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EVALUATING THE IMPACT OF THE CONSTRUCTION SECTOR ON OTHER SECTORS USING THE COST-BENEFIT METHOD (LITERATURE REVIEW)

Rumell Telman Jafarova [1], Pervin Xosrov Quliyeva [2]

[1] Associate Professor, Department of Economic Theory and Marketing, Azerbaijan University of Architecture and Construction, Baku, Azerbaijan
[2] Lecturer, Department of Information Technologies and Systems, Head of SABAH Center, Azerbaijan University of Architecture and Construction, Baku, Azerbaijan

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Corresponding Author

Rumell Telman Jafarova,
Rumella17_22@mail.ru

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ABSTRACT

If we consider the Cobb-Douglas production function at both the micro and macro levels, we will see that the added value generated depends on capital and labor, as well as technology. Since the product generated in the construction sector itself often plays the role of capital for other sectors, the mechanism of the impact of this sector on economic development is related to the formation of capital and the creation of new jobs. In the previous paragraphs, we focused on the added value or product volume generated in the construction sector itself and the impact of these products on GDP growth, as well as on the level of welfare. However, it should be borne in mind that the added value generated by the construction sector, regardless of its form, is intended for the long term and is aimed at economic development and improving welfare in the long term. For example, housing construction has been of great importance in improving people's welfare for decades. Irrigation systems aimed at the development of the agricultural sector play the main capital role in increasing productivity in this sector for the long term.

Keywords: Construction, Cost-Benefit, Cobb-Douglas

1. INTRODUCTION

If we consider the Cobb-Douglas production function at both the micro and macro levels, we will see that the added value generated depends on capital and labor, as well as technology. Since the product generated in the construction sector itself often plays the role of capital for other sectors, the mechanism of the impact of this sector on economic development is related to the formation of capital and the creation of new jobs. In the previous paragraphs, we focused on the added value or product volume generated in the construction sector itself and the impact of these products on GDP growth, as well as on the level of welfare. However, it should be borne in mind that the added value generated by the construction sector, regardless of its form, is intended for the long term and is aimed at economic development and improving welfare in the long term. For example, housing construction has been of great importance in improving people's welfare for decades. Irrigation systems aimed at the development of the agricultural sector play the main capital role in increasing productivity in this sector for the long term.

The impact of added value generated in the construction sector on the aggregate economy and methods for assessing such impacts (e.g., Granger causality method) We have already discussed this in the previous paragraphs. There is other research methods designed to assess the impact of the construction sector on economic development. For example,hypothetical extraction method (hypothetical extraction method) Song et al. (2006), decomposition analysis (decomposition analysis) Kapelko et al. (2014), structural path analysis(structural path analysis) Günlük-Senesen et al. (2018) and other methods are used to assess the macroeconomic effects of the construction sector. The relationship of the construction sector with other sectors of the economy has also been widely studied in the economic literature on the example of various countries. At this time, Leontief (1936) The cost-output method (IO) developed by is more commonly used.

The main idea of the Hypothetical Extraction Method (HEM) is that if we theoretically exclude any economic sector, then how much aggregate output could decrease. That is, if the economy did not have a construction sector, then how much aggregate output of the country would decrease. The decreasing difference allows us to quantitatively assess the relationship between the economic sector under consideration and other sectors. Of course, such an exclusion is not possible in reality, but as an evaluation methodology, the HEM method can be applied to assess the role of the construction sector in economic development. One of such Miller et al. (2001) conducted by. Comparison of the results obtained during the study with the IOM suggests that it is also possible to assess the contribution of the construction sector to economic development using the HEM method.

