South-East Region in Bulgaria: Economic Performance and Key Sectors Analysis

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Abstract. The present paper attempts to provide insight into the economic performance of the South-east region (SER) of Bulgaria by presenting quantitative relationships between sectors in the regional economy. Methodologically it is based on the construction of the regional Input–Output model. It was carried out trough applying the non-servey GRIT technique, based on Flegg & Webber location quotient (2000). The dirived Rasmussen & Hirschman backward linkages and Mattas & Shrestha input-output elasticities from the model enable to identify the key economic sectors within the region. This could be considered as a starting point for the future impact assesment of different EU policies, as well as designing of better regional development strategies, assuring better economic performance.

Keywords: Input-Output, GRIT, backward linkages, input-output elasticities, SER

1. Introduction

The accession to the EU is a milestone for Bulgaria. According to the experiences from the previous enlargements, the accession of the country to the EU is going to change the economic environment to a significant extent. Apart from this, Bulgaria records significant regional differences in economic development. Moreover, there is a lack of empirical tools to investigate and model economic performance of Bulgarian regions. The aim of this paper is to present the methodological approach for derivation of regional I-O table for the South-east region of Bulgaria (NUTS II), previously selected following a set of criteria. RIOT provides a detailed snapshot of the I-O linkages that exist within the region. This can be used for predicting the consequences of any planned and potential changes in the demand for the region's outputs as a result of investments and changes in consumption of households and Government.

2. South-East Region of Bulgaria

The region occupies 13.2% of Bulgarian territory and provides residence for 10.0 % of its population (table 1).

Table 1: South-east region: main-socio-economic characteristics (year 2006)

	Bulgaria	SER	Share of SER (%)
Area (km2)	111,001	14,648	13.2
Population (1000)	7,679	771.5	10.0
GDP (Million PPP)	61,075	5,320	8.7
GDP per capita (% EU average)	35.3	30.7	86.8
Unemployment rate (%)	9.0	9.7	

Source: NSI (2006)

As a general observation, in terms of economic development the South-east region of Bulgaria is advancing over the last decade. And despite the fact that it contributes only 8.7% to the national GDP, in year 2006 the GDP per capita is around 13% lower than the national one,

which rank the region as a second developed NUTS II region (after the South-west region, where the capital Sofia is situated) in the country. The biggest shares for this contribute the services sectors and mainly those connected to tourism activities. The registered annual unemployment rate is gradually reducing and reaches the lowest level of unemployment for the country and the region since year 1991. Most of the people of the region are engaged with tourism and other services activities, agriculture, food manufacturing and construction. Despite the regional relatively successful economic performance, there are still present inter-regional disparities between the three administrative units among SER. On the other hand, the rapidly growing services sectors can not meet the proper infrastructure and needed qualified working force. A problem that is also rising is the environmental balance due to the "hashed" development of industries and over-populated area where the tourist resorts are located.

3. Input-Output Model for South-East Region in Bulgaria

3.1. Data used

All the necessary data for the regionalization procedure were collected from the National Statistical Institute of Bulgaria (NSI): the latest available symmetric I-O table for year 2003; employment at national and regional level. The 59 sectors of economic activity of the national I-O table were aggregated to 21 sectors. For estimating the regional I.O table, and especially in the interpretation of results, all the "classical" drawbacks of the I-O approach (static, linear production function, no substitution or scale economy effects, infinite elasticity of supply) were taken into consideration.

