An Impact Analysis of SAPARD in Rural Areas by Alternative Methods of Regionalization

Andrea Bonfiglio and Francesco Chelli[1]

Abstract

The aim of this article is to evaluate sensitivity of policy impact to the use of different methods of regionalization based on I-O approach. Policy impact is that coming from the application of the SAPARD pre-accession instrument for the period 2000-06 in three rural regions. Towards this aim, 8 alternative methods are applied to derive 8 corresponding I-O matrices for every region considered, from which impacts are calculated. The main results from this analysis are the following ones. First, results in terms of impact are influenced by the method employed, although variability among methods is contained. Second, methods would not seem to be affected by territorial dimension, since structure of differences among methods is generally the same in all the regions considered and for any kind of impact estimated.

[1] **Andrea Bonfiglio**: Dipartimento di Economia, Facoltà di Economia "G. Fuà", Università Politecnica delle Marche, Piazzale Martelli, 8, 60121 Ancona (Italy), Tel. 071-2207116, Fax. 071-2207102, e-mail: bonfiglio@dea.unian.it.

Francesco Chelli: Dipartimento di Economia, Facoltà di Economia "G. Fuà", Università Politecnica delle Marche, Piazzale Martelli, 8, 60121 Ancona (Italy), Tel. 071-2207054, Fax. 071-2207102, e-mail: chelli@dea.unian.it.

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1. Introduction[2]

This research is related to an on-going European Research Project entitled “Rural Employment and Agricultural Perspective in the Balkan Applicant Countries” (REAPBALK)[3].

The project focuses on development perspectives of rural regions of five countries of Balkan area: Bulgaria, Croatia, Greece, Romania and Slovenia. Three of the case study countries are applying for accession to EU, while Greece and Slovenia are already member states. The objective of the project is to analyse, by an I-O approach, the overall impact generated by several policies (national, regional and European) in the economy of these regions.

Within the REAPBALK project, 5 rural regions, one for each country under study, have been identified through specific criteria[4]. For every region, I-O tables were derived using the same regionalization method. These tables represent the basis from which impact analysis has been carried out. However, results from impact analysis might be affected by the method employed to derive regional tables. Therefore, it becomes interesting to verify whether and how results in terms of impact vary, using different methods of constructing regional I-O tables.

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[2] Although the contents of this article are shared by both authors, the authorship may be attributed as follows: par. 2.1, 3.2 and 4 to Andrea Bonfiglio; par. 1, 2.2 and 3.1 to Francesco Chelli.

[3] This project began in October 2001 and will last for the next three years. The project is financed by EU Fifth Framework Research Programme: “Quality of Life and Management of Living Resources”, Key Action 1.1.1.-5.5: “New tools and models for the integrated development of rural and other relevant areas”. It is co-ordinated by prof. Franco Sotte of University of Ancona (Italy) and involves a further six countries: Bulgaria, Croatia, Greece, Romania, Slovenia and United Kingdom.

[4] Rural regions were selected on the basis of the following criteria: (a) classification as a region at a NUTS 2 level; (b) rurality according to the OECD definition (OECD, 1994; 1996); (c) positive employment dynamics during the transition period (1991-2001).

This research focuses on the following regions: the Bulgarian North-East region (NE), the Romanian North-West region (NW) and the “Peripheral” Slovenia (PS)[5] (Tab. 1). The target is to assess sensitivity of policy impact to the use of alternative methods of constructing regional I-O matrices. In other words, the interest is in verifying if and to what extent the use of different methods of regionalization affects the results in terms of impact. Policy examined is SAPARD pre-accession instrument for the period 2000-06.

Tab. 1 – Some indicators about the regions under study

Region	Country	Area (km^2)	National area coverage (%)	Population (inhabitants)	National population coverage (%)
North-East (NE)	Bulgaria	19,967	18.0	1,343,382	16.4
North-West (NW)	Romania	34,159	14.3	2,849,876	12.7
“Peripheral” Slovenia* (PE)	Slovenia	16,733	82.5	1,499,859	75.5
Total		70,859	19.2	5,693,117	17.6

Source: REAPBALK Database

2. Methodology to assess impact

Estimation of impact from application of SAPARD for the period 2000-06 is carried out by a traditional demand-driven open I-O model in order to measure the total effects (direct and indirect) produced by European pre-accession policy. The focus is on total public contribution (both national and European) allocated within SAPARD. For this, the impact estimated is the potential one, which would derive from policy application, if the total public amount of funds appropriated was entirely spent.

For each region, overall impacts in terms of output, value added and employment are determined starting from 8 different regional I-O matrices

[5] Peripheral Slovenia is an artificial rural region which consists of the whole country except for the most urbanized area made up of the Ljiubljana capital and its surroundings, both forming the “Osrednjeslovenska” NUTS 3 region.

constructed by various regionalization methods. Then, in order to analyse impact sensitivity to the use of different approaches for regionalising tables, methods are compared in terms of both overall impact and impact by sector.

2.1 Construction of the I-O tables by different methods

The construction of an input-output transactions table implies the knowledge of all flows of goods and services related to intermediate and final demand sectors expressed in a disaggregated form and related to a given time period (Hewings, 1985). That means the need for collecting a considerable volume of information, which is difficult to obtain especially when the objective is constructing a table at a sub-national level. For this reason, different approaches for the preparation of regional input-output tables have been developed in an attempt to contrive methods capable of providing satisfactory results. These approaches can be divided into three main categories: “survey”, “non-survey” and “hybrid” approaches. Presently, the hybrid approach (Jensen *et al.,* 1979; Greenstreet, 1989; West, 1990; Midmore, 1991; Lahr, 1993; Jackson, 1998; Madsen and Jensen-Butler, 1999; Imansyah, 2000) and ready-made models (Brucker *et al.*, 1987; Jensen, 1987; Round, 1987; Treyz *et al.*, 1992; Lindall and Olson, 1998) (essentially based on non-survey techniques) are the most widespread for construction of regional I-O tables. Some feel that the hybrid approach is the most feasible method to derive regional tables since it gains the advantages of both non-survey and survey methods avoiding the relevant disadvantages (Lahr, 2001; Fritz, 2002). The hybrid approach is subordinated to the availability of superior data (primary and secondary data) which, unfortunately, were not available for all regions under study. Accordingly, it was decided to focus only on non-survey methods, whose request of data is by far lesser.

