Ejercicio Empírico 5 - Macroeconometría

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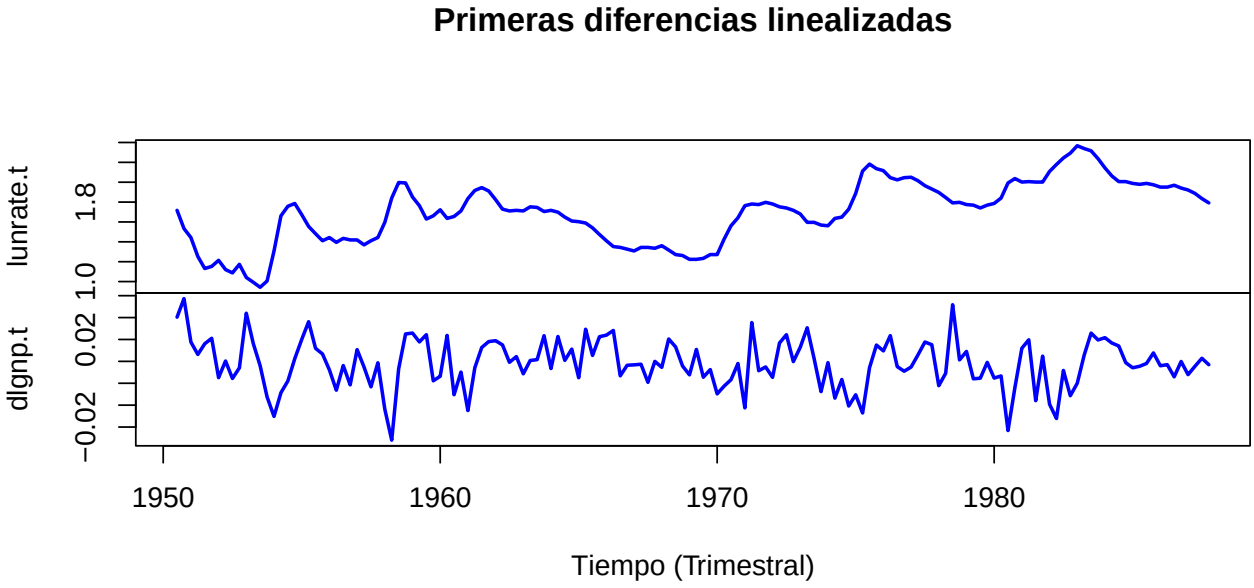
Grafica de Los Datos Agrupados



Parte 1

```
##
## ###############################################
## # Augmented Dickey-Fuller Test Unit Root Test #
## ###############################################
##
## Test regression trend
##
##
## Call:
## lm(formula = z.diff ~ z.lag.1 + 1 + tt + z.diff.lag)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.71036 -0.19517 -0.05013  0.19789  1.06548
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
```

```
## (Intercept)  0.3527841  0.0946147   3.729 0.000276 ***
## z.lag.1     -0.0905823  0.0216014  -4.193 4.78e-05 ***
## tt           0.0022547  0.0008715   2.587 0.010664 *
## z.diff.lag   0.6445111  0.0622384  10.356  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3255 on 144 degrees of freedom
## Multiple R-squared:  0.4413, Adjusted R-squared:  0.4296
## F-statistic: 37.91 on 3 and 144 DF,  p-value: < 2.2e-16
##
##
## Value of test-statistic is: -4.1933 5.9499 8.8963
##
## Critical values for test statistics:
##       1pct  5pct 10pct
## tau3 -3.99 -3.43 -3.13
## phi2  6.22  4.75  4.07
## phi3  8.43  6.49  5.47
##
## ###############################################
## # Augmented Dickey-Fuller Test Unit Root Test #
## ###############################################
##
## Test regression drift
##
##
## Call:
## lm(formula = z.diff ~ z.lag.1 + 1 + z.diff.lag)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.86783 -0.18382 -0.03954  0.19459  1.10017
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.30139    0.09431   3.196  0.00171 **
## z.lag.1     -0.05173    0.01583  -3.268  0.00135 **
## z.diff.lag   0.62741    0.06309   9.945  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3319 on 145 degrees of freedom
## Multiple R-squared:  0.4153, Adjusted R-squared:  0.4072
## F-statistic:  51.5 on 2 and 145 DF,  p-value: < 2.2e-16
##
##
## Value of test-statistic is: -3.2679 5.3671
##
## Critical values for test statistics:
##       1pct  5pct 10pct
## tau2 -3.46 -2.88 -2.57
## phi1  6.52  4.63  3.81
```

```
##
## ###############################################
## # Augmented Dickey-Fuller Test Unit Root Test #
## ###############################################
##
## Test regression none
##
##
## Call:
## lm(formula = z.diff ~ z.lag.1 - 1 + z.diff.lag)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.92233 -0.14617 -0.00949  0.20535  1.10501
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## z.lag.1    -0.003302   0.004721  -0.699    0.485
## z.diff.lag  0.603567   0.064594   9.344   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3422 on 146 degrees of freedom
## Multiple R-squared:  0.3744, Adjusted R-squared:  0.3658
## F-statistic: 43.69 on 2 and 146 DF,  p-value: 1.347e-15
##
##
## Value of test-statistic is: -0.6994
##
## Critical values for test statistics:
##       1pct  5pct 10pct
## tau1 -2.58 -1.95 -1.62
```

```
## [1] 1
```

