Excercício BUENO

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Packages

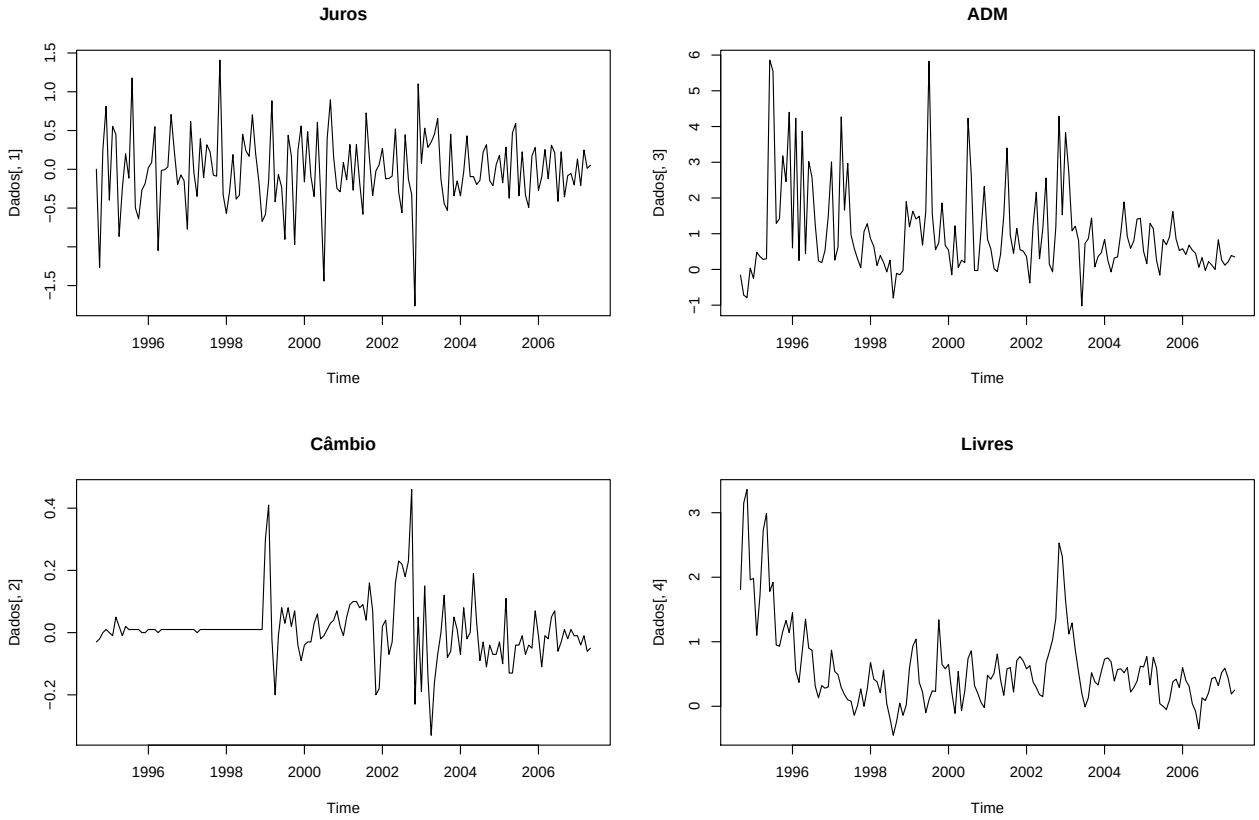
```
library(MASS)
library(urca)
library(vars)
library(lmtest)
library(readxl)
```

Transformar a série em times series

```
DadosBueno = read_excel("~/Videos/Unicamp_IE 2019/HO:236A Times Series/Aula 10/DadosBueno.xls")
Dados = ts(DadosBueno[,2:17], start = c(1994, 9), frequency = 12)
head(Dados)
```

```
##          Juros   Cam   ADM Livres Tend Jan Fev Mar Abr Mai Jun Jul Ago Set
## [1,]  0.001962 -0.03 -0.16   1.81    1   0   0   0   0   0   0   0   0   1
## [2,] -1.264789 -0.02 -0.72   3.15    2   0   0   0   0   0   0   0   0   0
## [3,]  0.249741  0.00 -0.79   3.36    3   0   0   0   0   0   0   0   0   0
## [4,]  0.813917  0.01  0.04   1.96    4   0   0   0   0   0   0   0   0   0
## [5,] -0.397657  0.00 -0.25   1.98    5   1   0   0   0   0   0   0   0   0
## [6,]  0.555150 -0.01  0.48   1.10    6   0   1   0   0   0   0   0   0   0
##      Out Nov
## [1,]   0   0
## [2,]   1   0
## [3,]   0   1
## [4,]   0   0
## [5,]   0   0
## [6,]   0   0
```

```
layout(matrix(1:4, nrow = 2, ncol = 2))
plot(Dados[,1], main = "Juros")
plot(Dados[,2], main = "Câmbio")
plot(Dados[,3], main = "ADM")
plot(Dados[,4], main = "Livres")
```



Test de RU

Vou fazer depois

Nova organizaçao

```
colunas <- c(4:1, 5:16)
Dados1 <- ts(Dados[, colunas], start = c(1994, 9), frequency = 12)
head(Dados1, 24)
```

```
##       Livres   ADM   Cam     Juros Tend Jan Fev Mar Abr Mai Jun Jul Ago
##  [1,]   1.81 -0.16 -0.03  0.001962    1   0   0   0   0   0   0   0   0
##  [2,]   3.15 -0.72 -0.02 -1.264789    2   0   0   0   0   0   0   0   0
##  [3,]   3.36 -0.79  0.00  0.249741    3   0   0   0   0   0   0   0   0
##  [4,]   1.96  0.04  0.01  0.813917    4   0   0   0   0   0   0   0   0
##  [5,]   1.98 -0.25  0.00 -0.397657    5   1   0   0   0   0   0   0   0
##  [6,]   1.10  0.48 -0.01  0.555150    6   0   1   0   0   0   0   0   0
##  [7,]   1.72  0.36  0.05  0.449621    7   0   0   1   0   0   0   0   0
##  [8,]   2.73  0.28  0.02 -0.865289    8   0   0   0   1   0   0   0   0
##  [9,]   2.99  0.30 -0.01 -0.240895    9   0   0   0   0   1   0   0   0
## [10,]   1.78  5.86  0.02  0.200542   10   0   0   0   0   0   1   0   0
## [11,]   1.92  5.55  0.01 -0.113650   11   0   0   0   0   0   0   1   0
## [12,]   0.95  1.29  0.01  1.177943   12   0   0   0   0   0   0   0   1
## [13,]   0.93  1.42  0.01 -0.496009   13   0   0   0   0   0   0   0   0
## [14,]   1.16  3.18  0.01 -0.638512   14   0   0   0   0   0   0   0   0
## [15,]   1.33  2.46  0.00 -0.268922   15   0   0   0   0   0   0   0   0
```

```
## [16,]   1.14  4.40  0.00 -0.184021   16   0   0   0   0   0   0   0   0
## [17,]   1.45  0.60  0.01  0.021269   17   1   0   0   0   0   0   0   0
## [18,]   0.55  4.23  0.01  0.086787   18   0   1   0   0   0   0   0   0
## [19,]   0.37  0.25  0.01  0.549122   19   0   0   1   0   0   0   0   0
## [20,]   0.85  3.87  0.00 -1.046790   20   0   0   0   1   0   0   0   0
## [21,]   1.35  0.44  0.01 -0.014676   21   0   0   0   0   1   0   0   0
## [22,]   0.90  3.02  0.01 -0.005137   22   0   0   0   0   0   1   0   0
## [23,]   0.87  2.58  0.01  0.031319   23   0   0   0   0   0   0   1   0
## [24,]   0.31  1.25  0.01  0.705922   24   0   0   0   0   0   0   0   1
##       Set Out Nov
##  [1,]   1   0   0
##  [2,]   0   1   0
##  [3,]   0   0   1
##  [4,]   0   0   0
##  [5,]   0   0   0
##  [6,]   0   0   0
##  [7,]   0   0   0
##  [8,]   0   0   0
##  [9,]   0   0   0
## [10,]   0   0   0
## [11,]   0   0   0
## [12,]   0   0   0
## [13,]   1   0   0
## [14,]   0   1   0
## [15,]   0   0   1
## [16,]   0   0   0
## [17,]   0   0   0
## [18,]   0   0   0
## [19,]   0   0   0
## [20,]   0   0   0
## [21,]   0   0   0
## [22,]   0   0   0
## [23,]   0   0   0
## [24,]   0   0   0
```

