

**REPUBLIC OF AZERBAIJAN**

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**ABSTRACT**

of the dissertation for the degree of Doctor of Philosophy

**DEVELOPMENT OF THE ASSESSMENT MODEL  
OF THE FACTORS AFFECTING THE GROWTH  
OF NON-OIL EXPORT**

Specialty: 5302.01 – Econometrics; economic statistics

Field of science: Economic sciences

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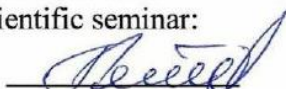
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## INTRODUCTION

**Relevance of the topic.** Global technological advances created by the 4th industrial revolution in the world have led to radical changes in the sectors of the economy. High technology has already become attractive to developing countries, that aim to produce high value-added goods and services to increase their share in exports. Therefore, it is necessary to increase the competitiveness of the Azerbaijani economy against the background of these global challenges, using the factor of oil and gas wealth, to ensure the creation of non-oil industry, especially on the basis of high technologies to increase its exports. This requires an assessment of the impact of domestic and international factors on increasing non-oil exports in our country and the creation of appropriate decision-making mechanisms.

The creation of a decision-making mechanism for the development of the non-oil sector in Azerbaijan and the increase of its exports is formed by assessing the impact factors and explaining the export process through selected priority factors. It is obvious that many international, regional, national, socio-cultural, political-economic and other factors influence local changes in the context of global changes. Thus, the large number of factors affecting the growth of non-oil exports, their different nature and inability to give a clear advantage to the impact, the inability to take into account the impact of all factors in the assessment process, be it measurable and other features greatly complicate the decision-making process. This indicates a clear need for a new approach.

In this regard, it is important to identify a set of potentially superior factors, evaluate their degree of priority, and, consequently, select a limited number of factors that are important for the decision-making mechanism.

Identification of the dominant factors influencing the growth of non-oil exports makes it possible to explain exports by a limited number of factors with a high impact. Selected high-impact factors allow more flexible analysis and calculation of medium-term and long-term forecast prices.

**Degree of development of the problem.** Analysis and forecasting models of the non-oil sector in Azerbaijan, especially

aimed at increasing its export potential, have been implemented at the macro-, meso- and micro-levels by the Ministry of Economy and the Central Bank of the Republic of Azerbaijan, mainly by their research institutions. Since 1998, international financial institutions such as TACIS, the International Monetary Fund, the World Bank, the Asian Development Bank, and SECO have supported this research by involving overseas experts.

Azerbaijan General Equilibrium Model (AzMOD) was created at the Institute for Scientific Research on Economic Reforms under the Ministry of Economy. The AzMOD model is important as a special modeling tool for assessing of the non-oil sector and its impact on export potential. However, the model is not sensitive to either multivariate analysis, or to regular variability.

At the same time, complex work has been done at the institute to assess the impact on non-oil exports by various authors: econometric models of the impact of the world oil prices on the non-oil sector and budget expenditures, the exchange rate of non-oil exports, its dependence on overseas direct investment and on other relevant factors and the impact of bank lending to the private sector on the non-oil sector have been established. The impact of foreign direct investment and remittances on the development of the non-oil sector was also modeled, and the impact of fiscal policy elements and micro-level factors on the non-oil sector, including non-oil exports, was studied. It should be noted that in the assessments conducted in these studies, the factors affecting non-oil exports were not selected on the basis of a special approach, they were identified and considered separately according to the used standard models.

The Central Bank Research Department has created a Dynamic Stochastic General Equilibrium (DSGE) model to monitor the country's economic development. Relevant sub-models developed by various authors allow to address issues such as inflation forecasting, stress testing, analysis of the commercial and non-commercial sector, determining the equilibrium price of real estate and the real effective exchange rate of manat, economic development trends, especially the impact of foreign direct investment on non-oil exports. However, these models do not allow to implement multi-factor analysis and forecasting of non-oil exports.

These studies mainly contribute to the development of the non-oil sector, in particular the study of its export potential, and show that there are different factors and it is important to take them into account. However, it does not allow for a multifactor analysis of the factors affecting non-oil sector and selection of factors with a dominant impact.

**Goals and objectives of the study.** The purpose of the study is to identify and classify a set of factors affecting non-oil exports in Azerbaijan, to select the factors that have a significant impact in multi-criteria, to develop models of econometric analysis and to build a multinational export forecast model based on it.

To achieve the set goal, the dissertation provides tasks for solving the following issues:

1. research and classification of factors affecting non-oil exports in the experience of countries rich in natural resources and in scientific sources;
2. development of a calculation procedure to assess the importance of factors affecting non-oil exports;
3. to identify the main factors that increase Azerbaijan's non-oil exports and to rank them by priority;
4. to identify a limited number of priority factors affecting non-oil exports;
5. forming and initial processing of time series on selected superior factors for non-oil exports;
6. development of a model of econometric analysis of non-oil exports for the medium term, taking into account the impact of technological progress;
7. building of a forecast model for non-oil exports.

