



ASSESSING THE EFFICIENCY OF THE LEONTIEF MODEL AND ECONOMETRIC ANALYSIS OF INFLATION INDICATORS

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Abstract: *This article examines the theoretical foundations and practical significance of the Leontief model in analyzing intersectoral relationships within the economy. The main objective of the study is to assess the efficiency of resource allocation across sectors and to conduct an econometric analysis based on inflation indicators. The paper analyzes the core equations of the Leontief model, technological input coefficients, and their economic interpretation. In the empirical part, a regression model is constructed using inflation data, where annual inflation is considered as the dependent variable and year-to-date inflation as the independent variable. The results of the analysis indicate that the model has a low explanatory power ($R^2 \approx 0.08$) and is statistically insignificant. This suggests that inflation is a complex and multi-factor economic phenomenon that cannot be adequately explained by a simple regression model. The findings highlight the necessity of applying multivariate econometric models for more accurate analysis and forecasting. Furthermore, the study emphasizes the importance of a scientific approach in economic policy formulation and decision-making processes.*

Keywords: *Leontief model, input-output analysis, econometrics, regression analysis, inflation, intersectoral linkages, technological coefficients, economic efficiency, macroeconomic analysis, forecasting*

Annotatsiya: *Mazkur maqolada iqtisodiyot tarmoqlari o'rtasidagi o'zaro bog'liqlikni tahlil qilishda Leontev modelining nazariy asoslari va amaliy ahamiyati kompleks tarzda yoritilgan. Tadqiqotning asosiy maqsadi tarmoqlararo resurslar oqimi va ishlab chiqarish jarayonlarining samaradorligini aniqlash hamda*

inflyatsiya ko'rsatkichlari asosida ekonometrik tahlilni amalga oshirishdan iborat. Ishda Leontev modelining asosiy tenglamalari, texnologik xarajatlar koeffitsientlari va ularning iqtisodiy mazmuni tahlil qilindi. Amaliy qismda inflyatsiya ko'rsatkichlari asosida regressiya modeli qurilib, yillik inflyatsiya natijaviy o'zgaruvchi, yil boshidan inflyatsiya esa tushuntiruvchi omil sifatida olindi. Hisob-kitob natijalari modelning determinatsiya koeffitsienti past ($R^2 \approx 0,08$) ekanligini va statistik jihatdan ahamiyatsizligini ko'rsatdi. Bu holat inflyatsiya jarayonining murakkab va ko'p omilli ekanligini tasdiqlaydi. Tadqiqot natijalari iqtisodiy tahlil va prognozlashda ko'p omilli ekonometrik modellarni qo'llash zarurligini asoslab beradi hamda iqtisodiy siyosatni shakllantirishda ilmiy yondashuv muhim ekanligini ko'rsatadi.

Kalit so'zlar: *Leontev modeli, input-output modeli, ekonometrika, regressiya tahlili, inflyatsiya, tarmoqlararo bog'liqlik, texnologik koeffitsientlar, iqtisodiy samaradorlik, makroiqtisodiy tahlil, prognozlash*

Introduction: In the context of a modern economy, analyzing intersectoral relationships and ensuring the efficient use of resources has become one of the key challenges. The increasing complexity of economic systems, the diversification of production processes, and the ongoing processes of global economic integration have significantly raised the demand for scientifically grounded analytical models. In this regard, the Leontief model plays a crucial role as an effective tool for systematically studying intersectoral linkages within the economy.

The Leontief model, also known as the input-output model, provides a mathematical framework for representing economic systems. It enables the analysis of resource flows between sectors, production volumes, and final demand in an integrated manner. Through this model, it is possible to evaluate the structural composition of the economy, the degree of intersectoral dependence, and the efficiency of resource utilization. Furthermore, the model serves as a theoretical foundation for economic forecasting, strategic planning, and investment decision-making.

In addition, econometric methods, particularly regression analysis, play an important role in modern economic research. Regression models allow researchers to identify relationships between economic variables and assess the degree of their interaction. Inflation, as one of the key macroeconomic indicators, is essential for evaluating economic stability, and its analysis is crucial for effective economic policy formulation.

The main objective of this study is to examine the theoretical foundations of the Leontief model and assess its role in evaluating economic efficiency, as well as to conduct an econometric analysis based on inflation indicators. The study investigates intersectoral relationships, resource efficiency, and the statistical characteristics of inflation dynamics.

Literature review and methodology: The issue of analyzing intersectoral relationships in the economy has been widely studied in economic literature, and existing research provides a solid theoretical foundation for assessing resource allocation and production efficiency across sectors. In Uzbek economic literature, significant attention is given to the problems of sustainable economic development, efficient use of resources, and maintaining intersectoral balance. These studies emphasize the importance of applying a systematic approach to the analysis of economic processes.

A key theoretical framework in this field is the Leontief input-output model, which provides a mathematical representation of intersectoral relationships within the economy. This model allows for a comprehensive analysis of production volumes and resource flows between sectors. The fundamental solution of the Leontief model can be expressed as:

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

where **X** represents the vector of total output, **A** is the matrix of technological input coefficients, **Y** denotes the final demand vector, and $(\mathbf{I} - \mathbf{A})^{-1}$ is the Leontief inverse matrix, reflecting the full interdependence of economic sectors. This model

enables the assessment of how changes in one sector affect others and allows for evaluating overall economic efficiency.

