EMPIRICAL ASSESSMENT OF THE IMPACT OF THE NON-FINANCIAL SECTOR ON THE FINANCIAL SECTOR IN THE AZERBAIJANI ECONOMY BASED ON THE LEONTIEF INPUT–OUTPUT MODEL

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Abstract

This paper analyzes intersectoral linkages within the Azerbaijani economy and examines the impact of the non-financial sector on the financial sector through price and value-added transmission channels. Using the Leontief input–output model, intersectoral interdependencies are modeled, and the effects of structural and value-added changes in the non-financial sector (real sector) on the equilibrium state of the financial sector are evaluated. Empirical simulation results based on intersectoral balance tables indicate that a 10% increase in the value-added coefficient of the non-financial sector raises equilibrium prices in the financial sector by 1.54% in financial services, 1.82% in insurance and pension services (excluding compulsory social security), and 2.22% in auxiliary activities supporting financial and insurance services. Furthermore, a 10% increase in the final output of the non-financial sector increases total output in the financial sector by 7.53%, 9.02%, and 7.93%, respectively. These findings demonstrate strong transmission linkages between the non-financial and financial sectors, highlighting that the Leontief model allows for a quantitative assessment of these interdependencies and an analysis of the mechanisms of price and value-added transmission.

Keywords: *Leontief model, input–output analysis, value-added transmission, financial sector, equilibrium prices.*

AZƏRBAYCAN İQTİSADİYYATINDA QEYRİ-MALİYYƏ SEKTORUNUN MALİYYƏ SEKTORUNA TƏSİRİNİN LEONTYEV XƏRCLƏR–BURAXILIŞ MODELİ ƏSASINDA EMPİRİK QİYMƏTLƏNDİRİLMƏSİ

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Xülasə

Bu məqalə Azərbaycan iqtisadiyyatında sektorlararası əlaqələri təhlil edir və qeyri-maliyyə sektorunun maliyyə sektoruna təsirini qiymət və əlavə dəyər transmissiya kanalları vasitəsilə araşdırır. Leontyevin xərclər–buraxılış modeli əsasında sektor-lararası qarşılıqlı asılılıqlar modelləşdirilmiş və qeyri-maliyyə sektorunda (real sektorda) baş verən struktur və əlavə dəyər dəyişikliklərinin maliyyə sektorunun tarazlıq vəziyyətinə təsiri qiymətləndirilmişdir. Sahələrarası balans cədvəllərinə əsaslanan empirik simulyasiya nəticələri göstərir ki, qeyri-maliyyə sektorunda əlavə dəyər normasının 10% artması maliyyə sektorunun tarazlıq qiymətlərini maliyyə xidmətlərində 1,54%, sığorta və pensiya xidmətlərində (məcburi sosial təminat istisna olmaqla) 1,82%, maliyyə və sığorta xidmətlərinə yardımçı sahələrdə isə 2,22% artırır. Həmçinin, qeyri-maliyyə sektorunun son məhsulunun 10% artımı maliyyə sektorunun ümumi buraxılışını müvafiq olaraq 7,53%, 9,02% və 7,93% artırır. Nəticələr göstərir ki, qeyri-maliyyə və maliyyə sektorları arasında güclü transmissiya əlaqələri mövcuddur və Leontyev modeli bu qarşılıqlı asılılıqların kəmiyyətcə qiymətləndirilməsinə, həmçinin qiymət və əlavə dəyər transmissiyasının mexanizmlərinin təhlilinə imkan verir.

Açar sözlər: *Leontyev modeli, xərclər–buraxılış analizi, əlavə dəyərin transmissiyası, maliyyə sektoru, tarazlıq qiymətləri.*

ЭМПИРИЧЕСКАЯ ОЦЕНКА ВЛИЯНИЯ НЕФИНАНСОВОГО СЕКТОРА НА ФИНАНСОВЫЙ СЕКТОР ЭКОНОМИКИ АЗЕРБАЙДЖАНА НА ОСНОВЕ МОДЕЛИ ЛЕОНТЬЕВА «ЗАТРАТЫ–ВЫПУСК»