**Research methods.** The dissertation is based on official statistics of the State Statistics and State Customs of the Republic of Azerbaijan, the Central Bank, the Ministry of Economy, Institute for Scientific Research on Economic Reforms, OPEC, World Bank, UNSTAD Comtrade reports and materials obtained from official internet portals, as well as other sources related to the topic.

The study used expert and hierarchical estimation methods, fuzzy set theory, econometric analysis methods, as well as calculations in MS Excel, Python (Spyder), EViews software packages.

**Main provisions of the defense.** The following main provisions are defended in the research work:

- identification of a set of factors affecting non-oil exports and their classification;
- assessment of the importance of the factors affecting non-oil exports on the basis of multi-criteria;
- ranking of factors affecting non-oil exports according to their dominance and identification of a limited number of factors with priority advantage;
- econometric analysis of non-oil exports based on the selected group of factors and building of medium-term forecast models;
- development of a model for assessing the impact of technological progress on increasing non-oil exports;
- identification of areas of non-oil exports that need more promotion and support through impact factors;
- development of a multifaceted decision-making mechanism to increase non-oil exports in the country.

**Scientific novelty of the research.** The following results of scientific innovation were obtained in the research work:

- a new approach has been introduced to identify the factors affecting non-oil exports and to assess the impact factors in the fuzzy environment created by the multi-criteria;
- based on the formation of expert opinions, the factors affecting non-oil exports are ranked according to their degree of priority and the group with the most dominant factors was identified that can explain the export process;
- an econometric analysis of exports, medium-term and long-term forecasting models have been developed taking into account the impact of technological progress for Azerbaijan's non-oil export for the six largest export partners based on a group of selected factors;
- taking into account the impact of technological progress, a methodological approach was developed to develop appropriate scenarios and policy solutions to increase Azerbaijan's non-oil exports.

**Theoretical significance of the research.** The theoretical significance of the research is the development of proposed and

specially developed methodological approaches, econometric models and decision-making mechanisms. First of all, the selection of alternatives in the fuzzy conditions formed on the basis of multi-criteria, expert assessments on comparative advantage, building of econometric analysis and forecasting models taking into account the effects of technological progress and finally development of decision-making mechanisms are of special theoretical importance.

**Practical significance of the research.** The practical significance of the research is that its results are directly aimed at promoting, supporting and forecasting non-oil exports in Azerbaijan. Thus, the identification of the selected factors in the research by experts with direct practical experience, taking into account the impact of the industry based on innovative and new technologies implemented in the country since 2010 is of practical importance, it is also important to include in the analysis and forecasting model the impact of partner countries such as Turkey, Russia, China Italy, Georgia and Switzerland with a high share in non-oil exports.

The results of the research work were used in the research carried out by the Institute for Scientific Research on Economic Reforms under the Ministry of Economy of the Republic of Azerbaijan to increase the non-oil industry, especially its exports.

Methodological approaches proposed in the framework of the research development of scenarios to increase non-oil exports of Azerbaijan, strategic goals, as well as practical proposals to increase the efficiency of exports to support agencies in this area, can be used for developing a scientific-methodological and practical tool for stakeholders in this direction.

**Approbation and application of the research work.** In total, on the dissertation work 4 theses were presented at international and local scientific-practical conferences and 11 articles, including 4 articles and 1 thesis were published in abroad.

As well as, the research project on the dissertation work of “Modeling of factors affecting the promotion of non-oil exports, preparation of proposals and recommendations,” which was realized on the scientific field of “Humanities and social Sciences-Mathematical and Instrumental Methods of Economics” in the

framework of the 3rd Grant Competition for Young Scientists and Specialists (EIF/GAM-3-2014-6(21)) funded by the Science Development Foundation under the President of the Republic of Azerbaijan was realized in 2016.

As well as, the work done under the KIEP Visiting Fellows Program at the South Korean Institute of Foreign Economic Policy in 2012 was described in the article “Accession to the WTO: the case of Azerbaijan”.

Joint research work on “Agricultural Trade and Foreign Investment for Regional Integration in the Caucasus and Central Asia” at the Leibniz Institute of Agricultural Development in Transition Economies in Germany in 2018 with financial support from the German Scientific Exchange Service (DAAD) was carried out by partners.

According to the institute research work plans for 2012-2020 the following works as “Initial study of e-commerce models on increasing of non-oil exports in Azerbaijan”, “Non-oil sector development, including initial development of decision-making models to increase its export potential”, “Non-oil sector development, including development models on increasing the sector export potential”, “Submission of substantiated proposals on increasing and diversification of non-oil export” were done on the topic of dissertation.