Seleção de ordem de VAR

Seleciona-se as variáveis endógenas de 1:4; e as variáveis exógenas de 5:16. O lag.max = 8 significa que estão sendo ajustados 8 modelos. A partir dos critérios de informação, seleciona-se a melhor especificão do melhor modelo.

```
m = VARselect(Dados1[,1:4], lag.max = 8, type = "const", exogen = Dados1[,5:16])
print(m)
```

```
## $selection
## AIC(n)  HQ(n)  SC(n) FPE(n)
##      1      1      1      1
##
## $criteria
##                   1             2             3             4
## AIC(n) -9.764684e+00 -9.714316e+00 -9.642489e+00 -9.601733e+00
## HQ(n)  -9.197448e+00 -9.013613e+00 -8.808318e+00 -8.634095e+00
## SC(n)  -8.368698e+00 -7.989863e+00 -7.589569e+00 -7.220346e+00
## FPE(n)  5.769439e-05  6.091008e-05  6.582096e-05  6.910578e-05
```

```
##                   5             6             7             8
## AIC(n) -9.610366e+00 -9.536191e+00 -9.523368e+00 -9.371988e+00
## HQ(n)  -8.509260e+00 -8.301619e+00 -8.155327e+00 -7.870480e+00
## SC(n)  -6.900512e+00 -6.497870e+00 -6.156579e+00 -5.676732e+00
## FPE(n)  6.924105e-05  7.559891e-05  7.790555e-05  9.258988e-05
```