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Резюме

Эта статья анализирует межсекторальные связи в экономике Азербайджана и исследует влияние нефинансового сектора на финансовый сектор через каналы передачи цен и добавленной стоимости. На основе модели затрат–выпусков Леонтьева были смоделированы межсекторальные взаимозависимости и оценено влияние структурных изменений и изменений добавленной стоимости в нефинансовом секторе (реальном секторе) на равновесное состояние финансового сектора. Эмпирические результаты симуляций, основанных на таблицах межотраслевых балансов, показывают, что увеличение нормы добавленной стоимости в нефинансовом секторе на 10% повышает равновесные цены в финансовом секторе: в финансовых услугах — на 1,54%, в страховых и пенсионных услугах (за исключением обязательного социального обеспечения) — на 1,82%, в вспомогательных отраслях финансовых и страховых услуг — на 2,22%. Кроме того, увеличение конечного продукта нефинансового сектора на 10% увеличивает общий выпуск финансового сектора соответственно на 7,53%, 9,02% и 7,93%. Результаты показывают, что между нефинансовым и финансовым секторами существуют сильные каналы передачи, а модель Леонтьева позволяет количественно оценить эти взаимозависимости, а также проанализировать механизмы передачи цен и добавленной стоимости.

Ключевые слова: *модель Леонтьева, анализ «затраты–выпуск», передача добавленной стоимости, финансовый сектор, равновесные цены.*

Introduction

Different sectors of the economy operate in close interrelation with one another. The production of each good requires products and resources produced in other sectors. For instance, while the operations of the industrial sector depend on outputs from the agricultural, energy, and transportation sectors, these sectors, in turn, utilize resources from the industrial and service sectors. Such interdependencies characterize the economy as a unified, multi-layered system based on mutual interactions. In this context, any structural or price change in one sector generates a cascading effect across other sectors, ultimately influencing overall macroeconomic stability and development dynamics.

One of the most widely applied methodological approaches to measure these interconnections and to determine the direction and magnitude of their effects is Leontief's input–output model. This model enables the evaluation of flows of goods and services between economic sectors, as well as the mechanisms through which these flows impact final consumption and value-added formation, on a formal mathematical basis. The Leontief model holds significant scientific and practical relevance for analyzing economic structure, identifying intersectoral dependencies, and examining the direction and strength of transmission effects. The core principle of the model is that the production process of each sector generates demand for products and resources from other sectors. Consequently, changes occurring in the non-financial sector are transmitted to the financial sector, while changes in the financial sector, in turn, affect other production sectors, creating a chain of mutual interactions. This interdependence is particularly manifested through value-added and price channels. By representing these economic linkages in a mathematical matrix form, Leontief's input–output model allows for the empirical assessment of the scope and direction of transmission mechanisms between sectors. Thus, the Leontief model serves not only as a tool for analyzing the general equilibrium of the economy but also as an effective analytical instrument for studying the price formation mechanisms among sectors and the transmission effects of value-added. Within the framework of this study, the model has been applied to the Azerbaijani economy to empirically assess the transmission effects of changes in the non-financial sector on the financial sector.

Statistical Data and Methodology

For the mathematical calculations based on matrices presented in this article, statistical data from the 2021 Input–Output Table of the State Statistical Committee of the Republic of Azerbaijan were utilized [1]. The intersectoral balance analysis and the input–output model were first developed by Wassily Leontief [2]. It should be noted that Leontief was awarded the Nobel Prize specifically for his research in this field [3]. His work, "Studies in the Structure of the American Economy", plays a significant role in improving the understanding of macroeconomic modeling through the input–output framework [4]. This model forms the basis for both the quantity demand model and the equilibrium price model. In general, the structure of the intersectoral balance table can be described as follows:

Table 1. Structure of the Intersectoral Balance Table

Sector No.	Intermediate Consumption					Total Intermediate Product	Final Demand (d)	Components of Final Demand				Total output (X)
	1	…	j	…	N			Households Final Consumption	Government Final Consumption	Gross Fixed Capital Formation	Net export	
1	x_{11}	…	x_{1j}	…	x_{1n}		d_1					X_1
…	…	…	…	…	…		…					…
I	x_{i1}	…	x_{ij}	…	x_{in}		d_i					X_i
…	…	…	…	…	…		…					…
N	x_{n1}	…	x_{nj}	…	x_{nn}		d_n					X_n
Total Intermediate Consumption	AI_1	…	AI_j	…	AI_n		d					X
Total Value Added	VA_1	…	VA_j	…	VA_n	VA						
Net Taxes	NT_1	…	NT_j	…	NT_n	NT						
Gross Domestic Product	GDP_1	…	GDP_j	…	GDP_n	GDP						
Total Output (X)	X_1	…	X_j	…	X_n	X						

Input–Output Tables (IOTs) have become one of the principal analytical tools in the system of national accounts, as they clearly illustrate the interrelationships between final and intermediate use in the economy. In the context of globalization, the significance of IOTs has further increased, particularly as a key instrument for analyzing international production chains and economic interdependencies. These tables provide policymakers with a crucial database for informed decision-making regarding trade, competitiveness, and sustainable development [5].