**Name of the organization where the dissertation work was carried out.** The dissertation work was carried out at the Institute for Scientific Research on Economic Reforms under the Ministry of Economy of the Republic of Azerbaijan.

**The total volume of the dissertation with a sign, indicating the volume of the structural units of the dissertation separately.**

Dissertation work consists of a total of 135 pages: a title page - 1 page, table of contents - 1 page (1704 characters), introduction - 7 pages (12385 characters), chapter 1 - 34 pages (73637 characters), chapter 2 – 38 pages (75107 characters), chapter 3 - 31 pages (50642 characters), main results - 3 pages (5473 characters), bibliography of 118 titles - 15 pages (20293 characters). The volume of the dissertation is 204420 characters with the exception of 4 figures, 16 tables, 2 graphs, bibliography and appendix used in the dissertation.



## CONTENT OF THE DISSERTATION

**The Introduction** substantiates the relevance of the topic, the level of the problem study, goals and objectives, the main provisions of the defense, theoretical and methodological bases and methods, scientific innovations and practical significance.

In the first chapter of the dissertation, entitled “**Theoretical and methodological bases of increasing of non-oil exports**”, development of non-oil sector, especially theoretical and methodological bases of export diversification, assessment of factors affecting the increase of non-oil exports and the experience of countries in eliminating dependence on export of a single natural resource were studied.

The analysis of countries rich in natural resources shows that the vast majority of these countries, along with the fight against global problems caused by wealth, have different characteristics in economic development. It is here that an important point for each country is not only the goal of development, but also the emergence of sustainable competitiveness that can be formed in a dynamic and long-term period. Thus, the main way out of the problem is to create (i) a stability fund (savings funds, long-term planning), (ii) the economy and liberalization and diversification of foreign trade; (iii) it is recommended that transparency should be made a priority, emphasizing that non-oil export diversification is an important and inevitable step.

The experience of Australia, Canada, Malaysia, Norway, Saudi Arabia, Russia and Kazakhstan as oil exporters was considered in terms of the development of the non-oil sector, especially in terms of increasing exports. The analysis shows that it is impossible to increase non-oil exports only due to successful macroeconomic indicators. To this end, increasing non-oil exports, reducing oil dependence, building a trade-oriented ecosystem in general, increasing foreign confidence, determining the competitiveness of non-oil sectors, strengthening capacity, analyzing the factors influencing export growth and improving them in a balanced and coordinated manner requires the implementation of policies and mechanisms.

The second chapter of the dissertation, entitled “**Study of factors affecting the growth of non-oil exports in Azerbaijan**”, first of all, considers the factors affecting the development of the non-oil sector in Azerbaijan, especially its export potential, and classifies the factors:

- the current situation of the non-oil sector has been studied in detail by areas of economic activity and current trends have been shown;
- the main indicators of non-oil exports were analyzed in terms of goods and services, as well as the geographical structure: macro-, meso- and micro-levels of harmful indicators for 1995-2020 were analyzed and summarized;
- the essence and goals of the current economic policy to increase non-oil exports such as product promotion, organization of export mission, research and marketing of foreign markets, support for local companies, e-commerce, licenses and permits, export promotion and dozens of other supporting policy documents (concepts, government programs, strategies, etc.) and relevant targets, features of their implementation were investigated;
- the work on development of researches related to the continuous support of small and medium-sized enterprises in increasing of non-oil exports in Azerbaijan, creating an institutional structure to support these entrepreneurs, establishing business relations with foreign partners, stimulation of local and foreign investments aimed at regional development, cooperation between state and private sectors was carried out.

The results of these studies show that the development of the non-oil sector, and in particular the increase in export potential, is influenced by many factors of different nature, and the levels of impact of these factors, the characteristics of explaining exports are quite different. In order to increase non-oil exports, it is important to assess the characteristics and impact advantages of each of the factors considered, as well as their classification priority, in order to make right decisions in policy, especially institutional, governance and regulatory reforms.

It should be noted that the identification of factors affecting non-oil exports is based on the assessment of relevant expert opinions on the comparison of factors. Such an assessment creates a fuzzy situation

in a multi-criteria environment. Therefore, when analyzing the impact based on the linguistic opinions of experts, fuzzy logic methods were used to assess the impact. A fuzzy methodological approach to assessment is given below.

Initially, the analysis determines the set of possible factors (n number)  $F = \{F_1, F_1, \dots, F_n\}$  that affect the changes in non-oil exports. The goal is to select the group of factors that have the greatest impact on the change in non-oil exports from the identified factors.

The selection of fuzzy sets is made in the form

$$U = \{\mu_u(F_1)/F_1; \mu_u(F_2)/F_2 \dots; \mu_u(F_n)/F_n\}$$

Here  $\mu_u(F_i) - F_i$  is a function of factor  $F_i$  belonging to the set  $U \rightarrow [0,1]$  and characterizes the degree of influence of factor  $F_i$  on changes in non-oil exports. Equality is provided for all factors:  $\sum_{i=1}^n \mu_u(F_i) = 1$ .

