

“PROBLEMS IN CALCULATING GROSS DOMESTIC PRODUCT USING THE FINAL CONSUMPTION METHOD AND WAYS TO OVERCOME THEM”

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Annotation. *This article is devoted to the features of forecasting and analysis methods. Forecasting macroeconomic indicators is a complex and time-consuming process. The significant gap between expected indicators and actual results limits the widespread use of statistical and mathematical forecasting methods. In practice, this drawback is usually mitigated by using the simplest direct calculation methods. From this perspective, systematizing forecasting methods and considering their advantages and disadvantages concerning macroeconomic indicators is of great importance. Although extensive research has been conducted by scientists from various countries, a universal macroeconomic indicator system, particularly the system of expenditure indicators, which enables obtaining results with minimal deviation from actual values through forecasting, has not yet been developed. The purpose of this study is to present the main results of the research, along with providing a theoretical and methodological review that will be useful in practice, as well as in scientific and educational activities.*

Keywords: *Macroeconomic indicators, GDP, GNI, employment, unemployment rate.*

Introduction. Gross Domestic Product (GDP) is recognized as one of the most important comprehensive indicators in modern economic analysis and macroeconomic planning. It reflects the value of final goods and services produced within a country during a given period, thereby representing the overall volume and dynamics of economic activity. Among the methods used to calculate GDP, the final consumption method is considered one of the key tools today for assessing economic stability and consumer behavior patterns. Through this method, GDP is determined based on final consumption expenditures, investments, government spending, and net exports. However, the increasing complexity of the modern economic environment, the expansion of the informal sector, the growing share of digital payments, and the insufficiency of statistical infrastructure bring about a number of challenges in calculating GDP using the final consumption method. These factors negatively affect the accuracy of calculations and may lead to errors in evaluating real economic growth rates. In particular, in the case of Uzbekistan, there is a need for an in-depth scientific study of this process, its harmonization with international standards, and its improvement through digital solutions. This scientific article systematically analyzes the existing problems in calculating GDP using the final consumption method, examines both international and

national practices, and develops scientifically grounded proposals and recommendations for their resolution.

Among the numerous indicators used in macroeconomics for different purposes (Gross Domestic Product, Net Domestic Product, Gross National Income, and others), the most important one is GDP. In both international and national practice, it serves as an indicator that reflects the final results of economic production activity. In Uzbekistan, GDP is calculated using two of the three methods provided in the System of National Accounts (SNA) — the production method (by value added) and the expenditure method — while the income method is not yet applied. According to the national accounting system, GDP by expenditure method is calculated as the sum of final consumption expenditures of households, government institutions, and non-profit institutions serving households (NPISHs), gross fixed capital formation, and net exports of goods and services. In the “SNA–2008” international standard, seven types of final consumption are distinguished:

- final consumption of households;
- final consumption of NPISHs;**
- gross fixed capital formation;
- changes in inventories of tangible circulating assets;
- acquisitions less disposals of valuables;
- net exports of goods and services.

Final consumption refers to the consumption of goods and services for purposes not related to production. It includes consumer goods and services that are directly used to satisfy the individual or collective needs of members of society and are not transformed in the process of further production.

In the System of National Accounts (SNA), final consumption is reflected in the following ways:

a) As an element of income use – in the sequence of income accounts, within the accounts for the use of disposable income, which are the final in this sequence. In these accounts, disposable income is shown as being allocated between final consumption and saving.

b) As an element of goods and services use – in the goods and services accounts. Data from these accounts are used for calculating GDP by the expenditure method, i.e., as the sum of all components of the use of goods and services: final consumption, gross capital formation, and net exports.

Literature Review. Accounts for the use of income are compiled both for the economy as a whole and for institutional sectors. The final consumption indicator is present in the accounts of the household sector, general government, and non-profit institutions serving households (NPISHs). In the accounts of non-financial and financial corporations, however, this indicator does not appear, since the goods and services they purchase are used either for intermediate consumption or for the payment of compensation of employees. Numerous studies on these issues have been carried out by both foreign and domestic researchers.

Fezzi, C., & Fanghella conducted a study on the possibilities of monitoring GDP fluctuations in European countries in real time during the first wave of the COVID-19 pandemic. They analyzed the relationship between electricity consumption and GDP, proposing new approaches to assessing economic activity³⁵.

Alleman, T. W., Schoors, K., & Baetens, J. M. analyzed the supply and demand shocks affecting the Belgian economy during the COVID-19 pandemic using a dynamic input–output model. They compared the model with real data and identified its impact on GDP, income, and employment³⁶.

