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SYSTEMS MODELING AND REGRESSION ANALYSIS OF PUBLIC BUDGET EFFICIENCY IN CENTRAL ASIA

Zaifun A. Yernazarova[1]

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A B S T R A C T

The research aims to assess the socio-economic impact of government budget expenditures in Central Asian countries and identify prospects for enhancing this impact in each considered state. To this end, the author conducted a regression analysis of statistical data for the five Central Asian economies over 2022–2024. As a result, the author developed an economic-mathematical model to describe the relationship between the targeted areas of improvement in the socio-economic systems of Central Asian countries and the conditions of public governance applied to these systems. The theoretical contribution of the model lies in its specification of the public governance conditions influencing the effectiveness of government budget spending in these countries: the quantitative condition (the volume of budgetary funds allocated to the economy) and the qualitative condition (the progressiveness of the fiscal and budgetary system). The principal conclusion is that the socio-economic effect of government budget expenditures in Central Asia is manifested in accelerating economic growth, raising living standards, while reducing income inequality, fostering import substitution, and more fully realizing export potential. The research also highlights the prospects for amplifying the impact of budgetary expenditures in the region through improvements in public governance. Evidence-based forecasts of socio-economic development in each of the five Central Asian countries up to 2030 are presented, assuming enhanced quality of state regulation. The author also formulates recommendations for achieving such improvements in governance quality. The practical significance of the research lies in strengthening the methodological and scientific foundations for improving government budget planning and optimizing the allocation of public funds in the countries of Central Asia.

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1. INTRODUCTION

The quality of government regulation of the economy is a crucial determinant of its development. This factor belongs to the institutional foundations of economic systems, differences in which are widely recognized as a key reason for the divide between developed and developing countries. The global commitment to reducing inequality, endorsed by the international community and reflected, among other places, in Sustainable Development Goal (SDG) 10, presupposes the removal of institutional barriers to accelerating and more fully realizing the socio-economic potential of developing nations.

[1] Corresponding author: Zaifun A. Yernazarova
Email: ecword@mail.ru

However, it is important to note that the institutional environment within developing countries, an exceptionally large and diverse group, is far from uniform. Simultaneously, institutional similarities are characteristic of certain groups of developing countries that share common geography, history, and culture. One such group comprises Central Asian countries, where the specific features of the institutional environment of their socio-economic systems are largely shaped by the relatively recent completion of market reforms and the enduring influence of cultural traditions.

This makes the study of the quality of government regulation of the economy in Central Asian countries particularly relevant. In assessing this quality, it is essential to evaluate the socio-economic impact of government budget expenditures for several key reasons. One reason lies in the fact that the financial support of public institutions largely determines their ability to meet the needs of economic actors. When budgetary allocations are insufficient, even the most advanced and well-functioning institutions under current economic conditions are forced to curtail their activities and lose their capacity to sustain economic development (Buryk et al., 2025).

Another reason is that the return on government budget spending defines the effectiveness of the state apparatus in managing the economy. Wasteful use of these resources indicates poor quality in government regulation. Such waste prevents the achievement of intended effects in the present and restricts the state's ability to generate necessary benefits from economic governance in the future, owing to depleted financial resources.

A further reason is that the socio-economic impact of national budget expenditures serves as a measure of the success of state policy within the economic system. If the intended effect is not achieved, this may indicate the failure of socio-economic policy. In such cases, the economic system becomes poorly managed, developing chaotically and unpredictably, deviating from the national plan and the chosen course of development.
Economic cyclicality also plays a role. During financial crises, government institutions face reduced tax revenues and budget deficits, which necessitate careful rationalization of expenditures. Coupled with capital flight from a crisis-stricken economy, this creates an urgent need to ensure the high effectiveness of budgetary spending, as alternative sources of financing become severely limited.

Guided by these arguments, this article sets out to assess the socio-economic impact of government budget expenditures in Central Asian countries, as well as to identify prospects for increasing this impact in each of them. This goal is pursued through two main objectives: first, to measure the socio-economic impact of government budget expenditures in Central Asia; and second, to determine the possibilities for enhancing this impact in the countries of the region.

2. LITERATURE REVIEW

This research is conducted within the framework of the scientific and theoretical concept of monitoring and managing the quality of government regulation of the economy (Bogoviz et al., 2017; Kusakina et al., 2016). According to this concept, government budget expenditures are intended to generate tangible socio-economic effects in contemporary economic systems, expressed through the following improvements:

- Acceleration of economic growth, toward which a significant portion of national budget funds is traditionally directed, either directly or indirectly (Bogoviz et al., 2018a, 2018b; Mkrtchyan & Navasardyan, 2024). Government regulation of economic growth is achieved by stimulating domestic production and promoting healthier competition through antitrust policies;
- Rising household incomes as an indicator of living standards and an important measure of the socio-economic condition of economic systems (Bazinyan & Mayilyan, 2024; Kitsai et al., 2023). State regulation of income occurs through the establishment of subsistence minimums, public oversight of wages, and the protection of social and labor rights;
- Reduction of income inequality, which fosters greater socio-economic justice and helps eliminate financial imbalances within the economy (Mayilyan & Torosyan, 2023). Government regulation in this area is carried out by providing subsidies and support to the most financially vulnerable groups of the population;
- Lower unemployment, enabling fuller utilization of the labor potential of economic actors (Hayrapetyan & Isayan, 2022; Isayan & Mayilyan, 2022). Regulation of unemployment involves creating jobs in state-owned enterprises and incentivizing private businesses to expand employment opportunities;
- Growth in medium- and high-tech industries, signaling innovation-driven development and strengthening the economy's digital competitiveness (Melkamu, 2025; Popkova & Giyazov, 2021). Government regulation of high-tech industries takes the form of stimulating innovation activity within the economy;
- Import substitution, reflected in reduced import levels and a corresponding decrease in dependence on external supplies of resources and finished products (Tadevosyan, 2023). This is achieved through policies that support domestic business activity;
- Expansion of exports, leading to fuller realization of the economy's export potential and diversification of markets for national products (Sngryan, 2022). Government regulation of exports includes customs administration and support for foreign trade activities of domestic enterprises.