One of the most perfect methods used to determine the degree of influence of factors is to rank the factors according to the degree of influence with the participation of experts. When applying this method, the expert can evaluate with linguistic expressions to form comparisons. That is, during the comparison, “equal impact”, “low impact”, “medium impact”, “high impact” or “equal advantage”, “low advantage”, “medium advantage”, “high priority” or “important”, linguistic expressions such as “less important”, “moderately important”, “highly important” are used. The application of these expressions provides some flexibility for the expert to make a comparative assessment. However, in the fuzzy conditions created by this multi-criterion, there are substantial difficulties due to the lack of additional numerical values.

To overcome this difficulty, each of these linguistic comparative expressions of experts is evaluated in a natural ordinary value, and for this purpose the comparison Scale given by Thomas Saaty <sup>1</sup> is used (Table 1).

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<sup>1</sup> Т. Саати. Принятие решений. Метод анализа иерархий. - М.: Радио и связь, - 1993, - 278 с

**Table 1. Comparison Scale**

The relationship between $F_i$ , $F_j$ factors	Points	Explaining
The importance of $F_i$ and $F_j$ factors is the same	1	The expert has ground to believe that the effect of factors is equal
$F_i$ is relatively important than $F_j$	3	The expert gives less preference to one factor over another in terms of experience and logical judgment
$F_i$ is important than $F_j$	5	The expert sees clear advantage of one factor over another in terms of experience and logics
$F_i$ is significantly more important than $F_j$	7	The expert gives one of the factors a more important advantage than the other, the result of which is of practical importance.
$F_i$ is absolutely important than $F_j$	9	The expert has a high preference for one factor over the other, which results in the strongest evidence
Used like intermediate points	2,4,6,8	During each assessment, the expert uses them as intermediate grades and makes the assessment more objective

*Source: compiled on the basis of the Saaty's Scale.*

As noted, experts are offered a scale of considerations for comparison. Based on the Scale, each expert evaluates the degree of preference of factor  $i$  over factor  $j$ . Using this Scale, feedback on the comparisons of factors is transferred to quantitative indicators in such a way that the measurements are made on a relative Scale. One of the necessary conditions here is that each expert can give only one measurable value estimate of factors  $i$  and  $j$  from the set of factors  $U$ . Let us denote the evaluation by the factor  $a_{ij}$  which shows that the

factor  $F_i$  is more important than the factor  $F_{-j}$ . When comparing factor  $j$  with factor  $i$ , the principle of inverse proportionality is adopted, ie  $a_{ij} = 1/a_{ji}$ . Based on the comparison of factors, the matrix  $A = \|a_{i,j}\|_{i=1,n;j=1,n}$  is constructed for each factor (explanatory factor) of non-oil exports.

Initially, the eigenvalues of the matrix  $A(\lambda_1, \dots, \lambda_n)$  are calculated and the maximum eigenvalue is determined ( $\lambda_{\max} \geq n$ ).

Then the eigenvector of the matrix is calculated according to the maximum eigenvalue -  $(v_1, \dots, v_n)$ , where  $\sum_{i=1}^n v_i = 1$ . The values of the calculated specific vectors -  $v_i, i = \overline{1, n}$  are taken as the degree of influence of the factor  $F_{-i}$  on non-oil exports:  $\mu_u(F_i) = v_i, i = \overline{1, n}$

It should be noted that the difference between the maximum specific value and the number  $n$  indicates a discrepancy in the evaluation of the elements of the matrix  $A$  by experts and makes it necessary to reconsider them. On the other hand, if it is a quantity  $\lambda_{\max}$  closer to  $n$ , then the specific vector normalized to the unit can be taken as the degree of influence of the factors.

The defined specific vectors are adjusted according to their maximum values and the priority levels (importance level) of the factors affecting the exports of the non-oil sector are adjusted according to the relative size of the corresponding eigenvector.

Thus, in accordance with the fuzzy logic methodology outlined above, an expert group of specialists in the field was formed to determine the comparative predominant factors influencing the increase of non-oil exports according to the Saaty's Scale and to compile an appropriate matrix.

Out of the 49 factors initially identified by the experts, 20 factors were selected as a result of a comparative advantage assessment. Assessments of 20 factors selected on the basis of observations were presented to a total of 8 experts. The predominance of factors is determined according to the algorithm for estimating the eigenvalues and eigenvectors of the matrix compiled in accordance with the methodology. For each expert, the discovery of eigenvalues and

eigenvectors of the matrix was evaluated using Python (Spyder) software based on the matrices processed in MS Excel (Table 2).