Conclusiones, tenemos que nuestro test de raiz unitaria de unrate es de orden de integracion 1, por lo que si hay estacionariedad.

```
##
## ###############################################
## # Augmented Dickey-Fuller Test Unit Root Test #
## ###############################################
##
## Test regression trend
##
##
## Call:
## lm(formula = z.diff ~ z.lag.1 + 1 + tt + z.diff.lag)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -187.331  -26.775    4.163   33.031  188.512
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
```

```
## (Intercept) 64.10879   32.56570   1.969   0.0509 .
## z.lag.1     -0.02767    0.01769  -1.564   0.1199
## tt           1.31549    0.73046   1.801   0.0738 .
## z.diff.lag   0.33650    0.07893   4.263 3.62e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 50.76 on 145 degrees of freedom
## Multiple R-squared:  0.1535, Adjusted R-squared:  0.1359
## F-statistic: 8.762 on 3 and 145 DF,  p-value: 2.228e-05
##
##
## Value of test-statistic is: -1.5643 11.2064 2.952
##
## Critical values for test statistics:
##       1pct  5pct 10pct
## tau3 -3.99 -3.43 -3.13
## phi2  6.22  4.75  4.07
## phi3  8.43  6.49  5.47
##
## ###############################################
## # Augmented Dickey-Fuller Test Unit Root Test #
## ###############################################
##
## Test regression drift
##
##
## Call:
## lm(formula = z.diff ~ z.lag.1 + 1 + z.diff.lag)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -192.431  -24.951    0.056   32.792  189.981
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  9.745042  12.311287   0.792    0.430
## z.lag.1      0.003894   0.002405   1.619    0.108
## z.diff.lag   0.317748   0.078842   4.030 8.94e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 51.15 on 146 degrees of freedom
## Multiple R-squared:  0.1345, Adjusted R-squared:  0.1227
## F-statistic: 11.35 on 2 and 146 DF,  p-value: 2.628e-05
##
##
## Value of test-statistic is: 1.6188 14.9581
##
## Critical values for test statistics:
##       1pct  5pct 10pct
## tau2 -3.46 -2.88 -2.57
## phi1  6.52  4.63  3.81
```

```
##
## ###############################################
## # Augmented Dickey-Fuller Test Unit Root Test #
## ###############################################
##
## Test regression none
##
##
## Call:
## lm(formula = z.diff ~ z.lag.1 - 1 + z.diff.lag)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -194.704  -25.999    2.894   31.381  188.608
##
## Coefficients:
##            Estimate Std. Error t value Pr(>|t|)
## z.lag.1    0.005612   0.001036   5.419 2.40e-07 ***
## z.diff.lag 0.321826   0.078574   4.096 6.92e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 51.09 on 147 degrees of freedom
## Multiple R-squared:  0.4583, Adjusted R-squared:  0.4509
## F-statistic: 62.18 on 2 and 147 DF,  p-value: < 2.2e-16
##
##
## Value of test-statistic is: 5.4189
##
## Critical values for test statistics:
##       1pct  5pct 10pct
## tau1 -2.58 -1.95 -1.62
```

```
## [1] 1
```

Conclusiones, tenemos que nuestro test de raiz unitaria de gnp es de orden de integracion 1, por lo que si hay estacionariedad.

Parte 2

Para comenzar, evaluamos un modelo estándar de VAR(1)

```
## $lunrate.t
##                Estimate Std. Error   t value      Pr(>|t|)
## lunrate.t.l1  0.9592268 0.01680961 57.064181 1.015261e-101
## dlgnp.t.l1   -4.2943446 0.47635572 -9.014995  1.017109e-15
## const         0.1085405 0.02951015  3.678072  3.296784e-04
##
## $dlgnp.t
##                  Estimate  Std. Error   t value     Pr(>|t|)
## lunrate.t.l1  0.005092840 0.002661400  1.913594 5.762910e-02
## dlgnp.t.l1    0.363802459 0.075419538  4.823716 3.506521e-06
## const        -0.003001074 0.004672227 -0.642322 5.216715e-01

## $selection
```

```
## AIC(n)  HQ(n)  SC(n) FPE(n)
##      6      3      2      6
##
## $criteria
##                    1             2             3             4             5
## AIC(n) -1.537604e+01 -1.550295e+01 -1.554419e+01 -1.552586e+01 -1.551855e+01
## HQ(n)  -1.527260e+01 -1.536503e+01 -1.537179e+01 -1.531898e+01 -1.527719e+01
## SC(n)  -1.512150e+01 -1.516356e+01 -1.511995e+01 -1.501678e+01 -1.492462e+01
## FPE(n)  2.100472e-07  1.850400e-07  1.776094e-07  1.809613e-07  1.823838e-07
##                    6             7             8             9            10
## AIC(n) -1.555080e+01 -1.551301e+01 -1.548887e+01 -1.547950e+01 -1.545822e+01
## HQ(n)  -1.527496e+01 -1.520268e+01 -1.514407e+01 -1.510022e+01 -1.504446e+01
## SC(n)  -1.487202e+01 -1.474937e+01 -1.464039e+01 -1.454617e+01 -1.444005e+01
## FPE(n)  1.767183e-07  1.836900e-07  1.883880e-07  1.904236e-07  1.948411e-07
##                   11            12
## AIC(n) -1.545085e+01 -1.543551e+01
## HQ(n)  -1.500261e+01 -1.495278e+01
## SC(n)  -1.434783e+01 -1.424763e+01
## FPE(n)  1.966700e-07  2.001727e-07
```

