The Impact of EU Accession in Romania. An Analysis of Regional Development Policy Effects by a Multiregional I-O Model

Andrea Bonfiglio

Department of Economics, Polytechnic University of the Marche

Piazzale Martelli, 8, 60121, Ancona (Italy)

Tel.: +39 071 2207116 Fax.: +39 071 2207102

e-mail: bonfiglio@dea.unian.it

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Abstract

The objective of this article is to assess labour income and employment effects in Romania coming from rural development and structural policies defined in the proposed 2007-09 EU accession financial package. The methodology used is based on a multiregional I-O model derived by a three-stage estimation procedure. Main results show that EU accession will lead to large positive effects in Romania, which vary according to the region considered. In this connection, the South and the North-East regions are those on which benefits tend to concentrate. Finally, policy would seem to reduce regional and sectoral income disparities, leading to more balanced development. On the contrary, in terms of employment, policy would increase divergences, albeit, from an analysis of single region economy, a general tendency to a reduction of sector disparities is noticed.

Keywords: EU accession, rural development, structural actions, policy impact, multiregional I-O model; **C82**, **R15**, **R58**

1 Introduction

Romania submitted application for EU membership on June 22, 1995. In October 1999, the Commission recommended starting accession negotiations with Romania, provided that Romania engaged to improve the situation of children in institutional care and drafted a medium-term economic strategy. Following the Helsinki European Council's decision in December 1999, accession negotiations started with Romania on February 15, 2000.

Romania's objective is to gain EU membership in 2007. This aim is likely to be reached since, in June 2004, of the 31 chapters under negotiation, 24 have been provisionally closed (European Commission, 2004a, 2004b).

In order to prepare the ground for the completion of the negotiations, in 2004, the EU Commission drew up a proposal defining a financial package for the accession negotiations with Bulgaria and Romania (European Commission, 2004c). This proposal is based largely on the existing *acquis* and on the principles and methodology underlying the financial package developed for the negotiations with the ten countries entered EU in 2004. In view of possible future modifications of the financial package due to policy reforms or other fundamental changes, the time period covered has been expressly limited to three years and goes from 2007 to 2009.

The proposal establishes 5 expenditure chapters: (a) agriculture; (b) structural actions; (c) internal policies (nuclear safety and transition facility for institution building); (d) budgetary compensation; (e) administration. With reference to chapter (a), appropriations relate to market measures, direct payments and rural development. Chapter (b) involves structural and cohesion funds.

Although the EU commission gives an estimate of funds allocated to Romania, no evaluation of possible impact coming from application of the financial package is carried out. The objective of this paper is just to attempt to estimate employment and labour income impact in Romania deriving from application of development policies included in the proposed financial package for the period 2007-09[1]. Development policies considered are rural development policies and structural actions (cohesion

[1] An attempt to estimate impact coming from accession of Romania to EU for the period 2007-09 is contained in Vincze (2004). This work, which is a synthesis of results produced within the REAPBALK European project, is aimed at

funds and structural funds), which represent about 84% of total expenditure (excluding the chapters of internal policies and administration, whose distribution among the two countries is not well specified). In Tab. 1, the distribution of funds appropriated to Romania is shown.

Table 1. Financial Allocation per kind of policy instrument, Romania, 2007-09 (million euro, 2000 prices*).

Policy	Total Funds	%
Rural development policies	2,218	24.2
Structural Funds	3,643	39.8
Cohesion Funds	1,822	19.9
Total	7,683	100.0

* Within the EC's proposal, funds are expressed in 2004 prices. Since the multiregional I-O model developed in this research refers to the year 2000, funds were converted into 2000 prices using the Harmonised Index of Consumer Prices (HICPs)

Source: Author's elaboration on data from European Commission (2004c)

2 Methodology used and area under study

In order to estimate impact from EU policy application for the period 2007-09, a multiregional I-O model is adopted. In spite of some restrictive assumptions (Gerking *et al.*, 2001), I-O model is still considered a valid tool to quantify total effects in terms of output and, by a simple extension, of income and employment, deriving from final demand variation (Doyle *et al*., 1997). Moreover, the multiregional version offers further advantages: it guarantees major internal consistency than one-region models, it allows taking account of the diverse pattern of consumption in the different regions, capturing effects due to trade relationships among regions and mapping impact distribution on the territory.

The regions under study are the eight Romanian NUTS-2 level development regions[2]: the North-East region (NER), the South-East region (SER), the South region (SR), the South-West region (SWR), the West region (WR), the North-West region (NWR), the Center region (CR), and the Bucharest region (BR).

A peculiar characteristic of Romania's economic growth over the last ten years has been the increasing importance of BR. With about 10% of national population, BR in 1998 produced 17% of total GDP (Tab. 2). Development of BR is due to the presence of the capital Bucharest. In 2001, Bucharest attracted more than 50% of total foreign investment. In addition, the capital is one of the few areas which are experiencing high positive internal migration flows for work and school reasons. Nevertheless, the capital has not produced so far significant spill-over in favour of neighbouring areas. In fact, several counties which are in its immediate surroundings are still undeveloped (Romanian Ministry of Integration, 2003).

A further feature of the Romania's economic growth is the unbalanced development in favour of the western and central regions which have benefited from several factors: proximity to western markets, historically lower dependence on the primary sector and relatively higher flows of foreign direct investments. The eastern area is the less developed. Here, NER and SR are those which present lower levels of development. The former has suffered from its proximity to the border with Moldova and Ukraine and from its traditional heavy dependence on agriculture whereas the latter, besides its strong dependence on the primary sector, has been hindered by the Danube which has acted as a barrier to cross-border trade.

