MEASURING THE IMPACTS OF FINANCIAL SUPPORTS BASED ON INPUT-OUTPUT ANALYSIS

Michaela Antoušková

Czech University of Life Sciences, Prague

Abstract: *The article deals with an evaluation of financial supports. It focuses on the Action Plan of the Regional Development Program (AP PRK) in Southern Bohemia and specializes on tourism development. Within the 3 grant programmes supporting tourism, it analyses distribution of financial means to the regions. The disparities among the regions are measured by Gini coefficient. Moreover, using an input-output analysis, the direct and indirect impact of financial support on regional production is considered.*

Keywords: *Input-output Analysis, Tourism, Financial Supports, Regional Development*

1. Introduction

Multiplier effects are commonly measured as impacts arising from the effects of tourist expenditures on production, income or employment. To evaluate these tangible impacts, several methods may be used. In the past Base Theory models or Keynesian multiplier models were used. [see 3] From Keynes' multiplier several ad hoc models evolved. Finally these models were extended and an input-output model derived. Daniel Stynes used these models for evaluating tourism impacts in the U.S.A. [9, 10] Based on multiplier effects he developed his General Money Model. Other authors applied Social Accounting Matrix or General Equilibrium Model to measure tourism impacts. [see 1, 11, 13] Whilst some authors considered the input-output model as obsolete. [see 2] However other authors think that the input-output models are still appropriate, especially for local economies. [see 4]

The multiplier is defined as a system of economic transactions that follow a disturbance in an economy. The multiplier effect has three components: direct, indirect and induced effects.

- A direct effect is the change in purchases due to a change in an economic activity
- An indirect effect is the change in the purchases of suppliers to those economic activities directly experiencing change
- An induced effect is the change in consumer spending that is generated by changes in labour income within the region as a result of the direct effects of the economic activity.

2. Input – output analysis

Input-output economics was founded and popularized by Wassily Leontief, Nobel Laureate In Economic Sciences 1973. He introduced a model based on the equilibrium of sources (supply) and consumption (demand). Leontief defined the matrix of

complex coefficients. He declared that the changes in final demand for production of individual products may be quantified by the matrix of complex coefficients.

After Leontief constructed the first input-output table for the U.S.A. in the early twentieth century, governments of major industrialized countries began to adopt their own input-output tables, among them Japan and several European countries. Due to its comprehensive yet easy to understand description of complex economic systems, input-output analysis has become one of the primary statistical tools for most economically advanced countries. Generally, input-output analysis divides the economic system into a number of sectors, and considers the flows of commodities and services in and out of each sector. Each sector needs other products from supplier sectors to produce its own outputs. The principle of structural analysis is the study of the system of n sectors in which the interchange of the products is realized. [5]

The basic instrument for structural analysis is the input-output model. This model quantifies the interchanges of products and describes connections in the economy. The quantified links between the input and the outputs of individual sectors are characterized in the model. These links may be divided into four sectors: The first sector is the core of the input-output model. It is a square matrix of consumption of inputs, in which the rows and columns are structured similarly. The rows and columns are structured as product x product, or sector x sector. The columns represent the structure of the inputs. It characterizes the amount of products (inputs) used for the production of specific products (output). In short, the change in demand for outputs leads to the change in demand for inputs. [6] The second quadrant of the input-output model characterizes the links between supply production sectors and autonomous sectors producing final products. The third quadrant shows the value added. The value added includes labour costs, consumption of fixed capital, taxes and profits. The fourth quadrant defines direct links between the primary actors and final consumption. [8]

Pricing using indexed prices is recommended. This approach is more homogenous and the links between inputs and outputs expressed by currency better identify the technological relations. ESA[1] 95 recommends to arrange the input-output models in the structure of product x product because this structure enables a more homogenous description of the production process. However there are some arguments advocating input-output tables using the sector x sector structure as it can be prepared under weaker presumptions. [12]

The symmetric input-output tables are specified as follows: the matrix of input in the size of n x n, zij represents the supply from the sector i to the sector j. y represents the vector of final consumption in the size of n x 1 (private consumption, investments, net export); v represents a vector of value added in the size of 1 x n (payments for labour and capital, net indirect taxes and profits). The sum of i-th column equals to the sum of i-th row and it equals to final production xi. [8]