It is important to emphasize that these improvements are grouped deliberately, as they are closely interconnected and mutually reinforcing. High-quality government regulation of the economy generates a synergistic effect, producing more substantial systemic improvements in the socio-economic system, while poor-quality regulation leads to its overall deterioration.

When these improvements are achieved, economic institutions can be deemed effective. Conversely, the absence of such improvements from government budget expenditures indicates the presence of institutional traps. The extraction of socio-economic benefits from government spending depends on two key conditions:

- Primary condition: the actual volume of budgetary resources allocated to the economy, which represents the quantitative parameter of the fiscal system (Salnazaryan et al., 2022);
- Secondary condition: the progressiveness of the fiscal system, which serves as its qualitative parameter and determines the rationality of resource allocation (Guo & Liang, 2025).

Despite the abundance of publications on this topic, the return on government budget expenditures in Central Asian countries has not been concretely examined in the available academic literature and remains unknown. This gap justifies the formulation of the research question: "How do the conditions of public governance of socio-economic systems in Central Asia influence the outcomes of government budget expenditures?"

3. MATERIALS AND METHODS

The research sample includes five Central Asian countries: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan. To ensure coverage of a sufficiently long period for producing reliable scientific results, the research examines statistics for 2022–2024.

The first research objective is addressed through regression analysis. The socio-economic impact of government budget expenditures in Central Asian countries is measured by identifying the regression relationship between the target areas of improvement in their socio-economic systems (economic growth rate (Ef_1, according to World Bank (2025c)), income levels (Ef_2, according to World Bank (2025e)), Gini index, whose reduction indicates declining income inequality (Ef_3, according to World Bank (2025d)), unemployment (Ef_4, according to World Bank (2025h)), the share of medium- and high-tech industries in industrial output (Ef_5, according to World bank (2025g)), the share of imports in GDP, where a decrease signals import substitution (Ef_6, according to World Bank (2025f)), and the share of exports in GDP (Ef_7, according to World Bank (2025b))) and the conditions of public governance of socio-economic systems: the volume of government budget expenditures (R_1, according to IMF (2025)) and the progressiveness of the fiscal system (R_2, according to World Bank (2025a)). The research model is formulated as follows:

$$Ef=a+b_1R_1+b_2R_2 \quad (1)$$

In model (1), positive values of the regression coefficients b_1 and b_2 in the equations for Ef_1, Ef_2, Ef_5, and Ef_7, along with negative values of these coefficients in the equations for Ef_3, Ef_4, and Ef_6 indicate high-quality government regulation of the economy. Conversely, negative values of b_1 and b_2 in the equations Ef_1, Ef_2, Ef_5, and Ef_7, coupled with positive values of these coefficients in the equations for Ef_3, Ef_4, and Ef_6, signal the presence of institutional traps. Table 1 presents the statistical base of this research.

Table 1. Statistics on the quality of government regulation of the economy in Central Asian countries, 2022–2024

Year	Central Asian country	General government total expenditure (Percent of GDP)	CPIA quality of budgetary and financial management rating (1=low to 6=high)	GDP growth (annual %)	GNI per capita, Atlas method (thousand current US$)	Gini index	Unemployment, total (% of total labor force) (modeled ILO estimate)	Medium and high-tech manufacturing value added (% manufacturing value added)	Imports of goods and services (% of GDP)	Exports of goods and services (% of GDP)
		Ef_1	Ef_2	Ef_3	Ef_4	Ef_5	Ef_6	Ef_7	R_1	R_2
2022	Kazakhstan	21.72	0.00	3.20	9.42	28.00	4.86	16.82	25.02	33.64
	Kyrgyzstan	35.02	3.00	8.97	1.54	29.00	4.04	2.12	64.46	35.81
	Tajikistan	27.95	3.50	8.00	1.36	0.00	11.63	2.82	47.64	24.18
	Turkmenistan	9.44	0.00	6.20	7.78	0.00	4.11	0.00	12.50	20.56
	Uzbekistan	31.35	4.00	6.00	2.5	32.90	4.49	18.02	36.15	21.31
2023	Kazakhstan	23.39	0.00	5.10	10.69	28.70	4.82	16.89	26.77	41.57
	Kyrgyzstan	32.90	3.00	9.01	1.84	28.80	3.99	2.27	87.45	46.34
	Tajikistan	31.03	3.50	8.30	1.4	0.00	11.55	2.82	49.08	16.35
	Turkmenistan	10.93	0.00	6.30	8.25	0.00	4.10	0.00	12.48	24.88
	Uzbekistan	29.90	4.00	6.29	2.75	31.20	4.46	17.51	39.57	23.27

2024	Kazakhstan	21.04	0.00	4.80	12.15	29.20	4.79	17.52	27.45	34.51
	Kyrgyzstan	33.71	3.00	9.04	2.15	26.40	3.29	2.27	95.49	36.89
	Tajikistan	30.03	3.50	8.40	1.65	0.00	11.64	2.82	48.44	17.19
	Turkmenistan	11.30	0.00	2.26	8.39	0.00	4.30	0.00	12.47	21.62
	Uzbekistan	27.77	4.00	6.50	3.02	34.50	4.49	17.63	41.68	24.42

Source: developed by the author based on the materials from the IMF (2025) and World Bank (2025a, 2025b, 2025c, 2025d, 2025e, 2025f, 2025g, 2025h)

Given the logical interdependence of the variables in Table 1, a multicollinearity test is conducted to eliminate duplicate indicators. The reliability of model (1) is verified using Fisher's F-test. If this test is passed, the regression equations considered valid. Additionally, a multiple correlation analysis is performed, with particular attention paid to standard errors, which should remain relatively small.