This diverse path of economic growth has generated a self-reinforcement process also due to fiscal policy mechanisms. In the regions lagging behind, investments have increasingly decreased also

estimating impact in Romania and in the North-West region through application of a national I-O model and a regional I-O model, respectively.

[2] Law No.151 regarding regional development, adopted in 1998, established the institutional framework, objectives, competences, and specific instruments for regional development policy in Romania. With the aim of achieving the main objectives of regional development policy, Law No.151/1998 authorized the creation of 8 development regions - corresponding with NUTS II level, through the voluntary association of counties. These regions are not administrative units, and do not have legal personality.

because fiscal problems have caused a decline in public expenditure and, in turn, a decrease in investments in public infrastructure which has made the degree of attractiveness still lower.

Another peculiarity of regional development in Romania is the coexistence of areas of different levels of development within the single regions and the scarce economic integration among the sub-regional areas. In fact, despite a dense urban network, there are few and insufficient links among urban centres and the surrounding areas. In addition, the system of local transport appears to be extremely inadequate to establish and maintain foreign contacts and economic relationships between counties. This implies that the closure of the only company in a given county generally leads to migration to rural areas or to Bucharest and not to other urban centres located in the same region, causing an urban decline of small and medium size towns.

A last remarkable characteristic of regional development is the presence of a high number of localities having an only one economic activity, generally a State-owned company, likely to undergo restructuring and concentrating a disproportionate share of non-agricultural employment. It is evident that this situation is highly critical for the serious consequences which labour market shocks could produce in the future.

Table 2. Some geographic and socio-economic indicators about the Romanian NUTS-2 level development regions.

Regions	Area (km^2)	%	GDP (billion lei, 1998)	%	Population (inhabitants, 2000)	%	GDP per capita (million lei)
NER	36,850	15.5	50,385.4	13.5	3,823,492	17.0	13.2
SER	35,762	15.0	48,959.2	13.1	2,934.319	13.1	16.7
SR	34,453	14.5	49,675.0	13.3	3,465.468	15.4	14.3
SWR	29,212	12.3	36,101.5	9.7	2,399.831	10.7	15.0
WR	32,034	13.4	34,377.8	9.2	2,041.129	9.1	16.8
NWR	34,159	14.3	45,320.3	12.1	2,844.042	12.7	15.9
CR	34,100	14.3	46,683.1	12.5	2,642.242	11.8	17.7
BR	1,821	0.8	61,784.5	16.6	2,284.682	10.2	27.0
Romania	238,391	100.0	373,286.8	100.0	22,435,205	100.0	16.6

Source: Author’s elaboration on data from Romania National Institute of Statistics

2.1 *The multiregional I-O model*

A multiregional I-O system describes all economic transactions among productive sectors and among the regions considered. Formally, it can be written as:

$$\begin{bmatrix} \mathbf{X}^1 \\ \text{--} \\ \mathbf{X}^2 \\ \text{--} \\ \vdots \\ \text{--} \\ \mathbf{X}^{N-1} \\ \text{--} \\ \mathbf{X}^N \end{bmatrix} = \begin{bmatrix} \mathbf{A}^{11} & | & \mathbf{A}^{12} & | & \cdots & | & \mathbf{A}^{1(N-1)} & | & \mathbf{A}^{1N} \\ \text{--} & | & \text{--} & | & \text{--} & | & \text{--} & | & \text{--} \\ \mathbf{A}^{21} & | & \mathbf{A}^{22} & | & \cdots & | & \mathbf{A}^{2(N-1)} & | & \mathbf{A}^{2N} \\ \text{--} & | & \text{--} & | & \text{--} & | & \text{--} & | & \text{--} \\ \vdots & | & \vdots & | & \vdots & | & \vdots & | & \vdots \\ \text{--} & | & \text{--} & | & \text{--} & | & \text{--} & | & \text{--} \\ \mathbf{A}^{(N-1)1} & | & \mathbf{A}^{(N-1)2} & | & \cdots & | & \mathbf{A}^{(N-1)(N-1)} & | & \mathbf{A}^{(N-1)N} \\ \text{--} & | & \text{--} & | & \text{--} & | & \text{--} & | & \text{--} \\ \mathbf{A}^{N1} & | & \mathbf{A}^{N2} & | & \cdots & | & \mathbf{A}^{N(N-1)} & | & \mathbf{A}^{NN} \end{bmatrix} \times \begin{bmatrix} \mathbf{X}^1 \\ \text{--} \\ \mathbf{X}^2 \\ \text{--} \\ \vdots \\ \text{--} \\ \mathbf{X}^{N-1} \\ \text{--} \\ \mathbf{X}^N \end{bmatrix} + \begin{bmatrix} \mathbf{FD}^1 \\ \text{--} \\ \mathbf{FD}^2 \\ \text{--} \\ \vdots \\ \text{--} \\ \mathbf{FD}^{N-1} \\ \text{--} \\ \mathbf{FD}^N \end{bmatrix} \tag{1}$$

where N is the number of the regions, $\mathbf{X}$ is output vector, $\mathbf{A}$ is the coefficient matrix and $\mathbf{FD}$ is a final demand vector. In particular, $\mathbf{A}^{SS}$ $(S = 1, \ldots, N)$ refers to flows of goods and services (per unit of output) exchanged among sectors within region *S*. $\mathbf{A}^{TS}$ $(T, S = 1, \ldots, N \ \wedge \ T \neq S)$ relates to export flows of sectors of region *T* to sectors of region *S*, which equal import flows of sectors of region *S* from sectors of region *T*.