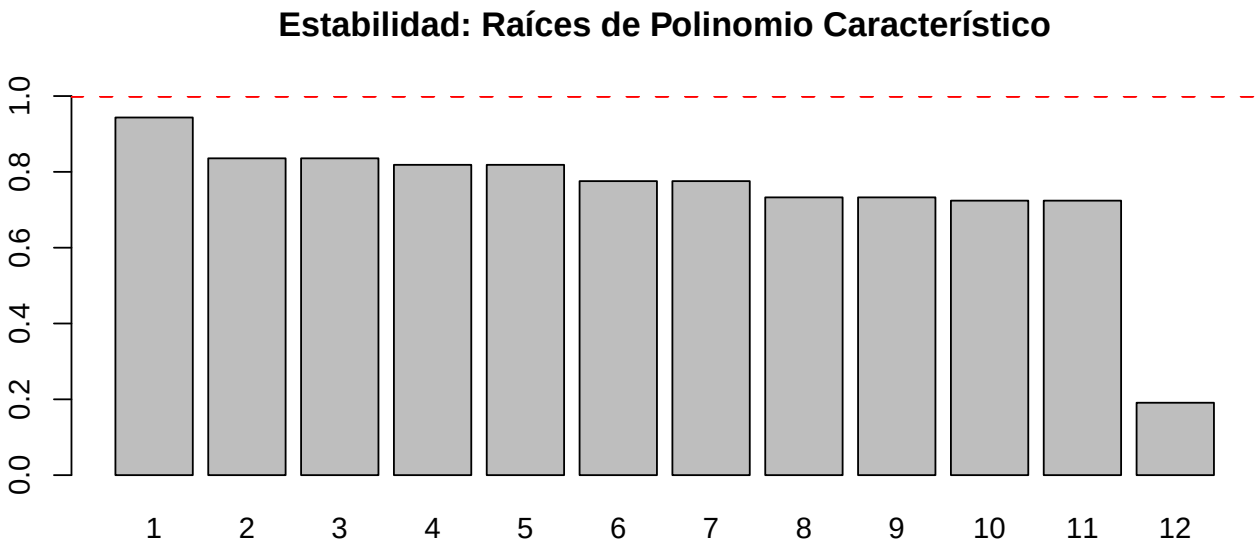
Comprobamos que nuestro mejor modelo de VAR es tomando en cuenta 6 rezagos como max segun el criterio de minimizacion de AIC.

Generamos nuestro nuevo modelo VAR(6):

```
##
## VAR Estimation Results:
## ========================
## Endogenous variables: lunrate.t, dlgnp.t
## Deterministic variables: const
## Sample size: 144
## Log Likelihood: 732.336
## Roots of the characteristic polynomial:
## 0.9434 0.8357 0.8357 0.8186 0.8186 0.7756 0.7756 0.7327 0.7327 0.7241 0.7241 0.191
## Call:
## VAR(y = data, p = 6, type = "const")
##
##
## Estimation results for equation lunrate.t:
## ==========================================
## lunrate.t = lunrate.t.l1 + dlgnp.t.l1 + lunrate.t.l2 + dlgnp.t.l2 + lunrate.t.l3 + dlgnp.t.l3 + lunra
##
##              Estimate Std. Error t value Pr(>|t|)
## lunrate.t.l1  1.31032    0.11053  11.855  < 2e-16 ***
## dlgnp.t.l1   -2.06019    0.65360  -3.152  0.00201 **
## lunrate.t.l2 -0.54936    0.17089  -3.215  0.00164 **
## dlgnp.t.l2   -1.58000    0.66141  -2.389  0.01833 *
## lunrate.t.l3  0.08974    0.17697   0.507  0.61294
## dlgnp.t.l3   -1.24898    0.67183  -1.859  0.06526 .
## lunrate.t.l4 -0.10492    0.17055  -0.615  0.53947
## dlgnp.t.l4   -0.07159    0.67855  -0.106  0.91614
## lunrate.t.l5  0.16327    0.16600   0.984  0.32716
## dlgnp.t.l5   -0.28143    0.68896  -0.408  0.68359
## lunrate.t.l6  0.03384    0.10608   0.319  0.75024
## dlgnp.t.l6   -1.80092    0.54899  -3.280  0.00133 **
```

```
## const         0.16333    0.03681   4.438 1.91e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## Residual standard error: 0.05518 on 131 degrees of freedom
## Multiple R-Squared: 0.9705,  Adjusted R-squared: 0.9678
## F-statistic: 359.7 on 12 and 131 DF,  p-value: < 2.2e-16
##
##
## Estimation results for equation dlgnp.t:
## ========================================
## dlgnp.t = lunrate.t.l1 + dlgnp.t.l1 + lunrate.t.l2 + dlgnp.t.l2 + lunrate.t.l3 + dlgnp.t.l3 + lunrat
##
##               Estimate Std. Error t value Pr(>|t|)
## lunrate.t.l1 -0.034064   0.019049  -1.788  0.07605 .
## dlgnp.t.l1    0.132803   0.112639   1.179  0.24053
## lunrate.t.l2  0.082463   0.029451   2.800  0.00588 **
## dlgnp.t.l2    0.171833   0.113983   1.508  0.13408
## lunrate.t.l3 -0.041529   0.030498  -1.362  0.17562
## dlgnp.t.l3    0.055771   0.115780   0.482  0.63082
## lunrate.t.l4  0.056750   0.029391   1.931  0.05566 .
## dlgnp.t.l4    0.225681   0.116939   1.930  0.05578 .
## lunrate.t.l5 -0.047075   0.028608  -1.646  0.10226
## dlgnp.t.l5    0.128218   0.118732   1.080  0.28217
## lunrate.t.l6 -0.011203   0.018282  -0.613  0.54106
## dlgnp.t.l6    0.174386   0.094610   1.843  0.06756 .
## const        -0.008624   0.006343  -1.360  0.17629
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## Residual standard error: 0.00951 on 131 degrees of freedom
## Multiple R-Squared: 0.2734,  Adjusted R-squared: 0.2068
## F-statistic: 4.107 on 12 and 131 DF,  p-value: 1.951e-05
##
##
##
## Covariance matrix of residuals:
##           lunrate.t    dlgnp.t
## lunrate.t  0.003045 -3.420e-04
## dlgnp.t   -0.000342  9.044e-05
##
## Correlation matrix of residuals:
##           lunrate.t dlgnp.t
## lunrate.t    1.0000 -0.6517
## dlgnp.t     -0.6517  1.0000
```