It is important to highlight the general characteristics of the input–output model, which forms the basis of this research and reflects its methodological and theoretical features. These characteristics play a vital role in ensuring the balance within the table's structure, as essential elements of the national accounts system. As can be seen from Table 1, the first part of the table depicts the flow of intermediate products between sectors. The second part covers various components of final demand in the economy, including households' final consumption expenditure, government final consumption expenditure, gross fixed capital formation, and net exports. The third and final part of the table presents the composition of value added [6, 7].

For the respective raws of the table 1, we can write the folowing equations:

$$X_i = (x_{i1} + x_{i2} + \cdots + x_{in}) + y_i \quad (1)$$

Accordingly, the following equations can be expressed for the respective columns of the above table:

$$X_j = \left(x_{1j} + x_{2j} + \cdots + x_{nj}\right) + V_j \quad (2)$$

By summing the equation (1) over j and the equation (2) over i, we obtain the following:

$$\sum_{i=1}^{n} X_i = \sum_{j=1}^{n} \sum_{i=1}^{n} x_{ij} + \sum_{i=1}^{n} y_i \quad (3)$$

$$\sum_{j=1}^{n} X_j = \sum_{i=1}^{n} \sum_{j=1}^{n} x_{ij} + \sum_{j=1}^{n} V_j \quad (4)$$

Since $\sum_{i=1}^{n} X_i = \sum_{j=1}^{n} X_j$, we obtain the following equality:

$$\sum_{i=1}^{n} y_i = \sum_{j=1}^{n} V_j \quad (5)$$

As shown mathematically in (5), the total value added is equal to the sum of final demand. Considering the expression $a_{ij} = \frac{x_{ij}}{X_j}$ in equation (3), the equality can be written as follows:

$$X_i = \sum_{i=1}^{n} a_{ij} x_i + y_i \quad (6)$$

The application of the matrix approach in the input–output model clearly demonstrates its effectiveness in formalizing and analyzing the structural relationships within economic systems. This approach allows for the scientific modeling of interdependencies in the economy, enabling a more precise assessment of resource flows and interactions between production sectors. Since it represents a system of equations, it can be expressed in matrix form. Accordingly, the equality presented in (6) can be written as follows:

$$\begin{pmatrix} X_1 \\ X_2 \\ \cdot \\ \cdot \\ X_n \end{pmatrix} = \begin{pmatrix} a_{11}, a_{12}, \dots, a_{1n} \\ a_{21}, a_{22}, \dots, a_{2n} \\ \dots \dots \\ \dots \dots \\ a_{n1}, a_{n2}, \dots, a_{nn} \end{pmatrix} \begin{pmatrix} X_1 \\ X_2 \\ \cdot \\ \cdot \\ X_n \end{pmatrix} + \begin{pmatrix} y_1 \\ y_2 \\ \cdot \\ \cdot \\ y_n \end{pmatrix} \quad (7)$$

or

$$X = AX + Y \tag{8}$$

Equation (8) can be expressed mathematically as follows:

$$X = (I - A)^{-1}Y \tag{9}$$

This can also be referred to as the quantity demand model [8]. The equilibrium price model is considered an auxiliary model of the input–output framework. Intersectoral balance analysis not only allows us to examine how changes in one sector affect other sectors but also provides the means to study price variations. The equilibrium price model expresses the relationships among total outputs, intermediate consumption, and total value added across the respective columns of the input–output table for each sector of the economy.

Mathematically, for the respective columns of the table, the total output of each sector is equal to the sum of its intermediate consumption and value added. The above equality can be expressed as follows:

$$X_j = \left(x_{1j} + x_{2j} + \cdots + x_{nj}\right) + V_j \tag{10}$$

In this model, the price of each product is determined in accordance with the prices of the resources and other products required for its production. Prices are formed in such a way that demand and supply are balanced across all sectors. For each product, the production cost (raw materials + labor + value added) equals its selling price, reflecting microeconomic equilibrium. In this case, the price vector p represents a set of prices at which the total costs of each sector are equal to its total revenue. Within this pricing system, there is neither excess profit nor loss; that is, the value of the produced goods is exactly equal to the total cost of the resources (raw materials + labor + products from other sectors) used in their production.

