IMPACT OF DEFENCE SPENDING, INTERNAL THREAT, POLITICAL INSTABILITY AND ARMS IMPORTATION ON ECONOMIC GROWTH IN NIGERIA

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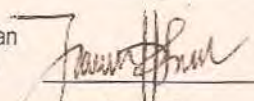
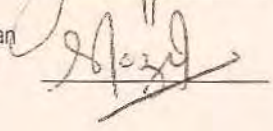
Pemeriksa Luar *(External Examiner)*	: Prof. Dr. Muzafar Shah Habibullah	Tandatangan *(Signature)*	
Pemeriksa Dalam *(Internal Examiner)*	: Assoc. Prof. Dr. Nor' Aznin Abu Bakar	Tandatangan *(Signature)*	

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ABSTRACT

The existence of internal threat, political instability and arms importation has led to the rise in defence expenditure in Nigeria. Whether defence expenditure, with or without threat has a benign or malign impact on the economic growth, is a matter that needs rigorous academic investigation. The objective of this study include examining the impacts of defence expenditure on economic growth in the presence of threats, political instability and arms importation in Nigeria. It also examines the impacts of defence research and development, defence components on the Nigeria`s economic growth. In addition it examines the asymmetric causal relationship between defence expenditure and economic growth in Nigeria. Using the robust Autoregressive Distributive Lag (ARDL) model, and asymmetric causality approach. The results reveal that defence expenditure-internal threat and defence-political instability interactions both have positive and significant impacts on economic growth. On the contrary, it reveals that defence arms import interaction has a significant and negative impact on growth in Nigeria. However, the impact of defence Research and Development on economic growth it is not significant as a result of insufficient funding. The result furthermore found that the causation between defence expenditure on economic growth in Nigeria is unidirectional from defence to economic growth. This implies that defence expenditure stimulates growth during the time of threat and civil unrest. The study recommends a revisit on the funding of defence sector in Nigeria. The current defence budget is grossly inadequate for the defence, considering the threats in Nigeria since it independence and recent threats such as the *"*Boko Haram*"* and Niger Delta Militancy among others. Regarding the defence R&D, proper funding, as well as management should be considered on Defence Industrial Cooperation of Nigeria to avoid over dependence on foreign sources.

Keywords: defence, internal threat, economic growth, autoregressive distributive lag model

ABSTRAK

Kewujudan ancaman dalaman, ketidakstabilan politik, dan pengimportan senjata telah meningkatkan perbelanjaan pertahanan di Nigeria. Sama ada perbelanjaan pertahanan, dengan atau tanpa ancaman mempunyai kesan benigna atau buruk terhadap pertumbuhan ekonomi, adalah satu perkara yang memerlukan siasatan akademik yang padu. Kajian ini mengkaji kesan perbelanjaan pertahanan terhadap pertumbuhan ekonomi dalam situasi wujudnya ancaman, ketidakstabilan politik, dan pengimportan senjata di Nigeria. Ia juga menyiasat impak penyelidikan dan pembangunan pertahanan, iaitu komponen pertahanan, terhadap pertumbuhan ekonomi Nigeria. Selain itu, ia turut menilai hubungan sebab dan akibat yang asimetri antara perbelanjaan pertahanan dan pertumbuhan ekonomi di Nigeria. Menggunakan model Autoregresif Lag Teredar (ARDL) yang jitu dan pendekatan sebab akibat asimetri, keputusan kajian mendedahkan bahawa interaksi perbelanjaan pertahanan-ancaman dalaman dan pertahanan-ketidakstabilan politik mempunyai kesan positif dan signifikan terhadap pertumbuhan ekonomi. Sebaliknya, interaksi import senjata pertahanan mempunyai kesan yang signifikan dan negatif terhadap pertumbuhan. Walau bagaimanapun, kesan penyelidikan pertahanan dan pembangunan terhadap pertumbuhan ekonomi tidak signifikan akibat pembiayaan yang tidak mencukupi. Hasil kajian juga mendapati kesan perbelanjaan pertahanan terhadap pertumbuhan ekonomi adalah satu arah, yang menunjukkan bahawa perbelanjaan pertahanan merangsang pertumbuhan pada zaman ancaman dan rusuhan awam. Kajian ini mencadangkan penerokaan semula terhadap pembiayaan sektor pertahanan di Nigeria. Bajet pertahanan semasa adalah tidak memadai untuk pertahanan disebabkan oleh ancaman di Nigeria sejak kemerdekaan dan ancaman baru-baru ini seperti Boko Haram dan Militan Delta Niger antara lainnya. Mengenai penyelidikan dan pembangunan pertahanan, pembiayaan yang betul serta pengurusan perlu mempertimbang Kerjasama Pertahanan Industri Nigeria untuk mengelakkan terlalu bergantung kepada sumber luar.

