THE RELATIONSHIPS BETWEEN BRANCHES AS A ECONOMICAL GROWTH STRATEGY

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Abstract

Economic growth is ensured not only by the efficiency of economic agents, enterprises, corporations, branches etc., but also by the level of professionalism of the economists in governmental structures.

One of the most important methodologies from a practical standpoint is the Balance of Branch Connections (BBC). This method is successfully used by developed countries.

For the purpose of demonstrating the methodology of economic growth we will examine a virtual economy with only two branches:

1. *Producing goods for unproductive consumption;*
2. *Producing means of production.*

Keywords: *methodology, economic growth, economic agent, branch production, virtual economy*

Classification JEL: **F60, F61. F62, F63**

1. Introduction

In the scientific interpretation of the economical realities, of high importance is the methodology as a science about the methods, proceedings, technicalities and instruments used in research, the research method being the combination of ways and methods of research in the modification of economic relations and their reproduction under the form of categories, laws and models.

Following up, we will study the model of the balance between the branches which apply under the economical projection of demand, production, work force and investments at the level of sectors, regions or at the level of the entire economy, the research of the technological changes and their effects over the productivity, study of the economical relations both interregional and international, the analysis of the influence that the modification of salaries has, profits and taxes over prices.

And because the goal is to expose only the methology of economic growth, we will examine a virtual economy based only on two branches:

1. The branch responsible with producing the goods for unproductive consumation
2. The branch responsible with means of production

In the majority of the activity domains the process of production represents a vector of structural coefficients. The interdependent relationships which are based between the branches of economy, appear as a system of liniar equations, a system which in its essence defines the balance between the total costs and the final production of every service or used product used in a certain interval of time.

Assuming that the product of a branch appears as a cost to another branch of the national economy, this input-output analysis is looking to create a stable economy for the future, by stabilising real proportions of the production volume of those branches.

2. Production workflows between branches

One of the most important methodologies from a practical standpoint is the Balance of Branch Connections (BBC). This method is successfully used by developed countries.

According to this methodology the branch production i, i=1,2, ... , n, can be written as the following equation:

$$X_i = x_{i1} + x_{i2} + \ldots + x_{ij} + \ldots + x_{in} + y_i \qquad or,$$

$$\begin{cases} X_1 = x_{11} + x_{12} + \ldots + x_{1j} + \ldots + x_{1n} + y_1 \\ X_2 = x_{21} + x_{22} + \ldots + x_{2j} + \ldots + x_{2n} + y_2 \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ X_i = x_{i1} + x_{i2} + \ldots + x_{ij} + \ldots + x_{in} + y_i \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ X_n = x_{n1} + x_{n2} + \ldots + x_{nj} + \ldots + x_{nn} + y_n \end{cases} \quad (1)$$

For a more detailed explanation of the BBC methodology the equation system (1) will be written as a table (Table 1).

Table 1. Production fluxes between branches

Branches	1	2	.....	j	.....	n	Y- final product	Global product
1	x_{11}	x_{12}	....	x_{1j}	....	x_{1n}	y_1	X_1
2	x_{21}	x_{22}	 I	x_{2j}	....	x_{2n}	y_2 II	X_2
....	....	....	....	....	....	....	....	....
i	x_{i1}	x_{i2}	....	x_{ij}	....	x_{in}	y_i	X_i
....	....	....	....	....	....	....	....	....
n	x_{n1}	x_{n2}	....	x_{nj}	....	x_{nn}	y_n	X_n
Labour Remuneration	v_1	v_2	 III	v_j	....	v_n	v IV	
Plus product	m_1	m_2	....	m_j	....	m_n	m	
Global production	X_1	X_2	....	X_j	....	X_n		X

We will separate Table 1 in 4 quadrants: I, II, III, IV.