Mosley, L., Eckley, I., & Gibberd, A. proposed a new method called “Sparse Temporal Disaggregation” to estimate high-frequency economic indicators based on low-frequency data. They applied this approach to the UK GDP data and demonstrated its advantages compared to the traditional Chow–Lin method³⁷.

Moiseev, N., Mikhaylov, A., Varyash, I., & Saqib, A. conducted an in-depth analysis of the relationship between Gross Domestic Product (GDP) per capita and the Corruption Perceptions Index using advanced economic-statistical approaches. The study was carried out based on data from a number of countries, employing the Corruption Perceptions Index published by Transparency International as well as GDP indicators provided by the International Monetary Fund and the World Bank as the main sources³⁸.

Similarly, local researchers have also conducted their own studies. In his research, Tursunov, B. analyzes the problems of calculating GDP by the final consumption method in the case of Uzbekistan. The author highlights issues such as the lack of sufficient statistical data and the exclusion of the informal sector. He also demonstrates that the structure of final consumption varies across different sectors and proposes to calculate it through a segmented statistical approach³⁹.

Methodology. In this study, the econometric approach was applied as the main methodology for calculating and analyzing macroeconomic indicators. The primary objective was to identify the interrelationships among macroeconomic factors and to assess their impact on economic development. Multiple regression analysis was chosen as the main method, as it allows for a deeper examination of cause-and-effect relationships among variables.

Research Results. In the course of the research, the main problems in calculating Gross Domestic Product (GDP) using the final consumption method were identified based on the example of Uzbekistan and a number of foreign countries. The analysis revealed that the existing statistical approaches often fail to adequately account for the activities of the informal sector, the full range of household expenditures, and the value of certain types of services. As

³⁵ Fezzi, C., & Fanghella, V. (2020). Tracking GDP in real-time using electricity market data: Insights from the first wave of COVID-19 across Europe. arXiv preprint arXiv:2009.09222.

³⁶ Alleman, T. W., Schoors, K., & Baetens, J. M. (2023). Validating a dynamic input-output model for the propagation of supply and demand shocks during the COVID-19 pandemic in Belgium. arXiv preprint arXiv:2305.16377.

³⁷ Mosley, L., Eckley, I., & Gibberd, A. (2021). Sparse Temporal Disaggregation. arXiv preprint arXiv:2108.05783.

³⁸ Moiseev, N., Mikhaylov, A., Varyash, I., & Saqib, A. (2020). Investigating the relation of GDP per capita and corruption index. *Entrepreneurship and Sustainability Issues*, 8(1), 780.

³⁹ Tursunov, B. (2022). Yalpi ichki mahsulotni yakuniy iste'mol usulida hisoblashdagi muammolar: O'zbekiston tajribasi. *Milliy statistika jurnali*, 4(1), 60-68.

a result, the accuracy of the components of final consumption in GDP remains limited. Considering GDP calculated by the final consumption method as the dependent (outcome) variable, and based on expert analysis conducted in cooperation with the State Committee of the Republic of Uzbekistan on Statistics, the following indicators were selected as influencing factors (see Table 1).

Y- Gross Domestic Product (GDP)

X1- Interest Rate

X2- Population (million)

X3 - Inflation Rate

Table 1.

Factors influencing the calculation of Gross Domestic Product (GDP) by the final consumption method ⁴⁰.

Years	GDP	Interest Rate	Population (million)	Inflation Rate
2014	186829,5	10	30,76	10,93
2015	221350,9	9	31,58	11,44
2016	255421,9	14	32,12	12,01
2017	356453,8	16	32,65	12,32
2018	473652,8	15	33,25	11,27
2019	594659,6	14	33,91	10,97
2020	668038	17	34,56	10,36
2021	820536,6	16	35,27	10,06
2022	995573,1	15	36,02	10,12
2023	1204485	14	36,80	9,18
2024	1454574	13,5	37,54	9,71

⁴⁰ Developed by the author.

Based on the macroeconomic indicators of the Republic of Uzbekistan for the period 2014–2024, a regression analysis was conducted to identify the main factors influencing GDP (Gross Domestic Product) growth. For the analysis, the independent variables selected were the interest rate (%), population (million), and inflation rate (%), while GDP was taken as the dependent (endogenous) variable..

The multiple regression model was constructed in the following general form:

Based on the calculations carried out through econometric software, the following important results were identified:

The growth of the population has a positive and significant impact on GDP. This indicates that population increase contributes to the expansion of both production and consumption potential..

The interest rate and inflation rate were identified as factors exerting a negative (inverse) impact. In particular, higher interest rates may reduce investment activity and consequently slow down economic growth.