Kata kunci: perbelanjaan pertahanan, ancaman dalaman, pertumbuhan ekonomi, model autoregresif lag teredar

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LIST OF ABBREVIATIONS

ADF	Augmented Dickey Fuller
APC	Arewa People's Congress
ARDL	Autoregressive Distributed Lag
BRIC	Britain Russia, India and China
CBN	Central Bank of Nigeria
COMA	Coalition for Militant Action
CUSUM	Cumulative sum of Recursive Residuals
CUSUMQ	Cumulative sum of Recursive Residuals Square
DH	Defence Headquarters
DICON	Defence Industrial Cooperation of Nigeria
ECT	Error Correction Term
FDI	Foreign Direct Investment
GPI	Global Peace Index
ICRG	International Country Risk Guide
IMF	International Monetary Fund
IVF	Iduwini Volunteer Force
LDCs	Less Developed Countries
MASSOB	Movement for the Actualization of the Sovereign State of Biafra
MEND	Movement for the Emancipation of the Niger Delta
MINT	Mexico, Indonesia, Nigeria and Turkey
MoD	Ministry of Defence
MOSOP	Movement for the Survival of the Ogoni People
MSSND	Movement for the Self-governing State of the Niger Delta
NDA	Nigerian Defence Academy
NDCG	Niger Delta Coastal Guerillas
NDMFS	Niger Delta Militant Force Squad
NDPSF	Niger Delta People's Salvation Front
NHIS	National Health Insurance Scheme
NPC	National Planning Commission
OECD	Organization of Economic Cooperation and Development
OPC	Oodua People's Congress
OPEC	Organization Petroleum Exporting Countries
PKO`s	Peace Keeping Operations
PPF	Production Possibility Frontier
R&D	Research and Development
SAARC	South Asian Association for Regional Cooperation
SAP	Structural Adjustment Programmes
SIPRI	Stockholm International Peace Research Institute
TCC	Troops Contributing Countries
TRADOC	Training and Doctrine
UN	United Nations
UNAMSIL	United Nations Mission in Sierra Leon

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Economic growth is a much-desired goal of every nation of the world. The need to study economic growth in countries became more attractive at the end of the Second World War. Then it became glaring that some nations experienced growth while others experienced either very minimal or no growth or even negative growth (Easterly, 2001). The search for economic growth started from the works of Adam Smith, who led an enquiry into the 'Wealth of Nations' and Thomas Malthus, who postulated that population growth would affect economic growth. To the view of scholars, such as Lucas (1988) and Rostow (1960), investment in dams, roads and machines would lead to growth in backwards countries. Solow (1956) however, argues that investment in tools would not lead to growth, but it is technological change that would stimulate growth in a weak economy. This debate persists where economists built more sophisticated models in which one or more of the factors are endogenously determined (Todaro & Smith, 2003).

While the search for economic growth continues, there has been rising debate over the impact of government expenditure on economic growth. Barro (1989) for instance, found the coefficient of government expenditure on economic growth frequently non-significant. When the impact of government expenditure is narrowed down to the field of defence expenditure on growth, an array of conclusions are reached using varying empirical and statistical methods. From the time Benoit (1973)

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APPENDICES

Appendix A

Economic Growth Model

Autoregressive Distributed Lag Estimates

ARDL(2,2,2,2,1,2,2,2,2) selected based on Schwarz Bayesian Criterion

Dependent variable is LRGDPK
30 observations used for estimation from 1985 to 2014