Ahora, generamos una grafica de estabilidad de las raices del modelo, en donde comprobamos que al ser todos <1, es estable.



Conclusion: al ser todos los polinomios caracteristicos del modelo menores a 1, comprobamos que nuestro modelo VAR si presenta estabilidad.

Para comprobar la normalidad del modelo, usamos la función *"normality.test"*

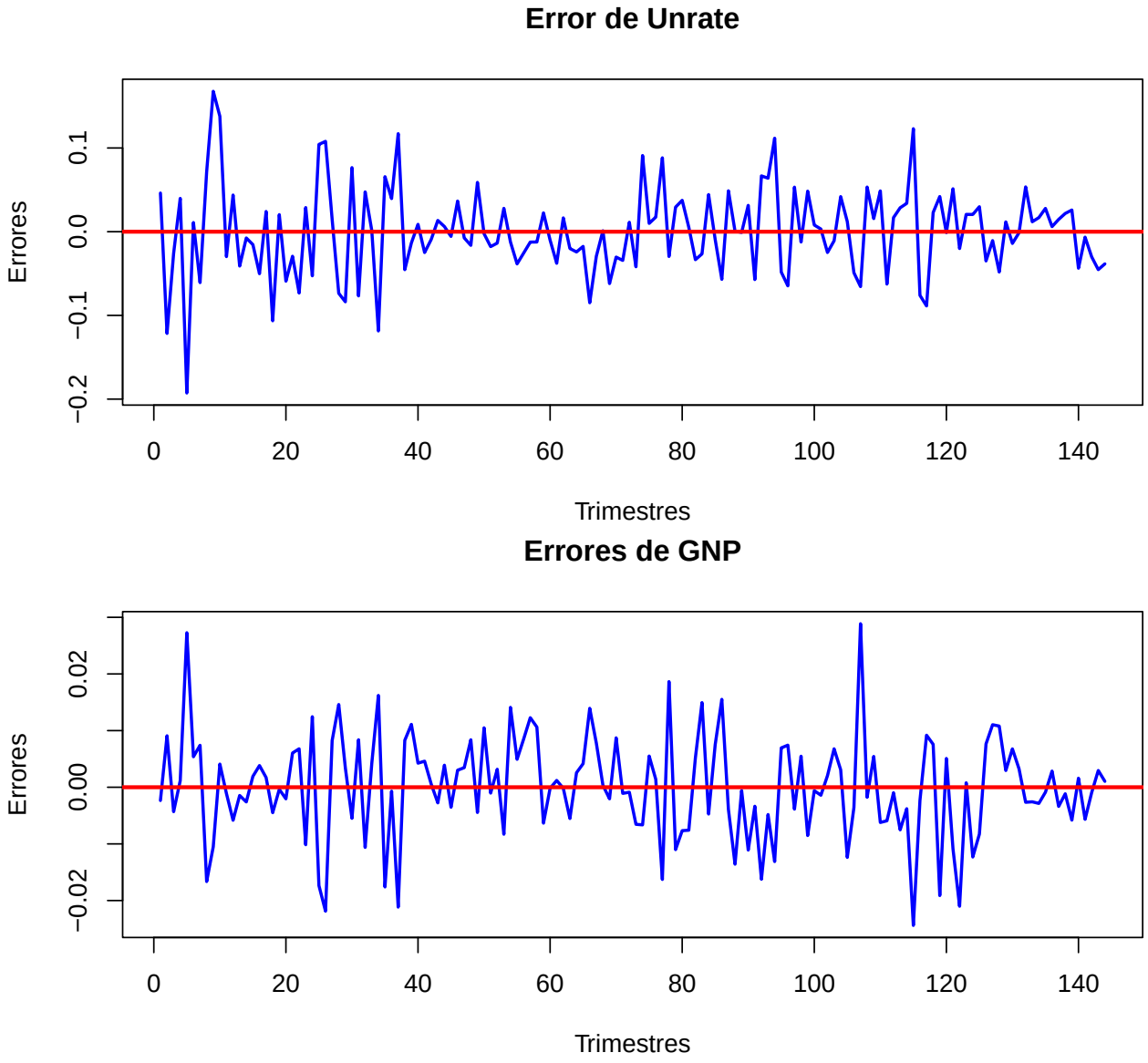
```
## $JB
##
##  JB-Test (multivariate)
##
## data:  Residuals of VAR object VAR.1.opt
## Chi-squared = 13.304, df = 4, p-value = 0.009881
##
##
## $Skewness
##
##  Skewness only (multivariate)
##
## data:  Residuals of VAR object VAR.1.opt
## Chi-squared = 0.24428, df = 2, p-value = 0.885
##
##
## $Kurtosis
##
##  Kurtosis only (multivariate)
##
## data:  Residuals of VAR object VAR.1.opt
## Chi-squared = 13.06, df = 2, p-value = 0.001459
```

H0 = Los errores distribuyen normalmente. > 0.05

H1 = Los errores no distribuyen con normalidad. < 0.05

Conclusión: Tenemos que la prueba Skewness con p-value de 0.885, por tanto, rechazamos hipotesis alternativa, los errores se distribuyen normal.