The second research objective is addressed through forecasting. To identify the potential for enhancing the socio-economic impact of government budget expenditures in Central Asian countries, the maximum values of the factor variables R_1 and R_2 from the 2024 sample in Table 1 are substituted into model (1). Based on this, forecasts of socio-economic development are constructed for each of the five Central Asian countries, assuming improvements in the quality of government regulation of their economic systems up to the year 2030.

4. RESULTS

4.1. Socio-economic impact of government budget expenditures in Central Asian countries

In addressing the first research objective, a multicollinearity test was conducted to eliminate duplicate variables when preparing the empirical base of the study from Table 1 for statistical processing and econometric analysis. The results of this test are summarized in Table 2.

Table 2. Multicollinearity test

-	Ef1	Ef2	Ef3	Ef4	Ef5	Ef6	Ef7	R1	R2
Ef_1	1.00	-	-	-	-	-	-	-	-
Ef_2	0.83	1.00	-	-	-	-	-	-	-
Ef_3	0.68	0.68	1.00	-	-	-	-	-	-
Ef_4	-0.75	-0.93	-0.79	1.00	-	-	-	-	-
Ef_5	0.49	0.21	-0.02	0.01	1.00	-	-	-	-
Ef_6	0.24	0.36	0.33	-0.39	-0.58	1.00	-	-	-
Ef_7	0.18	0.06	-0.41	0.29	0.73	-0.24	1.00	-	-
R_1	0.82	0.63	0.78	-0.69	0.34	0.05	-0.21	1.00	-
R_2	0.24	-0.22	0.10	0.22	0.60	-0.51	0.15	0.45	1.00

Source: Developed by the author.

The results of the multicollinearity test from Table 2 revealed no duplicate variables in Table 1, which makes it possible to proceed with the regression analysis of the collected data. Based on research model (1), the author constructed a regression model to capture the relationship between the target areas of improvement in the socio-economic systems of Central Asian countries in 2022–2024 and the conditions of public governance of these systems. The results of the regression analysis are summarized in Table 3.

Table 3. Results of the regression analysis

Field of analysis	Element of analysis	Ef_1	Ef_2	Ef_3	Ef_4	Ef_5	Ef_6	Ef_7
Regression statistics	Multiple R	0.7110	0.9303	0.6010	0.3754	0.2477	0.8284	0.7936
	Standard error	1.5985	1.5542	13.1748	3.0486	8.4076	15.2895	6.0508
	Observations	15	15	15	15	15	15	15
Variance analysis	Observed F	6.1341	38.6172	3.3922	0.9845	0.3923	13.1187	10.2086
	Significance F	0.0146	0.000006	0.0680	0.4019	0.6838	0.0010	0.0026
Coefficients	Y intercept	3.3418	8.7290	-15.7612	5.5783	0.6861	-23.9261	6.1405
	R_1	0.0921	0.0301	1.7686	-0.0644	0.4004	2.7895	1.4469
	R_2	0.4285	-2.1397	-5.1579	0.8633	-1.3311	-2.1394	-6.8490
Standard error	Y intercept	3.3418	1.5784	13.3799	3.0961	8.5385	15.5276	6.1451
	R_1	0.0882	0.0858	0.7269	0.1682	0.4639	0.8436	0.3338
	R_2	0.4206	0.4090	3.4667	0.8022	2.2123	4.0232	1.5922

Source: developed by the author.

The results presented in Table 3 show that the rate of economic growth in the Central Asian economies during 2022–2024 is determined by the two examined conditions of public governance at a level of 71.10% (high multiple correlation). For the dependent variable Ef_1, Fisher's F-test is passed at the 0.05 significance level (observed F = 6.1341; significance F = 0.0146), confirming the reliability of the established relationship

and allowing the following multiple linear regression equation to be constructed:

$$Ef_1=3.3418+0.0921R_1+0.4285R_2 \quad (2)$$

According to equation (2), an increase in government budget expenditures by 1% of GDP in Central Asian countries contributes to accelerating economic growth by 0.0921%. In turn, a one-point increase in the progressiveness of the fiscal system leads to a 0.4258% increase in the economic growth rate.

All standard errors are relatively small. The overall standard error for equation (2) is 1.5985, with factor variable errors of 0.0882 for R_1 and 0.4206 for R_2. The positive values of regression coefficients in equation (2) indicate high-quality government regulation of Central Asia's economies in terms of supporting economic growth.

Household income levels in the socio-economic systems of Central Asia during 2022–2024 are determined by the two governance conditions at a rate of 93.03% (very high multiple correlation). For the dependent variable Ef_2, Fisher's F-test is passed at the 0.01 significance level (observed F = 38.6172; significance F = 0.000006), confirming the reliability of the established relationship and allowing the following multiple linear regression equation to be constructed:

$$Ef_2=8.7290+0.0301R_1-2.1397R_2 \quad (3)$$

The opposite signs of the regression coefficients in equation (3) indicate a contradictory quality of government regulation in terms of raising living standards. An increase in government budget expenditures by 1% of GDP raises income levels by \$0.0301 thousand. However, the negative coefficient for R_2 points to the existence of an institutional trap, whereby a one-point increase in the progressiveness of the fiscal system results not in higher but in lower incomes by \$2.1397 thousand. Standard errors are relatively small. The overall error for equation (3) is 1.5542, with factor variable errors of 0.0858 for R_1 and 0.4090 for R_2.