Eight non-survey methods were applied to derive 8 corresponding 22-sector I-O matrices for each of the regions under study[6]. The adopted non-survey methods are both well-known techniques and more recent techniques, i.e: the Simple Location Quotient (SLQ), the Purchases-only Location Quotient (PLQ), the Cross-Industry Location Quotient (CILQ), the Semilogarithmic Location Quotient (RLQ), the Symmetric Cross Industry Location Quotient (SCILQ), two versions of the Flegg's Location Quotient (FLQ and RFLQ) and the Supply Demand Pool technique (SDP). Since all these methods have been widely discussed in the literature, here only a brief description will be given.

The SLQ (Shaffer and Chu, 1969a, 1969b; Morrison and Smith, 1974; Round, 1978; Sawyer and Miller, 1983; Robison and Miller, 1988; Harris and Liu, 1998; Flegg and Webber, 2000; Beyers, 2000; Gerking *et al.*, 2001; Parrè *et al.*, 2002) takes the following form:

$$SLQ_i = \frac{X_i^R / X^R}{X_i^N / X^N}$$

[6] The starting national I-O tables, from which regional matrices were obtained, are: the 1997 53-sector Bulgarian I-O table, the 1999 Romanian 28-sector I-O table and the 2000 58-sector Slovenian I-O table. All tables are expressed in current prices and basic values. Non-survey methods were applied on total intermediate flows (domestic flows plus imports). The Romanian and Bulgarian tables were expressed in domestic flows. Therefore, since import matrices were not available, we followed suggestions from Jensen *et al.* (1979), by proportionally redistributing imports along the columns of the tables on the basis of the weight of intermediate costs. Once derived, regional matrices were aggregated into 22 sectors in order to represent the simpler economic structure characterising the regions and to guarantee comparability of results.

where i indexes a given sector, X is output, R and N indicate the region and the nation, respectively. X is often substituted with employment or value added for lack of data on output.

The regional input coefficient (a_{ij}^{R}) is estimated as: $a_{ij}^{R} = \mathrm{SLQ}_i r_{ij}^{N}$, where r_{ij}^{N} is the national technical coefficient. The difference between the national technical coefficient and the regional input coefficient equals the regional import (or trade) coefficient. It is established that $\mathrm{SLQ}_i = 1$ when $\mathrm{SLQ}_i \geq 1$. The SLQ is applied uniformly along the rows of the national technological matrix. The logic behind is that if a regional sector is relatively less important than the same sector at a national level ($\mathrm{SLQ}_i < 1$), the regional sector will not be able to satisfy all local requirements and a part of supply will be imported. In the opposite case ($\mathrm{SLQ}_i \geq 1$), the regional sector will be able to satisfy all local demand.

The PLQ was suggested by Tiebout (Consad, 1967) and explored by Morrison and Smith (1974). It takes the following form:

$$PLQ_i = \frac{X_i^R / X^{*R}}{X_i^N / X^{*N}}$$

where X^* is output of only those industries that use i as input. The PLQ is applied as the SLQ.

The CILQ (Schaffer and Chu, 1969a, 1969b; Morrison and Smith, 1974; Brand, 1997; Flegg and Webber, 2000; Oude Wansink, 2000) takes the following form:

$$CILQ_{ij} = \frac{X_i^R / X_i^N}{X_j^R / X_j^N}$$

This location quotient is applied as the SLQ with the difference that the national matrix is adjusted cell by cell.

The SCILQ (Oude Wansink and Maks, 1998) is one variant of the traditional CILQ. It is designed to take into consideration the possibility of deriving regional coefficients that exceed the national ones, overcoming the problem of asymmetric adjustments. It takes the following form:

$$SCILQ_{ij} = 2 - \frac{2}{CILQ_{ij} + 1}$$

The logic behind is the following one. If CILQ equals zero or one, then SCILQ equals zero or one. If CILQ goes to infinity, SCILQ goes to two. In so doing, the regional coefficients not only take account of the fact that sectors may be less concentrated in a region, but also that sectors may be more concentrated.

The RLQ (Round, 1972, 1978; Morrison and Smith, 1974; Batey *et al*., 1993; Flegg *et al*., 1995; Brand, 1997) takes the following form:

$$RLQ_{ij} = \frac{SLQ_i}{\log_2\left(1+SLQ_j\right)}$$

According to Round, this method would incorporate the properties of both the SLQ and CILQ methods. In other words, the RLQ would take account of the importance of the region, of the selling sectors and of the purchasing sectors.

The FLQ is a modification of the RLQ (Flegg *et al.* 1995; Flegg and Webber, 1996a, 1996b, 1997; Brand, 1997; McCann and Dewhurst, 1998; Flegg and Webber, 2000). The FLQ takes the following form:

$$FLQ_{ij} = \frac{E_i^R / E_j^R}{E_i^N / E_j^N} \cdot l^* = CILQ_{ij} \cdot l^*$$

where E is employment, $l^* = \left[\log_2\left(1+E^R/E^N\right)\right]^d$, $0 \le d < 1$, $0 \le l^* \le 1$.

The FLQ is designed to incorporate the properties of the CILQ and the SLQ. The use of FLQ requires estimating the d parameter. If the value of d is bigger, the adjustment for regional imports will be greater. So, this parameter is inversely related to the size of the region. On the basis of studies concerning the small English town of of Peterborough in 1968 (Morrison and Smith, 1974) and Scotland in 1989 (Flegg and Webber, 1996a, 1996b), Flegg and Webber (1997) find that an approximate value for d of 0.3 allows deriving closer multipliers to those obtained by surveys than multipliers obtained by the conventional cross industry location quotients.

The RFLQ (Mattas *et al.*, 2003) is a variant of the FLQ used within the REAPBALK project. The parameter d is chosen in such a way that the difference for all sectors between regional output, estimated using employment ratios, and intermediate sales (derived by applying the FLQ) is always positive.

The SDP (Moore and Petersen, 1955; Schaffer and Chu, 1969a; Morrison and Smith, 1974; Sawyer and Miller, 1983; Mattas *et al.,* 1984; Jin, 1991; Tzouvelekas and Mattas, 1995; Jackson, 1998) is based on the concept of regional commodity balance developed by Isard (1953). The commodity balance is the total regional output produced by a specific sector less the regional demand of that sector represented by the local production needs (as input) and local consumption needs. Regional demand (D_i^R) is estimated as a sum of the product between each national coefficient (r_{ij}^N) and actual regional output (X_j^R) and the product between national proportions of final demands (c_{if}^N) and regional final demands (Y_f). That is:

$$D_i^R = \sum_j r_{ij}^N X_j^R + \sum_f c_{if}^N Y_f$$

The regional commodity balance for a given sector is calculated as a difference between regional output and regional demand ($b_i = X_i^R - D_i^R$). Regional input coefficients are estimated in a similar way to that used with the SLQ, i.e: $a_{ij}^R = r_{ij}^N \left(X_i^R / D_i^R \right)$, when $b_i < 0$ and $a_{ij}^R = r_{ij}^N$, when $b_i \geq 0$. Regional import coefficients are estimated as a difference. The logic behind is that if the balance is positive or zero, all inputs can be supplied by local producers, imports are set to zero and exports are assumed equal to the surplus. In this case, national coefficients remain unmodified. Instead, if the balance is negative, some inputs must be imported and national coefficients are scaled down by the amount necessary to make the regional balance exactly zero.

