ECONOMETRIC MODEL FOR ANALYSING THE STRUCTURAL FUNDS ABSORPTION AT REGIONAL LEVEL – THE REGIONAL OPERATIONAL PROGRAMME

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1. Introduction

The Regional Operational Programme 2007 - 2013 (ROP) is one of the Romanian operational programmes agreed with the European Union and a very important tool for implementing the national strategy and the regional development policies. It is applicable to all eight development regions of Romania. The overall objective of the ROP consists of "supporting and promoting sustainable local development, both economically and socially, in the regions of Romania, by improving the conditions of infrastructure and business environment, which support economic growth". This means that the ROP's aim is to reduce economic and social development disparities between the more developed regions and the less developed ones.

The Regional Operational Programme in Romania is financed under one of the structural funds of the European Union – the European Regional Development Fund (ERDF). This fund supports EU regions with a GDP per capita below 75% of the European average.

The total budget allocated to the ROP is approximately 4.4 billion euros in the first 7 years after accession (2007-2013). EU funding represents approximately 84% of the ROP budget. The rest comes from national funds, public co-financing (14%) and private co-financing (2%).

The distribution of funds is done on 6 priority axes of the Regional Operational Programme. Each priority axis is allocated a certain budget and includes a number of key areas of intervention whose target is the achievement of development objectives.

Regional development is a new concept that aims at stimulating and diversifying economic activities, stimulating investments in the private sector, contributing to decreasing unemployment and, last but not least, a concept that would lead to an improvement in the living standards. In order to apply the regional development strategy, eight development regions were set up, spreading throughout the whole territory of Romania. Each development region comprises several counties. Development regions are not territorial-administrative entities, do not have legal personality, being the result of an agreement between the county and the local boards.

Regional development policy is an ensemble of measures planned and promoted by the local and central public administration authorities, having as partners different actors (private, public, volunteers) in order to ensure a dynamic and lasting economic growth, through the effective use of the local and regional potential, in order to improve living conditions. The main areas regarded by the regional policies are: development of enterprises, the labor market, attracting investments, development of the SMEs sector, improvement of infrastructure, the quality of the environment, rural development, health, education, culture.

The main objectives of the regional development policies are as follows:

- to reduce the existing regional disparities, especially by stimulating the well-balanced development and the revitalization of the disadvantaged areas (lagging behind in development) and by preventing the emergence of new imbalances;
- to prepare the institutional framework in order to comply with the integration criteria into the EU structures and to ensure access to the financial assistance instruments (the Structural Funds and the Cohesion Fund of the EU);
- to correlate the governmental sector development policies and activities at the level of regions by stimulating the inter-regional, internal and international, cross-border cooperation which contributes to the economic development and is in accordance with the legal provisions and with the international agreements to which Romania is a party;

The principles that the elaboration and the application of the development policies are based on:

- decentralization of the decision making process, from the central/governmental level to the level of regional communities;
- partnership among all those involved in the area of regional development;
- planning – utilization process of resources (through programs and projects) in view of attaining the established objectives;
- co-financing – the financial contribution of the different actors involved in the accomplishment of the regional development programs and projects.

2. Research Methodology and Paper Review

Autoregressive Conditional Heteroskedasticity (ARCH) models are specifically designed to model and forecast conditional variances. The variance of the dependent variable is modeled as a function of past values of the dependent variable and independent or exogenous variables.

ARCH models were introduced by Engle (1982) and generalized as GARCH (Generalized ARCH) by Bollerslev (1986). These models are widely used in various branches of econo- metrics, especially in financial time series analysis. See Bollerslev, Chou, and Kroner (1992) and Bollerslev, Engle, and Nelson (1994) for recent surveys. The current research shows the fact that the absorption of stuctural funds within ROP in Romania follows a natural process and, if the case, quantitative and other qualitative date could be depicted.

In order to perform the Analysis we will use such a statistical model applied to the structural model presented in Figure no. 1.

The following set of variables has been considered:

POR_P_X – payments at regional level from ROP;
POR_V_X – value of contracts within POR at regional level;
POP_REG – population of development regions;
PIB_REG – GDP per capita at regional level;
INFRA_PRE – infrastructure pre-accession funds at regional level;
DR_PRE – length of roads at regional level;
DRM_PRE – length of modernized roads at regional level;
DRDENS_PRE – density of roads at regional level.

The set of variables here above mentioned has been selected following several assumptions, as follows:

- due to the lack of temporal data on structural funds absorption (the first payments have been performed only in 2008), it was realized a connection with pre-accession funds – in this way the absorption capacity of each development region have been extended on a larger time interval;

- all considered variables are relevant for the subject of this research and are in line with previous studies in the same field of interest (Capello, 2007);
- the data have been updated on August 1st, 2010;
- it was chosen a logarithmic scale due to the different magnitude orders of chosen variables.

