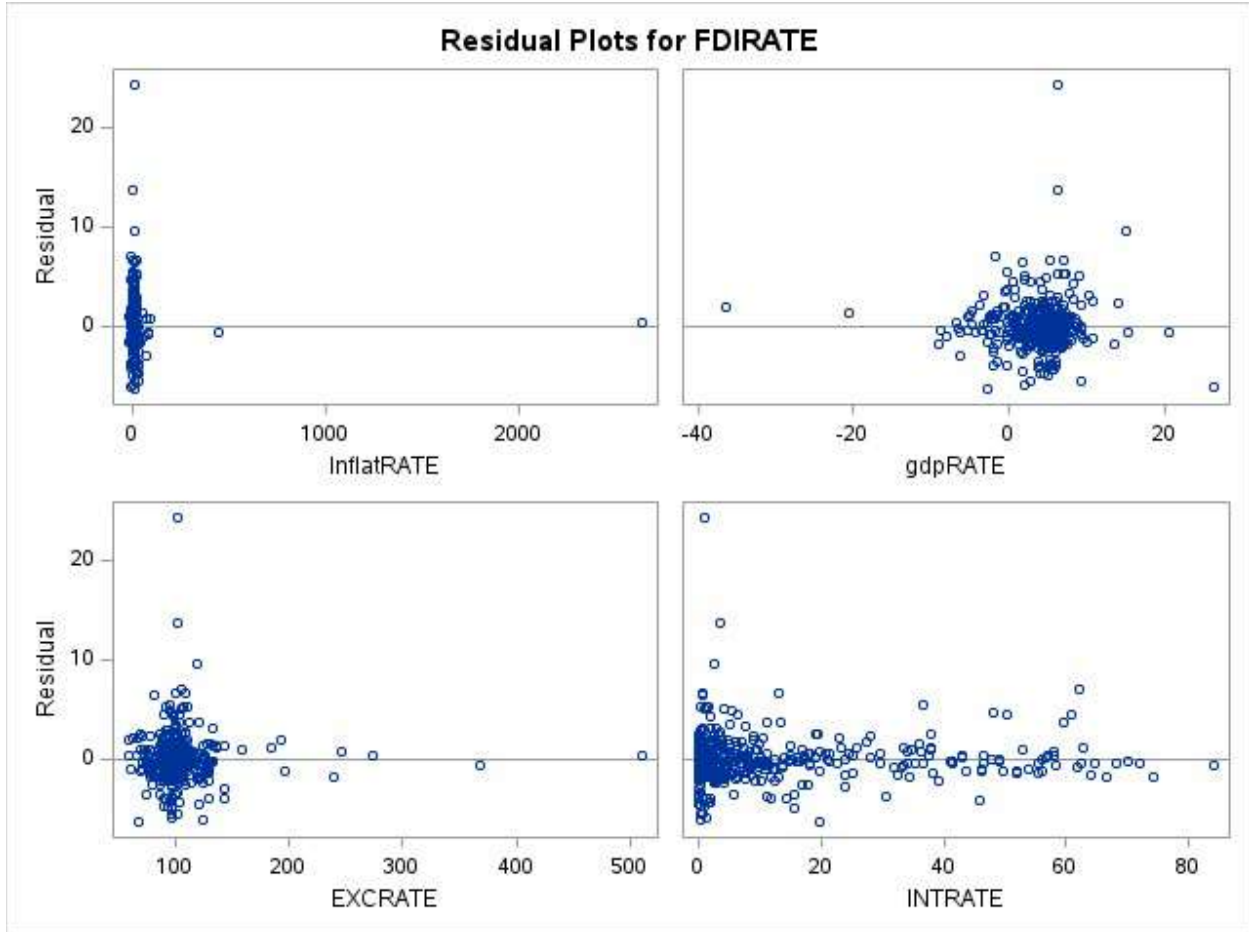
Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
InflatRATE	1	366	0.11	0.7402
gdpRATE	1	366	8.40	0.0040
EXCRATE	1	366	0.72	0.3961
INTRATE	1	366	0.36	0.5468
LFPRATE	1	366	5.62	0.0183
TradRATE	1	366	20.70	<.0001
unempRATE	1	366	0.32	0.5740
Index	1	366	2.67	0.1029

