



*An Empirical study and Time Series Analysis on impact of Federal Debt,
International Trade, Corruption Perceptions Index, Unemployment Rate,
Consumer Price Index (CPI) on Foreign Direct Investment (FDI) in The United
States of America*

Karthikeya Nalluri



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1. Introduction

In the current project, I tried to understand the impacts of economic indicators like Unemployment Rate, International Trade (Exports and Imports), Federal Debt, Gross Domestic Product (GDP), Corruption Perceptions Index, Consumer Price Index (CPI) on Foreign Direct Investment (FDI) and tried to forecast Foreign Direct Investment (FDI) for 3 years (12 periods). The main hypothesis of the paper is that Unemployment in the country, higher Federal Debt, higher corruption, higher imports, and higher CPI will have a negative impact on the FDI, and higher GDP and higher international Exports will have a positive impact on FDI. The data collected is explicitly related to the United States of America at a quarterly level from 1995 to 2022. Based on the findings from various test results and model estimations, it is concluded that these economic variables have a short-term and long-term impact on FDI, but the impacts are not significant. Hence, the variables considered in the paper do not fully explain the impacts on FDI. The impacts of corruption levels in other countries and the effects of labor markets are not considered in the current paper and these variables can be used for further studies in analyzing the impacts on FDI.

2. Literature Review

Various studies examine the association among Corruption, Foreign Direct Investment (FDI), and economic growth in various contexts. These studies find that higher corruption levels are associated with lower FDI in natural resources, with the impact being less pronounced during economic downturns and fiscal crises (Cruz, Jha, Kırşanlı, & Sedai, 2023). One of the studies focused on FDI and economic growth in Malta (Magazzino & Mele, 2022), revealing that while FDI is stationary, no statistically significant causal relationship is found between FDI and

economic growth. Few studies examined corruption and FDI in Latin America, highlighting an asymmetrical impact of corruption on FDI (Goswami & Saikia, 2012).

3. Data

The data for all the variables except Corruption Perception Index, are collected from FRED. The corruption perception index data is collected from transparency.org. The data is not seasonally adjusted quarterly data from January 1995 to December 2022. Below Table 1 shows the variables and the short forms of the variables used in the paper.

Variable	Shortform
Foreign Direct Investment (FDI) in U.S. (Millions of Dollars)	fdi
Federal Debt: Total Public Debt (Millions of Dollars)	feddebt
Unemployment Rate: Aged 15-64: All Persons for the United States	unemp
International Trade: Exports: Value (goods): Total for the United States (Millions of Dollars)	exports
International Trade: Imports: Value (goods): Total for the United States (Millions of Dollars)	imports
Gross Domestic Product (Millions of Dollars)	gdp
Consumer Price Index: Total All Items for the United States	cpi
Corruption Perceptions Index	corruption
Log feddebt	lfeddebt
Seasonally differenced log imports	dlimports
Seasonally differenced log exports	dlexports
Log fdi	lfdi
Seasonally differenced log gdp	dlgdp
Differenced log feddebt	dlfeddebt
Differenced unemp	dunemp
Double differenced log imports	ddlimports
Double differenced log exports	ddexports
Differenced log fdi	dlfdi
Double differenced log gdp	ddl gdp
Differenced cpi	dcpi
Differenced corruption	dcorruption

Table 1

The data is a Time series data and overall, there are 112 observations and 8 variables

The Corruption Perceptions Index is annual data from 1995 to 2022. The Corruption Perceptions Index data is converted into quarterly data using the Cubic Spline Interpolation technique as all the other variables are quarterly data.

Logs for all the variables are used except for the Unemployment rate, CPI, and Corruption Perceptions Index to normalize the data. The following Figure 1 shows the time series plot for all the variables before using logs.

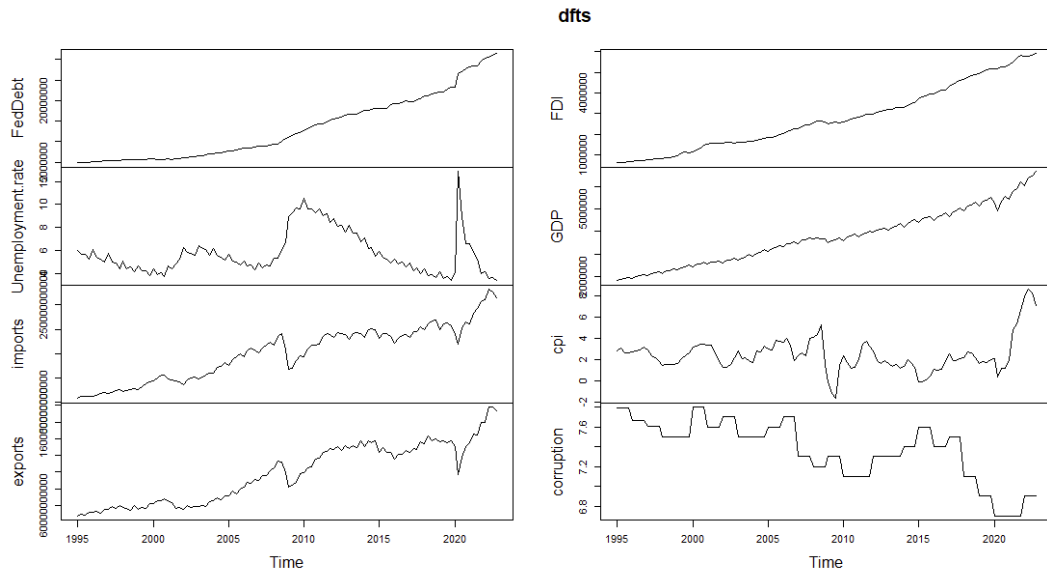


Figure 1

Based on the above plot, it can be observed that there is a trend in all the variables except unemployment, CPI, and corruption perception index. The following are summary statistics of all the variables at the level before using logs.

FedDebt	Unemployment.rate	imports	exports	FDI
Min. : 4864116	Min. : 3.39	Min. : 58697666667	Min. : 47070333333	Min. : 627421
1st Qu.: 5990384	1st Qu.: 4.45	1st Qu.: 99753666667	1st Qu.: 61991833333	1st Qu.: 1591795
Median : 10913373	Median : 5.27	Median : 161000000000	Median : 98465666667	Median : 2574180
Mean : 13280856	Mean : 5.76	Mean : 151701122024	Mean : 98279592262	Mean : 2782916
3rd Qu.: 19007869	3rd Qu.: 6.25	3rd Qu.: 191250000000	3rd Qu.: 129000000000	3rd Qu.: 3941086
Max. : 31419689	Max. : 12.87	Max. : 282000000000	Max. : 178000000000	Max. : 5903708
GDP	cpi	corruption		
Min. : 1835147	Min. : -1.62	Min. : 6.70		
1st Qu.: 2697855	1st Qu.: 1.60	1st Qu.: 7.18		
Median : 3677834	Median : 2.20	Median : 7.45		
Mean : 3736014	Mean : 2.47	Mean : 7.37		
3rd Qu.: 4615644	3rd Qu.: 3.05	3rd Qu.: 7.60		
Max. : 6655020	Max. : 8.64	Max. : 7.80		

4. Empirical Methodology

4.1 Test for Stationarity

Since this is time series data, only stationary variables can be used for further analysis. Hence testing for stationarity is a crucial step. The stationarity test is conducted by using the standard deviation, Autocorrelation Function (ACF) and Augmented Dickey-Fuller (ADF) test results. The plots can be found in Appendix 1.

Initially, the variables imports, exports, gdp are at a level of integration of 2. They are seasonally differenced and are converted into a level of integration of 1. The below Table 2 shows the level of integration of all the variables at level, and at the first differenced level.

Variable	Shortform	Level of Integration I()
Log feddebt	lfeddebt	1
unemployment	unemp	1
Seasonally differenced log imports	dlimports	1
Seasonally differenced log exports	dlexports	1
Log fdi	lfdi	1
Seasonally differenced log gdp	dlgdp	1
cpi	cpi	1
corruption	corruption	1
Differenced log feddebt	dlfeddebt	0
Differenced unemp	dunemp	0
Double differenced log imports	ddlimports	0
Double differenced log exports	ddexports	0
Differenced log fdi	dlfdi	0
Double differenced log gdp	ddl gdp	0
Differenced cpi	dcpi	0
Differenced corruption	dcorruption	0

Table 2

4.2 Co-integration Test

Understanding the short-term and long-term relationship among the variables is important to understand any impact that can cause on fdi. Hence, the co-integration test is used to determine the long-term relationship among the variables.

Using a proper lag length is a crucial step in testing for co-integration. Using the VARselect() function in R, the lag length is determined. The results from the function are as follows.

```
$selection
AIC(n)  HQ(n)  SC(n) FPE(n)
      8      1      1      5
```

From the above results, the value of SC(n) is 1. Hence the lag length is considered to be 2. Once the lag length is determined, the co-integration among the variables can be tested.

The co-integration can be tested using either of the following two methods

- Johansen Co-integration method
- Engle-Granger method

The Johansen co-integration method can be calculated using two tests – Eigen values or Trace values.

Using the lag length of 2, the output for the Johansen Co-integration method using the Eigenvalue method is formulated and is as below

```
#####
# Johansen-Procedure #
#####

Test type: maximal eigenvalue statistic (lambda max) , without linear trend and constant in cointegration

Eigenvalues (lambda):
[1] 0.544157501345332362 0.531670687740983805 0.330181632647329415 0.256635019252614560 0.183304540040912567
[6] 0.126558224810933900 0.094074398505614595 0.070220629340197252 0.0000000000000000392

values of teststatistic and critical values of test:

      test 10pct  5pct 1pct
r <= 7 |   7.72   7.52   9.24 13.0
r <= 6 |  10.47  13.75  15.67 20.2
r <= 5 |  14.34  19.77  22.00 26.8
r <= 4 |  21.46  25.56  28.14 33.2
r <= 3 |  31.44  31.66  34.40 39.8
r <= 2 |  42.48  37.45  40.30 46.8
r <= 1 |  80.41  43.25  46.45 51.9
r = 0  |  83.27  48.91  52.00 58.0
```

From the above output, it can be observed that the test statistic is more than the critical values at 1% significance level when $r \leq 1$. This indicates that there is a one-point relation and there is long-run co-integration among the variables.

Using the lag length of 2, the output for the Johansen co-integration method using Trace values is formulated and is as follows.

```
#####
# Johansen-Procedure #
#####

Test type: trace statistic , without linear trend and constant in cointegration

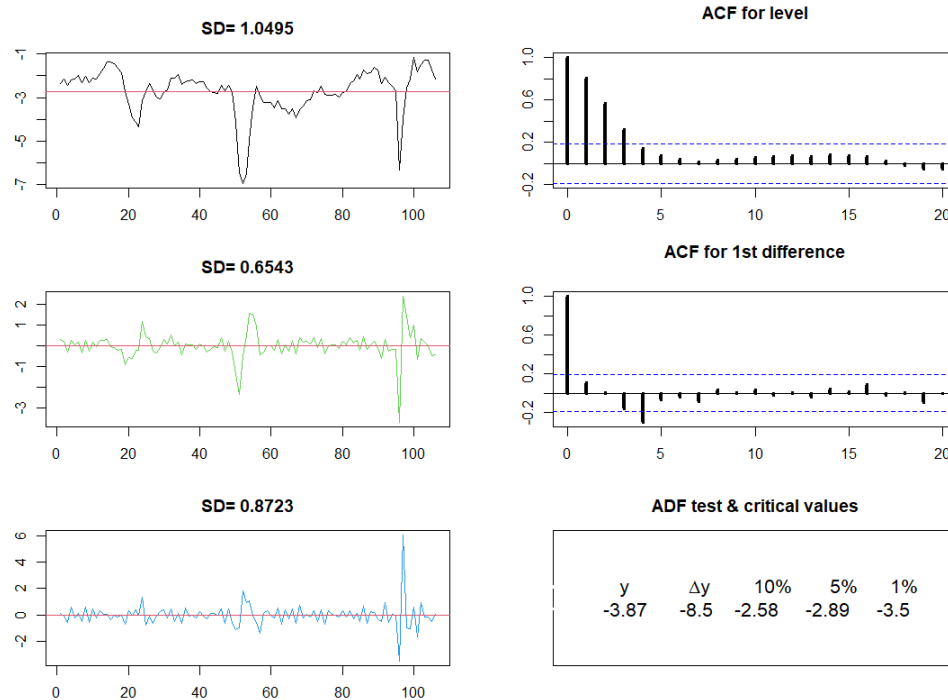
Eigenvalues (lambda):
[1] 0.544157501345332362 0.531670687740983805 0.330181632647329415 0.256635019252614560 0.183304540040912567
[6] 0.126558224810933900 0.094074398505614595 0.070220629340197252 0.0000000000000000392

values of teststatistic and critical values of test:

      test 10pct  5pct 1pct
r <= 7 |   7.72   7.52   9.24 13.0
r <= 6 |  18.19  17.85  19.96 24.6
r <= 5 |  32.53  32.00  34.91 41.1
r <= 4 |  54.00  49.65  53.12 60.2
r <= 3 |  85.43  71.86  76.07 84.5
r <= 2 | 127.91  97.18 102.14 111.0
r <= 1 | 208.32 126.58 131.70 143.1
r = 0  | 291.60 159.48 165.58 177.2
```

From the above output, it can be observed that the test statistic is more than the critical values at 1% significance level when $r \leq 1$, $r \leq 2$, $r \leq 3$. This indicates that there is a three-point relation and there is long-run co-integration among the variables.

