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ASSESSMENT OF THE MULTIPLICATIVE EFFECTS OF THE MINING AND MANUFACTURING SECTORS IN AZERBAIJAN

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ABSTRACT

In the article, the multiplicative effects of the mining and manufacturing sectors of the Azerbaijani economy have been evaluated and the results have been compared. For this purpose, using the input-output model and multiplier model based on the social accounting matrix (SAM) for the year of 2016, the impact of the increase in demand in these sectors on the demand in these sectors themselves and in the others was evaluated. The result of the study showed that although the effects of the manufacturing industry are high when production relations are considered, the impact of the manufacturing industry on the economy is not as high as expected since some part of the financial resources flows abroad due to the import. And since the mining industry is less connected with the sectors of the country's economy (more precisely, due to the low share of intermediate consumption in the production volume), the input-output multiplier of this sector is small compared to the manufacturing industry, but the SAM multiplier is significantly higher. It should be noted that, because there are more accounts in SAM compared to input-output tables, in the multiplier model based on SAM, the effect of other accounts, including wages, capital costs, on demand growth in other sectors is also added. However, this positive difference may not be attributed to all sectors. So, in sectors with a negative balance in the accounts, for example, in sectors where imports exceed exports, SAM multiplier is usually smaller than the input-output multiplier. The results of the study contribute to the identification of problems of industry in oil-rich countries and can be used in decision-making as well.

Keywords: Manufacturing, multiplier effects, oil-rich countries, input-output model, SAM

Jel Classification: C63, D58, E17

INTRODUCTION

Industry is one of the leading sectors of the economy and is considered one of the main driving forces of the country's economic development. Because the diversification of the country's economy and continuous improvement of the standard of living of the population depends on the competitiveness of the industrial complex. The development of the industry in a country causes in an increase in employment and as a result an increase in standard of living of population. The production of the country also increases by creating conditions for the efficient use of resources. From this point of view, as in all countries, the development of industry is one of the important issues in Azerbaijan. In Azerbaijan, the industrial sector has a large share in the economy. The figure 1 shows the share of added value of industry in the country's economy for 2005-2022.

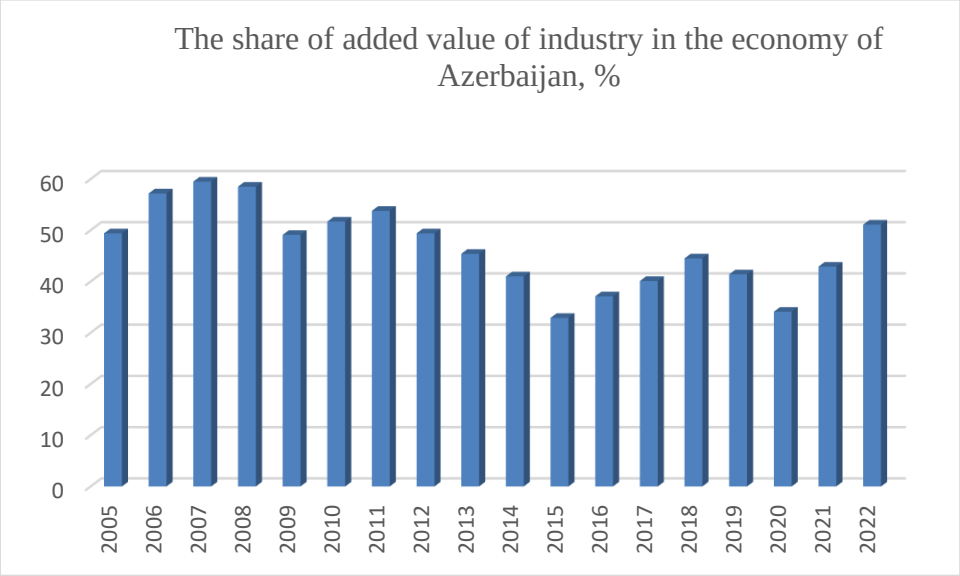

Fig. 1. The share of added value of industry in the economy of Azerbaijan
Source: www.stat.gov.az

It can be seen from the figure that, although the share of the industry was high during the considered period, it did not have a stable trend. In 2007, the industry's share was the highest at 59.5%, and in 2020 it was the lowest at 34.1%. In 2022, the share of added value of the industry in the country's economy was 51.1%, which means that a little more than half of the added value created in the country belongs to the industry. But one of the main problems here is that the majority of the industrial output is in the mining industry.

