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Role of Labor Market Indicators and Demographic Trends on the Possibilities of Planning Socio-Economic Sustainable Development of Countries: Cluster Analysis

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ABSTRACT

In modern conditions, socio-economic planning requires considering not only macroeconomic indicators, but also labor market and demographic dynamics factors directly related to achieving the Sustainable Development Goals. The purpose of this study was to identify patterns of the influence of labor market and demographic factors on GDP per capita in countries with common historical ties, where the modern economic model of these countries was established in the 1990s. The analysis is based on data from 2018–2021, which allows us to record the pre-war structural relationships before the start of large-scale geopolitical upheavals in the region (the Russia-Ukraine conflict, escalation in Armenia and Azerbaijan), which radically changed migration and labor processes. The methodological basis of the study was the cluster approach, which enabled the grouping of countries by levels of economic welfare and growth rates. Three clusters were identified: countries with relatively high GDP and moderate growth rates (Russia, Kazakhstan), countries with medium GDP but more dynamic development (Belarus, Armenia, Azerbaijan, Moldova), and economies with low welfare but significant demographic potential (Kyrgyzstan, Tajikistan, and Uzbekistan). The results showed that for the first group, the key factors were employment and wages; for the second group, population growth and economic activity; and for the third group, high age dependence and vulnerable employment. The findings enable the consideration of country-specific factors when developing sustainable development strategies aimed at reducing unemployment, enhancing job quality, and leveraging demographic potential. They also form the basis for improving socio-economic planning and creating a national strategy consistent with Sustainable Development Goal 8, "Decent work and economic growth," and Sustainable Development Goal 10, "Reduced inequality."

1. INTRODUCTION

The growth of GDP per capita improves the material standard of living for the population and makes a significant contribution to the state's development. The steady growth of the economy in the long term is primarily determined by the labor market situation and the country's demographic potential [1].

At the same time, under the influence of various technological and demographic trends, such as population aging and the growth of a young, mobile migrant population, the labor market is undergoing rapid changes [2, 3]. Demographic profiles are changing, and this has implications for the working-age population [4]. In many countries, the birth rate is declining, and, combined with an aging population and an increase in life expectancy, pressure on the working population is intensifying. This pressure is resulting in a growing burden on healthcare and other essential services that support the elderly population. As a result, the retirement age is being raised or is the subject of widespread debate worldwide. All this puts a significant burden on budgets and has important consequences for national economies.

Phenomena such as unemployment and underutilization of the labor force lead to a decrease in people's welfare, reduce opportunities for inclusive and sustainable economic development, and indicate problems in the labor market.

In the current situation, creating conditions for economic growth based on increased labor productivity, which in turn leads to higher salaries and a higher level of welfare for the population, is one of the urgent tasks for researchers in this field [5].

Under current conditions, the study of the strength and nature of the impact of labor market indicators and demographic trends on the country's economic development is particularly relevant.

The purpose of this study was to identify patterns of the influence of the labor market and demographic factors on GDP per capita in countries with common historical ties, where the modern economic model of these countries was formed in the 1990s.

2. LITERATURE REVIEW

Currently, a significant amount of fundamental and applied scientific research is focused on studying factors that affect GDP growth, one of the most important macroeconomic indicators of a country's development [6]. A significant part of such studies aims to assess the impact of demographic factors on economic growth.

Piketty [7] notes that economic growth "always includes a purely demographic component and a purely economic component, and only the latter allows for an improvement in the standard of living."

Some studies have shown a positive relationship between the size of a population and the state's economic growth [8].

The study of Peterson [9] supports the idea that population is an important factor in economic growth, contributing to higher GDP growth per capita. He also claimed that the population growth rate increased the annual economic growth by more than three percentage points.

Li [10] demonstrated that the influence of population had a more significant impact on a country's GDP than the country's size and was a necessary component for calculating and forecasting economic growth [10, 11].

However, a meta-regression analysis of the macroeconomic literature conducted in the study [12] showed that due to various methods, control variables, and other factors, conclusions about the positive relationship between population growth and GDP per capita are not reliable.

Other authors [13, 14] also find the exact relationship between population growth and per capita income inconclusive, arguing that the relationship does not clearly explain the determinants of rapid population growth in developing countries where there is no birth control or birth management system.

The precise relationship between population growth and income per capita is also considered unconvincing by other authors, who argue that this relationship does not clearly explain the determinants of rapid population growth in developing countries, where systems of fertility control and population management are largely absent [13, 14]. Sebikabu et al. [15] conclude that population growth does not exert any significant impact on the economic development of developing countries; however, in the long run, population growth may have a positive and statistically significant effect on economic growth.

Examining the impact of population growth on sustainable development, Güney [16] found that its effects are heterogeneous: it is beneficial for high-income countries while simultaneously detrimental to low-income ones.

Other studies show a negative relationship between variables such as GDP and population growth [17-19].

Researchers [20, 21] argue that the share of the working-age population in relation to the total population has no significant impact on GDP per capita, and economic growth is stimulated mainly by industrialization, technological progress, and savings growth.