The following output shows the ACF, standard deviation, ADF test & critical values of Engle-Granger Co-integration method.



From the above output, it can be observed that the ADF test value at the level is smaller than the critical value at 1% significance level and the value of standard deviation at the First Difference is not more than half of the value of the standard deviation at the level. Hence, there is co-integration among the variables.

From the above tests results, it can be concluded that there is long-term co-integration among the variables under the Engle-Granger co-integration method.

4.3 Model Estimation

Since it is observed that there is co-integration relationship exists among the variables, the Vector Error Correction Models (VECM) are used for estimation along with Vector Autoregression (VAR) method. Variables can be estimated by using the VECM either by the Johansen method or Engle-Granger method. After testing with various number of lags, the maximum number of lags that show significant are at 9 lags of the variables. Hence, while estimating using the VECM methods, the maximum number of lags of 9 was considered. The effect of seasonal dummies is also captured in the model. The VECM model considers the exogenous variables that affect the model estimation and the error correction term.

From the summary output of VECM using the Johansen method (Appendix 2), it can be observed that the exogenous term is not negative and not significant at any number of lags. Hence, the exogenous term is invalid and cannot be estimated using the VECM using the Johansen method.

From the summary output of VECM using the Engle-Granger method (Appendix 3), it can be observed that the exogenous term is negative but not significant. Hence, the exogenous terms are invalid and cannot estimate the model using VECM using Engle-Granger methods.

Insignificant exogenous term in the VECM means that the inclusion of the exogenous variables does not contribute significantly to explaining the dynamics of the endogenous variables.

Based on the summary outputs of VECM methods and co-integration tests, it can be concluded that there is a long-term relationship among the variables, but it is not significant.

VECM methods are an extension of the VAR method including the exogenous terms and error correction term in the model. Since the exogenous terms in the VECM model estimations do not

show any significance, the VAR method is used to estimate the variables and formulate a relationship among the variables.

The VAR model is estimated using the same number of lags of the variables of 9, that are used in estimating the VECM methods. The seasonal dummies did not have any significant effect on the model; hence they were eliminated. The summary output of the VAR model can be observed in Appendix 4.

From the VAR summary output, it can be observed that lag 8 of lfdi is significant at 10%, lag 9 of dcpi is significant at 10%, lag 9 of ddlexports is significant at 10%, lag 2 of ddlimports have significance at 10%, lag 7 of dunemp has significance at 10%, lag 3 of ddlgdp has significance at 10%, lag 6 of dlfeddebt has significance at 10%, and dcorruption does not have any significant impact on dlfdi at any lags.

4.4 Test for Serial Correlation for Residuals

After the model estimation using the VAR method, the residuals of the variables are tested for any serial correlation. The Ljung-Box test is used to test for any serial correlation in the residuals.

The Null Hypothesis for the Ljung-Box test is ‘ No Serial Correlation’

The following Table 3 shows the test results for all the variables

Variable	P-value	Result	Serial Correlation
dlfeddebt	0.8	Fail to Reject the Null Hypothesis	No
dunemp	0.3	Fail to Reject the Null Hypothesis	No
ddlimports	0.5	Fail to Reject the Null Hypothesis	No
ddlexports	0.8	Fail to Reject the Null Hypothesis	No
dlfdi	1	Fail to Reject the Null Hypothesis	No
ddlqdp	0.9	Fail to Reject the Null Hypothesis	No
dcpi	0.7	Fail to Reject the Null Hypothesis	No
dcorruption	0.1	Fail to Reject the Null Hypothesis	No

Table 3

Since the p-values are greater than 0.05, the Null hypothesis is not rejected and concludes that there is no serial correlation in the residuals of the variables.

This can be better understood from the following plots of fitted values and residuals from the VAR model.

4.5 plotting of fitted values and Residuals from VAR model.

The following are the plots of fitted values and residuals from the VAR model.