And this is one of the main reasons for the instability in the industry's share because of its dependence on oil price fluctuations. In the database of the State Statictical Committee of the Republic of Azerbaijan, the country's industry is divided into four sectors:

1) Mining industry (crude oil, natural gas, mineral ores and other mining products);

2) Manufacturing industry (consists of a large number of production areas by types of economic activities;

3) Electricity, gas and steam production, distribution and supply;

4) Water supply, waste treatment and processing

Figure 2 shows the share of these sectors in the country's industry for the year of 2022:

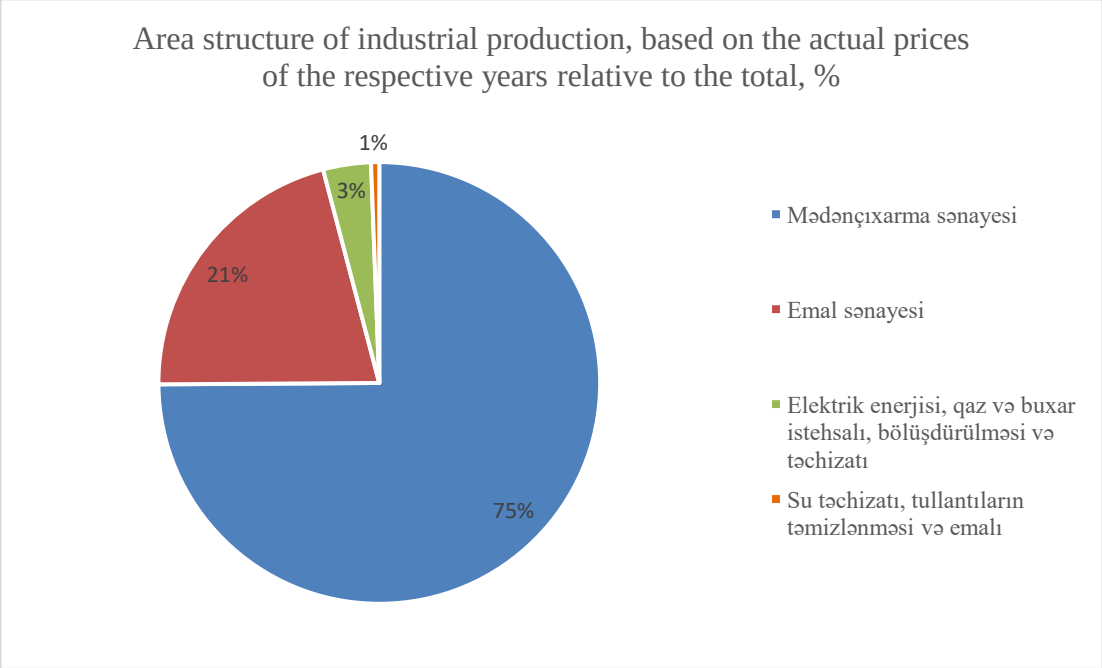

Fig.2. Area structure of industrial production in Azerbaijan
Source: www.stat.gov.az

As can be seen from Figure 2, in 2022, the mining industry accounted for an absolute majority of 75% of the total industrial output. The reason for this is that the country is rich in oil and gas resources. However, the development of the non-oil sector, including the non-oil industry, is in the center of attention in the country, and measures are being taken in this direction. As an example, we can show that the Oil Fund (OF) was created and every year money is transferred from the OF to the state budget and directed to the development of the non-oil sector.

By forming the optimal level of the area structure of each country's industry, it is possible to speed up the solution of economic and social problems, such as ensuring the efficient operation of the economy, increasing the economic efficiency of public production, and improving the welfare of the population.

Improving the structure of Azerbaijan's industry, diversifying the country's economy and exports, and developing the non-oil industry have been among the main priorities of the government's economic policy since 2010, and a number of policy documents (state programs and strategies) aimed at solving this task have been adopted and are being implemented. In this regard, the assessment of the effects of the development of these sectors on the country, the assessment of the effects of the development of industrial sectors on other sectors, as well as the identification of problems in these areas are relevant for the country's economy. In this article, the multiplier effects of the increase in the demand for the production of the mining and manufacturing sectors, which have the main share in the industry, were estimated using multiplier models based on the input-output table and SAM.

LITERATURE REVIEW

Technical and technological advancements are the most significant and inevitable factors in the development of civilization. Over the ages, advancements in technology determined changes in the political, social, and cultural spheres that either supported or inhibited it. When these elements came together, innovations were made that revolutionized the way materials are produced (Benazzouz, 2018). From the standpoint of technological development and technology, modern history separates these simultaneously advancing phases into four groups, which are referred to as technological revolutions. They allowed to the enormous acceleration of scientific advancement and the application of its discoveries in industrial production (Rymarczyk, J., 2020: 186).

The phrase "Fourth Industrial Revolution" was first made public by Schwab (2016) following the German government's 2011 introduction of the "Industry 4.0" program to encourage digitization of production. Since then, Industry 4.0 and the Fourth Industrial Revolution have emerged as the primary keywords for structural change globally. After Industry 4.0 was introduced, countries have realized that innovation, technical advancement, and human capital are what are really causing the economy and society to change. Nevertheless, different nations have not all been equally prepared for the industrial revolution (Chung, 2021). The majority of nations are currently taking economic steps to guarantee the shift to the fourth industrial revolution, and Azerbaijan is undergoing this process, too.