2.2 The I-O model and policy evaluation

In order to estimate impact from SAPARD at a regional level, three questions have to be faced: choosing the most appropriate I-O model, estimating regional funds and distributing measures and funds sectorally.

One of the problems to be faced in modelling policy through an I-O model is to define how to link policy measures to the I-O framework. It is known that the traditional I-O approach is well suited to the analysis of effects generated by policy affecting final demand. The SAPARD program can actually be analysed through the application of a classic I-O approach, since SAPARD mostly gives public contribution to sector investments, which, in the I-O framework, are part of final demand vector.

The demand-driven I-O model takes the following form:

$$\mathbf{X} = (\mathbf{I} - \mathbf{A})^{-1}\,\mathbf{FD} \tag{1}$$

where $\mathbf{X}$ is output vector, $\mathbf{A}$ is the input coefficient matrix, $(\mathbf{I} - \mathbf{A})^{-1}$ is the Leontief inverse and $\mathbf{FD}$ is a final demand vector.

To measure the effects in terms of value added generated by final demand variation, the I-O model has to be modified by converting goods and services flows into value added flows, i.e.:

$$\mathbf{Y} = \hat{\mathbf{h}}\left(\mathbf{I} - \mathbf{A}\right)^{-1} \mathbf{FD} \qquad (2)$$

where $\mathbf{Y}$ is a vector of value added and $\mathbf{h}$ is a vector of value added coefficients obtained as ratios between sector value added and outputs.

Similarly, to capture the effects in terms of employment generated by final demand variation, the I-O model has to be modified by converting goods and services flows into employment flows, i.e.:

$$\mathbf{E} = \hat{\mathbf{e}}(\mathbf{I} - \mathbf{A})^{-1} \mathbf{FD} \qquad (3)$$

where $\mathbf{E}$ is a vector of employment and $\mathbf{e}$ is a vector of employment coefficients obtained as ratios between sector employment and outputs.

Once the I-O model has been defined, a further question related to the analysis of effects from SAPARD at a regional level is to estimate the amount of funds that will be appropriated to the regions under study. As for the NW region, a percentage of 11.9% was applied to allocate national funds to the region as established by the Romanian National Development Plan for 2004-06[7].

With regard to the NE and PS regions, a simple criterion based on population ratios was applied to allocate funds regionally, as suggested

[7] This percentage has been derived using a complex index which takes account of population size, income, unemployment and infrastructure endowment of the regions. For more details, refer to Romanian Ministry of Integration (2003).

within the REAPBALK project. Percent ratios amount to 16.4% and 75.4% for the NE and PS regions, respectively.

A last question related to the link between policy and I-O approach refers to sector distribution of funds. SAPARD program is made up of measures that are addressed to given sectors. Therefore, there exists a problem of distributing funds established by each measure among the sectors represented within an I-O table. In the literature, the problem of allocating funds among sectors has been often neglected (Morillas *et al.*, 2000). Morillas *et al*. (2000) illustrate a possible strategy in this respect. In their study, the measures of the CSF (Common Structural Funds) program for the period 1988-1993 are translated into eight areas (BIPE classification). Funds aggregated into these areas are then distributed among 44 NACE-CLIO sectors on the basis of fixed percentages.

We decided to apply the Morillas' general approach, making some adjustments to conform it to the SAPARD program and to the sector disaggregation of the tables produced.

The first step was to reclassify the SAPARD measures into 7 categories, taking account of finalities and objectives related to each measure (Tab. 2-4): (1) Support to agricultural sector, (2) Support to food industry, (3) Construction, (4) Infrastructure, (5) Education and Research, (6) Assistance and Information, (7) Economic Development and Diversification.

Then, a matrix of allocation based on fixed percentages[8] was applied to distribute expenditure for each category among the 22 sectors represented

[8] The matrix of allocation was supposed to be identical for all the regions considered.

within the regional I-O tables (Tab. 5). In Tab. 6, distribution of expenditure among sectors and for each region is shown[9].

Tab. 2 – SAPARD – Financial Allocation per measure and category, Bulgaria, 2000-2006 (thousand euro, 2000 prices)

Measures	Area		Category*
	Nation	North-East region	
Farm investments	150,667	24,657	1
Processing and Marketing	114,850	18,795	2
Environmentally-sensitive agricultural methods	12,000	1,964	4
Forestry	40,000	6,546	1
Setting up producer groups	4,667	764	1
Managing water resources	26,667	4,364	4
Economic development and diversification	30,667	5,019	7
Village renovation and protection of rural heritage	38,000	6,219	4
Rural infrastructures	27,587	4,515	4
Training	21,333	3,491	5
Technical assistance	18,667	3,055	6
Assistance under art 7(4) of regulation 12688/99	7,335	1,200	6
TOTAL	492,459	80,592	

* (1) Support to agricultural sector, (2) Support to food industry, (3) Construction, (4) Infrastructure, (5) Education and Research, (6) Assistance and Information, (7) Economic Development and Diversification

Source: Author's elaboration on data from European Commission

Tab. 3 – SAPARD – Financial Allocation per measure and category, Romania, 2000-2006 (thousand euro, 2000 prices)

Measures	Area		Category*
	Nation	North-West region	
Priority 1			
Processing and Marketing	234,059	27,853	2
Structures for monitoring, quality, animal and plant health and food safety	37,399	4,450	3
Priority 2			
Rural infrastructures	399,188	47,503	4
Water supply management	39,367	4,685	4
Priority 3			
Farm investments	207,489	24,691	1
Producer groups	23,616	2,810	1
Agri-environmental measures	35,428	4,216	4
Diversification	136,800	16,279	7
Forestry	144,453	17,190	1
Priority 4			
Vocational training	74,047	8,812	5
Technical assistance	70,081	8,340	6
Assistance under art 7(4) of regulation 12688/99	70,081	8,340	6
TOTAL	1,472,008	175,169	

* (1) Support to agricultural sector, (2) Support to food industry, (3) Construction, (4) Infrastructure, (5) Education and Research, (6) Assistance and Information, (7) Economic Development and Diversification

Source: Author's elaboration on data from European Commission

[9] It is clear that a different distribution of expenditure among sectors would affect results in terms of impact, since multipliers tend to differ according to the sector considered. However, in this research, estimation of impact generated by policy is only functional to the analysis of impact sensitivity to the use of alternative regionalization methods. A sensitivity analysis to the different sector distribution of expenditure will be an object of future research.