Income inequality in Central Asia's socio-economic systems during 2022–2024 is explained by the two governance conditions at a rate of 60.10% (high multiple correlation). For the dependent variable Ef_3, Fisher's F-test is passed at the 0.10 significance level (observed F = 3.3922; significance F = 0.0680), confirming the reliability of the relationship and allowing the following multiple linear regression equation to be constructed:

$$Ef_3=-15.7612+1.7686R_1-5.1579R_2 \quad (4)$$

The opposite signs of the regression coefficients in equation (4) suggest a contradictory quality of government regulation in combating income inequality. A one-point increase in the progressiveness of the fiscal system reduces the Gini index by 5.1579. However, the positive coefficient for R_1 indicates an institutional trap: an increase in government budget expenditures by 1% of GDP raises the Gini index by 1.7686, thereby worsening income inequality. Standard errors are relatively small. The overall error for equation (4) is 13.1748, with factor variable errors of 0.7269 for R_1 and 3.4667 for R_2.

Unemployment levels in the socio-economic systems of Central Asia during 2022–2024 are explained by the two governance conditions at only 37.54% (moderate multiple correlation). For the dependent variable Ef_4, Fisher's F-test is not passed (observed F = 0.9845; significance F = 0.4019), indicating insufficient reliability of the relationship and preventing the construction of a regression equation for Ef_4.

The share of medium- and high-tech industries in the industrial structure of Central Asian economies in 2022–2024 is explained by the two examined conditions of public governance at only 24.77% (moderate multiple correlation). For the dependent variable Ef_5, Fisher's F-test is not passed (observed F = 0.3923; significance F = 0.6838), indicating insufficient reliability of the relationship and preventing the construction of a regression equation for Ef_5.

The volume of imports of goods and services in Central Asian economies in 2022–2024 is explained by the two governance conditions at 82.84% (high multiple correlation). For the dependent variable Ef_6, Fisher's F-test is passed at the 0.01 significance level (observed F = 13.1187; significance F = 0.0010), confirming the reliability of the relationship and allowing the following multiple linear regression equation to be constructed:

$$Ef_6=-23.9261+2.7895R_1-2.1394R_2 \quad (5)$$

The opposite signs of the regression coefficients in equation (5) indicate a contradictory quality of government regulation with respect to import substitution. A one-point increase in the progressiveness of the fiscal system reduces the volume of imports of goods and services by 2.1394% of GDP. However, the positive coefficient for R_1 signals the presence of an institutional trap: an increase in government budget expenditures by 1% of GDP leads to an increase in imports by 2.7895% of GDP, thereby hindering import substitution and deepening the economy's dependence on imports. Standard errors are relatively small. The overall error for equation (5) is 15.2895, with factor variable errors of 0.8436 for R_1 and 4.0232 for R_2.

The volume of exports of goods and services in Central Asian economies in 2022–2024 is explained by the two governance conditions at 79.36% (high multiple correlation). For the dependent variable Ef_7, Fisher's F-test is passed at the 0.01 significance level (observed F = 10.2086; significance F = 0.0026), confirming the

reliability of the relationship and allowing the following multiple linear regression equation to be constructed:

$$Ef_7=6.1405+1.4469R_1-6.8490R_2 \quad (6)$$

The opposite signs of the regression coefficients in equation (6) reveal a contradictory quality of government regulation in terms of stimulating export activity of national enterprises. An increase in government budget expenditures by 1% of GDP raises exports of goods and services by 1.4469% of GDP. However, the negative coefficient for R2 points to an institutional trap: a one-point increase in the progressiveness of the fiscal system leads not to growth but to a decline in exports by 6.8490% of GDP. Standard errors are relatively small. The overall error for equation (6) is 6.0508, with factor variable errors of 0.3338 for R_1 and 1.5922 for R_2.

4.3. Prospects for enhancing the impact of government budget expenditures in Central Asian countries through improved public governance

In addressing the second research objective, the author substituted the maximum values of the factor variables from the 2024 sample in Table 1 (R_1=33.71% of GDP and R_2=4.00 points) were substituted into equations (2)–(6) to determine the potential for increasing the socio-economic impact of government budget expenditures in Central Asian countries. For each of the five countries, an individual forecast of socio-economic development was prepared, assuming an improvement in the quality of government regulation of its economic system through 2030. The forecast for Kazakhstan is presented in Figure 1.

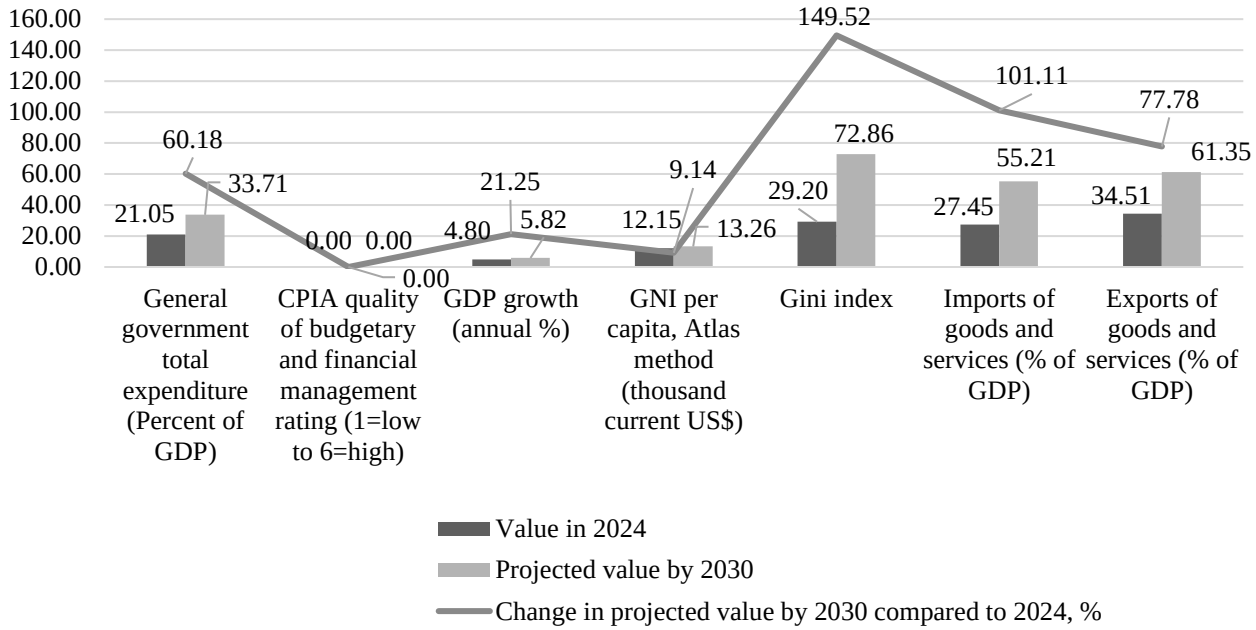


Figure 1. Forecast of Kazakhstan's socio-economic development with improved quality of government regulation through 2030. Source: developed by the author