It is well known that Azerbaijan's economy, particularly its industrial sector, is heavily influenced by the oil factor. But in the present day, on the edge of a new industrial revolution characterized by the widespread application of advanced technology, the issues of ending reliance on oil and modernizing the Azerbaijani economy have taken on much greater significance.

In various studies, issues such as analysis of the results of measures implemented for the development of non-oil industry (Amin, 2022), directions for achieving the development of the industrial regions (Yahyayeva, 2018), modern situation of industrial parks, industrial districts of technoparkaks ((Arif, 2016), directions for the improvement of the food industry (Guliyev and Abutalibov, 2016) in Azerbaijan were analysed. In the research by Jahangirov (2022), on the eve of the new industrial revoultion the problems of the modernization of the Azerbaijan industry were examined, and it is emphasized that to ensure flexible transformation of Azerbaijani industry, special attention should be paid issues like implementing major economic projects to ensure the flexible transformation of the Azerbaijan industry, urgent measures should be implemented, the structure of the industry should be analyzed, problem areas should be revealed in time and more effective tools should be used. In this regard, in our study, the effects of investments in this sector and its mutual relations with the rest of the economy were evaluated in order to determine problems in the industry and create development prospects.

It is better to use economy-wide modeling rather than partial-equilibrium analysis to examine the growth and distributional implications of different development routes. The latter leaves out a great deal of significant elements, many of which are hard to predict and that work simultaneously and interactively. Numerous economic sectors have significant interactions that affect the direction and strength of policy effects, according to quantitative studies on the macro and distributional effects of development programs (Bautista et al., 1999). To estimate economy-wide effect of a sector, multiplier models and CGE models are widely used in the literature (Mustafaev and Naydenov, 2021; Zhang et al., 2020; Garza-Gil et al., 2017; Nejati and Bahmani, 2020; Kat et al., 2018). (Kyophilavong, 2016) investigates the impact of the mining sector on the Laos' economy using CGE model and it finds that higher capital stock and productivity lead to increased value added, production, exports and investment in the mining sector and these increases result in higher real gross domestic product, exports and investment.

However, the effects from the associated Dutch disease negatively impact real production and value added in the agriculture and industry. (Fatah, 2008) uses a Social Accounting Matrix (SAM) to analyze the impact of the coal mining industry on the economy and to do simulations to find alternative policies on the coal industry that are suitable for economic improvement and environmental sustainability.

For Azerbaijan economy, the impact of various sectors on the economy was evaluated based on the multiplier based on the expenditure-output model and the Social Accounts matrix (Sadik-Zada et al., 2021; Hasanli et al., 2019; Rahimli and Mammadova, 2022). (Hasanli and Rahimli, 2023) estimates and compares the country-wide effect of investments in each sector using both models. In this article, we will evaluate the additional demand created by the increase in demand for the products of the mining and manufacturing sectors in these sectors, in other sectors and in the country as a whole. Also, the analysis of these demand volumes helps to reveal the problems in these sectors.

METHODOLOGY

The relationships between the various economic sectors are displayed in the input-output table. Thus, each sector uses production elements and intermediate consumption products from other sectors to generate its own output, which it then sells to consumers as a final good and to other sectors as an intermediate product. The input-output table (Table 1)'s rows and columns, respectively, represent this process (Greton, 2013).

Table 1: Input output table

Output / Input		Intermediate demand			Final demand	Output
		Sector 1	Sector 2	Sector 3		
Intermediate demand	Sector 1	x_{11}	x_{11}	x_{11}	Y_1	X_1
	Sector 2	x_{11}	x_{11}	x_{11}	Y_2	X_2
	Sector 3	x_{11}	x_{11}	x_{11}	Y_3	X_3
Value Added		V_1	V_2	V_3		
Input		X_1	X_2	X_3		

The entire output of each sector can be seen by examining the rows of the input-output table, which sums the intermediate and final consumption. Then input-output table's main equation can be written as follows (Hasanli, 2011):

$$X=AX+Y \qquad (1)$$

The variables in this case are total production (X), final consumption (Y), and a vector of direct cost coefficients (A). The direct cost coefficient shows how much resources from the i-th sector are required to make one unit of the j-th sector's product:

$$a_{ij} = \frac{x_{ij}}{X_j} \quad , \quad i,j, = 1,2,...,n$$

When we solve equation (1) in relation to X, we obtain:

$$X = (\dot{I} - A)^{-1} Y \qquad (2)$$

Here, B=(İ-A)$^{-1}$ is called the full cost matrix.

Using equation (3), we can express the change (ΔX) in the total output vector X when any change (ΔY) occurs in the final demand vector Y as:

$$\Delta X = (E - A)^{-1} \Delta Y = B\Delta Y \qquad (3)$$

This is the input-output model's fundamental simulation equation.

