

Στο παράδειγμα αυτό θέλουμε να ελέγξουμε τη σχέση μεταξύ χρηματιστηριακού δείκτη και δείκτη βιομηχανικής παραγωγής στην Ελλάδα (μια χώρα που δεν στηρίζει την ανάπτυξή της κατά κύριο λόγο στη βιομηχανική παραγωγή) λαμβάνοντας ως control variables το Γερμανικό χρηματιστηριακό δείκτη και το Δείκτη Βιομηχανικής Παραγωγής Γερμανίας (μια χώρα που στηρίζει την ανάπτυξή της κατά κύριο λόγο στη βιομηχανική παραγωγή). Σύμφωνα με τη θεωρία, Errunza and Hogan (1998), οι μεταβολές της βιομηχανικής παραγωγής μπορούν να εξηγήσουν τις μεταβολές του χρηματιστηριακού δείκτη.

Καταρχάς όλοι οι δείκτες (Γενικός δείκτης Ελληνικού Χρηματιστηρίου, Γενικός δείκτης Γερμανικού Χρηματιστηρίου, Δείκτης Βιομηχανικής Παραγωγής Ελλάδας, Δείκτης Βιομηχανικής Παραγωγής Γερμανίας) είναι σε log τιμές. Από τα παραπάνω γραφήματα παρατηρούμε μια θετική γραμμική συσχέτιση του Ελληνικού Χρηματιστηριακού δείκτη με τις άλλες μεταβλητές.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Covariance Analysis: Ordinary | | |  |  |
| Date: 07/20/14 Time: 14:19 | | |  |  |
| Sample: 1 94 | |  |  |  |
| Included observations: 94 | | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Correlation | |  |  |  |
| Probability | GREECESMI\_1 | GREECE\_IIP\_1 | GERMANYSMI\_1 | GERMANY\_IIP\_1 |
| GREECESMI\_1 | 1.000000 |  |  |  |
|  | ----- |  |  |  |
|  |  |  |  |  |
| GREECE\_IIP\_1 | 0.282140 | 1.000000 |  |  |
|  | 0.0059 | ----- |  |  |
|  |  |  |  |  |
| GERMANYSMI\_1 | 0.441996 | 0.796667 | 1.000000 |  |
|  | 0.0000 | 0.0000 | ----- |  |
|  |  |  |  |  |
| GERMANY\_IIP\_1 | 0.637943 | 0.157893 | 0.196915 | 1.000000 |
|  | 0.0000 | 0.1285 | 0.0571 | ----- |
|  |  |  |  |  |
|  |  |  |  |  |

Οι συντελεστές συσχέτισης επιβεβαιώνουν το παραπάνω συμπέρασμα. Δηλαδή την ύπαρξη θετικής και πλέον στατιστικά σημαντικής συσχέτισης μεταξύ Ελληνικού χρηματιστηριακού δείκτη και των άλλων μεταβλητών. Στη συνέχεια εφαρμόζουμε το απλό μοντέλο πολλαπλής γραμμικής παλινδρόμησης. Στατιστικά σημαντικοί είναι οι Γερμανικοί δείκτες και όχι ο Ελληνικός δείκτης βιομηχανικής παραγωγής. Ο λόγος είναι ότι η «ανάπτυξη» της Ελληνικής οικονομίας έχει σταματήσει εδώ και αρκετά χρόνια να στηρίζεται στη βιομηχανική της παραγωγή επομένως δεν έχει σημαντική επίδραση στο χρηματιστηριακό δείκτη αντίθετα με τη Γερμανική οικονομία. Λαμβάνοντας υπόψη της διασύνδεση των αγορών έχουμε το παρακάτω αποτέλεσμα της σημαντικής σχέσης. Δηλαδή η βελτίωση της Γερμανικής βιομηχανικής παραγωγής έχει θετική επίδραση στον Γερμανικό δείκτη και αυτός κατ’ επέκταση στον Ελληνικό χρηματιστηριακό δείκτη.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Dependent Variable: GREECESMI\_1 | | | |  |
| Method: Least Squares | | |  |  |
| Date: 07/20/14 Time: 23:34 | | |  |  |
| Sample: 1 94 | |  |  |  |
| Included observations: 94 | | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| GREECE\_IIP\_1 | -1.129919 | 0.703283 | -1.606634 | 0.1116 |
| GERMANYSMI\_1 | 0.766278 | 0.192118 | 3.988578 | 0.0001 |
| GERMANY\_IIP\_1 | 2.798053 | 0.361729 | 7.735220 | 0.0000 |
| C | -6.456459 | 2.611770 | -2.472063 | 0.0153 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.524733 | Mean dependent var | | 7.934834 |
| Adjusted R-squared | 0.508891 | S.D. dependent var | | 0.379778 |
| S.E. of regression | 0.266145 | Akaike info criterion | | 0.232073 |
| Sum squared resid | 6.375003 | Schwarz criterion | | 0.340298 |
| Log likelihood | -6.907439 | Hannan-Quinn criter. | | 0.275788 |
| F-statistic | 33.12242 | Durbin-Watson stat | | 0.089697 |
| Prob(F-statistic) | 0.000000 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |



Από το παραπάνω γράφημα είναι εμφανής η ύπαρξη αυτοσυσχέτισης λόγω συγκεκριμένης μορφής όπως επιβεβαιώνεται και από την τιμή του συντελεστή των Durbin-Watson που είναι πολύ χαμηλή. Επίσης, δεν υφίσταται πρόβλημα πολυσυγγραμμικότητας αφού όλοι οι συντελεστές VIF είναι κάτω από την τιμή 10.