Tab. 4 – SAPARD – Financial Allocation per measure and category, Slovenia, 2000-2006 (thousand euro, 2000 prices)

Measures	Area		Category*
	Nation	"Peripheral" Slovenia	
Measure 1: Investments in agricultural holdings	23,248	17,534	1
Measure 2: Investments in food processing industry	26,569	20,039	2
Measure 3: Economic diversification of farms	9,300	7,014	7
Measure 4: Development and improvement of rural infra-structure	8,856	6,680	4
Measure 5: Technical Assistance Art. 2	524	395	6
Total – measures	68,497	51,662	
Technical assistance on the initiative of Commission – Art. 7(4)	894	674	6
TOTAL	69,392	52,336	

* (1) Support to agricultural sector, (2) Support to food industry, (3) Construction, (4) Infrastructure, (5) Education and Research, (6) Assistance and Information, (7) Economic Development and Diversification

Source: Author's elaboration on data from Slovenian M.A.F.F. (2000)

Tab. 5 – Matrix of sector distribution of funds according to category

Sectors	Category*						
	1	2	3	4	5	6	7
Agriculture	0.3	0	0.05	0.02	0	0	0
Mining	0	0	0	0.07	0	0	0
Foods, beverages, and tobacco	0	0.7	0	0	0	0	0
Textile and wearing apparel	0	0	0	0	0	0	0
Leather, leather and fur clothes, footwear and products	0	0	0	0	0	0	0
Wood and products of wood and cork, plaiting materials	0	0	0	0	0	0	0
Pulp, paper and paper products, publishing and printing	0	0	0.1	0	0	0.15	0
Chemicals, chemical products and manmade fibbers	0.15	0	0	0.02	0	0	0
Rubber and plastic products	0	0	0.03	0	0	0	0
Metal products, machinery and equipment, casting	0.15	0	0	0.13	0	0	0.2
Electrical and optical equipment	0.1	0	0	0	0	0	0.15
Transport equipment	0	0	0	0.08	0	0	0.17
Other products of manufacturing	0	0	0	0.25	0	0.05	0
Electricity, gas and water supply	0	0	0	0.08	0	0	0
Construction	0.05	0.05	0.55	0.18	0	0	0.1
Trade; repairing activities	0	0	0.1	0	0	0	0.03
Hotels and restaurants	0	0	0	0	0.05	0	0
Transport and communication	0	0	0	0.08	0.05	0	0.12
Financial intermediation	0.05	0.05	0.07	0	0	0	0
Real estate, renting and business activities	0.07	0.07	0.09	0.09	0.3	0.5	0.1
Public administration; compulsory social security	0.06	0.06	0	0	0.2	0.2	0.06
Other community, social and personal service activities	0.07	0.07	0.01	0	0.4	0.1	0.07
TOTAL	1	1	1	1	1	1	1

* (1) Support to agricultural sector, (2) Support to food industry, (3) Construction, (4) Infrastructure, (5) Education and Research, (6) Assistance and Information, (7) Economic Development and Diversification

Source: Authors' elaboration on data from Morillas et al. (2000)

Tab. 6 – Sector final demand activated by SAPARD in the regions under study, 2000-2006 (thousand euro, 2000 prices)

Sectors	NE		NW		PS	
	Value	%	Value	%	Value	%
Agriculture	9,931	12.3	14,758	8.4	5,394	10.3
Mining	1,194	1.5	3,948	2.3	468	1.0
Foods and tobacco	13,157	16.3	19,497	11.1	14,027	26.7
Textile and apparel	0	0.0	0	0.0	0	0.0
Leather and footwear	0	0.0	0	0.0	0	0.0
Timber and furniture	0	0.0	0	0.0	0	0.0
Paper, publishing and printing	638	0.8	2,947	1.7	160	0.4
Chemicals	5,136	6.4	7,832	4.5	2,764	5.3
Rubber and plastic products	0	0.0	134	0.1	0	0.0
Metal products, machinery and equipment	8,017	9.9	17,292	9.9	4,901	9.4
Electrical and optical equipment	3,949	4.9	6,911	3.9	2,805	5.3
Transport equipment	2,218	2.8	7,280	4.2	1,727	3.2
Other manufacturing	4,478	5.6	14,935	8.5	1,723	3.2
Energy and water	1,365	1.7	4,512	2.6	534	1.0
Construction	6,111	7.6	17,856	10.2	3,782	7.3
Trade	151	0.2	933	0.5	210	0.4
Hotels and restaurants	175	0.2	441	0.3	0	0.0
Transport and communication	2,142	2.7	6,906	3.9	1,376	2.7
Financial intermediation	2,538	3.1	3,939	2.2	1,879	3.6
Real estate, renting and business activities	8,766	10.9	23,166	13.2	4,468	8.6
Public administration	4,896	6.1	10,428	6.0	2,889	5.5
Other services	5,727	7.1	11,455	6.5	3,228	6.1
TOTAL	80,589	100.0	175,170	100.0	52,336	100.0

Source: Authors' elaboration

3. Impact sensitivity analysis using alternative regionalization methods

3.1 Assessing overall impact generated by SAPARD

For each rural region, 8 open I-O models were applied. Each model is based on a regional I-O matrix obtained by a given regionalization method. The application of these models allowed assessing impacts in terms of output, value added and employment, generated by SAPARD for the period 2000-06 in the regions under study. Results of this analysis are shown in Tab. 7, Tab. 8 and Tab. 9.

On average (Tab. 7), in the NE region, the increase in output will be 142 € million, the increase in employment will be 22,633 labour units and the rise in value added will be 23 € million. These results imply that SAPARD will generate in this region for the period 2000-2006, an increase in output by 0.8%, in employment by 3.4% and in value added by 1.5%, in comparison with 1999 aggregates. For every one € million, policy produces an increase in output and value added, by 1.77 and 0.29 € million, respectively, and an increase in employment by 281 labour units. Analysing macro-sectors, bigger increases tend to concentrate on industry sector, both in absolute terms and in comparison with 1999 data.