Estimação do modelo

```
modelo.estima1 = VAR(Dados1[,1:4],
                     p = 24,
                     type = "const",
                     exogen = Dados1[,5:16])
summary(modelo.estima1)
```

```
##
## VAR Estimation Results:
## ========================
## Endogenous variables: Livres, ADM, Cam, Juros
## Deterministic variables: const
## Sample size: 129
## Log Likelihood: 428.593
## Roots of the characteristic polynomial:
## 0.993 0.993 0.9899 0.9899 0.9897 0.9897 0.9855 0.9846 0.9846 0.9843 0.9843 0.9841 0.9841 0.984 0.984
## Call:
## VAR(y = Dados1[, 1:4], p = 24, type = "const", exogen = Dados1[,
##     5:16])
##
##
## Estimation results for equation Livres:
## =======================================
## Livres = Livres.l1 + ADM.l1 + Cam.l1 + Juros.l1 + Livres.l2 + ADM.l2 + Cam.l2 + Juros.l2 + Livres.l3
##
##              Estimate Std. Error t value Pr(>|t|)
## Livres.l1   0.314592   0.253633   1.240   0.2292
## ADM.l1      0.033287   0.085538   0.389   0.7013
## Cam.l1      1.247889   0.548988   2.273   0.0342 *
## Juros.l1   -0.114861   0.160019  -0.718   0.4812
## Livres.l2  -0.008140   0.330741  -0.025   0.9806
## ADM.l2     -0.032660   0.080539  -0.406   0.6894
## Cam.l2      0.213299   0.643093   0.332   0.7436
## Juros.l2   -0.076588   0.196429  -0.390   0.7007
## Livres.l3   0.112469   0.319805   0.352   0.7288
## ADM.l3      0.035029   0.067585   0.518   0.6099
## Cam.l3      0.783876   0.676177   1.159   0.2600
## Juros.l3   -0.075568   0.183067  -0.413   0.6842
## Livres.l4   0.366732   0.331219   1.107   0.2813
## ADM.l4     -0.025659   0.056435  -0.455   0.6542
## Cam.l4      0.838542   0.711247   1.179   0.2522
## Juros.l4    0.004151   0.163369   0.025   0.9800
## Livres.l5   0.057796   0.304704   0.190   0.8515
## ADM.l5      0.019639   0.052861   0.372   0.7142
## Cam.l5      0.282303   0.752925   0.375   0.7117
## Juros.l5    0.042752   0.168611   0.254   0.8024
```

```
## Livres.l6   0.337462   0.318808   1.059   0.3024
## ADM.l6     -0.048696   0.057894  -0.841   0.4102
## Cam.l6      0.015208   0.829993   0.018   0.9856
## Juros.l6   -0.050361   0.161109  -0.313   0.7578
## Livres.l7  -0.089705   0.317692  -0.282   0.7806
## ADM.l7      0.014142   0.056948   0.248   0.8064
## Cam.l7     -0.886241   0.810631  -1.093   0.2873
## Juros.l7    0.129480   0.169663   0.763   0.4543
## Livres.l8  -0.233220   0.297487  -0.784   0.4422
## ADM.l8     -0.029073   0.054370  -0.535   0.5987
## Cam.l8     -0.435642   0.855517  -0.509   0.6162
## Juros.l8   -0.254924   0.169132  -1.507   0.1474
## Livres.l9   0.297015   0.304791   0.974   0.3415
## ADM.l9      0.012548   0.051058   0.246   0.8084
## Cam.l9     -0.378156   0.747837  -0.506   0.6186
## Juros.l9   -0.262766   0.188844  -1.391   0.1794
## Livres.l10  0.071998   0.321819   0.224   0.8252
## ADM.l10    -0.024113   0.050588  -0.477   0.6388
## Cam.l10    -0.831375   0.657334  -1.265   0.2205
## Juros.l10  -0.073789   0.186895  -0.395   0.6972
## Livres.l11 -0.104720   0.302724  -0.346   0.7330
## ADM.l11     0.006257   0.051689   0.121   0.9049
## Cam.l11     0.562131   0.638255   0.881   0.3889
## Juros.l11  -0.216022   0.213089  -1.014   0.3228
## Livres.l12 -0.067427   0.299273  -0.225   0.8240
## ADM.l12     0.036775   0.062494   0.588   0.5628
## Cam.l12    -0.711322   0.619816  -1.148   0.2647
## Juros.l12  -0.038996   0.242451  -0.161   0.8738
## Livres.l13  0.166549   0.295623   0.563   0.5794
## ADM.l13     0.075569   0.058176   1.299   0.2087
## Cam.l13    -0.186553   0.565891  -0.330   0.7451
## Juros.l13   0.143383   0.237974   0.603   0.5536
## Livres.l14 -0.292342   0.309461  -0.945   0.3561
## ADM.l14    -0.028052   0.054787  -0.512   0.6142
## Cam.l14    -0.060043   0.582536  -0.103   0.9189
## Juros.l14   0.154755   0.219240   0.706   0.4884
## Livres.l15  0.071468   0.309898   0.231   0.8200
## ADM.l15    -0.043335   0.060973  -0.711   0.4855
## Cam.l15     0.162288   0.648461   0.250   0.8049
## Juros.l15   0.050147   0.209770   0.239   0.8135
## Livres.l16 -0.095053   0.307604  -0.309   0.7605
## ADM.l16     0.046138   0.058105   0.794   0.4365
## Cam.l16     0.303316   0.645415   0.470   0.6435
## Juros.l16   0.014891   0.171544   0.087   0.9317
## Livres.l17 -0.037822   0.281905  -0.134   0.8946
## ADM.l17    -0.075203   0.061256  -1.228   0.2338
## Cam.l17     0.277313   0.667696   0.415   0.6823
## Juros.l17  -0.108671   0.186411  -0.583   0.5664
## Livres.l18  0.111474   0.269862   0.413   0.6839
## ADM.l18    -0.004857   0.065173  -0.075   0.9413
## Cam.l18     0.318353   0.646010   0.493   0.6275
## Juros.l18  -0.030728   0.194736  -0.158   0.8762
## Livres.l19 -0.148472   0.273596  -0.543   0.5934
## ADM.l19    -0.052855   0.060007  -0.881   0.3889
```

```
## Cam.l19    -0.019275   0.657555  -0.029   0.9769
## Juros.l19  -0.125502   0.214003  -0.586   0.5641
## Livres.l20  0.406803   0.319755   1.272   0.2179
## ADM.l20    -0.017877   0.059752  -0.299   0.7679
## Cam.l20     0.465894   0.769548   0.605   0.5517
## Juros.l20  -0.095022   0.215983  -0.440   0.6647
## Livres.l21  0.080766   0.340291   0.237   0.8148
## ADM.l21     0.060813   0.054333   1.119   0.2763
## Cam.l21    -0.602079   0.714722  -0.842   0.4095
## Juros.l21   0.114332   0.221100   0.517   0.6108
## Livres.l22 -0.068440   0.381773  -0.179   0.8595
## ADM.l22     0.038916   0.059022   0.659   0.5172
## Cam.l22    -0.344718   0.638383  -0.540   0.5952
## Juros.l22   0.158169   0.207448   0.762   0.4547
## Livres.l23  0.039883   0.335934   0.119   0.9067
## ADM.l23     0.074900   0.057459   1.304   0.2072
## Cam.l23    -0.483243   0.651051  -0.742   0.4666
## Juros.l23   0.349993   0.256060   1.367   0.1868
## Livres.l24 -0.266766   0.272069  -0.981   0.3385
## ADM.l24    -0.014560   0.046666  -0.312   0.7583
## Cam.l24    -0.185850   0.540164  -0.344   0.7344
## Juros.l24   0.074841   0.132165   0.566   0.5775
## const       0.232176   0.253877   0.915   0.3713
## Tend       -0.002149   0.010848  -0.198   0.8449
## Jan        -0.013593   0.275927  -0.049   0.9612
## Fev         0.046946   0.296068   0.159   0.8756
## Mar        -0.036136   0.317736  -0.114   0.9106
## Abr        -0.401109   0.345738  -1.160   0.2596
## Mai        -0.272537   0.404194  -0.674   0.5079
## Jun        -0.713472   0.428426  -1.665   0.1114
## Jul        -0.579275   0.408269  -1.419   0.1713
## Ago        -0.621521   0.375255  -1.656   0.1133
## Set        -0.439940   0.350604  -1.255   0.2240
## Out        -0.239041   0.358459  -0.667   0.5125
## Nov        -0.289649   0.305079  -0.949   0.3537
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## Residual standard error: 0.2399 on 20 degrees of freedom
## Multiple R-Squared: 0.9515,  Adjusted R-squared: 0.6898
## F-statistic: 3.635 on 108 and 20 DF,  p-value: 0.0008627
##
##
## Estimation results for equation ADM:
## ====================================
## ADM = Livres.l1 + ADM.l1 + Cam.l1 + Juros.l1 + Livres.l2 + ADM.l2 + Cam.l2 + Juros.l2 + Livres.l3 + A
##
##            Estimate Std. Error t value Pr(>|t|)
## Livres.l1   0.45886    0.76932   0.596  0.55757
## ADM.l1      0.05914    0.25945   0.228  0.82202
## Cam.l1      2.73697    1.66519   1.644  0.11588
## Juros.l1    0.37797    0.48537   0.779  0.44526
## Livres.l2  -0.14764    1.00320  -0.147  0.88447
```

```
## ADM.l2     -0.08815    0.24429  -0.361  0.72199
## Cam.l2     -2.01006    1.95062  -1.030  0.31509
## Juros.l2    0.52868    0.59581   0.887  0.38545
## Livres.l3  -0.67339    0.97003  -0.694  0.49555
## ADM.l3      0.08834    0.20500   0.431  0.67113
## Cam.l3     -0.77366    2.05098  -0.377  0.70999
## Juros.l3    0.34819    0.55528   0.627  0.53772
## Livres.l4  -0.36057    1.00465  -0.359  0.72343
## ADM.l4     -0.02152    0.17118  -0.126  0.90122
## Cam.l4      0.50982    2.15735   0.236  0.81559
## Juros.l4    0.70060    0.49553   1.414  0.17278
## Livres.l5   0.90965    0.92422   0.984  0.33676
## ADM.l5      0.04711    0.16034   0.294  0.77194
## Cam.l5      4.69780    2.28377   2.057  0.05296 .