As can be seen from Table 2, the assessment of the comparative advantage of 20 factors indicates a low level of expertise. Thus, the difference between the eigenvalue and 20 traces of the matrix  $\lambda_{\max}$  is more than 30%. Based on the results obtained, it was difficult to determine the relative advantage, and therefore the factors were given low priority. Thus, the analysis showed that although experts were competent in their work, in the first half of the year there was a relatively careful approach to the selection of factors, however, lots of factors made it difficult to assess their advantages.

The number of factors has been reduced to make the selection process more efficient. Thus, as a result of the analysis of the obtained results and repeated interviews with experts, 10 factors affecting non-oil exports were selected.

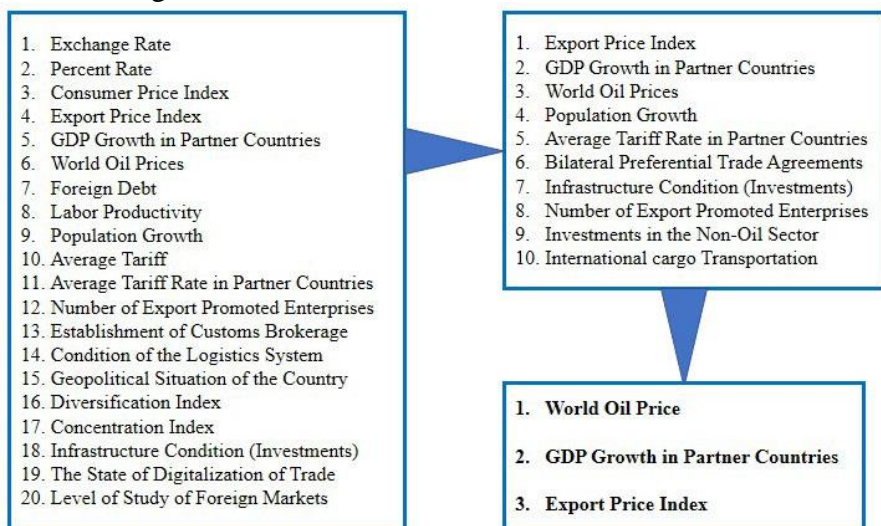
**Table 2. Eigenvalues and correspondence of experts**

Experts	For 20 factors				For 10 factors			
	$\lambda_{\max}$	$n$	$\lambda_{\max} - n$		$\lambda_{\max}$	$n$	$\lambda_{\max} - n$	
Expert (1)	28.88	20	8.88	31%	12.59	10	2.59	21%
Expert (2)	30.14	20	10.14	34%	12.15	10	2.15	18%
Expert (3)	26.25	20	6.25	24%	13.32	10	3.32	25%
Expert (4)	28.85	20	8.85	31%	12.30	10	2.30	19%
Expert (5)	31.33	20	11.33	36%	11.94	10	1.94	16%
Expert (6)	23.98	20	3.98	17%	11.92	10	1.92	16%
Expert (7)	29.20	20	9.20	32%	11.99	10	1.99	17%
Expert (8)	31.73	20	11.73	37%	12.04	10	2.04	17%

*Source: the Python software package is based on the results of the implementation of a fuzzy methodological approach.*

For the 10 selected factors, an expert assessment was conducted in the same sequence as in the above approach. As can be seen from Table 2, the assessment of the comparative advantage of the 10 factors shows that the coherence of the experts is high, the difference between the eigenvalue and the 10 eigenvalues of the matrix  $\lambda_{\max}$  is generally less than 20%. This shows the adequacy of the experts and the reliability of the results, and the results are given in Table 2.

Finally, processing the results identified three factors that have the highest impact on increasing non-oil exports: World Oil Prices (0.68); GDP growth in partner countries (0.66); Export Price Index (0.64). The selection process is schematically shown in Figure 1. The selection process of the dominant group of factors influencing the increase of Azerbaijan's non-oil exports on the basis of the presented fuzzy approach, formed on the basis of multi-criteria, is schematically shown in Figure 1.



**Figure 1. Selection of impact factors by stages**

*Source: compiled based on expert comparisons and the results of a fuzzy methodological approach*

In the third chapter of the dissertation entitled “**Multifactorial assessment and forecasting of non-oil exports**”, an econometric assessment of the export of the non-oil sector in Azerbaijan was conducted on the basis of three selected factors and for 2027 was given.

Initially, the export price index selected on the basis of the above new methodology, GDP growth in partner countries and the impact of world oil price factors on non-oil exports were analyzed econometrically.