In this paper, the calculation of equilibrium prices is demonstrated based on Leontief's input–output model, which is used to model intersectoral interdependencies in economic systems. The model assumes that the prices of products depend on the prices of other products used in their production, as well as on the value-added components.

Leontief's price model is based on the following key assumptions [9]:

- The economy operates under fixed technology, meaning that the technical coefficients (a_{ij}) remain constant and do not change even if production increases.
- Production is carried out with constant productivity, implying that as output rises, inputs increase proportionally, and returns to scale remain constant.

- The output of each sector consists solely of products from other sectors and value added.
- There exists a balance between demand and supply across all sectors.

For any sector X_j in the above input–output table, the total output of goods and services is determined by their sale at a given price P_j. To produce one unit of the product in each sector, the required inputs consist of the costs of purchasing intermediate products $(a_{1j}p_1 + a_{2j}p_2 + \cdots + a_{nj}p_n)$ and the value added V_j. The value added includes components such as wages, profits, and other related elements. Based on the above, the equilibrium price model can be expressed mathematically as follows [10]:

$$X_j p_j = X_j\left(a_{1j}p_1 + a_{2j}p_2 + \cdots + a_{nj}p_n\right) + V_j \quad (11)$$

By dividing both sides of equation (11) by X_j, we obtain the following equality:

$$p_j = a_{1j}p_1 + a_{2j}p_2 + \cdots + a_{nj}p_n + v_j \quad (12)$$

Here, $v_j = \frac{V_j}{X_j}$. The above equality (12) can be expressed in matrix form as follows:

$$\begin{pmatrix} p_1 \\ p_2 \\ \cdot \\ \cdot \\ p_n \end{pmatrix} = \begin{pmatrix} a_{11}, a_{21}, \dots, a_{n1} \\ a_{12}, a_{22}, \dots, a_{n2} \\ \cdots\cdots \\ \cdots\cdots \\ a_{1n}, a_{2n}, \dots, a_{nn} \end{pmatrix} \begin{pmatrix} p_1 \\ p_2 \\ \cdot \\ \cdot \\ p_n \end{pmatrix} + \begin{pmatrix} v_1 \\ v_2 \\ \cdot \\ \cdot \\ v_n \end{pmatrix} \quad (13)$$

Similarly, expression (13) can be written as follows:

$$P = A^T P + v \quad (14)$$

Here, A^T denotes the transposed matrix. By performing the mathematical transformations in (14), we obtain the following equalities:

$$P = (I - A^T)^{-1} v \quad (15)$$

Thus, the change in prices (inflation) across the sectors of the economy can be expressed as follows, in accordance with (15):

$$\Delta P = (I - A^T)^{-1} \Delta v \quad (16)$$

Review of Previous Studies

Various scientific studies have been conducted based on input–output tables. Moreover, the input–output model and its related equilibrium price model play a significant role in analyzing interdependencies between countries. These models allow for the simultaneous examination of economic impacts under different scenarios. In the paper "Transmission of Global Inflation to India: A Structural Analysis", N. Meenakshi and S. Gustav assessed the transmission of global inflation to the price level in India using the input–output model [11]. In a study on the Australian economy, A. Valadkhani and V. Mitchell examined the impact of oil price changes on inflation and household expenditures, determining the overall effect of oil price increases on the national economy using the input–output framework [12]. The effects of oil price fluctuations on price levels in China were analyzed by W. Libo, L. Jing, and Z. Zhong Xiang, who suggested a phased reduction of price controls to enhance the economy's resilience to oil price shocks [13]. The first studies on input–output tables for Azerbaijan were conducted by Y. H. Hasanli [14].

In the Leontief model, the economy is considered to consist of several sectors, with each sector using products from other sectors. The price of the output produced by each sector depends on the prices of products from other sectors used in its production and the value-added components. Value added generally includes wages, profits (operating income), depreciation, taxes, and other components, with profit being part of value added.

The equilibrium price model serves several purposes in the economy:

- *Evaluation of intersectoral relationships:* It allows for measuring the degree of interconnection between sectors and the impact of these relationships on prices.
- *Assessment of production efficiency:* If the equilibrium price of a product is high, its production requires significant resources.
- *Support for economic policy:* It can be used in government planning, price regulation, and the determination of subsidies.
- *Competitiveness analysis:* Equilibrium prices also indicate the relative competitiveness of sectors.

