Exemples d'application du test ADF

Exemple 1 : Le Test ADF

Suivant la stratégie simplifiée des tests de racine unitaire, nous commençons par tester l'hypothèse de l'existence de la tendance, On estimera alors le modèle 3 de ADF.

Application du modèle 3:

Les résultats du test ADF sur la série EXPO nous donne les résultats suivants :

Null Hypothesis: EXPO has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.961616	0.6065
Test critical values:	1% level	-4.165756	
	5% level	-3.508508	
	10% level	-3.184230	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXPO)
Method: Least Squares
Date: 02/25/19 Time: 16:27
Sample (adjusted): 1971 2017
Included observations: 47 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXPO(-1)	-0.175752	0.089595	-1.961616	0.0562
C	-1.31E+08	2.60E+09	-0.050274	0.9601
@TREND(1970)	2.16E+08	1.53E+08	**1.408512**	0.1660

R-squared	0.082266	Mean dependent var	7.84E+08
Adjusted R-squared	0.040551	S.D. dependent var	8.51E+09
S.E. of regression	8.33E+09	Akaike info criterion	48.58631
Sum squared resid	3.05E+21	Schwarz criterion	48.70440
Log likelihood	-1138.778	Hannan-Quinn criter.	48.63075
F-statistic	1.972083	Durbin-Watson stat	1.902371
Prob(F-statistic)	0.151277		

Test du trend:

H_0 : B=0
H_1 : B≠0
Tb = |1.40| < T^{ADF}= **3.18** , on accepte H_0 : B=0, la tendance n'est pas significative. On passe à l'estimation du modèle 02

Modèle 2 : $X_t = c + \phi_1 X_{t-1} + a_t$

Null Hypothesis: EXPO has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.385033	0.5817
Test critical values:	1% level	-3.577723	
	5% level	-2.925169	
	10% level	-2.600658	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXPO)
Method: Least Squares
Date: 02/25/19 Time: 16:28
Sample (adjusted): 1971 2017
Included observations: 47 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXPO(-1)	-0.073453	0.053033	-1.385033	0.1729
C	2.56E+09	1.78E+09	**1.442181**	0.1562

R-squared	0.040886	Mean dependent var	7.84E+08
Adjusted R-squared	0.019573	S.D. dependent var	8.51E+09
S.E. of regression	8.42E+09	Akaike info criterion	48.58786
Sum squared resid	3.19E+21	Schwarz criterion	48.66659
Log likelihood	-1139.815	Hannan-Quinn criter.	48.61748
F-statistic	1.918317	Durbin-Watson stat	2.015584
Prob(F-statistic)	0.172871		

Test de la constante :

$H_0 : C=0$
$H_1 : C\neq 0$

$Tc = |1.44| < T^{ADF} = \mathbf{2.89}$, on accepte $H_0 : C= 0$, la constante n'est pas significative. On passe à l'estimation du modèle 01.

Modèle 1 : $X_t = \phi_1 X_{t-1} + a_t$

Null Hypothesis: EXPO has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.490171	0.4984
Test critical values:	1% level	-2.615093	
	5% level	**-1.94**7975	
	10% level	-1.612408	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXPO)

Method: Least Squares
Date: 02/25/19 Time: 16:28
Sample (adjusted): 1971 2017
Included observations: 47 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXPO(-1)	-0.018176	0.037081	**-0.490171**	0.6263

R-squared	-0.003444	Mean dependent var	7.84E+08
Adjusted R-squared	-0.003444	S.D. dependent var	8.51E+09
S.E. of regression	8.52E+09	Akaike info criterion	48.59049
Sum squared resid	3.34E+21	Schwarz criterion	48.62985
Log likelihood	-1140.876	Hannan-Quinn criter.	48.60530
Durbin-Watson stat	2.035727		

Test de ϕ:

$$\begin{cases} H_0 : \phi = 1 \\ H_1 : \phi < 1 \end{cases}$$

$T\phi = -0.49 > T^{ADF}(5\%) = -1.94$. On accepte H_0 $\phi = 1$, le processus est **non stationnaire**
Le processus de cette série est un processus **« DS sans dérive »**

La stationnarisation de la série et récupération de l'ordre d'intégration :

Null Hypothesis: D(EXPO) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.921577	0.0000
Test critical values:	1% level	-2.616203	
	5% level	**-1.948140**	
	10% level	-1.612320	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXPO,2)
Method: Least Squares
Date: 02/25/19 Time: 16:29
Sample (adjusted): 1972 2017
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXPO(-1))	-1.034365	0.149441	**-6.921577**	0.0000

R-squared	0.515618	Mean dependent var	1.01E+08
Adjusted R-squared	0.515618	S.D. dependent var	1.24E+10
S.E. of regression	8.63E+09	Akaike info criterion	48.61695
Sum squared resid	3.35E+21	Schwarz criterion	48.65670
Log likelihood	-1117.190	Hannan-Quinn criter.	48.63184
Durbin-Watson stat	1.997989		

Test du ϕ:

$H_0 : \phi = 1$
$H_1 : \phi < 1$

$T\phi = -6.92 < T^{ADF}(5\%) = -1.94$. On accepte H_1 $\phi < 1$, le processus est **stationnaire**

Le processus EXPO est devenu stationnaire avec une seule différenciation. Donc **EXPO→I(1)**

Exemple 2 : Une serie comportant une tendance

L'Application du test ADF, modèle 3, sur la série Y donne les résultats de l'estimation sous eviews, sont consignés dans le tableau suivant :