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LRGDPK(-1)	-.22327	.22533	-.99085[.378]
LRGDPK(-2)	.54713	.15868	3.4480[.026]
LDE	.071255	.12119	.58796[.588]
LDE(-1)	-.92304	.15321	-6.0247[.004]
LDE(-2)	-.71640	.17637	-4.0619[.015]
LAI	.54872	2.3368	.23482[.826]
LAI(-1)	18.8811	3.0750	6.1402[.004]
LAI(-2)	15.3946	3.5852	4.2939[.013]
PI	-.030959	.018709	-1.6547[.173]
PI(-1)	-.11410	.026987	-4.2282[.013]
PI(-2)	-.054297	.021906	-2.4787[.068]
THR	-.13571	.031182	-4.3521[.012]
THR(-1)	-.11118	.029936	-3.7139[.021]
LDETHR	.24389	.080631	3.0248[.039]
LDETHR(-1)	.35524	.12305	2.8870[.045]
LDETHR(-2)	-.084378	.054376	-1.5518[.196]
LDEPI	.11730	.089878	1.3051[.262]
LDEPI(-1)	.14550	.078070	1.8637[.136]
LDEPI(-2)	.34999	.079839	4.3838[.012]
LDEAI	-.50746	2.3343	-.21739[.839]
LDEAI(-1)	-18.8437	3.0721	-6.1338[.004]
LDEAI(-2)	-15.3528	3.5813	-4.2869[.013]
LEDU	.74256	.26272	2.8265[.048]
LEDU(-1)	-1.3985	.37957	-3.6846[.021]
LEDU(-2)	.68682	.22451	3.0593[.038]
INPT	71.7628	12.0927	5.9344[.004]

R-Squared	.99837	R-Bar-Squared	.98816
S.E. of Regression	.029264	F-Stat. F(25,4)	97.8230[.000]
Mean of Dependent Variable	6.5142	S.D. of Dependent Variable	.26895
Residual Sum of Squares	.0034254	Equation Log-likelihood	93.5978
Akaike Info. Criterion	67.5978	Schwarz Bayesian Criterion	49.3822
DW-statistic	3.1059		

Testing for existence of a level relationship among the variables in the ARDL model

F-statistic	95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound
8.5486	2.8218	4.3963	2.3301	3.7152

W-statistic	95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound
76.9375	25.3963	39.5670	20.9707	33.4365

Diagnostic Tests

Test Statistics	LM Version	F Version
A:Serial Correlation	CHSQ(1) = 2.4862[.115]	F(1,2) = .18073[.712]
B:Functional Form	CHSQ(1) = .034747[.852]	F(1,3) = .0034787[.957]

```
*                     *                          *                              *
* C:Normality         *CHSQ(2)  =   3.9834[.136]*       Not applicable         *
*                     *                          *                              *
* D:Heteroscedasticity*CHSQ(1)  =  .068930[.793]*F(1,27)      =  .064329[.802]*
*******************************************************************************
   A:Lagrange multiplier test of residual serial correlation
   B:Ramsey's RESET test using the square of the fitted values
   C:Based on a test of skewness and kurtosis of residuals


          Estimated Long Run Coefficients using the ARDL Approach
     ARDL(2,2,2,2,1,2,2,2,2) selected based on Schwarz Bayesian Criterion
*******************************************************************************
 Dependent variable is LRGDPK
 30 observations used for estimation from 1985 to 2014
*******************************************************************************
 Regressor               Coefficient       Standard Error         T-Ratio[Prob]
 LDE                        -2.3193             .35570            -6.5205[.003]
 LAI                        51.5043             7.9648             6.4665[.003]
 PI                         -.29485            .061146            -4.8220[.009]
 THR                        -.36514            .064642            -5.6487[.005]
 LDE_THR                     .76130             .16246             4.6860[.009]
 LDE_PI                      .90631             .18769             4.8287[.008]
 LDE_LAI                   -51.3263             7.9445            -6.4606[.003]
 LEDU                       .045627             .18305             .24926[.815]
 INPT                      106.1354            16.1307             6.5797[.003]
*******************************************************************************

Testing for existence of a level relationship among the variables in the ARDL model
*******************************************************************************
 F-statistic  95% Lower Bound  95% Upper Bound  90% Lower Bound  90% Upper Bound
    8.5486         2.8218           4.3963           2.3301           3.7152

 W-statistic  95% Lower Bound  95% Upper Bound  90% Lower Bound  90% Upper Bound
   76.9375         25.3963          39.5670          20.9707          33.4365
*******************************************************************************
 If the statistic lies between the bounds, the test is inconclusive. If it is
 above the upper bound, the null hypothesis of no level effect is rejected. If
 it is below the lower bound, the null hypothesis of no level effect can't be
 rejected. The critical value bounds are computed by stochastic simulations
 using 20000 replications.

          Error Correction Representation for the Selected ARDL Model
     ARDL(2,2,2,2,1,2,2,2,2) selected based on Schwarz Bayesian Criterion
*******************************************************************************
 Dependent variable is dLRGDPK
 30 observations used for estimation from 1985 to 2014
*******************************************************************************
 Regressor               Coefficient       Standard Error         T-Ratio[Prob]
 dLRGDPK1                   -.54713             .15868            -3.4480[.005]
 dLDE                       .071255             .12119             .58796[.567]
 dLDE1                      -.71640             .17637            -4.0619[.002]
 dLAI                        .54872             2.3368             .23482[.818]
 dLAI1                     -15.3946             3.5852            -4.2939[.001]
 dPI                       -.030959            .018709            -1.6547[.124]
 dPI1                      -.054297            .021906            -2.4787[.029]
 dTHR                       -.13571            .031182            -4.3521[.001]
 dLDETHR                     .24389            .080631             3.0248[.011]
 dLDETHR1                   .084378            .054376             1.5518[.147]
 dLDEPI                      .11730            .089878             1.3051[.216]
 dLDEPI1                    -.34999            .079839            -4.3838[.001]
 dLDEAI                     -.50746             2.3343            -.21739[.832]
 dLDEAI1                    15.3528             3.5813             4.2869[.001]
 dLEDU                       .74256             .26272             2.8265[.015]
 dLEDU1                     -.68682             .22451            -3.0593[.010]
 ecm(-1)                    -.67614             .15000            -4.5076[.001]
*******************************************************************************
```