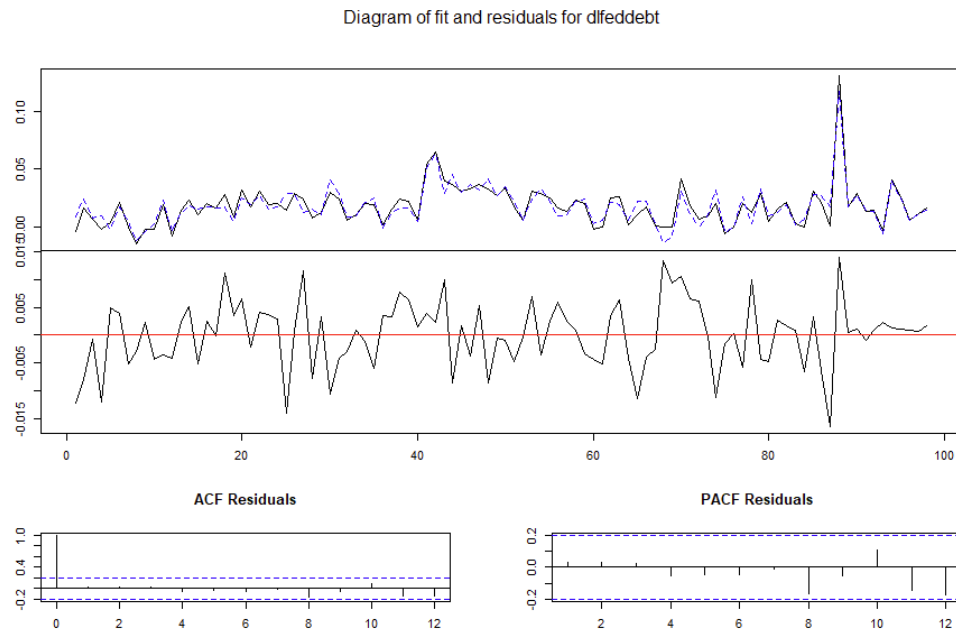


Figure 2

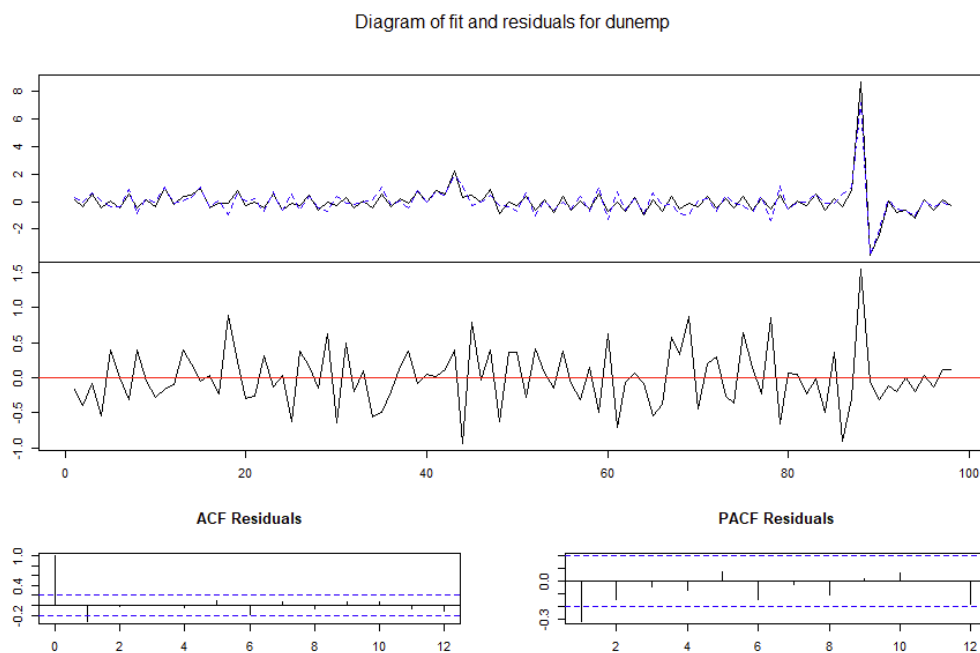


Figure 3

Diagram of fit and residuals for ddlimports

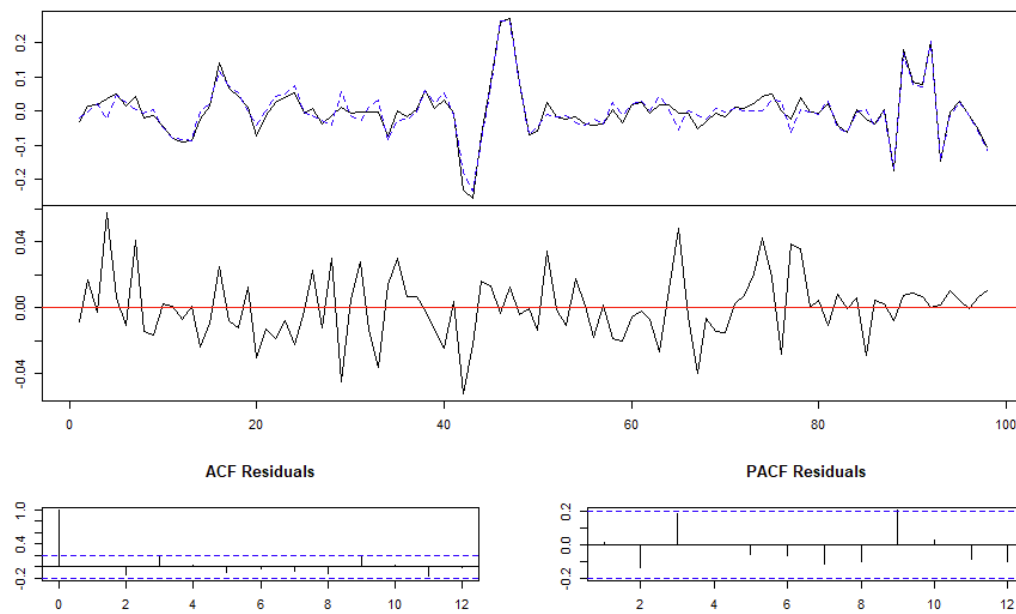


Figure 4

Diagram of fit and residuals for ddlexports

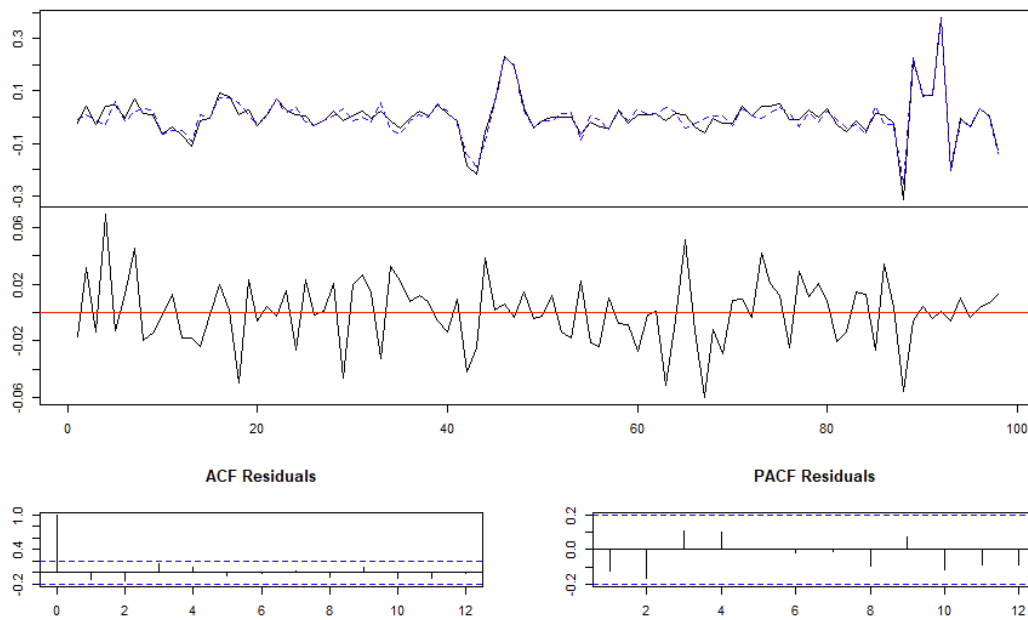


Figure 5

Diagram of fit and residuals for dlfdi

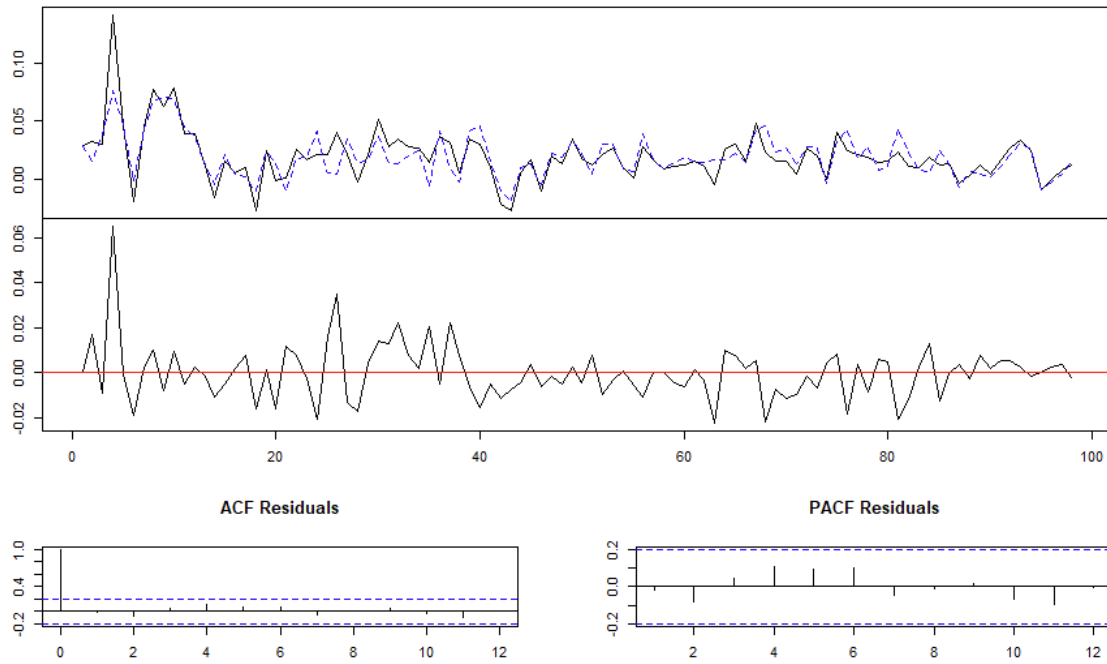


Figure 6

Diagram of fit and residuals for ddlgdp

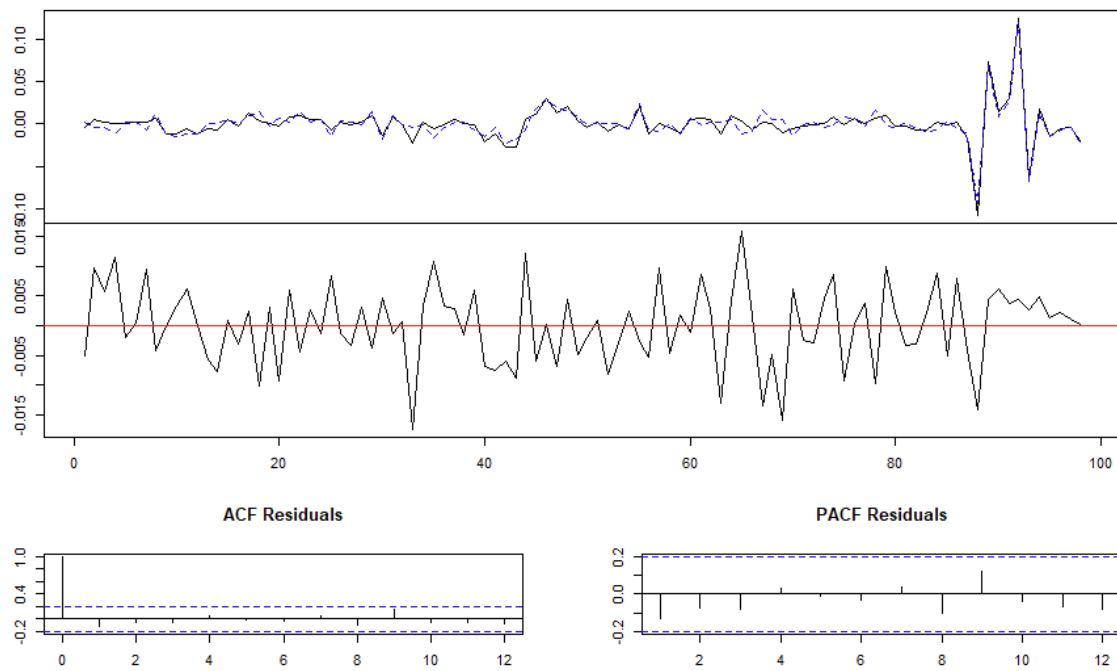


Figure 7

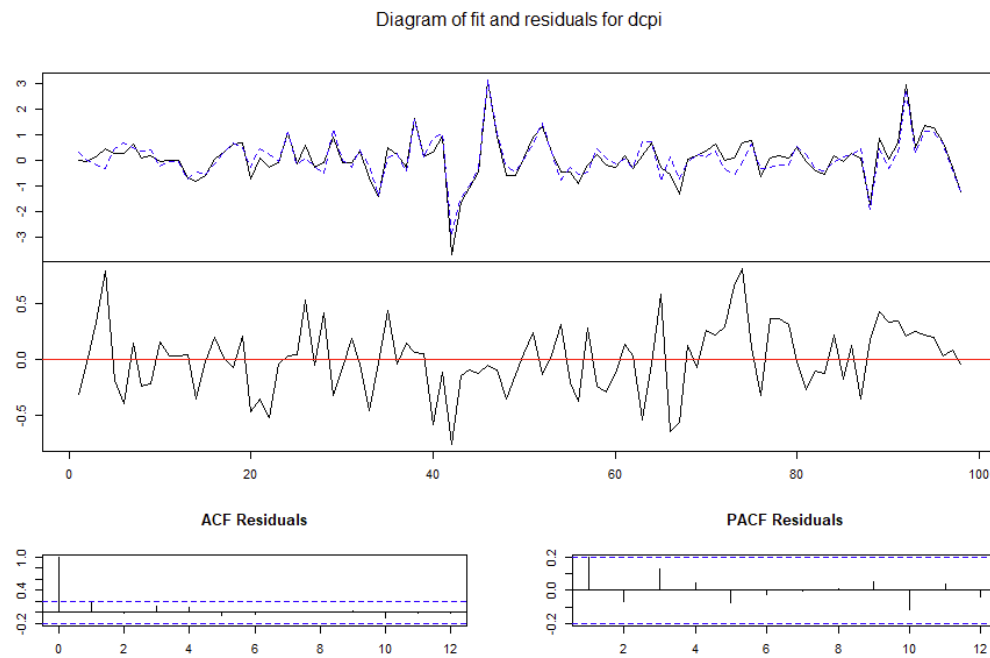


Figure 8

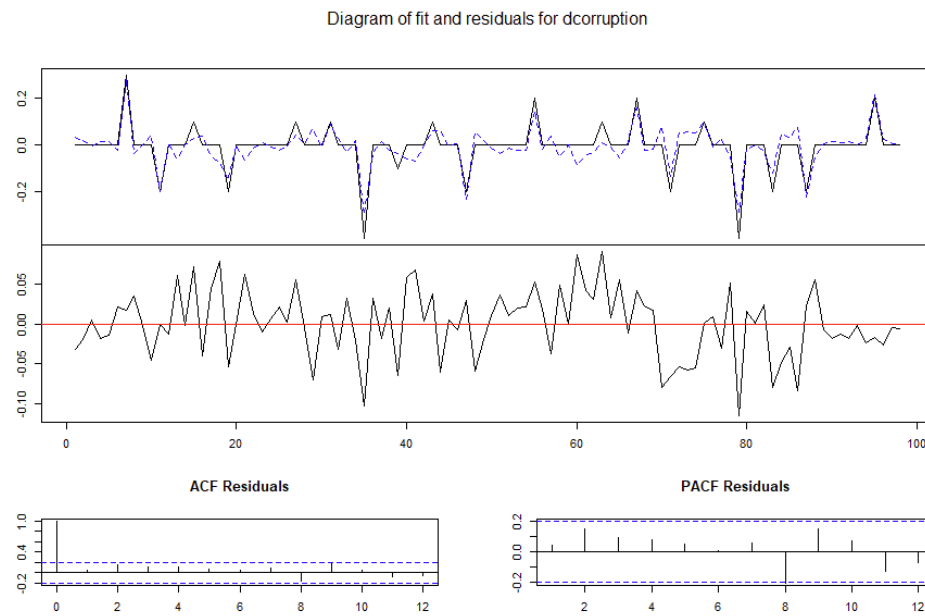


Figure 9

All the plots of fitted values and residuals for the variables indicate good performance of the model, as fitted values go along the actual values and none of the residuals seem to be serially correlated.

4.6 Granger causality test

After model estimation and testing for serial correlation, the test for Granger causality is used to check if the variables Granger causes the other variables.

The Granger causality tests do not establish causation in the true causal sense instead, they provide the evidence of causation in time series sense. The test for Granger causality is used to determine whether one time series variable can be used to predict another variable in a statistical sense

The Null Hypothesis for the Granger Causality test is – ‘variable x doesn’t Granger cause variable y’

The following Table 4 shows the outputs for the Granger Causality test.

Does the variable Granger Cause Ifdi			
Variable	P-value	Result	Granger Cause
Ifeddebt	3.10E-03	Reject the Null Hypothesis	Yes
unemp	2.00E-16	Reject the Null Hypothesis	Yes
dlimports	2.00E-16	Reject the Null Hypothesis	Yes
dlexports	2.00E-16	Reject the Null Hypothesis	Yes
dlgdp	8.00E-10	Reject the Null Hypothesis	Yes
cpi	2.00E-16	Reject the Null Hypothesis	Yes
corruption	2.00E-16	Reject the Null Hypothesis	Yes

Does the Ifdi Granger Cause variable			
Variable	P-value	Result	Granger Cause
Ifeddebt	5.20E-08	Reject the Null Hypothesis	Yes
unemp	1.30E-08	Reject the Null Hypothesis	Yes
dlimports	3.30E-08	Reject the Null Hypothesis	Yes
dlexports	1.40E-08	Reject the Null Hypothesis	Yes
dlgdp	3.10E-08	Reject the Null Hypothesis	Yes
cpi	4.10E-08	Reject the Null Hypothesis	Yes
corruption	1.10E-08	Reject the Null Hypothesis	Yes

Table 4

Since the p-values are less than 0.05, the Null hypothesis is rejected and concluded that the variable Ifdi Granger causes all the other variables and all the other variables Granger causes Ifdi.

4.7 Impulse Response

The Orthogonal Impulse Responses from all the variables on dlfdi are as follows.

The x-axis represents the number of Periods, and the y-axis represents the standard deviation in dlfdi.