Gráficos de Residuos del Modelo



Parte 3

Grafico 1

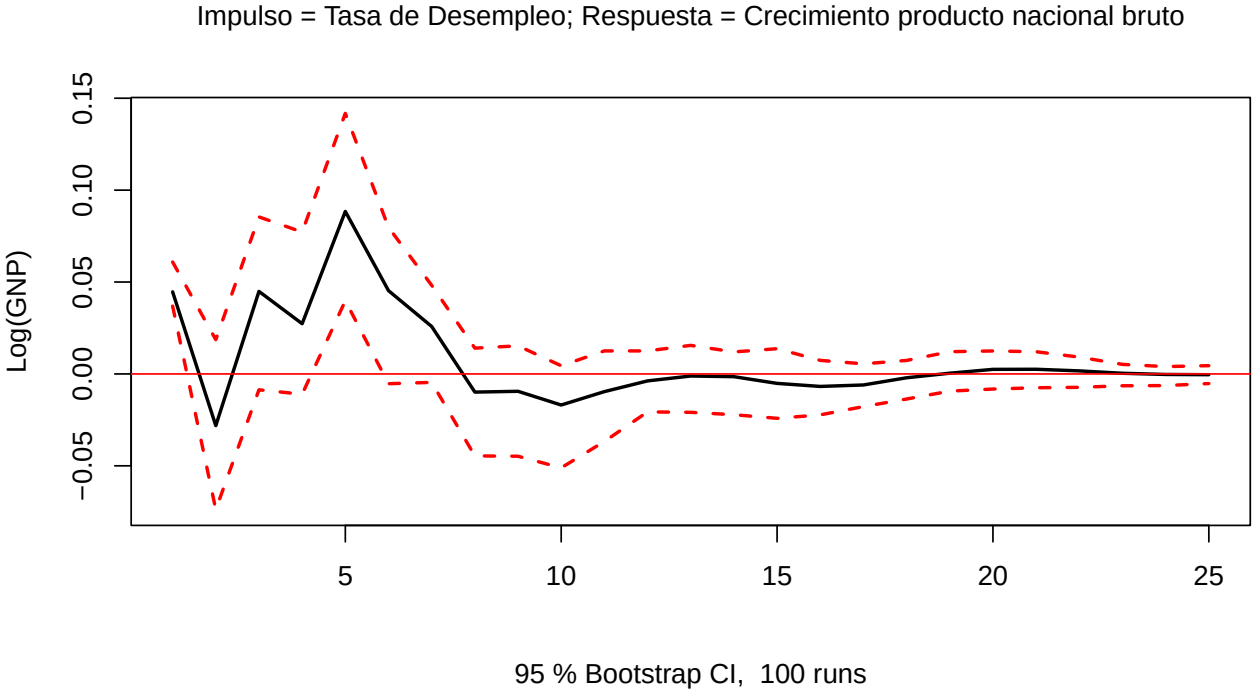
