

Séries temporelles

TP 4 : Test de stationnarité

Nom : TATA

Prénom : ILès

Groupe : 1

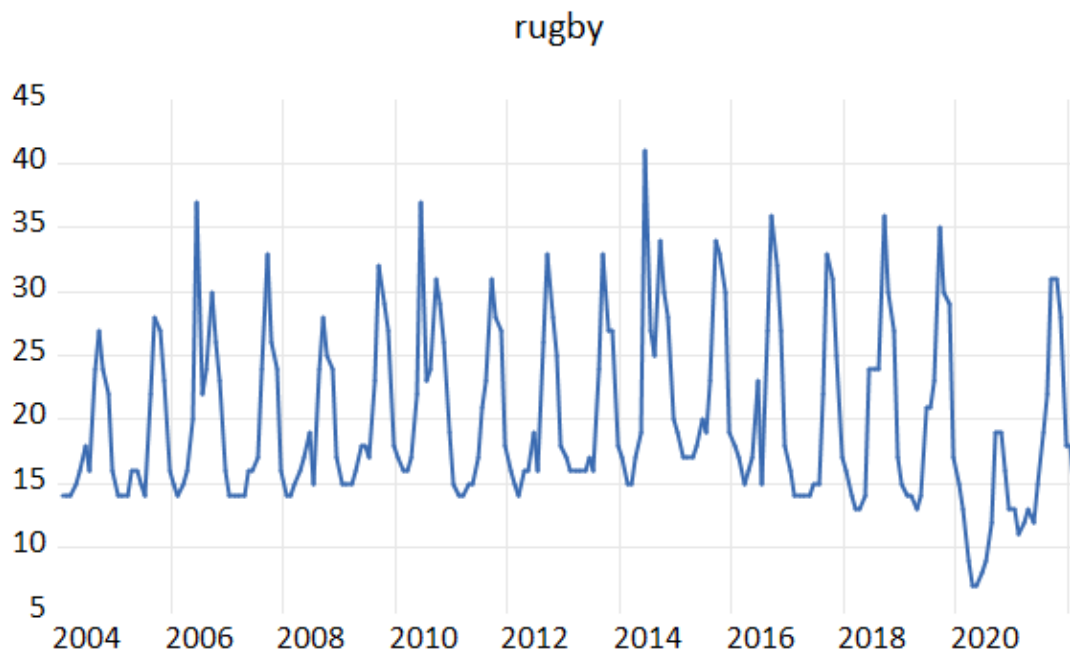
Section : 1

1 Analyse de la série

1.1 Informations sur la série

- Nombre d'observations : $n=219$
- Valeurs manquantes : 0
- Nature des données : Mensuel
- Date début : 2004
- Date fin : 2022
- Nombre d'années $A=1$
- Périodes $P=12$

1.2 Représentation graphique



- Analyse du graphe :

D'après le graphe, la série ne paraît pas être affectée par une tendance et donc elle paraît stationnaire par rapport à la tendance, il reste de tester la significativité.

La série peut être affectée par une saisonnalité.

1.2.1 test de saisonnalité

Dependent Variable: RUGBY-RUGBY(-12)