## Juros.l5    0.40449    0.51143   0.791  0.43828
## Livres.l6  -0.52268    0.96701  -0.541  0.59481
## ADM.l6     -0.04078    0.17560  -0.232  0.81874
## Cam.l6      1.40534    2.51753   0.558  0.58289
## Juros.l6    0.27617    0.48867   0.565  0.57826
## Livres.l7  -0.40404    0.96362  -0.419  0.67947
## ADM.l7      0.20817    0.17274   1.205  0.24222
## Cam.l7      1.27522    2.45880   0.519  0.60971
## Juros.l7    0.43248    0.51462   0.840  0.41063
## Livres.l8  -0.95926    0.90234  -1.063  0.30041
## ADM.l8     -0.07104    0.16491  -0.431  0.67123
## Cam.l8     -0.18825    2.59495  -0.073  0.94289
## Juros.l8    0.03035    0.51301   0.059  0.95340
## Livres.l9   1.01141    0.92449   1.094  0.28695
## ADM.l9     -0.14729    0.15487  -0.951  0.35294
## Cam.l9      2.21486    2.26833   0.976  0.34052
## Juros.l9   -0.02516    0.57280  -0.044  0.96541
## Livres.l10  1.28737    0.97614   1.319  0.20213
## ADM.l10     0.01532    0.15344   0.100  0.92149
## Cam.l10    -1.56213    1.99382  -0.783  0.44252
## Juros.l10   0.72635    0.56689   1.281  0.21475
## Livres.l11 -2.09213    0.91822  -2.278  0.03382 *
## ADM.l11    -0.46392    0.15678  -2.959  0.00776 **
## Cam.l11    -0.56684    1.93595  -0.293  0.77269
## Juros.l11  -1.45401    0.64634  -2.250  0.03589 *
## Livres.l12  0.80456    0.90775   0.886  0.38598
## ADM.l12    -0.14109    0.18956  -0.744  0.46534
## Cam.l12     1.37931    1.88002   0.734  0.47167
## Juros.l12  -1.23689    0.73540  -1.682  0.10813
## Livres.l13  1.67916    0.89668   1.873  0.07581 .
## ADM.l13     0.01574    0.17646   0.089  0.92982
## Cam.l13    -1.79704    1.71646  -1.047  0.30761
## Juros.l13  -0.05825    0.72182  -0.081  0.93649
## Livres.l14  0.04944    0.93865   0.053  0.95852
## ADM.l14    -0.15884    0.16618  -0.956  0.35057
## Cam.l14    -3.05673    1.76694  -1.730  0.09904 .
## Juros.l14   0.13230    0.66500   0.199  0.84431
## Livres.l15 -2.11904    0.93998  -2.254  0.03555 *
## ADM.l15    -0.51178    0.18494  -2.767  0.01189 *
## Cam.l15    -1.25897    1.96691  -0.640  0.52939
```

```
## Juros.l15  -0.66698    0.63627  -1.048  0.30702
## Livres.l16 -0.01332    0.93302  -0.014  0.98875
## ADM.l16     0.10460    0.17624   0.594  0.55949
## Cam.l16     3.25075    1.95767   1.661  0.11241
## Juros.l16  -1.22471    0.52032  -2.354  0.02892 *
## Livres.l17  0.73160    0.85507   0.856  0.40235
## ADM.l17     0.15614    0.18580   0.840  0.41064
## Cam.l17     0.97757    2.02525   0.483  0.63456
## Juros.l17  -0.04110    0.56542  -0.073  0.94277
## Livres.l18 -0.39032    0.81854  -0.477  0.63864
## ADM.l18    -0.08157    0.19768  -0.413  0.68428
## Cam.l18     3.12893    1.95947   1.597  0.12599
## Juros.l18   0.15438    0.59067   0.261  0.79649
## Livres.l19 -1.68396    0.82987  -2.029  0.05596 .
## ADM.l19    -0.24665    0.18201  -1.355  0.19048
## Cam.l19     3.53267    1.99449   1.771  0.09176 .
## Juros.l19  -0.65142    0.64911  -1.004  0.32758
## Livres.l20  0.54893    0.96988   0.566  0.57771
## ADM.l20    -0.01954    0.18124  -0.108  0.91520
## Cam.l20     3.70103    2.33419   1.586  0.12852
## Juros.l20  -0.84828    0.65512  -1.295  0.21012
## Livres.l21  2.46958    1.03217   2.393  0.02666 *
## ADM.l21     0.08643    0.16480   0.524  0.60572
## Cam.l21     1.61282    2.16789   0.744  0.46555
## Juros.l21   0.46620    0.67064   0.695  0.49495
## Livres.l22  0.05097    1.15799   0.044  0.96533
## ADM.l22     0.08510    0.17903   0.475  0.63967
## Cam.l22    -0.72606    1.93634  -0.375  0.71163
## Juros.l22   1.73062    0.62923   2.750  0.01234 *
## Livres.l23 -1.49354    1.01895  -1.466  0.15826
## ADM.l23    -0.27914    0.17428  -1.602  0.12492
## Cam.l23     1.01382    1.97476   0.513  0.61330
## Juros.l23  -0.31512    0.77668  -0.406  0.68925
## Livres.l24  1.06603    0.82524   1.292  0.21116
## ADM.l24    -0.03933    0.14155  -0.278  0.78395
## Cam.l24     1.80542    1.63842   1.102  0.28358
## Juros.l24  -0.33721    0.40088  -0.841  0.41019
## const       1.53576    0.77006   1.994  0.05993 .
## Tend        0.03395    0.03290   1.032  0.31453
## Jan        -1.03820    0.83694  -1.240  0.22916
## Fev        -0.65207    0.89803  -0.726  0.47618
## Mar        -0.01777    0.96376  -0.018  0.98547
## Abr         1.53928    1.04869   1.468  0.15771
## Mai         1.00275    1.22600   0.818  0.42305
## Jun         0.52314    1.29950   0.403  0.69154
## Jul         2.05779    1.23836   1.662  0.11217
## Ago         1.29679    1.13822   1.139  0.26804
## Set         0.49134    1.06345   0.462  0.64905
## Out        -0.53679    1.08727  -0.494  0.62689
## Nov         0.25588    0.92536   0.277  0.78499
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
```

```
## Residual standard error: 0.7276 on 20 degrees of freedom
## Multiple R-Squared: 0.9255,  Adjusted R-squared: 0.5229
## F-statistic: 2.299 on 108 and 20 DF,  p-value: 0.01766
##
##
## Estimation results for equation Cam:
## ====================================
## Cam = Livres.l1 + ADM.l1 + Cam.l1 + Juros.l1 + Livres.l2 + ADM.l2 + Cam.l2 + Juros.l2 + Livres.l3 + A
##
##              Estimate Std. Error t value Pr(>|t|)
## Livres.l1  -0.1930213  0.1042866  -1.851   0.0790 .
## ADM.l1     -0.0124670  0.0351707  -0.354   0.7267
## Cam.l1      0.2324707  0.2257283   1.030   0.3154
## Juros.l1   -0.1693148  0.0657953  -2.573   0.0181 *
## Livres.l2   0.1526884  0.1359911   1.123   0.2748
## ADM.l2      0.0147534  0.0331151   0.446   0.6607
## Cam.l2      0.4862434  0.2644214   1.839   0.0808 .
## Juros.l2   -0.0018358  0.0807658  -0.023   0.9821
## Livres.l3   0.1868279  0.1314948   1.421   0.1708
## ADM.l3     -0.0081045  0.0277890  -0.292   0.7736
## Cam.l3      0.3452611  0.2780247   1.242   0.2287
## Juros.l3   -0.0698891  0.0752719  -0.928   0.3642
## Livres.l4  -0.0755385  0.1361879  -0.555   0.5853
## ADM.l4     -0.0102190  0.0232043  -0.440   0.6644
## Cam.l4     -0.2613646  0.2924442  -0.894   0.3821
## Juros.l4    0.0699339  0.0671726   1.041   0.3102
## Livres.l5   0.0086295  0.1252853   0.069   0.9458
## ADM.l5     -0.0334715  0.0217350  -1.540   0.1392
## Cam.l5     -0.1645450  0.3095810  -0.532   0.6009
## Juros.l5    0.0416142  0.0693282   0.600   0.5551
## Livres.l6  -0.2428820  0.1310847  -1.853   0.0787 .
## ADM.l6     -0.0001345  0.0238043  -0.006   0.9955
## Cam.l6     -0.3552230  0.3412693  -1.041   0.3103
## Juros.l6   -0.0824252  0.0662434  -1.244   0.2278
## Livres.l7   0.0736851  0.1306258   0.564   0.5790
## ADM.l7      0.0227224  0.0234156   0.970   0.3434
## Cam.l7     -0.1330795  0.3333081  -0.399   0.6939
## Juros.l7   -0.0683703  0.0697605  -0.980   0.3388
## Livres.l8   0.1626953  0.1223182   1.330   0.1985
## ADM.l8      0.0066947  0.0223554   0.299   0.7677
## Cam.l8      0.2414136  0.3517642   0.686   0.5004
## Juros.l8   -0.0396610  0.0695423  -0.570   0.5748
## Livres.l9  -0.1499690  0.1253211  -1.197   0.2454
## ADM.l9     -0.0008515  0.0209938  -0.041   0.9680
## Cam.l9      0.0272877  0.3074893   0.089   0.9302
## Juros.l9   -0.0153256  0.0776471  -0.197   0.8455
## Livres.l10  0.0699512  0.1323228   0.529   0.6029
## ADM.l10    -0.0140329  0.0208005  -0.675   0.5076
## Cam.l10     0.3932652  0.2702769   1.455   0.1612
## Juros.l10  -0.0768722  0.0768459  -1.000   0.3291
## Livres.l11  0.0388441  0.1244714   0.312   0.7582
## ADM.l11     0.0153994  0.0212530   0.725   0.4771
## Cam.l11    -0.1388685  0.2624323  -0.529   0.6025
## Juros.l11   0.1473635  0.0876162   1.682   0.1081
```

```
## Livres.l12 -0.0942061  0.1230523  -0.766   0.4529
## ADM.l12    -0.0041452  0.0256957  -0.161   0.8735
## Cam.l12     0.0483275  0.2548505   0.190   0.8515
## Juros.l12   0.0515851  0.0996891   0.517   0.6105
## Livres.l13 -0.0011475  0.1215518  -0.009   0.9926
## ADM.l13    -0.0050974  0.0239203  -0.213   0.8334
## Cam.l13     0.2460257  0.2326783   1.057   0.3030
## Juros.l13  -0.0439028  0.0978479  -0.449   0.6585
## Livres.l14  0.1542192  0.1272414   1.212   0.2396
## ADM.l14     0.0208382  0.0225268   0.925   0.3660
## Cam.l14    -0.0853731  0.2395222  -0.356   0.7253
## Juros.l14   0.0664492  0.0901451   0.737   0.4696
## Livres.l15 -0.1150768  0.1274211  -0.903   0.3772
## ADM.l15    -0.0166011  0.0250705  -0.662   0.5154
## Cam.l15     0.0520974  0.2666286   0.195   0.8471
## Juros.l15  -0.0374826  0.0862515  -0.435   0.6685
## Livres.l16 -0.1179461  0.1264780  -0.933   0.3622
## ADM.l16    -0.0345061  0.0238913  -1.444   0.1641
## Cam.l16    -0.0970704  0.2653761  -0.366   0.7184
## Juros.l16  -0.1020449  0.0705338  -1.447   0.1635
## Livres.l17  0.0460054  0.1159111   0.397   0.6956
## ADM.l17    -0.0047371  0.0251865  -0.188   0.8527
## Cam.l17     0.0514320  0.2745374   0.187   0.8533
## Juros.l17  -0.0806845  0.0766468  -1.053   0.3050
## Livres.l18  0.1284542  0.1109594   1.158   0.2606
## ADM.l18     0.0236978  0.0267974   0.884   0.3870
## Cam.l18     0.2159762  0.2656209   0.813   0.4257
## Juros.l18  -0.0762504  0.0800697  -0.952   0.3523
## Livres.l19  0.1558798  0.1124948   1.386   0.1811
## ADM.l19     0.0092407  0.0246732   0.375   0.7120
## Cam.l19    -0.3773729  0.2703679  -1.396   0.1781
## Juros.l19   0.1234766  0.0879920   1.403   0.1759
## Livres.l20 -0.1725095  0.1314742  -1.312   0.2043
## ADM.l20     0.0158526  0.0245683   0.645   0.5261
## Cam.l20     0.0827691  0.3164162   0.262   0.7963
## Juros.l20   0.0658613  0.0888061   0.742   0.4669
## Livres.l21 -0.1376513  0.1399177  -0.984   0.3370
## ADM.l21    -0.0054723  0.0223400  -0.245   0.8090
## Cam.l21    -0.0648313  0.2938730  -0.221   0.8276
## Juros.l21   0.0307263  0.0909101   0.338   0.7389
## Livres.l22  0.0503554  0.1569740   0.321   0.7517
## ADM.l22     0.0260735  0.0242682   1.074   0.2954
## Cam.l22     0.4846610  0.2624848   1.846   0.0797 .
## Juros.l22  -0.0244427  0.0852966  -0.287   0.7774
## Livres.l23 -0.0970986  0.1381262  -0.703   0.4902
## ADM.l23    -0.0138265  0.0236256  -0.585   0.5649
## Cam.l23    -0.0813294  0.2676934  -0.304   0.7644
## Juros.l23  -0.0842612  0.1052844  -0.800   0.4329
## Livres.l24  0.1422522  0.1118669   1.272   0.2181
## ADM.l24    -0.0106145  0.0191877  -0.553   0.5863
## Cam.l24    -0.0151948  0.2220997  -0.068   0.9461
## Juros.l24  -0.0626362  0.0543423  -1.153   0.2627
## const       0.0447514  0.1043871   0.429   0.6727
## Tend       -0.0001667  0.0044603  -0.037   0.9706
```