|  |  |  |  |
| --- | --- | --- | --- |
| Variance Inflation Factors | | |  |
| Date: 07/20/14 Time: 23:40 | | |  |
| Sample: 1 94 | |  |  |
| Included observations: 94 | | |  |
|  |  |  |  |
|  |  |  |  |
|  | Coefficient | Uncentered | Centered |
| Variable | Variance | VIF | VIF |
|  |  |  |  |
|  |  |  |  |
| GREECE\_IIP\_1 | 0.494607 | 13767.57 | 2.737327 |
| GERMANYSMI\_1 | 0.036909 | 3626.198 | 2.776755 |
| GERMANY\_IIP\_1 | 0.130848 | 3734.883 | 1.040343 |
| C | 6.821342 | 9052.319 | NA |
|  |  |  |  |
|  |  |  |  |

Στη συνέχεια ελέγχουμε για παραλειπόμενη μεταβλητή. Επιλέγουμε το χρηματιστηριακό δείκτη της Πορτογαλίας. Παρατηρούμε ότι p-value=0 οπότε απορρίπτεται η μηδενική υπόθεση ότι δεν είναι παραλειπόμενη μεταβλητή ο Πορτογαλικός χρηματιστηριακός δείκτης και επομένως δείκτης χρειάζεται να ενταχθεί στο μοντέλο.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Omitted Variables Test | | |  |  |
| Equation: UNTITLED | | |  |  |
| Specification: GREECESMI\_1 GREECE\_IIP\_1 GERMANYSMI\_1 | | | | |
| GERMANY\_IIP\_1 C | | |  |  |
| Omitted Variables: PORTUGAL\_IIP\_1 | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  | Value | df | Probability |  |
| t-statistic | 9.612176 | 89 | 0.0000 |  |
| F-statistic | 92.39393 | (1, 89) | 0.0000 |  |
| Likelihood ratio | 66.93126 | 1 | 0.0000 |  |
|  |  |  |  |  |
|  |  |  |  |  |
| F-test summary: | | |  |  |
|  | Sum of Sq. | df | Mean Squares |  |
| Test SSR | 3.247140 | 1 | 3.247140 |  |
| Restricted SSR | 6.375003 | 90 | 0.070833 |  |
| Unrestricted SSR | 3.127862 | 89 | 0.035145 |  |
|  |  |  |  |  |
|  |  |  |  |  |
| LR test summary: | | |  |  |
|  | Value | df |  |  |
| Restricted LogL | -6.907439 | 90 |  |  |
| Unrestricted LogL | 26.55819 | 89 |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Unrestricted Test Equation: | | |  |  |
| Dependent Variable: GREECESMI\_1 | | | |  |
| Method: Least Squares | | |  |  |
| Date: 07/20/14 Time: 23:44 | | |  |  |
| Sample: 1 94 | |  |  |  |
| Included observations: 94 | | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| GREECE\_IIP\_1 | 0.996459 | 0.542531 | 1.836684 | 0.0696 |
| GERMANYSMI\_1 | 1.442397 | 0.152514 | 9.457468 | 0.0000 |
| GERMANY\_IIP\_1 | 2.689512 | 0.255046 | 10.54519 | 0.0000 |
| C | 5.519425 | 2.221879 | 2.484125 | 0.0149 |
| PORTUGAL\_IIP\_1 | -5.881516 | 0.611882 | -9.612176 | 0.0000 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.766813 | Mean dependent var | | 7.934834 |
| Adjusted R-squared | 0.756332 | S.D. dependent var | | 0.379778 |
| S.E. of regression | 0.187469 | Akaike info criterion | | -0.458685 |
| Sum squared resid | 3.127862 | Schwarz criterion | | -0.323403 |
| Log likelihood | 26.55819 | Hannan-Quinn criter. | | -0.404041 |
| F-statistic | 73.16687 | Durbin-Watson stat | | 0.758110 |
| Prob(F-statistic) | 0.000000 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Στη συνέχεια ελέγχουμε για περισσευούμενη μεταβλητή. Επιλέγουμε τον Ελληνικό δείκτη Βιομηχανικής Παραγωγής. Παρατηρούμε ότι p-value=0,1116 οπότε δεν απορρίπτεται η μηδενική υπόθεση ότι είναι περισσευούμενη μεταβλητή ο Ελληνικός δείκτης Βιομηχανικής Παραγωγής και επομένως χρειάζεται να είναι εκτός του μοντέλου.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Redundant Variables Test | | |  |  |
| Equation: UNTITLED | | |  |  |
| Specification: GREECESMI\_1 GREECE\_IIP\_1 GERMANYSMI\_1 | | | | |
| GERMANY\_IIP\_1 C | | |  |  |
| Redundant Variables: GREECE\_IIP\_1 | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  | Value | df | Probability |  |
| t-statistic | 1.606634 | 90 | 0.1116 |  |
| F-statistic | 2.581274 | (1, 90) | 0.1116 |  |
| Likelihood ratio | 2.658059 | 1 | 0.1030 |  |
|  |  |  |  |  |
|  |  |  |  |  |
| F-test summary: | | |  |  |
|  | Sum of Sq. | df | Mean Squares |  |
| Test SSR | 0.182840 | 1 | 0.182840 |  |
| Restricted SSR | 6.557843 | 91 | 0.072064 |  |
| Unrestricted SSR | 6.375003 | 90 | 0.070833 |  |
|  |  |  |  |  |
|  |  |  |  |  |
| LR test summary: | | |  |  |
|  | Value | df |  |  |
| Restricted LogL | -8.236468 | 91 |  |  |
| Unrestricted LogL | -6.907439 | 90 |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Restricted Test Equation: | | |  |  |
| Dependent Variable: GREECESMI\_1 | | | |  |
| Method: Least Squares | | |  |  |
| Date: 07/20/14 Time: 23:46 | | |  |  |
| Sample: 1 94 | |  |  |  |
| Included observations: 94 | | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| GERMANYSMI\_1 | 0.522191 | 0.118612 | 4.402527 | 0.0000 |
| GERMANY\_IIP\_1 | 2.797055 | 0.364858 | 7.666154 | 0.0000 |
| C | -9.526832 | 1.795625 | -5.305581 | 0.0000 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.511102 | Mean dependent var | | 7.934834 |
| Adjusted R-squared | 0.500357 | S.D. dependent var | | 0.379778 |
| S.E. of regression | 0.268448 | Akaike info criterion | | 0.239074 |
| Sum squared resid | 6.557843 | Schwarz criterion | | 0.320243 |
| Log likelihood | -8.236468 | Hannan-Quinn criter. | | 0.271860 |
| F-statistic | 47.56645 | Durbin-Watson stat | | 0.100699 |
