**Appendices**

**Appendix I:** Estimating the optimal order of VARVAR Lag Order Selection Criteria

Endogenous variables: LNRGDP LNGK LNAID LNEXD LNEXHE LNEXT INF

Exogenous variables: C

Sample: 1974 2017

Included observations: 44

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Lag | LogL | LR | FPE | AIC | SC | HQ |
| 0 | -191.7097 | NA | 4.87e-05 | 9.935485 | 10.23104 | 10.04235 |
|  |  |  |  |  |  |  |
| 1 | 51.87551 | 389.7363 | 3.01e-09 | 0.206225 | 2.570656\* | 1.061128 |
|  |  |  |  |  |  |  |
| 2 | 89.97861 | 47.62887 | 6.54e-09 | 0.751070 | 5.184378 | 2.354014 |
|  |  |  |  |  |  |  |
| 3 | 156.5457 | 59.91042 | 5.41e-09 | -0.127287 | 6.374899 | 2.223698 |
|  |  |  |  |  |  |  |
| 4 | 294.3761 | 75.80670\* | 3.65e-10\* | -4.568805\* | 4.002258 | -1.469779\* |

\* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information

criterion

SC: Schwarz information

criterion

HQ: Hannan-Quinn information criterion

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**Appendix II:** Variable Addition Test (OLS case)

*Dependent variable is DLNRGDP*

*List of the variables added to the regression:*

*LNRGDP (-1) LNGK (-1) LNAID (-1) LNEXD (-1) LNEXHE (-1) LNEXT (-1) INF (-1) 44 observations used for estimation from 1974 to 2017*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Regressorss | Coefficients | Standard error | T-ratio | Probability |
| DLNRGDP(-1) | 0.243693 | 0.278681 | 0.874450 | 0.3977 |
| DLNRGDP(-2) | -0.255801 | 0.201581 | -1.268971 | 0.2267 |
| DLNGK(-1) | -0.202101 | 0.136565 | -1.479890 | 0.1627 |
| DLNGK(-2) | -0.104219 | 0.089041 | -1.170454 | 0.2628 |
| DLNAID(-1) | 0.009261 | 0.036862 | 0.251239 | 0.8056 |
| DLNAID(-2) | 0.016717 | 0.039523 | 0.422973 | 0.6792 |
| DLNEXD(-1) | 0.036107 | 0.037306 | 0.967864 | 0.3508 |
| DLNEXD(-2) | 0.032630 | 0.030453 | 1.071494 | 0.3034 |
| DLNEXHE(-1) | -0.106136 | 0.141242 | -0.751446 | 0.4658 |
| DLNEXHE(-2) | -0.178493 | 0.114760 | -1.555365 | 0.1439 |
| DLNEXT(-1) | 6.90E-05 | 0.062831 | 0.001098 | 0.9991 |
| DLNEXT(-2) | 0.006358 | 0.061949 | 0.102635 | 0.9198 |
| DINF(-1) | -0.002474 | 0.001641 | -1.507385 | 0.1556 |
| DINF(-2) | -4.17E-05 | 0.000913 | -0.045630 | 0.9643 |
| LNRGDP(-1) | -1.134579 | 0.372569 | -3.045282 | 0.0094 |
| LNGK(-1) | 0.491741 | 0.143134 | 3.435533 | 0.0044 |
| LNAID(-1) | -0.043854 | 0.055221 | -0.794146 | 0.4414 |
| LNEXD(-1) | -0.064144 | 0.042918 | -1.494547 | 0.1589 |
| LNEXHE(-1) | 0.285963 | 0.194401 | 1.470994 | 0.1651 |
| LNEXT(-1) | -0.040818 | 0.061090 | -0.668158 | 0.5157 |
| INF(-1) | 0.005536 | 0.003201 | 1.729747 | 0.1073 |
| C | 7.837333 | 3.647870 | 2.148468 | 0.0511 |
|  |  |  |  |  |

* *Joint test of zero restrictions on the coefficients of additional variables:*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *\** | *Lagrange Multiplier Statistic* | *CHSQ ( 7)* | | *=* | 65.71797 *[0.000]* |
| *\** | *Likelihood Ratio Statistic* | *CHSQ* | *( 7)* | *=* | 89.35721 *[0.000]* |
| *\** | F Statistic | F (7, | 15) | = | 9.388 [0.000] |

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**Appendix III**: Diagnostic Test for the Long Run

Autoregressive Distributed Lag Estimates

ARDL (1, 0, 0, 2, 2, 0, 0) selected based on Akaike Information Criterion

|  |  |  |
| --- | --- | --- |
| *Test Statistics* | *LM Version* | *F Version* |
| Serial Correlation | CHSQ( 1 ) = 3.9989 [0.1354] | F( 1, 35) = 1.7495 |
|  |  | [0.1887] |
| Functional Form | CHSQ( 1) = 5.8677 [0.0532] | F (1, 35) = 2.4965 |
|  |  | [0.0969] |
| Normality | CHSQ(2) = 0.23279 [0.890122] | Not applicable |
|  |  |  |
| Heteroscedasticity | CHSQ( 1) = 8.1414 [0.2279] | F( 1, 37) = 1.4001 |
|  |  |  |