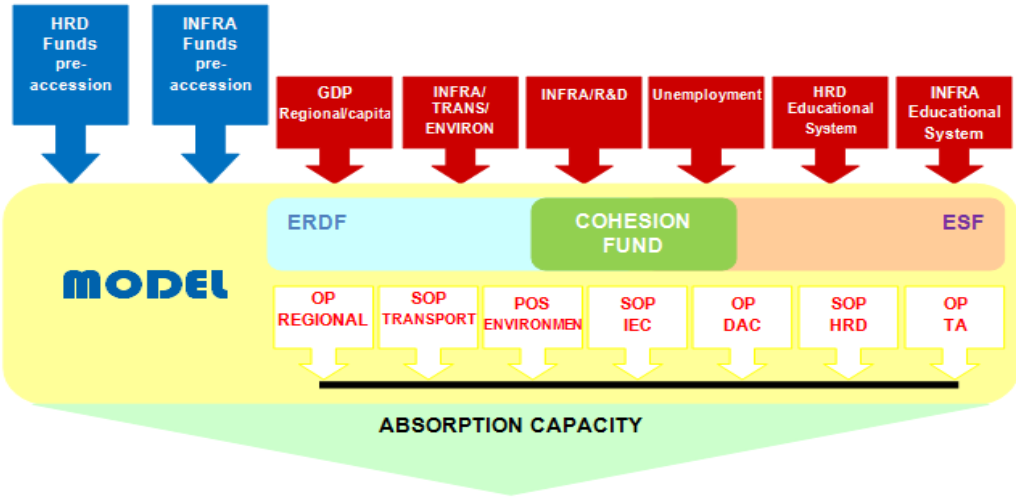


Figure no. 1- The structural model and the position of the current analysis into it

3. Results and Conclusions

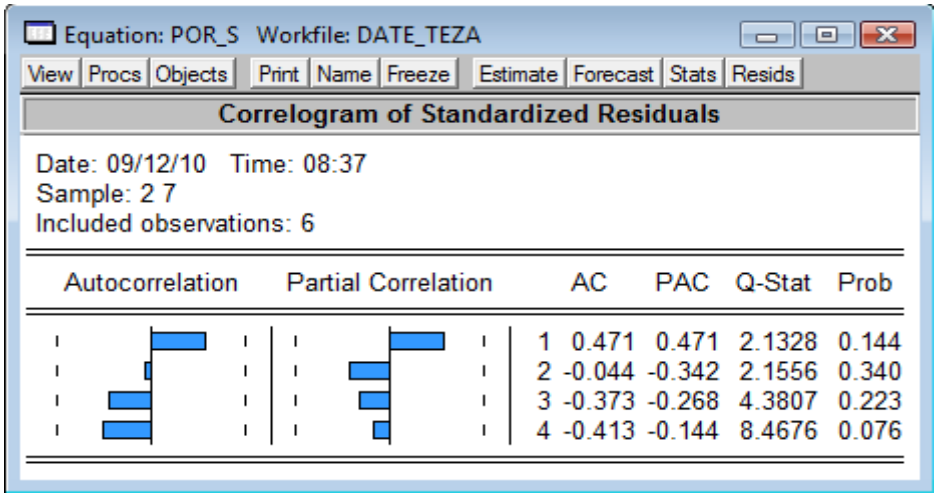
After running the model, next results have been obtained, in the case of all 8 development regions:

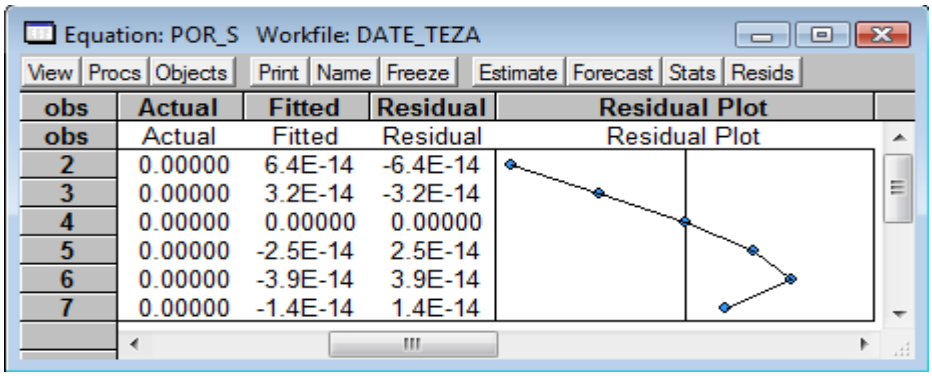
a) South Region

Dependent Variable: Implicit Equation Estimated by GMM
Method: ML - ARCH
Date: 09/11/10 Time: 20:59
Sample(adjusted): 2 7
Included observations: 6 after adjusting endpoints
Convergence achieved after 1 iterations
LOG(POR_P_X(1,1))-(C(1)*LOG(POR_V_X(1,1)*POP_REG(1,1)
*PIB_REG(1,1))+C(2)*LOG(INFRA_PRE_S(-1)) +C(3)
*LOG(DR_PRE_S(-1)*PIB_REG(1,1)*POP_REG(1,1)
*DRM_PRE_S(-1)*DRDENS_PRE_S(-1)))

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.421866	0.001727	244.2352	0.0000
C(2)	1.35E-13	2.28E-05	5.90E-09	1.0000
C(3)	0.000000	9.80E-05	0.000000	1.0000
C(4)	8.08E-28	8.92E-05	9.06E-24	1.0000
C(5)	0.150000	8.521515	0.017603	0.9860
C(6)	0.600000	8.293824	0.072343	0.9423