It is evident that altering any one of its components can result in a change in the final demand's volume. For instance, the demand for the final products of different sectors rises when government agencies' investment and consumption costs are altered through the state budget. Consequently, the change in the final demand brought about by a change in any one or more of the aforementioned components can be quantified by using formula (3) to measure the change in the total output vector. Therefore, any sector's production rises in response to a rise in the demand for its products. Simultaneously, the output-input model enables the estimation of the overall sum of these effects when more intermediate consumption products utilized in other sectors to make this sector's product are produced. However, only the multiplier effects resulting from production relations are considered in the input-output model. Additional multiplier effects are produced during the processes of income distribution, redistribution, and use. These impacts can be evaluated by utilizing the Social Accounting matrix.

SAM based multiplier model

A Social Accounting Matrix (SAM) is an extensive database that encompasses an economy and records information on every transaction made by economic actors within that economy over a given time frame (Mainar-Causapé et al., 2018). By include the entire path of income in the economy, a SAM expands the input-output table.

SAMs are compiled for two reasons: first, they present an all-inclusive and easily comprehensible picture of the current state of the economy; second, they serve as the industry standard database for economy modellers, providing information for economic models (such as the more detailed Computable General Equilibrium or multi-sectorial linear models).

Table 2: Social Accounting Matrix

			EXPENDITURES						
			ENDOGENOUS			EXOGENOUS			TOTALS
			FACTORS	HOUSEHOLDS	PRODUCTIVE ACTIVITIES	GOVERNMENT	REST OF THE WORLD	CAPITAL ACCOUNT	
RECEIPTS OR INCOMES	ENDO-GENOUS	FACTORS	0	0	T_{13}	X_{14}	X_{15}	X_{16}	Y_1
		HOUSEHOLDS	T_{21}	T_{22}	0	X_{24}	X_{25}	X_{26}	Y_2
		PRODUCT ACTIVIT	0	T_{32}	T_{33}	X_{34}	X_{35}	X_{36}	Y_3
	EXO-GENOUS	GOVERNMENT	L_{41}	L_{42}	L_{43}	t_{44}	t_{45}	t_{46}	Y_4
		REST OF WORLD	L_{51}	L_{52}	L_{53}	t_{54}	t_{55}	t_{56}	Y_5
		CAPITAL ACTS	L_{61}	L_{62}	L_{63}	t_{44}	t_{45}	t_{46}	Y_6
	TOTALS		Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	

Source: (Antonopoulos R., Kim K., 2008)

Multiplier models based on SAM can be formulated as follows: column coefficients are calculated as in input-output tables. The matrix A is then obtained by dividing each column element of this matrix by the column sum (Y) from the T SAM matrix. It is evident that this will satisfy the following equality:

$$T=AY \tag{4}$$

We can construct the following equation for each line:

$$Y=AY+X \tag{5}$$

From here we can get:

$$Y = (\dot{I} - A)^{-1} X = M_a X \tag{6}$$

Here, M_a is the multiplier matrix. When the matrix A is fixed, M_a will also be fixed, and then equation (6) determines the equilibrium value of y corresponding to any change in X (Defourny and Thorbecke, 1984). This formula can be used to calculate the amount that changes in any one of the exogenous accounts that affect Y.

DATA

The 2016 input-output table was used as the input-output model's database. A simulation model was constructed based on the table, which had 96 sectors, but was reduced to 25 primary sectors by grouping appropriate areas.The database of the multiplier model based on the SAM is the social accounting matrix built by adding production factors, households, government, enterprises, investment/savings and rest of the world accounts to the input-output table for the year of 2016.

FINDINGS

Firstly, in the article, using simulation equations (3) and (6), the multiplier effects of the 1 million manat investment in the Mining sector have been evaluated through the multiplier models based on the input-output table and the social accounting matrix, and the results of both models are reflected in table 3.

The third column of the table shows the results of the assessment based on the input-output model. It can be seen from the results that 1 million manat investment allocated to the mining sector creates a demand for the total output of about 1.2 million manat in the country. The largest part of this demand - 1.08 million manats is for the output of the mining sector itself, and the remaining 0.12 million manats is for the output of other sectors of the country's economy. This shows that the mining sector has very weak connections with other sectors of the country's economy. The reason for this is that this sector mainly includes of the oil and gas sector, and oil and gas are mostly exported in the form of raw materials, and as a result, less intermediate products are bought from other economic activities. In general, it can be seen that the increase in the demand for the production of the mining sector by 1 million manats creates demand of 25 thousand manats for the products of the ‘Production of non-metallic products and base metals’ sector, 14.5 thousand manats for the products of the ‘Production of machinery, equipment, furniture’ sector, 12 thousand manats for the products of the ‘Transport and warehousing’ sector, 10.8 thousand manats to the ‘Professional and technical activities’ sector. Because the mining sector uses the intermediate products of other sectors when orginizing its production. There is a demand for the products of these sectors to some degree. However, as we mentioned, only production relations are taken into account here. Thus, when the demand for the product of the mining sector increases, it is clear that this sector buys intermediate products from other sectors, which is called the direct effect. Also, in order to produce the additional output volume of these sectors, their demand for the products of other sectors also increases.