In addition, Uzbek-language econometrics literature extensively discusses the theoretical foundations of regression analysis, the stages of model construction, and statistical evaluation methods. These sources highlight the importance of econometric models in identifying relationships between economic variables. In particular, they emphasize that inflation is a complex, multi-factor phenomenon that requires comprehensive modeling approaches.

Based on these theoretical considerations, a комплекс methodological approach was applied in this study. The system analysis method was used to examine intersectoral relationships through the Leontief model. Economic-statistical methods were applied to analyze the dynamics of inflation indicators and identify their main trends.

Furthermore, an econometric analysis was conducted using a regression model, where annual inflation was considered as the dependent variable and year-to-date inflation as the independent variable. The model parameters were estimated using the Ordinary Least Squares (OLS) method, and the statistical significance and reliability of the model were evaluated.

The data used in this study were obtained from official statistics of the Central Bank of Uzbekistan . This methodological approach made it possible to conduct a comprehensive and systematic analysis of economic processes and to derive well-grounded scientific conclusions.

Empirical analysis: In the empirical part of this study, an econometric analysis was conducted based on inflation indicators. The analysis utilized official statistical data provided by the Central Bank of Uzbekistan . The study is based on a dataset covering a 10-month period, including both monthly and annual inflation rates.

During the analysis, monthly inflation (compared to the previous month) and annual inflation (compared to the same month of the previous year) were examined. Based on these indicators, a dataset was constructed to perform econometric

modeling. Additionally, the natural logarithms of the variables were calculated to facilitate further analysis of their dynamics.

No	Month	Monthly Inflation (%)	Annual Inflation (%)	Ln (monthly)	Ln (annual)
1	January	0.7	7.2	-0.35667	1.974081
2	February	0.9	7.3	-0.10536	1.987874
3	March	0.7	7.5	-0.35667	2.014903
4	April	0.6	7.8	-0.51083	2.054124
5	May	0.6	8.0	-0.51083	2.079442
6	June	0.4	8.8	-0.91629	2.174752
7	July	0.2	8.9	-1.60944	2.186051
8	August	0.2	8.7	-1.60944	2.163323
9	September	1.5	8.7	0.405465	2.163323
10	October	0.7	10.1	-0.35667	2.312535

Based on the dataset, a linear regression model was selected to analyze the relationship between the variables. This model is one of the most commonly used approaches in econometrics for identifying relationships between economic indicators.

Model

Specification

$$Y = a + bX$$

where:

- **Y** – annual inflation (dependent variable)
- **X** – year-to-date inflation (independent variable)

The parameters of the model were estimated using the Ordinary Least Squares (OLS) method. This approach allows for determining the coefficients of the regression model and evaluating the relationship between inflation indicators.

The analysis was conducted using Microsoft Excel, where regression estimation and statistical calculations were performed. The obtained results are presented and discussed in the following section.

Results and discussion: As a result of the econometric analysis, the estimated regression model is expressed as follows:

$$Y = 2.9389 - 1.6729X$$

where **Y** represents the annual inflation rate, and **X** denotes the year-to-date inflation indicator.

Main Statistical Results

The estimated model is characterized by the following statistical indicators:

- Multiple R = 0.2837
- $R^2 = 0.0805$
- Adjusted $R^2 = -0.0344$
- F-statistic = 0.7003
- P-value = 0.4269
- Number of observations = 10

The results show that the coefficient of determination ($R^2 = 0.0805$) is very low, indicating that the model explains only 8.05% of the variation in annual inflation. This suggests that the explanatory power of the model is weak and that other important factors significantly influence inflation dynamics.

The negative value of the adjusted R^2 further confirms the poor overall quality of the model and indicates that the selected independent variable does not adequately explain the dependent variable.

The F-statistic (0.7003) and its corresponding p-value (0.4269) demonstrate that the regression model is statistically insignificant. Since the p-value exceeds the commonly accepted significance level (0.05), the null hypothesis cannot be rejected, meaning that the model lacks statistical reliability.

Although the regression coefficient is negative ($b = -1.6729$), suggesting an inverse relationship between year-to-date inflation and annual inflation, this relationship is not statistically significant due to the high p-value. Therefore, the observed relationship cannot be considered reliable.

The findings indicate that there is no strong statistical relationship between the analyzed inflation indicators. This confirms that inflation is a complex and multi-factor economic phenomenon.

The low explanatory power of the model can be attributed to the inclusion of only one independent variable. In reality, inflation is influenced by multiple macroeconomic factors such as money supply, interest rates, exchange rates, and external economic conditions, which were not included in the model.

Therefore, the results highlight the necessity of applying multivariate econometric models to achieve a more accurate and comprehensive understanding of inflation dynamics. Incorporating additional relevant variables would significantly improve the model's explanatory power and reliability.

Conclusion: This study examined the theoretical foundations of the Leontief model and its role in analyzing intersectoral relationships within the economy. The findings demonstrate that the model serves as an effective tool for comprehensive economic analysis, optimization of resource allocation, and evaluation of production efficiency.

The empirical results indicate that the simple regression model constructed based on inflation indicators has low explanatory power and lacks statistical significance. This confirms that inflation is a complex and multi-factor economic phenomenon that cannot be adequately explained by a single-variable model.

Based on the findings, it is recommended to apply multivariate econometric models for a more accurate analysis of inflation dynamics. In particular, incorporating variables such as money supply, interest rates, exchange rates, and other macroeconomic indicators would significantly improve the model's explanatory capacity.

Overall, while the Leontief model remains a powerful framework for analyzing economic systems, combining it with advanced econometric methods can enhance the depth and reliability of empirical research.

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