In the NW region, output variation will be 346 € million, while value added variation will be 130 € million. Finally, change in employment will be 37,138 labour units. Therefore, application of SAPARD in this region will produce an increase in output by 4.7%, in employment by 3.2% and in value added by 4.6%. For every one € million, policy generates a rise in output, value added and employment, by 198 € million, 74 € million and 212 labour units, respectively. At a more disaggregated level, it emerges that, bigger increases are attracted by industry (as for output), by agriculture (as for employment) and by services (as for value added). However, considering the percent variation from 1999 to 2006, the highest variation involves both industry and services whilst agriculture grows to a lesser extent.

Lastly, in the "peripheral" Slovenia, output, employment and value added positive variations will be respectively: 88 € million, 29 € million and 1,220 labour units. So, in comparison with 1999 figures, variation is about 0.2% for all impact variables considered. For every one € million, policy brings about an increase in output by 168 € and in value added by 56 €, whilst, rise in employment amounts to 23 labour units. In absolute terms, industry registers the highest output variation, while both industry and services attract most of employment and value added increases. Nevertheless, although secondary and tertiary sectors share out total increases, agriculture grows more, with respect to 1999.

Comparing the regions under study, it results that SAPARD will produce the biggest impacts in the NW region, followed by the NE and the PS regions. But this result obviously depends on the different distribution of funds among the regions under study. An indicator of effectiveness, which is not affected by the extent of funds apportioned, is the impact-expenditure ratio ($\cdot / PE$). From comparison of this measure calculated for each region, we might conclude that SAPARD reveals itself to be more effective, in stimulating economy, in the NW region, when output and value added are concerned, and in the NE region, in terms of employment. This outcome can be explained by a lower level of development and thus by a higher growth rate characterising the NE and NW regions (in comparison with the PS region), which is reflected in a better capability of valorising investments.

The use of more regionalization methods allows providing a range policy impact instead of only one punctual estimate. In Tab. 8 and Tab. 9, minimum and maximum impacts, estimated by applying alternative methods of constructing regional I-O matrices, are shown.

Conclusions abovementioned in average terms about sector ranking and relative policy effectiveness are generally the same also considering minimum and maximum impacts.

Tab. 7 – Average impact variation in macro-sectors of rural regions induced by SAPARD, 2000-2006

	Output			Employment			Value Added		
	Euro (000)	% (1999-2006)	X/PE (%)	Units	% (1999-2006)	E/PE	Euro (000)	% (1999-2006)	VA/PE (%)
NE									
Agriculture	31,183	0.3	38.7	5,810	2.6	72	1,109	0.3	1.4
Industry	74,424	3.4	92.4	9,316	5.1	116	13,410	3.6	16.6
Services	36,826	1.0	45.7	7,508	2.8	93	8,768	1.1	10.9
TOTAL	142,433	0.8	176.7	22,633	3.4	281	23,288	1.5	28.9
NW									
Agriculture	29,472	3.1	16.8	13,096	2.5	75	15,268	3.1	8.7
Industry	224,364	5.0	128.1	12,629	4.1	72	48,439	5.2	27.7
Services	92,514	5.1	52.8	11,413	3.6	65	66,617	4.9	38.0
TOTAL	346,351	4.7	197.7	37,138	3.2	212	130,324	4.6	74.4
PS									
Agriculture	9,627	0.8	18.4	194	0.8	4	3,927	0.8	7.5
Industry	53,066	0.2	101.4	531	0.2	10	11,314	0.2	21.6
Services	25,028	0.2	47.8	494	0.2	9	13,853	0.2	26.5
TOTAL	87,722	0.2	167.6	1,220	0.2	23	29,094	0.2	55.6

Note: X is output, E is employment, VA is value added and PE is public expenditure. The ratio employment-public expenditure is expressed per one € million.

Source: Authors' elaboration

Tab. 8 – Minimum impact variation in macro-sectors of rural regions induced by SAPARD, 2000-2006

	Output			Employment			Value Added		
	Euro (000)	% (1999-2006)	X/PE (%)	Units	% (1999-2006)	E/PE	Euro (000)	% (1999-2006)	VA/PE (%)
NE									
Agriculture	23,040	0.2	28.6	4,293	1.9	53	820	0.2	1.0
Industry	63,209	2.9	78.4	7,994	4.4	99	11,432	3.1	14.2
Services	32,063	0.9	39.8	6,688	2.5	83	7,980	1.0	9.9
TOTAL	118,312	0.7	146.8	18,975	2.8	235	20,232	1.3	25.1
NW									
Agriculture	23,179	2.4	13.2	10,300	2.0	59	12,007	2.4	6.9
Industry	174,546	3.9	99.6	10,231	3.3	58	38,678	4.1	22.1
Services	77,472	4.3	44.2	10,138	3.2	58	58,144	4.3	33.2
TOTAL	275,196	3.8	157.1	30,669	2.7	175	108,830	3.9	62.1
PS									
Agriculture	6,690	0.6	12.8	135	0.6	3	2,728	0.6	5.2
Industry	38,312	0.2	73.2	378	0.2	7	8,085	0.2	15.4
Services	16,662	0.1	31.8	337	0.1	6	9,502	0.1	18.2
TOTAL	61,664	0.2	117.8	850	0.2	16	20,315	0.2	38.8

Note: X is output, E is employment, VA is value added and PE is public expenditure. The ratio employment-public expenditure is expressed per one € million.

Source: Authors' elaboration

Tab. 9 – Maximum impact variation in macro-sectors of rural regions induced by SAPARD, 2000-2006

	Output			Employment			Value Added		
	Euro (000)	% (1999-2006)	X/PE (%)	Units	% (1999-2006)	E/PE	Euro (000)	% (1999-2006)	VA/PE (%)
NE									
Agriculture	36,707	0.3	45.5	6,839	3.1	85	1,306	0.3	1.6
Industry	95,318	4.4	118.3	12,023	6.6	149	17,571	4.7	21.8
Services	41,914	1.1	52.0	8,346	3.2	104	9,556	1.2	11.9
TOTAL	173,939	1.0	215.8	27,208	4.1	338	28,433	1.9	35.3
NW									
Agriculture	33,083	3.4	18.9	14,701	2.8	84	17,138	3.4	9.8
Industry	292,137	6.5	166.8	15,826	5.1	90	61,332	6.5	35.0
Services	106,633	5.9	60.9	12,528	4.0	72	74,431	5.5	42.5
TOTAL	431,853	5.9	246.5	43,054	3.8	246	152,901	5.5	87.3
PS									
Agriculture	10,402	0.9	19.9	210	0.9	4	4,242	0.9	8.1
Industry	57,320	0.2	109.5	575	0.2	11	12,242	0.3	23.4
Services	28,674	0.2	54.8	560	0.2	11	15,799	0.2	30.2
TOTAL	96,396	0.3	184.2	1345	0.2	26	32,284	0.3	61.7

Note: X is output, E is employment, VA is value added and PE is public expenditure. The ratio employment-public expenditure is expressed per one € million.