This effect is called indirect effect. In addition to these, the created volume of production due to direct and indirect effects also means an increase in value added, and the elements of value added (profit, labor payments, taxes on production, etc.) also increase. This increase leads to a growth in the income of the population, and as a result, increase in their demand for various goods and services. This effect is called induced effect. However, since the cost-output model reflects only production relations, this effect cannot be estimated with this model. In order to estimate this effect, the SAM multiplier model, which contains information on the generation, distribution and use of income along with production relations, was used, and the results of this model are given in the fourth column of table 3. Note that the results of this model retain most of the growth in the input-output model and additionally take into account the induced effect.

Table 3: Multiplier effect of 1 million manat inverstment in Mining industry

	Sectors	**Change of output based on IO model, manat**	**Change in total demand based on SAM, manat**
1	Agriculture, forestry and fishing	0,19	113,97
2	Mining industry	1079,15	1097,18
3	Production of food, drinks and tobacco	0,55	81,49
4	Production of non-metallic products and base metals	25,52	128,01
5	Production of machinery, equipment, furniture	14,52	57,26
6	electricity, gas, steam	3,19	32,43
7	Water supply	0,18	2,40
8	Waste management	0,41	1,74
9	Construction	5,10	85,47
10	Trade and repair of transport uses	7,36	144,65
11	Transport and warehousing	12,23	94,69
12	Accommodation and catering for tourists	0,72	30,48
13	Information and communication	3,65	23,48
14	Financial intermediation, insurance and pension services	4,55	24,67
15	Real estate services	4,31	31,43
16	Research and development	1,55	2,39
17	Professional and technical activities	10,82	29,97
18	Administrative and ancillary services	1,55	7,87
19	public administration and defense	0,20	0,49
20	Education	0,09	13,36
21	Healtcare	0,03	5,57
22	social services	0,08	11,87
23	Services of library, archive, museum and other cultural institutions	0,00	0,75
24	Rest, entertaiment, art services	0,03	7,96
25	Other services	1,23	19,04
	Total	**1177,22**	**2048,58**

The results show that the effect created by the creation of 1 million demand for the production of the mining sector is 2.05 million manats. This is much larger than the figure obtained from the input-output model. As it can be seen, a little more than half of the additional demand resulting from this effect - 1,097 million manats, is for the goods and services of the mining sector itself, and the rest is for the output of other sectors of the country's economy.

Table 4. Multiplier effect of 1 million manat inverstment in Production of food, drinks and tobacco

Sectors	**Change of output based on IO model, manat**	**Change in total demand based on SAM, thousand manat**
Agriculture, forestry and fishing	176,38	165,94
Mining industry	62,35	38,74
Production of food, drinks and tobacco	1211,05	1170,87
Production of non-metallic products and base metals	139,76	123,76
Production of machinery, equipment, furniture	60,55	51,79
electricity, gas, steam	78,48	60,56
Water supply	6,34	4,91
Waste management	2,52	2,10
Construction	28,85	56,39
Trade and repair of transport uses	261,05	224,83
Transport and warehousing	74,85	85,60
Accommodation and catering for tourists	4,59	18,31
Information and communication	13,96	17,32
Financial intermediation, insurance and pension services	67,39	48,37
Real estate services	34,59	33,77
Research and development	3,75	1,83
Professional and technical activities	44,27	31,58
Administrative and ancillary services	11,28	9,30
public administration and defense	0,53	0,43
Education	0,10	7,14
Healtcare	0,24	3,08
social services	0,30	6,44
Services of library, archive, museum and other cultural institutions	0,00	0,40
Rest, entertaiment, art services	0,39	4,46
Other services	2,28	10,65
Total	**2285,85**	**2178,56**

From the results, we can see that an additional demand of 144,000 manats was created for 'Trade and repair of transport uses', 128 thousand manats for 'Production of non-metallic products and base metals', and 114 thousand manats for 'Agriculture, forestry and fishing'. In general, although the indirect effects on the production of other sectors are small, due to low level of connection of mining sector with others, the increase in the value added of this sector greatly boosts the development of the country's economy through the induced effect. In the research, then we evaluated the multiplier effects of the additional demand for the products of the 'Production of food, drinks and tobacco' sector. Table 4 shows the results of this assessment. It can be seen from the table that the creation of an additional demand of 1 million manats for the product of the 'Production of food, drinks and tobacco' sector creates a total demand of 2.3 million manats due to production relations.

1.2 million manats of this demand is in this sector itself. Among other fields, the highest value of increased demand is in 'Trade and repair of transport uses' with 261 thousand manats, the second highest value is in 'Agriculture, forestry and fishing' with 176 thousand manats, and the third highest value is in 'Production of non-metallic products and base metals', which can be explained by the use of trade services and agricultural and non-metallic products as intermediate products in the 'Production of food, drinks and tobacco sector'. As it can be seen, there has been an increase in other sectors to some degree, too. The lowest rates of growth were observed in services such as 'Services of library, archive, museum and other cultural institutions', 'Education', 'Healthcare', 'Rest, entertainment and art services', 'Social services' and 'Public administration and defense', because 'and shows that these services are used very little in the organization of production of food, drinks and tobacco products.