Econometric assessment was conducted on the basis of multiplicative models in the usual form (option 1) and in two options, taking into account the obvious impact of technological progress (option 2):

Option 1:

$$\begin{aligned} noil\_ex &= a \cdot exp\_in^\alpha \cdot oil\_pr^\beta \cdot pgdp^\gamma \\ \log(noil\_ex) &= c + \alpha \cdot exp\_in + \beta \cdot oil\_pr \end{aligned} \quad (1)$$

Option 2:

$$\begin{aligned} noil\_ex &= a \cdot exp\_in^\alpha \cdot oil\_pr^\beta \cdot pgdp^\gamma \cdot exp(\lambda \cdot t) \\ \log(noil\_ex) &= c + \alpha \cdot exp\_in + \beta \cdot oil\_pr + \gamma \cdot pgdp + \lambda \cdot t \end{aligned} \quad (2)$$

Here,  $exp\_in$  is the export price index,  $oil\_pr$  is the world market price of oil,  $pgdp$  is the volume (growth) of GDP for partner countries,  $exp(\lambda \cdot t)$  is the limit of technological progress,  $c = exp(a)$ .

The analyzes show that, as export partners, Russia, Turkey, Italy, Switzerland, Georgia and China have the largest share in exports. Therefore, the calculations show the GDP of the countries that have a major share in non-oil exports: Russia, Turkey, Italy, Switzerland, Georgia, Italy and China:

$$pgdp = \{ru\_gdp, tr\_gdp, ge\_gdp, sw\_gdp, it\_gdp, ch\_gdp\} \quad (3)$$

It should be noted that the establishment of short-term forecasting models and short-term monitoring of the economy requires reliable monthly and quarterly data. Obviously, it is practically impossible to obtain such information. Therefore, as can be seen in the



building a predictive model, annual data are used, which allows the forecast model to explain more medium-term processes.

It should also be noted that in the first years of independence, there was a sharp decline in non-oil exports. It can be said that the formation of non-oil exports began in the early 2000s, and the information was presented in 2001. At the same time, all sources claim that the chronology of non-oil export data is more reliable based on the sources of 2000. At the same time, as noted, it is difficult to see complete monotony in the growth rate of non-oil exports. This is due to structural changes in the country and the beginning and continuation of industrial reforms based on innovative high technologies. When creating model it would be more efficient to conduct additional research in this direction. However, the results obtained in the analysis of time series show that they are important, first of all, in building corresponding models.

As already noted, the relationship between the indicators is based on their logarithms. So, in the EViews 9.0 software package, an econometric analysis of medium-term dependencies between the logarithms of indicators was performed. The results of the assessment are presented in Table 3 for each partner country based on the required statistical parameters. The table shows the estimated coefficients of the explanatory variables and the corresponding probabilities, R-squared, Durbin-Watson statistics for each country.

It should be noted that one of the main factors affecting non-oil exports today is the conditions created by the use of high technologies. If we consider it as technical progress, it can be assumed that the impact of this indicator is different for different countries. Of course, this depends on the level of technological progress in the partner countries themselves. Therefore, econometric assessments were carried out in two versions, without taking into account and with taking into account the direct impact of technical progress. It should be noted that the impact of technological progress is taken into account by the limit  $\exp(\lambda \cdot t)$ .

We interpret the results of the econometric analysis separately for six partner countries with a high share in our country's non-oil exports.

**Table 3. Results of the analysis for partner countries**

Explanatory variables	Option 1	Option 2	Option 1	Option 2
	<b>Turkey</b>		<b>Russia</b>	
<i>log(exp_in)</i>	0.309759	-0.141821	-0.119846	-0.111658
<i>log(oil_pr)</i>	0.033767	0.257041	-0.435862	-0.399991
<i>log(tr_gdp)</i>	1.183812	0.968258	1.397275	1.352715
<i>T</i>		0.028358		0.002080
<i>C</i>	-2.227061	-56.74525	-0.656130	-4.704827
<i>r-squared</i>	0.928053	0.939197	0.923934	0.923957
Durbin-Watson	0.531318	0.547943	0.681157	0.673192
	<b>China</b>		<b>Italy</b>	
<i>log(exp_in)</i>	0.935229	1.412252	1.451221	-0.359713
<i>log(oil_pr)</i>	0.415041	0.827691	-0.057847	0.178137
<i>log(ch_gdp)</i>	0.258624	-1.540146	1.468459	2.207871
<i>T</i>		0.217066		0.064173
<i>C</i>	-1.155177	-425.8732	-10.41319	-137.9150
<i>r-squared</i>	0.892434	0.947479	0.904141	0.963085
Durbin-Watson	0.534128	1.025396	0.689770	1.813710
	<b>Switzerland</b>		<b>Georgia</b>	
<i>log(exp_in)</i>	0.481469	0.500342	0.176821	0.433601
<i>log(oil_pr)</i>	0.327767	0.478419	0.220204	0.440798
<i>log(sw_gdp)</i>	1.202517	0.525505	0.850307	0.323747
<i>T</i>		0.028368		0.029345
<i>C</i>	-4.123652	-57.59015	3.235697	-56.55863
<i>r-squared</i>	0.908317	0.911539	0.908785	0.910713
Durbin-Watson	0.555951	0.576705	0.563724	0.591597

Source: compiled based on the results of econometric assessment in the EVIEWS 9.0 software package.