In a study conducted by Song et al. (2006), the results obtained on the impact of the construction sector on the economy over a period of 20 years using the example of developed countries were realized by applying the IOM and HEM. In the HEM method, the relationship of the construction sector with other sectors is classified into three groups: 1) relationship with the aggregate economy; 2) supply-oriented relationship; 3) consumer-oriented relationship. During the study, the construction sector was evaluated in all three types of relationships from the economic system. An interesting result is that the role of the construction sector in the economy varies depending on the level of economic development. On the other hand, the nature of the relationship of the construction sector with other sectors of the economy depends on the level of state intervention in the economy as a whole, as well as the level of interventions in the construction sector, the level of institutionalization in the country, etc. Ren et al. (2014) In a study conducted by the Institute of Economic Research, the effects of the real estate construction sector on various sectors of the economy in different provinces in China were assessed using the IOM method. According to the results of this study, the construction sector plays an important role in the development of the country's overall economy and the creation of new jobs. Comparison of the Spanish construction sector with the construction sectors of some developed countries Bielsa and Duarte (2011) This is reflected in a study conducted by Alonso-Nuez et al. (2015). In this study, a cost-output table was compiled based on data from 2000-2004. The important conclusion is that if the weight of the construction sector in the economy is high, then the economy is also highly dependent on the demand volume in this sector. However, Alonso-Nuez et al. (2015) According to the results of the assessments with the IOM, the role of the construction sector in the Spanish economy is largely due to its linkages with other sectors. The weakness in the Spanish economy is also immediately reflected in the construction sector.

It should be noted that among the currently available methods, the IOM is the most successful method for assessing the balance between economic sectors. This method is widely applied in both developed and developing countries. Bhattacharya and Rajeev (2013) India, Rameezdeen and Ramachandra (2008) Sri Lanka, Chen et al. (2003) Taiwan, Gündes (2011) In the case of Turkey, the role of the construction sector in economic development has been studied with the IOM method over different periods. In some studies, the analysis of the construction sector of a country using the IOM method has been compared with the construction sectors of other countries. For example, İlhan and Yaman (2011) Using IOM tables for 1998-2002, they compared the role of the Turkish construction sector in economic development with the construction sectors of Sweden, France, Ireland, Portugal, the Netherlands, the United Kingdom, the Czech Republic, Slovakia and Hungary and concluded that the Turkish construction sector is more similar to the construction sectors of the Czech Republic, Portugal, Slovakia and Hungary. In these countries, the share of the construction sector in GDP and national income is also high.

Gregory and Pietroforte (2015) in their research, they comparatively studied the construction sectors of Russia, India, China, Brazil, Indonesia and South Africa using the IOM method. During the study, data covering the years 1995-2005 were used and the following conclusion was reached: despite the different levels of economic development and welfare in these countries, 1) the share of demand in the construction sector in aggregate demand exceeds the volume of added value created; 2) in other countries, with the exception of Brazil, the share of the construction sector in aggregate output is higher than its share in added value; 3) the structure of intermediate costs is different in these countries; 4) the data used in the compilation of cost-output tables for some countries were not used because they raised doubts about the reliability of the estimates; 5) since each country uses different resources in the construction process, using the same cost-output tables creates certain difficulties.

It should be noted that the IOM has some limitations. The main limitation is that all sectors are given the same weight here. However, it is known that the role of all economic sectors in the economy is not the same. Even depending on the strategic priorities adopted by the country, the weight of economic activity areas may change over time. For example, most developed countries are currently interested in developing the service sector as a strategic priority area. However, at certain times, the manufacturing industry was considered a strategic priority for these countries. On the other hand, some agrarian countries are increasingly trying to develop the manufacturing industry, and the volume of investments in these areas is increasing.

Despite the existence of various methods and numerous studies on the role of the construction sector in economic development, it is still impossible to fully claim that such methods are perfect, and the results obtained are reliable. In particular, if the study consists of comparing the results obtained across different countries, the difficulty increases somewhat. As we have noted above, the use of different intermediate products in different countries leads to the diversity of input-output tables for the IOM. However, a comparative analysis of studies conducted across different countries suggests that the IOM can be used to a certain extent to determine the relationship between the construction sector and other sectors of the economy.

The IOM method can be used as an important tool in the analysis and forecasting of structural relationships in the economy, as well as in ensuring general macroeconomic balance. This model is more interesting because it covers all stages of the production process, including the stages of production, distribution or exchange and final consumption. When applying the IOM model, an inter-sectoral balance scheme is used. This scheme consists of four main quadrants. Each quadrant covers a certain stage of the production process. The first quadrant reflects the volume of demand for production needs, the second quadrant groupings depending on how the product is used, the third quadrant includes the added value of the commodity, and the fourth quadrant reflects the distribution of national income.