Method: Least Squares

Date: 05/19/22 Time: 12:31

Sample (adjusted): 2005M03 2022M03

Included observations: 205 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|--------------------|-------------|-----------------------|-------------|--------|
| C | 7.017879 | 2.369308 | 2.961996 | 0.0034 |
| OMEGA(0) | -0.029142 | 0.009812 | -2.969915 | 0.0034 |
| OMEGA(2PI/12) | -0.009420 | 0.008424 | -1.118341 | 0.2648 |
| OMEGA(22PI/12) | -0.007667 | 0.008453 | -0.906995 | 0.3656 |
| OMEGA(4PI/12) | -0.043346 | 0.021320 | -2.033144 | 0.0434 |
| OMEGA(20PI/12) | -0.032340 | 0.021215 | -1.524416 | 0.1291 |
| OMEGA(6PI/12) | -0.063952 | 0.029058 | -2.200832 | 0.0290 |
| OMEGA(18PI/12) | -0.058885 | 0.029059 | -2.026397 | 0.0441 |
| OMEGA(8PI/12) | -0.121469 | 0.038675 | -3.140796 | 0.0020 |
| OMEGA(16PI/12) | -0.082381 | 0.039921 | -2.063570 | 0.0404 |
| OMEGA(10PI/12) | -0.108297 | 0.035308 | -3.067242 | 0.0025 |
| OMEGA(14PI/12) | -0.027337 | 0.035206 | -0.776484 | 0.4384 |
| OMEGA(PI) | -0.171565 | 0.045634 | -3.759569 | 0.0002 |
| DEP(-1) | 0.182202 | 0.084681 | 2.151636 | 0.0327 |
| DEP(-2) | 0.154599 | 0.072418 | 2.134822 | 0.0341 |
| R-squared | 0.524463 | Mean dependent var | 0.063415 | |
| Adjusted R-squared | 0.489423 | S.D. dependent var | 5.308232 | |
| S.E. of regression | 3.792980 | Akaike info criterion | 5.574536 | |
| Sum squared resid | 2733.472 | Schwarz criterion | 5.817683 | |
| Log likelihood | -556.3900 | Hannan-Quinn criter. | 5.672884 | |
| F-statistic | 14.96772 | Durbin-Watson stat | 2.010082 | |
| Prob(F-statistic) | 0.000000 | | | |

Les probabilités contiennent des valeurs < 0.05 ce qui implique la présence d'une saisonnalité

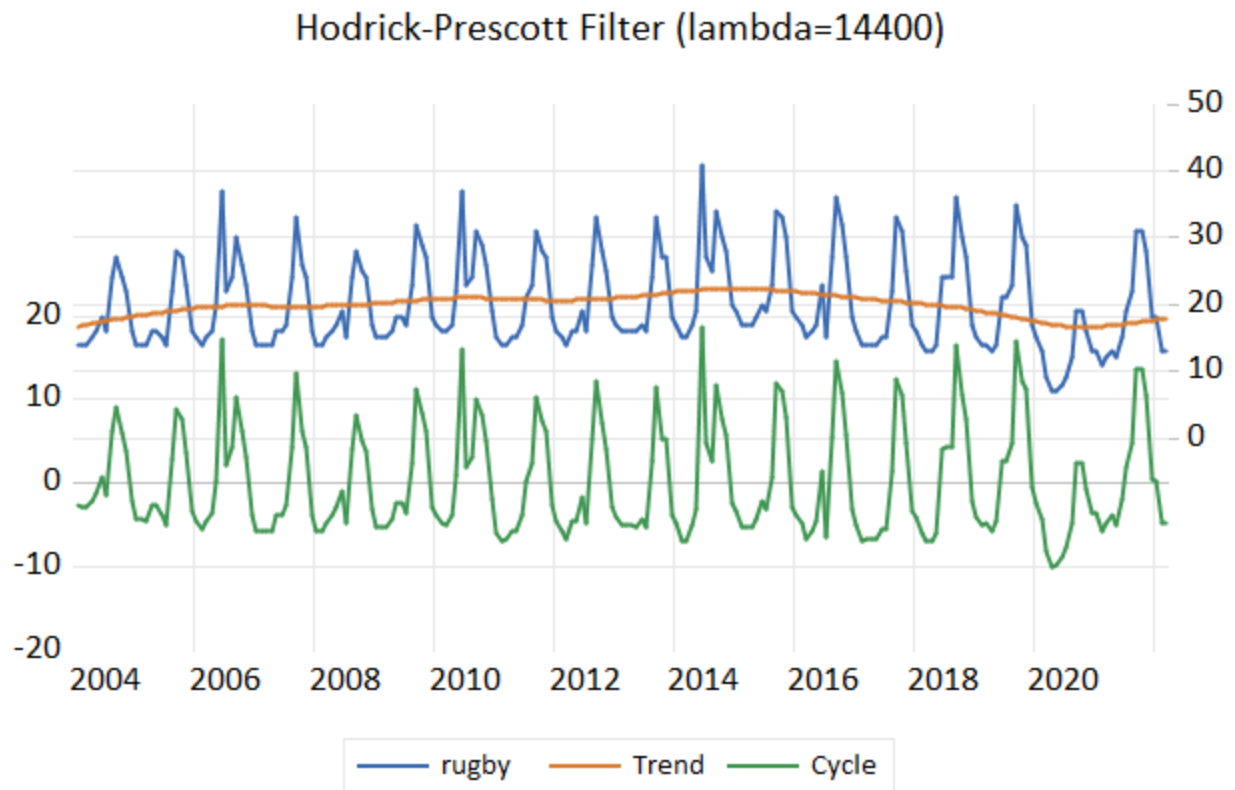
1.2.2 test de tendance

Dependent Variable: RUGBY
Method: Least Squares
Date: 05/19/22 Time: 13:22
Sample: 2004M01 2022M03
Included observations: 219