The export price index for partner countries, the world oil prices and the interpretation of the impact of GDP of partner countries' on Azerbaijan's non-oil exports using econometric analysis models are given below.

Under stable conditions, the increase in the Export Price Index (EXP\_IN) by 1% in line with Azerbaijan's real non-oil exports increases by 0.309% (taking into account the influence of Turkey), 0.935% (China), 1.451% (Italy), 0.481% (Switzerland), 0.177% (Georgia) and decreased 0.120% (Russia). Also, the increase in the World Oil Price (OIL\_PR) by 1% in line with Azerbaijan's real non-oil export increase by 0.034% (including Turkey), 0.415% (China), 0.328% (Switzerland), 0.220% (Georgia) and respectively, decrease by 0.436% (Russia) and 0.058% (Italy). Following the assessment, the increase in the GDP growth in partner countries by 1% in line with Azerbaijan's real non-oil exports increases 1.183% (taking into account the influence of Turkey), 1.397% (Russia), 0.259% (China), 468% (Italy), 1.203% (Switzerland), and 0.850% (Georgia).

Accounting the impact of technological progress creates qualitative and quantitative changes. Thus, under the same stable conditions, an increase in the Export Price Index (EXP\_IN) by 1% increased Azerbaijan's real non-oil exports by 1.412% (China), 0.500% (Switzerland), 0.434% (Georgia) and 0.142% (Turkey), and decreased by 0.112% (Russia), 0.360% (Italy). Also, a 1% increase in World Oil Prices (OIL\_PR) increased Azerbaijan's real non-oil exports by 0.257% (Turkey), 0.828% (China), 0.178% (Italy), 0.478% (Switzerland) and respectively, 0.441% (Georgia), 0.400% (Russia). Under the same conditions, the 1% increase in GDP of export partner countries increased Azerbaijan's real non-oil exports by 0.968% (Turkey), 1.352% (Russia), 2.208% (Italy), 0.526% (Switzerland), 0.324% (Georgia), and decreased by 1.540% (China).

The above econometric analysis models were used as the basis for the development of a multinational forecast model for Azerbaijan's non-oil exports. Therefore, the established econometric analysis models are used to forecast non-oil exports based on selected explanatory factors.

The complex econometric analysis showed that the impact of GDP growth in Switzerland and Georgia as export partners is not statistically significant. Thus, given the share and importance of our country in non-oil exports, it makes more sense not to take into account the influence of Switzerland and Georgia as partner countries in building an economic forecast model. Therefore, given the economic importance of Azerbaijan in non-oil exports, as well as the high role of our country in the import process, it is more expedient to look at the influence of China, Russia, Turkey and Italy as partner countries to build a forecast model.

Taking this into account all-mentioned, in order to build a forecast model for Azerbaijan's non-oil exports, the impact of the GDPs of China, Italy, Turkey and Russia as export partner countries was considered together and the forecast for 2027 was given. Thus, the forecast model of Azerbaijan's non-oil exports in the EViews 9.0 statistical software package is based on changes in the export price index, world oil prices, GDP of China, Russia, Turkey and Italy as partner countries:

$$\begin{aligned} \text{LOG}(\text{NOIL\_EX}) = & -0.531*\text{LOG}(\text{OIL\_PR}) - \\ & - 0.785*\text{LOG}(\text{EXP\_ID}) + 0.211*\text{LOG}(\text{CH\_GDP}) + \\ & + 1.946*\text{LOG}(\text{IT\_GDP}) + 0.201*\text{LOG}(\text{TR\_GDP}) + \\ & + 0.853*\text{LOG}(\text{RU\_GDP}) - 11.294 \end{aligned} \quad (4)$$

$$\text{R-squared} = 0.960; \text{Durbin-Watson stat} = 1.617$$

The forecast model (4) based on the impact of GDP growth on China, Italy, Russia and Turkey as major export partners (4) is a model of sufficient adequacy and statistical significance for the growth of Azerbaijan's non-oil sector.

The proposed forecast model allows for certain scenarios in the process of developing policy decisions to increase non-oil exports in Azerbaijan, both in terms of changes in world oil prices and the pace of economic development in exporting partner countries. Improving the accuracy of forecasts based on this model requires, first of all, constant monitoring of the economic development of China, Italy, Russia and Turkey as partner countries. On the other hand, one

should always keep in mind the use of high technologies in the development of the non-oil sector in our country. Thus, the analysis and assessments for the forecast model dictate the importance of the application of high technological progress in the non-oil exports of Azerbaijan to China and Italy as key partners. This partly applies to the Turkish market, while the Russian market is not yet sensitive to the consequences of high technological progress. However, the development of today's high-tech industry, of course, determines the development of innovative non-oil industry in Azerbaijan.