More compactly, system (1) can be rewritten as a system of block matrices; i.e.:

$$\mathbf{X} = \mathbf{AX} + \mathbf{FD} \tag{2}$$

As usual, the solution of the system is:

$$\mathbf{X} = (\mathbf{I} - \mathbf{A})^{-1}\,\mathbf{FD} \tag{3}$$

System (3) represents the multiregional I-O model which allows determining output variation in the regions under study induced by a change in final demand. Output change takes account of both direct and indirect effects generated by sector linkages within regions and spill-over and feedback effects produced by interrelationships between the regions (Miller and Blair, 1985). To analyse employment and income dynamics, system (3) has to be modified transforming goods and services flows into employment and labour income flows, respectively. System (3) becomes:

$$\mathbf{E} = \tilde{\mathbf{E}} \times \mathbf{FD} \tag{4}$$

$$\mathbf{Y} = \tilde{\mathbf{Y}} \times \mathbf{FD} \tag{5}$$

where $\mathbf{E}$ is employment vector and $\mathbf{Y}$ is labour income vector. $\tilde{\mathbf{E}} = \left[e_{ij}^{ST} \right]$ is the employment inverse matrix where $e_{ij}^{ST} = b_{ij}^{ST} \cdot \frac{E_i^S}{X_i^T}$; b_{ij}^{ST} is an element of $\left(\mathbf{I - A}\right)^{\mathbf{-1}}$ and E_i^S / X_i^T is an employment coefficient, which expresses the number of employees of region *S* per one output unit of sector *i* in region *T*. $\tilde{\mathbf{Y}} = \left[h_{ij}^{ST} \right]$ is the labour income inverse matrix where $h_{ij}^{ST} = b_{ij}^{ST} \cdot \frac{Y_i^S}{X_i^T}$ and Y_i^S / X_i^T is a labour income coefficient, expressing the amount of income paid to workers of region *S* per one output unit of sector *i* in region *T*.

2.2 Deriving the multiregional I-O matrix: a three-stage estimation method

To construct a multiregional matrix, it is necessary to have at disposal much information, which involve both intraregional flows among sectors and interregional flows. Since collecting information by survey is costly, indirect techniques reducing need for data have been introduced over time (Chenery, 1953; Moses, 1955; Leontief and Strout, 1963; Polenske, 1970).

In the case of a bi-regional I-O model, the Round's interregional approach (Round, 1972; 1978; 1983) can be a straightforward solution. This approach allows deriving both interregional imports and exports and offers a higher degree of internal consistency than single region applications[3]. A problem associated to this technique is that there is no obvious extension of the approach to multiregional input-output tables involving three or more regions (Hewings and Janson, 1980). In this research, we tried to extend the Round's approach to production of multiregional models implementing that within an integrated procedure. The technique proposed is a *three-stage estimation method*. Stage 1 provides the application of a location quotient technique to estimate the intersectoral flows within a given region (input coefficient matrix) and imports of the region from the rest of the country (total trade coefficient matrix). In stage 2, a gravity model is used to allocate total imports of a given region among the other regions (trade coefficients matrices). Finally, stage 3 provides the application of an optimization technique to reconcile discrepancies within the multiregional I-O table and the calculation of multipliers. The first two stages are repeated recursively as many times as is the number of the regions under study. In next paragraphs, the three stages are described in more detail.

2.3 Stage 1: estimating input and total trade coefficients matrices

In this stage, a preliminary estimate of input and total trade coefficients is obtained using a location quotient technique. Within the location approach, several methods can be included, such as: simple location quotient, purchases-only location quotient, West's location quotient, cross industry location quotient, symmetric cross industry location quotient, semilogarithmic quotient and Flegg's location quotient (West, 1980; Miller and Blair, 1985; Flegg *et al*., 1995; Flegg and Webber, 1996a, 1996b, 1997; Oude Wansink and Maks, 1997).

The Flegg's location quotient (FLQ) has been designed to overcome some theoretical drawbacks related to traditional location quotients. Of the properties which a regionalization method should incorporates (Round, 1978), the FLQ, different from other location quotients, takes account of all the three properties: importance of selling sectors, importance of purchasing sectors and size of the region. Moreover, recent empirical evidence (Flegg and Webber, 2000) has shown that the FLQ outperforms traditional location quotients in reproducing survey-based models.

[3] Round proposed a two-stage estimation method based on SLQ for deriving the regional requirement coefficients. The first stage involves a preliminary estimation of intraregional and interregional flows using location quotients. Consider two regions R and S. The location quotient approach establishes that if $q_{ij}^R \geq 1$, then region R is supposed to be self-sufficient and the surplus is exported. In the case of one region, this amount is undefined. However, in a closed system with two regions, if $q_{ij}^R \geq 1$, there results that $q_{ij}^S < 1$. It signifies that region *S* will import goods and services by an amount of $\left(1 - q_{ij}^S\right) r_{ij}^N$, where r_{ij}^N represents the national technological coefficient. This quantity is supposed to be imports from the other region (imports from abroad are therefore excluded) and consequently exports from region R. The second stage involves the adjustment of initial estimates to conform them to known vectors of intermediate output.