[1] European System of Accounts

Table 1: The model of symmetric input-output tables

Sector	1	…	j	….	N	Final consumption	Total
1	z_{11}	…….	Z_{1j}	…….	Z_{1n}	y_1	x_1
……	…….	…….		…….	…….	…….	
I	z_{i1}	…….	Z_{ij}	…….	…….	Y_i	x_i
…….	…….	…….		…….	…….	…….	
N	z_{n1}	…….	Z_{nj}	…….	Z_{nn}	y_n	x_n
Value added	v_1	…….	V_j	…….	V_n	…….	
Total	x_1	…….	X_j	…….	X_n	…….	

Source: Rojíček, 2007

The matrix of coefficient of inputs is calculated by normalization of symmetric input-output tables according to the row - aij=zij/xi. The matrix of distributive coefficients is calculated according to the columns - bij=zij/xi.

In the matrix expression:

$$A = Zx^{-1} \qquad (1)$$

$$B = x^{-1}Z, \qquad (2)$$

Where x represents the diagonal matrix with xi elements on the diagonal and other elements that equals zero. Z represents the supply matrix, A is the matrix of direct coefficients (coefficients of inputs), B is the matrix of distributive coefficients.

The direct coefficients identify the value of individual products spent in the production of a single unit of product (the supplier view). Distributive coefficients identify the ratio given from single units to the sectors. Besides direct consumption, indirect consumption is visible. The sum of direct and indirect consumption represents complex consumption as described by the following equation:

$$Ax + y = x \qquad (3)$$

$$X – Ax = y \qquad (4)$$

$$(I – A)x = y \qquad (5)$$

The solution to the above determined system of linear equations is

$$X = (I – A)\text{-}1y, \qquad (6)$$

Where L = (I – A) -1 is the matrix of coefficients of complex consumption. The coefficients are also presented as multipliers of production.

The multipliers include both the direct influence of final demand on the production of single products and the indirect influence arising from the production process. The indirect effect is caused by the fact that the output of a single sector is concurrently the input for other sectors of the national economy.

These multipliers include both the direct influence of final demand for production of tangible products and the indirect effects arising from the multiplication of the manufacturing process. An output from one industry is an input for another industry and vice versa – this causes the multiplier effect. The sum of all multipliers for

individual industries represents the multiplier for the sector, so called measuring backward linkages. The backward linkages are demand orientated.

Besides backward linkages there are forward linkages (front). These linkages are supply-orientated and measure the power of individual sectors in relation to their consumers. The higher the value of the multiplier, the greater the impact i.e. the increase in prices on the price level in the economy. The interpretation of forward linkages is not as explicit as interpreting backward linkages.

The multipliers of backward linkages can be interpreted as follows: if the final demand increases by 1 unit, the total production in all sectors will increase by the value of the multiplier.

Leontief's model and hence the input-output analysis, is based on the following presumptions:

- Supply conforms totally to demand, manufacturing capacities are not limited
- The products are produced within a fixed structure, including the structure of VAT
- There are no economies of scale to production in an industry (the proportion of inputs used in industry's production processes do not change regardless of the level of production.
- The technology does not change over time
- Production processes are spatially invariant and are all represented by the nation's average technology (especially for regional models)

The assumptions the model makes are relatively large, and so misrepresent the real changes in final demand. Technical coefficients cannot be considered as constant in the long run, they adapt to prices of inputs and respect new technologies in time. Because of this, it is recommend limiting the use of this model to modelling short-term impacts. That said, the changes in final production need some time to show up, so the changes cannot be expected to be visible in a really short time frame. Both factors are running contrary to each other, this has to be taken into consideration whilst modelling impacts.

Furthermore the assumption that supply conforms to demand does not follow in all economic cycles. It is stronger during a recession because there is spare manufacturing capacity. The quantification of impacts determines the optimal impacts. Customizing processes tends to eliminate these impacts.