Appendix B

Research and Development Model

```
                Autoregressive Distributed Lag Estimates
          ARDL(1,2,0,0) selected based on Schwarz Bayesian Criterion
*****************************************************************************
 Dependent variable is LRGDPK
 31 observations used for estimation from 1984 to 2014
*****************************************************************************
 Regressor              Coefficient       Standard Error         T-Ratio[Prob]
 LRGDPK(-1)                .84832             .10765             7.8806[.000]
 LLFT                     24.5563             4.3913             5.5921[.000]
 LLFT(-1)                -41.8992             7.6338            -5.4886[.000]
 LLFT(-2)                 23.9600             4.2660             5.6165[.000]
 LINV                      .17553            .090313             1.9435[.063]
 LRD                     -.042581            .011518            -3.6968[.001]
 INPT                      .91337             .51293             1.7807[.087]
*****************************************************************************
 R-Squared                  .96490   R-Bar-Squared                    .95950
 S.E. of Regression        .053359   F-Stat.    F(4,26)    178.6763[.000]
 Mean of Dependent Variable  6.5107   S.D. of Dependent Variable      .26514
 Residual Sum of Squares    .074027   Equation Log-likelihood        49.5912
 Akaike Info. Criterion     44.5912   Schwarz Bayesian Criterion     41.0062
 DW-statistic                1.7379   Durbin's h-statistic      .91141[.362]
*****************************************************************************

Testing for existence of a level relationship among the variables in the ARDL model
*****************************************************************************
 F-statistic  95% Lower Bound  95% Upper Bound  90% Lower Bound  90% Upper Bound
    7.0973         3.7320           5.0460           3.0233           4.1943

 W-statistic  95% Lower Bound  95% Upper Bound  90% Lower Bound  90% Upper Bound
    4.3890         14.9281          20.1841          12.0933          16.7770
*****************************************************************************
 If the statistic lies between the bounds, the test is inconclusive. If it is
 above the upper bound, the null hypothesis of no level effect is rejected. If
 it is below the lower bound, the null hypothesis of no level effect can't be
 rejected. The critical value bounds are computed by stochastic simulations
 using 20000 replications.

                              Diagnostic Tests
*****************************************************************************
*    Test Statistics  *        LM Version       *          F Version          *
*****************************************************************************
*                     *                         *                             *
* A:Serial Correlation*CHSQ(1)  =   .72142[.396]*F(1,25)      =   .59566[.447]*
*                     *                         *                             *
* B:Functional Form   *CHSQ(1)  =  1.3947[.238]*F(1,25)      =  1.1778[.288]*
*                     *                         *                             *
* C:Normality         *CHSQ(2)  =   .33719[.845]*       Not applicable        *
*                     *                         *                             *
* D:Heteroscedasticity*CHSQ(1)  =   .61783[.432]*F(1,29)      =   .58973[.449]*
*****************************************************************************
   A:Lagrange multiplier test of residual serial correlation
   B:Ramsey's RESET test using the square of the fitted values
   C:Based on a test of skewness and kurtosis of residuals
   D:Based on the regression of squared residuals on squared fitted values
```

Estimated Long Run Coefficients using the ARDL Approach
ARDL(1,2,0,0) selected based on Schwarz Bayesian Criterion

Dependent variable is LRGDPK
30 observations used for estimation from 1985 to 2014