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|--------------------|-------------|-----------------------|-------------|--------|
| C | 20.23005 | 0.897113 | 22.55016 | 0.0000 |
| @TREND | -0.003158 | 0.007120 | -0.443549 | 0.6578 |
| R-squared | 0.000906 | Mean dependent var | 19.88584 | |
| Adjusted R-squared | -0.003698 | S.D. dependent var | 6.648496 | |
| S.E. of regression | 6.660779 | Akaike info criterion | 6.639440 | |
| Sum squared resid | 9627.418 | Schwarz criterion | 6.670391 | |
| Log likelihood | -725.0187 | Hannan-Quinn criter. | 6.651940 | |
| F-statistic | 0.196736 | Durbin-Watson stat | 0.613975 | |
| Prob(F-statistic) | 0.657810 | | | |

La probabilité $0.6578 > 0.05$ donc notre série n'est pas affectée par une tendance

- Décomposition









































































1.3 Analyse des correlogrammes

Date: 05/16/22 Time: 19:12

Sample: 2004M01 2022M03

Included observations: 219

| Autocorrelation | Partial Correlation | AC | PAC | Q-Stat | Prob | |
|---|---|----|--------|--------|--------|-------|
|  |  | 1 | 0.689 | 0.689 | 105.40 | 0.000 |
|  |  | 2 | 0.360 | -0.218 | 134.33 | 0.000 |
|  |  | 3 | 0.056 | -0.191 | 135.04 | 0.000 |
|  |  | 4 | -0.211 | -0.214 | 145.04 | 0.000 |
|  |  | 5 | -0.362 | -0.094 | 174.63 | 0.000 |
|  |  | 6 | -0.464 | -0.207 | 223.46 | 0.000 |
|  |  | 7 | -0.379 | 0.093 | 256.20 | 0.000 |
|  |  | 8 | -0.254 | -0.076 | 270.97 | 0.000 |
|  |  | 9 | -0.019 | 0.194 | 271.06 | 0.000 |
|  |  | 10 | 0.230 | 0.121 | 283.31 | 0.000 |
|  |  | 11 | 0.472 | 0.306 | 335.23 | 0.000 |
|  |  | 12 | 0.659 | 0.274 | 436.83 | 0.000 |
|  |  | 13 | 0.491 | -0.273 | 493.57 | 0.000 |
|  |  | 14 | 0.232 | -0.120 | 506.33 | 0.000 |
|  |  | 15 | -0.022 | -0.001 | 506.44 | 0.000 |
|  |  | 16 | -0.259 | -0.084 | 522.44 | 0.000 |
|  |  | 17 | -0.399 | -0.014 | 560.63 | 0.000 |
|  |  | 18 | -0.509 | -0.145 | 623.00 | 0.000 |
|  |  | 19 | -0.432 | 0.036 | 668.07 | 0.000 |
|  |  | 20 | -0.301 | -0.053 | 690.10 | 0.000 |
|  |  | 21 | -0.061 | 0.094 | 691.01 | 0.000 |
|  |  | 22 | 0.218 | 0.100 | 702.63 | 0.000 |
|  |  | 23 | 0.444 | 0.085 | 751.22 | 0.000 |
|  |  | 24 | 0.643 | 0.201 | 853.90 | 0.000 |
|  |  | 25 | 0.460 | -0.284 | 906.62 | 0.000 |
|  |  | 26 | 0.235 | 0.092 | 920.51 | 0.000 |
|  |  | 27 | -0.023 | -0.111 | 920.64 | 0.000 |
|  |  | 28 | -0.258 | 0.006 | 937.53 | 0.000 |
|  |  | 29 | -0.394 | -0.030 | 977.02 | 0.000 |
|  |  | 30 | -0.483 | 0.048 | 1036.7 | 0.000 |
|  |  | 31 | -0.409 | -0.036 | 1079.7 | 0.000 |
|  |  | 32 | -0.298 | -0.032 | 1102.8 | 0.000 |
|  |  | 33 | -0.070 | 0.009 | 1104.0 | 0.000 |
|  |  | 34 | 0.180 | -0.005 | 1112.5 | 0.000 |
|  |  | 35 | 0.418 | 0.119 | 1158.4 | 0.000 |
| | | 36 | 0.590 | 0.010 | 1250.5 | 0.000 |