In the SAM-based multiplier model, since we can estimate the effects of growth in value added along with intermediate consumption relationships, our expectation would be that the results of the second model would exceed the results of the first model, as in the case of the mining industry. However, contrary to this expectation, according to the SAM-based multiplier model, the effects of investments in the 'Production of food, drinks and tobacco' are lower, with the value of 2.18 million manats. The reason for this is that, in addition to taking into account value added effects, the SAM-based model also takes into account import and export relations. Thus, the total demand for goods and services in each sector is met by local production and imports, and we face the situation of losing a part of the effects caused by the fact that most of the demand for the products of this sector is imported.

The use of more imported products as intermediate products in the production of this sector also plays a role in obtaining this result. On the other hand, since the level of value added, including profit, wages in agriculture is low, these factors can increase the demand for products of other sectors at a low level. As a result, the multiplicative effects of expenditures on the basis of SAM in the agriculture are lower than the multiplicative effects based on the input-output model. In Table 5, the multiplicative effects of the creation of an additional demand of 1 million manats for the products of the 'Production of non-metallic products and base metals' sector have been evaluated for the country. As can be seen, according to the results of the input-output model, the investment of 1 million manats in this sector increases the total output of the country by 1.9 million manats due to production relations. 1.26 million manats of this increase is in this sector itself, and the rest is in other sectors. The 2nd sector with the highest impact is 'Mining industry'. Thus, the investment of 1 million manats in the 'Production of non-metallic products and base metals' creates an additional demand of 248 thousand manats for 'Mining industry' products across the country.

This is due to the fact that the products of that field are used as intermediate products in the production of non-metallic products and base metals and in the production of other sectors from which it receives its intermediate products. The lowest price of impact was recorded in areas such as 'Education', 'Healthcare', 'Services of library, archive, museum and other cultural institutions', 'Social services', 'Rest, entertainment, art services', 'Public administration and defense', and the additional demand in these areas is less than 500 manats. Looking at the SAM-based multiplier model, we can see that for this sector also the result of this model is lower than the result of the io model (1.6 million manats). The reason for this is that this sector is highly dependent on imports.

Thus, the creation of an additional demand of 1 million manats for non-metallic products and base metals requires an increase of 1.3 million manats in the output of this field due to production relations. However, the result of the SAM-based model shows that this increase is 1.1 million manats. This means that the corresponding demand for the part that arose as a difference was due to the fact that imports exceeded exports and the value added rate was at a low level. For comparison, let's note that the rate of value added in the 'Mining' sector is 0.87, while in the Production of non-metallic products and base metals' sector it is 0.4.

Table 5. Multiplier effect of 1 million manat inverstment in Production of non-metallic products and base metals

Sectors	Change of output based on IO model, manat	Change in total demand based on SAM, thousand manat
Agriculture, forestry and fishing	5,04	42,76
Mining industry	248,17	93,55
Production of food, drinks and tobacco	0,53	29,36
Production of non-metallic products and base metals	1259,94	1125,75
Production of machinery, equipment, furniture	28,78	24,07
electricity, gas, steam	40,56	24,53
Water supply	0,90	1,10
Waste management	0,43	0,62
Construction	38,18	41,60
Trade and repair of transport uses	98,46	83,20
Transport and warehousing	70,13	53,77
Accommodation and catering for tourists	1,97	11,34
Information and communication	7,75	9,55
Financial intermediation, insurance and pension services	28,73	16,90
Real estate services	20,37	16,63
Research and development	2,24	0,95
Professional and technical activities	19,01	12,58
Administrative and ancillary services	12,27	6,45
public administration and defense	0,42	0,25
Education	0,07	4,80
Healtcare	0,17	2,05
social services	0,31	4,34
Services of library, archive, museum and other cultural institutions	0,00	0,27
Rest, entertaiment, art services	0,17	2,92
Other services	1,54	6,88
Total	**1886,14**	**1616,22**

Looking at the table, we can see that the demand of 1 million manats for the sector of 'Production of non-metallic products and base metals' creates an additional demand of 248 thousand manats for the 'Mining industry' due to production relations.

However, according to the SAM-based model, this demand is 93.6 thousand manats. This shows that more than half of the demand for intermediate products of the 'Mining industry' by the 'Production of non-metallic products and base metals' sector and by the sectors from which it receives intermediate products is covered by imported products. If we look at the sector of 'Agriculture, forestry and fishing', we can see that the demand for this sector due to production relations is 5 thousand manats, and the demand for the SAM-based model is 42.8 thousand manats. The reason for this increase is that the increase in the income of the population through the increase of the value added as a result of the increase in the production volume in all sectors to meet the demand for the 'Production of non-metallic products and base metals' sector increases the demand for the products of this sector. We can observe the same trend in the field of 'Production of food, drinks and tobacco', as well as in most service sectors. This means that the increase in population income is primarily spent on meeting the demand for the products of these areas.