Given a stronger theoretical validity than other location quotients and the latest empirical results, the FLQ is applied in this analysis to estimate for every Romanian region the matrices of input and total trade coefficients.

The FLQ takes the following form[4]:

$$FLQ_{ij} = \frac{X_i^S / X_j^S}{X_i^{NA} / X_j^{NA}} \cdot \lambda^* \tag{6}$$

where $\lambda^* = \left[\log_2\left(1 + X^S / X^{NA}\right)\right]^\delta$, $0 \le \delta < 1$, NA refers to the nation. δ is a parameter that has to be estimated[5]. The larger the value of δ, the greater the adjustment for regional imports. So, δ is inversely related to the size of the region.

Starting from a 2000 13-sector national I-O table[6], for a given region *S*, input coefficients matrix, $\mathbf{A}^{SS} = \left[a_{ij}^{SS}\right]$, and total trade coefficients matrix, $\mathbf{A}^{RS} = \left[a_{ij}^{RS}\right]$, are derived as follows:

$$a_{ij}^{SS} = \begin{cases} r_{ij}^{NA} FLQ_{ij}^S & \text{if } FLQ_{ij}^S < 1 \\ r_{ij}^{NA} & \text{if } FLQ_{ij}^S \ge 1 \end{cases} \tag{7}$$

$$a_{ij}^{RS} = \begin{cases} r_{ij}^{NA} \cdot \left(1 - FLQ_{ij}^S\right) & \text{if } FLQ_{ij}^S < 1 \\ 0 & \text{if } FLQ_{ij}^S \ge 1 \end{cases} \tag{8}$$

where *R* expresses the rest of the country; r_{ij}^{NA} is the national technology coefficient; a_{ij}^{SS} is the input coefficient of region *S*; a_{ij}^{RS} is the total trade coefficient of region *S* and expresses the amount of imports of good *i* (per unit of output *j*) to region *S* from the rest of the country.

The logic behind the above systems is that the relatively less important sector *i* than sector *j* in region *S* and the relatively smaller region *S* ($FLQ_{ij}^S < 1$), the more the local production cannot satisfy the entire local demand and a part of production will be imported from the rest of the country. Technically, the national technology coefficient is reduced and the difference is attributed to the total trade coefficient.

Otherwise, the relatively more important sector *i* than sector *j* in region *S* and the relatively bigger region *S* ($FLQ_{ij}^S \ge 1$), the more the local production can fulfil all local requirements and no goods and services will be imported from the rest of country. In this case, the input coefficient of region *S* will be given equal to the national technology coefficient whereas the total trade coefficient will be null.

[4] The version elaborated by the authors uses employment data instead of output data. Employment data are generally used when reliable data on output (or value added) are missing. In this research, we used output data estimated by applying ratio between regional and national sector GDP to national output.

[5] A value of 0.3 was assigned to the parameter δ. The FLQ's authors demonstrated that this value can be good for even very different regions (Flegg and Webber, 1997).

[6] The available national I-O table was a 2000 34-sector Romanian I-O table expressed in basic values and reporting domestic flows. Before regionalizing, first, national imports were reallocated within the secondary sectors of the national I-O table to derive a technology matrix, as Jensen *et al*. (1979) suggest. Second, the national I-O table was aggregated into 13 sectors owing to the reduced availability of sector data at a sub-national level.

2.4 Stage 2: estimating trade coefficients matrices

For every region, trade coefficients matrices, describing commercial relationships between a given region and the others, are estimated using a readapted version of a gravity model (Mitchell, 1996), applied to the total trade coefficient matrix.

The hypothesis of the model is that the probability of import flows attraction exerted by a region is an indirect function of its distance from the import region and a direct function of its ability to attract import flows. Given regions *L* and *S*, the attraction probability of region *L* relative to import flows of good *i* to region *S* is given by:

$$p_i^{LS} = \frac{X_i^L \big/ (d_{LS})^2}{\sum_{k=1}^{N} X_i^k \big/ (d_{jS})^2} \quad (k \neq S) \tag{9}$$

where d_{LS} is the geographical distance between export region L and import region S (this is a straight line distance between the barycentre of the respective regions); X is used as a proxy of the ability of attracting import flows. It is assumed that import flows of a given good (or service), whatever import sector is, are mostly attracted (or rather produced and exported) by regions with high levels of output in the relevant sector. Output has a greater importance than the distance factor, which is squared just to reduce its effects on the attraction probability.

For a given region *S*, trade coefficients matrices are derived as follows:

$$\mathbf{A}^{LS} = \hat{\mathbf{p}}^{LS}\mathbf{A}^{RS} \qquad \left(L = 1, 2, \ldots, N \wedge L \neq S\right) \tag{10}$$

where $\mathbf{p}^{LS} = \left(p_1^{LS}, p_2^{LS}, \ldots, p_s^{LS}\right)$.