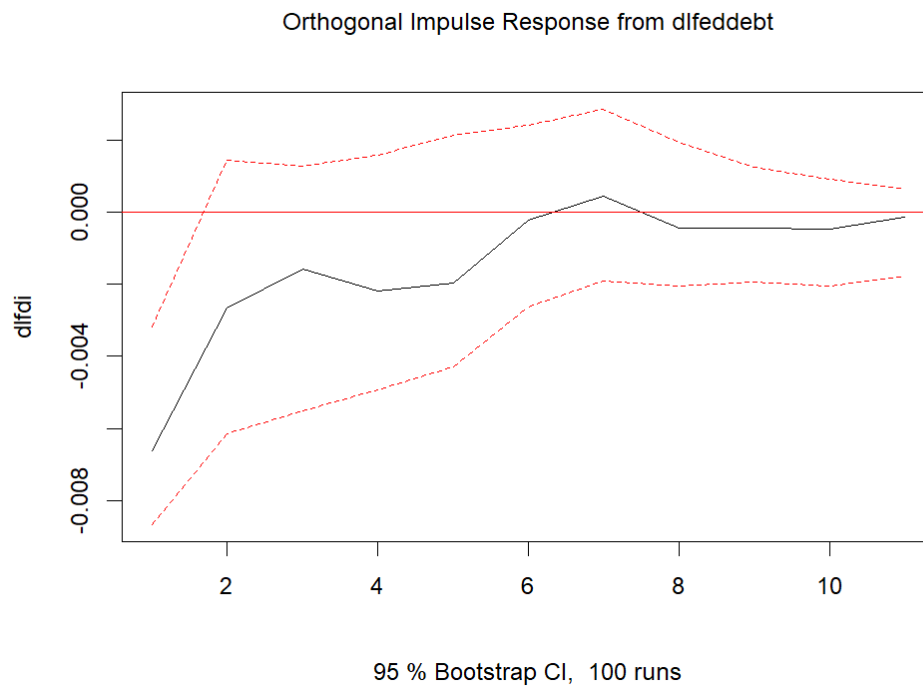


Figure 10

From the above Figure 10, it can be observed that one Standard Deviation shock to dlfeddebt has a negative impact on dlfdi in period 1, then a positive impact in period 2, gradually decreasing and then increasing impact in further periods. There is an asymmetric impact on dlfdi

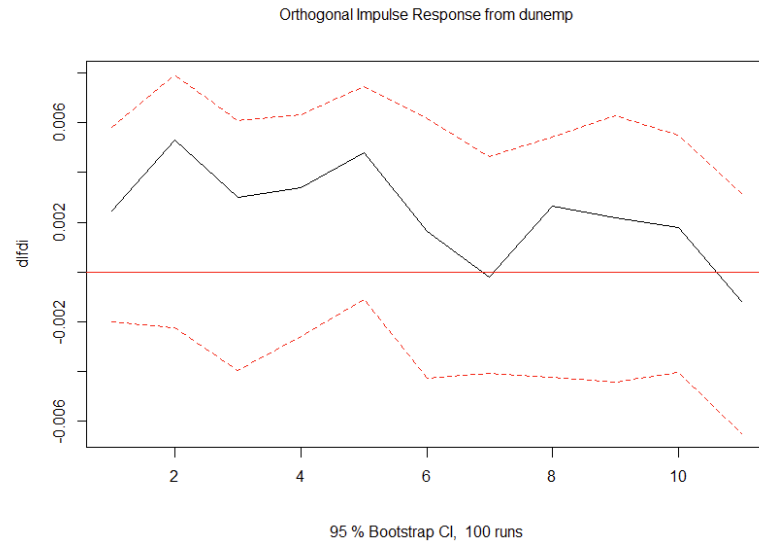


Figure 11

From the above Figure 11, it can be observed that one standard deviation shock to dunemp has a positive impact on dlfdi in period 1, gradually increasing and then gradually decreasing and keeps fluctuating.

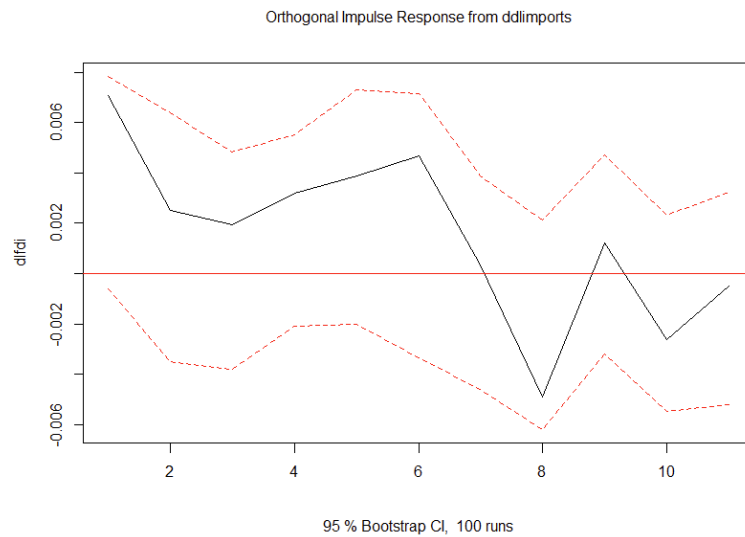


Figure 12

From the above Figure 12, it can be observed that one standard deviation shock to ddlimports initially has a positive impact on dlfdi in period 1, gradually decreasing in period 2 and then increasing and fluctuating in further periods.

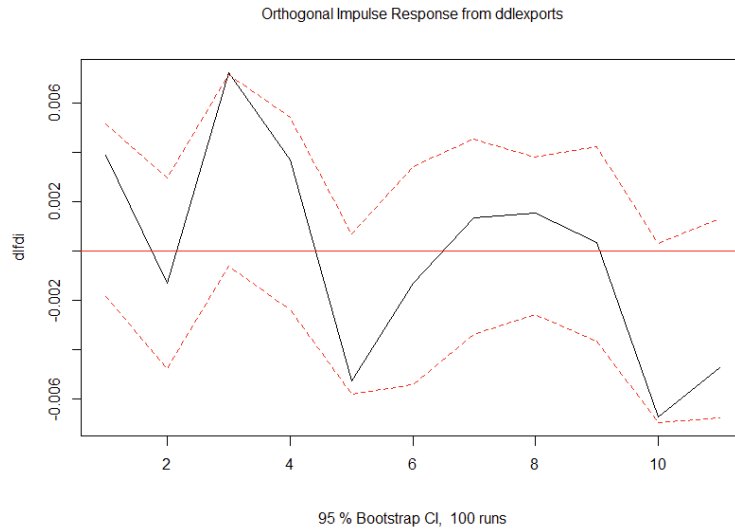


Figure 13

From the above Figure 13, it can be observed that one standard deviation shock to ddlexports initially has a positive impact on dlfdi in period 1 and then a negative impact in period 2, a positive impact in period 3, and keeps fluctuating in further periods

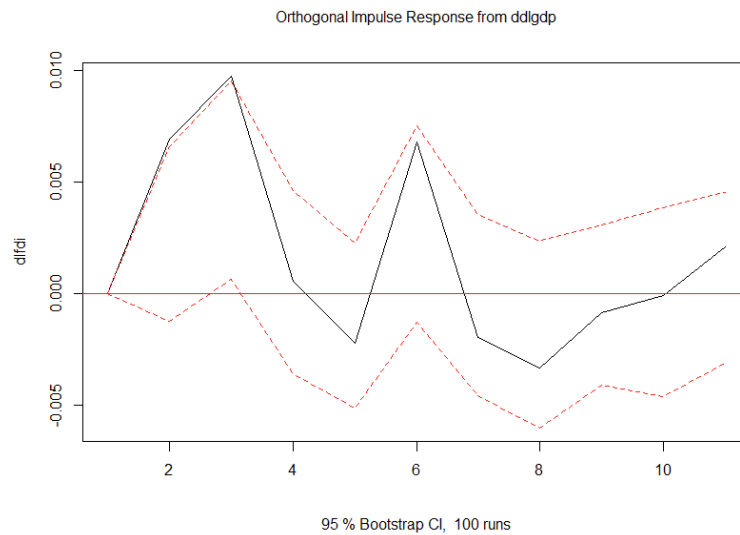


Figure 14

From the above Figure 14, it can be observed that one standard deviation shock to ddlgdp has no impact on dlfdi in period 1, then a positive increasing impact till period 3, negative impact in periods 4, and 5, increasing impact from period 5 to period 6 and keeps fluctuating.

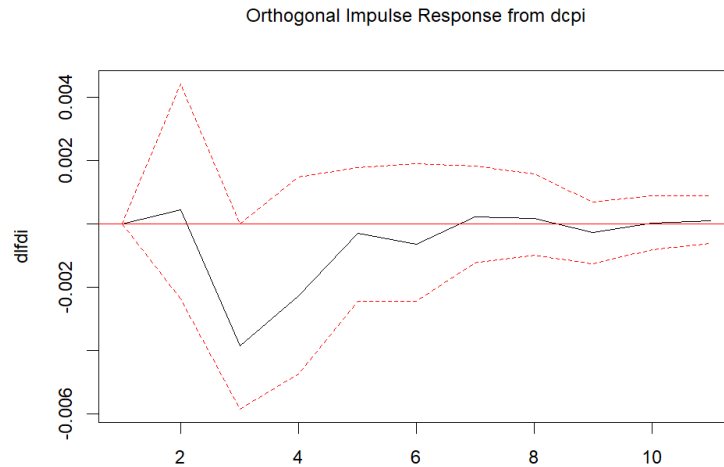


Figure 15

From the above Figure 15, it can be observed that one standard deviation shock on dcpi has a negative impact on dlfdi in periods 1,2 and keeps decreasing till period 3, positive increase in periods 4, 5, and then merges into equilibrium in further periods.

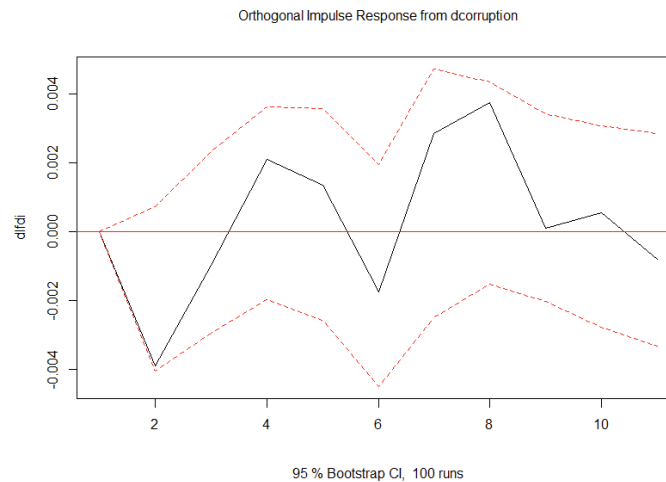


Figure 16

From the above Figure 16, it can be observed that one standard deviation shock on dcorruption has no impact on dlfdi in period 1, a negative impact in period 2, a positive impact in periods 3 and 4 and further keeps fluctuating.

Overall, all the variables have asymmetric impacts on dlfdi and the impacts are minor impacts as the standard deviation shown in the y-axis is low.

4.8 Variance Decomposition

The Variance decomposition explains how much the variability in the dependent variable is explained by its own shocks vs. the shocks in the other variables. (Forecast error variance). The below Figure 17 and the output results explain the variance decomposition of all the variables.