In addition to demographic factors, one of the most critical aspects of economic growth and development is the labor market [22, 23]. An increase in real GDP by 2-3% leads to a decrease in unemployment by 1% [24, 25], and a linear relationship between GDP per capita and employment is also revealed in the previous studies [26, 27].

At the same time, the results of other studies have not shown a close relationship between real GDP and the unemployment rate [28].

One of the most important labor market factors influencing economic growth are informal employment and average monthly wages. Current studies show that reducing the informal economy leads to an increase in GDP per capita [29-32].

A number of researchers analyzed the relationship between average wages and GDP per capita [33-35]. Research results show that these variables are closely interconnected; however, the nature of this connection is bidirectional.

On the one hand, GDP per capita growth creates preconditions for wage increases due to higher labor productivity, the emergence of new jobs, and growth in enterprises' financial resources [34, 35].

On the other hand, an increase in real wages stimulates consumer demand, which, in turn, contributes to economic growth [33].

Thus, the literature review provides a rationale for selecting six key variables to analyze the impact of demographic factors and the labor market on GDP per capita. The population growth rate (X1) was chosen based on studies demonstrating its ambiguous yet significant influence on economic growth [9, 15, 16]. The age dependency ratio (X2) reflects the demographic burden on the working-age population and serves as an indicator of either a demographic dividend or a demographic burden [20, 21]. The labor force participation rate (X3) characterizes the degree of population involvement in economic activity and is directly linked to the productive capacity of the economy [27]. The unemployment rate (X4) is a key indicator of the efficiency of labor resource utilization and is closely associated with GDP dynamics [24, 25]. Vulnerable employment (X5) reflects job quality and the degree of economic formalization, which is critically important for sustainable development [29-32]. Finally, the average monthly nominal wage (X6) serves as an indicator of labor productivity and the population’s purchasing power, both of which are directly related to the level of economic well-being [33-35].

3. METHODS

3.1 Design of the study, information base, and sampling period

To achieve this goal, we developed a panel regression model that enabled us to assess the contributions of demographic factors and the labor market to GDP per capita for all the countries selected for the study, as well as for individual clusters.

We selected the countries (Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, and Uzbekistan) based on the following characteristics:

- participation in joint economic and political unions,
- modern market relations began to take shape at the end of the 20th century.

The countries were grouped into three clusters based on two indicators reflecting their level of economic welfare over five years: the average annual GDP per capita and the average annual growth rate.

The information base for the analysis was provided by national and international statistical databases on demographic and labor market development, such as ILOSTAT and the World Bank Group, as well as official statistical documents on

the level of development of each country selected for the study.

The choice of the observation period is deliberately limited to 2018-2021, since this period captures stable structural relationships between labor market indicators, demographics, and GDP before the onset of large-scale geopolitical shocks in the region. Since 2022, there has been a qualitative shift in migration flows [36, 37], as well as changes in the behavioral strategies of households, companies, and labor market policies, in connection with the armed conflict between Russia and Ukraine (beginning in 2022), and the escalation of the armed conflict between Armenia and Azerbaijan. These events have led to dramatic shifts in employment, wages, structure, and workforce mobility in both the countries involved and in neighboring economies (for example, Kazakhstan) [38], making the data obtained after 2022 incomparable to that of the pre-war period [39]. Consequently, 2018–2021 is considered by us as a reference pre-war base for cross-country comparison and subsequent post-crisis stability comparisons [40]. At the same time, the pandemic shock of 2020 and the recovery of 2021 are accounted for in the models through annual fictitious variables/time effects, which enable the separation of the cyclical impact of COVID-19 from the long-term (structural) relationships between explanatory factors and GDP per capita [41]. This design minimizes the mixing of effects and increases the validity of conclusions about the structural impact of demographic and labor indicators in the normal mode of economic functioning [42].

3.2 Stages and methods

The first step of the study involves cluster analysis, which enables us to identify homogeneous groups based on welfare per inhabitant and reduce the number of regressions, thereby building a statistically robust regression model that allows us to determine the contribution of the labor market to GDP.

The k-means method using the statistical software DATAtab was chosen as a method for clustering countries by GDP per capita [43]. The initial centroids are set randomly. The number of repetitions is 10. Two indicators are identified for the qualitative classification and structuring of countries:

- The average annual GDP per capita for 5 years.
- The average annual rate of GDP growth per capita for 5 years.

The second step was to assess the degree and nature of the impact of labor market factors on the country's level of economic welfare, using the multiple panel regression method with the specialized Gretl software product.

The dependent variable is the indicator of GDP per capita in US dollars (USD), and six leading indicators characterizing the state of the labor market are selected as independent variables (Table 1).