| Prob(F-statistic) | 0.000000 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Το παρακάτω διάγραμμα των ACF PACF μας δείχνει ότι υπάρχει αυτοσυσχέτιση των καταλοίπων (εξάλλου όλα τα p-values=0 άρα οι τιμές είναι στατιστικά σημαντικές). Η λύση που προτείνεται από το γράφημα είναι η χρήση αυτοπαλίνδρομου σχήματος πρώτου βαθμού.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Date: 07/21/14 Time: 00:05 | | | |  |  |  |
| Sample: 1 94 | |  |  |  |  |  |
| Included observations: 94 | | |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| Autocorrelation | Partial Correlation |  | AC | PAC | Q-Stat | Prob |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| . |\*\*\*\*\*\*\* | . |\*\*\*\*\*\*\* | 1 | 0.931 | 0.931 | 84.068 | 0.000 |
| . |\*\*\*\*\*\*| | .\*|. | | 2 | 0.849 | -0.128 | 154.81 | 0.000 |
| . |\*\*\*\*\*\*| | . |. | | 3 | 0.765 | -0.056 | 212.87 | 0.000 |
| . |\*\*\*\*\* | | . |. | | 4 | 0.678 | -0.065 | 259.01 | 0.000 |
| . |\*\*\*\* | | .\*|. | | 5 | 0.576 | -0.168 | 292.67 | 0.000 |
| . |\*\*\* | | . |. | | 6 | 0.472 | -0.064 | 315.49 | 0.000 |
| . |\*\*\* | | .\*|. | | 7 | 0.366 | -0.077 | 329.43 | 0.000 |
| . |\*\* | | . |\* | | 8 | 0.289 | 0.147 | 338.20 | 0.000 |
| . |\* | | .\*|. | | 9 | 0.210 | -0.098 | 342.87 | 0.000 |
| . |\* | | .\*|. | | 10 | 0.124 | -0.115 | 344.52 | 0.000 |
| . |. | | . |. | | 11 | 0.043 | -0.034 | 344.72 | 0.000 |
| . |. | | . |. | | 12 | -0.018 | 0.039 | 344.76 | 0.000 |
| . |. | | . |\* | | 13 | -0.056 | 0.103 | 345.11 | 0.000 |
| .\*|. | | . |. | | 14 | -0.086 | -0.014 | 345.93 | 0.000 |
| .\*|. | | . |\* | | 15 | -0.102 | 0.081 | 347.13 | 0.000 |
| .\*|. | | . |. | | 16 | -0.113 | -0.056 | 348.61 | 0.000 |
| .\*|. | | . |. | | 17 | -0.111 | -0.001 | 350.06 | 0.000 |
| .\*|. | | . |\* | | 18 | -0.086 | 0.147 | 350.93 | 0.000 |
| .\*|. | | .\*|. | | 19 | -0.070 | -0.107 | 351.53 | 0.000 |
| . |. | | . |. | | 20 | -0.061 | -0.017 | 351.98 | 0.000 |
| . |. | | . |. | | 21 | -0.048 | -0.025 | 352.26 | 0.000 |
| . |. | | . |. | | 22 | -0.032 | -0.008 | 352.39 | 0.000 |
| . |. | | . |\* | | 23 | -0.006 | 0.097 | 352.40 | 0.000 |
| . |. | | . |. | | 24 | 0.016 | -0.018 | 352.43 | 0.000 |
| . |. | | . |. | | 25 | 0.021 | -0.062 | 352.49 | 0.000 |
| . |. | | . |. | | 26 | 0.029 | 0.001 | 352.60 | 0.000 |
| . |. | | . |. | | 27 | 0.046 | 0.063 | 352.89 | 0.000 |
| . |. | | .\*|. | | 28 | 0.041 | -0.161 | 353.12 | 0.000 |
| . |. | | . |. | | 29 | 0.019 | -0.061 | 353.17 | 0.000 |
| . |. | | . |. | | 30 | -0.004 | 0.061 | 353.17 | 0.000 |
| . |. | | . |\* | | 31 | -0.007 | 0.120 | 353.18 | 0.000 |
| . |. | | . |. | | 32 | -0.010 | -0.019 | 353.19 | 0.000 |
| . |. | | . |. | | 33 | -0.009 | 0.050 | 353.20 | 0.000 |
| . |. | | . |. | | 34 | -0.017 | -0.035 | 353.25 | 0.000 |
| . |. | | . |. | | 35 | -0.013 | 0.051 | 353.28 | 0.000 |
| . |. | | .\*|. | | 36 | -0.018 | -0.162 | 353.33 | 0.000 |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

Από τον έλεγχο Jarque-Bera συμπεραίνουμε ότι τα σφάλματα ακολουθούν κανονική κατανομή αφού p-value=0,7169 (δεν απορρίπτεται η μηδενική υπόθεση της κανονικότητας).



Το πρόβλημα της αυτοσυσχέτισης των καταλοίπων επιβεβαιώνεται και από τον παρακάτω έλεγχο.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Breusch-Godfrey Serial Correlation LM Test: | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| F-statistic | 369.4312 | Prob. F(2,88) | | 0.0000 |
| Obs\*R-squared | 83.99592 | Prob. Chi-Square(2) | | 0.0000 |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Test Equation: | |  |  |  |
| Dependent Variable: RESID | | |  |  |
| Method: Least Squares | | |  |  |
| Date: 07/21/14 Time: 00:08 | | |  |  |
| Sample: 1 94 | |  |  |  |
| Included observations: 94 | | |  |  |
| Presample missing value lagged residuals set to zero. | | | | |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| GREECE\_IIP\_1 | 0.375564 | 0.233083 | 1.611291 | 0.1107 |
| GERMANYSMI\_1 | -0.052935 | 0.063451 | -0.834267 | 0.4064 |
| GERMANY\_IIP\_1 | -0.037024 | 0.119864 | -0.308882 | 0.7581 |
| C | -1.096203 | 0.863904 | -1.268896 | 0.2078 |
| RESID(-1) | 1.096347 | 0.104810 | 10.46033 | 0.0000 |
| RESID(-2) | -0.149434 | 0.106169 | -1.407509 | 0.1628 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.893574 | Mean dependent var | | 4.83E-15 |
| Adjusted R-squared | 0.887527 | S.D. dependent var | | 0.261818 |
| S.E. of regression | 0.087806 | Akaike info criterion | | -1.965675 |
| Sum squared resid | 0.678469 | Schwarz criterion | | -1.803337 |
| Log likelihood | 98.38673 | Hannan-Quinn criter. | | -1.900103 |
| F-statistic | 147.7725 | Durbin-Watson stat | | 1.757495 |
| Prob(F-statistic) | 0.000000 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Οι δύο παρακάτω έλεγχοι δείχνουν ότι υπάρχει και πρόβλημα ετεροσκεδαστικότητας αφού απορρίπτεται η μηδενική υπόθεση της ομοσκεδαστικότητας.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Heteroskedasticity Test: ARCH | | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| F-statistic | 87.26895 | Prob. F(4,85) | | 0.0000 |