The forecast in Figure 1 anticipates an increase in Kazakhstan's government budget expenditures by 60.18%: from 21.05% of GDP in 2024 to 33.71% of GDP by 2030. The forecast also considers that Kazakhstan does not maintain statistical records of the progressiveness of its fiscal system in terms of CPIA, which limits the ability to measure, plan, and improve the quality of economic governance. According to the forecast, the rise in government budget expenditures is expected to generate the following improvements in Kazakhstan's socio-economic system:

- Acceleration of economic growth by 21.25%: from 4.80% annually in 2024 to 5.82% annually by 2030;
- An increase in income levels by 9.14%: from $12.15 thousand in 2024 to $13.26 thousand by 2030;
- Growth in exports of goods and services by 77.78%: from 34.51% of GDP in 2024 to 61.35% of GDP by 2030.

However, due to the presence of identified institutional traps in Kazakhstan's economic governance, the projected increase in government budget expenditures is accompanied by side effects. These include a 149.52% rise in income inequality (with the Gini index increasing from 29.20 in 2024 to 72.86 by 2030) and a 101.11% increase in the economy's dependence on imports (with imports of goods and services rising from 27.45% of GDP in 2024 to 55.21% of GDP by 2030). Avoiding or mitigating these side effects will require Kazakhstan to adopt international best practices in improving the progressiveness of its fiscal system as measured by CPIA. The forecast for Kyrgyzstan is presented in Figure 2.

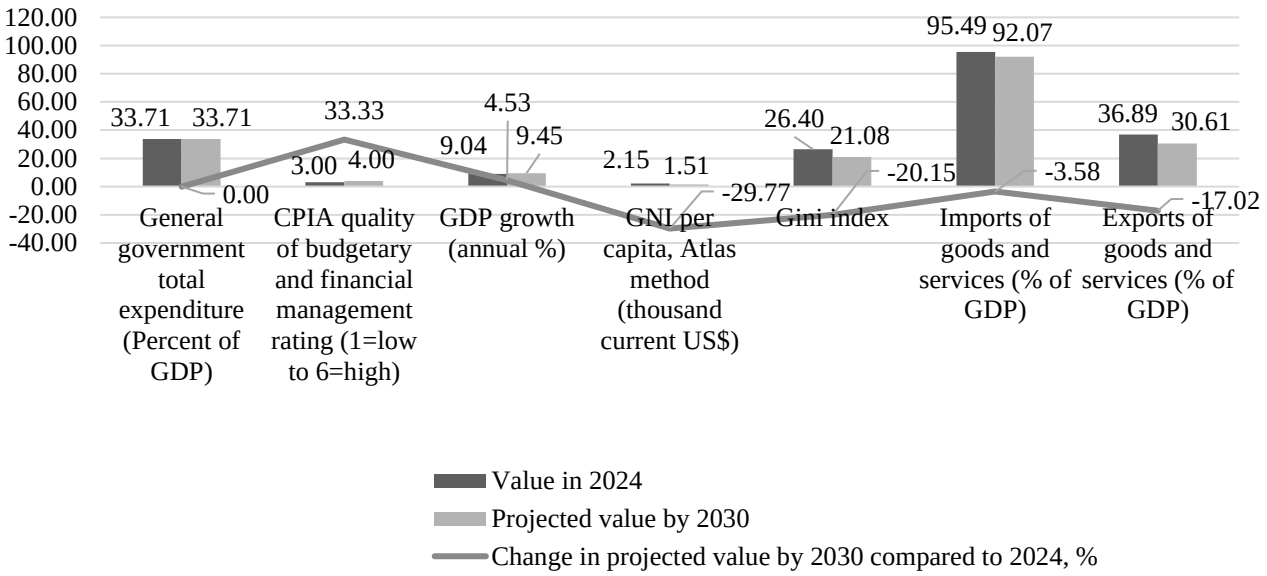


Figure 2. Forecast of Kyrgyzstan's socio-economic development with improved quality of government regulation through 2030. Source: Developed by the author

The forecast in Figure 2 assumes that government budget expenditures in Kyrgyzstan will remain unchanged at the 2024 level (33.71% of GDP) through 2030, as Kyrgyzstan is the regional leader in Central Asia in terms of such spending. The forecast also anticipates an increase in the progressiveness of the fiscal system, as measured by CPIA, by 33.33%: from 3.00 points in 2024 to 4.00 points by 2030. Thanks to this, the forecast projects the following improvements in Kyrgyzstan's socio-economic system:

- Acceleration of economic growth by 4.53%: from 9.04% annually in 2024 to 9.45% annually by 2030;
- Reduction of income inequality, with the Gini index declining by 20.15% from 26.40 in 2024 to 21.08 by 2030;
- More successful import substitution, with the economy's dependence on imports decreasing by 3.58% as the share of imports in GDP falls from 95.49% in 2024 to 92.07% by 2030.

However, due to the presence of identified institutional traps in Kyrgyzstan's economic governance, the forecasted increase in the progressiveness of the fiscal system (CPIA) is accompanied by side effects. These include a 29.77% decline in income levels: from $2.15 thousand in 2024 to $1.51 thousand by 2030, as well as a 17.02% reduction in exports of goods and services: from 36.89% of GDP in 2024 to 30.61% by 2030. Avoiding or mitigating these side effects will require a further increase in Kyrgyzstan's government budget expenditures. The forecast for Tajikistan is presented in Figure 3.