Source: Authors' elaboration

3.2 Analysing relationships among regionalization methods

In terms of overall impact, methods do not produce very different results (Tab. 10). This is confirmed by the analyses of both impact range and variation coefficient: the differences between maximum and minimum values are not particularly great as well as the degree of variability existing among methods. The level of variability is included in the interval 11-15% in the all three regions and for all kinds of impact. Therefore, with respect to territorial dimension, methods would seem to behave in the same way. This can be indicative of robustness of the methods examined.

Further information can be obtained ranking methods on the basis of their related impacts. As emerges from Tab. 11, the ranking of methods remains about unchanged for all kinds of impact. In all regional cases, SDP and SCILQ tend to produce bigger impacts, whilst both versions of FLQ produce lower impacts. The SLQ (and PLQ) produces middle results which are normally lower than impacts estimated by other location quotients based on cell-by-cell adjustments (CILQ, RLQ, SCILQ).

Tab. 10 – Policy impact in rural regions measured using 8 alternative regionalization methods, 2000-2006

	Output variation (€ 000; 2000 prices)	Employment variation (units)	Value added variation (€ 000; 2000 prices)
NORTH-EAST (NE)			
Minimum (RFLQ – FLQ)	118,312	18,975	20,232
Maximum (SDP)	170,574	26,580	28,117
Average	142,433	22,633	23,288
VC* (%)	12.7	11.8	11.3
NORTH-WEST (NW)			
Minimum (RFLQ – FLQ)	275,196	30,669	108,830
Maximum (SCILQ)	421,935	42,617	151,244
Average	346,351	37,138	130,324
VC* (%)	14.9	11.8	11.6
"PERIPHERAL" SLOVENIA (PS)			
Minimum (RFLQ)	61,664	850	20,315
Maximum (SDP)	95,231	1,328	31,955
Average	87,722	1,220	29,094
VC* (%)	12.4	12.6	12.6

* Variation Coefficient

Source: Authors' elaboration

Tab. 11 – Regionalization methods sorted by impact

REGION	Output		Employment		Value Added	
	Methods	Euro (000)	Methods	Units	Methods	Euro (000)
North-East (NE)	SDP	170,574	SDP	26,580	SDP	28,117
	SCILQ	160,947	SCILQ	25,429	SCILQ	25,737
	CILQ	144,040	CILQ	22,948	CILQ	23,259
	RLQ	143,634	RLQ	22,892	RLQ	23,155
	SLQ	141,823	SLQ	22,632	SLQ	22,786
	PLQ	141,823	PLQ	22,632	PLQ	22,786
	FLQ	118,312	FLQ	18,975	FLQ	20,232
	RFLQ	118,312	RFLQ	18,975	RFLQ	20,232
North-West (NW)	SCILQ	421,935	SCILQ	42,617	SCILQ	151,244
	SDP	413,946	SDP	41,657	SDP	148,434
	CILQ	362,924	CILQ	38,662	CILQ	135,433
	RLQ	355,376	RLQ	38,346	RLQ	133,747
	SLQ	333,150	PLQ	37,249	PLQ	128,061
	PLQ	333,082	SLQ	37,236	SLQ	128,012
	FLQ	275,196	FLQ	30,669	FLQ	108,830
	RFLQ	275,196	RFLQ	30,669	RFLQ	108,830
"Peripheral" Slovenia (PS)	SDP	95,231	SDP	1,328	SDP	31,955
	SCILQ	94,991	SCILQ	1,323	SCILQ	31,586
	RLQ	90,810	RLQ	1,263	RLQ	30,076
	CILQ	90,686	PLQ	1,261	CILQ	30,052
	PLQ	90,516	SLQ	1,260	PLQ	29,936
	SLQ	90,453	CILQ	1,260	SLQ	29,907
	FLQ	87,424	FLQ	1,215	FLQ	28,926
	RFLQ	61,664	RFLQ	850	RFLQ	20,315

Source: Authors' elaboration

This result openly contrasts with the presumed tendency of SLQ to overestimate impact in comparison with CILQ. Johns and Leat (1987), commenting on their empirical results, state this tendency can be justified theoretically[10].

In any way, Johns and Leat's assertions can be partly confuted or, at least, attenuated. Indeed, it has been noted that CILQ, being equal to 1 along the principal diagonal ($CILQ_{ii} = 1$), may overestimate multipliers for two reasons. Firstly, this implies that every sector is always able to satisfy all its requirements even when the local industry is small (Morrison and Smith, 1974). Secondly, the regional input coefficient, remaining equal to the national coefficient, would incorporate trade among regions (Flegg *et al.*, 1995).

On the basis of both results obtained in this research and results coming from Johns and Leat, we argue that an *a priori* order, theoretically justifiable, between the two methods cannot be established. In particular, SLQ can produce higher impact than CILQ but it can also produce lower impacts, according to sectoral and regional data used.

In order to look into the analysis of relationships among methods, two multivariate statistical procedures were applied: factor analysis and the multidimensional scaling procedure (MSP)[11]. These are analyses aimed at

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[10] "[…] Compared with the national economy some buying sectors may be under-represented regionally and others over-represented. In the case of under-representation the technical coefficient would not be reduced when the SLQ for the selling industry was greater than or equal to one. But in fact it should be reduced because it may not be possible to sell to the under-represented buying industry at the level suggested by the national coefficient. The CILQ approach overcomes this problem and, even for rows where the selling industry is relatively well represented, there may well be some coefficient reduction. By reducing coefficients further than with the use of SLQs the linkages between regional sectors are reduced and hence the multipliers are smaller." (Johns and Leat, 1987, p. 248).

[11] Software Package SPSS 11.5 (FACTOR and PROXSCAL procedures).

reducing original dimensions of a problem, using variance and covariance matrix (factor analysis) and matrix of distances (MSP). Both are useful to identify clusters of methods.

Factor analysis is used to analyse correlation among methods examining results in terms of output, value added and employment separately and trying to extract the underlying components for facilitating clustering. Matrices of correlation among methods are calculated using impacts by sector as input data.

For all kinds of impact, it emerges that one factor is sufficient to explain relationships among methods. This demonstrates that methods are highly correlated to each other and is consistent with the analysis of variability among methods. Results from factor analysis are summarised in Tab. 12.