- Quadrant I: inter-branch product fluxes, productive costs;
- Quadrant II : the final product in the branch profile;
- Quadrant III: labour remuneration, plus product in the branch profile;
- Quadrant IV: labour remuneration, plus product at a national economy level according to relation (1):

$$\sum_{j=1}^{n} x_{ij} + y_i \ ; \quad \sum_{i=1}^{n}\sum_{j=1}^{n} x_{ij} + \sum_{i=1}^{n} y_i = \sum_{i=1}^{n} x_i = x \qquad (2)$$

$$\sum_{i=1}^{n} x_{ij} + (v_j + m_j) = x_j \ ; \quad \sum_{j=1}^{n}\sum_{i=1}^{n} x_{ij} + \sum_{j=1}^{n} (v_j + m_j) = \sum_{j=1}^{n} x_j = x \qquad (3)$$

The right sides of relations (2) and (3) coincide, so:

$$\sum_{i=1}^{n}\sum_{j=1}^{n} x_{ij} + \sum_{i=1}^{n} y_i = \sum_{j=1}^{n}\sum_{i=1}^{n} x_{ij} + \sum_{j=1}^{n} (v_j + m_j) \qquad (4)$$

In relation (4)

$$\sum_{i=1}^{n}\sum_{j=1}^{n} x_{ij} = \sum_{j=1}^{n}\sum_{i=1}^{n} x_{ij} \ deci$$

$$\boxed{\sum_{i=1}^{n} y_i = \sum_{j=1}^{n} (v_j + m_j)}$$

The values of quadrant II and III are identically equal.

If $\frac{x_{ij}}{x_j} = a_{ij}$, $x_{ij} = a_{ij}x_j$, the equation system (1) can be written as:

$$\begin{cases} a_{11}x_1 + a_{12}x_2 + ... + a_{1j}x_j + ... + a_{1n}x_n + y_1 = X_1 \\ a_{21}x_1 + a_{22}x_2 + ... + a_{2j}x_j + ... + a_{2n}x_n + y_2 = X_2 \\ .... \\ a_{i1}x_1 + a_{i2}x_2 + ... + a_{ij}x_j + ... + a_{in}x_n + y_i = X_i \\ .... \\ a_{n1}x_1 + a_{n2}x_2 + ... + a_{nj}x_j + ... + a_{nn}x_n + y_n = X_n \end{cases} \quad (5)$$

The system of equations (5) can also be written as:

$$\begin{pmatrix} a_{11} & a_{12} & ... & a_{1j} & ... & a_{1n} \\ a_{21} & a_{22} & ... & a_{2j} & ... & a_{2n} \\ ... & ... & ... & ... & ... & ... \\ a_{i1} & a_{i2} & ... & a_{ij} & ... & a_{in} \\ ... & ... & ... & ... & ... & ... \\ a_{n1} & a_{n2} & ... & a_{nj} & ... & a_{nn} \end{pmatrix} \begin{pmatrix} X_1 \\ X_2 \\ ... \\ X_j \\ ... \\ X_n \end{pmatrix} + \begin{pmatrix} y_1 \\ y_2 \\ ... \\ y_i \\ ... \\ y_n \end{pmatrix} = \begin{pmatrix} X_1 \\ X_2 \\ ... \\ X_i \\ ... \\ X_n \end{pmatrix} \quad (6)$$

Or in matrix form: AX+Y=X, where :
AX-productive costs;
Y- final product;
X- global product.

In the overall dynamics, the economic growth is ensured not only by the efficiency of economic agents, enterprises, corporations, branches etc., but also by the level of professionalism of the economists in governmental structures.

Only the methodological aspect can highlight the contribution of the decision making economists. For the purpose of demonstrating the methodology of economic growth we will examine a virtual economy with only two branches:

1. Producing goods for unproductive consumption;
2. Producing means of production.

Initial statistical data

Branch indicators	AX		Y^a		Y^c	X	ΔX
	1	2	1	2			
1	60	50	80	50	100	?	20
2	70	80	60	70	150	?	50

1. We calculate global production in branches 1 and 2 for t=0:
$X_1(0) = 60+50+80+50+100=340$
$X_2(0) = 70+80+60+70+150=430$
$X(0) = 340+430=770$

The results: $X_1(0) = 340$; $X_2(0) = 430$ şi $X(0) = 770$ can be found in table 2 .