| Obs\*R-squared | 72.37635 | Prob. Chi-Square(4) | | 0.0000 |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Test Equation: | |  |  |  |
| Dependent Variable: RESID^2 | | |  |  |
| Method: Least Squares | | |  |  |
| Date: 07/21/14 Time: 00:09 | | |  |  |
| Sample (adjusted): 5 94 | | |  |  |
| Included observations: 90 after adjustments | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| C | 0.008456 | 0.005140 | 1.644919 | 0.1037 |
| RESID^2(-1) | 0.981371 | 0.108082 | 9.079837 | 0.0000 |
| RESID^2(-2) | -0.016328 | 0.147711 | -0.110541 | 0.9122 |
| RESID^2(-3) | -0.095992 | 0.141826 | -0.676832 | 0.5004 |
| RESID^2(-4) | -0.014021 | 0.102793 | -0.136400 | 0.8918 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.804182 | Mean dependent var | | 0.061536 |
| Adjusted R-squared | 0.794967 | S.D. dependent var | | 0.083238 |
| S.E. of regression | 0.037691 | Akaike info criterion | | -3.664846 |
| Sum squared resid | 0.120751 | Schwarz criterion | | -3.525968 |
| Log likelihood | 169.9181 | Hannan-Quinn criter. | | -3.608842 |
| F-statistic | 87.26895 | Durbin-Watson stat | | 2.004661 |
| Prob(F-statistic) | 0.000000 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Heteroskedasticity Test: White | | | |
|  |  |  |  |
|  |  |  |  |
| F-statistic | 24.03070 | Prob. F(9,84) | |
| Obs\*R-squared | 67.70422 | Prob. Chi-Square(9) | |
| Scaled explained SS | 50.58689 | Prob. Chi-Square(9) | |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Test Equation: | |  |  |
| Dependent Variable: RESID^2 | | |  |
| Method: Least Squares | | |  |
| Date: 07/21/14 Time: 00:10 | | |  |
| Sample: 1 94 | |  |  |
| Included observations: 94 | | |  |
|  |  |  |  |
|  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic |
|  |  |  |  |
|  |  |  |  |
| C | 157.1796 | 51.57797 | 3.047417 |
| GREECE\_IIP\_1^2 | 1.740224 | 2.803981 | 0.620626 |
| GREECE\_IIP\_1\*GERMANYSMI\_1 | -1.505899 | 1.356037 | -1.110515 |
| GREECE\_IIP\_1\*GERMANY\_IIP\_1 | -2.110359 | 2.327240 | -0.906808 |
| GREECE\_IIP\_1 | 6.359677 | 22.29699 | 0.285226 |
| GERMANYSMI\_1^2 | 0.400321 | 0.191590 | 2.089472 |
| GERMANYSMI\_1\*GERMANY\_IIP\_1 | -0.449959 | 0.601264 | -0.748355 |
| GERMANYSMI\_1 | 2.190366 | 5.106112 | 0.428969 |
| GERMANY\_IIP\_1^2 | 9.689967 | 1.263465 | 7.669362 |
| GERMANY\_IIP\_1 | -77.10350 | 10.06001 | -7.664353 |
|  |  |  |  |
|  |  |  |  |
| R-squared | 0.720258 | Mean dependent var | |
| Adjusted R-squared | 0.690285 | S.D. dependent var | |
| S.E. of regression | 0.048447 | Akaike info criterion | |
| Sum squared resid | 0.197158 | Schwarz criterion | |
| Log likelihood | 156.4709 | Hannan-Quinn criter. | |
| F-statistic | 24.03070 | Durbin-Watson stat | |
| Prob(F-statistic) | 0.000000 |  |  |
|  |  |  |  |
|  |  |  |  |

Στη συνέχεια εξετάζουμε την αρχική σχέση χρησιμοποιώντας αυτοπαλίνδρομο σχήμα πρώτου βαθμού. Ο επιπρόσθετος όρος που χρησιμοποιείται είναι στατιστικά σημαντικός (σελ 92 του user Guide II eviews 8) ενώ διορθώνονται τα προβλήματα αυτοσυσχέτισης και ετεροσκεδαστικότητας. Ωστοσο λόγω αλλαγής στη σημαντικότητα των μεταβλητών θα προσπαθήσουμε να επιλύσουμε το πρόβλημα της ετεροσκεδαστικότητας με τη χρήση των υποδειγμάτων GARCH.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Dependent Variable: GREECESMI\_1 | | | |  |
| Method: Least Squares | | |  |  |
| Date: 07/21/14 Time: 00:15 | | |  |  |
| Sample (adjusted): 2 94 | | |  |  |
| Included observations: 93 after adjustments | | | |  |
| Convergence achieved after 7 iterations | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| GREECE\_IIP\_1 | -0.459058 | 0.216742 | -2.117992 | 0.0370 |
| GERMANYSMI\_1 | 1.049963 | 0.109684 | 9.572600 | 0.0000 |
| GERMANY\_IIP\_1 | -0.029267 | 0.313174 | -0.093451 | 0.9258 |
| C | 1.375310 | 1.862596 | 0.738383 | 0.4622 |
| AR(1) | 0.956013 | 0.016808 | 56.87849 | 0.0000 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.979104 | Mean dependent var | | 7.940960 |
| Adjusted R-squared | 0.978154 | S.D. dependent var | | 0.377138 |
| S.E. of regression | 0.055743 | Akaike info criterion | | -2.883876 |
| Sum squared resid | 0.273438 | Schwarz criterion | | -2.747715 |
| Log likelihood | 139.1002 | Hannan-Quinn criter. | | -2.828898 |
| F-statistic | 1030.813 | Durbin-Watson stat | | 1.965113 |
| Prob(F-statistic) | 0.000000 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Inverted AR Roots | .96 | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Date: 07/21/14 Time: 00:19 | | | |  |  |  |
| Sample: 1 94 | |  |  |  |  |  |
| Included observations: 93 | | |  |  |  |  |
| Q-statistic probabilities adjusted for 1 ARMA term | | | | | |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| Autocorrelation | Partial Correlation |  | AC | PAC | Q-Stat | Prob\* |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| . |. | | . |. | | 1 | 0.003 | 0.003 | 0.0008 |  |
| . |. | | . |. | | 2 | -0.028 | -0.028 | 0.0748 | 0.785 |
| . |. | | . |. | | 3 | -0.060 | -0.059 | 0.4231 | 0.809 |
| . |. | | . |. | | 4 | 0.020 | 0.020 | 0.4633 | 0.927 |
| . |\* | | . |\* | | 5 | 0.097 | 0.094 | 1.4036 | 0.844 |