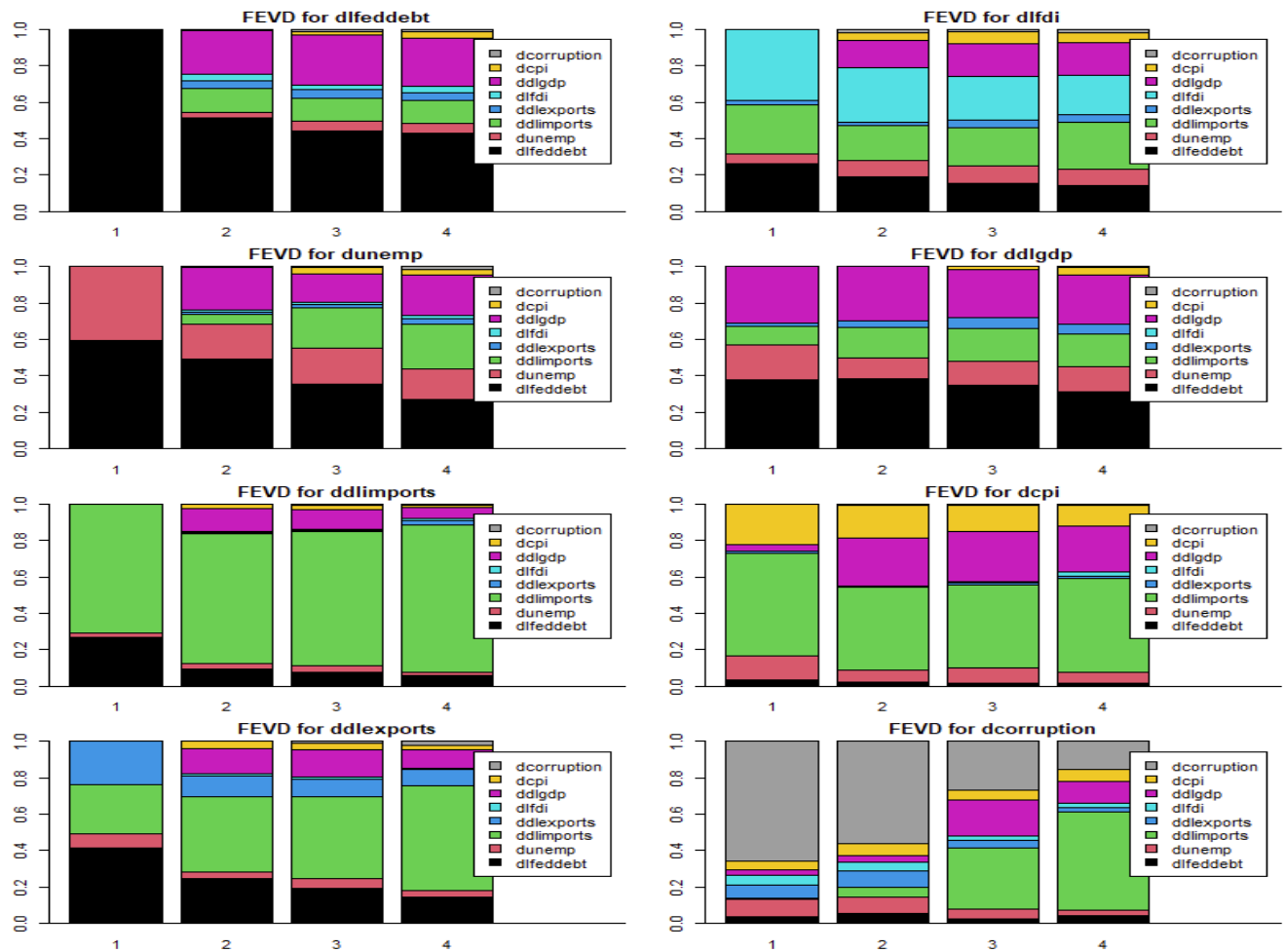


Figure 17

```

$dlfeddebt
dlfeddebt dunemp ddlimports ddlexports dlfdi ddlgdp dcpi dcorruption
[1,] 1.000 0.0000 0.000 0.0000 0.0000 0.000 0.00000 0.00000
[2,] 0.513 0.0277 0.135 0.0431 0.0318 0.242 0.00135 0.00673
[3,] 0.441 0.0546 0.123 0.0473 0.0280 0.272 0.02085 0.01298
[4,] 0.430 0.0516 0.127 0.0446 0.0362 0.262 0.03582 0.01254

$dunemp
dlfeddebt dunemp ddlimports ddlexports dlfdi ddlgdp dcpi dcorruption
[1,] 0.596 0.404 0.0000 0.0000 0.0000 0.000 0.000000 0.00000
[2,] 0.493 0.193 0.0536 0.0112 0.0102 0.236 0.000105 0.00239
[3,] 0.356 0.197 0.2204 0.0208 0.0119 0.154 0.038327 0.00158
[4,] 0.269 0.167 0.2507 0.0303 0.0136 0.226 0.028999 0.01458

$ddlimports
dlfeddebt dunemp ddlimports ddlexports dlfdi ddlgdp dcpi dcorruption
[1,] 0.2651 0.0250 0.710 0.00000 0.00000 0.0000 0.0000 0.0000000
[2,] 0.0958 0.0284 0.714 0.00718 0.00149 0.1310 0.0222 0.0000255
[3,] 0.0788 0.0347 0.733 0.00896 0.00475 0.1096 0.0211 0.0092624
[4,] 0.0579 0.0156 0.810 0.02318 0.01195 0.0643 0.0130 0.0043702

$ddlexports
dlfeddebt dunemp ddlimports ddlexports dlfdi ddlgdp dcpi dcorruption
[1,] 0.416 0.0751 0.269 0.2401 0.00000 0.000 0.0000 0.0000000
[2,] 0.246 0.0352 0.416 0.1136 0.00911 0.143 0.0372 0.0000422
[3,] 0.196 0.0520 0.451 0.0927 0.00994 0.154 0.0344 0.0097854
[4,] 0.144 0.0339 0.579 0.0893 0.00724 0.100 0.0272 0.0193792

$dlfdi
dlfeddebt dunemp ddlimports ddlexports dlfdi ddlgdp dcpi dcorruption
[1,] 0.259 0.0590 0.270 0.0220 0.390 0.000 0.0000 0.0000
[2,] 0.191 0.0891 0.193 0.0165 0.297 0.151 0.0443 0.0175
[3,] 0.156 0.0923 0.213 0.0412 0.239 0.181 0.0610 0.0154
[4,] 0.139 0.0910 0.261 0.0404 0.213 0.181 0.0556 0.0182

$ddlbgdp
dlfeddebt dunemp ddlimports ddlexports dlfdi ddlbgdp dcpi dcorruption
[1,] 0.381 0.192 0.0977 0.0219 0.000557 0.307 0.00000 0.0000000
[2,] 0.384 0.115 0.1652 0.0379 0.001493 0.296 0.00013 0.000124
[3,] 0.350 0.133 0.1746 0.0615 0.001911 0.265 0.01372 0.000132
[4,] 0.311 0.137 0.1798 0.0546 0.004908 0.268 0.03902 0.005929

$dcpi
dlfeddebt dunemp ddlimports ddlexports dlfdi ddlbgdp dcpi dcorruption
[1,] 0.0345 0.1305 0.565 0.00927 0.000998 0.039 0.221 0.00000
[2,] 0.0198 0.0703 0.453 0.00597 0.001462 0.262 0.178 0.00991
[3,] 0.0188 0.0790 0.457 0.01011 0.008793 0.274 0.144 0.00821
[4,] 0.0147 0.0616 0.513 0.01281 0.025346 0.249 0.115 0.00868

$dcorruption
dlfeddebt dunemp ddlimports ddlexports dlfdi ddlbgdp dcpi dcorruption
[1,] 0.0378 0.0948 0.00733 0.0697 0.0557 0.0273 0.0520 0.655
[2,] 0.0535 0.0899 0.05502 0.0891 0.0482 0.0348 0.0657 0.564
[3,] 0.0271 0.0540 0.33078 0.0432 0.0232 0.1980 0.0585 0.265
[4,] 0.0421 0.0313 0.53750 0.0232 0.0280 0.1157 0.0679 0.154

```

Since the main focus is on dlfdi variable, the results are interpreted as follows.

- In the short run, there is a 39% of forecast error variance in dlfdi. It means dlfdi is explained by itself and other variables do not have a significant impact on the predicting dlfdi – strongly exogenous
- In the long run, there is a significant impact due to other variables increasing but has a weak influence on dlfdi. The major part is explained by itself

4.9 Forecasting dlfdi

Based on model estimation and other test results, dlfdi is forecasted for 12 periods ahead (3 years) and can be observed as follows (Figure18).

The red lines show the upper limit and the lower limit with a 95% confidence interval. The actual values can take any values between these limits.

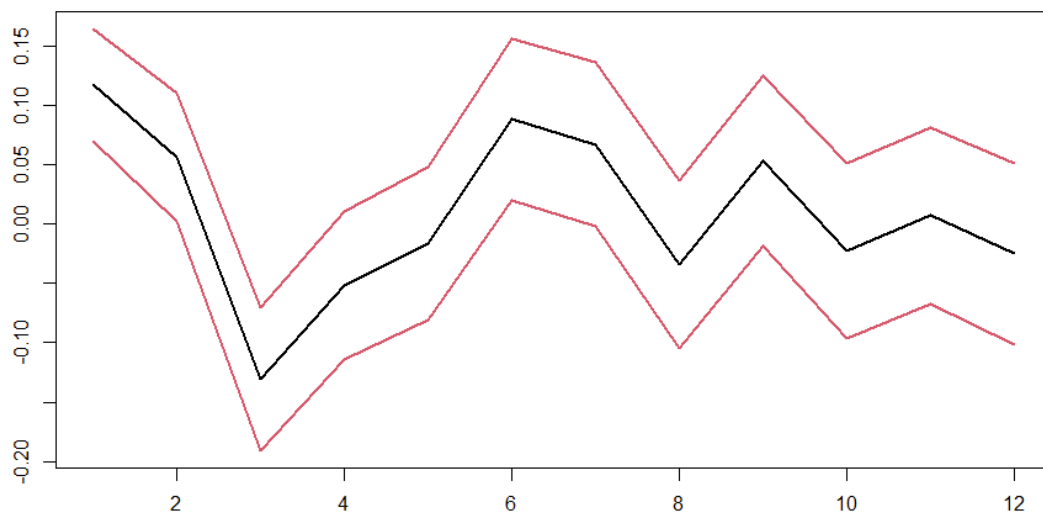


Figure 18

It is forecasted that dlfdi is going to decrease in the next 3 periods and then gradually increase till period 6.

5. Conclusion

Based on the findings from various tests and outputs, it can be concluded that the variables Unemployment, International Trade (Exports and Imports), Federal Debt, GDP, Corruption Perceptions Index, and Consumer Price Index (CPI) have short-term and long-term impacts on Foreign Direct Investment (FDI), but the impacts do not have much significance. Even though there is no serial correlation among the residuals of the variables and all the variables Granger cause FDI, there is no significant impact of the lags of the variables on FDI. These results are based on the data collected from 1995 to 2022. The availability of limited data is considered to be the limitation of current analysis. The impacts of corruption levels in other countries and the effects of labor markets are not considered in the current paper and these variables can be used for further studies in analyzing the impacts on FDI.

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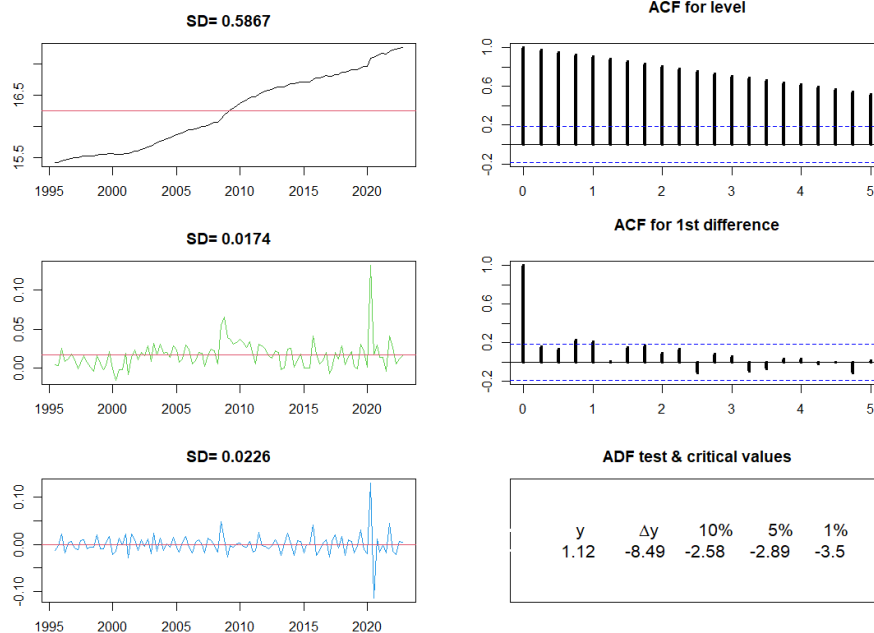
Organization for Economic Co-operation and Development, Consumer Price Index: Total All Items for the United States [CPALTT01USM657N], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/CPALTT01USM657N>, June 9, 2023.