Tab. 12 – Factor matrix (one only extracted factor)

Methods	North-East (NE) region			North-West (NW) region			Peripheral Slovenia (PS)		
	X	E	VA	X	E	VA	X	E	VA
SLQ	0.9980	0.9987	0.9965	0.9949	0.9997	0.9983	0.9997	0.9995	0.9993
PLQ	0.9980	0.9987	0.9965	0.9948	0.9997	0.9983	0.9997	0.9995	0.9994
CILQ	0.9993	0.9993	0.9997	0.9975	0.9997	0.9988	0.9999	0.9998	0.9998
RLQ	0.9991	0.9992	0.9992	0.9985	0.9997	0.9992	0.9998	0.9997	0.9998
SCILQ	0.9962	0.9961	0.9952	0.9747	0.9983	0.9877	0.9990	0.9985	0.9984
FLQ	0.9895	0.9885	0.9916	0.9765	0.9966	0.9839	0.9999	0.9998	0.9998
RFLQ	0.9895	0.9885	0.9916	0.9765	0.9966	0.9839	0.9878	0.9739	0.9772
SDP	0.9844	0.9908	0.9476	0.9643	0.9981	0.9874	0.9978	0.9961	0.9951

Note: X – Output; E – Employment; VA – Value Added

Source: Authors' elaboration

The MSP is employed to identify the overall degree of dissimilarity existing among regionalization methods, taking into consideration all the three kinds of impact and all sectors simultaneously. First, matrices of distances among regionalization methods in terms of output, value added and employment are calculated. Distances among methods are derived as normalized Euclidean distances[12]. Afterwards, the MSP is applied on the three

[12] Several distance measures could be adopted (Flegg and Webber, 2000; Lahr, 2001). However, in order to avoid complicating the reading of results, we decided to adopt only one measure, choosing one of the most used.

distance matrices jointly. Graphical results are shown in Fig. 1, Fig. 2 and Fig. 3. A first consideration is that in all regional cases, explained dispersion is very high, being near 100%. This is an index of goodness of the statistical technique employed.

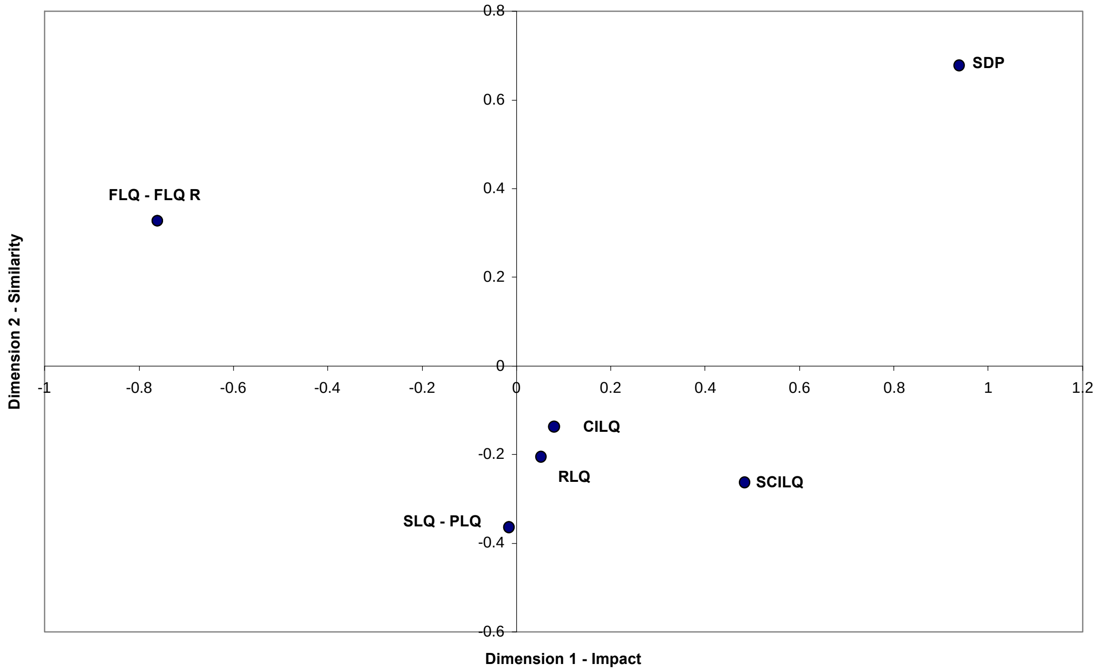
Moreover, as clearly emerges from the comparison of the graphs, results are very similar to each other. In other words, the same structure of distances among methods is roughly replicated in all regional cases. Again, results from analysis of variability are confirmed.

With respect to dimension 1, FLQ, on one hand, and SCILQ and SDP, on the other hand, are located in opposed points. Between these two extreme categories of methods, we find all the other methods. Examining the sequence of methods from the left side to the right one, dimension 1 may be interpreted as extent of impact or tendency to overestimate (or underestimate) impacts. This interpretation is consistent with the ranking of methods on the basis of the size of impact. Therefore, SDP would tend to overestimate impacts, whilst FLQ would underestimate effects.

Analysing the degree of closeness of methods in respect to dimension 2, there can be identified three distinct and repeated groups: one regroups SLQ and PLQ, another one consists of RLQ, CILQ, SCILQ and a last one coincides with SDP. Both versions of FLQ are not easily classifiable. They are located between SDP and the other location quotients (NE region) or are close to SDP (NW region) or fall into the group represented by the other location quotients (PS region). In any case, they move together and thus they can be defined as a further group.

Therefore, dimension 2 would seem to propound the technical classification of the methods used, which can be first classified into location quotients and supply-demand pool technique.