## CONCLUSION

### **The following results were obtained in the dissertation:**

As part of the study, comprehensive work was carried out to develop the non-oil sector of Azerbaijan in a multi-criteria environment, in particular, the study of factors affecting the increase in its export potential, the identification of priority factors, the development of multinational models of econometric analysis and export forecasting.

The following important results have been achieved:

1. the experience of oil exporting countries has shown that the factors influencing the development of the non-oil sector of Azerbaijan and the increase in exports have certain differences compared to other oil-rich countries, both in terms of assortment and classification, and in terms of the degree of impact. Based on the experience of the country, the results of research and econometric analysis at the initial stage, 49 factors were identified that affect the growth of non-primary exports, which were classified into groups of macroeconomic, economic development and other factors. With this in mind, an expert group was formed to select factors influencing the development of the country's non-oil sector, especially its exports. Based on the analysis and expert observations, 20 factors have been identified that have a high impact on the increase in non-oil exports at the next stage in accordance with the current economic situation in Azerbaijan;

2. it has been pointed out that the priority factors of the factors influencing the increase of non-oil exports of Azerbaijan are different and the process of selecting a limited number of factors with a dominant effect makes it necessary to make decisions on the basis of multi-criteria in fuzzy conditions. Thus, on the basis of fuzzy logic, a methodological approach has been developed to assess the prevalence of factors affecting non-oil exports, rank them by priority, and select a limited number of high-priority factors;

3. based on the proposed fuzzy approach selective assessments of each expert on the basis of comparative advantage of each expert on the identified factors are analytically summarized. As a result, three priority factors were selected that affect Azerbaijan's non-oil exports and are able to fully explain the changes in the export process: (1) world oil prices (0.68), (2) GDP growth in partner countries (0.66) and (3) the Export Price Index (0.64);

4. selected factors - world oil price, export price index and trends of GDP growth of China, Russia, Turkey, Italy, Switzerland and Georgia as partner countries were analyzed as explanatory variables. Based on the above explanatory indicators, a three-factor multiplier econometric analysis model of increasing Azerbaijan's non-oil exports was developed in two variants, taking into account the effects of innovative high technologies (technological progress) on exports to each of the exporting partner countries. The effect of technological progress is exponentially considered in the model -  $\exp(\lambda \cdot t)$ ;

5. an econometric analysis has shown that the role of high technologies in increasing Azerbaijan's non-oil exports is great, and it is necessary to take into account sensitivity of the markets of goods and services of those countries to the impact of high technologies must be taken into account when offered to the markets of exporting countries. Calculations show that China's market for goods and services as an export partner country is very sensitive to the impact of technological progress ( $\lambda = 0.217$ ) and requires high-tech goods and services. At the same time, as an

export partner country, the Italian market for goods and services is relatively sensitive to the impact of technological progress ( $\lambda = 0.064$ ). The markets for goods and services in Turkey, Switzerland and Georgia are weak and have the same sensitivity to the impact of technological progress (respectively  $\lambda = 0.028, 0.029, 0.028$ ). Russia, one of the largest export partners, is very sensitive to the impact of technological progress on the market of goods and services ( $\lambda = 0.002$ );

6. econometric analysis of the combined effects of GDP growth of all export partner countries shows that the influence of China, Russia, Turkey and Italy, the four export partners, is statistically higher in increasing Azerbaijan's non-oil exports, while the influence of other countries Switzerland and Georgia is relatively weak. Taking into account the above, the contribution of the GDP growth of China, Russia, Turkey and Italy as export partners to the construction of a forecast model covering the medium and long term of each of them was econometrically analyzed. The results show that Italy has the largest contribution to Azerbaijan's non-oil exports among its export partners. Thus, an increase in Italy's GDP (IT\_GDP) by 1% as an export partner country under stable conditions ensures an increase in non-oil exports of our country by 1.81%;

7. a medium-term and long-term forecast model for increasing Azerbaijan's non-oil exports has been developed, taking into account the world market price of oil, joint consideration of the GDP of the main export partners of China, Italy, Russia and Turkey, and the export price index. The created forecast model has a high statistical significance, the explanatory variables form an integral system, the positive contributions of exporting partner countries to the country's non-oil exports have been identified, and a forecast for the period up to 2027 has been built on the basis of the model.

8. a methodological approach to making decisions on increasing non-oil exports is proposed, which allows assessing the significance of factors affecting exports, identifying a limited number of factors that have the greatest impact, and on this basis, analyze and forecast

exports. The proposed approach requires regular monitoring of the economic development of China, Italy, Russia and Turkey as export partners, as well as fluctuations in world oil prices, in order to develop policy solutions to increase non-oil exports in Azerbaijan and develop specific scenarios.

**The following scientific articles and theses on the main scientific results of the dissertation were published:**

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