2 Estimation des modeles

2.1 Model[1] : None

Null Hypothesis: RUGBY has a unit root

Exogenous: None

Lag Length: 12 (Automatic - based on SIC, maxlag=14)

| | t-Statistic | Prob.* |
|--|-------------|--------|
| Augmented Dickey-Fuller test statistic | -0.184275 | 0.6187 |
| Test critical values: 1% level | -2.576236 | |
| 5% level | -1.942376 | |
| 10% level | -1.615674 | |

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(RUGBY)

Method: Least Squares

Date: 05/16/22 Time: 19:13

Sample (adjusted): 2005M02 2022M03

Included observations: 206 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|--------------------|-------------|-----------------------|-------------|--------|
| RUGBY(-1) | -0.002474 | 0.013424 | -0.184275 | 0.8540 |
| D(RUGBY(-1)) | -0.303832 | 0.070708 | -4.296980 | 0.0000 |
| D(RUGBY(-2)) | -0.375859 | 0.072187 | -5.206760 | 0.0000 |
| D(RUGBY(-3)) | -0.326277 | 0.073147 | -4.460570 | 0.0000 |
| D(RUGBY(-4)) | -0.393656 | 0.073712 | -5.340459 | 0.0000 |
| D(RUGBY(-5)) | -0.306800 | 0.072846 | -4.211634 | 0.0000 |
| D(RUGBY(-6)) | -0.448966 | 0.072552 | -6.188156 | 0.0000 |
| D(RUGBY(-7)) | -0.318789 | 0.072740 | -4.382571 | 0.0000 |
| D(RUGBY(-8)) | -0.420924 | 0.073099 | -5.758270 | 0.0000 |
| D(RUGBY(-9)) | -0.317450 | 0.073661 | -4.309599 | 0.0000 |
| D(RUGBY(-10)) | -0.332892 | 0.073495 | -4.529440 | 0.0000 |
| D(RUGBY(-11)) | -0.224587 | 0.071880 | -3.124476 | 0.0021 |
| D(RUGBY(-12)) | 0.262146 | 0.070215 | 3.733502 | 0.0002 |
| R-squared | 0.498069 | Mean dependent var | -0.004854 | |
| Adjusted R-squared | 0.466861 | S.D. dependent var | 5.307609 | |
| S.E. of regression | 3.875423 | Akaike info criterion | 5.608214 | |
| Sum squared resid | 2898.649 | Schwarz criterion | 5.818226 | |
| Log likelihood | -564.6461 | Hannan-Quinn criter. | 5.693150 | |
| Durbin-Watson stat | 2.058438 | | | |

2.2 Model[2] : Avec constante

Null Hypothesis: RUGBY has a unit root

Exogenous: Constant

Lag Length: 12 (Automatic - based on SIC, maxlag=14)

| | t-Statistic | Prob.* |
|--|-------------|--------|
| Augmented Dickey-Fuller test statistic | -2.618245 | 0.0909 |
| Test critical values: 1% level | -3.462095 | |
| 5% level | -2.875398 | |
| 10% level | -2.574234 | |

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(RUGBY)