<https://www.transparency.org/en/cpi/2022>

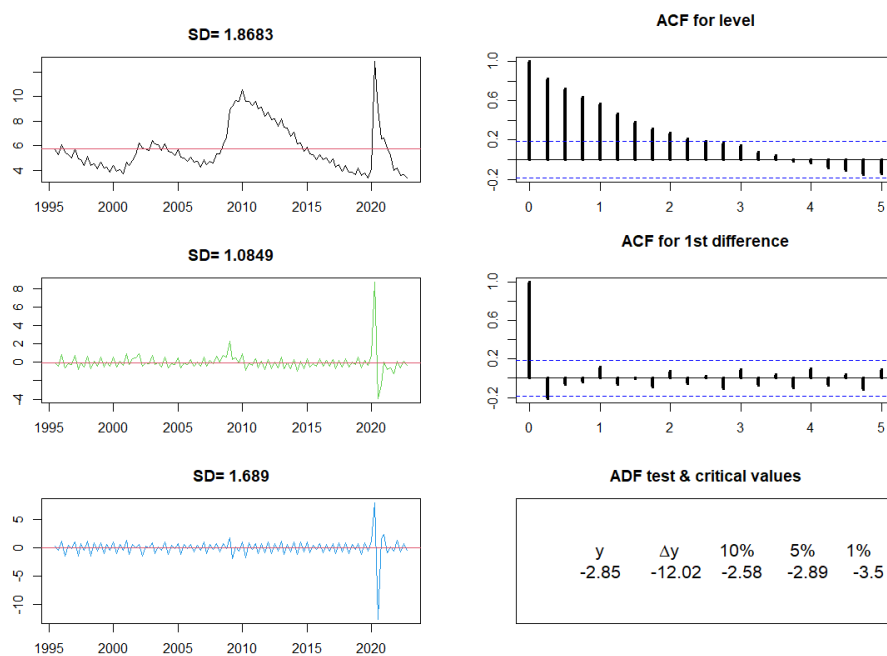
7. Appendix

1. Stationarity test

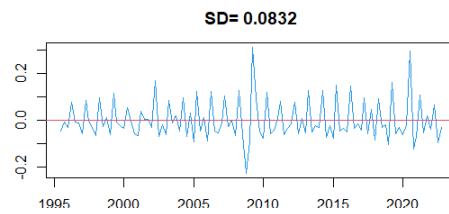
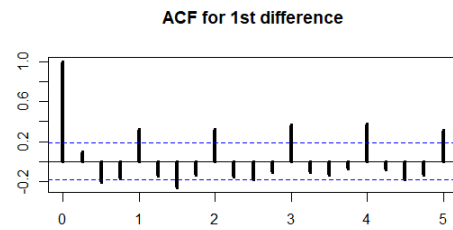
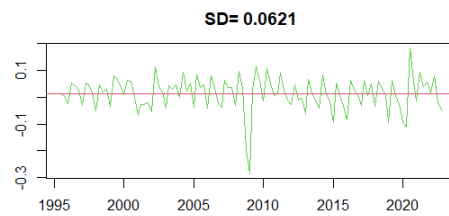
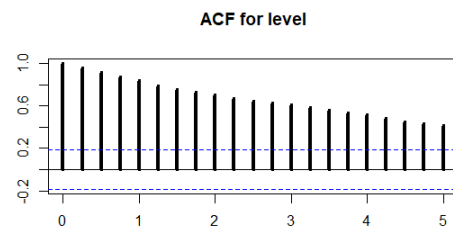
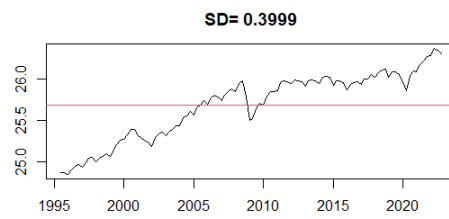
a. For feddebt



b. For unemp

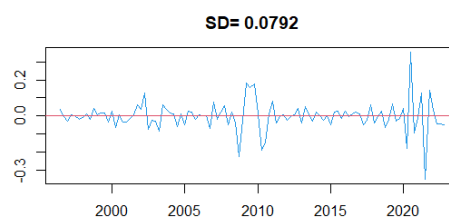
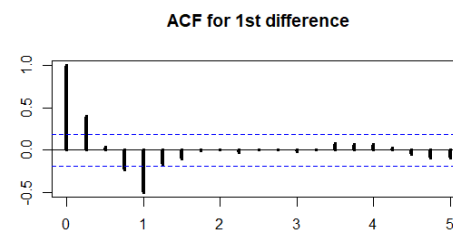
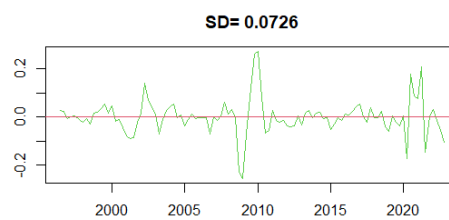
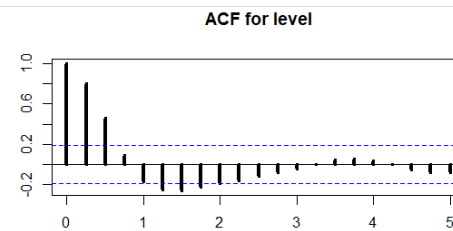
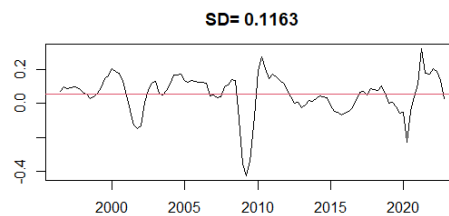


c. For imports



ADF test & critical values

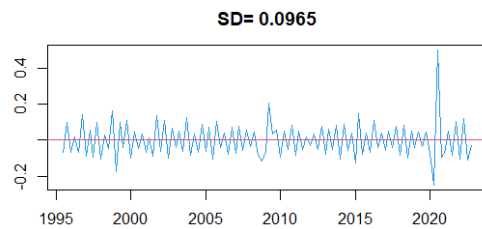
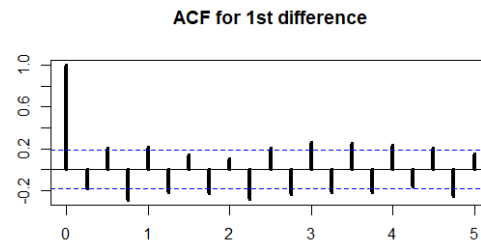
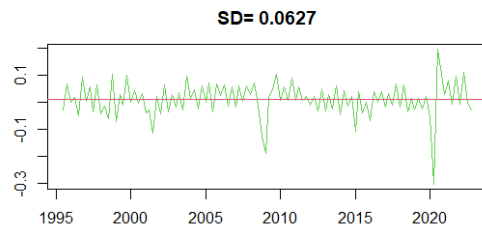
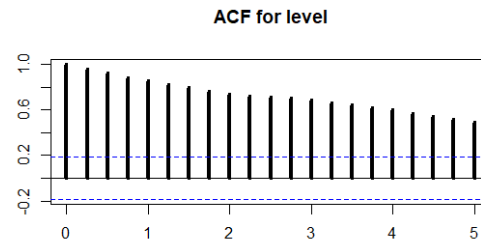
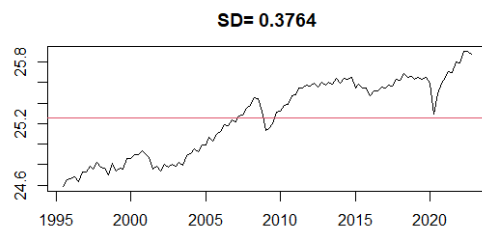
	y	Δy	10%	5%	1%
	-1.51	-5.35	-2.58	-2.89	-3.5



ADF test & critical values

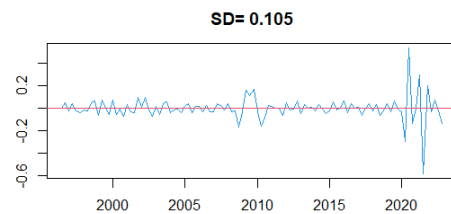
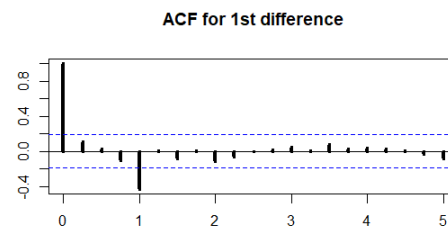
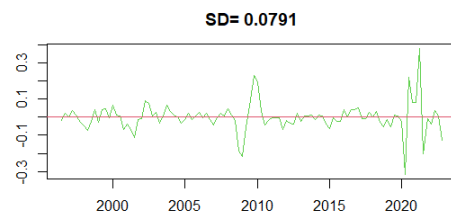
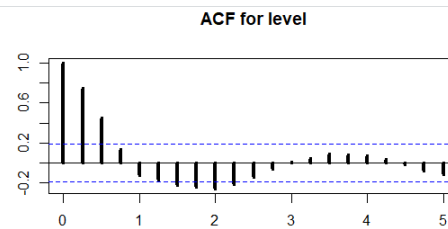
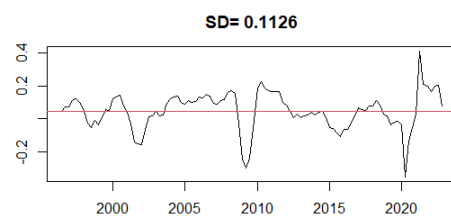
	y	Δy	10%	5%	1%
	-4.75	-4.79	-2.58	-2.89	-3.5

d. For exports



ADF test & critical values

y	Δy	10%	5%	1%
-0.82	-11.48	-2.58	-2.89	-3.5



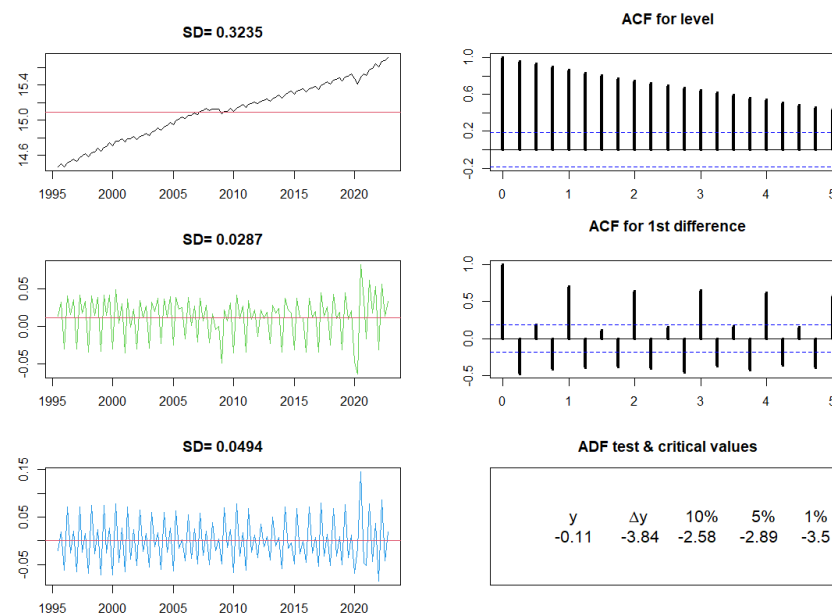
ADF test & critical values

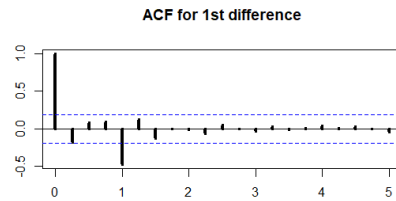
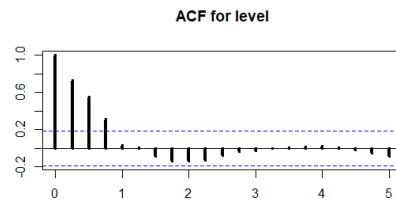
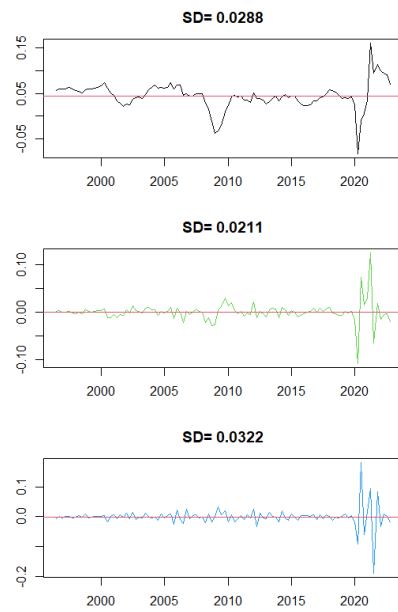
y	Δy	10%	5%	1%
-3.38	-7.12	-2.58	-2.89	-3.5

e. For Fdi



f. For gdp

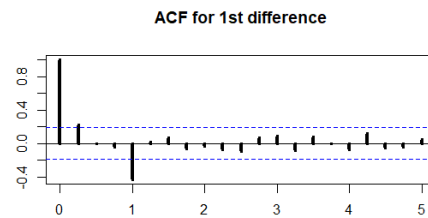
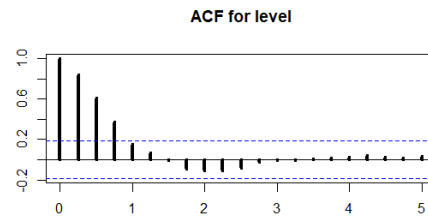
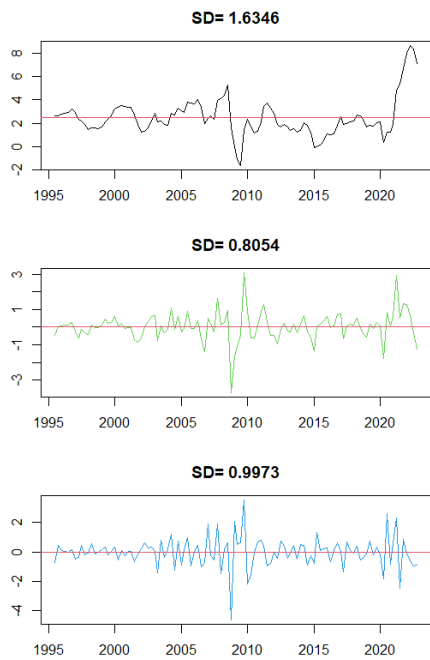