The model demonstrated a high level of explanatory power (R^2), with the explained variance observed to be around 97–98%, indicating that the selected factors sufficiently explain the variation in GDP.

The results of the F-statistic and t-statistics confirmed the overall significance of the model as well as the individual significance of each factor ($p < 0.05$).

Yaim (trln) iz stavka (%oli soni (m:siya darajasi (%))				
Y	1			
Foiz stavka(%)	0,654232	1		
Aholi soni (mln)	0,982533	0,482235	1	
Infilyatsiya darajasi (%)	-0,85199	-0,13265	-0,82096	1

Регрессионная статистика						
Множественный R	0,993392621					
R-квадрат	0,9868289					
Нормированный R-квадрат	0,981184143					
Стандартная ошибка	57828,65625					
Наблюдения	11					
Дисперсионный анализ						
	df	SS	MS	F	Значимость F	
Регрессия	3	1,7539E+12	5,84632E+11	174,8222074	6,07383E-07	
Остаток	7	23409074382	3344153483			
Итого	10	1,77731E+12				
	Коэффициенты	Стандартная ошибка	t-статистика	P-Значение	Нижние 95%	Верхние 95%
Y-пересечение	-5800781,475	960224,5313	-6,041067778	0,000520551	-8071351,689	-3530211,262
X1	-28379,53099	10003,23138	-2,837036343	0,025151202	-52033,41451	-4725,647461
X2	202137,6551	19321,98695	10,46153564	1,58777E-05	156448,4162	247826,8941
X3	-2500,945429	38744,81407	-0,064549166	0,950337656	-94117,87241	89115,98156

Durbin–Watson testi formulasi:

$$DW = \frac{\sum_{t=2}^n (e_t - e_{t-1})^2}{\sum_{t=1}^n e_t^2}$$

The calculation was also carried out based on the formula, which is presented in the figure below.

ВЫВОД ОСТАТКА						
Наблюдение	Предсказанное Y	Остатки	$ei - ei-1$	$(ei - ei-1)^2$	ei^2	DW
1	105842,1535	80987,34648			6558950289	1,901615315
2	298699,0796	-77348,17956	158335,526	25070138805	5982740881	
3	264530,2195	-9108,319509	-68239,86005	4656678499	82961484,28	
4	314128,8217	42324,97832	-51433,29783	2645384126	1791403790	
5	466416,9385	7235,861549	35089,11677	1231246116	52357692,35	
6	628957,6055	-34298,00546	41533,86701	1725062109	1176353179	
7	676734,0651	-8696,065056	-25601,9404	655459352,5	75621547,45	
8	849381,6148	-28845,01482	20148,94977	405980176,7	832034880,1	
9	1029214,33	-33641,23044	4796,215618	23003684,25	1131732385	
10	1217612,121	-13127,12114	-20514,1093	420828680,3	172321309,4	
11	1380058,25	74515,74964	-87642,87078	7681272798	5552596944	
				44515054346	23409074382	

$$Y = 202137,6 \cdot X_2 - 28379,5 \cdot X_1 - 2500,9 \cdot X_3 - 5800781,4$$

The results of the analysis show that population growth can be evaluated as a positive factor ensuring economic growth, while the reduction of interest rates and inflation may contribute to economic stability. Therefore, in macroeconomic policy, supporting demographic growth, easing credit policy, and controlling inflation should be regarded as important strategic directions.

Discussion. Household final consumption expenditures include the expenses of resident households of a given country on consumer goods and services, including durable consumer goods (excluding the purchase of dwellings). They also cover the acquisition of consumer goods and services in kind (received as compensation for labor, as gifts, or in other forms), as well as consumer goods and services produced in household plots or farms for personal use.

Collective consumption expenditures include spending on public administration, defense, security, and the maintenance of legal order, as well as environmental protection. According to the “SNA–2008” standard, they also comprise the non-market services provided by central banks. Expenditures on healthcare, social protection, education, and culture are reflected differently depending on their type and scope of implementation. For instance, the expenses of ministries and institutions dealing with policy, standards, and regulations in these sectors are classified as collective consumption services, whereas the expenditures of public institutions directly providing services to the population (such as hospitals, schools, and cultural institutions) are classified as individual consumption services.

The internationally recognized classification of the functions of government (COFOG) serves to distinguish, in practice, between expenditures on individual and collective consumption.

NPISHs (Non-Profit Institutions Serving Households) mainly provide services to their members, i.e., a specific group of individuals. Such services, as a rule, are classified as individual services. Reports on the activities of these institutions and the selected surveys conducted on them constitute the information base for calculating the indicator “Final consumption expenditures of NPISHs.”