```
## Jan        -0.0385068  0.1134532  -0.339   0.7378
## Fev         0.0519665  0.1217345   0.427   0.6740
## Mar        -0.1160088  0.1306440  -0.888   0.3851
## Abr        -0.0768693  0.1421576  -0.541   0.5947
## Mai        -0.1422139  0.1661928  -0.856   0.4023
## Jun         0.0488790  0.1761565   0.277   0.7843
## Jul        -0.0372585  0.1678684  -0.222   0.8266
## Ago        -0.0735118  0.1542939  -0.476   0.6389
## Set         0.1582331  0.1441584   1.098   0.2854
## Out        -0.0566331  0.1473880  -0.384   0.7049
## Nov        -0.0034592  0.1254398  -0.028   0.9783
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## Residual standard error: 0.09863 on 20 degrees of freedom
## Multiple R-Squared: 0.8618,  Adjusted R-squared: 0.1156
## F-statistic: 1.155 on 108 and 20 DF,  p-value: 0.3707
##
##
## Estimation results for equation Juros:
## ======================================
## Juros = Livres.l1 + ADM.l1 + Cam.l1 + Juros.l1 + Livres.l2 + ADM.l2 + Cam.l2 + Juros.l2 + Livres.l3 +
##
##              Estimate Std. Error t value Pr(>|t|)
## Livres.l1   0.6611855  0.4226777   1.564    0.133
## ADM.l1      0.1035101  0.1425482   0.726    0.476
## Cam.l1     -1.0415713  0.9148855  -1.138    0.268
## Juros.l1   -0.1107088  0.2666709  -0.415    0.682
## Livres.l2   0.0164170  0.5511770   0.030    0.977
## ADM.l2     -0.0858850  0.1342169  -0.640    0.530
## Cam.l2      0.7966371  1.0717103   0.743    0.466
## Juros.l2   -0.3425446  0.3273470  -1.046    0.308
## Livres.l3   0.1618173  0.5329534   0.304    0.765
## ADM.l3      0.0462107  0.1126300   0.410    0.686
## Cam.l3     -1.1011975  1.1268447  -0.977    0.340
## Juros.l3    0.0848731  0.3050799   0.278    0.784
## Livres.l4  -0.2403803  0.5519747  -0.435    0.668
## ADM.l4     -0.1243308  0.0940480  -1.322    0.201
## Cam.l4     -1.2173999  1.1852877  -1.027    0.317
## Juros.l4   -0.2898739  0.2722529  -1.065    0.300
## Livres.l5  -0.4277828  0.5077863  -0.842    0.409
## ADM.l5      0.0606214  0.0880926   0.688    0.499
## Cam.l5     -1.4483403  1.2547438  -1.154    0.262
## Juros.l5   -0.2223671  0.2809897  -0.791    0.438
## Livres.l6   0.1755676  0.5312912   0.330    0.744
## ADM.l6      0.0424214  0.0964796   0.440    0.665
## Cam.l6     -0.5522903  1.3831774  -0.399    0.694
## Juros.l6   -0.1650092  0.2684870  -0.615    0.546
## Livres.l7   0.1507738  0.5294314   0.285    0.779
## ADM.l7      0.0408314  0.0949042   0.430    0.672
## Cam.l7      0.8235776  1.3509108   0.610    0.549
## Juros.l7   -0.3171324  0.2827421  -1.122    0.275
## Livres.l8   0.4140746  0.4957605   0.835    0.413
```

```
## ADM.l8      0.0337584  0.0906071   0.373    0.713
## Cam.l8      0.1765647  1.4257137   0.124    0.903
## Juros.l8    0.1260049  0.2818577   0.447    0.660
## Livres.l9  -0.4551926  0.5079313  -0.896    0.381
## ADM.l9      0.0093994  0.0850886   0.110    0.913
## Cam.l9      0.2470334  1.2462660   0.198    0.845
## Juros.l9    0.0721668  0.3147067   0.229    0.821
## Livres.l10 -0.3366482  0.5363093  -0.628    0.537
## ADM.l10     0.0930859  0.0843050   1.104    0.283
## Cam.l10     0.4556611  1.0954426   0.416    0.682
## Juros.l10   0.1865351  0.3114595   0.599    0.556
## Livres.l11  0.4159594  0.5044873   0.825    0.419
## ADM.l11     0.0537687  0.0861390   0.624    0.540
## Cam.l11    -0.2392470  1.0636483  -0.225    0.824
## Juros.l11   0.4345176  0.3551119   1.224    0.235
## Livres.l12 -0.3259137  0.4987357  -0.653    0.521
## ADM.l12    -0.0057565  0.1041455  -0.055    0.956
## Cam.l12    -0.1057120  1.0329188  -0.102    0.920
## Juros.l12   0.2008452  0.4040436   0.497    0.625
## Livres.l13 -0.3392972  0.4926540  -0.689    0.499
## ADM.l13    -0.1621826  0.0969499  -1.673    0.110
## Cam.l13     0.6715070  0.9430540   0.712    0.485
## Juros.l13  -0.5062328  0.3965814  -1.276    0.216
## Livres.l14  0.4428169  0.5157142   0.859    0.401
## ADM.l14     0.0928108  0.0913019   1.017    0.322
## Cam.l14     0.3734505  0.9707927   0.385    0.705
## Juros.l14  -0.1831895  0.3653615  -0.501    0.622
## Livres.l15  0.3987486  0.5164425   0.772    0.449
## ADM.l15     0.1440757  0.1016119   1.418    0.172
## Cam.l15    -0.2811656  1.0806560  -0.260    0.797
## Juros.l15   0.0925678  0.3495805   0.265    0.794
## Livres.l16 -0.1069059  0.5126203  -0.209    0.837
## ADM.l16    -0.0244603  0.0968322  -0.253    0.803
## Cam.l16    -1.2933344  1.0755795  -1.202    0.243
## Juros.l16   0.3407867  0.2858764   1.192    0.247
## Livres.l17 -0.3384573  0.4697920  -0.720    0.480
## ADM.l17     0.0401276  0.1020820   0.393    0.698
## Cam.l17    -0.3691358  1.1127108  -0.332    0.744
## Juros.l17   0.0558370  0.3106523   0.180    0.859
## Livres.l18  0.4471479  0.4497228   0.994    0.332
## ADM.l18     0.1182452  0.1086110   1.089    0.289
## Cam.l18    -0.8847161  1.0765716  -0.822    0.421
## Juros.l18   0.1462155  0.3245258   0.451    0.657
## Livres.l19  0.1274285  0.4559457   0.279    0.783
## ADM.l19     0.0681269  0.1000014   0.681    0.504
## Cam.l19    -0.7941518  1.0958116  -0.725    0.477
## Juros.l19   0.3722034  0.3566348   1.044    0.309
## Livres.l20 -0.8312706  0.5328699  -1.560    0.134
## ADM.l20     0.0067065  0.0995763   0.067    0.947
## Cam.l20    -0.6332132  1.2824469  -0.494    0.627
## Juros.l20   0.1465516  0.3599346   0.407    0.688
## Livres.l21 -0.5633939  0.5670918  -0.993    0.332
## ADM.l21     0.0205497  0.0905448   0.227    0.823
## Cam.l21     0.8562088  1.1910785   0.719    0.481
```

```
## Juros.l21  -0.3331808  0.3684620  -0.904    0.377
## Livres.l22  0.1646559  0.6362216   0.259    0.798
## ADM.l22    -0.0241133  0.0983601  -0.245    0.809
## Cam.l22     0.4515141  1.0638611   0.424    0.676
## Juros.l22  -0.4778387  0.3457105  -1.382    0.182
## Livres.l23  0.6180142  0.5598309   1.104    0.283
## ADM.l23     0.0780081  0.0957553   0.815    0.425
## Cam.l23     0.0348943  1.0849718   0.032    0.975
## Juros.l23  -0.0289937  0.4267216  -0.068    0.947
## Livres.l24 -0.1545967  0.4534010  -0.341    0.737
## ADM.l24    -0.0744532  0.0777685  -0.957    0.350
## Cam.l24    -1.0205950  0.9001788  -1.134    0.270
## Juros.l24   0.0750300  0.2202513   0.341    0.737
## const      -0.5165079  0.4230850  -1.221    0.236
## Tend       -0.0082289  0.0180779  -0.455    0.654
## Jan         0.0018859  0.4598302   0.004    0.997
## Fev        -0.3313743  0.4933946  -0.672    0.510
## Mar        -0.1226347  0.5295053  -0.232    0.819
## Abr        -0.6657633  0.5761702  -1.155    0.262
## Mai        -0.0302982  0.6735859  -0.045    0.965
## Jun         0.2060218  0.7139692   0.289    0.776
## Jul        -0.0009738  0.6803769  -0.001    0.999
## Ago         0.4591084  0.6253592   0.734    0.471
## Set         0.2899053  0.5842796   0.496    0.625
## Out         0.2093497  0.5973692   0.350    0.730
## Nov         0.0263682  0.5084123   0.052    0.959
##
##
## Residual standard error: 0.3998 on 20 degrees of freedom
## Multiple R-Squared: 0.8724,  Adjusted R-squared: 0.1835
## F-statistic: 1.266 on 108 and 20 DF,  p-value: 0.2794
##
##
##
## Covariance matrix of residuals:
##           Livres       ADM       Cam    Juros
## Livres  0.057540  0.006731 -0.004211 -0.05036
## ADM     0.006731  0.529385  0.001885 -0.10230
## Cam    -0.004211  0.001885  0.009728  0.01057
## Juros  -0.050363 -0.102302  0.010571  0.15980
##
## Correlation matrix of residuals:
##          Livres      ADM      Cam   Juros
## Livres  1.00000  0.03857 -0.17798 -0.5252
## ADM     0.03857  1.00000  0.02627 -0.3517
## Cam    -0.17798  0.02627  1.00000  0.2681
## Juros  -0.52521 -0.35173  0.26810  1.0000
```

