ISSN 2348-1196 (print)
International Journal of Computer Science and Information Technology Research ISSN 2348-120X (online)
Vol. 6, Issue 2, pp: (24-27), Month: April - June 2018, Available at: www.researchpublish.com

Dissimilarities in Unit Root Computational Results Using Various Methods and Information Criteria

Gaolu Zou

School of Tourism and Economic Management, Chengdu University, Chengdu, China

Abstract: **There is a close link between the truncation lag and the unit root test power and size. Akaike Information Criterion (AIC) tend to select a small value of lag. The modified AIC (MAIC) may substantially improve the size. GLS detrending may improve the power. A good inference may arise from a conjunction between these two. This paper applied two Hong Kong annual GDP series for the 1970-2016 period. The standard augmented Dickey-Fuller test (ADF) and the Dickey-Fuller GLS (DF-GLS ERS) method were used. It suggests that MAIC may be crucial for the lag selection of DF-type tests.**

Keywords: **Information criterion, lag, power, size, unit root.**

I. INTRODUCTION

The standard augmented Dickey-Fuller test (ADF) is widely used in unit root analyses [1-5]. However, the test may suffer from the power loss as well as severe size distortions and accordingly lead to over-rejection of the unit root hypothesis [6, 7]. There is a close link between the truncation lag, *k*, and how much the power may lose and how much size distortions would occur [8]. Schwarz information criterion (SIC) and Akaike Information Criterion (AIC) tend to select a value of *k* that is too small to obtain a good size [9, 10]. Despite this, a local GLS detrending of the data significantly improves the power [11]. The modified AIC (MAIC) may lead to fewer size distortions. The MAIC performs well. Putting these two methods together produces the much-improved size and power [7]. This paper aims to compare the difference of unit root test results where the ADF, AIC and MAIC are used in four differing groups. Hong Kong GDP series were employed for the experiment.

II. METHODOLOGY

Unit root tests included the standard augmented Dickey-Fuller (ADF) test [1, 2], and the Dickey-Fuller GLS (DF-GLS ERS) method [7, 8, 11-13]. Truncation lags were chosen using the AIC and MAIC.

Tests were divided into four groups: A test using the ADF and AIC, a test using the ADF and MAIC, a test using the DF-GLS ERS and AIC, a test using the DF-GLS ERS and MAIC. The last group was expected to produce the 'best' result.

III. DATA

Data were obtained from United Nations Statistics Division's National Accounts Main Aggregates Database [14]. Two series were GDP at current prices (*GDPCURRENT*) (Hong Kong Dollar, HKD) and GDP at 2010 constant prices (*GDPCONSTANT*) (HKD). Data were annual changes for 1970 to 2016. TABLE II statistically describes the data. Fig. 1. Plotted the two variables, which shows that they were mean nonzero and appeared to contain a trend. GDP in Hong Kong grew quickly from 1970 to 1997. Growth appeared to be smooth since 1998.

ISSN 2348-1196 (print)
International Journal of Computer Science and Information Technology Research ISSN 2348-120X (online)
Vol. 6, Issue 2, pp: (24-27), Month: April - June 2018, Available at: www.researchpublish.com

TABLE I: DESCRIPTIVE STATISTICS

Description	Hong Kong GDP at current prices (Hong Kong Dollar)	Hong Kong GDP at 2010 constant prices (Hong Kong Dollar)
Variable	*GDPCURRENT*	*GDPCONSTANT*
Mean	26.91	27.39
Median	27.56	27.60
Maximum	28.54	28.37
Minimum	23.86	25.91
Std. Dev.	1.42	0.73
Skewness	-0.75	-0.51
Kurtosis	2.21	2.09
Jarque-Bera	5.64	3.68
Probability	0.06	0.16

Notes: Data were in logarithmic terms.