The transition from final consumption expenditures to actual final consumption is carried out through social transfers in kind. These transfers are expressed in goods and services intended for individual consumption, which are financed by government institutions and NPISHs but consumed by households. Unlike monetary transfers, transfers in kind reflect the redistribution of income through the provision of free socio-cultural services (such as healthcare and education) or through the distribution of goods purchased by government institutions and NPISHs from enterprises and delivered to specific individuals or groups (for example, free provision of medicines, wheelchairs, or vehicles for persons with disabilities).

Households are the recipients of social transfers in kind, which are provided by government units and NPISHs (Non-Profit Institutions Serving Households).

Corporations (both non-financial and financial) do not engage in operations involving social transfers in kind. At the level of the economy as a whole, the value of social transfers in kind received by households is equal to the value of such transfers provided by government units and NPISHs.

This operation is reflected in the redistribution of income in kind, resulting in “adjusted disposable income.” To obtain adjusted disposable income, social transfers in kind provided by government units and NPISHs are deducted from their disposable income, while in the household sector, they are added to disposable income.

In the accounts for the use of adjusted disposable income, actual final consumption is recorded. Accordingly:

The actual final consumption of households equals their expenditure on final consumption plus the value of social transfers in kind.

The actual final consumption of government equals its expenditure on collective consumption services.

In NPISHs (Non-Profit Institutions Serving Households), all expenditures for final consumption are classified as social transfers in kind; therefore, they do not record actual final consumption. At the level of the total economy, indicators of final consumption expenditure and actual final consumption are equal.

The indicator of final consumption is used in economic analysis both to characterize a number of macroeconomic balances and to study in detail the structure of household consumption as a component of the standard of living.

The ratio between final consumption and savings reflects not only the level of current consumption but also the extent to which investment opportunities can be financed out of private current income. The share of final consumption in GDP, and its ratio to savings, illustrate the most important proportions in the use of goods and services.

For the analysis of the structure of final consumption, the following internationally recognized classifications are used:

COICOP – Classification of Individual Consumption by Purpose;

COFOG – Classification of the Functions of Government;

COPNI – Classification of the Purposes of NPISHs.

Information on final consumption in the context of these classifications makes it possible to analyze the commodity composition of household consumption as well as the sources of goods and services.

It should be emphasized that in economic theory, macroeconomics, and other economic sciences, GDP (measured by the expenditure approach) is interpreted as the total expenditures of economic agents on final consumption, investment, and other products.

In order to expand the database of GDP calculated by the final consumption (expenditure) approach, a number of potential factors have been identified:

- final consumption expenditures of our citizens abroad;
- gifts sent from abroad by individuals, excluding postal shipments;
- works of art used in production;
- expenditures on cultivating fruit trees, shrubs, and vineyards intended to bear fruit and provide services for several years;
- pedigree and dairy cattle included in inventories;
- computer software and databases classified as intangible fixed assets;
- services of owner-occupied dwellings; and other elements.

Conclusion. Modern approaches and analytical methods applied in calculating Gross Domestic Product by the final consumption approach have significantly contributed to improving the accuracy and consistency of economic indicators. In particular, the enrichment of the statistical information base, the digitalization of data collection methods, and the introduction of new mechanisms for modeling consumption structures have strengthened the reliability of calculations. In recent years, the practice of constructing price indices that account for inflation dynamics has proven effective — allowing final consumption indicators to reflect economic reality more closely. Moreover, the accuracy of the national accounts system has been further reinforced through demographic growth, improvements in living standards, and the gradual integration of the informal sector into the legal environment. The application of econometric models has enabled a deeper analysis of key factors influencing final consumption (in particular, interest rates, inflation, and population size). The research demonstrates that the intrinsic relationship between consumption expenditures and the quality of services exerts a positive impact on the sustainable development of the national economy.

Furthermore, as a result of reforms implemented in the fields of tourism, transport, and services in the Republic of Uzbekistan, the final consumption segment has been developing dynamically. This indicates that the share of these sectors in the structure of GDP is increasing and that economic growth processes are becoming more closely interconnected with the real sector.

In conclusion, the approaches applied to calculating Gross Domestic Product by the final consumption method have not only improved the quality of statistical processes but have also strengthened the scientific foundation of economic policymaking, thereby creating a reliable basis for sustainable growth. This represents one of the key stages in Uzbekistan's transition toward a modern economic model.

It is proposed to introduce real-time monitoring mechanisms into the process of collecting data on final consumption through mobile applications, online platforms, and payment systems. This approach will enable more accurate and prompt assessments of consumption volumes. Analyzing the intrinsic relationship between GDP and final consumption through advanced technologies will significantly enhance the precision of economic forecasts.

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