The compilation of the inter-sectoral balance based on the IOM model allows for analysis and forecasting at the national economy, regional economy, intra-sectoral and intra-product levels. This model also allows for determining the main characteristics of macroeconomic indicators when ensuring a state of equilibrium in the national economy, as well as calculating the costs required for the production of one unit of any product, calculating the resource capacity of the aggregate economy or any of its sectors, and increasing the efficiency of the division of labor.

Let us consider the essence of IOM and each stage of the algorithm required for its application in the construction sector. As we have noted, IOM currently applied in economic research consists of the "traditional approach to relationships" and the "hypothetical extraction method", which are somewhat different from each other. We first describe the IOM in two studies - Ali et al. (2019) and Xianrui et al. (2019) We will use the successfully implemented form (traditional approach to relationships).

Ali et al. (2019) The traditional approach to the relationships they use in their research is Leontief's inter-sectoral balance model. In this model, aggregate output (X) across n sectors of the economy is a function that depends on the technical coefficient matrix characterizing inter-sectoral relationships and the product consumption in each sector. This function

$$X = A * X + F \quad (1)$$

or

$$X = (I - A)^{-1} * F \quad (2)$$

We can express who. Here (I-A) ^ (-1)- is called the inverse Leontief matrix. The elements of this matrix represent the output of intermediate goods required to produce one unit of the final product in any sector and produced in any other sector. The technical coefficient A is

$$A = Z * \hat{X}^{-1} \quad (3)$$

(G)-Ghosh (1958) and the inverse matrix is

$$B = \hat{X}^{-1} * Z \quad (4)$$

Using equations (1), (2), (3) and (4), we can calculate the total output

$$X' = V' * (I - B)^{-1} \tag{5}$$

HereV^'- is an (n+1) dimensional vector that represents the initial costs (input costs) and is used for the production of products in the n-th sector. Ali et al. (2019) (L)-Leontiev and (G)-Using Ghosh matrices, we propose two indices to express the volume of product production by sector - supply-oriented (backward linkage) and consumer-oriented (forward linkage) indices:

$$BL_j = \frac{\frac{1}{n} * \sum_{i=1}^{n} I_{ij}}{\frac{1}{n^2} * \sum_{i,j=1}^{n} I_{ij}} \tag{6}$$

Here -(L) are the elements of the Leontief inverse matrix.I_ij

Based on the (G)-matrix, an index expressing consumer-oriented relationships can be formed:

$$FL_i = \frac{\frac{1}{n} * \sum_{j=1}^{n} G_{ij}}{\frac{1}{n^2} * \sum_{i,j=1}^{n} G_{ij}} \tag{7}$$

Here (G) are the elements of the inverse matrix.

If for any economic sector 〖BL〗_j>1and if, then this sector is considered a key sector of the economy. If, but, then this sector is a consumer-oriented sector. if, but, then this sector is considered a supply-oriented sector. If and, then this sector is considered a weak sector of the economy. Determining whether a sector is strong or weak, as well as whether it is a supply-oriented or consumer-oriented sector through IOM is important for taking the right steps in the decision-making process regarding which area of the country's economy to strengthen further. $FL_i > 1 BL_j < 1 FL_i > 1 BL_j > 1 FL_i < 1 BL_j < 1 FL_i < 1$

Xianrui et al. (2019) In the study conducted by the application of the IOM model was mainly carried out according to an algorithm consisting of three stages: 1) total consumption coefficient and pull coefficient; 2) total distribution coefficient and push coefficient; 3) measurement of the construction sector and complex network.

When conducting an IOM analysis, the total consumption coefficient is the sum of the consumption volumes of other intermediate products consumed during the production of one unit of any product. This is

$$B=A+C \tag{8}$$

If we express it as, then B-final product can be expressed as the sum of the matrices of coefficients A-direct consumption and C-indirect consumption. Matrix A is a matrix of dimension (nxn) and has elements. Herea_ij a_ij- is the direct consumption volume of the i-th intermediate product consumed to produce one unit of product j. If we take into account that,

$$C=B*A \tag{9}$$

Then

$$B=(I-A)^{-1}-I \tag{10}$$

Here I is the identity matrix. Thus, the total consumption coefficient It can be calculated using the matrices given in equation (10). Here, matrix B characterizes the direct and indirect relationships between sectors. It reflects the proportion of intermediate products consumed directly and indirectly from other sectors to produce one unit of output of the construction sector. The construction sector attracts such intermediate products and a “pull effect” is created. This is also a supply-oriented relationship. This indicator, called the push coefficient (or supply-oriented relationship coefficient), is the same as in equation (6).