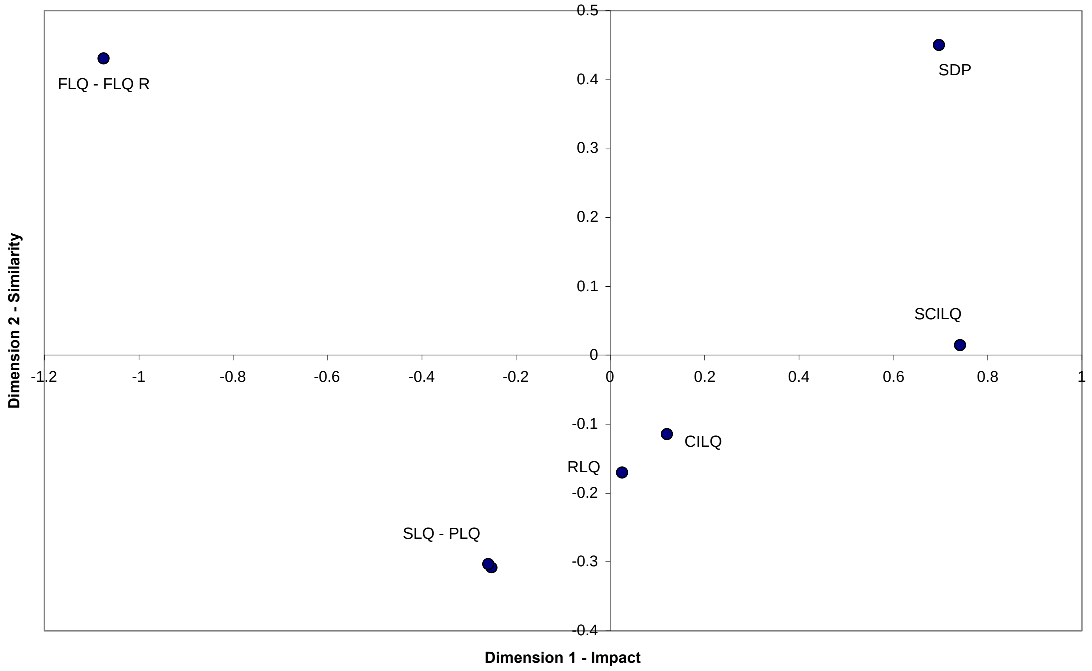
Fig. 1 – Plot of two-dimensional solution – output, value added and employment impacts (Multi-dimensional Scaling Procedure), the Bulgarian NE region



Measures of Fit – S-Stress: 0.11; Explained dispersion: 0.96

Source: Authors' elaboration

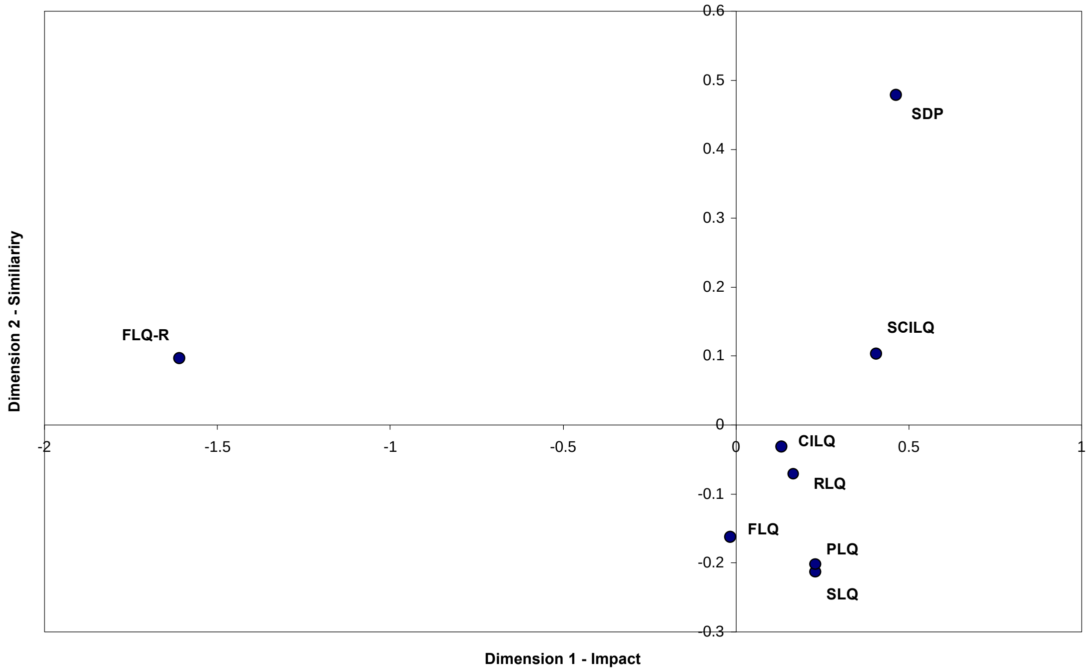
Fig. 2 – Plot of two-dimensional solution – output, value added and employment impacts (Multi-dimensional Scaling Procedure), the Romanian NW region



Measures of Fit – S-Stress: 0.04; Explained dispersion: 0.99

Source: Authors' elaboration

Fig. 3 – Plot of two-dimensional solution – output, value added and employment impacts (Multi-dimensional Scaling Procedure), the “Peripheral” Slovenia



Measures of Fit – S-Stress: 0.004; Explained dispersion: 1.0

Source: Authors’ elaboration

Within the location-quotient class, there are methods based on cell-by-cell adjustments (CILQ, RLQ, SCILQ, FLQ, RFLQ) and methods based on row adjustments (SLQ, PLQ). Within the former, there can be identified methods based on parameterization (FLQ, RFLQ) and methods which do not require estimation of any parameter (CILQ, RLQ, SCILQ). The parameterization might explain the changeable position of FLQ and RFLQ.

Definitively, dimension 2 may be referred as an index of similarity (in terms of technical construction) among methods.

4. Concluding remarks

In this research, there has been carried out a sensitivity analysis of policy impact to the use of alternative methods of constructing regional I-O matrices. The methods used are: the Simple Location Quotient (SLQ), the Purchases-only Location Quotient (PLQ), the Cross-Industry Location Quotient (CILQ), the Semilogarithmic Location Quotient (RLQ), the Symmetric Cross Industry Location Quotient (SCILQ), two versions of the Flegg's Location Quotient (FLQ and RFLQ) and the Supply Demand Pool technique (SDP). Estimated impacts in terms of output, value added and employment are those induced by application of SAPARD pre-accession instrument for the period 2000-06 in three rural regions: the Bulgarian North-East region, the Romanian North-West region and the "Peripheral" Slovenia. Impacts have been assessed by an I-O approach.

The main results of this analysis may be summarised as follows.

Estimation of policy impact at a regional level varies according to the used method of deriving regional I-O matrices. In particular, results show that, of the methods analysed, SDP produces higher impacts while FLQ produces lower impacts. However, although results are generally affected by the technique employed, differences among methods are contained.

Past empirical studies (Johns and Leat, 1987) have shown that SLQ tends to overestimate impacts in comparison with CILQ. And this outcome has been justified theoretically. Our results have instead shown that, in three regions of different nations, CILQ tends to generate higher impacts than SLQ. Therefore, we argue that an *a priori* order between the two methods cannot be identified and the relevant differences in terms of impact finally depend on regional and sectoral data used.

Surprisingly, the regionalization methods analysed would seem not to be affected by territorial dimension. In fact, the methods tend to behave in a similar way in all the three regions considered and for any kind of impact estimated.

These last considerations strengthen, in our opinion, the usefulness of any sensitivity analysis, like this, finalized to separate the effects produced by policy in a given region characterised by specific economic conditions from those generated by distortion (or *inertia*) related to the choice of regionalization method.

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