3.2. Regionalisation procedure

For the derivation of the regional Input-Output table for SER in Bulgaria the variable interference non-survey GRIT (Generation of Regional Input-Output Tables) technique developed by R.C. Jensen and others in the Department of Economics at the University of Queensland in Australia (Jensen *et.al.*, 1979) was selected. In summary, GRIT technique is a formalized non-survey method compilation with facility for the user to insert survey data at any stage of the compilation procedure. As any other non-survey technique, GRIT is based primarily on a mechanical procedure (mainly on Flegg & Webber location quotient-FLQ) for the regionalisation of the national direct requirements matrix (DRM), which is at the core of any I-O table. At the same time the analyst can determine the extent to which he/she should interfere by the insertion of superior data from survey or other secondary sources either at the elements of the regional direct requirement matrix or at the elements of other final payments and demand. The regionalisation procedure followed four steps:

- Adjustment to a national I-O table
- Computation of the regional direct requirement matrix
- Aggregation of regional sectors
- Computation of the complete regional Input-Output table

3.2.1. Adjustment to a national I-O table

As a start for the regionalisation the national transactions flow matrix was converted to the direct requirements matrix as follows:

$$\underset{(nxn)}{A_N} = \underset{(nxn)}{Z_N} \cdot \underset{(nxn)}{\hat{X}_N^{-1}} \qquad (1)$$

where A_N is the national direct requirements matrix, Z_N is the national transactions flow matrix and, $\hat{X}_N$ is the diagonal matrix of the national total sectoral output.

Based on the debate in the literature that transactions which appear as intrasectoral transactions at national level in majority of cases become imports when one turns to the regional economy

(Morrison & Smith, 1974; Jensen, 1978; Jensen *et al.*, 1979; Johns & Leat, 1987), it was agreed before the computation of the national direct requirements matrix, the intrasectoral flows in the main diagonal of the national transactions matrix to be deleted as proposed by Morrison & Smith (1974). This is necessary as the intrasectoral flows include interregional trade. So by maintaining these flows within the table, when deriving the regional table, the regional intermediate purchases would be overestimated.

3.2.2. Computation of the regional direct requirement matrix

As many other non-survey methods of Input-Output regionalisation, GRIT technique is based on the application of location quotient coefficients to separate the national technical coefficients into regional coefficients. Although location quotients can theoretically be based on a number of economic activity indicators (Richardson, 1972), output, employment, purchases and expenditures, the greater availability of employment data had resulted the frequently use of employment based location quotients. Due to the available employment data on regional level for the present study at the same classification scheme as in the national I-O table, employment was also chosen for the computation of the location quotient. To estimate the regional technical coefficients, the Flegg & Webber (2000) location quotient, based on CILQ –as modified from the original of Flegg *et al*. (1995)- denoted by FLQ was used. The parameter δ, without which FLQ cannot be applied, was estimated on the basis of the relative importance of the economic activity in the region. Practically, since the parameter is fixed at a value that makes final demand positive, the weighting parameter was empirically found to be 0.08.

After the calculation of FLQ_{ij} it was evident that only three quotionts were grater than one $\left(FLQ_{ij} > 1\right)$, which meant that regional sector's i supply is sufficient to meet the purchasing sector's j demand and the national coefficient is accepted as the regional coefficient. All other FLQ_{ij} were greater than zero and less than one, and it is assumed that regional production is insufficient to meet local demand and imports are required to make up the deficiency. In this case the respective technical coefficient of the national direct requirements matrix would over-estimate the regional inter-industry transactions and had to be reduced. This is done by multiplying the national technical coefficient by the relevant FLQ_{ij}. The residual is added to the relevant national import coefficient to yield and enhanced regional import coefficient. Than the values in the FLQ matrix that were greater than one, were replaced with one. Before the comuptation of the regional direct requirements matrix A_R the non-existing sectors in the region (the sectors with zero employment) were eliminated. Further, the respective rows of the national direct requirements matrix are added to the national imports coefficients row, while the columns to the national export coefficients column (Mattas *et al.*, 1984).

3.2.3. Aggregation of regional sectors

Until this stage it has been assumed that the economic structure is the same in the region and in the country. However, although this may be true for large regions it is unlikely to happen in small regions, as SER is. Therefore the dimensions of the RIOT have to be adjusted such that to reflect adequately the economic conditions in the region. To that end small and un-important sectors with low economic activity (low employment) were aggregated with sectors having a similar technological conditions. However, before that it is necessary to modify the regional direct requirements matrix as well as the regional import coefficient vector.