Method: Least Squares

Date: 05/16/22 Time: 19:13

Sample (adjusted): 2005M02 2022M03

Included observations: 206 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|--------------------|-------------|-----------------------|-------------|--------|
| RUGBY(-1) | -0.304787 | 0.116409 | -2.618245 | 0.0095 |
| D(RUGBY(-1)) | -0.027015 | 0.126759 | -0.213124 | 0.8315 |
| D(RUGBY(-2)) | -0.116566 | 0.122058 | -0.955008 | 0.3408 |
| D(RUGBY(-3)) | -0.090478 | 0.115461 | -0.783623 | 0.4342 |
| D(RUGBY(-4)) | -0.179392 | 0.109513 | -1.638085 | 0.1030 |
| D(RUGBY(-5)) | -0.120085 | 0.101258 | -1.185923 | 0.2371 |
| D(RUGBY(-6)) | -0.283863 | 0.095389 | -2.975859 | 0.0033 |
| D(RUGBY(-7)) | -0.182861 | 0.088544 | -2.065186 | 0.0402 |
| D(RUGBY(-8)) | -0.305869 | 0.084405 | -3.623837 | 0.0004 |
| D(RUGBY(-9)) | -0.229772 | 0.079949 | -2.873968 | 0.0045 |
| D(RUGBY(-10)) | -0.266770 | 0.076701 | -3.478063 | 0.0006 |
| D(RUGBY(-11)) | -0.182712 | 0.072607 | -2.516439 | 0.0127 |
| D(RUGBY(-12)) | 0.285970 | 0.069775 | 4.098470 | 0.0001 |
| C | 6.121485 | 2.341879 | 2.613920 | 0.0097 |
| R-squared | 0.515317 | Mean dependent var | -0.004854 | |
| Adjusted R-squared | 0.482500 | S.D. dependent var | 5.307609 | |
| S.E. of regression | 3.818159 | Akaike info criterion | 5.582955 | |
| Sum squared resid | 2799.041 | Schwarz criterion | 5.809122 | |
| Log likelihood | -561.0444 | Hannan-Quinn criter. | 5.674425 | |
| F-statistic | 15.70272 | Durbin-Watson stat | 2.086317 | |
| Prob(F-statistic) | 0.000000 | | | |

2.3 Model[3] : Avec constante et tendance

Null Hypothesis: RUGBY has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 12 (Automatic - based on SIC, maxlag=14)

| | t-Statistic | Prob.* |
|--|-------------|--------|
| Augmented Dickey-Fuller test statistic | -2.712567 | 0.2327 |
| Test critical values: 1% level | -4.003226 | |
| 5% level | -3.431789 | |
| 10% level | -3.139601 | |

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

Augmented Dickey-Fuller Test Equation
 Dependent Variable: D(RUGBY)
 Method: Least Squares
 Date: 05/16/22 Time: 19:14
 Sample (adjusted): 2005M02 2022M03
 Included observations: 206 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|--------------------|-------------|-----------------------|-------------|--------|
| RUGBY(-1) | -0.320525 | 0.118163 | -2.712567 | 0.0073 |
| D(RUGBY(-1)) | -0.014634 | 0.127816 | -0.114496 | 0.9090 |
| D(RUGBY(-2)) | -0.104612 | 0.123080 | -0.849951 | 0.3964 |
| D(RUGBY(-3)) | -0.079941 | 0.116315 | -0.687280 | 0.4927 |
| D(RUGBY(-4)) | -0.169197 | 0.110352 | -1.533241 | 0.1269 |
| D(RUGBY(-5)) | -0.111335 | 0.101940 | -1.092156 | 0.2761 |
| D(RUGBY(-6)) | -0.276653 | 0.095901 | -2.884772 | 0.0044 |
| D(RUGBY(-7)) | -0.177576 | 0.088872 | -1.998096 | 0.0471 |
| D(RUGBY(-8)) | -0.301725 | 0.084642 | -3.564730 | 0.0005 |
| D(RUGBY(-9)) | -0.227412 | 0.080078 | -2.839864 | 0.0050 |
| D(RUGBY(-10)) | -0.265531 | 0.076788 | -3.457979 | 0.0007 |
| D(RUGBY(-11)) | -0.182643 | 0.072675 | -2.513140 | 0.0128 |
| D(RUGBY(-12)) | 0.285125 | 0.069848 | 4.082070 | 0.0001 |
| C | 6.856956 | 2.517502 | 2.723714 | 0.0071 |
| @TREND("2004M01") | -0.003644 | 0.004550 | -0.800960 | 0.4242 |
| R-squared | 0.516940 | Mean dependent var | -0.004854 | |
| Adjusted R-squared | 0.481532 | S.D. dependent var | 5.307609 | |
| S.E. of regression | 3.821728 | Akaike info criterion | 5.589311 | |
| Sum squared resid | 2789.671 | Schwarz criterion | 5.831632 | |
| Log likelihood | -560.6990 | Hannan-Quinn criter. | 5.687314 | |
| F-statistic | 14.59970 | Durbin-Watson stat | 2.086364 | |
| Prob(F-statistic) | 0.000000 | | | |