APPENDIX B
GRAPHS OF RESIDUAL PLOTS

Fit Diagnostics for FDIRATE







APPENDIX C
SAS CODES

```
proc import datafile="//home/u62268751/mymultwork/Mycontent/DataStat1.csv"  
  out=FDIRATE  
  dbms=csv  
  replace;  
  
  getnames=yes;  
  
run;  
  
proc sort;  
  by country year;  
run;  
  
proc print;  
run;  
  
data FDIRATE;  
  set FDIRATE;  
  by country year;  
  
  index = year-1998;  
  FDIRATE_diff1 = FDIRATE-lag1(FDIRATE);  
  if first.country then do;  
    FDIRATE_diff1=.;  
  end;  
  
run;  
  
proc print data=FDIRATE;  
run;  
  
proc corr;  
  var FDIRATE inflatRATE gdpRATE EXCRATE INTRATE LFPRATE TradRATE unempRATE year;  
run;  
  
proc glm plots=all;  
  class country year;  
  model FDIRATE = inflatRATE gdpRATE EXCRATE INTRATE LFPRATE TradRATE unempRATE index  
  country/solution;  
run;
```

```

proc glm plots=all;
class country year;
model FDIRATE = inflatRATE gdpRATE EXCRATE INTRATE LFPRATE TradRATE unempRATE index
country/solution;
run;

```

```

proc glm plots=all;
class country;
model FDIRATE = inflatRATE gdpRATE EXCRATE INTRATE LFPRATE TradRATE unempRATE index
country/solution;
run;

```

```

proc mixed;
class country;
model FDIRATE = inflatRATE gdpRATE EXCRATE INTRATE LFPRATE TradRATE
unempRATE index/solution;
random country;
run;

```

```

proc mixed;
class country year;
model FDIRATE = inflatRATE gdpRATE EXCRATE INTRATE LFPRATE TradRATE
unempRATE index country/solution;
run;

```

```

proc mixed;
class country year;
model FDIRATE = inflatRATE gdpRATE EXCRATE INTRATE LFPRATE TradRATE
unempRATE index country/solution;
run;

```

```

proc mixed;
class country year;
model FDIRATE = inflatRATE gdpRATE EXCRATE INTRATE LFPRATE TradRATE
unempRATE index/solution;
repeated year / type=cs subject=country;
run;

```

```

proc mixed;
class country year;
model FDIRATE = inflatRATE gdpRATE EXCRATE INTRATE LFPRATE TradRATE
unempRATE index/solution;
repeated year / type=csh subject=country;
run;

```

```

proc mixed;
class country year;

```



```

model FDIRATE = inflatRATE gdpRATE EXCRATE INTRATE LFPRATE TradRATE
      unempRATE index/solution;
repeated year / type=AR(1) subject=country;
run;

```

```

proc mixed;
class country year;
model FDIRATE = inflatRATE gdpRATE EXCRATE INTRATE LFPRATE TradRATE
      unempRATE index/solution;
repeated year / type=arh(1) subject=country;
run;

```

```

proc mixed;
class country year;
model FDIRATE = inflatRATE gdpRATE EXCRATE INTRATE LFPRATE TradRATE
      unempRATE index/solution;
repeated year / type=arma(1,1) subject=country;
run;

```

```

proc mixed;
class country year;
model FDIRATE = inflatRATE gdpRATE EXCRATE INTRATE LFPRATE TradRATE
      unempRATE index/solution;
repeated year / type=toep subject=country;
run;

```

```

proc mixed;
class country year;
model FDIRATE = inflatRATE gdpRATE EXCRATE INTRATE LFPRATE TradRATE
      unempRATE index/solution;
repeated year / type=toeph subject=country;
run;

```

```

proc mixed;
class country year;
model FDIRATE = inflatRATE gdpRATE EXCRATE INTRATE LFPRATE TradRATE
      unempRATE index/solution;
repeated year / type=vc subject=country;
run;

```