2. Based on the data in table 1 we can calculate the matrix of the direct expenses quotient, matrix A:

$$A = \begin{pmatrix} \frac{60}{340} & \frac{50}{430} \\ \frac{70}{340} & \frac{80}{430} \end{pmatrix} = \begin{pmatrix} 0,18 & 0,17 \\ 0,21 & 0,19 \end{pmatrix}$$

3. We determine the matrix of the investment quotients:

$$D = \begin{pmatrix} \frac{80}{20} & \frac{50}{50} \\ \frac{60}{20} & \frac{70}{50} \end{pmatrix} = \begin{pmatrix} 4 & 1 \\ 3 & 1,4 \end{pmatrix}$$

4. To determine the growth of production in the upcoming year, we need to calculate the matrix opposite to matrix D, written as D^{-1}:

$$D = \begin{pmatrix} 4 & 1 \\ 3 & 1,4 \end{pmatrix} \qquad \det(D) \begin{vmatrix} 4 & 1 \\ 3 & 1,4 \end{vmatrix} = 4*1,4 - 3*1 = 5,6-3 = 2,6 \qquad D^* = \begin{pmatrix} 1,4 & -1 \\ -3 & 4 \end{pmatrix}$$

$$D^{-1} = \frac{1}{2,6} \begin{pmatrix} 1,4 & -1 \\ -3 & 4 \end{pmatrix} = 0,38 \begin{pmatrix} 1,4 & -1 \\ -3 & 4 \end{pmatrix} = \begin{pmatrix} 0,53 & -0,38 \\ -1,14 & 1,52 \end{pmatrix}$$

To verify this, the composition of matrices D and D^{-1} must be equal to the unit matrix, which is:

$$\begin{pmatrix} 4 & 1 \\ 3 & 1,4 \end{pmatrix} \begin{pmatrix} 0,53 & -0,38 \\ -1,14 & 1,52 \end{pmatrix} = \begin{pmatrix} 2,12-1,14 & -1,52+1,52 \\ 1,59+1,59 & -1,14+2,13 \end{pmatrix} = \begin{pmatrix} 1,02 & 0 \\ 0 & 1,01 \end{pmatrix}$$

5. We determine the final product meant for the accumulations in R1 and R2 for t=0:

$Y_1^a(0) = 80+50 = 130$ $\qquad Y^a(0) = Y_1^a(0) + Y_2^a(0) = 130+130 = 260$

$Y_2^a(0) = 60+70 = 130$

6. We establish the productive consumption in both branches:

$A_1X_1(0) = 60+50 = 110$ $\qquad AX(0) = 110+150 = 260$

$A_2X_2(0) = 70+80 = 150$

The results of no.5 and 6 are introduces in table 2.

7. We calculate the final product using the following formula: **AX + Y = X**, from which **Y = X – AX**

$Y_1(0) = X_1 - A_1X_1 = 340-110 = 230$ $\qquad Y(0) = Y_1(0) + Y_2(0) = 230+280 = 510$

$Y_2(0) = X_2 - A_2X_2 = 430-150 = 280$

8. We determine the final product destined for consumption using the following formula: $Y - Y^a = Y^c$

$Y_1^c(0) = Y_1(0) - Y_1^a(0) = 230-130 = 200$ $\qquad Y^c(0) = Y_1^c(0) + Y_2^c(0) = 200+250 = 450$

$Y_2^c(0) = Y_2(0) - Y_2^a(0) = 280-130 = 250$

9. The growth in production compared to the previous year is calculated based on the following relation:

$$\begin{pmatrix} \Delta X1(1) \\ \Delta X2(1) \end{pmatrix} = D^{-1} \begin{pmatrix} Y1a(0) \\ Y2a(0) \end{pmatrix} = \begin{pmatrix} 0,53 & -0,38 \\ -1,14 & 1,52 \end{pmatrix} \begin{pmatrix} 130 \\ 130 \end{pmatrix} = \begin{pmatrix} 68,9-49,4 \\ -148,2+197,9 \end{pmatrix} = \begin{pmatrix} 19,5 \\ 49,4 \end{pmatrix}$$