The original technical coefficients were adjusted by the vector of employment weights w, by which approximation towards the regional structure of economic activities is made. The vector of regional employment weights takes the value of 1 $\left(w_i = 1\right)$ for the sectors that are not aggregated in the regional classification scheme, while for the sectors that are to be aggregated takes the value of their employment shares. If this had not been done, the structure of

intermediate consumption in the region would be the same as the national one. The weights were additionally adjusted with regard to the structure of the economic activities from the original national I-O table, which inevitably implies assumption that there are no differences in sector productivity between the regional and national economy.

3.2.4. Computation of the complete regional Input-Output table

As Jensen *et al.* (1979) point out, the aim of this phase is the conversion of coefficient tables into prototype transactions table for the chosen region. In order to derive the complete regional Input-Output table first of all the regional direct requirements matrix and the imports coefficients vector are needed to be transformed into monetary flows. For doing so is necessary to have the vector of regional sectoral output. This can be approximated by using the employment ratios as well as an employment based Simple Location Quotient (SLQ). Here is followed the principle of FLQ, namely if the computed SLQ for any given sector is higher than one, then could be assumed that the sector is well represented in the region and thus the sectoral employment ratios to approximate regional sectoral output could be used. Otherwise if the computed SLQ is less than one for any given sector, then the economic activity of that sector in the region is very low and thus its sectoral output should be adjusted for that. Once the regional sectoral output has been computed we proceeded to the estimation of the regional transactions matrix and imports vector. The next step was estimating the final demand as a residual between total sectoral regional output and total sectoral intermediate sales. Since the value of FLQ's parameter was choosen empirically, the obtained final demand was positive. Regional household consumption and exports are estimated like output while other final demands are calculated as a residual by subtracting the sum of exports and consumption from regional final demand. The primary imputs are compled of three components: household income, imports and other final payments. Other final payments are computed as a residual subtracting the sum of intermediate purchases, imports and household income from total output.

3.3. Results: main macroeconomic aggregates

One of the characteristics and at the same time advantage of the IOT being a snapshot of the economy enables us to get a better insight to the structure of the regional economy. In table 2 are outlined some of the macroeconomic variables for the SER of Bulgaria that are readily computable from the RIOT. It could be concluded that the South-east region in Bulgaria is a region with domination of the service sectors, which is to be expected from its favorable geographical position. As it is visible from GVA structure, the share of agricultural sector in the region (15.6%) is higher than the national average (12.3%) mainly on count of the share of industry sector. In addition, the regional share in GVA of the services sector is slightly above the national average.

Table 2: South-east Region in Bulgaria: Comparative Overview of Some Key Macroeconomic Aggregates

		Bulgaria	**SER**
GVA	million EUR	14,840	1,252
Gross Output	million EUR	43,602	2,924
Structure of GVA			
Agriculture	%	12.3	15.6
Industry, incl. mining & construction	%	31.5	27.0
Services	%	56.2	57.4
Structure of Gross Output			
Agriculture	%	8.9	13.7
Industry, incl. mining & construction	%	51.2	41.0
Services	%	39.9	55.3
Source: NSI, own calculations			

4. Regional linkages (multipliers)

The main virtue of the I-O model is its ability to provide multipliers presenting the linkages between the sectors within the regional economy. These linkages indicates the strenght of the relationship between sectors. However, these results have to be taken with certain caution due to restrictive assumptions underlying to the I-O technique. Rasmussen (1956) and Hirschman (1958) backward linkages and Mattas & Shrestha input-output elasticities for total output, income and employment for each sector, present in the regional economic structure (21 sectors) were calculated. By applying the corresponding ranks to derived multipliers we can see the differences in the relative importance of a sectors within the regional economy. Looking at the Rasmussen and Hirschman output backward linkage coefficients (OBL) the sector with the highest potential to generate output impacts (both direct and indirect) in the South-east region of Bulgaria is "Maintenance and car repair services; fuel retail" (1.444). This value means that an increase by one unit in the final demand for the products of "Maintenance and car repair services; fuel retail" (i.e., exports, private consumption, public investments) will cause an increase in the total regional production by 1.444 units due to the indirect effects generated by that particular sector. The second highest output backward linkage coefficient is for "Construction" (1.383), followed by "Hotels & restaurants" (1.148). The lowest output backward linkage coefficients values are for "Real estate & renting services" (1.000), "Vehicles" (1.001) and, "Financial intermediation" (1.002).