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LLFT	23.0122	6.5785	3.4981[.002]
LINV	-.73512	.36742	-2.0008[.057]
LRD	-.28833	.16231	-1.7764[.089]
INPT	-8.4469	3.8348	-2.2027[.038]

Testing for existence of a level relationship among the variables in the ARDL model

F-statistic	95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound
2.2360	3.7038	5.0495	3.0123	4.1752

W-statistic	95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound
8.9439	14.8151	20.1980	12.0492	16.7008

If the statistic lies between the bounds, the test is inconclusive. If it is above the upper bound, the null hypothesis of no level effect is rejected. If it is below the lower bound, the null hypothesis of no level effect can't be rejected. The critical value bounds are computed by stochastic simulations using 20000 replications.

Error Correction Representation for the Selected ARDL Model
ARDL(1,1,2,0,0) selected based on Schwarz Bayesian Criterion

Dependent variable is dLRGDPK
30 observations used for estimation from 1985 to 2014

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
dLRGDPK1	-.54713	.15868	-3.4480[.005]
dLLFT	10.7477	3.4844	3.0845[.005]
dLLFT1	-11.7444	3.6366	-3.2295[.004]
dLINV	-.11887	.051638	-2.3019[.030]
dLRD	-.046621	.012458	-3.7424[.001]
ecm(-1)	-.16170	.080840	-2.0002[.057]

Model B

```
                Autoregressive Distributed Lag Estimates
       ARDL(1,2,0,0,0,0) selected based on Schwarz Bayesian Criterion
*****************************************************************************
 Dependent variable is LRGDPK
 30 observations used for estimation from 1985 to 2014
*****************************************************************************
 Regressor             Coefficient       Standard Error         T-Ratio[Prob]
 LRGDPK(-1)                .46048            .12583             3.6595[.001]
 LLFT                     13.2610           4.5643              2.9054[.008]
 LLFT(-1)                -22.9682           7.3133             -3.1406[.005]
 LLFT(-2)                 13.9233           3.9062              3.5644[.002]
 LINV                     -.10289          .048722             -2.1119[.047]
 LEXA                      1.7432           .73503              2.3716[.027]
 LEXAF                    -1.6882           1.4861             -1.1360[.269]
 LEXN                      1.7032           1.6081              1.0591[.302]
 INPT                     -8.1306           1.5588             -5.2159[.000]
*****************************************************************************
 R-Squared                    .97896   R-Bar-Squared                   .97094
 S.E. of Regression          .045849   F-Stat.    F(8,21)    122.1135[.000]
 Mean of Dependent Variable   6.5142   S.D. of Dependent Variable      .26895
 Residual Sum of Squares     .044144   Equation Log-likelihood        55.2542
 Akaike Info. Criterion      46.2542   Schwarz Bayesian Criterion     39.9488
 DW-statistic                 1.9716   Durbin's h-statistic      .10725[.915]
*****************************************************************************

Testing for existence of a level relationship among the variables in the ARDL model
*****************************************************************************
 F-statistic  95% Lower Bound  95% Upper Bound  90% Lower Bound  90% Upper Bound
    4.9350         3.1173          4.6127          2.5745          3.8443

 W-statistic  95% Lower Bound  95% Upper Bound  90% Lower Bound  90% Upper Bound
   29.6103        18.7037         27.6759         15.4469         23.0660
*****************************************************************************
 If the statistic lies between the bounds, the test is inconclusive. If it is
 above the upper bound, the null hypothesis of no level effect is rejected. If
 it is below the lower bound, the null hypothesis of no level effect can't be
 rejected. The critical value bounds are computed by stochastic simulations
 using 20000 replications.


                            Diagnostic Tests
*****************************************************************************
*    Test Statistics  *        LM Version       *          F Version          *
*****************************************************************************
*                     *                         *                             *
* A:Serial Correlation*CHSQ(1)  = .0031882[.955]*F(1,20)      = .0021257[.964]*
*                     *                         *                             *
* B:Functional Form   *CHSQ(1)  =   .80002[.371]*F(1,20)      =   .54796[.468]*
*                     *                         *                             *
* C:Normality         *CHSQ(2)  =   3.5095[.173]*       Not applicable        *
*                     *                         *                             *
* D:Heteroscedasticity*CHSQ(1)  =  .044002[.834]*F(1,28)      =  .041129[.841]*
*****************************************************************************
   A:Lagrange multiplier test of residual serial correlation
   B:Ramsey's RESET test using the square of the fitted values
   C:Based on a test of skewness and kurtosis of residuals
   D:Based on the regression of squared residuals on squared fitted values
```