ADF test & critical values

y	Δy	10%	5%	1%
-2.53	-6	-2.58	-2.89	-3.5

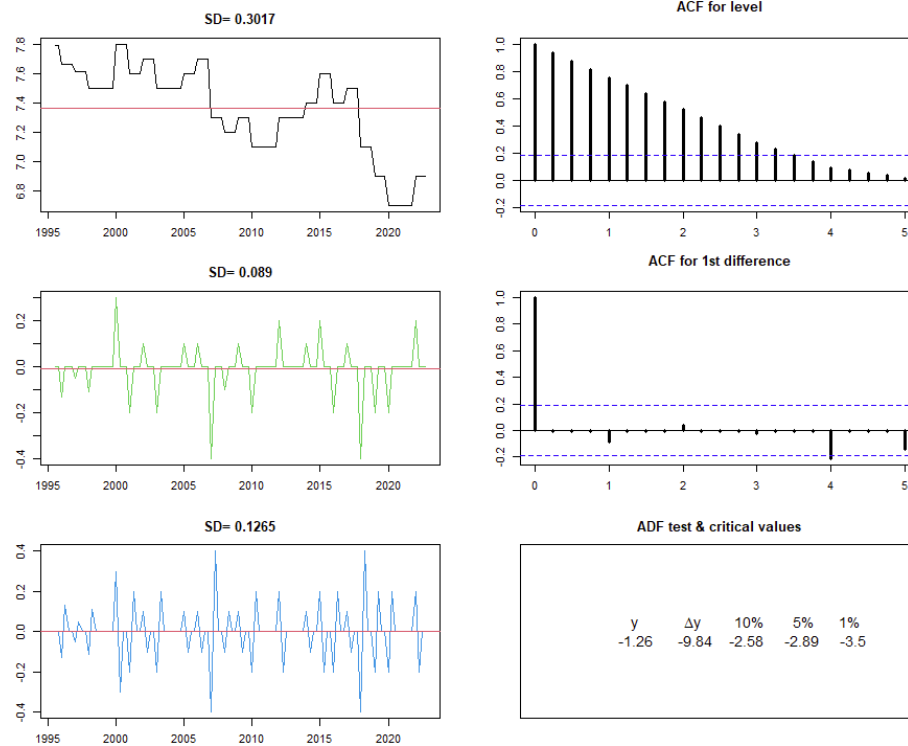
g. For cpi



ADF test & critical values

y	Δy	10%	5%	1%
-2.69	-3.71	-2.58	-2.89	-3.5

h. For corruption



2. Summary output of VECM using the Johansen Method

Estimation results for equation dlfdi:

```
=====
dlfdi = dlfeddebt.l1 + dunemp.l1 + ddlimports.l1 + ddlexports.l1 + dlfdi.l1 + ddlgdp.l1 + dcpi.l1 + dcorruption.l1 + dlfeddebt.l2 + dunemp.l2 + ddlimports.l2 + ddlexports.l2 + dlfdi.l2 + ddlgdp.l2 + dcpi.l2 + dcorruption.l2 + dlfeddebt.l3 + dunemp.l3 + ddlimports.l3 + ddlexports.l3 + dlfdi.l3 + ddlgdp.l3 + dcpi.l3 + dcorruption.l3 + dlfeddebt.l4 + dunemp.l4 + ddlimports.l4 + ddlexports.l4 + dlfdi.l4 + ddlgdp.l4 + dcpi.l4 + dcorruption.l4 + dlfeddebt.l5 + dunemp.l5 + ddlimports.l5 + ddlexports.l5 + dlfdi.l5 + ddlgdp.l5 + dcpi.l5 + dcorruption.l5 + dlfeddebt.l6 + dunemp.l6 + ddlimports.l6 + ddlexports.l6 + dlfdi.l6 + ddlgdp.l6 + dcpi.l6 + dcorruption.l6 + dlfeddebt.l7 + dunemp.l7 + ddlimports.l7 + ddlexports.l7 + dlfdi.l7 + ddlgdp.l7 + dcpi.l7 + dcorruption.l7 + dlfeddebt.l8 + dunemp.l8 + ddlimports.l8 + ddlexports.l8 + dlfdi.l8 + ddlgdp.l8 + dcpi.l8 + dcorruption.l8 + dlfeddebt.l9 + dunemp.l9 + ddlimports.l9 + ddlexports.l9 + dlfdi.l9 + ddlgdp.l9 + dcpi.l9 + dcorruption.l9 + const + sd1 + sd2 + sd3 + exo1
```

	Estimate	Std. Error	t value	Pr(> t)
dlfeddebt.l1	-0.1282036	0.7961488	-0.16	0.874
dunemp.l1	0.0231429	0.0138916	1.67	0.111
ddlimports.l1	0.1369455	0.3274766	0.42	0.680
ddlexports.l1	-0.1494407	0.2452307	-0.61	0.549
dlfdi.l1	0.1808512	0.2159240	0.84	0.412
ddlbgdp.l1	1.8563707	0.8381422	2.21	0.038 *
dcpi.l1	-0.0248534	0.0151200	-1.64	0.115
dcorruption.l1	-0.0576783	0.0569945	-1.01	0.323
dlfeddebt.l2	0.0532123	0.7170904	0.07	0.942
dunemp.l2	0.0221509	0.0136248	1.63	0.119
ddlimports.l2	-0.6409067	0.2997066	-2.14	0.044 *
ddlexports.l2	0.1554433	0.2666121	0.58	0.566
dlfdi.l2	0.0189857	0.2206215	0.09	0.932
ddlbgdp.l2	2.5292877	1.0398625	2.43	0.024 *
dcpi.l2	0.0048790	0.0142026	0.34	0.735
dcorruption.l2	0.0124982	0.0515716	0.24	0.811
dlfeddebt.l3	0.0781155	0.6902892	0.11	0.911
dunemp.l3	0.0192191	0.0152679	1.26	0.222
ddlimports.l3	-0.3868461	0.3761225	-1.03	0.315
ddlexports.l3	0.2391257	0.2516302	0.95	0.353
dlfdi.l3	0.1899817	0.2397613	0.79	0.437
ddlbgdp.l3	1.3553763	0.9149846	1.48	0.153
dcpi.l3	0.0082010	0.0174458	0.47	0.643
dcorruption.l3	0.0495249	0.0542594	0.91	0.372
dlfeddebt.l4	0.2650742	0.5840620	0.45	0.655
dunemp.l4	-0.0019225	0.0162495	-0.12	0.907
ddlimports.l4	0.2754108	0.3135911	0.88	0.390
ddlexports.l4	-0.0981477	0.2635629	-0.37	0.713
dlfdi.l4	0.2212680	0.2549713	0.87	0.395
ddlbgdp.l4	-0.1452463	0.8497826	-0.17	0.866
dcpi.l4	-0.0130611	0.0187587	-0.70	0.494
dcorruption.l4	0.0183823	0.0506003	0.36	0.720
dlfeddebt.l5	0.6906844	0.6649898	1.04	0.311
dunemp.l5	-0.0096647	0.0183070	-0.53	0.603
ddlimports.l5	0.3362808	0.3081517	1.09	0.288

ddlexports.15	-0.2368357	0.2687572	-0.88	0.388
dldfdi.15	0.1526757	0.2484843	0.61	0.546
ddlrgdp.15	1.7215229	1.0668031	1.61	0.122
dcpi.15	-0.0468105	0.0186449	-2.51	0.020 *
dcorruption.15	-0.0277578	0.0597773	-0.46	0.647
dldfedebt.16	0.9495246	0.5951702	1.60	0.126
dunemp.16	-0.0347934	0.0179757	-1.94	0.066 .
ddlimports.16	-0.2667959	0.2952451	-0.90	0.376
ddlexports.16	-0.0025649	0.2315232	-0.01	0.991
dldfdi.16	0.2916980	0.2505839	1.16	0.257
ddlrgdp.16	1.0534932	0.8582815	1.23	0.233
dcpi.16	-0.0032965	0.0125880	-0.26	0.796
dcorruption.16	0.0361740	0.0504956	0.72	0.482
dldfedebt.17	-0.6758750	0.5446394	-1.24	0.228
dunemp.17	-0.0184803	0.0213412	-0.87	0.396
ddlimports.17	-0.3513699	0.2558171	-1.37	0.184
ddlexports.17	0.2972577	0.2306950	1.29	0.212
dldfdi.17	0.1274295	0.3125502	0.41	0.688
ddlrgdp.17	0.0329928	0.7472654	0.04	0.965
dcpi.17	-0.0000449	0.0131768	0.00	0.997
dcorruption.17	-0.0550498	0.0694519	-0.79	0.437
dldfedebt.18	-0.1423654	0.5955916	-0.24	0.813
dunemp.18	-0.0051418	0.0194350	-0.26	0.794
ddlimports.18	0.3145590	0.2492491	1.26	0.221
ddlexports.18	-0.0190962	0.2617824	-0.07	0.943
dldfdi.18	0.4822353	0.2609341	1.85	0.079 .
ddlrgdp.18	-0.3078865	0.7533536	-0.41	0.687
dcpi.18	-0.0226538	0.0160352	-1.41	0.172
dcorruption.18	-0.0228529	0.0838877	-0.27	0.788
dldfedebt.19	0.2801654	0.6201193	0.45	0.656
dunemp.19	-0.0229845	0.0184567	-1.25	0.227
ddlimports.19	0.2996337	0.2657934	1.13	0.272
ddlexports.19	-0.2997046	0.2943187	-1.02	0.320
dldfdi.19	0.0346944	0.3189827	0.11	0.914
ddlrgdp.19	-0.0079394	0.7245988	-0.01	0.991
dcpi.19	-0.0285202	0.0133029	-2.14	0.044 *
dcorruption.19	-0.0031426	0.0606361	-0.05	0.959
const	-0.0378845	0.0425263	-0.89	0.383
sd1	0.0051805	0.0515927	0.10	0.921
sd2	0.0318775	0.0379992	0.84	0.411
sd3	0.0093487	0.0480752	0.19	0.848
exo1	0.0150682	0.0179869	0.84	0.412

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.0249 on 21 degrees of freedom
Multiple R-squared: 0.728, Adjusted R-squared: -0.258
F-statistic: 0.738 on 76 and 21 DF, p-value: 0.83

3. Summary output of VECM using the Engle-Granger method

Estimation results for equation dlfdi:

```
=====
dlfdi = dlfeddebt.l1 + dunemp.l1 + ddlimports.l1 + ddlexports.l1 + dlfdi.l1 + ddlgdp.l1 + dcpi.l1 + dcorruption.l1 + dlfeddebt.l2 + dunemp.l2 + ddlimports.l2 + ddlexports.l2 + dlfdi.l2 + ddlgdp.l2 + dcpi.l2 + dcorruption.l2 + dlfeddebt.l3 + dunemp.l3 + ddlimports.l3 + ddlexports.l3 + dlfdi.l3 + ddlgdp.l3 + dcpi.l3 + dcorruption.l3 + dlfeddebt.l4 + dunemp.l4 + ddlimports.l4 + ddlexports.l4 + dlfdi.l4 + ddlgdp.l4 + dcpi.l4 + dcorruption.l4 + dlfeddebt.l5 + dunemp.l5 + ddlimports.l5 + ddlexports.l5 + dlfdi.l5 + ddlgdp.l5 + dcpi.l5 + dcorruption.l5 + dlfeddebt.l6 + dunemp.l6 + ddlimports.l6 + ddlexports.l6 + dlfdi.l6 + ddlgdp.l6 + dcpi.l6 + dcorruption.l6 + dlfeddebt.l7 + dunemp.l7 + ddlimports.l7 + ddlexports.l7 + dlfdi.l7 + ddlgdp.l7 + dcpi.l7 + dcorruption.l7 + dlfeddebt.l8 + dunemp.l8 + ddlimports.l8 + ddlexports.l8 + dlfdi.l8 + ddlgdp.l8 + dcpi.l8 + dcorruption.l8 + dlfeddebt.l9 + dunemp.l9 + ddlimports.l9 + ddlexports.l9 + dlfdi.l9 + ddlgdp.l9 + dcpi.l9 + dcorruption.l9 + const + sd1 + sd2 + sd3 + exo1
```