3. Methodology

Tourism development can be supported within the 3 grant programmes of the Action Plan of the Regional Development Program (AP PRK), South Bohemia Region. However the distribution of financial means is not equal to all regions, it depends on the number of supported projects and of course on the cost of each project. This article looks in detail at the distribution of financial means to the regions within the South Bohemia Region. According to the number of realized projects and financial allocation it identifies more and less successful regions. The monitored period was 2006-2008. Disparities among regions are measured by the Gini coefficient. The Gini coefficient

measures the differences between the areas under an ideal Lorenz curve and those under a real Lorenz curve. It may be expressed as follows:

$$G = \frac{A - B}{A} \quad , \qquad (7)$$

Where G is the Gini coefficient, A represents the area under an ideal Lorenz curve, B represents are under a real Lorenz curve. The coefficient runs between 0 and 1 (0 means absolute equality and 1 represents absolute inequality).

The value of the multiplier of financial support was derived from the input-output analysis and the structure of supplies for individual projects. In order to find out the appropriate information about realized projects, successful applicants were interviewed. Applicants were asked about supplier data, specifically about the registered place of business and the sphere of business. 51 interviews were compiled.

The value of the multiplier of financial support was based on the multipliers derived from the input-output analysis and the ratio of individual sector on the realized projects. As the Southern Bohemia region is an open economy, economic leakage was taken into consideration. The impacts of financial support were estimated and evaluated allowing for different economic leakage scenarios.

4. Evaluating financial supports

151 subjects applied for support from 3 grant programmes within the Action Plan of the Regional Development Program supporting tourism development in 2008. The programmes were:

- Grant programme Products and Services in Tourism
- Grant programme Support of Incoming Agencies and Tourist Centres
- Grant programme Development of Infrastructure Supporting Sustainable Tourism

4.1 Distribution of financial support

4.1.1 Grant programme Products and Services in Tourism

The grant programme Products and Services in Tourism supported 40 projects totalling 4 100 000 CZK in 2008. The financial allocation exceeded the original allocation over 100 000 CZK. The financial support ran from 50 000 – 250 000 CZK for each project (the average financial support for each project was 102 500 CZK). The highest amount of supported projects was attained in the České Budějovice region (13 projects with a total of 1 400 000 CZK of funding). This financial support corresponded to double of financial support given to the Tábor region (here only 4 projects were realized). The region with the lowest level of financial support was the Prachatice region. Projects that represented the whole South Bohemian region gained a mere 5.4% of financial support.

The disparities among regions within the grant programme Products and Services in Tourism verified the Gini coefficient with the following values from the monitored period: 0.3555 (2006); 0.306 (2007), 0.3355 (2008)

4.1.2 Grant programme Support of Incoming Agencies and Tourist Centres

The grant programme Support of Incoming Agencies and Tourist Centres supported 20 projects with a total of 1 900 000 CZK of financial allocation in 2008. The financial support represented 40 000-170 000 CZK for individual projects. More than 20% of financial means supported projects were in the České Budějovice region – the highest support among the regions. The significant part of financial means went to the Jindřichův Hradec region. However there were no projects realized in the Český Krumlov region (there were no projects realized in 2007 also). Projects realized in other regions represented less than 10% of the total financial allocation within the programme (region Prachatice 2.1%; Písek 3%; Strakonice 5.4%)

The disparities among regions within the grant programme Support of Incoming Agencies and Tourist Centres in tourism verified the Gini coefficient with the following values from the monitored period: 0.3217 (2006); 0.4836 (2007); 0.4957 (2008).

4.1.3 Grant programme Development of Infrastructure Supporting Sustainable Tourism

With the grant programme Development of Infrastructure Supporting Sustainable Tourism there was an allocation of 5 100 000 CZK to 35 projects in 2008. The financial support ran from 50 000 CZK to 450 000 CZK for individual projects. With respect to the number of supported projects and amount of funding allocated the České Budějovice and Jindřichův Hradec regions were the largest benefactors. Projects realized in the České Budějovice region gained 32% of total financial allocation in 2008 (however in previous years the amount of financial support was lower, in 2007 only 7 %). On the other hand the lowest ratio on the total financial allocation in the monitored period originated from the Písek region. Here the ratio was only 10 %. However the most significant decrease in financial allocation during the monitored period is identified as the Tábor region (in 2008 only 5%).