Estimated Long Run Coefficients using the ARDL Approach
ARDL(1,2,0,0,0,0) selected based on Schwarz Bayesian Criterion

Dependent variable is LRGDPK
30 observations used for estimation from 1985 to 2014

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LLFT	7.8146	1.5371	5.0838[.000]
LINV	-.19071	.10184	-1.8727[.075]
LEXA	3.2311	1.5513	2.0829[.050]
LEXAF	-3.1291	2.9606	-1.0569[.303]
LEXN	3.1568	3.0496	1.0352[.312]
INPT	-15.0701	1.9005	-7.9296[.000]

Testing for existence of a level relationship among the variables in the ARDL model

F-statistic	95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound
4.9350	3.1173	4.6127	2.5745	3.8443

W-statistic	95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound
29.6103	18.7037	27.6759	15.4469	23.0660

If the statistic lies between the bounds, the test is inconclusive. If it is above the upper bound, the null hypothesis of no level effect is rejected. If it is below the lower bound, the null hypothesis of no level effect can't be rejected. The critical value bounds are computed by stochastic simulations using 20000 replications.

Error Correction Representation for the Selected ARDL Model
ARDL(1,2,0,0,0,0) selected based on Schwarz Bayesian Criterion

Dependent variable is dLRGDPK
30 observations used for estimation from 1985 to 2014

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
dLRGDPK1	-.44713	.15868	-3.4480[.005]
dLLFT	13.2610	4.5643	2.9054[.008]
dLLFT1	-13.9233	3.9062	-3.5644[.002]
dLINV	-.10289	.048722	-2.1119[.046]
dLEXA	1.7432	.73503	2.3716[.027]
dLEXAF	-1.6882	1.4861	-1.1360[.268]
dLEXN	1.7032	1.6081	1.0591[.301]
ecm(-1)	-.53952	.12583	-4.2876[.000]

Appendix C

Asymmetric Causality

```
DE+ to GDP+
This program performs an asymmetric causality test developed by Hatemi-J (2012).
Reference: Hatemi-J (2012) Asymmetric Causality Tests with an Application, Empirical Economics, 43:447_456

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No performance guarantee is made. Bug reports are welcome.

AhatTU=
 -3.4235088e+010    1.0090531        35.334215       4.2893255e+010    -0.10510747       -71.811229  -4.0487966e+010     0.092886632
  3.1117674e+008    0.00011692263    1.6629096      -2.1101154e+008    -0.00082807344     -0.46311271  2.0094870e+008     0.00067728830
  0.23426455       -6.9186569e-015  -4.6536320e-012  1.2499832         1.6740568e-014   6.0311661e-012   -0.30826727      2.1965732e-014

AhatTR=
 -3.5988419e+010       0.96806206       0.00000000     4.6567596e+010   -0.037566640      0.00000000     -4.7037692e+010     0.069872302
  3.1117674e+008       0.00011692263    1.6629096     -2.1101154e+008   -0.00082807344   -0.46311271      2.0094870e+008     0.00067728830
  0.23426455          -6.9186569e-015  -4.6536320e-012 1.2499832        1.6740568e-014    6.0311661e-012 -0.30826727       2.1965732e-014
----------------------------------------
Information criterion used; lags based on that =Hatemi-J Criterion (HJC) 2.000
Varorder chosen by information criterion (excluding augmentation lag(s)) is 2.000
additional lags=1.000
Wstat = 5.493
Wcriticalvals=
10.733
6.489
4.874


DE- to GDP-
```

```
This program performs an asymmetric causality test developed by Hatemi-J (2012).
Reference: Hatemi-J (2012) Asymmetric Causality Tests with an Application, Empirical Economics, 43:447_456

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proper reference and acknowledgments are provided. For non-Commercial applications only.No performance guarantee is made. Bug reports are
welcome.

AhatTU=
  3.5270072e+009       0.90023908       -1.4528217  -5.4341599e+008     -0.026937212        3.5054291   1.9541471e+009
       84521635.    -0.0011371703        1.0795248  -1.6420204e+008    0.00071734546     -0.085823360   2.2372328e+008
     -0.16367251  -4.0926558e-013  -8.7648350e-012        1.2740392   1.8080829e-013   1.4353625e-011      -0.28874489

AhatTR=
  3.4130834e+009       0.90009028       0.00000000  -3.0898607e+008     -0.025719292        2.0489361   1.6369805e+009
       84521635.    -0.0011371703        1.0795248  -1.6420204e+008    0.00071734546     -0.085823360   2.2372328e+008
     -0.16367251  -4.0926558e-013  -8.7648350e-012        1.2740392   1.8080829e-013   1.4353625e-011      -0.28874489
----------------------------------------
Information criterion used; lags based on that =Hatemi-J Criterion (HJC) 1.000
Varorder chosen by information criterion (excluding augmentation lag(s)) is 1.000
additional lags=1.000
Wstat = 0.248
Wcriticalvals=
20.976
3.986
1.630
```