*Lagrange multiplier test of residual serial correlation*

*Ramsey's RESET test using the square of the fitted values*

*Based on a test of skewness and kurtosis of residuals*

Based on the regression of squared residuals on squared fitted values

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|  |  |  |  |
| --- | --- | --- | --- |
| *R-Squared* | *0.998319* | *R-Squared* | 0.997703 |
| *S.E of Regression* | 0.034107 | *F-stat. F (14, 23 )* | 1619.671 *[0.000]* |
| *Mean of Dependent Variable* | 12.32627 | *S.D of Dependent Variable* | 0.711583 |
| *Residual Sum of Squares* | 0.034898 | *Equation Log-Likelihood* | 89.35721 |
| *Akaike Info.Criterion* | -3.683677 | *Schwarez Bayesian Criterion* | -3.187199 |
| *DW-statistic* | *2.297730* |  |  |

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**Appendix IV**: Estimated Long Run Coefficients using the ARDL Approach

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ARDL (1, 0, 0, 2, 2, 0, 0), selected based on Akaike information criterion (AIC) Dependent variable is *lnRGDP*

44 observations used for estimation from 1974 to 2017

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|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Regressorss | Coefficients | | Standard error | | T-ratio | Probability | | |
| *LNGK* | *0.277782* | | *0.044000* | | *6.313209* | *0.0000* | | |
| *LNAID* | *-0.058661* | | *0.018955* | | *-3.094804* | *0.0042* | | |
| *LNEXD* | *-0.089451* | | *0.015507* | | *-5.768575* | *0.0000* | | |
| *LNEXHE* | *0.397666* | | *0.034984* | | *11.367015* | *0.0000* | | |
| *LNEXT* | *-0.098263* | | *0.031894* | | *-3.080921* | *0.0044* | | |
| *INF* | *0.001433* | | *0.000925* | | *1.548245* | *0.1320* | | |
| *C* | *8.603722* | | *0.402023* | | *21.401095* | *0.0000* | | |
| R-squared | | *0.998319* | | Mean dependent variable | | | 12.32627 |
| Adjusted R-squared | | 0.997703 | | S.D. dependent variable | | | 0.711583 |
| S.E. of regression | | 0.034107 | | Akaike info criterion | | | -3.683677 |
| Sum squared residual | | 0.034898 | | Schwarz criterion | | | -3.187199 |
| Log likelihood | | 89.35721 | | DW-statistics | | | *2.297730* |
| F-statistic | | 1619.671 *[0.000]* | |  | | |  |

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**Appendix V:** Error Correction Representation for the Selected ARDL Model

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

ARDL (1, 0, 2, 2, 2, 0, 0) selected based on Akaike information criterion (AIC) Dependent variable is *dlnRGDP*

44 observations used for estimation from 1974 to 2017

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Regressorss | Coefficients | Standard error | T-ratio | Probability |
| *dlnGK* | *0.209950* | *0.041867* | *5.014652* | *0.0000* |
| *dlnAID* | *-0.100715* | *0.024522* | *-4.107118* | *0.0003* |
| *dlnEXD* | *-0.055339* | *0.020850* | *-2.654178* | *0.0123* |
| *dlnEXD1* | *0.037657* | *0.020241* | *1.860387* | *0.0720* |
| *dlnEXHE* | *0.286488* | *0.076431* | *3.748301* | *0.0007* |
| *dlnEXHE1* | *-0.010221* | *0.074436* | *-0.137308* | *0.8916* |
| *dlnEXT* | *-0.077853* | *0.058948* | *-1.320711* | *0.1960* |
| *dINF* | *0.001976* | *0.000602* | *3.282269* | *0.0025* |
| *dCONS* | *0.012666* | *0.012750* | *0.993398* | *0.3280* |
| *ECM(-1)* | *-0.846502* | *0.192044* | *-4.407857* | *0.000* |

*ECM = LNRGDP - 0.28*\**LNGK + 0.06*\**LNAID + 0.09*\**LNEXD - 0.40*\**LNEXHE + 0.09*\**LNEXT - 0.001*\**INF - 8.60*\**constant*

*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\**

|  |  |  |  |
| --- | --- | --- | --- |
| *R-squared* | *0.72467* | *Mean dependent variable* | *0.05634* |
| *Adjusted R-squared* | *0.64724* | *S.D. dependent variable* | *0.06551* |
| *S.E. of regression* | *0.03891* | *Akaike info criterion* | *-3.45091* |
| *Sum squared residual* | *0.04845* | *Schwarz criterion* | *-3.03718* |
| *Log likelihood* | *82.46902* | *DW-statistics* | *1.76595* |
| *F-statistic* | *9.3583 [0.000]* |  |  |

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*R-Squared and R-Bar-Squared measures refer to the dependent variable*

*DLNRGDP and in cases where the error correction model is highly*

*Restricted, these measures could become negative.*