The disparities among regions within the grant programme Development of Infrastructure Supporting Sustainable Tourism verified the Gini coefficient with the following values from the monitored period: 0.2724 (2006); 0.2424 (2007); 0.297 (2008).

Fig. 1 shows the allocation of funds within the South Bohemia region.

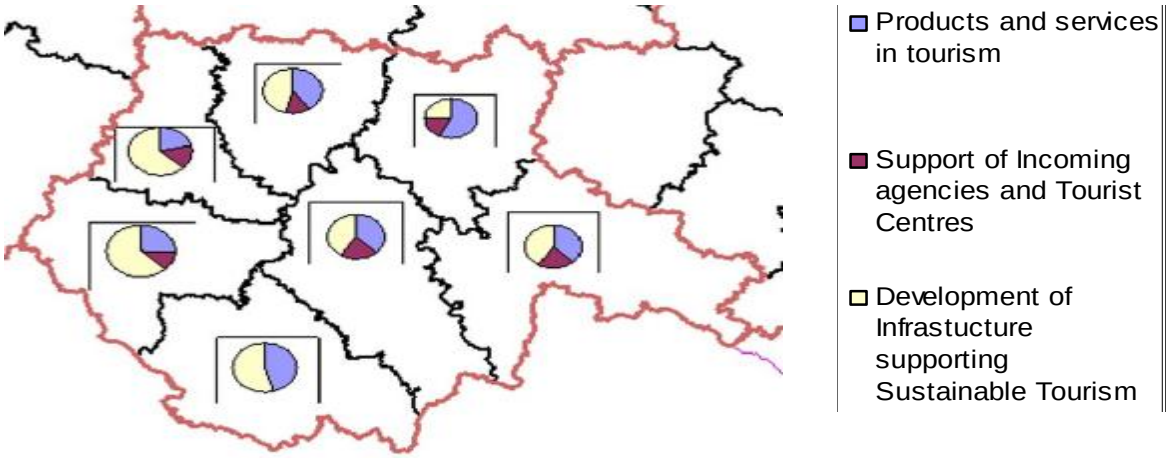

Fig. 1: Financial allocation among regions in 2008

Source:Author's calculation based on data supplied by South Bohemian Authority

4.2 Multiplier effects on regional production

4.2.1 Direct effects

The data from the primary research proves that funding from the Action Plan of the Regional Development Program went overwhelmingly to supporting the South Bohemia Region (almost 89%). Table. 2 shows the primary influence on the other regions. A smaller part of financial support went to Karlovy Vary region (2 %) and around 1 % to the region of Vysočina and Pardubice. Other parts of the Czech Republic were not influenced significantly (less than 1%).

Table 2: Primary effects of financial supports on Czech regions - %'s (2008)

Southern Bohemia	88.834
Hradec Králové region	0.894
Karlovy vary region	2.012
Prague	0.559
Plzeň region	0.559
Souhern Moravia	0.366
Pardubice region	0.895
Vysočina region	1.321
Olomouc region	1.524

Source: Author's calculations based on primary research

The reasons for choosing suppliers from regions other than South Bohemia may be divided into three main categories:

- Economic factors – suppliers from other regions were able and willing to offer lower prices for the same product or service
- Localization of suppliers of specific products – these products (e.g wellness equipment) are not manufactured in the region and therefore must be purchased from outside
- Personal preferences – personal relationships with a supplier, long-term cooperation, other advantages gained through partnerships.

To conclude the results, each 1 CZK from the Action Plan of the Regional Development Program, supported the production of the region by 88 %. From each 1 CZK of financial support 0,883 CZK remained within the region. According to the character of realized projects these influenced several sectors of the regional economy.

4.2.2 Indirect effects

The multiplier of financial supports was calculated from the structure of influenced sectors and the multiplier of individual products (see Table. 3). The multiplier of financial supports may be calculated as 2.32. This value represents the indirect effects of financial supports. Each 1 CZK of financial support influenced the regional production by 2.32 CZK.