Changes in the value-added rate in the financial sector require all production sectors using these services to reassess their costs. For example, interest rates or insurance premiums may rise in a particular sector. This increase triggers transmission effects: when service and industrial sectors account for financial/insurance services as costs, their input–output increases, raising the production cost of goods. This can lead to an increase in the overall price level, observable as price rises across all sectors in the equilibrium price model. Simultaneously, higher costs may affect consumption:

in countries where financial services become more expensive, credit costs and insurance premiums increase, raising the burden on consumers. When the value-added rate in one sector rises, its equilibrium price increases more significantly. Other sectors linked to it are also affected, and this effect gradually propagates throughout the entire economic system.

The equilibrium price model mathematically describes and explains these systemic interdependencies. According to this model, prices in the economy are interdependent, and the prices of all sectors influence one another. The model aims to determine the equilibrium price vector in the economy, identifying prices at which the production costs (intermediate inputs + value added) of all sectors are fully covered. This represents a price level where no sector incurs a loss and the economy is in balance.

By illustrating the economic structure and intersectoral dependencies, the model enables analysis of how government policies, taxes, and subsidies affect prices and overall economic equilibrium. The equilibrium price model is a scientific tool that explains the systematic, interrelated, and internally consistent formation and stabilization of prices in the economy. The equilibrium price vector provides a mathematical representation of sector-dependent prices, reflecting the production costs of all sectors and the balance of the price system. It also enables the analysis of the sources and transmission of price increases, as well as the strength and direction of their propagation.

Empirical Estimation and Analysis

In this article, the data for 81 sectors are represented in matrix form by separating the financial sector — "Financial service activities, except insurance and pension funding", "Insurance, reinsurance and pension funding, except compulsory social security services", "Activities auxiliary to financial services and insurance activities" and the non-financial sector.

$$P = A^T P + v$$

$P \in R^{1x81} -$ represents the equilibrium price vector of the sectors. $A^T[a_{ij}] \in R^{81x81}$ –the transposed form of the technology matrix whose elements consist of real numbers. $v \in R^{1x81} -$ the value-added vector.

$$I = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}; \ A^T = \begin{bmatrix} 0.11432 & 0.00327 & 0.00000 & 0.13967 \\ 0.02022 & 0.02676 & 0.00000 & 0.18153 \\ 0.01590 & 0.00279 & 0.00000 & 0.22661 \\ 0.00951 & 0.00315 & 0.00025 & 0.31334 \end{bmatrix}$$

By subtracting the transposed matrix from the identity matrix, we obtain the following matrix (Table 2):

$$I - A^T = \begin{bmatrix} 0.8857 & -0.0202 & 0.0000 & -0.13967 \\ -0.0202 & 0.9732 & 0.0000 & -0.18153 \\ -0.0159 & -0.00279 & 1.0000 & -0.2266 \\ -0.0095 & -0.00315 & -0.00025 & 0.68666 \end{bmatrix};$$

Table 2. The $I - A^T$ matrix

Sectors	Line of code	Financial service activities, except insurance and pension funding	Insurance, reinsurance and pension funding, except compulsorysocial security	Activities auxiliary to financial services and insurance activities	Other (non-financial sector)
		64	65	66	1-81 (<>64,64,66)
Financial service activities, except insurance and pension funding	64	0.88568	-0.00327	0.00000	-0.13967
Insurance, reinsurance and pension funding, except compulsorysocial security	65	-0.02022	0.97324	0.00000	-0.18153
Activities auxiliary to financial services and insurance activities	66	-0.01590	-0.00279	1.00000	-0.22661
Other (non-financial sector)	1-81 (<>64,64,66)	-0.00951	-0.00315	-0.00025	0.68666

Source: Author's calculations (MS Office Excel), based on the 2021 Input–Output Table of the State Statistical Committee, https://www.stat.gov.az/source/system_nat_accounts

We compute the inverse of the difference between the identity matrix (I) and the transposed technology matrix (A^T) (Table 3):

$$(I - A^T)^{-1} = \begin{bmatrix} 1.1367 & 0.00465 & 0.00006 & 0.23141 \\ 0.02646 & 1.0285 & 0.00007 & 0.27750 \\ 0.02165 & 0.00403 & 1.00008 & 0.33552 \\ 0.01580 & 0.00479 & 0.00037 & 1.46293 \end{bmatrix};$$