| . |\* | | . |\* | | 6 | 0.088 | 0.086 | 2.1857 | 0.823 |
| .\*|. | | .\*|. | | 7 | -0.192 | -0.189 | 5.9905 | 0.424 |
| .\*|. | | .\*|. | | 8 | -0.171 | -0.165 | 9.0128 | 0.252 |
| . |. | | . |. | | 9 | 0.055 | 0.057 | 9.3255 | 0.316 |
| .\*|. | | .\*|. | | 10 | -0.128 | -0.172 | 11.078 | 0.270 |
| . |. | | .\*|. | | 11 | -0.064 | -0.103 | 11.520 | 0.318 |
| .\*|. | | .\*|. | | 12 | -0.107 | -0.080 | 12.757 | 0.309 |
| .\*|. | | . |. | | 13 | -0.066 | -0.030 | 13.237 | 0.352 |
| . |. | | .\*|. | | 14 | -0.044 | -0.083 | 13.451 | 0.414 |
| . |. | | . |. | | 15 | 0.007 | -0.064 | 13.457 | 0.491 |
| .\*|. | | .\*|. | | 16 | -0.081 | -0.068 | 14.212 | 0.509 |
| . |\* | | . |\* | | 17 | 0.144 | 0.138 | 16.621 | 0.411 |
| . |\* | | . |. | | 18 | 0.118 | 0.069 | 18.275 | 0.372 |
| . |\* | | . |\* | | 19 | 0.096 | 0.079 | 19.384 | 0.369 |
| . |. | | . |. | | 20 | 0.041 | 0.031 | 19.583 | 0.420 |
| . |. | | . |. | | 21 | -0.025 | -0.041 | 19.657 | 0.480 |
| . |. | | . |. | | 22 | 0.063 | 0.010 | 20.147 | 0.512 |
| . |. | | . |. | | 23 | 0.055 | -0.044 | 20.533 | 0.550 |
| . |\* | | . |\* | | 24 | 0.170 | 0.157 | 24.247 | 0.390 |
| . |. | | . |\* | | 25 | 0.008 | 0.085 | 24.255 | 0.447 |
| .\*|. | | .\*|. | | 26 | -0.081 | -0.071 | 25.130 | 0.455 |
| . |. | | . |. | | 27 | -0.013 | 0.061 | 25.153 | 0.510 |
| . |. | | . |. | | 28 | 0.008 | 0.029 | 25.162 | 0.565 |
| .\*|. | | .\*|. | | 29 | -0.107 | -0.114 | 26.747 | 0.532 |
| .\*|. | | .\*|. | | 30 | -0.100 | -0.097 | 28.163 | 0.509 |
| . |. | | . |\* | | 31 | 0.010 | 0.123 | 28.177 | 0.561 |
| .\*|. | | . |. | | 32 | -0.130 | -0.043 | 30.634 | 0.485 |
| . |\* | | . |\* | | 33 | 0.132 | 0.138 | 33.198 | 0.409 |
| .\*|. | | . |. | | 34 | -0.082 | -0.048 | 34.212 | 0.409 |
| .\*|. | | .\*|. | | 35 | -0.159 | -0.131 | 38.064 | 0.290 |
| . |\* | | . |\* | | 36 | 0.115 | 0.113 | 40.099 | 0.254 |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| \*Probabilities may not be valid for this equation specification. | | | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Breusch-Godfrey Serial Correlation LM Test: | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| F-statistic | 0.034174 | Prob. F(2,86) | | 0.9664 |
| Obs\*R-squared | 0.073853 | Prob. Chi-Square(2) | | 0.9637 |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Test Equation: | |  |  |  |
| Dependent Variable: RESID | | |  |  |
| Method: Least Squares | | |  |  |
| Date: 07/21/14 Time: 00:20 | | |  |  |
| Sample: 2 94 | |  |  |  |
| Included observations: 93 | | |  |  |
| Presample missing value lagged residuals set to zero. | | | | |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| GREECE\_IIP\_1 | 0.004422 | 0.220167 | 0.020084 | 0.9840 |
| GERMANYSMI\_1 | -0.000970 | 0.118928 | -0.008153 | 0.9935 |
| GERMANY\_IIP\_1 | -0.000899 | 0.317453 | -0.002831 | 0.9977 |
| C | -0.004031 | 1.892204 | -0.002131 | 0.9983 |
| AR(1) | 0.000636 | 0.017497 | 0.036371 | 0.9711 |
| RESID(-1) | 0.002875 | 0.117858 | 0.024394 | 0.9806 |
| RESID(-2) | -0.028470 | 0.109625 | -0.259708 | 0.7957 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.000794 | Mean dependent var | | 1.15E-12 |
| Adjusted R-squared | -0.068918 | S.D. dependent var | | 0.054517 |
| S.E. of regression | 0.056365 | Akaike info criterion | | -2.841660 |
| Sum squared resid | 0.273221 | Schwarz criterion | | -2.651034 |
| Log likelihood | 139.1372 | Hannan-Quinn criter. | | -2.764690 |
| F-statistic | 0.011391 | Durbin-Watson stat | | 1.975302 |
| Prob(F-statistic) | 0.999993 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Heteroskedasticity Test: ARCH | | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| F-statistic | 0.071382 | Prob. F(4,84) | | 0.9905 |
| Obs\*R-squared | 0.301500 | Prob. Chi-Square(4) | | 0.9897 |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Test Equation: | |  |  |  |
| Dependent Variable: RESID^2 | | |  |  |
| Method: Least Squares | | |  |  |
| Date: 07/21/14 Time: 00:20 | | |  |  |
| Sample (adjusted): 6 94 | | |  |  |
| Included observations: 89 after adjustments | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| C | 0.002910 | 0.000859 | 3.386983 | 0.0011 |
| RESID^2(-1) | 0.029555 | 0.109013 | 0.271111 | 0.7870 |
| RESID^2(-2) | 0.001275 | 0.105899 | 0.012039 | 0.9904 |
| RESID^2(-3) | -0.045315 | 0.105792 | -0.428339 | 0.6695 |
| RESID^2(-4) | -0.016483 | 0.105843 | -0.155729 | 0.8766 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.003388 | Mean dependent var | | 0.002814 |
| Adjusted R-squared | -0.044070 | S.D. dependent var | | 0.005440 |
| S.E. of regression | 0.005558 | Akaike info criterion | | -7.492525 |
| Sum squared resid | 0.002595 | Schwarz criterion | | -7.352714 |
| Log likelihood | 338.4174 | Hannan-Quinn criter. | | -7.436171 |
| F-statistic | 0.071382 | Durbin-Watson stat | | 2.002171 |
| Prob(F-statistic) | 0.990550 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Χρησιμοποιώντας το απλό GARCH(1,1) υπόδειγμα παρατηρούμε ότι μόνο η χρονική υστέρηση της δεσμευμένης διακύμανσης είναι στατιστικά σημαντική.