3 Calcule de F1 et F3

3.1 Valeur calculée du test H_0^1

F1 Value
19.57647

3.2 Valeur calculée du test H_0^3

F3 Value
19.60546

4 Remplire le Tableau des statistiques

Table 1: Table des statistiques

| | H_0 | H_0^1 | H_0^3 |
|------|-----------|----------|----------|
| M[3] | -2.712567 | | 19.60546 |
| M[2] | -2.618245 | 19.57647 | |
| M[1] | -0.184275 | | |

5 l'analyse de la stationnarité en suivant la stratégie de Dickey Fuller

5.1 Test du modele 3

- test H_0

Hypothesis 1. $H_0 : \phi = 1$

Hypothesis 2. $H_1 : \phi \neq 1$

$$\text{Valeur calculée} = -2.712567 > \text{Valeur tabulée} = -4.003226$$

on accepte H_0

- test H_0^3

Hypothesis 3. $H_0 : (\phi, b, c) = (1, 0, 0)$

Hypothesis 4. $H_1 : (\phi, b, c) \neq (1, 0, 0)$

$$\text{Valeur calculée} = 19.60546 > \text{Valeur tabulée} = 6.49$$

on rejette H_0

D'après la stratégie ADF si on rejette une des hypothèse du modele 3 on va vers le test de tendance

5.2 test de tendance

Hypothesis 5. $H_0 : b = 0$

Hypothesis 6. $H_1 : b \neq 0$

Valeur calculée = $-0.800960 <$ Valeur tabulée = 2.79

on accepte H_0

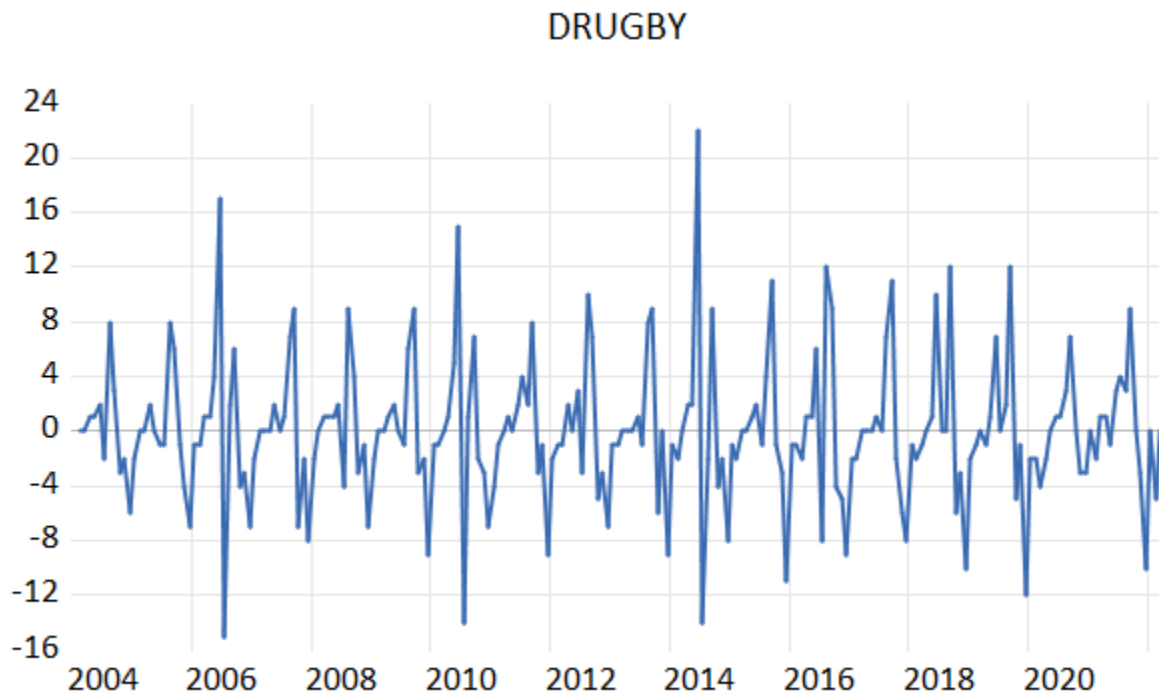
Alors une absence de tendance \Rightarrow la série n'est pas un Processus TS