Table 3. The $(I - A^T)^{-1}$ matrix

Sectors	Line of code	Financial service activities, except insurance and pension funding	Insurance, reinsurance and pension funding, except compulsorysocial security	Activities auxiliary to financial services and insurance activities	Other (non-financial sector
		64	65	66	1-81 (<>64,64,66)
Financial service activities, except insurance and pension funding	64	1.13167	0.00455	0.00006	0.23141
Insurance, reinsurance and pension funding, except compulsorysocial security	65	0.02646	1.02848	0.00007	0.27730
Activities auxiliary to financial services and insurance activities	66	0.02165	0.00403	1.00008	0.33552
Other (non-financial sector	1-81 (<>64,64,66)	0.01580	0.00479	0.00037	1.46093

Source: Author's calculations (MS Office Excel), based on the 2021 Input–Output Table of the State Statistical Committee, https://www.stat.gov.az/source/system_nat_accounts

It should be noted that the vector of actual value-added ratios is as follows. If we increase the value-added ratio in the non-financial sector by 10%, the equilibrium price vector of the sectors will be as follows:

$$v = \begin{bmatrix} 0.73 \\ 0.77 \\ 0.74 \\ 0.65 \end{bmatrix}; \quad p = \begin{bmatrix} 0.9762 \\ 0.9862 \\ 0.9809 \\ 0.9627 \end{bmatrix}; \; \Delta v = \begin{bmatrix} 0.73 \\ 0.77 \\ 0.74 \\ 0.71 \end{bmatrix}; \; p^{as} = \Delta p = \begin{bmatrix} 0.9912 \\ 1.0042 \\ 1.0027 \\ 1.057 \end{bmatrix};$$

Table 4. Change in Value-Added Ratios (Δv) and the Level of Equilibrium Prices

Sectors	Actual value-added rate (v)	δ	Δv	Equilibrium prices $P = (I - A^T)^{-1} v$	Equilibrium prices (model simulation) $\Delta P = (I - A^T)^{-1} \Delta v$	Change (%)
Financial service activities, except insurance and pension funding	0.73	1.00	0.73	0.97619	0.99119	1.54%
Insurance, reinsurance and pension funding, except compulsorysocial security	0.77	1.00	0.77	0.98624	1.00422	1.82%
Activities auxiliary to financial services and insurance activities	0.74	1.00	0.74	0.98092	1.00268	2.22%
Other (non-financial sector	**0.65**	**1.10**	**0.71**	**0.96270**	**1.05742**	**9.84%**

Source: Author's calculations (MS Office Excel), based on the 2021 Input–Output Table of the State Statistical Committee, https://www.stat.gov.az/source/system_nat_accounts

By performing simulations on the mathematical matrices, it can be determined that a 10% increase in the value-added ratio of the non-financial sector will, through price transmission to the financial sector, result in an increase in equilibrium prices as follows: 1.54% for Financial service activities, except insurance and pension funding, 1.82% for Insurance, reinsurance and pension funding, except compulsory social security services, and 2.22% for Activities auxiliary to financial services and insurance activities.

Next, let us examine the effects of changes in the final output of the non-financial sector on the financial sector:

$$I = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}; \; A = \begin{bmatrix} 0.11432 & 0.02022 & 0.01590 & 0.00951 \\ 0.00327 & 0.02676 & 0.00279 & 0.00315 \\ 0.00000 & 0.00000 & 0.00000 & 0.00025 \\ 0.13967 & 0.18153 & 0.22661 & 0.31334 \end{bmatrix};$$

We find the difference between the identity matrix (*I*) and the technological matrix *A*:

$$I - A = \begin{bmatrix} 0.8857 & -0.0202 & -0.0159 & -0.0095 \\ -0.0033 & 0.9732 & -0.0028 & -0.0032 \\ 0.0000 & 0.0000 & 1.0000 & -0.0003 \\ -0.1397 & -0.1815 & -0.2266 & 0.6867 \end{bmatrix};$$