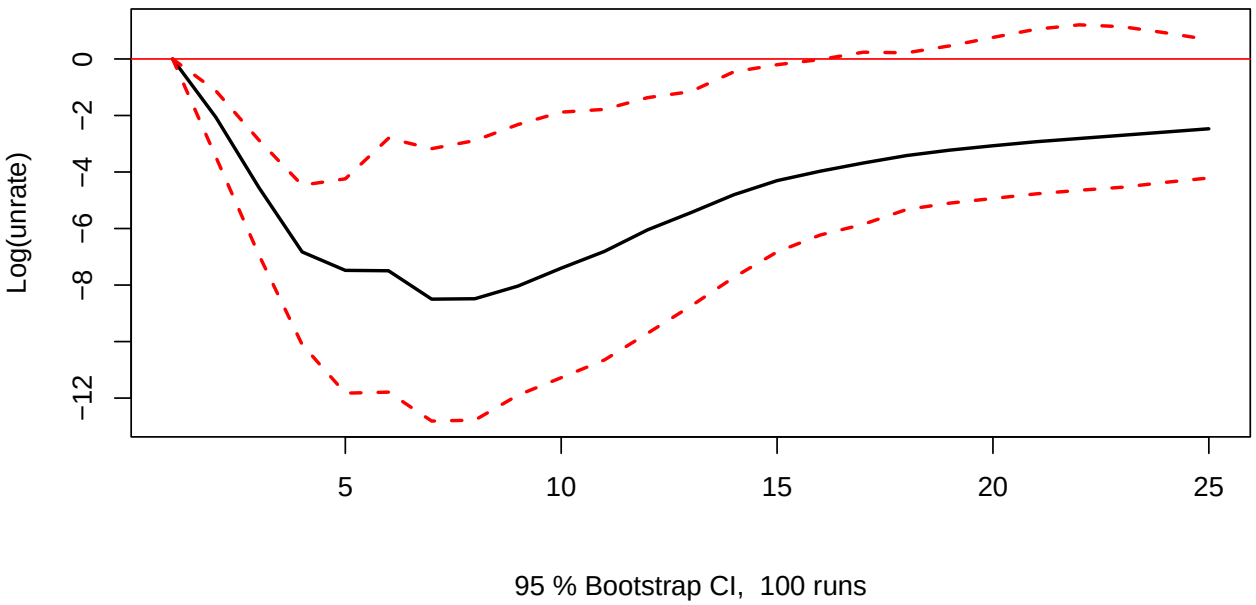
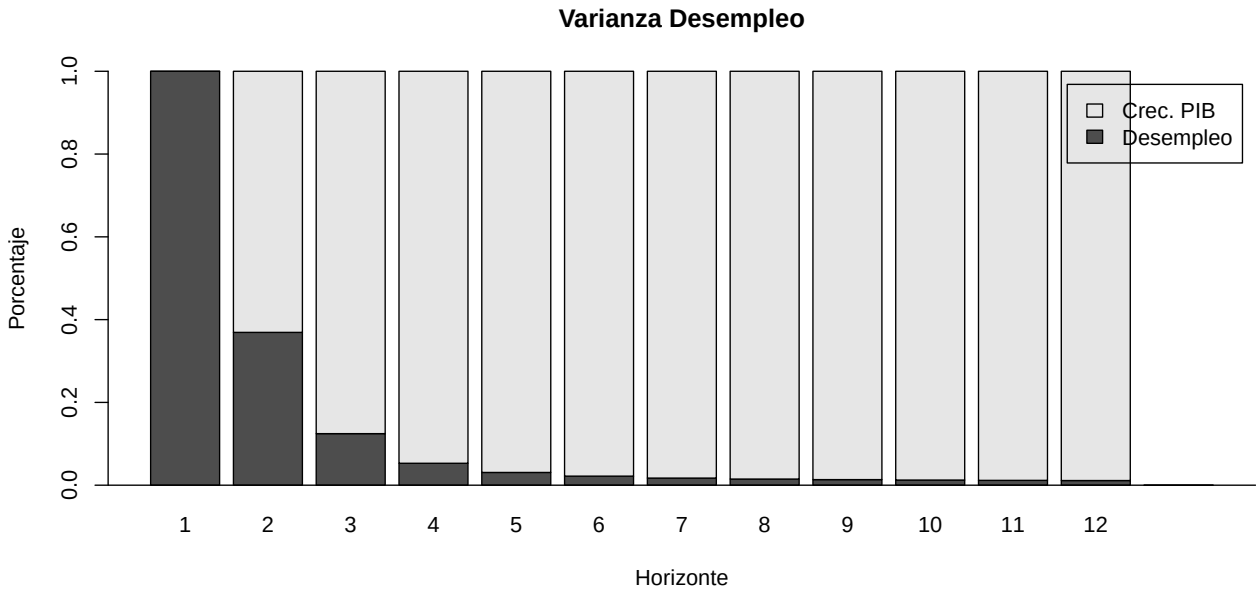
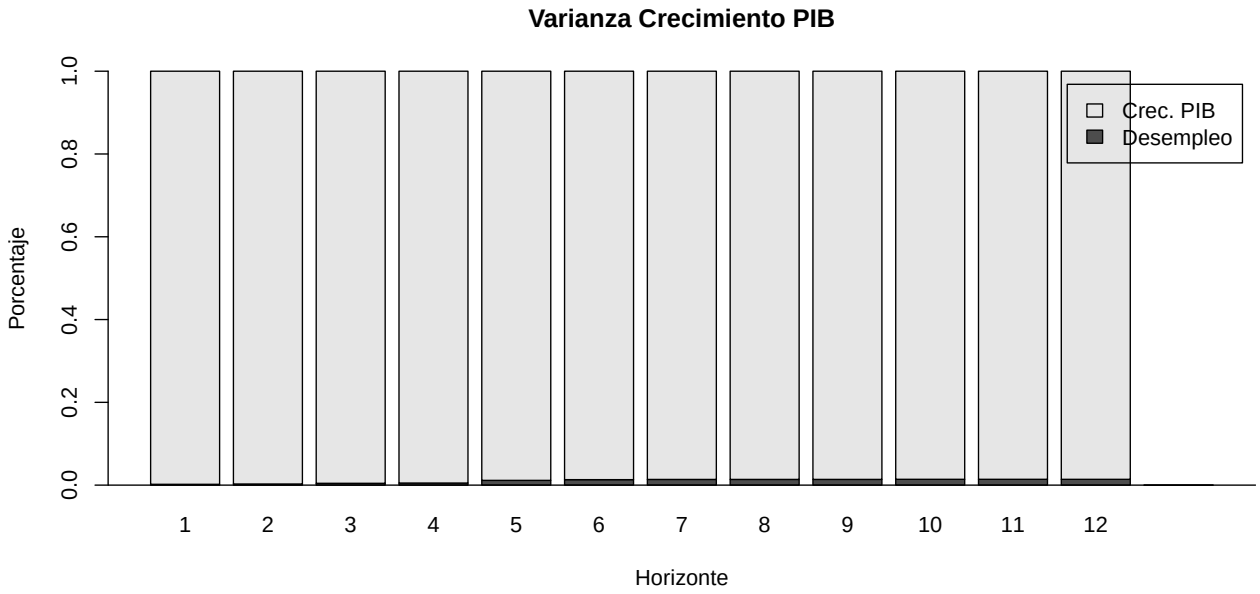