La présence de la racine unitaire indique une non stationarité DS

6 Stationnariser la série

Pour stationnariser cette série du type DS on doit appliquer un filtre au différence

genre $drugby = rugby - rugby(-1)$



6.1 Tester la sationnarité

- Test du modele 3

Null Hypothesis: DRUGBY has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 11 (Automatic - based on SIC, maxlag=14)

| | t-Statistic | Prob.* |
|--|-------------|--------|
| Augmented Dickey-Fuller test statistic | -7.289524 | 0.0000 |
| Test critical values: | | |
| 1% level | -4.003226 | |
| 5% level | -3.431789 | |
| 10% level | -3.139601 | |

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

Augmented Dickey-Fuller Test Equation
 Dependent Variable: D(DRUGBY)
 Method: Least Squares
 Date: 05/20/22 Time: 13:31
 Sample (adjusted): 2005M02 2022M03
 Included observations: 206 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|--------------------|-------------|-----------------------|-------------|----------|
| DRUGBY(-1) | -4.533989 | 0.621987 | -7.289524 | 0.0000 |
| D(DRUGBY(-1)) | 3.226884 | 0.576391 | 5.598426 | 0.0000 |
| D(DRUGBY(-2)) | 2.848082 | 0.527023 | 5.404091 | 0.0000 |
| D(DRUGBY(-3)) | 2.519034 | 0.476044 | 5.291596 | 0.0000 |
| D(DRUGBY(-4)) | 2.123018 | 0.423771 | 5.009818 | 0.0000 |
| D(DRUGBY(-5)) | 1.814030 | 0.373179 | 4.861020 | 0.0000 |
| D(DRUGBY(-6)) | 1.362746 | 0.321647 | 4.236776 | 0.0000 |
| D(DRUGBY(-7)) | 1.041879 | 0.271913 | 3.831665 | 0.0002 |
| D(DRUGBY(-8)) | 0.619001 | 0.220302 | 2.809787 | 0.0055 |
| D(DRUGBY(-9)) | 0.299722 | 0.169908 | 1.764029 | 0.0793 |
| D(DRUGBY(-10)) | -0.034843 | 0.118410 | -0.294257 | 0.7689 |
| D(DRUGBY(-11)) | -0.260853 | 0.070410 | -3.704762 | 0.0003 |
| C | 0.213467 | 0.592209 | 0.360459 | 0.7189 |
| @TREND("2004M01") | -0.001592 | 0.004560 | -0.349125 | 0.7274 |
| R-squared | 0.742796 | Mean dependent var | | 0.009709 |
| Adjusted R-squared | 0.725381 | S.D. dependent var | | 7.412574 |
| S.E. of regression | 3.884491 | Akaike info criterion | | 5.617402 |
| Sum squared resid | 2897.139 | Schwarz criterion | | 5.843569 |
| Log likelihood | -564.5924 | Hannan-Quinn criter. | | 5.708872 |
| F-statistic | 42.65304 | Durbin-Watson stat | | 2.057616 |
| Prob(F-statistic) | 0.000000 | | | |