DE+ to GDP-

This program performs an asymmetric causality test developed by Hatemi-J (2012).
Reference: Hatemi-J (2012) Asymmetric Causality Tests with an Application, Empirical Economics, 43:447_456

AhatTU=

9.1663097e+009	0.81712759	-4.5361582	6.0945202e+010	0.10526717	51.650915	-5.7652022e+010
-1.1914355e+008	-0.00027341947	1.0920909	42281196.	0.00029422555	-0.11315874	20439625.
0.22390637	1.8354227e-015	-7.0936017e-012	1.2551992	1.7744331e-014	5.4520903e-012	-0.28572687

AhatTR=

1.0687393e+010	0.81487290	0.00000000	5.7428947e+010	0.10743971	47.256223	-5.4534834e+010
-1.1914355e+008	-0.00027341947	1.0920909	42281196.	0.00029422555	-0.11315874	20439625.
0.22390637	1.8354227e-015	-7.0936017e-012	1.2551992	1.7744331e-014	5.4520903e-012	-0.28572687

Information criterion used; lags based on that =Hatemi-J Criterion (HJC) 1.000
Varorder chosen by information criterion (excluding augmentation lag(s)) is 1.000
additional lags=1.000
Wstat = 0.032
Wcriticalvals=
12.808
4.843
2.674

DE- to GDP+

This program performs an asymmetric causality test developed by Hatemi-J (2012).
Reference: Hatemi-J (2012) Asymmetric Causality Tests with an Application, Empirical Economics, 43:447_456

AhatTU=

-4.5245367e+010	0.81221691	1.6864994	5.0949606e+010	0.11110042	47.769040	-5.6016106e+010
73436426.	-0.00023554493	1.0872450	-1.4635815e+008	0.00028296827	-0.11973666	2.0245962e+008
-0.16983602	5.3316763e-014	-9.7610322e-012	1.2723172	-5.8023644e-014	1.3377251e-011	-0.28892188

AhatTR=

-4.5108970e+010	0.81318819	0.00000000	5.0651513e+010	0.11023630	49.379056	-5.5626778e+010
73436426.	-0.00023554493	1.0872450	-1.4635815e+008	0.00028296827	-0.11973666	2.0245962e+008
-0.16983602	5.3316763e-014	-9.7610322e-012	1.2723172	-5.8023644e-014	1.3377251e-011	-0.28892188

Information criterion used; lags based on that =Hatemi-J Criterion (HJC) 1.000
Varorder chosen by information criterion (excluding augmentation lag(s)) is 1.000
additional lags=1.000
Wstat = 0.005
Wcriticalvals=
12.714
4.851
2.598

GDP+ to DE+

This program performs an asymmetric causality test developed by Hatemi-J (2012).
Reference: Hatemi-J (2012) Asymmetric Causality Tests with an Application, Empirical Economics, 43:447_456

AhatTU=

3.1117674e+008	1.6629096	0.00011692262	-2.1101154e+008	-0.46311271	-0.00082807345	2.0094870e+008	-0.17516685
-3.4235088e+010	35.334215	1.0090531	4.2893255e+010	-71.811229	-0.10510747	-4.0487966e+010	37.138261
0.23426455	-4.6536320e-012	-6.9186574e-015	1.2499832	6.0311662e-012	1.6740567e-014	-0.30826727	-2.6742868e-012

AhatTR=

3.1863978e+008	1.6449330	0.00000000	-2.0085200e+008	-0.42784977	0.00000000	1.5785145e+008	-0.19447531
-							
-3.4235088e+010	35.334215	1.0090531	4.2893255e+010	-71.811229	-0.10510747	-4.0487966e+010	37.138261
0.23426455	-4.6536320e-012	-6.9186574e-015	1.2499832	6.0311662e-012	1.6740567e-014	-0.30826727	-2.6742868e-012