$\Delta X(1) = \Delta X1(1) + \Delta X2(1) = 19,5+49,4 = 68,9$

10. Knowing the growth of production in each branch for t=1, we can determine the global production for year 1:

$X_1(1) = X_1(0) + \Delta X_1(1) = 340-19,5 = 320,5$ $\qquad X(1) = X_1(1) + X_2(1) = 320,5+380,6 = 701,1$

$X_2(1) = X_2(0) + \Delta X_2(1) = 430-49,4 = 380,6$

The results of no.7-10 are introduced in table 2.

11. We can determine for year 1, the productive consumption in branches 1 and 2:

$$\begin{pmatrix} A1X1(1) \\ A2X2(1) \end{pmatrix} = A \begin{pmatrix} X1(1) \\ X2(1) \end{pmatrix} = \begin{pmatrix} 0,18 & 0,17 \\ 0,21 & 0,19 \end{pmatrix} \begin{pmatrix} 320,5 \\ 380,6 \end{pmatrix} = \begin{pmatrix} 57,69+64,70 \\ 67,31+72,31 \end{pmatrix} = \begin{pmatrix} 122,4. \\ 139,62 \end{pmatrix}$$

$AX(1) = A_1X_1(1) + A_2X_2(1) = 122,4+139,62 = 262,02$

12. Knowing the growth in production and the productive consumption, we can determine the volume of the final product:

$$\begin{pmatrix} Y1(1) \\ Y2(1) \end{pmatrix} = \begin{pmatrix} X1(1) \\ X2(1) \end{pmatrix} - \begin{pmatrix} A1X1(1) \\ A2X2(1) \end{pmatrix} = \begin{pmatrix} 320,5-122,4 \\ 380,6-139,62 \end{pmatrix} = \begin{pmatrix} 198,1 \\ 240,98 \end{pmatrix}$$

$Y(1) = Y_1(1) + Y_2(1) = 198,1+240,98 = 439,08$

13. The final product Y_1= 198,1 şi Y_2= 240,98 must be divided in the final product meant for productive accumulations and the final product for unproductive consumption. To this end, we write α_1, α_2 – the quota of the final consumption for productive accumulations.

We can determine the intervals for the admissible values of the quotients α_1 and α_2 from the condition:

$$D^{-1}\begin{pmatrix} Y1(1)\alpha 1 \\ Y2(1)\alpha 2 \end{pmatrix} > \begin{pmatrix} 0 \\ 0 \end{pmatrix} \quad \begin{pmatrix} 0,53 & -0,38 \\ -1,14 & 1,52 \end{pmatrix}\begin{pmatrix} 198,1\alpha 1 \\ 240,98\alpha 2 \end{pmatrix} > \begin{pmatrix} 0 \\ 0 \end{pmatrix} \quad \begin{pmatrix} 104,99\alpha 1-91,57\alpha 2 \\ -225,83\alpha 1+366,29\alpha 2 \end{pmatrix} > \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

$$\begin{cases} 104,99\alpha 1>91,57\alpha 2 \\ 225,83\alpha 1<366,29\alpha 2 \end{cases} \quad \begin{cases} \alpha 1>0,87\alpha 2 \\ \alpha 1<1,62\alpha 2 \end{cases}$$

We admit that α_2=0,1, then 0,087 < α_1 < 1,62; we admit that α_1=0,1. Knowing the values of the quotients α_2=0,1 and α_1=0,1, we can determine the growth of production in branches 1 and 2:

$Y_1^a(1) = 198,1*0,1 = 19,81$ $\quad Y^a(1) = Y_1^a(1) + Y_2^a(1) = 19,81+24,098 = 43,908$