Concerning the income backward linkage coefficients (IBL), these reveal that services and manufacturing sectors are having the greater impact in the regional economy of South-east Bulgaria. Specifically, "Public administration, education and health services" exhibits the highest income backward linkage coefficient (0.415) followed by "Mining and quarrying" (0.363), "Financial intermediation" (0.328). Contrary, the sectors with the lowest income backward linkages are "Real estate & renting services" (0.016), "Products of agriculture, hunting, fishing, forestry" (0.045), "Textile & leather products" (0.061). Regarding employment generation, the first place is taken from "Other services" (0.146), followed by "Products of agriculture, hunting, fishing, forestry" (0.106) and "Public administration, education and health services" (0.104). Again "Real estate & renting services" (0.003) is having the lowest potential to increase employment in the South-east region of Bulgaria. On contrary, "Real estate & renting services" (0.913) is the sector having the biggest potential for the increase of its value added and the value added of the regional economy.
Mattas & Shrestha input-output elasticities are being used for "final tuning" of the already derived backward linkages. The values and ranks are presented in table 3.

Table 3: I-O Multipliers & Elasticities for South-east Region of Bulgaria, 21 sectors

Sectors		Rasmussen & Hirschman Backward linkages				Mattas & Shrestha Input-output elasticities			
		OBL	IBL	EBL	VABL	OE	IE	EE	VAE
1	Products of agriculture, hunting, fishing, forestry	1.043 **(4)**	0.045 **(20)**	0.106 **(2)**	0.501 **(7)**	0.137 **(1)**	0.041 **(1)**	0.288 **(1)**	0.157 **(1)**
2	Mining and quarrying	1.003 **(18)**	0.363 **(2)**	0.044 **(11)**	0.709 **(2)**	0.007 **(20)**	0.017 **(10)**	0.016 **(20)**	0.009 **(20)**
3	Foods, beverages. and tobacco	1.020 **(7)**	0.130 **(14)**	0.037 **(13)**	0.268 **(19)**	0.057 **(9)**	0.017 **(9)**	0.119 **(9)**	0.065 **(9)**
4	Textile & leather products	1.016 **(8)**	0.061 **(19)**	0.041 **(12)**	0.442 **(9)**	0.050 **(10)**	0.015 **(11)**	0.105 **(10)**	0.057 **(10)**
5	Other manufacturing	1.010 **(11)**	0.088 **(18)**	0.018 **(20)**	0.134 **(21)**	0.123 **(2)**	0.037 **(2)**	0.258 **(2)**	0.140 **(2)**
6	Metal Products	1.005 **(15)**	0.176 **(9)**	0.054 **(10)**	0.211 **(20)**	0.008 **(19)**	0.002 **(20)**	0.016 **(19)**	0.009 **(19)**
7	Machinery and equipment	1.009 **(12)**	0.092 **(17)**	0.036 **(14)**	0.330 **(18)**	0.021 **(14)**	0.006 **(15)**	0.045 **(14)**	0.024 **(14)**
8	Vehicles	1.001 **(20)**	0.149 **(13)**	0.028 **(17)**	0.353 **(16)**	0.008 **(18)**	0.003 **(19)**	0.018 **(18)**	0.010 **(18)**
9	Furniture & secondary raw materials	1.004 **(16)**	0.102 **(16)**	0.062 **(8)**	0.358 **(15)**	0.006 **(21)**	0.002 **(21)**	0.012 **(21)**	0.006 **(21)**
10	Electrical energy, gas, water	1.006 **(14)**	0.153 **(11)**	0.018 **(19)**	0.423 **(11)**	0.045 **(12)**	0.013 **(13)**	0.094 **(12)**	0.051 **(12)**
11	Construction	1.383 **(2)**	0.202 **(4)**	0.055 **(9)**	0.446 **(8)**	0.088 **(4)**	0.027 **(4)**	0.185 **(4)**	0.101 **(4)**
12	Maintenance and car repair services; fuel retail	1.444 **(1)**	0.189 **(6)**	0.069 **(7)**	0.598 **(5)**	0.045 **(11)**	0.013 **(12)**	0.094 **(11)**	0.051 **(11)**
13	Wholesale & retail trade; Repair of apparatus	1.023 **(6)**	0.150 **(12)**	0.090 **(6)**	0.421 **(12)**	0.065 **(8)**	0.020 **(8)**	0.136 **(8)**	0.074 **(8)**