Table 6 shows the multiplicative effects of an increase in demand of 1 million manats for the products of 'Production of machinery, equipment, and furniture'. Here, too, we observe the trend in other groups of the manufacturing industry. Thus, the additional demand caused by the 1 million investment due to production relations is 2.08 million manats, while according to the SAM-based model, this figure is much less - 1.3 million manats. The increase in this sector itself is 1.3 million manats due to production relations, and 1.1 million manats according to the SAM-based model. The 2nd sector where the highest growth due to iroduction relations is observed is the field of 'Professional and technical activities'. Although the demand for the products of this field is 215.5 thousand manats due to production relations, as a result of the payment of most of this demand by import, the SAM-based model shows a demand of only 42.3 thousand manats. The same trend is observed in 'Production of non-metallic products and base metals', which is the 3rd sector with the highest growth. Although the additional demand in this area according to the io model is 193.7 thousand manats, the SAM-based model shows an increase in demand of only 48.4 thousand manats. In the areas of 'Agriculture, forestry and fishing', 'Production of food, drinks and tobacco', 'Education', 'Healthcare', 'Social Services', 'Rest, entertainment, art services', the result of the SAM-based model is higher than that of the io model, which is due to the demand for the products of these areas due to the increase in value added.

Table 6. Multiplier effect of 1 million manat inverstment in Production of machinery, equipment, furniture

Sectors	Change of output based on IO model, manat	Change in total demand based on SAM, thousand manat
Agriculture, forestry and fishing	0,98	19,37
Mining industry	49,22	8,38
Production of food, drinks and tobacco	0,74	13,80
Production of non-metallic products and base metals	193,66	48,39
Production of machinery, equipment, furniture	1291,59	1061,85
electricity, gas, steam	21,05	8,15
Water supply	1,55	0,63
Waste management	0,63	0,32
Construction	53,95	20,96
Trade and repair of transport uses	65,95	33,69
Transport and warehousing	23,80	16,97
Accommodation and catering for tourists	6,55	5,88
Information and communication	32,51	7,84
Financial intermediation, insurance and pension services	48,13	9,82
Real estate services	24,03	8,28
Research and development	37,97	6,93
Professional and technical activities	215,50	42,26
Administrative and ancillary services	10,93	2,60
public administration and defense	0,77	0,14
Education	0,24	2,27
Healtcare	0,33	0,97
social services	0,48	2,07
Services of library, archive, museum and other cultural institutions	0,00	0,13
Rest, entertaiment, art services	0,29	1,38
Other services	2,05	3,26
Total	**2082,90**	**1326,32**

CONCLUSIONS

In the article, the multiplier effects of the country's mining industry and manufacturing industry were evaluated using the input-output model and the SAM-based multiplier model of the Azerbaijani economy. During the research, the manufacturing industry was divided into 'Production of food, drinks and tobacco', 'production of non-metallic products and base metals' and 'production of machinery, equipment and furniture' groups.

In the article, the demand created by the creation of an additional demand of 1 million manats for the products of each of these areas in these areas themselves, in other areas and in the country as a whole was evaluated. We can summarize the multipliers for the results of both models in the table below:

İndustries	**Input-output multiplier**	**SAM multiplier**
Mining industry	1.18	2.05
Production of food, drinks and tobacco	2.29	2.18
Production of non-metallic products and base metals	1.89	1.62
Production of machinery, equipment and furniture	2.08	1.33

As it can be seen, the investment of 1 million manats in the mining sector creates a demand of only 1.18 million manats due to production relations, which is due to the weak relations of this sector with other areas of the country's economy. However, the SAM-based model, showing the results of the increase in value added, shows that this increase in demand increases the total demand for the country by 2.05 million manats. Part of this increase was caused by another indirect way, that is, the transfer of a part of the revenues from the export of crude oil and gas in the mining industry to the state budget through the OF, and these expenses affected the increase in demand in other areas. Looking at the groups of the manufacturing industry, a high io multiplier is observed due to the connection of this sector with other areas of economic activity. However, in the SAM-based model, we see that this effect is reduced, which can be explained by the fact that the resulting effect disappears due to the fact that imports exceed exports and the value added rate is low. It seems that this problem is particularly deep in the field of production of machinery, equipment and furniture, which is related to the mentioned factors.

REFERENCES

Amin, V.C., 2002. Analysis of the results of measures implemented for the development of the non-oil industry in Azerbaijan. *Journal of Baku Engineering University*, *6*(2), p.139.

Antonopoulos R., Kim K., 2008. South Africa Scaling up the expanded public works programme: a social sector intervention proposal, research project No.34 – The impact of public employment guarantee Strategies on gender equality and pro-poor economic development, Annandale-on-Hudson, New York, 92 p.