Grafico 2



Parte 4

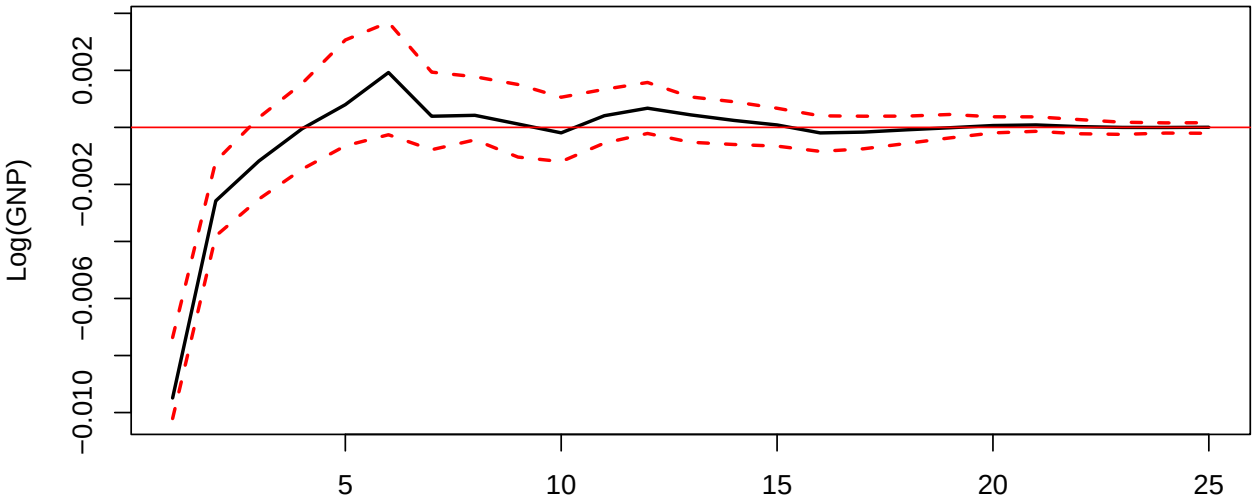

Varianza Desempleo
Porcentaje
0.0
0.2
0.4
0.6
0.8
1.0
1
2
3
4
5
6
7
8
9
10
11
12
Horizonte
Crec. PIB
Desempleo


Varianza Crecimiento PIB
Porcentaje
0.0
0.2
0.4
0.6
0.8
1.0
1
2
3
4
5
6
7
8
9
10
11
12
Horizonte
Crec. PIB
Desempleo

Parte 5

Gráfica 1

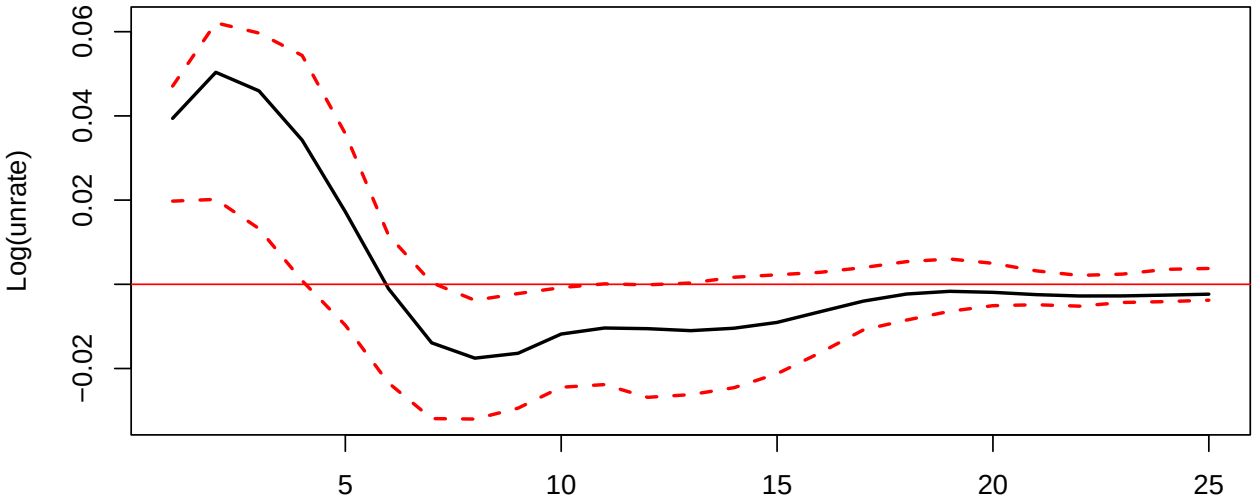
Impulso = Tasa de Desempleo; Respuesta = Crecimiento producto nacional bruto