GARCH(1,1)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Dependent Variable: GREECESMI\_1 | | | |  |
| Method: ML - ARCH (Marquardt) - Normal distribution | | | | |
| Date: 07/21/14 Time: 10:16 | | |  |  |
| Sample (adjusted): 2 94 | | |  |  |
| Included observations: 93 after adjustments | | | |  |
| Convergence achieved after 27 iterations | | | |  |
| Presample variance: backcast (parameter = 0.7) | | | | |
| GARCH = C(6) + C(7)\*RESID(-1)^2 + C(8)\*GARCH(-1) | | | | |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | z-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| GREECE\_IIP\_1 | -0.298199 | 0.001067 | -279.4211 | 0.0000 |
| GERMANYSMI\_1 | 0.991565 | 0.095738 | 10.35702 | 0.0000 |
| GERMANY\_IIP\_1 | 0.004680 | 0.239029 | 0.019577 | 0.9844 |
| C | 0.922200 | 1.323850 | 0.696604 | 0.4861 |
| AR(1) | 0.936505 | 0.020838 | 44.94147 | 0.0000 |
|  |  |  |  |  |
|  |  |  |  |  |
|  | Variance Equation | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| C | 3.87E-05 | 5.69E-05 | 0.680587 | 0.4961 |
| RESID(-1)^2 | -0.078563 | 0.049751 | -1.579113 | 0.1143 |
| GARCH(-1) | 1.051816 | 0.059267 | 17.74702 | 0.0000 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.978558 | Mean dependent var | | 7.940960 |
| Adjusted R-squared | 0.977583 | S.D. dependent var | | 0.377138 |
| S.E. of regression | 0.056466 | Akaike info criterion | | -3.083448 |
| Sum squared resid | 0.280583 | Schwarz criterion | | -2.865590 |
| Log likelihood | 151.3803 | Hannan-Quinn criter. | | -2.995483 |
| Durbin-Watson stat | 1.872600 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Inverted AR Roots | .94 | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Χρησιμοποιώντας το GARCH-M (1,1) με επιπλέον ανεξάρτητη μεταβλητή τη δεσμευμένη ρίζα της διακύμανσης η χρονική υστέρηση της δεσμευμένης διακύμανσης είναι στατιστικά σημαντική αλλά δεν είναι ο επιπρόσθετος όρος (που εκφράζει το ρίσκο του Ελληνικού δείκτη σελ 209 του user Guide II eviews 8)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Dependent Variable: GREECESMI\_1 | | | |  |
| Method: ML - ARCH (Marquardt) - Normal distribution | | | | |
| Date: 07/21/14 Time: 10:21 | | |  |  |
| Sample (adjusted): 2 94 | | |  |  |
| Included observations: 93 after adjustments | | | |  |
| Convergence achieved after 31 iterations | | | |  |
| Presample variance: backcast (parameter = 0.7) | | | | |
| GARCH = C(7) + C(8)\*RESID(-1)^2 + C(9)\*GARCH(-1) | | | | |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | z-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| @SQRT(GARCH) | 0.044643 | 0.034559 | 1.291773 | 0.1964 |
| GREECE\_IIP\_1 | -0.292395 | 0.170835 | -1.711563 | 0.0870 |
| GERMANYSMI\_1 | 0.993712 | 0.095398 | 10.41647 | 0.0000 |
| GERMANY\_IIP\_1 | 0.022365 | 0.226471 | 0.098752 | 0.9213 |
| C | 0.889614 | 1.377540 | 0.645799 | 0.5184 |
| AR(1) | 0.935880 | 0.022799 | 41.04923 | 0.0000 |
|  |  |  |  |  |
|  |  |  |  |  |
|  | Variance Equation | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| C | 8.58E-05 | 6.14E-05 | 1.397570 | 0.1622 |
| RESID(-1)^2 | -0.096181 | 0.048713 | -1.974436 | 0.0483 |
| GARCH(-1) | 1.044232 | 0.046408 | 22.50126 | 0.0000 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.978467 | Mean dependent var | | 7.940960 |
| Adjusted R-squared | 0.977230 | S.D. dependent var | | 0.377138 |
| S.E. of regression | 0.056910 | Akaike info criterion | | -3.083336 |
| Sum squared resid | 0.281767 | Schwarz criterion | | -2.838246 |
| Log likelihood | 152.3751 | Hannan-Quinn criter. | | -2.984375 |
| Durbin-Watson stat | 1.868343 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Inverted AR Roots | .94 | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

EGARCH (1,1,1)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Dependent Variable: GREECESMI\_1 | | | |  |
| Method: ML - ARCH (Marquardt) - Normal distribution | | | | |
| Date: 07/21/14 Time: 10:24 | | |  |  |
| Sample (adjusted): 2 94 | | |  |  |
| Included observations: 93 after adjustments | | | |  |
| Convergence achieved after 8 iterations | | | |  |
| Presample variance: backcast (parameter = 0.7) | | | | |
| LOG(GARCH) = C(6) + C(7)\*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(8) | | | | |
| \*RESID(-1)/@SQRT(GARCH(-1)) + C(9)\*LOG(GARCH(-1)) | | | | |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | z-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| GREECE\_IIP\_1 | -0.456908 | 0.221052 | -2.066967 | 0.0387 |
| GERMANYSMI\_1 | 1.023312 | 0.122462 | 8.356170 | 0.0000 |
| GERMANY\_IIP\_1 | 0.126764 | 0.337967 | 0.375080 | 0.7076 |
| C | 0.593168 | 1.912107 | 0.310217 | 0.7564 |
| AR(1) | 0.949981 | 0.023927 | 39.70303 | 0.0000 |
|  |  |  |  |  |
|  |  |  |  |  |
|  | Variance Equation | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| C(6) | -0.273923 | 0.337189 | -0.812370 | 0.4166 |
| C(7) | -0.004018 | 0.122617 | -0.032765 | 0.9739 |
| C(8) | -0.147125 | 0.088334 | -1.665562 | 0.0958 |
| C(9) | 0.947940 | 0.052004 | 18.22811 | 0.0000 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.977987 | Mean dependent var | | 7.940960 |
| Adjusted R-squared | 0.976986 | S.D. dependent var | | 0.377138 |