Akaike info criterion	-56.90121	Sum squared resid	7.46E-27
Schwarz criterion	-57.10945	Log likelihood	176.7036
Durbin-Watson stat	0.467005		



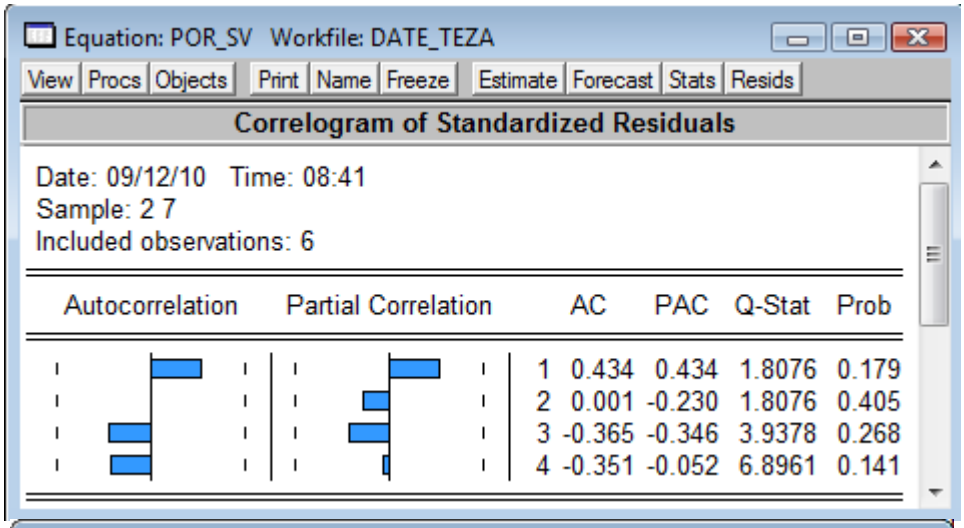


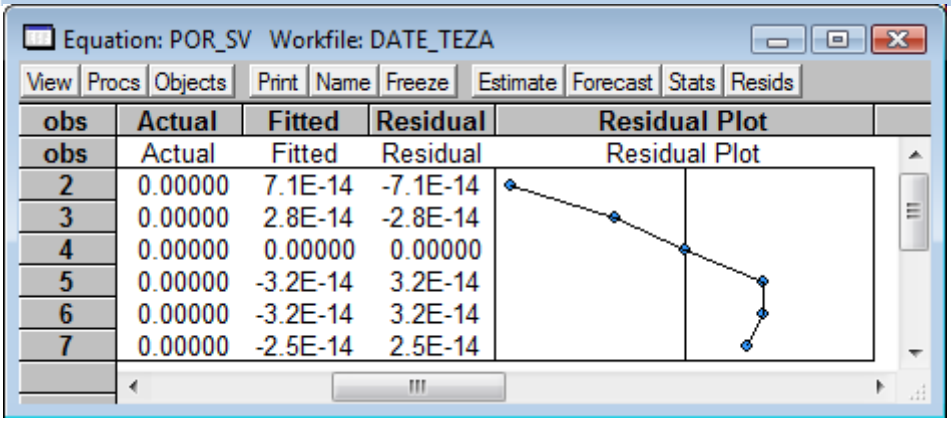
b) South-West Region

Dependent Variable: Implicit Equation Estimated by GMM
Method: ML - ARCH
Date: 09/11/10 Time: 20:59
Sample(adjusted): 2 7
Included observations: 6 after adjusting endpoints
Convergence achieved after 1 iterations
LOG(POR_P_X(2,1))-(C(1)*LOG(POR_V_X(2,1)*POP_REG(2,1)
*PIB_REG(2,1))+C(2)*LOG(INFRA_PRE_SV(-1)) +C(3)
*LOG(DR_PRE_SV(-1)*PIB_REG(2,1)*POP_REG(2,1)
*DRM_PRE_SV(-1)*DRDENS_PRE_SV(-1)))

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.431679	0.007202	59.94000	0.0000
C(2)	1.51E-13	0.000131	1.15E-09	1.0000
C(3)	0.000000	0.000167	0.000000	1.0000
C(4)	9.23E-28	0.000401	2.30E-24	1.0000
C(5)	0.150000	30.16977	0.004972	0.9960
C(6)	0.600000	17.41882	0.034445	0.9725

Akaike info criterion	-56.76662	Sum squared resid	8.52E-27
Schwarz criterion	-56.97486	Log likelihood	176.2999
Durbin-Watson stat	0.434074		