Information criterion used; lags based on that =Hatemi-J Criterion (HJC) 2.000
Varorder chosen by information criterion (excluding augmentation lag(s)) is 2.000
additional lags=1.000
Wstat = 1.234
Wcriticalvals=
11.466
6.574
4.744

GDP- to DE-

This program performs an asymmetric causality test developed by Hatemi-J (2012).
Reference: Hatemi-J (2012) Asymmetric Causality Tests with an Application, Empirical Economics, 43:447_456

AhatTU=

84521635.	1.0795248	-0.0011371703	-1.6420204e+008	-0.085823360	0.00071734546	2.2372328e+008
3.5270072e+009	-1.4528217	0.90023908	-5.4341599e+008	3.5054291	-0.026937212	1.9541471e+009
-0.16367251	-8.7648350e-012	-4.0926558e-013	1.2740392	1.4353625e-011	1.8080829e-013	-0.28874489

AhatTR=

79301327.	1.0794111	0.00000000	-1.7102882e+008	-0.087793269	-0.00029091346	2.2901594e+008
3.5270072e+009	-1.4528217	0.90023908	-5.4341599e+008	3.5054291	-0.026937212	1.9541471e+009
-0.16367251	-8.7648350e-012	-4.0926558e-013	1.2740392	1.4353625e-011	1.8080829e-013	-0.28874489

Information criterion used; lags based on that =Hatemi-J Criterion (HJC) 1.000
Varorder chosen by information criterion (excluding augmentation lag(s)) is 1.000
additional lags=1.000
Wstat = 0.145
Wcriticalvals=
20.966
3.926
1.794

```
GDP+ to DE-

This program performs an asymmetric causality test developed by Hatemi-J (2012).
Reference: Hatemi-J (2012) Asymmetric Causality Tests with an Application, Empirical Economics, 43:447_456

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AhatTU=
  2.5487545e+008        1.6439418    -0.0014416043  -1.6116037e+008      -0.42952527  -1.6664417e-005   1.4457694e+008      -0.19143700    .
 -3.3638170e+009       -1.5327630       0.95655738   7.0822117e+008        1.9838225     0.0026030504  -3.1546114e+009      -0.35007233     -
      0.25594971  -4.1477742e-012  -1.9591629e-013        1.2455471   4.9968646e-012   2.3821748e-013      -0.30871794  -4.1028943e-013

AhatTR=
  2.7266800e+008        1.6459022       0.00000000  -1.7714361e+008      -0.42918714       0.00000000   1.4912189e+008      -0.19406135   -
 -3.3638170e+009       -1.5327630       0.95655738   7.0822117e+008        1.9838225     0.0026030504  -3.1546114e+009      -0.35007233     -
      0.25594971  -4.1477742e-012  -1.9591629e-013        1.2455471   4.9968646e-012   2.3821748e-013      -0.30871794  -4.1028943e-013
----------------------------------------
Information criterion used; lags based on that =Hatemi-J Criterion (HJC) 2.000
Varorder chosen by information criterion (excluding augmentation lag(s)) is 2.000
additional lags=1.000
Wstat = 0.123
Wcriticalvals=
18.078
7.980
4.965
```

```
GDP- to DE+

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Commercial applications only.
No performance guarantee is made. Bug reports are welcome.

AhatTU=
 -2.7253824e+008        1.6521820    -0.0011958954  -7.8135559e+008      -0.44010476   -0.00027723355   4.5290815e+008      -0.19051167
  5.6882348e+009       -1.5525218       0.94060663   2.6175988e+009        1.9841414    0.00054161131  -1.8196876e+009      -0.28667062    -
  -0.17239514  -7.8331183e-012  -3.0556835e-013        1.2897090   1.1605222e-011   7.7969372e-014      -0.33977152  -3.2285125e-012

AhatTR=
 -2.8875444e+008        1.6537892       0.00000000  -7.8602631e+008      -0.43932069       0.00000000   4.4646671e+008      -0.19330443    -
  5.6882348e+009       -1.5525218       0.94060663   2.6175988e+009        1.9841414    0.00054161131  -1.8196876e+009      -0.28667062    -
 -0.17239514  -7.8331183e-012  -3.0556835e-013        1.2897090   1.1605222e-011   7.7969372e-014      -0.33977152  -3.2285125e-012
----------------------------------------
Information criterion used; lags based on that =Hatemi-J Criterion (HJC) 2.000
Varorder chosen by information criterion (excluding augmentation lag(s)) is 2.000
additional lags=1.000
Wstat = 0.104
Wcriticalvals=
18.028
7.561
4.838
```