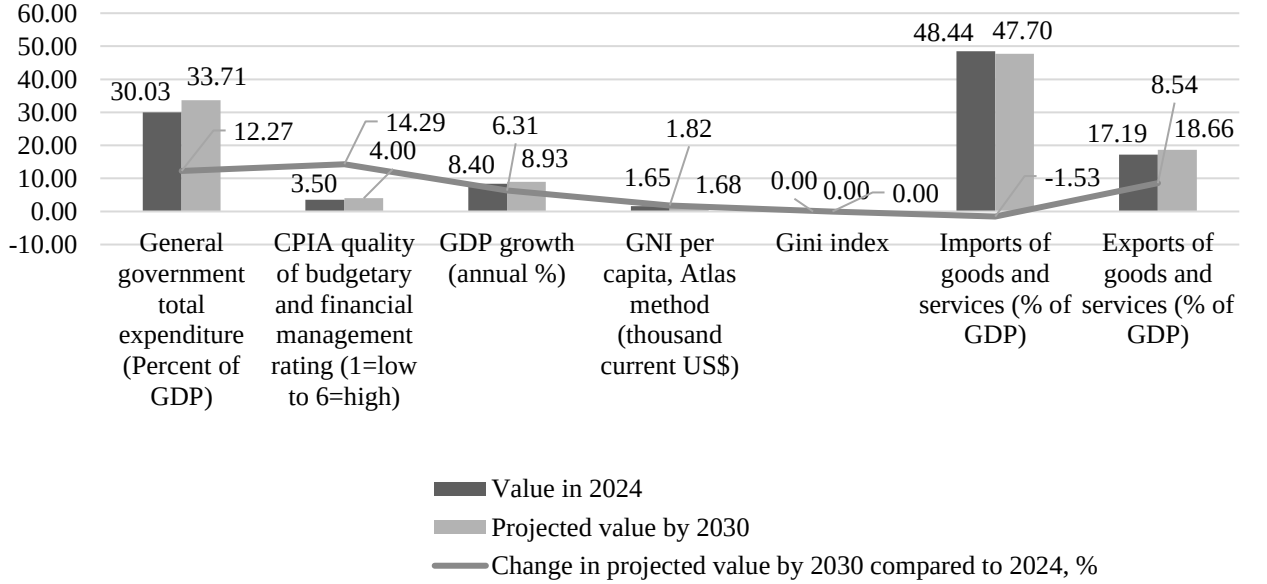


Figure 3. Forecast of Tajikistan's socio-economic development with improved quality of government regulation through 2030. Source: Developed by the author

The forecast in Figure 3 anticipates an increase in Tajikistan's government budget expenditures by 12.27%: from 30.03% of GDP in 2024 to 33.71% of GDP by 2030. It also projects a 14.29% rise in the progressiveness of the fiscal system as measured by CPIA: from 3.50 points in 2024 to 4.00 points by 2030. According to the forecast, this comprehensive improvement in the quality of economic governance is expected to generate the following positive outcomes for Tajikistan's socio-economic system:

– Acceleration of economic growth by 6.31%: from 8.40% annually in 2024 to 8.93% annually by 2030;
– An increase in income levels by 1.82%: from $1.65 thousand in 2024 to $1.68 thousand by 2030;
– More effective import substitution, with the economy's dependence on imports decreasing by 1.53% as the share of imports in GDP falls from 48.44% in 2024 to 47.70% by 2030;
– Growth in exports of goods and services by 8.54%: from 17.19% of GDP in 2024 to 18.66% of GDP by 2030.

However, it should be noted that Tajikistan does not maintain statistical records of income inequality as measured by the Gini index, a limitation reflected in the forecast shown in Figure 3. The forecast for Turkmenistan is presented in Figure 4.