| S.E. of regression | 0.057213 | Akaike info criterion | | -2.860288 |
| Sum squared resid | 0.288049 | Schwarz criterion | | -2.615198 |
| Log likelihood | 142.0034 | Hannan-Quinn criter. | | -2.761328 |
| Durbin-Watson stat | 1.841929 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Inverted AR Roots | .95 | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Για να ελέγξουμε για πιθανή ασυμμετρία της δεσμευμένης διακύμανσης χρησιμοποιούμε το TGARCH (1,1,1). Ο όρος που δείχνει την ασυμμετρία δεν είναι στατιστικά σημαντικός (p-value=0,4532)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Dependent Variable: GREECESMI\_1 | | | |  |
| Method: ML - ARCH (Marquardt) - Normal distribution | | | | |
| Date: 07/21/14 Time: 10:32 | | |  |  |
| Sample (adjusted): 2 94 | | |  |  |
| Included observations: 93 after adjustments | | | |  |
| Convergence achieved after 55 iterations | | | |  |
| Presample variance: backcast (parameter = 0.7) | | | | |
| GARCH = C(6) + C(7)\*RESID(-1)^2 + C(8)\*RESID(-1)^2\*(RESID(-1)<0) + | | | | |
| C(9)\*GARCH(-1) | | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | z-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| GREECE\_IIP\_1 | -0.461729 | 0.224238 | -2.059097 | 0.0395 |
| GERMANYSMI\_1 | 1.076759 | 0.097719 | 11.01897 | 0.0000 |
| GERMANY\_IIP\_1 | -0.042249 | 0.360546 | -0.117182 | 0.9067 |
| C | 1.249556 | 2.004221 | 0.623462 | 0.5330 |
| AR(1) | 0.958639 | 0.017857 | 53.68295 | 0.0000 |
|  |  |  |  |  |
|  |  |  |  |  |
|  | Variance Equation | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| C | 0.002980 | 0.002573 | 1.158126 | 0.2468 |
| RESID(-1)^2 | 0.123204 | 0.258491 | 0.476629 | 0.6336 |
| RESID(-1)^2\*(RESID(-1)<0) | -0.192064 | 0.256060 | -0.750075 | 0.4532 |
| GARCH(-1) | -0.043229 | 0.844799 | -0.051170 | 0.9592 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.979081 | Mean dependent var | | 7.940960 |
| Adjusted R-squared | 0.978130 | S.D. dependent var | | 0.377138 |
| S.E. of regression | 0.055773 | Akaike info criterion | | -2.810940 |
| Sum squared resid | 0.273735 | Schwarz criterion | | -2.565849 |
| Log likelihood | 139.7087 | Hannan-Quinn criter. | | -2.711979 |
| Durbin-Watson stat | 1.988432 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Inverted AR Roots | .96 | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Αντίστοιχα αποτελέσματα έχουμε και με τη χρήση του EGARCH (1,1,1). Δεν υπάρχει ασυμμετρία της δεσμευμένης διακύμανσης (ο όρος c(7) είναι στατιστικά μη σημαντικός).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Dependent Variable: GREECESMI\_1 | | | |  |
| Method: ML - ARCH (Marquardt) - Normal distribution | | | | |
| Date: 07/21/14 Time: 10:33 | | |  |  |
| Sample (adjusted): 2 94 | | |  |  |
| Included observations: 93 after adjustments | | | |  |
| Convergence achieved after 8 iterations | | | |  |
| Presample variance: backcast (parameter = 0.7) | | | | |
| LOG(GARCH) = C(6) + C(7)\*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(8) | | | | |
| \*RESID(-1)/@SQRT(GARCH(-1)) + C(9)\*LOG(GARCH(-1)) | | | | |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | z-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| GREECE\_IIP\_1 | -0.456908 | 0.221052 | -2.066967 | 0.0387 |
| GERMANYSMI\_1 | 1.023312 | 0.122462 | 8.356170 | 0.0000 |
| GERMANY\_IIP\_1 | 0.126764 | 0.337967 | 0.375080 | 0.7076 |
| C | 0.593168 | 1.912107 | 0.310217 | 0.7564 |
| AR(1) | 0.949981 | 0.023927 | 39.70303 | 0.0000 |
|  |  |  |  |  |
|  |  |  |  |  |
|  | Variance Equation | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| C(6) | -0.273923 | 0.337189 | -0.812370 | 0.4166 |
| C(7) | -0.004018 | 0.122617 | -0.032765 | 0.9739 |
| C(8) | -0.147125 | 0.088334 | -1.665562 | 0.0958 |
| C(9) | 0.947940 | 0.052004 | 18.22811 | 0.0000 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.977987 | Mean dependent var | | 7.940960 |
| Adjusted R-squared | 0.976986 | S.D. dependent var | | 0.377138 |
| S.E. of regression | 0.057213 | Akaike info criterion | | -2.860288 |
| Sum squared resid | 0.288049 | Schwarz criterion | | -2.615198 |
| Log likelihood | 142.0034 | Hannan-Quinn criter. | | -2.761328 |
| Durbin-Watson stat | 1.841929 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Inverted AR Roots | .95 | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

PARCH (1,1) Βλέπουμε ότι γ=-0,2935 δεν είναι στατ σημαντικό οπότε δεν υπάρχει ασυμμετρία μεταξύ τυπικής απόκλισης (λόγω PARCH) και καταλοίπων. Στατιστικά σημαντικός είναι μόνο ο συντελεστής του σ (1,0627) από οδηγό EVIEWS 8 (σελ 222).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Dependent Variable: GREECESMI\_1 | | | |  |
| Method: ML - ARCH (Marquardt) - Normal distribution | | | | |
| Date: 07/21/14 Time: 19:37 | | |  |  |
| Sample (adjusted): 2 94 | | |  |  |
| Included observations: 93 after adjustments | | | |  |
| Convergence achieved after 70 iterations | | | |  |
| Presample variance: backcast (parameter = 0.7) | | | | |
| @SQRT(GARCH) = C(6) + C(7)\*(ABS(RESID(-1)) - C(8)\*RESID(-1)) + C(9) | | | | |
| \*@SQRT(GARCH(-1)) | | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | z-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| GREECE\_IIP\_1 | -0.236697 | 0.180782 | -1.309291 | 0.1904 |