Os critérios de informação indicam que se trata de um VAR(1). Assim, usa-se p = 1.

Raíses

```r
roots(modelo.estima1, modulus = FALSE)
```

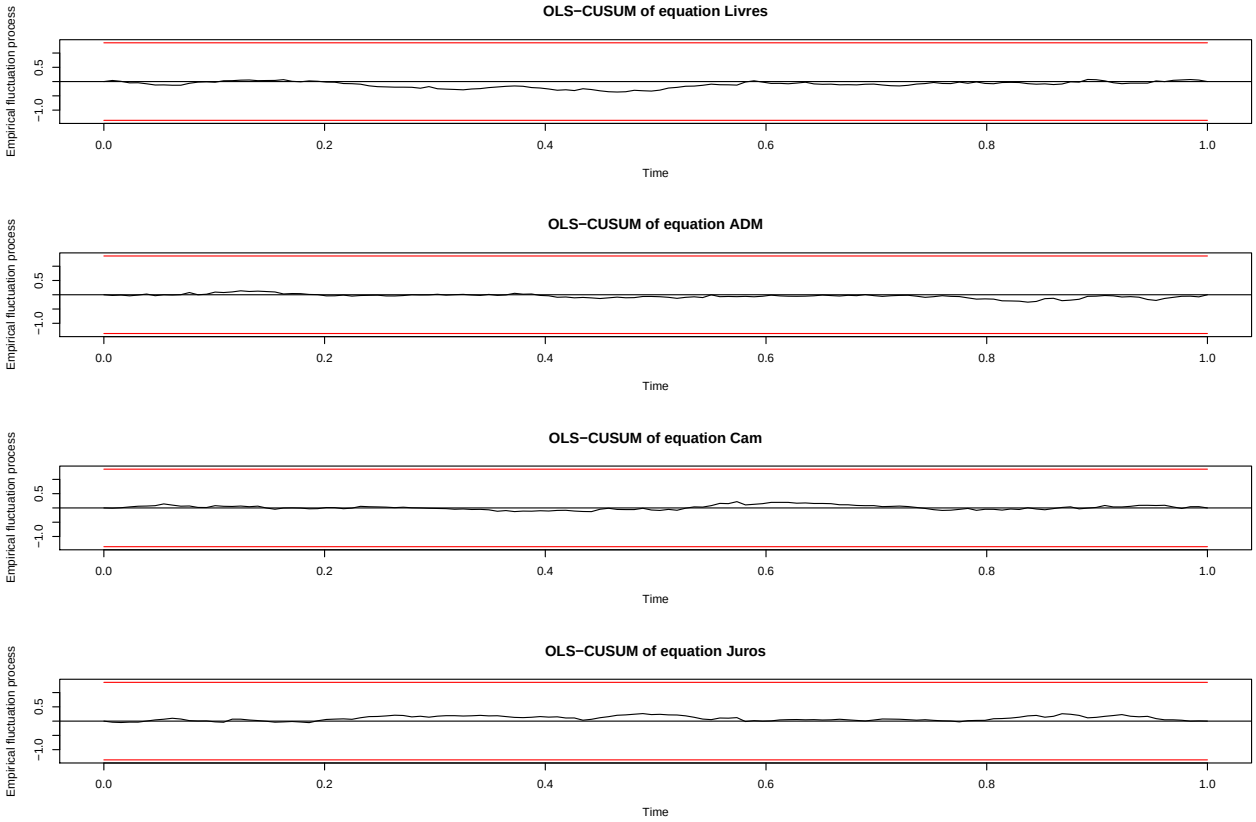
```
##  [1] -0.8045635+0.5820845i -0.8045635-0.5820845i  0.4077405+0.9020747i
##  [4]  0.4077405-0.9020747i  0.9468666+0.2880633i  0.9468666-0.2880633i
##  [7] -0.9854510+0.0000000i  0.5052183+0.8450849i  0.5052183-0.8450849i
## [10]  0.8088852+0.5609247i  0.8088852-0.5609247i  0.2650322+0.9477209i
## [13]  0.2650322-0.9477209i  0.1275066+0.9757404i  0.1275066-0.9757404i
## [16] -0.4012119+0.8983402i -0.4012119-0.8983402i  0.9824083+0.0424203i
## [19]  0.9824083-0.0424203i -0.7405098+0.6467882i -0.7405098-0.6467882i
## [22]  0.8764016+0.4432251i  0.8764016-0.4432251i -0.0763908+0.9782238i
## [25] -0.0763908-0.9782238i  0.9648383+0.1751302i  0.9648383-0.1751302i
## [28] -0.4529691+0.8675073i -0.4529691-0.8675073i -0.9263444+0.3150786i
## [31] -0.9263444-0.3150786i -0.1329835+0.9683691i -0.1329835-0.9683691i
## [34] -0.6360727+0.7412498i -0.6360727-0.7412498i  0.3461160+0.9129863i
## [37]  0.3461160-0.9129863i  0.6690953+0.7091348i  0.6690953-0.7091348i
## [40] -0.3102297+0.9230470i -0.3102297-0.9230470i  0.7124431+0.6632251i
## [43]  0.7124431-0.6632251i -0.5714914+0.7866558i -0.5714914-0.7866558i
## [46]  0.9207446+0.3120531i  0.9207446-0.3120531i -0.2217771+0.9461722i
## [49] -0.2217771-0.9461722i -0.6715386+0.7011964i -0.6715386-0.7011964i
## [52] -0.8070561+0.5382122i -0.8070561-0.5382122i  0.0498434+0.9687406i
## [55]  0.0498434-0.9687406i -0.9617041+0.0902160i -0.9617041-0.0902160i
## [58]  0.7436914+0.6156058i  0.7436914-0.6156058i -0.8796611+0.3818186i
## [61] -0.8796611-0.3818186i -0.9257872+0.2444302i -0.9257872-0.2444302i
## [64]  0.5832136+0.7588415i  0.5832136-0.7588415i -0.9475719+0.1308706i
## [67] -0.9475719-0.1308706i  0.2271689+0.9231526i  0.2271689-0.9231526i
## [70]  0.8586484+0.4056505i  0.8586484-0.4056505i -0.2764786+0.9019788i
## [73] -0.2764786-0.9019788i  0.9166348+0.2145747i  0.9166348-0.2145747i
## [76] -0.8356294+0.4169152i -0.8356294-0.4169152i  0.1120522+0.9182850i
## [79]  0.1120522-0.9182850i -0.9129289+0.1451668i -0.9129289-0.1451668i
## [82]  0.5158452+0.7648825i  0.5158452-0.7648825i -0.5006913+0.7739534i
## [85] -0.5006913-0.7739534i  0.9124607+0.0302550i  0.9124607-0.0302550i
## [88]  0.7149712+0.5111776i  0.7149712-0.5111776i -0.2955653+0.7739767i
## [91] -0.2955653-0.7739767i -0.4931473+0.3606078i -0.4931473-0.3606078i
## [94]  0.1904676+0.5683025i  0.1904676-0.5683025i  0.3289605+0.0000000i
```

```r
roots(modelo.estima1)
```

```
##  [1] 0.9930483 0.9930483 0.9899450 0.9899450 0.9897155 0.9897155 0.9854510
##  [8] 0.9845883 0.9845883 0.9843433 0.9843433 0.9840818 0.9840818 0.9840362
## [15] 0.9840362 0.9838628 0.9838628 0.9833237 0.9833237 0.9832038 0.9832038
## [22] 0.9821040 0.9821040 0.9812020 0.9812020 0.9806037 0.9806037 0.9786470
## [29] 0.9786470 0.9784623 0.9784623 0.9774576 0.9774576 0.9767495 0.9767495
## [36] 0.9763915 0.9763915 0.9749670 0.9749670 0.9737855 0.9737855 0.9733666
## [43] 0.9733666 0.9723321 0.9723321 0.9721871 0.9721871 0.9718163 0.9718163
## [50] 0.9708967 0.9708967 0.9700577 0.9700577 0.9700220 0.9700220 0.9659263
## [57] 0.9659263 0.9654260 0.9654260 0.9589521 0.9589521 0.9575114 0.9575114
## [64] 0.9570676 0.9570676 0.9565665 0.9565665 0.9506926 0.9506926 0.9496470
## [71] 0.9496470 0.9434014 0.9434014 0.9414148 0.9414148 0.9338602 0.9338602
## [78] 0.9250962 0.9250962 0.9243985 0.9243985 0.9225733 0.9225733 0.9217894
## [85] 0.9217894 0.9129622 0.9129622 0.8789120 0.8789120 0.8284918 0.8284918
## [92] 0.6109274 0.6109274 0.5993710 0.5993710 0.3289605
```