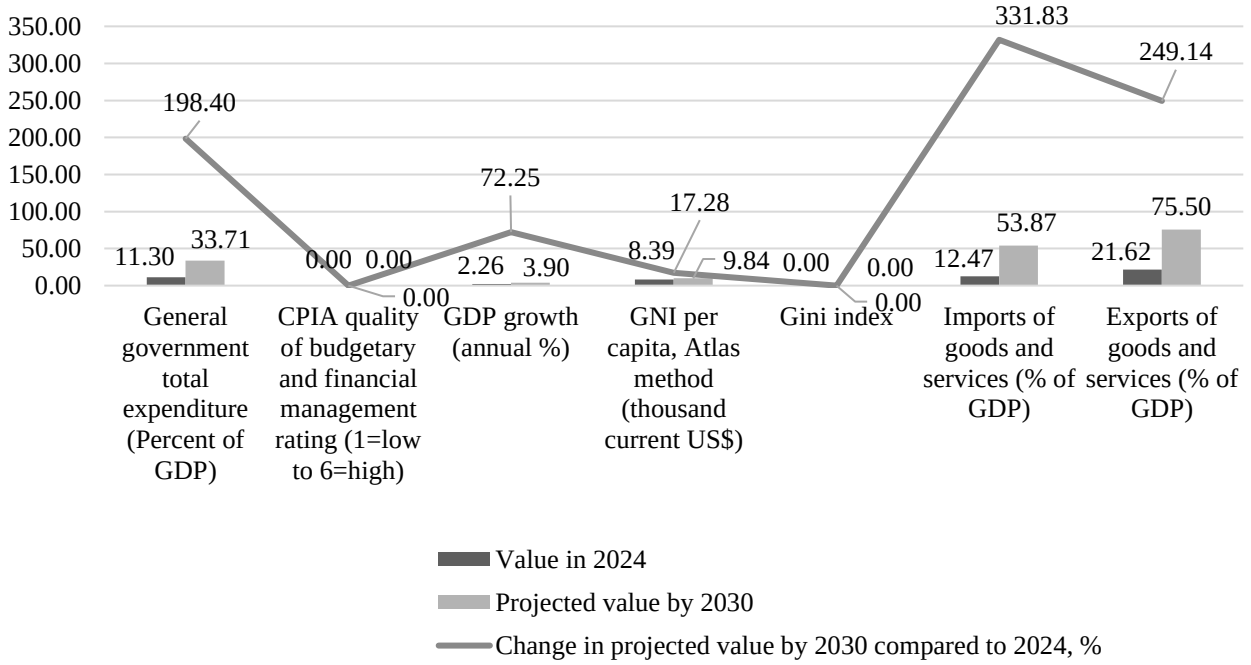


Figure 4. Forecast of Turkmenistan's socio-economic development with improved quality of government regulation through 2030. Source: Developed by the author

The forecast in Figure 4 anticipates an increase in Turkmenistan's government budget expenditures by 198.40%: from 11.30% of GDP in 2024 to 33.71% of GDP by 2030. It also notes that Turkmenistan does not maintain statistical records of the progressiveness of its fiscal system in terms of CPIA, which limits the ability to measure, plan, and improve the quality of economic governance. According to the forecast, the rise in government budget expenditures is expected to generate the following improvements in Turkmenistan's socio-economic system:

– Acceleration of economic growth by 72.25%: from 2.26% annually in 2024 to 3.90% annually by 2030;
– An increase in income levels by 17.28%: from $8.39 thousand in 2024 to $9.84 thousand by 2030;
– Growth in exports of goods and services by 249.14%: from 21.62% of GDP in 2024 to 75.50% of GDP by 2030.

However, due to the presence of identified institutional traps in Turkmenistan's economic governance, the projected increase in government budget expenditures is accompanied by the side effect of greater dependence on imports, which is expected to rise by 331.83% (with imports of goods and services increasing from 12.47% of GDP in 2024 to 53.87% of GDP by 2030).

Avoiding or mitigating this side effect will require Turkmenistan to adopt international best practices in improving the progressiveness of its fiscal system as measured by CPIA. It should also be noted that Turkmenistan does not collect statistical data on income inequality in terms of the Gini index, a limitation reflected in the forecast in Figure 4. The forecast for Uzbekistan is presented in Figure 5.

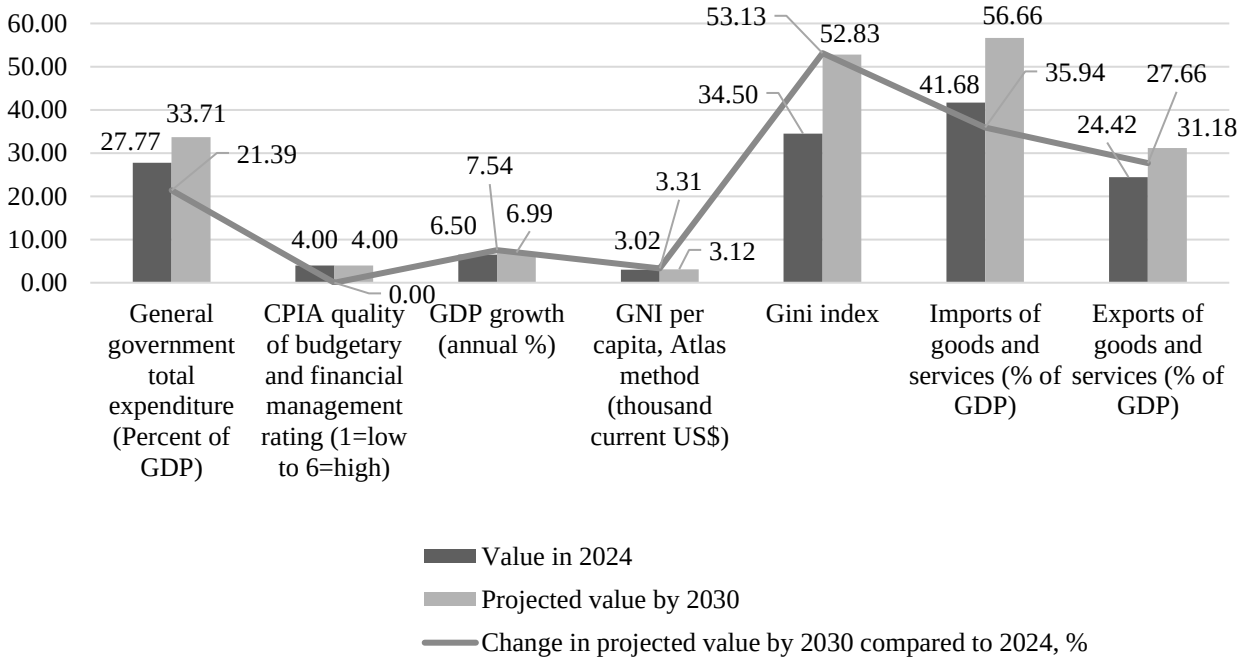


Figure 5. Forecast of Uzbekistan's socio-economic development with improved quality of government regulation through 2030. Source: Developed by the author

The forecast in Figure 5 anticipates an increase in Uzbekistan's government budget expenditures by 21.39%: from 27.77% of GDP in 2024 to 33.71% of GDP by 2030. It also assumes that the progressiveness of Uzbekistan's fiscal system, as measured by CPIA, will remain unchanged at the 2024 level (4.00 points) through 2030, since Uzbekistan is the regional leader in Central Asia on this indicator. According to the forecast, the increase in government budget expenditures is expected to generate the following improvements in Uzbekistan's socio-economic system:

- Acceleration of economic growth by 7.54%: from 6.50% annually in 2024 to 6.99% annually by 2030;
- An increase in income levels by 3.31%: from $3.02 thousand in 2024 to $3.12 thousand by 2030;
- Growth in exports of goods and services by 27.66%: from 24.42% of GDP in 2024 to 31.18% of GDP by 2030.