	Estimate	Std. Error	t value	Pr(> t)
dlfeddebt.l1	0.146182	0.814216	0.18	0.859
dunemp.l1	0.020129	0.013213	1.52	0.143
ddlimports.l1	0.313434	0.257866	1.22	0.238
ddlexports.l1	-0.178783	0.247061	-0.72	0.477
dlfdi.l1	0.235183	0.209932	1.12	0.275
ddlbgdp.l1	1.692877	0.809912	2.09	0.049 *
dcpi.l1	-0.023659	0.015307	-1.55	0.137
dcorruption.l1	-0.036323	0.072151	-0.50	0.620
dlfeddebt.l2	0.124156	0.728493	0.17	0.866
dunemp.l2	0.020214	0.013476	1.50	0.149
ddlimports.l2	-0.510824	0.273405	-1.87	0.076 .
ddlexports.l2	0.143630	0.274871	0.52	0.607
dlfdi.l2	0.049999	0.221929	0.23	0.824
ddlbgdp.l2	2.370449	1.021384	2.32	0.030 *
dcpi.l2	0.006476	0.014296	0.45	0.655
dcorruption.l2	0.022413	0.059814	0.37	0.712
dlfeddebt.l3	0.083984	0.697398	0.12	0.905
dunemp.l3	0.017654	0.015483	1.14	0.267
ddlimports.l3	-0.276683	0.359086	-0.77	0.450
ddlexports.l3	0.223157	0.255269	0.87	0.392
dlfdi.l3	0.249533	0.233255	1.07	0.297
ddlbgdp.l3	1.281609	0.936551	1.37	0.186
dcpi.l3	0.010946	0.017427	0.63	0.537
dcorruption.l3	0.068467	0.067033	1.02	0.319
dlfeddebt.l4	0.251731	0.594629	0.42	0.676
dunemp.l4	-0.003875	0.016295	-0.24	0.814
ddlimports.l4	0.366028	0.306420	1.19	0.246
ddlexports.l4	-0.109953	0.268520	-0.41	0.686
dlfdi.l4	0.241192	0.255987	0.94	0.357
ddlbgdp.l4	-0.263407	0.856409	-0.31	0.761
dcpi.l4	-0.009905	0.018450	-0.54	0.597
dcorruption.l4	0.031937	0.056563	0.56	0.578
dlfeddebt.l5	0.671357	0.673499	1.00	0.330
dunemp.l5	-0.010762	0.018431	-0.58	0.566
ddlimports.l5	0.433863	0.284374	1.53	0.142
ddlexports.l5	-0.244138	0.271364	-0.90	0.378
dlfdi.l5	0.166817	0.250043	0.67	0.512
ddlbgdp.l5	1.661861	1.074145	1.55	0.137
dcpi.l5	-0.044534	0.018569	-2.40	0.026 *
dcorruption.l5	-0.025820	0.061930	-0.42	0.681

dlfeddebt.16	1.035076	0.586766	1.76	0.092 .
dunemp.16	-0.038682	0.017105	-2.26	0.034 *
ddlimports.16	-0.233757	0.295846	-0.79	0.438
ddlexports.16	-0.007306	0.237666	-0.03	0.976
dlfdi.16	0.261626	0.267738	0.98	0.340
ddlgrp.16	0.905797	0.835393	1.08	0.291
dcpi.16	-0.000431	0.012562	-0.03	0.973
dcorruption.16	0.040535	0.052284	0.78	0.447
dlfeddebt.17	-0.670662	0.551906	-1.22	0.238
dunemp.17	-0.018175	0.022328	-0.81	0.425
ddlimports.17	-0.355999	0.259195	-1.37	0.184
ddlexports.17	0.307057	0.232786	1.32	0.201
dlfdi.17	0.156234	0.315584	0.50	0.626
ddlgrp.17	0.239691	0.771894	0.31	0.759
dcpi.17	0.003925	0.013077	0.30	0.767
dcorruption.17	-0.033731	0.082584	-0.41	0.687
dlfeddebt.18	-0.215787	0.608723	-0.35	0.727
dunemp.18	-0.002813	0.021514	-0.13	0.897
ddlimports.18	0.259564	0.251347	1.03	0.313
ddlexports.18	0.005704	0.266175	0.02	0.983
dlfdi.18	0.499144	0.262189	1.90	0.071 .
ddlgrp.18	-0.007667	0.809390	-0.01	0.993
dcpi.18	-0.018204	0.015463	-1.18	0.252
dcorruption.18	-0.010058	0.090460	-0.11	0.913
dlfeddebt.19	0.310741	0.639500	0.49	0.632
dunemp.19	-0.022361	0.018800	-1.19	0.248
ddlimports.19	0.297078	0.273864	1.08	0.290
ddlexports.19	-0.285871	0.305570	-0.94	0.360
dlfdi.19	0.088206	0.322076	0.27	0.787
ddlgrp.19	0.161067	0.734485	0.22	0.829
dcpi.19	-0.024653	0.013046	-1.89	0.073 .
dcorruption.19	-0.000106	0.064036	0.00	0.999
const	-0.048008	0.040873	-1.17	0.253
sd1	0.007005	0.052645	0.13	0.895
sd2	0.038388	0.039000	0.98	0.336
sd3	0.014492	0.049565	0.29	0.773
exo1	-0.003715	0.007024	-0.53	0.602

signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.0251 on 21 degrees of freedom
Multiple R-squared: 0.722, Adjusted R-squared: -0.283
F-statistic: 0.719 on 76 and 21 DF, p-value: 0.85

4. Summary output of VAR

Estimation results for equation dlfdi:

```
=====
dlfdi = dlfeddebt.l1 + dunemp.l1 + ddlimports.l1 + ddlexports.l1 + dlfdi.l1 + ddlgdp.l1 + dcpi.l1 + dcorruption.l1 + dlfeddebt.l2 + dunemp.l2 + ddlimports.l2 + ddlexports.l2 + dlfdi.l2 + ddlgdp.l2 + dcpi.l2 + dcorruption.l2 + dlfeddebt.l3 + dunemp.l3 + ddlimports.l3 + ddlexports.l3 + dlfdi.l3 + ddlgdp.l3 + dcpi.l3 + dcorruption.l3 + dlfeddebt.l4 + dunemp.l4 + ddlimports.l4 + ddlexports.l4 + dlfdi.l4 + ddlgdp.l4 + dcpi.l4 + dcorruption.l4 + dlfeddebt.l5 + dunemp.l5 + ddlimports.l5 + ddlexports.l5 + dlfdi.l5 + ddlgdp.l5 + dcpi.l5 + dcorruption.l5 + dlfeddebt.l6 + dunemp.l6 + ddlimports.l6 + ddlexports.l6 + dlfdi.l6 + ddlgdp.l6 + dcpi.l6 + dcorruption.l6 + dlfeddebt.l7 + dunemp.l7 + ddlimports.l7 + ddlexports.l7 + dlfdi.l7 + ddlgdp.l7 + dcpi.l7 + dcorruption.l7 + dlfeddebt.l8 + dunemp.l8 + ddlimports.l8 + ddlexports.l8 + dlfdi.l8 + ddlgdp.l8 + dcpi.l8 + dcorruption.l8 + dlfeddebt.l9 + dunemp.l9 + ddlimports.l9 + ddlexports.l9 + dlfdi.l9 + ddlgdp.l9 + dcpi.l9 + dcorruption.l9 + const
```

	Estimate	Std. Error	t value	Pr(> t)
dlfeddebt.l1	-0.16885	0.49535	-0.34	0.736
dunemp.l1	0.01641	0.01095	1.50	0.146
ddlimports.l1	0.33122	0.23878	1.39	0.178
ddlexports.l1	-0.24003	0.20436	-1.17	0.251
dlfdi.l1	0.18567	0.19577	0.95	0.352
ddlbgdp.l1	1.36723	0.71127	1.92	0.066
dcpi.l1	-0.02199	0.01273	-1.73	0.096
dcorruption.l1	-0.05664	0.04926	-1.15	0.261
dlfeddebt.l2	0.01754	0.45175	0.04	0.969
dunemp.l2	0.02207	0.01270	1.74	0.095
ddlimports.l2	-0.43628	0.24448	-1.78	0.086
ddlexports.l2	0.08489	0.22611	0.38	0.710
dlfdi.l2	0.05709	0.20394	0.28	0.782
ddlbgdp.l2	2.28075	0.86303	2.64	0.014 *
dcpi.l2	0.00426	0.01311	0.33	0.748
dcorruption.l2	-0.01273	0.04394	-0.29	0.774
dlfeddebt.l3	0.67843	0.48022	1.41	0.170
dunemp.l3	0.01626	0.01354	1.20	0.241
ddlimports.l3	-0.25106	0.26439	-0.95	0.351
ddlexports.l3	0.27664	0.23952	1.15	0.259
dlfdi.l3	0.30392	0.21546	1.41	0.171
ddlbgdp.l3	1.48464	0.79820	1.86	0.075
dcpi.l3	0.00723	0.01352	0.53	0.598
dcorruption.l3	0.04325	0.04186	1.03	0.311
dlfeddebt.l4	0.29943	0.51892	0.58	0.569
dunemp.l4	-0.00272	0.01349	-0.20	0.842
ddlimports.l4	0.32233	0.25220	1.28	0.213
ddlexports.l4	-0.12176	0.22680	-0.54	0.596
dlfdi.l4	0.22428	0.21617	1.04	0.309
ddlbgdp.l4	0.10389	0.78544	0.13	0.896
dcpi.l4	-0.00710	0.01462	-0.49	0.632
dcorruption.l4	0.01632	0.04082	0.40	0.693
dlfeddebt.l5	0.49571	0.56151	0.88	0.386
dunemp.l5	-0.01390	0.01568	-0.89	0.384
ddlimports.l5	0.41514	0.24752	1.68	0.106

ddlimports.15	0.41514	0.24752	1.68	0.106
ddlexports.15	-0.33807	0.25263	-1.34	0.193
dlfdi.15	0.26873	0.22288	1.21	0.239
ddl GDP.15	1.32553	0.91527	1.45	0.160
dcpi.15	-0.03648	0.01465	-2.49	0.020 *
dcorruption.15	-0.00183	0.04587	-0.04	0.968
dlfeddebt.16	0.81697	0.44844	1.82	0.080 .
dunemp.16	-0.03600	0.01400	-2.57	0.016 *
ddlimports.16	-0.10371	0.25652	-0.40	0.689
ddlexports.16	0.03501	0.20776	0.17	0.868
dlfdi.16	0.29548	0.23838	1.24	0.227
ddl GDP.16	0.49046	0.63876	0.77	0.450
dcpi.16	-0.00606	0.00998	-0.61	0.549
dcorruption.16	0.02332	0.04535	0.51	0.612
dlfeddebt.17	-0.25738	0.38737	-0.66	0.512
dunemp.17	-0.03063	0.01696	-1.81	0.083 .
ddlimports.17	-0.30171	0.24034	-1.26	0.221
ddlexports.17	0.31740	0.21973	1.44	0.161
dlfdi.17	0.17192	0.23191	0.74	0.465
ddl GDP.17	-0.00892	0.70185	-0.01	0.990
dcpi.17	-0.00150	0.01057	-0.14	0.888
dcorruption.17	-0.08189	0.05309	-1.54	0.136
dlfeddebt.18	-0.08915	0.41015	-0.22	0.830
dunemp.18	-0.01227	0.01829	-0.67	0.508
ddlimports.18	0.23459	0.23537	1.00	0.328
ddlexports.18	-0.04220	0.20301	-0.21	0.837
dlfdi.18	0.39359	0.21459	1.83	0.079 .
ddl GDP.18	-0.16504	0.70546	-0.23	0.817
dcpi.18	-0.01549	0.01139	-1.36	0.186
dcorruption.18	-0.03539	0.05981	-0.59	0.559
dlfeddebt.19	-0.00498	0.41841	-0.01	0.991
dunemp.19	-0.01664	0.01480	-1.12	0.272
ddlimports.19	0.38481	0.23764	1.62	0.118
ddlexports.19	-0.42277	0.24345	-1.74	0.095 .
dlfdi.19	0.15899	0.24701	0.64	0.526
ddl GDP.19	0.23265	0.64362	0.36	0.721
dcpi.19	-0.02101	0.01140	-1.84	0.077 .
dcorruption.19	0.02469	0.05109	0.48	0.633
const	-0.05271	0.03348	-1.57	0.128

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.0241 on 25 degrees of freedom
Multiple R-squared: 0.695, Adjusted R-squared: -0.185
F-statistic: 0.789 on 72 and 25 DF, p-value: 0.783