95 % Bootstrap CI, 100 runs

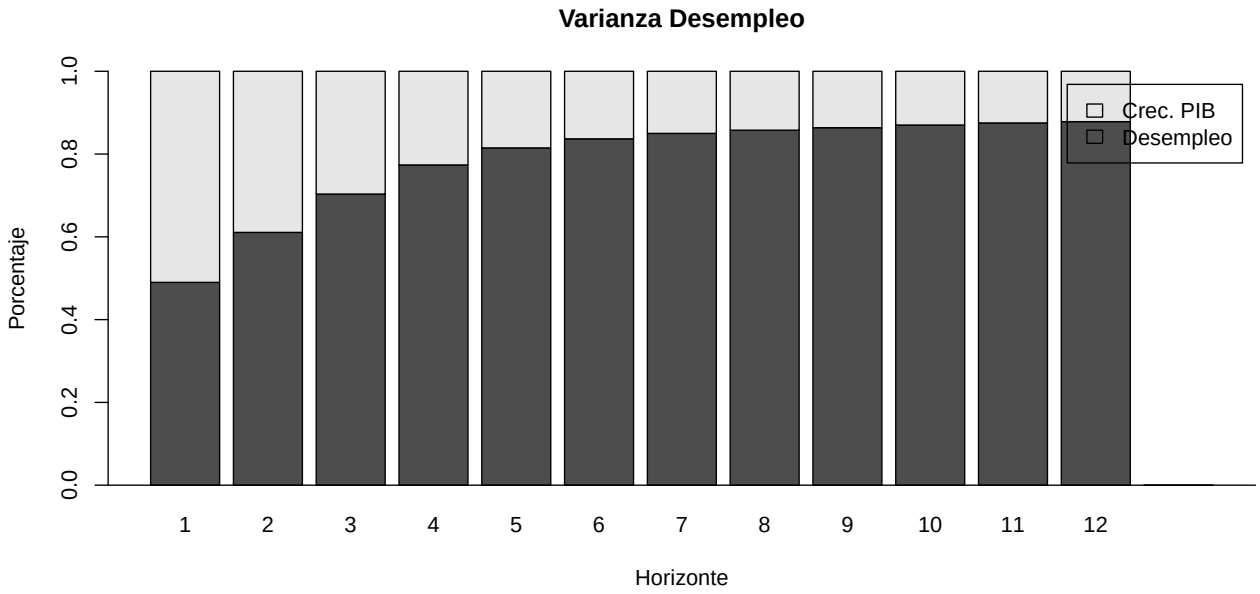
Grafica 2

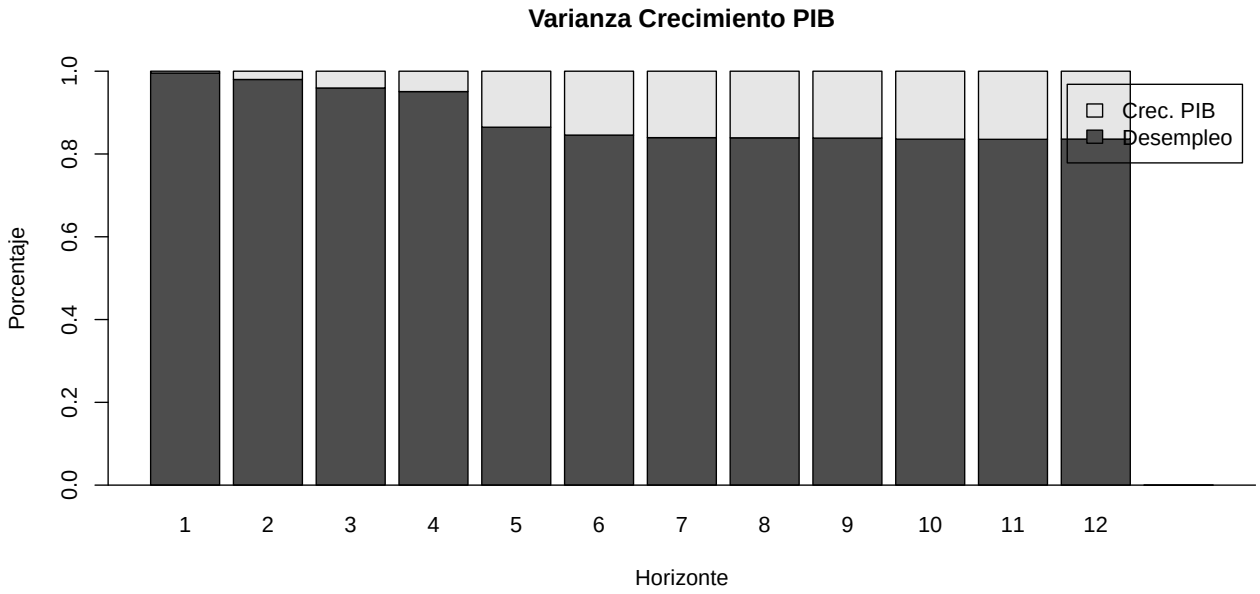
Impulso = Crecimiento producto nacional bruto; Respuesta = Tasa de Desempleo



95 % Bootstrap CI, 100 runs

Parte 6


Varianza Desempleo
Porcentaje
0.0
0.2
0.4
0.6
0.8
1.0
1
2
3
4
5
6
7
8
9
10
11
12
Horizonte
Crec. PIB
Desempleo


Varianza Crecimiento PIB
Porcentaje
0.0
0.2
0.4
0.6
0.8
1.0
1
2
3
4
5
6
7
8
9
10
11
12
Horizonte
Crec. PIB
Desempleo

Parte 7

Una de las diferencias es el hecho de que al corto plazo se ven efectos mayormente denotados y pronunciados al realizarse este shock tanto de PIB como de Tasa de Desempleo. En cambio, al ver los efectos de los investgadores en el paper, el efecto que se produce por el shock es de un menor grado y sostenidamente dura menos en el tiempo, llegando a su estado estacionario facilmente.