Table 3: Calculation of multiplier

Product	**Multiplier values**	**Supplies/ratio**	**Multiplier calculation**
Other enterprise services	2.36	0.716	1.69
Electronics	3.49	0.083	0.29
Furniture	3.02	0.038	0.11
Building services	3.01	0.051	0.15
Data elaboration	2.37	0.032	0.08
Multiplier	**2.32**		

Source: Author's calculations

The multiplier shows that financial support of 50 000 CZK increased production by 116 000 CZK; financial supports of 120 000 increased production by 278 400 CZK and financial support of 200 000 increased production by 464 000 CZK.

4.2.3 Economic leakage

The quantification of indirect effects presumed that there was no economic leakage in these indirect effects. As they may be seen some leakage in the direct effects of financial supports there may be presumed some leakage in indirect effects too. If leakage was 10 % the financial support of 50 000 would increase production by

104 400 CZK. If leakage was 20 % the same projects would influence production by 92 800 CZK; in the case of 30 % leakage the increase would be only 81 200 CZK.

5. Conclusion

The Action Plan of the Regional Development Program (AP PRK) is an important tool for tourism development. Applicants may apply for support from 3 grant programmes. The highest amount of financial support in the monitored period was distributed within the grant program Development of Infrastructure Supporting Sustainable Tourism. However the financial support was not distributed equally, the number of supported projects and financial allocation differed according to the regions. The values of Gini coefficient showed that the highest disparities in allocating financial support among regions were within the grant program Support of Incoming Agencies and Tourist Centres. On the other hand, the lowest disparities were proven within the grant programme Development of Infrastructure supporting Sustainable Tourism.

The analysis of financial allocation with the Action Plan of the Regional Development Programs showed more and less successful regions. According to the chosen indicators (number of supported projects, share of financial allocation) the regions may be ranged as in Table 4.

Table 4: The success of individual regions in the grant programmes

Products and Services in Tourism	**Support of Incoming Agencies and Tourist Centres**	**Development of Infrastucture Supporting Sustainable Tourism**
PRACHATICE	*ČESKÝ KRUMLOV*	*PRACHATICE*
TÁBOR	*PÍSEK*	*PÍSEK*
PÍSEK	*PRACHATICE*	*TÁBOR*
STRAKONICE	*TÁBOR*	*ČESKÝ KRUMLOV*
JINDŘICHŮV HRADEC	*STRAKONICE*	*JINDŘICHŮV HRADEC*
ČESKÝ KRUMLOV	*ČESKÉ BUDĚJOVICE*	*STRAKONICE*
ČESKÉ BUDĚJOVICE	*JINDŘICHŮV HRADEC*	*ČESKÉ BUDĚJOVICE*

Source: Author's calculations

Taking into account the evaluation of the regions in all 3 grant programmes in the monitored period 2006-2008 the most successful region is České Budějovice, followed by Český Krumluv, Jindřichův Hradec, Písek, Prachatice, Strakonice, and the least successful region was Tábor.

The indirect effects of financial supports may come out as the increase of production in the region. Zero economic leakage defined that each 1 CZK of financial support increased the production in the region by 2.32 CZK. In the case that the multiplier effect was weaker the increase in production was lower too. The structure of

multipliers taking into consideration some economic leakage is demonstrated in Fig.. 2. In case of 90% multipliers effects (10% economic leakage) 1 CZK supported regional production by 2.06 CZK. In case of 20% economic leakage the regional production increased only by 1.85 CZK.

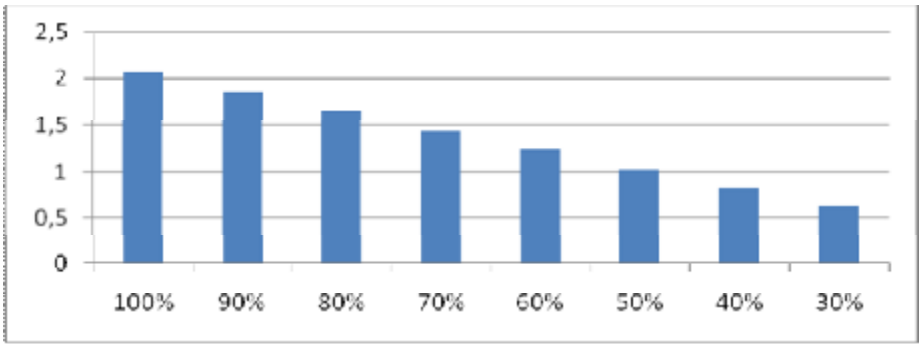

Fig. 2: Multiplier effects on production taking into consideration economic leakage