Arif, N., 2016. Modern condition of industrial parks, industrial districts and technological parks in Azerbaijan. *Scientific Works/Elmi Eserler*, (1).

Bautista, R.M., Robinson, S. and El-Said, M., 1999. *Alternative industrial development paths for Indonesia: SAM and CGE analyses* (No. 607-2016-40276).

Benazzouz, N.M., 2018. Disruptive innovation: A historical review and recent developments. *Horyzonty Polityki*, *9*(29), pp.113-130.

Cahangirov, X., 2022. IV Problems and solutions of modernization of Azerbaijani industry on the eve of the industrial revolution: on the example of industrial parks. *Journal of Science & Innovative Technologies*, (23).

Chung, H., 2021. Adoption and development of the fourth industrial revolution technology: features and determinants. *Sustainability*, *13*(2), p.871.

Defourny, J., & Thorbecke, E. (1984). Structural path analysis and multiplier decomposition within a social accounting matrix framework. *The Economic Journal*, *94*(373), 111-136.

Fatah, L., 2008. The impacts of coal mining on the economy and environment of South Kalimantan Province, Indonesia. *ASEAN economic bulletin*, pp.85-98.

Garza-Gil, M.D., Surís-Regueiro, J.C. and Varela-Lafuente, M.M., 2017. Using input–output methods to assess the effects of fishing and aquaculture on a regional economy: The case of Galicia, Spain. *Marine Policy*, *85*, pp.48-53.

Gretton, P. On input-output tables: uses and abuses, Staff Research Note, Productivity Commission, Canberra, 2013, 28 p.

Guliyev, S.M. and Abutalibov, R., 2016. Improvement Directions of Food Industry of the Republic of Azerbaijan. *Available at SSRN 2743074*.

Hasanli, Y. (2011). Modeling of inter-sectoral relations of Azerbaijan's economy. Baku: Science.

Hasanli, Y. and Rahimli, G., 2023, August. General Equilibrium Models of Azerbaijan Economy: Conceptual View and Multiplier Effects. In *2023 5th International Conference on Problems of Cybernetics and Informatics (PCI)* (pp. 1-5). IEEE.

Kat, B., Paltsev, S. and Yuan, M., 2018. Turkish energy sector development and the Paris Agreement goals: A CGE model assessment. *Energy Policy*, *122*, pp.84-96.

Kyophilavong, P., 2016. Mining booms and growth in Laos–empirical result from CGE model. *International Journal of Development Issues*, *15*(1), pp.51-61.

Mainar-Causapé, A. J., Ferrari, E., & McDonald, S. (2018). Social accounting matrices: basic aspects and main steps for estimation. Publications Office of the European Union: Luxembourg.

Mustafaev, A.A. and Naydenov, N.D., 2021. Increasing the Multiplier Effect of the Agro-Industrial Complex in the Northern Region: New Guidelines for Strategic Development. *SOCIAL AND ECONOMIC DEVELOPMENT*, p.5.

Nejati, M. and Bahmani, M., 2020. The economic impacts of foreign direct investment in oil and gas sector: A CGE analysis for iranian economy. *Energy Strategy Reviews*, *32*, p.100579.

Rahimli, G. and Mammadova, N., 2022. Estimating multiplier effects of investment in healthcare. *9ROXPH*, p.393.

Rymarczyk, J., 2020. Technologies, opportunities and challenges of the industrial revolution 4.0: theoretical considerations. *Entrepreneurial business and economics review*, *8*(1), pp.185-198.

Sadik-Zada, E.R., Loewenstein, W. and Hasanli, Y., 2021. Production linkages and dynamic fiscal employment effects of the extractive industries: Input-output and nonlinear ARDL analyses of Azerbaijani economy. *Mineral Economics*, *34*, pp.3-18.

Schwab, K. The Fourth Industrial Revolution; World Economic Forum: Cologny, Switzerland, 2016

Yəhyayeva, A.Y., 2018. Azərbaycanda sənaye müəssisələrinin investisiya cəlbediciliyinin yüksəldilməsi istiqamətləri. *TURAN-SAM*, *10*(40), pp.242-247.

Zhang, Y., Diao, X., Chen, K.Z., Robinson, S. and Fan, S., 2020. Impact of COVID-19 on China's macroeconomy and agri-food system–an economy-wide multiplier model analysis. *China Agricultural Economic Review*, *12*(3), pp.387-407.

Murad Y. Yusifov, 2022. Econometric Assessment of Optimal Interest Burden: Case Study For Azerbaijan. *Journal of Economic Sciences: Theory And Practice*, V.79, # 2, pp. 19-36.

Orkhan Dadashov, 2023 The Effect of Foreign Direct Investment on Azerbaijan's Non-Oil GDP. *Journal of Economic Sciences: Theory And Practice*, V.80, # 1, pp. 94-105