Note that for the closed IOM model, the total output produced is consumed by the sectors themselves, between which the relationship is sought. In this case, the cost is equal to the output and there is no external demand for the products produced. X=A*X or (IA)*X=0

If the IOM model is used for the Ashug economy, then in this case the expenditure is equal to the output, but foreign consumers (for example, a certain part of the produced product is exported) are included in the model. In this case, X=A*X+D or. Where D is a matrix representing the volume of foreign consumption. $\boldsymbol{X}=(\boldsymbol{I}-\boldsymbol{A})^{-1}*\boldsymbol{D}$

Table 1

Table 1 Simplified Table of the İnput-Output Model (IOM)

				Buying sectors				**Last request**		**Total release (X)**		
		1	...	j	...	n	n+1					
production sectors	1	x_{11}	...	x_{1j}	...	$x'_{1,n}$	$x'_{1,n+1}$	c_1	i_1	g_1	e_1	X_1
	⋮	⋮	...	⋮	...	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	I	x_{i1}	...	x_{ij}	...	$x'_{i,n}$	$x'_{i,n+1}$	c_i	i_i	g_i	e_i	X_i
	⋮	⋮	...	⋮	...	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	n	$x_{n,1}$	...	$x'_{n,j}$	...	$x'_{n,n}$	$x'_{n,n+1}$	c'_n	i'_n	g'_n	e'_n	X'_n
	n+1	$x_{n+1,1}$	...	$x'_{n+1,j}$	...	$x'_{n+1,n}$	$x'_{n+1,n+1}$	c'_{n+1}	i'_{n+1}	g'_{n+1}	e'_{n+1}	X'_{n+1}
Added value (ν)		ν_1	...	ν_j	...	ν'_n	ν'_{n+1}	ν_c	ν_i	ν_g	ν_e	V
Import (m)		m_1	...	m_j	...	m'_n	m'_{n+1}	m_c	m_i	m_g		M
Total cost (X)		X_1	...	X_j	...	X'_n	X'_{n+1}	C	I	G	E	

Note: Compiled Based on Data From The IO Model

Although the IOM method is based on the methodology of applying the construction sector to the construction sector, they differ in the number and type of economic sectors involved in the study. For example, Ali et al. (2021) included the relationship of the construction sector with 14 other sectors, including the agricultural sector, the extractive industry, trade, etc. in the model during their study. İlhan and Yaman (2011) included the relationship of the construction sector with the manufacturing industry and the service sector in the IOM model. Alonso-Nuez et al. (2015) included the relationship of 13 sectors in the IOM model.

Based on a comparison of a large number of studies in the economic literature devoted to the analysis of the construction sector and applying the IOM model, we consider it necessary to select the following algorithm as the research methodology:

1) Obtaining the data necessary for applying the IOM model to the construction sector. Extensive calculations on countries based on the IOM model are carried out by the Eora research group. However, in order to study the relationship of the construction sector with several sectors for which statistical data are included in the ARDSK, in particular, with the processing industry, agriculture, energy, trade, transport, telecommunications, and tourism sectors, we consider it more appropriate to obtain data from official statistical databases, including the database of the State Statistical Committee of the Republic of Azerbaijan and the official website of the World Bank;
2) Analysis of the “push” and “pull” effects characterizing the relationship of the construction sector with other sectors. Such analyses are carried out by calculating the total consumption coefficient, the total distribution coefficient, the “push” and “pull” coefficients:
    - The total consumption coefficient characterizes the sum of products consumed from other sectors for the production of one unit of construction product.
    - A "push" coefficient for the construction sector will be calculated based on the total consumption coefficient.
    - To calculate the distribution coefficient, the initial investments in construction and installation works in the sectors included in the study will be calculated. Then, the Total Distribution Coefficient will be calculated.
    - The "push" effect of the construction sector will be calculated based on the total distribution coefficient.

CONFLICT OF INTERESTS

None.

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