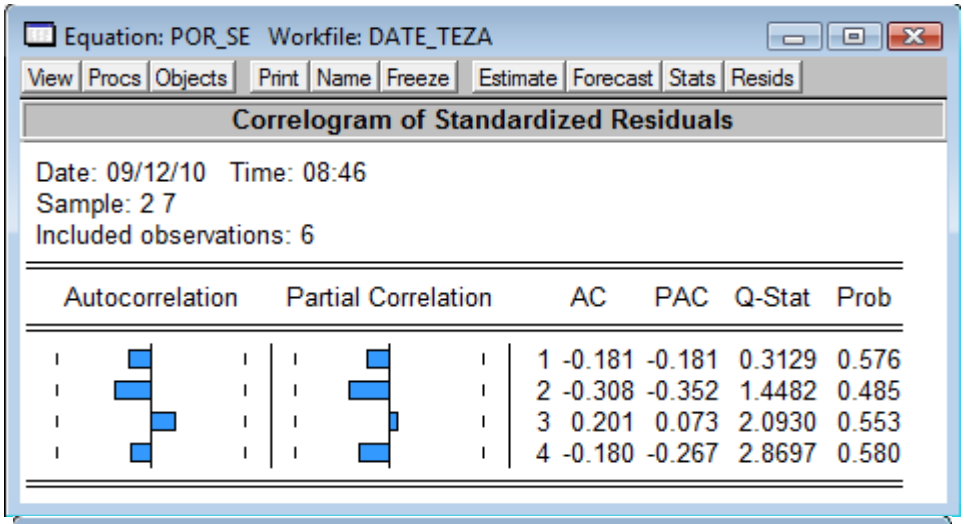


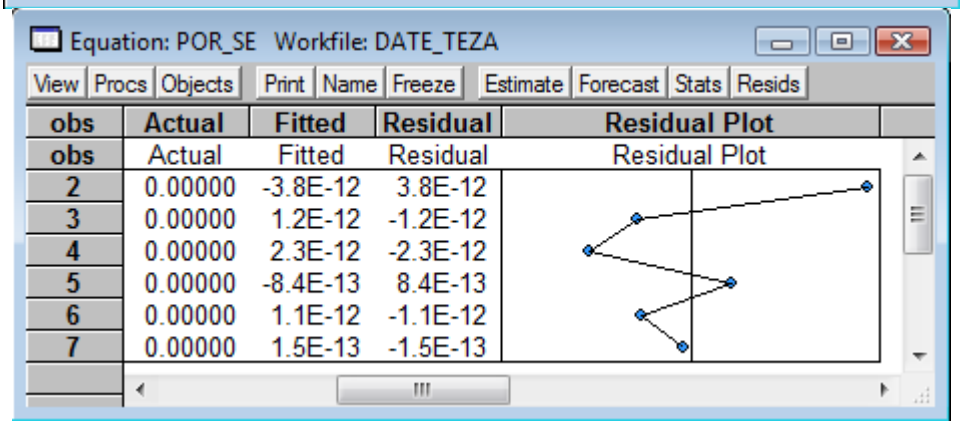
c) South-East Region

Dependent Variable: Implicit Equation Estimated by GMM
Method: ML - ARCH
Date: 09/11/10 Time: 20:59
Sample(adjusted): 2 7
Included observations: 6 after adjusting endpoints
Convergence achieved after 1 iterations
LOG(POR_P_X(3,1))-(C(1)*LOG(POR_V_X(3,1)*POP_REG(3,1)
*PIB_REG(3,1))+C(2)*LOG(INFRA_PRE_SE(-1)) +C(3)
*LOG(DR_PRE_SE(-1)*PIB_REG(3,1)*POP_REG(3,1)
*DRM_PRE_SE(-1)*DRDENS_PRE_SE(-1)))

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.421627	0.008680	48.57387	0.0000
C(2)	2.23E-12	6.81E-06	3.28E-07	1.0000
C(3)	2.51E-11	0.000316	7.96E-08	1.0000
C(4)	2.48E-24	6.09E-05	4.07E-20	1.0000
C(5)	0.150000	8.844505	0.016960	0.9865
C(6)	0.600000	28.78509	0.020844	0.9834

Akaike info criterion	-48.86355	Sum squared resid	2.29E-23
Schwarz criterion	-49.07179	Log likelihood	152.5906
Durbin-Watson stat	1.753038		