Next we find the inverse of the difference between the identity matrix (*I*) and the technological matrix A:

$$(I-A)^{-1} = \begin{bmatrix} 1.1317 & 0.0265 & 0.0216 & 0.0158 \\ 0.0045 & 1.0285 & 0.0040 & 0.0048 \\ 0.0001 & 0.0001 & 1.0001 & 0.0004 \\ 0.2314 & 0.2773 & 0.3355 & 1.4609 \end{bmatrix}; \quad Y^s = \begin{bmatrix} 404925.9 \\ 42899.7 \\ 8430.6 \\ 97326144.1 \end{bmatrix};$$

Now, we determine the vector of output levels following the simulation of a 10% increase in the final product (Y^s).

$$X^s = (I-A)^{-1} * Y^s = \begin{bmatrix} 1.1317 & 0.0265 & 0.0216 & 0.0158 \\ 0.0045 & 1.0285 & 0.0040 & 0.0048 \\ 0.0001 & 0.0001 & 1.0001 & 0.0004 \\ 0.2314 & 0.2773 & 0.3355 & 1.4609 \end{bmatrix} * \begin{bmatrix} 404925.9 \\ 42899.7 \\ 8430.6 \\ 97326144.1 \end{bmatrix} = \begin{bmatrix} 1997279.4 \\ 512051.6 \\ 44076.5 \\ 142294694.3 \end{bmatrix}$$

Thus, by conducting a comparative economic analysis of the actual output vector (*X*) and the new output vector (X^s) resulting from the simulation of a 10% increase in the final product, we obtain the corresponding conclusions.

$$X = \begin{bmatrix} 1857486.8 \\ 469683.0 \\ 40838.4 \\ 129368670.3 \end{bmatrix}; \quad X^s = \begin{bmatrix} 1997279.4 \\ 512051.6 \\ 44076.5 \\ 142294694.3 \end{bmatrix}$$

Table 5. Changes in the Final Product Vector (*ΔY*) and the New Output Levels

Sectors	Line of code	Final product vector (Y)	δ	ΔY	Total domestic product used at basic prices (X)	*Total domestic product used at basic prices (after simulation) ΔX*	Change (%)
Financial service activities, except insurance and pension funding	64	404,925.9	1.0	404,925.9	**1,857,486.8**	**1,997,279.4**	**7.53%**
Insurance, reinsurance and pension funding, except compulsorysocial security	65	42,899.7	1.0	42,899.7	**469,683.0**	**512,051.6**	**9.02%**
Activities auxiliary to financial services and insurance activities	66	8,430.6	1.0	8,430.6	**40,838.4**	**44,076.5**	**7.93%**
Other (non-financial sector	1-81 (<>64,64,66)	88,478,312.8	1.1	97,326,144.1	**129,368,670.3**	**142,294,694.3**	**9.99%**

Source: Author's calculations (MS Office Excel), based on the 2021 Input–Output Table of the State Statistical Committee, https://www.stat.gov.az/source/system_nat_accounts

By performing matrix-based simulations, it can be determined that a 10% increase in the final output of the non-financial sector would transmit to the total output of the financial sector as follows: a 7.53% increase for financial activities excluding insurance and pension services, a 9.02% increase for insurance, reinsurance, and pension services excluding compulsory social security services, and a 7.93% increase for activities auxiliary to financial services and insurance activities.

Conclusion

The results of the mathematical simulation based on Leontief's model of equilibrium prices indicate that a 10% increase in the value-added rate in the non-financial sector exerts a significant impact on other sectors of the economy, particularly the financial sector, in the form of price transmission. According to the modeling outcomes, such an increase leads to a rise in equilibrium prices of 1.54% in financial services, 1.82% in insurance, reinsurance, and pension services (excluding compulsory social security), and 2.22% in auxiliary services for financial and insurance activities. These findings demonstrate that structural changes and value-added growth in the non-financial sector have a direct transmission effect on the price system of the financial sector. Price increases are particularly pronounced in the financial and insurance services sectors, reflecting their high degree of economic integration with other sectors.

Furthermore, simulations of a 10% increase in the final output of the non-financial sector show that this change has a significant transmission effect on the total output of the financial sector. Specifically, the total output of financial services increased by 7.53%, insurance, reinsurance, and pension services (excluding compulsory social security) by 9.02%, and auxiliary services for financial and insurance activities by 7.93%. These results highlight the structural and price linkages between the non-financial and financial sectors and demonstrate the strength of their mutual interactions. At the same time, they indicate the integration of financial services with the non-financial sector, which is crucial for forecasting intersectoral risks and price changes. The findings provide a practical analytical framework for both policymakers and financial institutions to assess price transmission and the effects of structural changes.

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