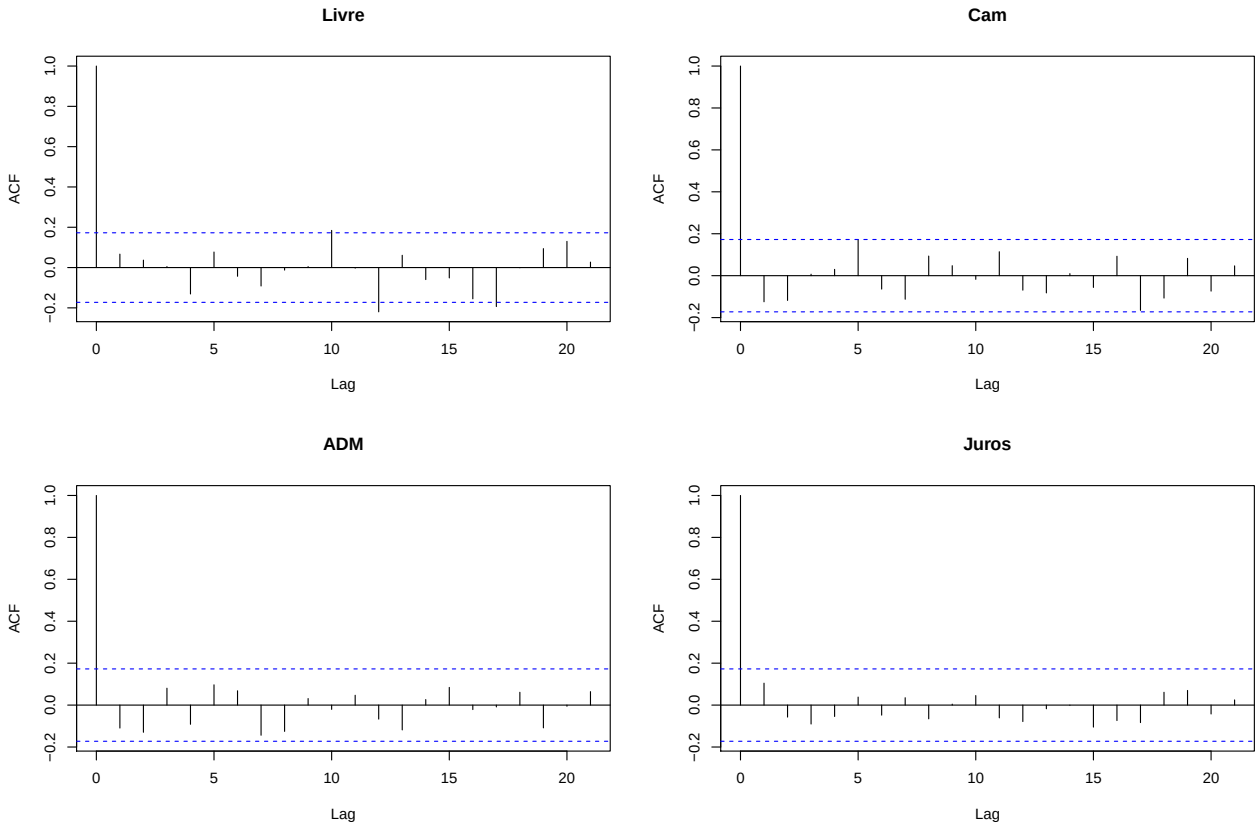
Estabilidade

```
modelo.estabili = stability(modelo.estima1, type = "OLS-CUSUM")
plot(modelo.estabili)
```



Autocorrelacao

```
layout(matrix(1:4, nrow = 2, ncol = 2))
acf(residuals(modelo.estima1)[,1], main = "Livre")
acf(residuals(modelo.estima1)[,2], main = "ADM")
acf(residuals(modelo.estima1)[,3], main = "Cam")
acf(residuals(modelo.estima1)[,4], main = "Juros")
```