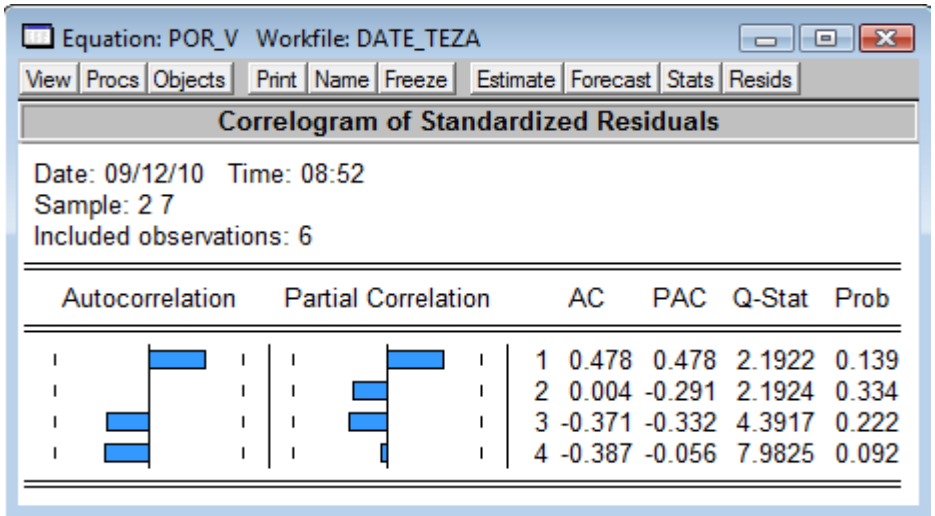


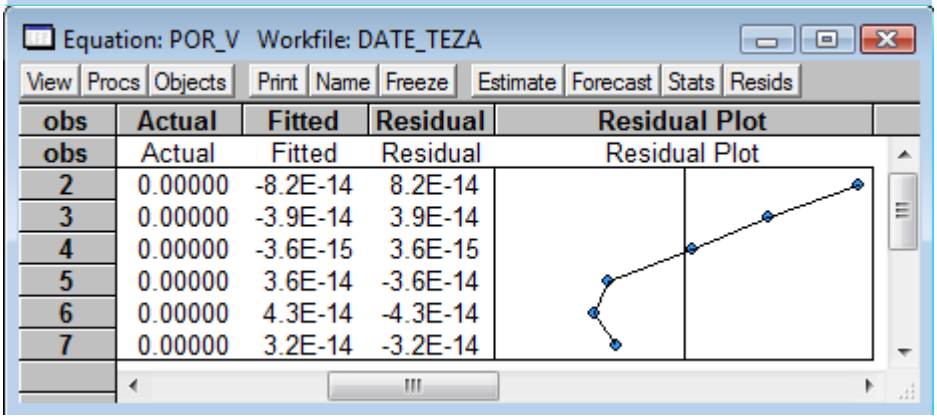
d) West Region

Dependent Variable: Implicit Equation Estimated by GMM
Method: ML - ARCH
Date: 09/11/10 Time: 21:00
Sample(adjusted): 2 7
Included observations: 6 after adjusting endpoints
Convergence achieved after 1 iterations
LOG(POR_P_X(4,1))-(C(1)*LOG(POR_V_X(4,1)*POP_REG(4,1)
*PIB_REG(4,1))+C(2)*LOG(INFRA_PRE_V(-1)) +C(3)
*LOG(DR_PRE_V(-1)*PIB_REG(4,1)*POP_REG(4,1)
*DRM_PRE_V(-1)*DRDENS_PRE_V(-1)))

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.429232	0.002324	184.6842	0.0000
C(2)	-2.13E-13	6.10E-05	-3.48E-09	1.0000
C(3)	0.000000	0.000136	0.000000	1.0000
C(4)	1.33E-27	0.000161	8.30E-24	1.0000
C(5)	0.150000	15.90026	0.009434	0.9925
C(6)	0.600000	16.66567	0.036002	0.9713

Akaike info criterion	-56.40457	Sum squared resid	1.23E-26
Schwarz criterion	-56.61281	Log likelihood	175.2137
Durbin-Watson stat	0.387295		