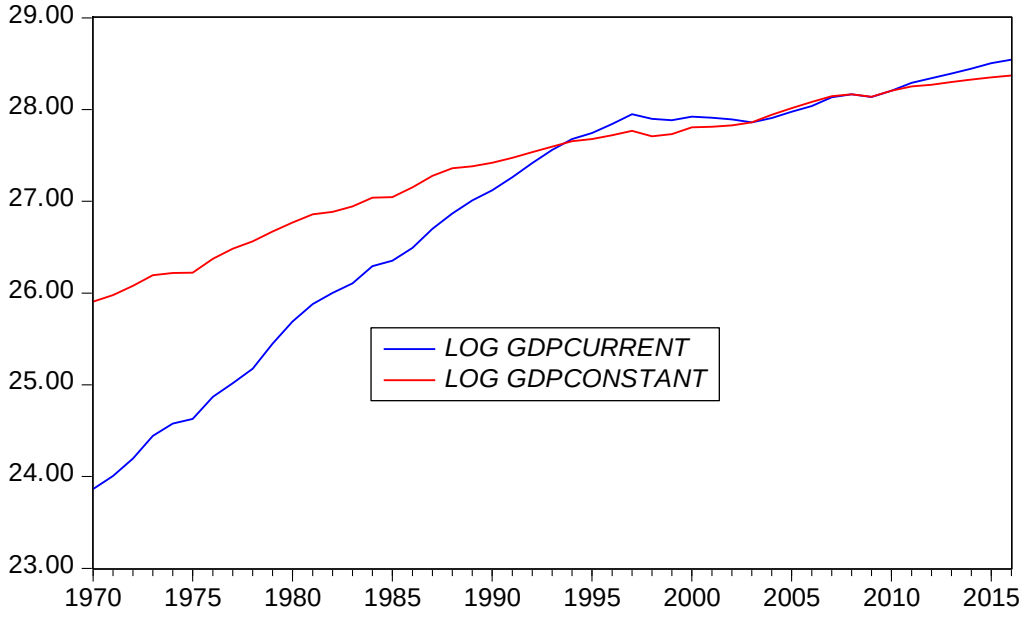

Fig 1: Growth in GDP in Hong Kong (1970-2016)

IV. EMPIRICAL RESULTS

The ADF-AIC conjunction shows that both *GDPCURRENT* and *GDPCONSTANT* contained a unit root (TABLE II). Also, the DF-GLS ERS-AIC conjunction shows that both *GDPCURRENT* and *GDPCONSTANT* contained a unit root (TABLE IV).

The ADF-MAIC conjunction shows that *GDPCURRENT* contained two unit roots and *GDPCONSTANT* contained one (TABLE III). Also, the DF-GLS ERS-MAIC conjunction shows that *GDPCURRENT* contained two unit roots and *GDPCONSTANT* contained one (TABLE V).

TABLE II: UNIT ROOT TESTS USING THE ADF METHOD AND AKAIKE INFORMATION CRITERION

Variable	*k*	Level	*k*	First difference
GDPCURRENT	1	-1.43	0	-4.69***
GDPCONSTANT	0	-1.28	1	-6.15***

Notes: Method used was the standard augmented Dickey-Fuller test (ADF). Truncation lags, *k*, were chosen using the Akaike information criterion (AIC). Following Fig. 1, test equations contained the trend and intercept. **, ***Rejection of a unit root at the 5% and 1% levels, respectively.

ISSN 2348-1196 (print)
International Journal of Computer Science and Information Technology Research ISSN 2348-120X (online)
Vol. 6, Issue 2, pp: (24-27), Month: April - June 2018, Available at: www.researchpublish.com

TABLE III: UNIT ROOT TESTS USING THE ADF METHOD AND MODIFIED AKAIKE INFORMATION CRITERION

Variable	*k*	Level	*k*	First difference	*k*	Second difference
GDPCURRENT	1	-1.43	2	-2.19	0	-8.58***
GDPCONSTANT	0	-1.28	0	-6.06***		

Notes: Method used was still the standard augmented Dickey-Fuller test (ADF). However, truncation lags, *k*, were chosen using the modified Akaike information criterion (MAIC). Following Fig.1, test equations contained the trend and intercept. **, ***Rejection of a unit root at the 5% and 1% levels, respectively.

TABLE IV: UNIT ROOT TESTS USING THE DF-GLS ERS METHOD AND AKAIKE INFORMATION CRITERION

Variable	*k*	Level	*k*	First difference
GDPCURRENT	7	-2.29	0	-4.61***
GDPCONSTANT	3	-0.75	1	-6.21***

Notes: Method used was the Dickey-Fuller GLS detrending test (DF-GLS ERS) [1, 11]; however, truncation lags, *k*, were chosen still using the standard Akaike information criterion (AIC). Following Fig. 1, test equations contained the trend and intercept. **, ***Rejection of a unit root at the 5% and 1% levels, respectively.