Null Hypothesis: Y has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 6 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.041157	0.0016
Test critical values:	1% level	-4.284580	
	5% level	-3.562882	
	10% level	-3.215267	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(Y)
Method: Least Squares
Date: 04/27/19 Time: 19:13
Sample (adjusted): 1987 2017
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y(-1)	-0.534336	0.105995	-5.041157	0.0000
D(Y(-1))	0.430805	0.145076	2.969523	0.0071
D(Y(-2))	-0.031805	0.169304	-0.187860	0.8527
D(Y(-3))	0.557266	0.206000	2.705175	0.0129
D(Y(-4))	0.331010	0.244879	1.351729	0.1902
D(Y(-5))	0.402116	0.215548	1.865552	0.0755
D(Y(-6))	0.674157	0.232865	2.895058	0.0084
C	-9.686533	2.969369	-3.262152	0.0036
@TREND("1980")	1.692245	0.340462	**4.970432**	0.0001

R-squared	0.650021	Mean dependent var	3.428087
Adjusted R-squared	0.522755	S.D. dependent var	5.468270
S.E. of regression	3.777639	Akaike info criterion	5.733776
Sum squared resid	313.9523	Schwarz criterion	6.150095
Log likelihood	-79.87353	Hannan-Quinn criter.	5.869486
F-statistic	5.107604	Durbin-Watson stat	2.155190
Prob(F-statistic)	0.001106		

Test du trend:

$H_0 : B=0$
$H_1 : B\neq 0$

$Tb = |4.97| < T^{ADF} = 3.18$, on rejette $H_0 : B=0$, la tendance est significative.

On passe au test de ϕ

Test du ϕ:

$H_0 : \phi = 1$
$H_1 : \phi < 1$

$T\phi = -5.04 < T^{ADF}(5\%) = -3.65$; on rejette H_0 $\phi = 1$, le processus est un TS**.** Il convient de le stationnariser en retranchant la tendance de la serie Y par la methode des MCO :

L'estimation de l'équation de la tendance (par les (MCO) ,
Les résultats de l'estimation sont donnés dans le tableau ci-apres :

Dependent Variable: T
Method: Least Squares
Date: 04/27/19 Time: 19:45
Sample: 1980 2017
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
@TREND(1980)	0.241394	0.036592	6.596920	0.0000

R-squared	-1.043790	Mean dependent var	6.217105
Adjusted R-squared	-1.043790	S.D. dependent var	3.393242
S.E. of regression	4.851019	Akaike info criterion	6.022218
Sum squared resid	870.6983	Schwarz criterion	6.065312
Log likelihood	-113.4221	Hannan-Quinn criter.	6.037551
Durbin-Watson stat	0.059825		

- Tester la stationnarité des résidus en menant le test ADF avec le premier modèle.

Null Hypothesis: RESID01Y has a unit root
Exogenous: None
Lag Length: 3 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.762418	0.0072
Test critical values:	1% level	-2.634731	
	5% level	-1.951000	
	10% level	-1.610907	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RESID01Y)
Method: Least Squares
Date: 04/27/19 Time: 20:53
Sample (adjusted): 1984 2017
Included observations: 34 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID01Y(-1)	-0.201467	0.072931	-2.762418	0.0097
D(RESID01Y(-1))	0.466225	0.155104	3.005886	0.0053
D(RESID01Y(-2))	-0.124718	0.168120	-0.741838	0.4640
D(RESID01Y(-3))	0.584671	0.196173	2.980377	0.0057

R-squared	0.381199	Mean dependent var	0.375246
Adjusted R-squared	0.319319	S.D. dependent var	5.308341
S.E. of regression	4.379561	Akaike info criterion	5.901905
Sum squared resid	575.4166	Schwarz criterion	6.081477
Log likelihood	-96.33238	Hannan-Quinn criter.	5.963144
Durbin-Watson stat	2.060358		

Donc, le processus **resid01y**→I(0), par contre la série T est intégré d'ordre 1.

Exemple 3: **Une serie comportant une contante**

Apres avoir testé la tendance, nous l'avons trouvé non significative, nous avons ainsi passe à l'estimation du modèle 2. Le résultat de l'estimation de ce modèle est donné dont le tableau suivant :

Null Hypothesis: M has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.899478	0.0003
Test critical values:	1% level	-3.621023	
	5% level	-2.943427	
	10% level	-2.610263	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(M)
Method: Least Squares
Date: 04/27/19 Time: 20:13
Sample (adjusted): 1981 2017
Included observations: 37 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
M(-1)	-0.820393	0.167445	-4.899478	0.0000
C	12.30044	2.990904	4.112615	0.0002

R-squared	0.406829	Mean dependent var	-0.246343
Adjusted R-squared	0.389881	S.D. dependent var	12.03302
S.E. of regression	9.399008	Akaike info criterion	7.371624
Sum squared resid	3091.947	Schwarz criterion	7.458700
Log likelihood	-134.3750	Hannan-Quinn criter.	7.402322
F-statistic	24.00489	Durbin-Watson stat	1.977555
Prob(F-statistic)	0.000022		

Test de la constante :

$H_0 : C=0$
$H_1 : C\neq 0$

$Tc = |4.11| > T^{ADF}$, donc on accepte $H_1 : C\neq 0$, la constante est significative. On passe au test de ϕ

Test de ϕ:

$H_0 : \phi = 1$
$H_1 : \phi < 1$

$T\phi = -4.899478 < T^{ADF}(5\%) = -2.96$ on rejette H_0 $\phi = 1$, le processus est **stationnaire**

Le processus M est intégré d'ordre 0 ; Donc, M→I(0)