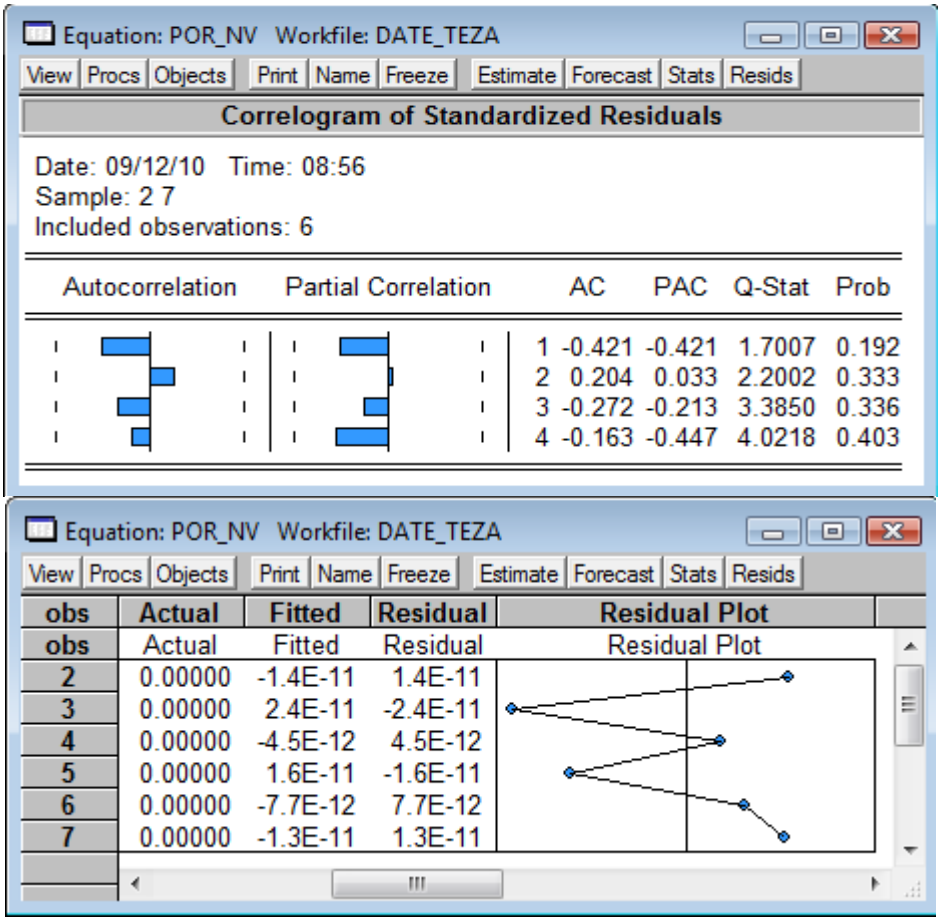


e) North-West Region

Dependent Variable: Implicit Equation Estimated by GMM
Method: ML - ARCH
Date: 09/11/10 Time: 21:00
Sample(adjusted): 2 7
Included observations: 6 after adjusting endpoints
Convergence achieved after 1 iterations
LOG(POR_P_X(5,1))-(C(1)*LOG(POR_V_X(5,1)*POP_REG(5,1)
*PIB_REG(5,1))+C(2)*LOG(INFRA_PRE_NV(-1)) +C(3)
*LOG(DR_PRE_NV(-1)*PIB_REG(5,1)*POP_REG(5,1)
*DRM_PRE_NV(-1)*DRDENS_PRE_NV(-1)))

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.423851	0.002800	151.3744	0.0000
C(2)	-1.02E-10	1.27E-05	-8.00E-06	1.0000
C(3)	6.82E-10	7.20E-05	9.48E-06	1.0000
C(4)	1.34E-22	1.61E-05	8.35E-18	1.0000
C(5)	0.150000	3.642651	0.041179	0.9672
C(6)	0.600000	9.182464	0.065342	0.9479

Akaike info criterion	-44.91518	Sum squared resid	1.24E-21
Schwarz criterion	-45.12342	Log likelihood	140.7456
Durbin-Watson stat	2.531753		

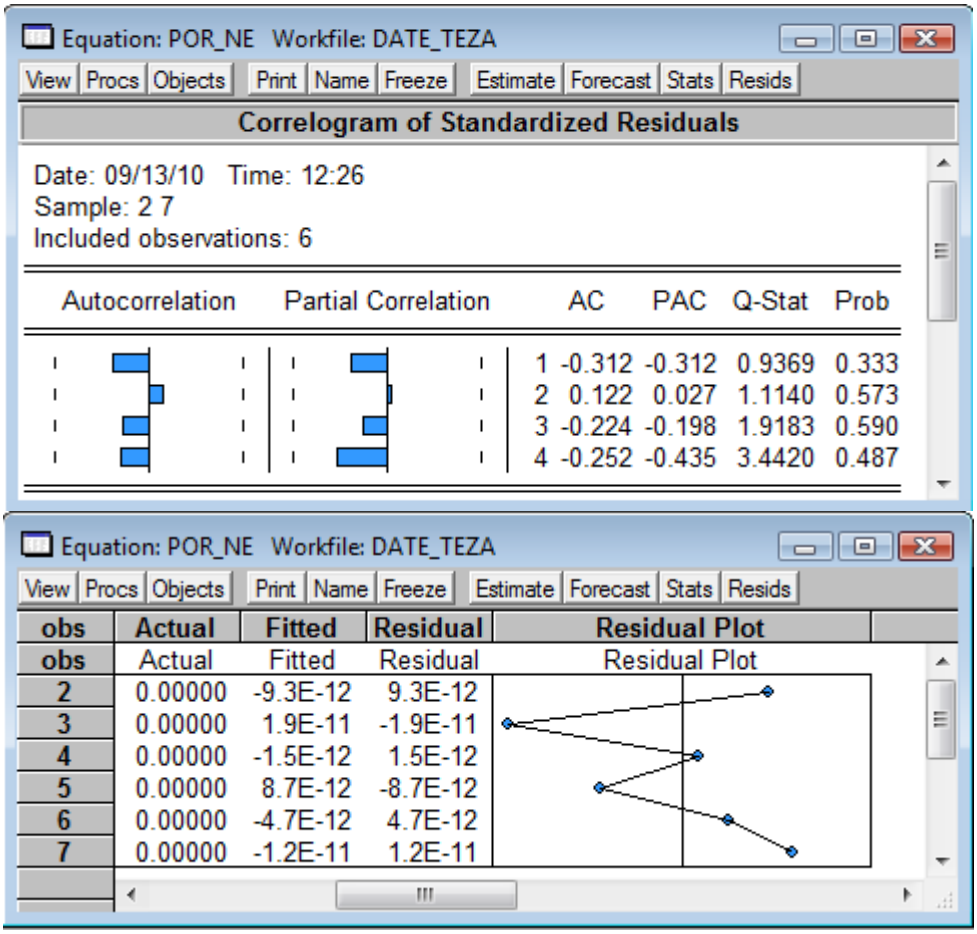


f) North-East Region

Dependent Variable: Implicit Equation Estimated by GMM
Method: ML - ARCH
Date: 09/13/10 Time: 12:24
Sample(adjusted): 2 7
Included observations: 6 after adjusting endpoints
Convergence achieved after 1 iterations
LOG(POR_P_X(6,1))-(C(1)*LOG(POR_V_X(6,1)*POP_REG(6,1)
*PIB_REG(6,1))+C(2)*LOG(INFRA_PRE_NE(-1)) +C(3)
*LOG(DR_PRE_NE(-1)*PIB_REG(6,1)*POP_REG(6,1)
*DRM_PRE_NV(-1)*DRDENS_PRE_NV(-1)))