2.5 Stage 3: balancing the multiregional I-O matrix and deriving multipliers

The input and trade coefficients matrices form the 13 sector x 8 region I-O matrix described in system (1). The matrix is then converted into flows multiplying coefficients by output data. As is logical to expect, the multiregional table presents internal inconsistencies and is not coherent with the national I-O table. Therefore we proceed to balance the multiregional I-O table. Balancing of an I-O table, which is a more general problem than updating or estimating, is a technical matter frequently faced by I-O analysts (Bulmer-Thomas, 1982; Canning and Wang, 2004; Jackson and Murray, 2004). Matrix-balancing techniques can be roughly classified into two categories: scaling algorithms (like RAS) and optimization techniques. The former iteratively multiply rows and columns of a prior matrix by positive constants until reaching a solution matrix. This approach requires at least the knowledge of row and column totals. The latter minimise an objective (or penalty) function measuring the distance between the elements of a matrix to be balanced and the elements of the objective matrix, under some constraints which impose accounting identities and/or introduce exogenous information. This approach gives the analyst more flexibility in balancing matrices since the quantity and the kind of prior information can vary. However, empirical evidence showed that the RAS technique performs better than several formulations of optimization problems when *a priori* information concerns row and columns totals (Jackson and Murray, 2002).

In this research, given the kind of prior information, an optimization technique, based on the Pearson χ^2 (or normalized square of differences) penalty function (Friedlander, 1961), is used[7]. The objective function takes the following form:

[7] The analyst is free to choose the penalty function which feels to be the most appropriate to the aims of the research.

$$f\left(a_{ij}^{LS}\right)=\sum_{L=1}^{N}\sum_{S=1}^{N}\sum_{i=1}^{s}\sum_{j=1}^{s}\frac{\left(a_{ij}^{LS}-\overline{a}_{ij}^{LS}\right)^{2}}{\overline{a}_{ij}^{LS}} \tag{11}$$

where $\overline{a}_{ij}^{LS}$ represents known coefficients of the unbalanced matrix whereas a_{ij}^{LS} indicates coefficients of the objective matrix. Minimization[8] is carried out under the following constraints:

$$\sum_{L=1}^{N}\sum_{S=1}^{N}a_{ij}^{LS}\cdot X_{j}^{S}=\overline{Z}_{ij}^{N} \qquad \left(i,j=1,2,\ldots,s\right) \tag{12}$$

$$a_{ij}^{LS}\geq 0 \qquad \left(i,j=1,2,\ldots,s \quad L,S=1,2,\ldots,N\right) \tag{13}$$

where $\overline{Z}_{ij}^{N}$ represents the national intermediate flows from sector *i* to sector *j*. System (12) imposes that the sum of flows from sector *i* to sector *j* for all regions must equal the relevant national flows whereas system (13) imposes non-negativity of coefficients[9].

From the resulting balanced multiregional I-O table, there are calculated employment and income multipliers used for impact analysis[10] (Tabs. 3 and 4).

2.6 Modelling policy into the multiregional I-O model

Assessing impact from EU policy by a multiregional I-O model requires estimating regional funds and distributing funds sectorally.

As regards regional allocation, there was used information from the Romanian Development Plan 2004-2006 (Romanian Ministry of Integration, 2003). The National Development Plan calculates for every development region a complex index $\left(I_r\right)$, named “development index”, which is proposed to allocate structural funds regionally. This index should reflect the disparities among regions and give preference to underdeveloped regions in the process of distribution of resources. It is composed of three parts: (a) a combination of per capita income and population reflecting the basic criteria for “structural underemployment”; (b) a combination of unemployment rate and population highlighting peculiar problems regarding employment; (c) a combination of basic transport and utilities infrastructure highlighting the problems regarding the structural endowment.

From development indices, shares of allocations[11] are calculated as: $\left(I_r/I_{\cdot}\right)$. These shares were applied to the national amounts to estimate regional funds for all policies considered. Tab. 5 shows the allocation of national funds among the regions.

[8] This problem of non-linear programming was codified and solved by an algorithm developed within GAMS.

[9] Through the specification of further constraints, it is also possible to insert all available exogenous information, which the analyst considers to be appropriate to improve the overall reliability of the multiregional I-O table.

[10] From an analysis of multipliers, one can identify for every region the so-called key sectors i.e. sectors which can stimulate economic growth in terms of income and employment in the regions under study by means of interrelationships with the other sectors of both the region examined and the other regions. Identifying key sectors helps policy makers to select sectors to which investments should be addressed in order to favour economic development.

[11] Percentages of allocation are: 21.6 (NER), 13.6 (SER), 16.5 (SR), 11.8 (SWR), 8.6 (WR), 11.9 (NWR), 10.8 (CR), 5.2 (BR).

Table 3. Labour income multipliers by region, Romania, 2000.

Sectors	NER	SER	SR	SWR	WR	NWR	CR	BR
Agriculture	0.18	0.18	0.18	0.21	0.20	0.18	0.16	0.34
Mining	0.19	0.20	0.21	0.22	0.35	0.21	0.21	0.19
Manufacturing	0.18	0.21	0.21	0.26	0.42	0.21	0.19	0.26
Energy, gas and water	0.31	0.32	0.32	0.34	0.50	0.34	0.34	0.36
Construction	0.32	0.34	0.34	0.38	0.41	0.33	0.32	0.37
Trade	0.36	0.33	0.44	0.45	0.45	0.42	0.39	0.40
Hotels and restaurants	0.24	0.30	0.27	0.28	0.33	0.29	0.33	0.39
Transports	0.32	0.53	0.36	0.42	0.42	0.32	0.37	0.49
Communication	0.38	0.34	0.45	0.45	0.39	0.37	0.34	0.23
Finance, banking and insurance	0.60	0.60	0.60	0.47	0.68	0.64	0.75	0.72
Real estate and other services	0.14	0.15	0.19	0.19	0.19	0.13	0.15	0.23
Public administration	0.50	0.61	0.59	0.69	0.74	0.58	0.61	1.74
Other services	0.48	0.54	0.49	0.53	0.58	0.47	0.52	0.65

Source: Author's elaboration

Table 4. Employment multipliers by region, Romania, 2000 (for every one € million).