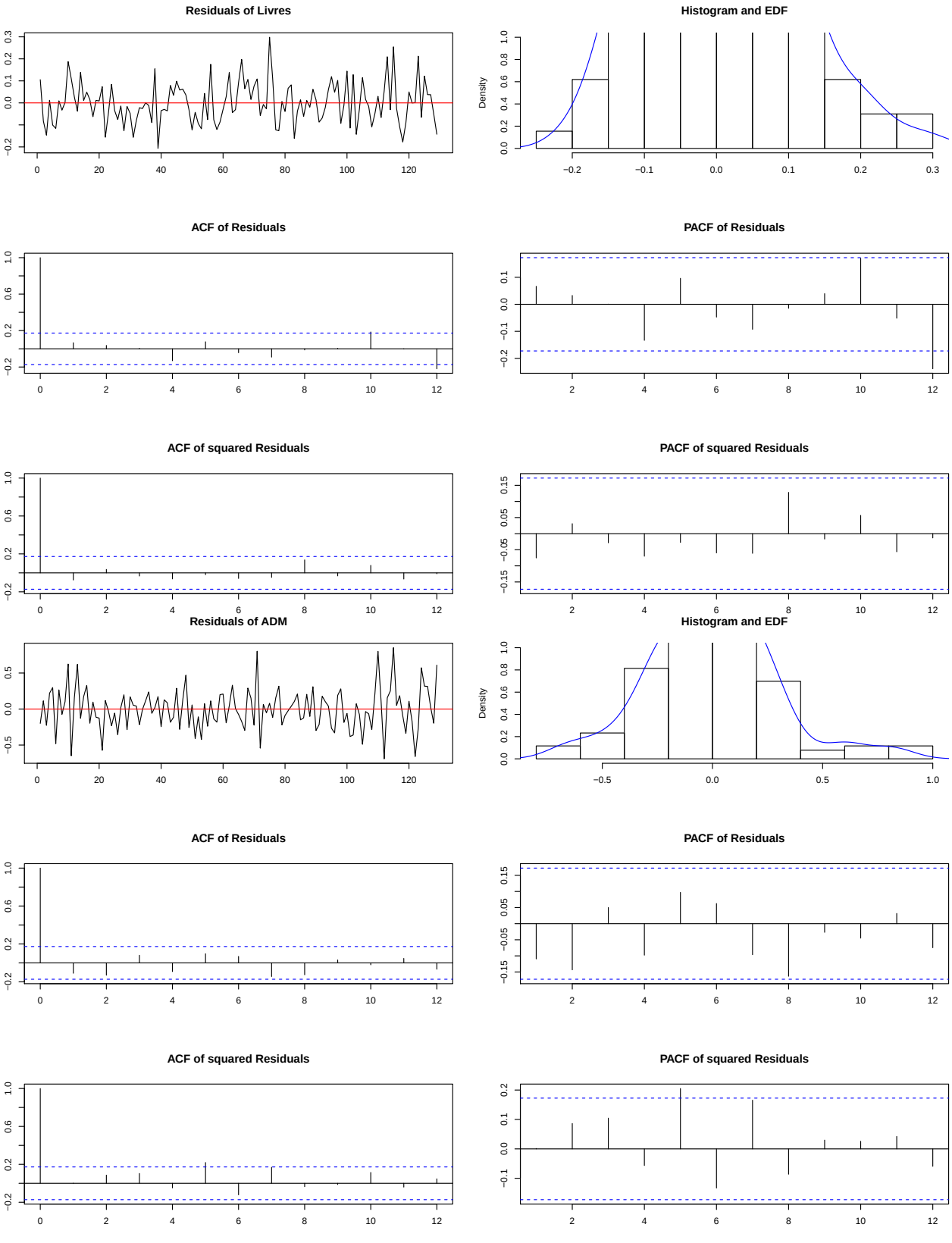
Estatistique des tests

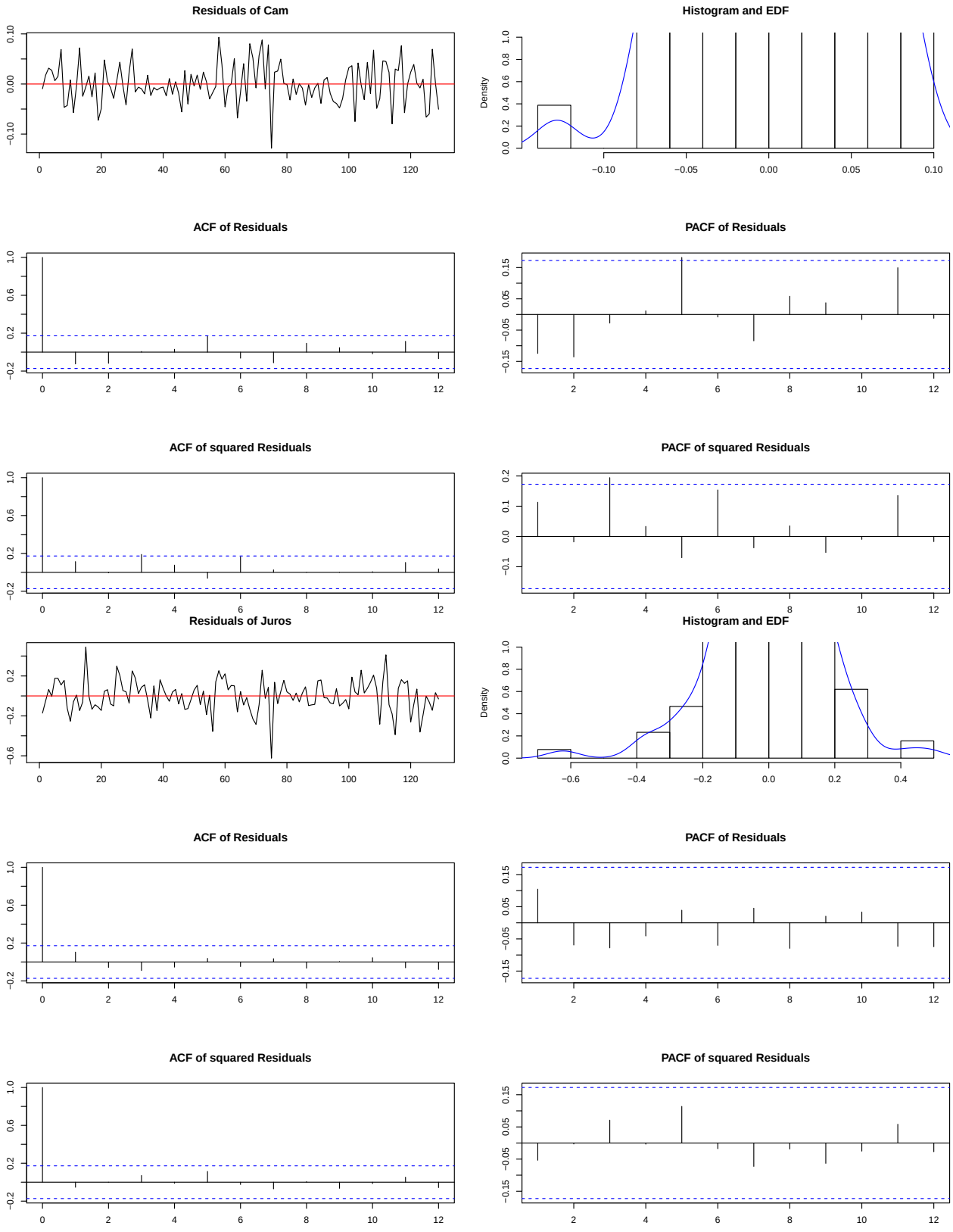
```
modelo.pt.asy = serial.test(modelo.estima1, lags.pt = 12, type = "PT.adjusted")
```

```
## Warning in pchisq(STATISTIC, df = PARAMETER): NaNs produced
```

```
## Warning in pchisq(STATISTIC, df = PARAMETER): NaNs produced
```

```
plot(modelo.pt.asy)
```


Residuals of Livres
Histogram and EDF
Density
ACF of Residuals
PACF of Residuals
ACF of squared Residuals
PACF of squared Residuals
Residuals of ADM
Histogram and EDF
Density
ACF of Residuals
PACF of Residuals
ACF of squared Residuals
PACF of squared Residuals


Residuals of Cam
Histogram and EDF
Density
ACF of Residuals
PACF of Residuals
ACF of squared Residuals
PACF of squared Residuals
Residuals of Juros
Histogram and EDF
Density
ACF of Residuals
PACF of Residuals
ACF of squared Residuals
PACF of squared Residuals

test de heterocedasticidade

```
modelo.arch = arch.test(modelo.estima1, lags.single = 12, lags.multi = 8,
                        multivariate.only = FALSE)
print(modelo.arch)
```

```
## $Livres
##
##  ARCH test (univariate)
##
## data:  Residual of Livres equation
## Chi-squared = 5.7915, df = 12, p-value = 0.9262
##
##
## $ADM
##
##  ARCH test (univariate)
##
## data:  Residual of ADM equation
## Chi-squared = 16.06, df = 12, p-value = 0.1885
##
##
## $Cam
##
##  ARCH test (univariate)
##
## data:  Residual of Cam equation
## Chi-squared = 12.954, df = 12, p-value = 0.3724
##
##
## $Juros
##
##  ARCH test (univariate)
##
## data:  Residual of Juros equation
## Chi-squared = 4.2669, df = 12, p-value = 0.9781
##
##
##
##  ARCH (multivariate)
##
## data:  Residuals of VAR object modelo.estima1
## Chi-squared = 939.68, df = 800, p-value = 0.0004442
```

```
## $arch.uni
## $arch.uni$Livres
##
##  ARCH test (univariate)
##
## data:  Residual of Livres equation
## Chi-squared = 5.7915, df = 12, p-value = 0.9262
##
##
## $arch.uni$ADM
```

```
##
##  ARCH test (univariate)
##
## data:  Residual of ADM equation
## Chi-squared = 16.06, df = 12, p-value = 0.1885
##
##
## $arch.uni$Cam
##
##  ARCH test (univariate)
##
## data:  Residual of Cam equation
## Chi-squared = 12.954, df = 12, p-value = 0.3724
##
##
## $arch.uni$Juros
##
##  ARCH test (univariate)
##
## data:  Residual of Juros equation
## Chi-squared = 4.2669, df = 12, p-value = 0.9781
##
##
##
## $arch.mul
##
##  ARCH (multivariate)
##
## data:  Residuals of VAR object modelo.estima1
## Chi-squared = 939.68, df = 800, p-value = 0.0004442
```

Test de causalidade

```
modelo.causal = causality(modelo.estima1, cause = c("Cam", "Juros"),
                          vcov. = vcovHC(modelo.estima1))
print(modelo.causal)
```

```
## $Granger
##
##  Granger causality H0: Cam Juros do not Granger-cause Livres ADM
##
## data:  VAR object modelo.estima1
## F-Test = 0.21361, df1 = 96, df2 = 80, p-value = 1
##
##
## $Instant
##
##  H0: No instantaneous causality between: Cam Juros and Livres ADM
##
## data:  VAR object modelo.estima1
## Chi-squared = 38.07, df = 4, p-value = 1.084e-07
```

```r
grangertest(Livres ~ Juros, order = 4, data = Dados1)
```

```
## Granger causality test
##
## Model 1: Livres ~ Lags(Livres, 1:4) + Lags(Juros, 1:4)
## Model 2: Livres ~ Lags(Livres, 1:4)
##   Res.Df Df      F   Pr(>F)
## 1    140
## 2    144 -4 3.5523 0.008578 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
grangertest(Livres ~ Cam, order = 4, data = Dados1)
```

```
## Granger causality test
##
## Model 1: Livres ~ Lags(Livres, 1:4) + Lags(Cam, 1:4)
## Model 2: Livres ~ Lags(Livres, 1:4)
##   Res.Df Df      F    Pr(>F)
## 1    140
## 2    144 -4 5.8833 0.0002093 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Funcao respostas impulsos

```r
modeloo.irf = irf(modelo.estima1, impulse = c("Cam", "Juros"),
                  response = c("Livres"), boot = T, cumulative = F, n.ahead = 10)
```