However, due to the presence of identified institutional traps in Uzbekistan's economic governance, the projected increase in government budget expenditures is accompanied by side effects. These include a 53.13% rise in income inequality (with the Gini index increasing from 34.50 in 2024 to 52.83 by 2030), as well as a 35.94% increase in the economy's dependence on imports (with imports of goods and services rising from 41.68% of GDP in 2024 to 56.66% of GDP by 2030). Avoiding or mitigating these side effects will require Uzbekistan to further improve the progressiveness of its fiscal system as measured by CPIA.

5. DISCUSSION

The results obtained complement the works of Bogobiz et al. (2017) and Kusakina et al. (2016), which relate to the scientific and theoretical concept of monitoring and managing the quality of government regulation of the economy, by specifying the previously unknown returns on government budget expenditures in Central Asian countries. The answer to the research question, in comparison with earlier literature, is presented in Table 4.

Table 4. Answer to the research question in comparison with previous literature

Tangible socio-economic effect in the form of improvements	Reflection of the effect in the literature	Conditions determining the quality of government regulation	
		Volume of government budget funds (quantitative condition)	Progressiveness of the fiscal system (qualitative condition)
Acceleration of economic growth	Bogoviz et al. (2018a, 2018b), Mkrtchyan and Navasardyan (2024)	the condition is significant and has a correct effect	the condition is significant and has a correct effect
Increase in household income levels	Bazinyan and Mayilyan (2024); Kitsai et al. (2023)	the condition is significant and has a correct effect	the condition is significant, but its effect is distorted
Reduction of income inequality	Mayilyan and Torosyan (2023)	the condition is significant, but its effect is distorted	the condition is significant and has a correct effect

Decrease in unemployment	Hayrapetyan and Isayan (2022), Isayan and Mayilyan (2022)	the condition is not significant	the condition is not significant
Growth in the share of medium- and high-tech industries in the industrial structure	Melkamu (2025), Popkova and Giyazov (2021)	the condition is not significant	the condition is not significant
Import substitution (reduction of imports)	Tadevosyan (2023)	the condition is significant, but its effect is distorted	the condition is significant and has a correct effect
Expansion of exports	Sngryan (2022)	the condition is significant and has a correct effect	the condition is significant, but its effect is distorted

Source: developed by the author.

According to the results summarized in Table 4, the high quality of government regulation of the economy in Central Asian countries is evidenced by the proven significant and correct influence of both conditions (quantitative and qualitative) on accelerating economic growth (confirming the findings of Bogoviz et al. (2018a, 2018b) and Mkrtchyan and Navasardyan (2024)), the established significant and correct impact of government budget expenditures on raising household incomes (confirming the findings of Bazinyan and Mayilyan (2024) and Kitsai et al. (2023)) and on boosting exports (confirming the findings of Sngryan (2022)), ; as well as the substantiated significant and correct influence of fiscal system progressiveness on reducing income inequality (confirming the findings of Mayilyan and Torosyan (2023)) and import substitution (confirming the findings of Tadevosyan (2023)).

Simultaneously, the author identified institutional traps of economic governance in Central Asia, which undermine its quality. These are manifested in the absence of significant contributions from either condition (quantitative or qualitative) to reducing unemployment (contrary to the findings of Hayrapetyan and Isayan (2022) and Isayan and Mayilyan (2022)) and to increasing the share of medium- and high-tech industries in the industrial structure (contrary to the findings of Melkamu (2025) and Popkova and Giyazov (2021)), as well as in the distorted influence of government budget expenditures on income inequality and import substitution (contrary to the findings of Salnazaryan et al. (2022)) and the distorted influence of fiscal system progressiveness on household income levels and export volumes (contrary to the findings of Guo and Liang (2025)).

6. CONCLUSION

The main findings of this research are as follows. First, the author constructed an economic-mathematical model to capture the dependence of target areas of improvement in the socio-economic systems of Central Asian countries in 2022–2024 on the conditions of public governance of these systems. The model has theoretical significance because it specifies the governance conditions that influence the effectiveness of government budget expenditures in these countries.

The quantitative condition (the volume of budgetary resources allocated to the economy) is crucial for stimulating household income growth and fostering import substitution. In turn, the qualitative condition (the progressiveness of the fiscal system) largely determines the success of Central Asian countries in reducing income inequality and promoting import substitution. Both conditions, quantitative and qualitative, must be met to accelerate economic growth.

The overall conclusion, based on the research results, is that the socio-economic impact of government budget expenditures in Central Asian countries is reflected in accelerated economic growth, rising incomes and reduced inequality, import substitution, and fuller realization of export potential. Second, the research identifies the prospects for enhancing the impact of government budget expenditures in Central Asian countries through improvements in public governance.

The forecasts of socio-economic development for each of the five Central Asian countries through 2030, assuming improved quality of governance, supplemented by policy recommendations for strengthening such improvements, have empirical value. They reinforce the methodological and scientific basis for enhancing budget planning and rationalizing public expenditure in Central Asian countries.

A limitation of the results is that they did not reveal a statistically significant contribution of government budget expenditures or fiscal system progressiveness to reducing unemployment or advancing high-tech economic growth in the region. Therefore, future research should focus on a deeper exploration of the causal links between unemployment, high-tech production, and the quality of governance in Central Asian states, possibly through case studies that would allow for a more meaningful qualitative interpretation of these countries' experiences.

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Zaifun A. Yernazarova
Kyrgyz-Russian Slavic University
named after B.N. Yeltsin,
Bishkek,
Kyrgyzstan;
Department of Public Finance
Reporting and Statistics of the Ministry
of Finance of the Republic of
Kazakhstan,
Astana,
Kazakhstan
ecword@mail.ru
ORCID 0009-0002-7436-2226