TABLE V: UNIT ROOT TESTS USING THE DF-GLS ERS METHOD AND MODIFIED AKAIKE INFORMATION CRITERION

Variable	*k*	Level	*k*	First difference	*k*	Second difference
GDPCURRENT	1	-0.81	2	-2.30***	9	-1.02
GDPCONSTANT	1	-0.87	0	-6.13***		

Notes: Method used was the Dickey-Fuller GLS detrending test (DF-GLS ERS) [1, 11]. Also, truncation lags, *k*, were chosen using the Akaike information criterion (MAIC). Following Fig. 1, test equations contained the trend and intercept. **, ***Rejection of a unit root at the 5% and 1% levels, respectively.

V. CONCLUDING REMARKS

Different conjunctions between unit root tests and the information criteria that were used to select the truncation lag produce differential results. Past studies suggest that the DF test using GLS detrending (DF-GLS ERS) and the modified Akaike information criterion (MAIC) group may lead to the optimal inference.

Using the Hong Kong GDP series, the study examined four cases and found that results between using AIC and using MAIC were inconsistent. However, it seems that test methods applied had consistent results. Therefore, MAIC may be crucial for the lag selection of DF-type tests.

REFERENCES

[1] D. A. Dickey and W. A. Fuller, "Distribution of the Estimators for Autoregressive Time Series with a Unit Root," Journal of the American Statistical Association, vol. 74, no. 386, pp. 427-31, 1979.

[2] D. A. Dickey, D. P. Hasza and W. A. Fuller, "Testing for Unit Roots in Seasonal Time Series," Journal of the American Statistical Association, vol. 79, no. 386, pp. 355-65, 1984.

[3] G. W. Schwert, "Tests for Unit Roots: A Monte Carlo Investigation," Journal of Business & Economic Statistics, vol. 7, no. pp. 147-59, 1989.

[4] R. I. D. Harris, "Testing for Unit Roots Using the Augmented Dickey-Fuller Test : Some Issues Relating to the Size, Power and the Lag Structure of the Test," Economics Letters, vol. 38, no. 4, pp. 381-86, 1992.

[5] S. R. Cunningham, "Unit Root Testing: A Critique from Chaos Theory," Review of Financial Economics, vol. 3, no. 1/2, pp. 1, 1993.

[6] P. Perron and S. Ng, "Useful Modifications to Some Unit Root Tests with Dependent Errors and Their Local Asymptotic Properties," Review of Economic Studies, vol. 63, no. 3, pp. 435-63, 1996.

[7] S. Ng and P. Perron, "Lag Length Selection and the Construction of Unit Root Tests with Good Size and Power," Econometrica, vol. 69, no. 6, pp. 1519-54, 2001.

[8] ———, "Unit Root Tests in Arma Models with Data Dependent Methods for the Selection of the Truncation Lag," Journal of the American Statistical Association, vol. 90, no. 429, pp. 268-81, 1995.

[9] H. Akaike, "A New Look at Statistical Model Identification," IEEE Transactions on Automatic Control, vol. AC19, no. 6, pp. 716-23, 1974.

[10] G. Schwarz, "Estimating the Dimension of a Model," Annals of Statistics, vol. 6, no. 2, pp. 461-64, 1978.

[11] G. Elliott, T. J. Rothenberg and J. H. Stock, "Efficient Tests for an Autoregressive Unit Root," Econometrica, vol. 64, no. pp. 813-36, 1996.

[12] J. L. Carrion-I-Silvestre, D. Kim and P. Perron, "Gls-Based Unit Root Tests with Multiple Structural Breaks under Both the Null and the Alternative Hypotheses," Econometric Theory, vol. 25, no. 6, pp. 1754-92, 2009.

[13] G. Elliott and M. Jansson, "Testing for Unit Roots with Stationary Covariates," Journal of Econometrics, vol. 115, no. 1, pp. 75-89, 2000.

[14] United Nations Statistics Division, "National Accounts Main Aggregates Database," United Nations Statistics Division, (2018). Available from <https://unstats.un.org/unsd/snaama/dnlList.asp>.