Sectors	NER	SER	SR	SWR	WR	NWR	CR	BR
Agriculture	674	625	587	699	548	699	578	1,388
Mining	52	49	51	49	83	58	57	107
Manufacturing	115	114	109	145	216	136	125	507
Energy, gas and water	93	90	94	93	148	104	104	154
Construction	154	139	144	168	181	155	142	264
Trade	209	167	215	236	249	212	198	268
Hotels and restaurants	98	96	97	108	130	108	109	240
Transports	119	155	123	146	150	120	135	212
Communication	96	80	99	110	99	92	85	60
Finance, banking and insurance	121	123	113	99	154	134	144	93
Real estate and other services	82	69	82	95	94	73	79	160
Public administration	88	103	99	123	146	107	105	293
Other services	125	124	116	134	160	125	134	244

Source: Author's elaboration

Table 5. Financial Allocation to regions per kind of policy instrument, Romania, 2007-09.

Policy	NER	SER	SR	SWR	WR	NWR	CR	BR	Romania
Rural development policies	479	302	366	262	191	264	240	115	2,218
Structural Funds	787	495	601	430	313	434	393	189	3,643
Cohesion Funds	393	248	301	215	157	217	197	95	1,822
TOTAL	1,659	1,045	1,268	907	661	914	830	399	7,683

Source: Author's elaboration

Once regional funds have been estimated, it is necessary to hypothesise how expenditure will be distributed among sectors.

The first step was to distribute national funds among sectors. Towards this aim, a criterion proposed by Vincze (2004) was applied. This criterion treats rural development policies and cohesion funds in the same way but distinguishes those policies from structural funds. With regard to rural development policies and cohesion funds, sector distribution of funds is essentially founded on both past experience in pre-accession instruments (such as SAPARD and ISPA) and local knowledge. With reference to structural funds, distribution is made using a methodology suggested in Morillas *et al.* (2000), readapted to the specific characteristics and needs of Romania. Funds are first redistributed into 8 axes on the basis of Romanian national priorities and measures: 45% to Infrastructure, 15% to Education and Research, 15% to Aids to primary sector enterprises, 5% to office-supply material computer equipment and precision equipment, 5% to other industrial equipment, 5% to construction, 5% to studies, advice and communication, 5% to aids to enterprises (except for primary sector). Then, vectors of fixed percentages, each one corresponding to a different axis, are applied to funds assigned to each axis to estimate distribution among sectors.

The second step was to allocate national sector funds to regional sectors. For every sector, regional funds were estimated applying regional and national output ratio to national sector funds. However, in so doing, it happened that the sum of regional funds over all sectors of each region did not correspond to the overall amount of funds allocated to the region on the basis of the development index. Therefore, sector funds were reconciled by constraining the matrix of regional and sector funds to the vector of national sector funds (row vector) and to the vector of overall amount of regional funds allocated (column vector) using a RAS-type technique. Tab. 6 shows actual allocation of funds among regions and sectors.

Table 6. Financial Allocation to regions by sector, Romania, 2007-09 (million euro; 2000 prices).

Sector	NER	SER	SR	SWR	WR	NWR	CR	BR	Romania
Agriculture	190	98	143	101	72	87	69	3	763
Mining	35	21	43	45	26	24	18	4	217
Manufacturing	492	292	374	214	116	251	283	94	2,116
Energy, gas and water	104	69	73	87	32	45	45	22	477
Construction	178	146	142	117	89	97	90	54	913
Trade	53	36	35	22	23	28	28	25	249
Hotels and restaurants	36	32	27	26	24	24	23	12	204
Transports	213	148	181	119	121	146	112	54	1,094
Communication	106	69	74	50	54	66	56	80	555
Finance, banking and insurance	6	4	5	5	3	4	3	4	32
Real estate and other services	43	34	36	22	30	33	22	17	237
Public administration	61	30	44	28	20	28	22	7	241
Other services	143	65	90	70	52	82	58	24	584
TOTAL	1,659	1,045	1,268	907	661	914	830	399	7,683

Source: Author’s elaboration

3 Assessing overall impact induced by policy

By applying the multiregional I-O model developed, there were estimated employment and labour income impacts produced in Romania by application of development policies related to EU accession financial package for the period 2007-09.

Results from impact analysis reveal that labour income and employment variations in Romania will be 2,425 million euro and about 1.4 million of labour units, respectively. Variation of income per capita is estimated to be 108 €. In terms of income, services and industry are the sectors attracting most part of impact: services absorb 50% of impact whereas industry attracts 45% of income variation. Agricultural employees only receive 5% of income variation. As regards employment, most part of impact is concentrated on agriculture (50% of employment variation) whereas the remained part is distributed between industry (29%) and services (21%) (Tab. 7).

In comparison with 2000 data, income and employment are forecasted to increase by about 16% and 17%, respectively. The bigger variation is registered by agriculture, followed by industry and, finally, services. In terms of effectiveness, policy generates an increase in income by 32% of public expenditure and in employment by 183 labour units for each one million euro. At a sector level, policy demonstrates to be more effective in services, as for income, and in agriculture, as for employment.