- test H_0

Hypothesis 7. $H_0 : \phi = 1$

Hypothesis 8. $H_1 : \phi \neq 1$

Valeur calculée = $-7.289524 < \text{Valeur tabulée} = -3.431789$

on rejette H_0 et on teste la tendance

Hypothesis 9. $H_0 : b = 0$

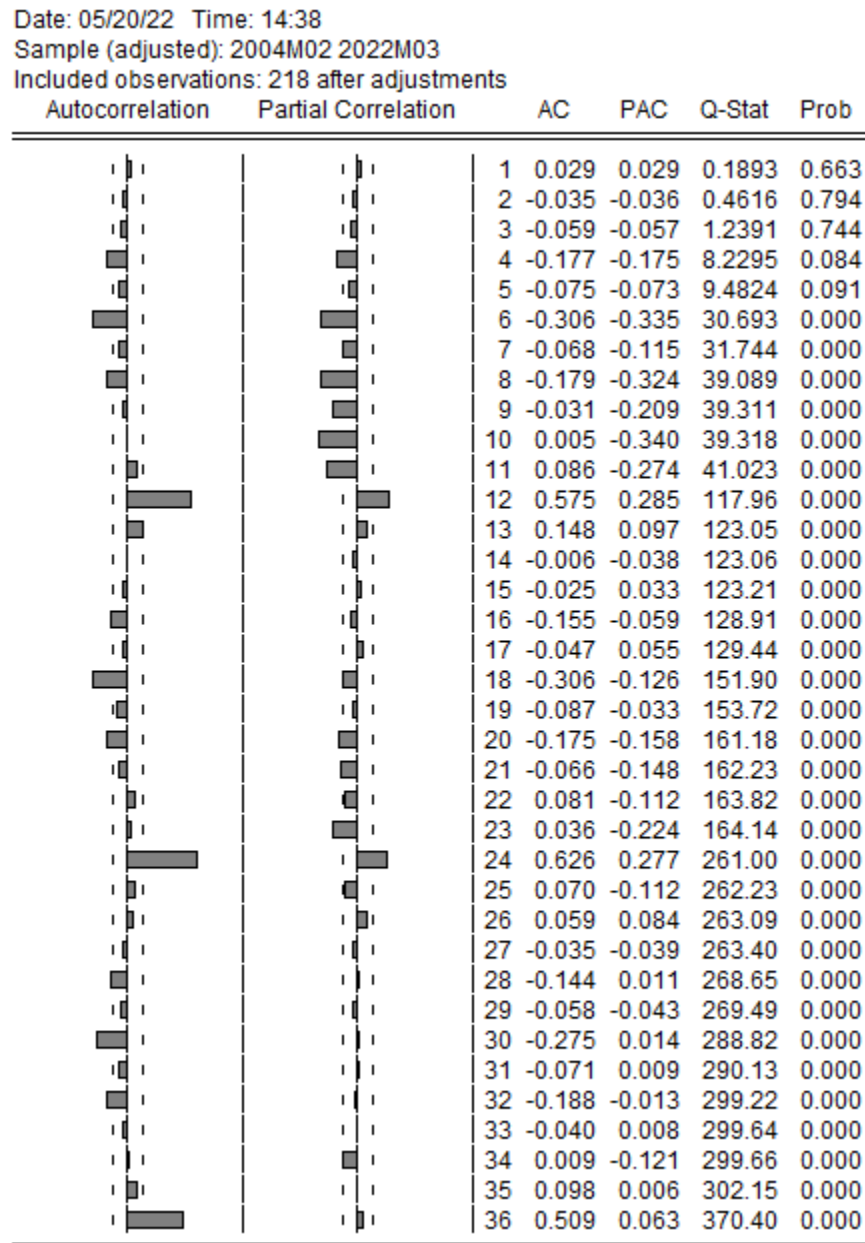
Hypothesis 10. $H_1 : b \neq 0$

$$\text{Valeur calculée} = -0.349125 < \text{Valeur tabulée} = 2.79$$

on accepte H_0

Absence d'une racine unitaire et d'une tendance alors la série est stationnaire

7 Correlogramme



Contents

| | | |
|----------|---|-----------|
| 1 | Analyse de la série | 1 |
| 1.1 | Informations sur la série | 1 |
| 1.2 | Représentation graphique | 1 |
| 1.2.1 | test de saisonnalité | 2 |
| 1.2.2 | test de tendance | 3 |
| 1.3 | Analyse des correlogrammes | 4 |
| 2 | Estimation des modeles | 5 |
| 2.1 | Model[1] : None | 5 |
| 2.2 | Model[2] : Avec constante | 6 |
| 2.3 | Model[3] : Avec constante et tendance | 7 |
| 3 | Calcule de F1 et F3 | 8 |
| 3.1 | Valeur calculée du test H_0^1 | 8 |
| 3.2 | Valeur calculée du test H_0^3 | 8 |
| 4 | Remplire le Tableau des statistiques | 8 |
| 5 | l'analyse de la stationnarité en suivant la stratégie de Dickey Fuller | 8 |
| 5.1 | Test du modele 3 | 8 |
| 5.2 | test de tendance | 9 |
| 6 | Stationnariser la série | 9 |
| 6.1 | Tester la sationnarité | 10 |
| 7 | Correlogramme | 11 |