$Y_2^a(1) = 240,98*0,1 = 24,098$

14. We determine the final product for consumption for year 1:

$Y_1^c(1) = Y_1(1) - Y_1^a(1) = 198,1 - 19,81 = 178,29$ $\quad Y^c(1) = Y_1^c(1) + Y_2^c(1) = 178,29 + 216,88 = 395,17$

$Y_2^c(1) = Y_2(1) - Y_2^a(1) = 240,98 - 24,098 = 216,88$

15. We calculate the growth of the global product for year 2 in branches 1 and 2:

$$\begin{pmatrix} \Delta X1(2) \\ \Delta X2(2) \end{pmatrix} = D^{-1}\begin{pmatrix} Y1a(1) \\ Y2a10 \end{pmatrix} = \begin{pmatrix} 0,53 & -0,38 \\ -1,14 & 1,52 \end{pmatrix}\begin{pmatrix} 19,81 \\ 24,1 \end{pmatrix} = \begin{pmatrix} 10,5-9,16 \\ -22,58+36,63 \end{pmatrix} = \begin{pmatrix} 1,34 \\ 14,05 \end{pmatrix}$$

$\Delta X(2) = \Delta X1(2) + \Delta X2(2) = 1,34+14,05 = 15,39$

The results of no.7-15 are introduced in table 2.

Table.2. The evolution of the economic indicators

No.	Indicators		Year 0	1	2	3
1	Global production in branch 1	$X_1(0)$	340	320,5	321,64	322,05
2	Global production in branch 2	$X_2(0)$	430	380,6	394,65	411,05
3	Total global production	$X(0)$	770	701,1	715,99	753,1
4	Productive consumption in branch 1	$A_1X_1(0)$	110	122,4	124,93	123,85
5	Productive consumption in branch 2	$A_2X_2(0)$	150	139,62	139,46	145,73
6	Total productive consumption	$AX(0)$	260	262,02	264,39	269,58
7	Productive accumulations in branch 1	$Y_1^{(a)}(0)$	130	19,81	19,64	19,82
8	Productive accumulations in branch 2	$Y_2^{(a)}(0)$	130	24,098	25,519	26,53
9	Total productive accumulations	$Y^{(a)}(0)$	260	43,908	45,16	46,35
10	Unproductive consumption in branch 1	$Y_1^{(c)}(0)$	200	178,29	176,77	178,38
11	Unproductive consumption in branch 2	$Y_2^{(c)}(0)$	250	216,88	229,67	238,74
12	Total unproductive consumption	$Y^{(c)}(0)$	450	395,17	406,44	417,17
13	Final product in branch 1	$Y_1(0)$	230	198,1	196,41	198,2

14	Final product in branch 2	$Y_2(0)$	280	240,38	225,19	265,38
15	Total final product	$Y(0)$	510	439,08	451,6	463,52
16	Production growth in branch 1	$\Delta X_1(0)$	20	19,5	1,34	0,71
17	Production growth in branch 2	$\Delta X_2(0)$	50	49,4	14,05	16,40
18	Total production growth	$\Delta X(0)$	70	68,9	15,39	17,11

2. Conclusion

The initial date are detailed in tables 1 and 2, where we calculated the quotients for direct productive expenses, the investment quotients, the productive expenses and the final product is devided in the final product for the productive branches and the final product for the unproductive consumption and we calculate the growth in production in the profiles of the branches, while the calculations for the upcoming period are conducted in the same order.

This methodology defines the realisation of economic growth. In the methodology of economic growth we can highlight the positive or negative contribution of the decision making economist and the value of the quota of the productive accumulations in the profit of the branches. The methodology of economic growth can be applied at a national level, at a territorial level, at the level of a branch or corporation. To this end, the above mentioned operations must be translated into an operating software. Such a methodology is successfully used in Japan, the USA, Germany, France, Italy, Canada and Great Britain. The methodology of economic growth ensures a balanced growth and considerably reduces the loses from the national economy.

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