To improve the analysis of effectiveness, it is interesting to verify if policy will contribute or less towards a reduction of territorial and sector disparities. Through the analysis of income distribution, there emerges that territorial variability[12] among regions tends to diminish, passing from 24.4% to 22.4% (Tab. 8). Even the variability among sectors decreases going from 86.5% to 83.3%. Considering all sectors and regions jointly, total variability decreases from 92.8% to 89.3%. As far as employment distribution is concerned, variability tends to increase. Variability among regions passes from 20.4% to 24.3%. That among sectors goes from 157.9% to 159.6%. Finally, total variability shifts from 168.8% to 173.1%.

Results in terms of variability show that, at an aggregate level, policy helps to reduce both sector and territorial disparities in terms of income, favouring a more uniform development, but sharpens the differences among sectors and regions from an employment point of view.

Application of a multiregional I-O model permits to increase the level of detail, analysing impact at a sub-national level.

The regions attracting bigger impacts are SR and NER whereas the regions registering lower impacts are WR, at an income level, and BR, as for employment (Tab. 7). In terms of income, in all the regions, services and industry attract a bigger share of regional impact. As far as employment is concerned, agriculture absorbs most impacts in all the regions except for CR and BR where effects are concentrated on extra-agricultural sectors.

Compared to 2000 data, following to policy application, SR and NER grow more in terms of both income and employment. BR is the region growing less.

In terms of effectiveness, policy is by far more effective in generating income in BR (78% of public expenditure transforms into income). In the other regions, the level of effectiveness is roughly similar going from 23% (NER) to 35% (CR). Services are the sector where policy effectiveness is bigger in all the regions except for WR, where the sector in which policy is more effective is industry. As far as employment is concerned, SR demonstrates to be the region able to valorise policy funds better: for each one million euro, policy generates about 272 labour units. The less competitive region from the policy-use standpoint is SER with 137 labour units for each one million euro. At a sector level, higher effectiveness can be noticed in agriculture in all the regions reaching in BR the level of about 1,758 labour units for each one million euro.

An analysis of sector differences can be also extended at a regional level. In terms of income distribution, there can be noted that sector variability decreases in all the regions. Bigger decreases in sector disparities involve SR and NER. Also with regard to employment, sector differences tend to decrease with the exceptions of SR, where variability increases by 8%, and NER, where variability remains unaltered.

[12] Variability is measured by variation coefficient, calculated before and after application of policy.

Table 7. Impact by region induced by accession financial package per macro-sector, Romania, 2007-09.

Region	Labour Income					Employment				
	Million euro (2000 prices)	%	% on nation	Var %	Y/PE (%)	Units	%	% on nation	Var %	E/PE*
NER										
Agric.	27.7	7.2	21.5	21.3	14.6	153,720	55.7	22.1	21.3	809.9
Industry	153.3	39.7	14.2	21.6	19.0	66,916	24.2	16.4	21.1	82.8
Services	204.8	53.1	16.9	21.1	31.0	55,491	20.1	18.5	18.8	83.9
TOTAL	385.8	100.0	15.9	21.3	23.3	276,126	100.0	19.7	20.7	166.4
SER										
Agric	12.7	4.6	9.9	13.8	12.9	66,576	46.5	9.6	13.8	678.2
Industry	110.7	40.1	10.2	14.2	20.9	39,189	27.3	9.6	14.2	74.1
Services	152.9	55.3	12.6	15.5	36.6	37,556	26.2	12.6	14.0	89.9
TOTAL	276.3	100.0	11.4	14.9	26.4	143,321	100.0	10.2	14.0	137.2
SR										
Agric	42.8	9.7	33.3	35.0	29.8	220,106	63.8	31.6	35.0	1,534.2
Industry	220.4	50.0	20.4	24.8	34.9	78,571	22.8	19.2	23.3	124.3
Services	177.4	40.3	14.6	18.7	36.1	46,246	13.4	15.5	17.1	94.0
TOTAL	440.6	100.0	18.2	22.5	34.8	344,923	100.0	24.6	27.9	272.1
SWR										
Agric	14.1	5.3	11.0	16.2	14.0	79,200	52.1	11.4	16.2	786.8
Industry	134.2	50.8	12.4	19.5	28.9	43,262	28.5	10.6	19.4	93.3
Services	116.0	43.9	9.6	16.4	33.9	29,483	19.4	9.9	15.0	86.1
TOTAL	264.3	100.0	10.9	17.8	29.2	151,945	100.0	10.8	16.7	167.6
WR										
Agric	6.8	3.3	5.3	13.0	9.5	38,455	38.6	5.5	13.0	537.2
Industry	96.4	47.4	8.9	14.2	36.6	34,790	35.0	8.5	13.8	132.2
Services	100.0	49.2	8.2	13.5	30.7	26,289	26.4	8.8	11.9	80.7
TOTAL	203.2	100.0	8.4	13.8	30.8	99,533	100.0	7.1	12.9	150.6
NWR										
Agric	13.4	5.3	10.4	14.3	15.5	77,027	48.6	11.1	14.3	888.8
Industry	109.0	43.0	10.1	16.0	26.1	46,854	29.6	11.5	15.7	112.3
Services	131.1	51.7	10.8	14.1	31.9	34,590	21.8	11.6	12.9	84.3
TOTAL	253.5	100.0	10.5	14.9	27.7	158,471	100.0	11.3	14.4	173.3
CR										
Agric	9.9	3.4	7.7	15.4	14.3	55,529	36.4	8.0	15.4	802.5
Industry	157.0	53.9	14.5	18.0	36.0	63,786	41.9	15.6	17.5	146.5
Services	124.7	42.8	10.3	13.0	38.4	33,098	21.7	11.1	12.0	101.8
TOTAL	291.5	100.0	12.0	15.4	35.1	152,413	100.0	10.9	15.2	183.7
BR										
Agric	1.2	0.4	0.9	10.7	37.4	5,847	7.5	0.8	10.7	1,757.8
Industry	101.7	32.9	9.4	12.7	58.5	35,249	45.4	8.6	12.2	202.9
Services	206.5	66.7	17.0	9.7	92.9	36,484	47.0	12.2	9.0	164.0
TOTAL	309.5	100.0	12.8	10.5	77.5	77,579	100.0	5.5	10.4	194.2
Romania										
Agric	128.6	5.3	100.0	19.7	16.9	696,459	49.6	100.0	19.5	912.9
Industry	1,082.7	44.7	100.0	17.8	29.1	408,617	29.1	100.0	17.3	109.8
Services	1,213.4	50.0	100.0	14.5	38.0	299,236	21.3	100.0	13.6	93.6
TOTAL	2,424.8	100.0	100.0	16.0	31.6	1,404,312	100.0	100.0	17.3	182.8