| GERMANYSMI\_1 | 0.969781 | 0.098093 | 9.886344 | 0.0000 |
| GERMANY\_IIP\_1 | -0.019250 | 0.210926 | -0.091265 | 0.9273 |
| C | 0.901912 | 1.395623 | 0.646243 | 0.5181 |
| AR(1) | 0.945092 | 0.020180 | 46.83394 | 0.0000 |
|  |  |  |  |  |
|  |  |  |  |  |
|  | Variance Equation | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| C(6) | 0.001258 | 0.001432 | 0.878290 | 0.3798 |
| C(7) | -0.114751 | 0.078334 | -1.464896 | 0.1429 |
| C(8) | -0.293533 | 0.340090 | -0.863104 | 0.3881 |
| C(9) | 1.062790 | 0.060746 | 17.49565 | 0.0000 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.978559 | Mean dependent var | | 7.940960 |
| Adjusted R-squared | 0.977584 | S.D. dependent var | | 0.377138 |
| S.E. of regression | 0.056465 | Akaike info criterion | | -3.080970 |
| Sum squared resid | 0.280570 | Schwarz criterion | | -2.835880 |
| Log likelihood | 152.2651 | Hannan-Quinn criter. | | -2.982010 |
| Durbin-Watson stat | 1.898777 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Inverted AR Roots | .95 | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Component GARCH (1,1) that includes threshold term. The coefficients c(6) c(7) c(8) are statistically significant. Thereby, we confirm the existence of time-varying long-run volatility. The coefficient c(10) is statistically significant. Thus, we have asymmetry between variance and residuals. The coefficient c(11) is statistically significant. Hence the lag effect of conditional variance is significant. (Guide II EVIEWS 8 page 223-224). However, this model has the lower AIC with statistically significant variables.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Dependent Variable: GREECESMI\_1 | | | |  |
| Method: ML - ARCH (Marquardt) - Normal distribution | | | | |
| Date: 07/21/14 Time: 20:04 | | |  |  |
| Sample (adjusted): 2 94 | | |  |  |
| Included observations: 93 after adjustments | | | |  |
| Convergence achieved after 40 iterations | | | |  |
| Presample variance: backcast (parameter = 0.7) | | | | |
| Q = C(6) + C(7)\*(Q(-1) - C(6)) + C(8)\*(RESID(-1)^2 - GARCH(-1)) | | | | |
| GARCH = Q + (C(9) + C(10)\*(RESID(-1)<0))\*(RESID(-1)^2 - Q(-1)) + C(11) | | | | |
| \*(GARCH(-1) - Q(-1)) | | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | z-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| GREECE\_IIP\_1 | -0.591348 | 0.217344 | -2.720800 | 0.0065 |
| GERMANYSMI\_1 | 1.056146 | 0.104473 | 10.10929 | 0.0000 |
| GERMANY\_IIP\_1 | 1.167880 | 0.264163 | 4.421059 | 0.0000 |
| C | -3.725221 | 1.566599 | -2.377903 | 0.0174 |
| AR(1) | 0.943766 | 0.009520 | 99.13373 | 0.0000 |
|  |  |  |  |  |
|  |  |  |  |  |
|  | Variance Equation | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| C(6) | 0.002753 | 0.000300 | 9.170577 | 0.0000 |
| C(7) | 0.965810 | 0.000207 | 4671.419 | 0.0000 |
| C(8) | -0.088383 | 0.007663 | -11.53432 | 0.0000 |
| C(9) | -0.054004 | 0.036475 | -1.480574 | 0.1387 |
| C(10) | 0.042400 | 0.014823 | 2.860495 | 0.0042 |
| C(11) | 0.948248 | 0.089399 | 10.60694 | 0.0000 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.975616 | Mean dependent var | | 7.940960 |
| Adjusted R-squared | 0.974507 | S.D. dependent var | | 0.377138 |
| S.E. of regression | 0.060216 | Akaike info criterion | | -2.852175 |
| Sum squared resid | 0.319080 | Schwarz criterion | | -2.552620 |
| Log likelihood | 143.6261 | Hannan-Quinn criter. | | -2.731224 |
| Durbin-Watson stat | 1.888754 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Inverted AR Roots | .94 | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |





|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Dependent Variable: GREECESMI\_1 | | | |  |
| Έλεγχος για εποχικότητα  Method: Least Squares | | |  |  |
| Date: 07/21/14 Time: 20:48 | | |  |  |
| Sample (adjusted): 14 94 | | |  |  |
| Included observations: 81 after adjustments | | | |  |
| Convergence achieved after 11 iterations | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| GREECE\_IIP\_1 | -0.172613 | 0.218833 | -0.788788 | 0.4327 |
| GERMANYSMI\_1 | 1.034044 | 0.098265 | 10.52298 | 0.0000 |
| GERMANY\_IIP\_1 | -0.102246 | 0.298810 | -0.342177 | 0.7332 |
| C | 0.515864 | 1.711491 | 0.301412 | 0.7639 |
| AR(1) | 0.927816 | 0.025989 | 35.69972 | 0.0000 |
| SAR(12) | -0.092929 | 0.100682 | -0.922998 | 0.3590 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.976761 | Mean dependent var | | 8.025460 |
| Adjusted R-squared | 0.975211 | S.D. dependent var | | 0.325183 |
| S.E. of regression | 0.051198 | Akaike info criterion | | -3.035035 |
| Sum squared resid | 0.196595 | Schwarz criterion | | -2.857668 |
| Log likelihood | 128.9189 | Hannan-Quinn criter. | | -2.963873 |
| F-statistic | 630.4532 | Durbin-Watson stat | | 2.104923 |
| Prob(F-statistic) | 0.000000 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Inverted AR Roots | .93 | .79-.21i | .79+.21i | .58-.58i |
|  | .58+.58i | .21+.79i | .21-.79i | -.21+.79i |
|  | -.21-.79i | -.58+.58i | -.58-.58i | -.79-.21i |
|  | -.79+.21i | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Errunza, V., & Hogan, K. (1998). Macroeconomic determinants of European stock

market volatility. *European Financial Management* 4(3), 361-377.