Sectors		Rasmussen & Hirschman Backward linkages				Mattas & Shrestha Input-output elasticities			
		OBL	IBL	EBL	VABL	OE	IE	EE	VAE
14	Hotels & restaurants	1.148 **(3)**	0.178 **(8)**	0.095 **(5)**	0.604 **(4)**	0.033 **(13)**	0.010 **(14)**	0.069 **(13)**	0.037 **(13)**
15	Transport services	1.036 **(5)**	0.165 **(10)**	0.034 **(15)**	0.397 **(13)**	0.075 **(5)**	0.023 **(5)**	0.158 **(5)**	0.086 **(5)**
16	Travel agencies; post & telecommunication	1.008 **(13)**	0.114 **(15)**	0.019 **(18)**	0.510 **(6)**	0.094 **(3)**	0.028 **(3)**	0.197 **(3)**	0.107 **(3)**
17	Financial intermediation	1.002 **(19)**	0.328 **(3)**	0.033 **(16)**	0.387 **(14)**	0.015 **(15)**	0.004 **(16)**	0.031 **(15)**	0.017 **(15)**
18	Real estate & renting services	1.000 **(21)**	0.016 **(21)**	0.003 **(21)**	0.913 **(1)**	0.070 **(6)**	0.021 **(6)**	0.146 **(6)**	0.079 **(6)**
19	RD & other business services	1.003 **(17)**	0.200 **(5)**	0.095 **(4)**	0.426 **(10)**	0.010 **(17)**	0.003 **(18)**	0.022 **(17)**	0.012 **(17)**
20	Public administration, education and health services	1.015 **(9)**	0.415 **(1)**	0.104 **(3)**	0.627 **(3)**	0.068 **(7)**	0.020 **(7)**	0.141 **(7)**	0.077 **(7)**
21	Other services	1.013 **(10)**	0.179 **(7)**	0.146 **(1)**	0.332 **(17)**	0.012 **(16)**	0.004 **(17)**	0.025 **(16)**	0.014 **(16)**

where: OBL - output backward linkages; IBL - income backward linkages; EBL - employment backward linkages; VABL –value added backward linkages; etc.

Source: own calculations

Conclusions

There were two initial sub-objectives for carrying out the presented research. The first one was to regionalise the national I-O table by the use of GRIT technique (Jensen *et al*., 1979) for the South-east region of Bulgaria. A step forward this stage is the use of superior data. The second objective was to identify the key economic sectors within the region by deriving the output, employment, income and value added multipliers from the regional I-O model. What was achived in this paper is being used ad a policy analysis tool simulating exogenous shocks to the regional economy. These shocks from one side, would apply primarily on various policies affecting economic development of the South-east region in Bulgaria, such as Structural Funds expenditure, Cohesion policy or Common agricultural policy. From the other side, better design regional strategies aiming to the sectors with higher potentail to generate impact would speed the rate of economic development by stimulating the investment flow.

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