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.416026	0.001763	235.9645	0.0000
C(2)	-8.30E-11	3.35E-05	-2.48E-06	1.0000
C(3)	7.35E-10	4.44E-05	1.66E-05	1.0000
C(4)	7.24E-23	2.85E-05	2.54E-18	1.0000
C(5)	0.150000	2.868246	0.052297	0.9583
C(6)	0.600000	9.912897	0.060527	0.9517

Akaike info criterion	-45.53046	Sum squared resid	6.68E-22
Schwarz criterion	-45.73870	Log likelihood	142.5914
Durbin-Watson stat	2.266179		

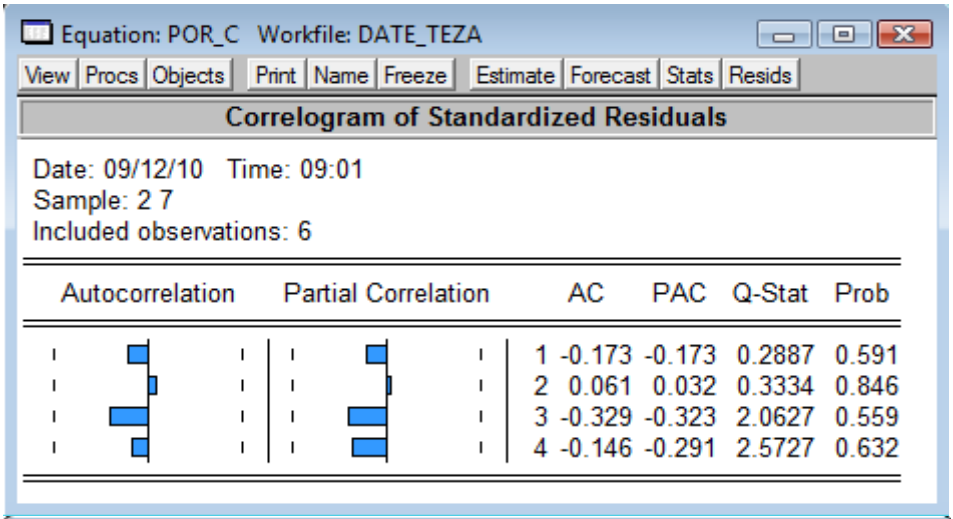


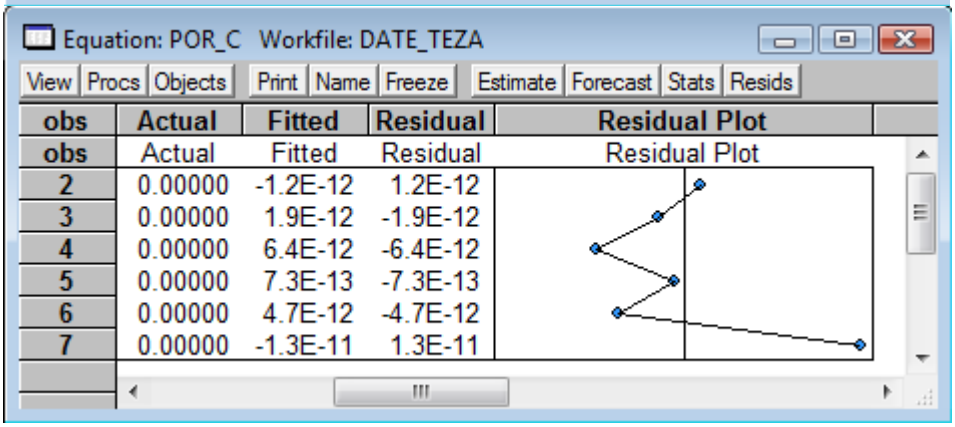
g) Center Region

Dependent Variable: Implicit Equation Estimated by GMM
Method: ML - ARCH
Date: 09/11/10 Time: 21:00
Sample(adjusted): 2 7
Included observations: 6 after adjusting endpoints
Convergence achieved after 1 iterations
LOG(POR_P_X(7,1))-(C(1)*LOG(POR_V_X(7,1)*POP_REG(7,1)
*PIB_REG(7,1))+C(2)*LOG(INFRA_PRE_C(-1)) +C(3)
*LOG(DR_PRE_C(-1)*PIB_REG(7,1)*POP_REG(7,1)
*DRM_PRE_C(-1)*DRDENS_PRE_C(-1)))

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.425582	0.003434	123.9235	0.0000
C(2)	-3.21E-11	1.55E-05	-2.07E-06	1.0000
C(3)	2.49E-10	7.46E-05	3.34E-06	1.0000
C(4)	2.46E-23	1.73E-05	1.42E-18	1.0000
C(5)	0.150000	7.916696	0.018947	0.9849
C(6)	0.600000	8.844845	0.067836	0.9459

Akaike info criterion	-46.80813	Sum squared resid	2.27E-22
Schwarz criterion	-47.01637	Log likelihood	146.4244
Durbin-Watson stat	1.658673		