Source: Author's calculation

The input-output analysis is based on many large assumptions. Nevertheless all economic models are based on assumptions. This approach may bring into closer focus the impacts of financial supports. These impacts as well as the analysis of the distribution of financial means among regions may help in the decision making process governing regional development and the further distribution of financial support. Potential efficiencies gained from this methodology may not be limited to tourism strategy and development; rather it has the potential to extend beyond into other areas of economic and regional policy.

Acknowledgements

Research findings introduced in this paper originated from an institutional research intention MSM 6046070906 "Economics of resources of Czech agriculture and their efficient use in frame of multifunctional agri-food systems".

References:

[1] Adams, P., Parmenter, B.: The medium-term significance of international tourism for the Australian economy. Canberra: Bureau of Tourism Research. [online] [cit.6.8.2008]. Available on: <jtr.sagepub.com/cgi/reprint/33/2/58-b >

[2] Briassoulis, H.: Analysis of Land Use Change: Theoretical and Modeling Approaches. [online] [cit.8.12.2008]. Available on: <http://www.rri.wvu.edu/WebBook/Briassoulis/contents.htm >

[3] Cooper, C., Fletcher, J. et al.: Tourism, Principles and Practice. London: Prentice Hall, 2005. 851 s. ISBN 978-0273684060

[4] Dwyer, L., Forsyth, P., Spurr, R.: Evaluating tourism's economic effects: new and old approches. [online] [cit.25.11.2008]. Available on: < linkinghub.elsevier.com/retrieve/pii/S0261517703001316>

[5] Kučera, P., Švasta, J.: Strukturální Analýza I. Praha: ČZU, 2004. ISBN 80-213-1196-7

[6] Rojíček, M., Vavrla, L.: Využití input-output tabulek v ekonomické analýze. Pracovní sešity CES VŠEM. 2005, č.12. ISSN 1801-5956

[7] Rojíček, M.: Klíčová odvětví v české ekonomice z pohledu input-output analýzy. Pracovní sešity CES VŠEM. 2007, č. 2. ISSN: 0322-788x.

[8] Rojíček, M.: Strukturální analýza české ekonomiky. Pracovní sešity CES VŠEM. 2006, č. 1. ISSN 1801-2728

[9] Stynes, D. J: Estimanting Economic Impacts of Tourism Spending on Local Regions; A Comparison of Satellite and Survey/I-O Approaches. c1996 [online] [cit.8.12.2008]. Dostupné z < www.prr.msu.edu/miteim/censtatesTSA.pdf >

[10] Stynes, D. J.: Guidelines for measuring tourism spending. c1988 [online] [cit.8.12.2008]. Dostupné z < https://www.msu.edu/~stynes/>

[11] THORBECKE, E.: The social accounting matrix and Consistency – Type planning models. In Social accounting Matrices: A Basis for Planning [online] [cit.6.8.2008]. Dostupné z < mpra.ub.uni-muenchen.de/4454/ - 23k l >

[12] Vysušil, J.: Národní účty a meziodvětvové vztahy. Praha: Academia, 2002.128 s. ISBN 80-200-1010-6

[13] Wagner, J. E.: Estimating the Economic Impacts of Tourism. Annal of Tourism Research. 1997, vol 24, no. 3. s 592 – 608. [online] [cit.8.12.2008]. Dostupné z <http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V7Y-3SX24XY->

Contact address:

Ing. Michaela Antoušková, Ph.D.
Czech University of Life Sciences, Prague
Kamýcká 129, 165 21 Praha
Email: antouskova@pef.czu.cz
Phone: +420 224382338