*The ratio employment-public expenditure is expressed for each one € million.

Source: Author's elaboration

Table 8. Sector variability calculated by region, Romania.

Region	Labour Income			Employment		
	VC (1)	VC (2)	Diff.	VC (1)	VC (2)	Diff.
NER	95.9	90.9	-5.0	191.3	191.3	0.0
SER	95.0	92.1	-2.9	167.1	166.0	-1.1
SR	98.3	93.5	-4.8	180.9	189.3	8.4
SWR	75.9	73.0	-2.9	186.0	184.7	-1.3
WR	86.1	83.0	-3.1	141.5	140.3	-1.2
NWR	94.2	91.7	-2.5	174.1	173.6	-0.5
CR	114.9	114	-0.9	148.9	148.8	-0.1
BR	74.3	70.5	-3.8	95.3	93.2	-2.1
Romania (VCs)	86.5	83.3	-3.2	157.9	159.6	1.7
Romania (VCr)	24.4	22.4	-2.0	20.4	24.3	3.9
Romania (VCsr)	92.8	89.3	-3.5	168.8	173.1	4.3

VC = Variation Coefficient calculated as a percent ratio between standard deviation and average on all sectors. VC (1) and VC (2) are calculated before and after policy application, respectively
VCs = VC calculated on all sectors aggregated over all regions
VCr = VC calculated on all regions
VCsr = VC calculated on all sectors of all regions
Source: Author's elaboration

4 Concluding remarks

This paper has estimated employment and labour income impact in Romania deriving from application of development policies (rural development policy, structural funds and cohesion funds) defined in the proposed EU accession financial package for the period 2007-09. Impacts have been estimated by the use of a multiregional I-O model. Results show that policy will lead to large positive effects. Income and employment variations will be 2,425 million euro (2000 prices) and about 1.4 million of labour units, respectively. Moreover, variation of income per capita will be 108 €. In comparison to 2000 data, increases will be by 16%, as for income, and by 17%, as for employment.

Sectors which will mostly benefit from impacts are services and industry, in terms of income, and agriculture, with reference to employment. This last result can be partly explained by the fact that Romania is still a developing country in which agriculture, although is losing its importance, still plays a significant role in the economy especially in terms of employment, as the high agricultural employment multipliers demonstrate.

In terms of effectiveness, policy produces an increase in income by 32% of public expenditure and in employment by 183 labour units for each one million euro. Moreover, policy would seem to be able to reduce disparities existing among regions and sectors, leading towards more uniform development, but only in terms of income since, at an employment level, differences would seem to increase.

At a sub-national level, consistently with the declared policy objectives of sustaining the less developed areas, the South and the North-East regions are those on which impacts tend to concentrate and those which grow to a bigger extent. Analysing ratio impacts-public expenditure, the best policy results are produced in the Bucharest region, in terms of income, and in the South region, in terms of employment. In line with results at an aggregate level, income disparities among sectors tend to decrease in all the regions. On the contrary, at an employment level, different from what can be noticed at a national level, there is general trend towards a reduction of differences.

From a methodological point of view, two points deserve to be discussed. Firstly, in this research, a three-stage estimation method for deriving multiregional I-O tables has been developed and applied. This method is relatively straightforward and guarantees internal consistency. It can be included in the category of hybrid methods of building multiregional I-O tables, since it is based on non-survey techniques to produce a preliminary estimate of intraregional and interregional I-O coefficients and, in addition, allows the analyst to insert all available exogenous information finalised to improve the reliability of the multiregional I-O table. Secondly, it is clear that impact results are strongly affected by hypotheses on regional and sectoral distribution of funds. A different distribution would lead to different results. But this cannot be considered only as a limitation. In fact, if the distribution here supposed is considered one of the possible policy combinations, the methodology developed, once some restrictive assumptions are accepted, can be then used as an instrument for policy makers to carry out experiments and to identify the most preferable policy combination.

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