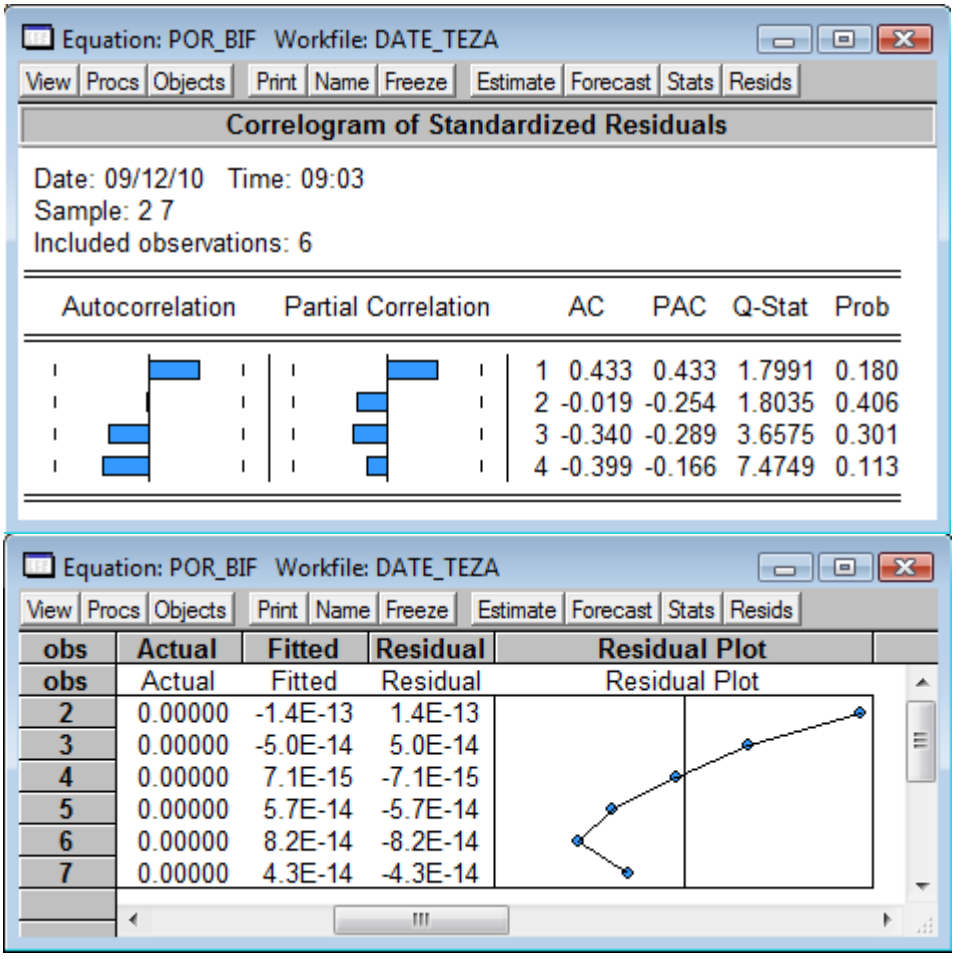


h) Bucharest-Ilfov Region

Dependent Variable: Implicit Equation Estimated by GMM
Method: ML - ARCH
Date: 09/11/10 Time: 21:00
Sample(adjusted): 2 7
Included observations: 6 after adjusting endpoints
Convergence achieved after 1 iterations
LOG(POR_P_X(8,1))-(C(1)*LOG(POR_V_X(8,1)*POP_REG(8,1)
*PIB_REG(8,1))+C(2)*LOG(INFRA_PRE_BIF(-1)) +C(3)
*LOG(DR_PRE_BIF(-1)*PIB_REG(8,1)*POP_REG(8,1)
*DRM_PRE_BIF(-1)*DRDENS_PRE_BIF(-1)))

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.398498	0.006857	58.11597	0.0000
C(2)	-2.87E-13	0.000106	-2.71E-09	1.0000
C(3)	0.000000	7.62E-05	0.000000	1.0000
C(4)	3.52E-27	0.000303	1.16E-23	1.0000
C(5)	0.150000	22.51351	0.006663	0.9947
C(6)	0.600000	7.211531	0.083200	0.9337

Akaike info criterion	-55.43057	Sum squared resid	3.25E-26
Schwarz criterion	-55.63881	Log likelihood	172.2917
Durbin-Watson stat	0.465604		



After running the models for each region, the following set of conclusions has been depicted:

- Due to the differences in magnitude order of several variables it was considered a logarithmic scale in order to facilitate the convergence process. A very peculiar task was to slightly modify the values of time-series in cases when the same value for two consecutive years appeared, hence to eliminate the overflow errors.
- All models converge, but present a quite high degree of volatility. This is explained both by the limited number of observations and by the impossibility of modelling some external factors (e.g. political factors, delays in reimbursement of VAT etc.).
- All applied statistical tests (Akaike, Schwarz, Durbin-Watson) and the corresponding correlograms present normal values and shapes.
- It is very much sensitive to asses the quality of the absorption process at regional level. However, as an example, if using the Akaike criterion, it ranges between -44.9 (North-West Region) down to -56.9 (South Region). A ranking, under these assumptions, in terms of efficiency of absorption the funds via ROP, is: Region NW-NE-C-SE-BI-W-SW-S.
- The model might be used for future analyses concerning the absorption of structural funds in Romania.
- The model could be refined by introducing supplementary variables and

could be also serve as a powerful instrument in developing future strategies for absorbing the structural funds in Romania, to have better programming exercises in the future.

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