Table 1. The leading indicators characterizing the state of the labor market

Indicator	Description
X1	Population growth rate
X2	The age dependence coefficient (% of the working-age population) is an indicator of the age structure, which is the ratio of the population of the unemployable age to the population of the working age (from 15 to 64 years)
X3	The labor force participation rate (LFPR) reflects the level of economic activity within the population and the success of its involvement in producing goods and services
X4	The level of vulnerable employment
X5	The unemployment rate is defined as the percentage of the total workforce that is unemployed
X6	Nominal accrued average monthly wages, USD

3.3 GDP of the countries participating in the study

The year 2020 became one of the most challenging years for the economies of countries over the past decade. Due to restrictive measures aimed at combating the pandemic and falling global demand for energy resources, the total GDP of the participating countries fell by 2.9%. The economies of the Republics of Armenia, Moldova, and Kyrgyzstan showed the most substantial declines. After emerging from the recession in 2021, the economies of the countries experienced strong growth. The total GDP of the participating countries increased by 21.7% to reach 2,243.9 billion USD.

In 2021, GDP growth was observed in most of the countries participating in the study. Moldova, Tajikistan, and Uzbekistan demonstrated the highest GDP growth rates, exceeding the combined indicator among the selected countries (Figure 1).

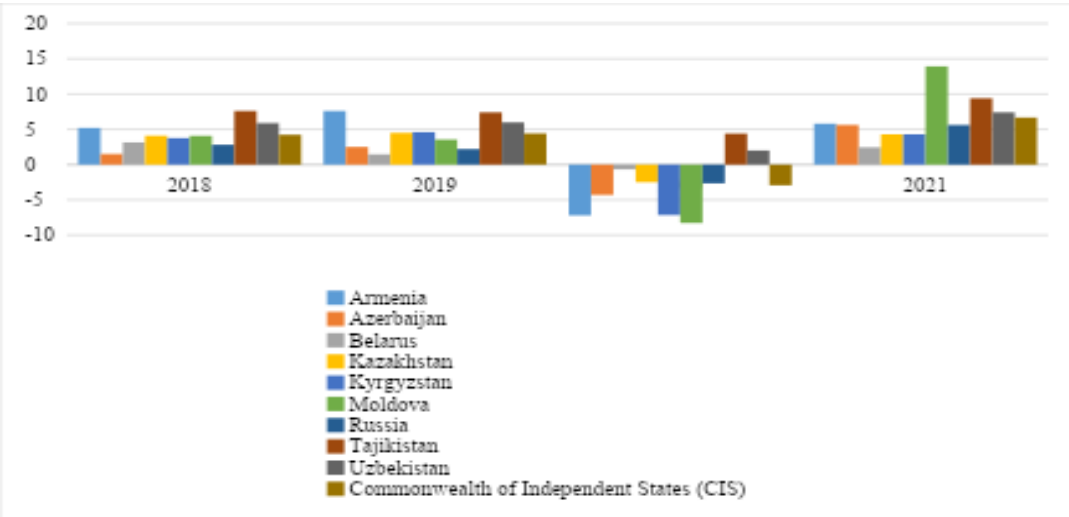

Figure 1. Countries' GDP growth rates (for 2018–2021), %

Despite the downturn caused by the COVID-19 pandemic in 2020, the average growth rate of total GDP per capita in the participating countries over the past five years was 6%.

The initial data for the cluster analysis between the selected countries are presented in Table 2.

Table 2. The initial data for the cluster analysis

Countries	Average Annual GDP per Capita, USD	Average Annual Growth Rate of GDP per Capita, USD
Armenia	4,548.21	4.33
Azerbaijan	4,666.14	0.34
Belarus	6,603.19	2.14
Kazakhstan	9,673.65	1.56
Kyrgyzstan	1,324.97	0.10
Moldova	4,333.57	5.11
Russia	11,254.09	2.07
Tajikistan	870.62	4.83
Uzbekistan	1,813.79	3.22

4. RESULTS

4.1 Cluster analysis

As a result of clustering, considering the uneven economic development of countries, three groups of countries were identified:

Cluster 1 consists of countries with a high level of economic welfare and average growth rates. It includes Kazakhstan and Russia. The average annual GDP per capita for this cluster increased from 9,900 USD to 11,450 USD per person. The average annual growth rate of GDP per capita over five years does not exceed 4%.

This cluster accounts for approximately 68% of the permanent population of the countries, and over the past five years, this figure has increased by 598,000 people. At the same time, the increase in the permanent population was primarily due to the Republic of Kazakhstan, where this indicator increased by more than 5%, or by 963,000 people. In Russia, however, there was a decrease in the total population (366.3 thousand people). Kazakhstan maintains high rates of population reproduction, but during the period under review, its population growth rate decreased from 1.36 to 1.3.

The low birth rate in Russia leads to an aging population. Thus, the aging coefficient (the proportion of people over 65 years of age) in the total population is 16%, which is almost twice as high as the same indicator in Kazakhstan (7.9%).

Ehe age dependence coefficient has been steadily increasing: the cumulative annual average for the cluster has increased from 50.56 to 54.95 over the past five years. This means that for every 100 people of working age, there are now about 55 dependents under the age of 15 and over 65.

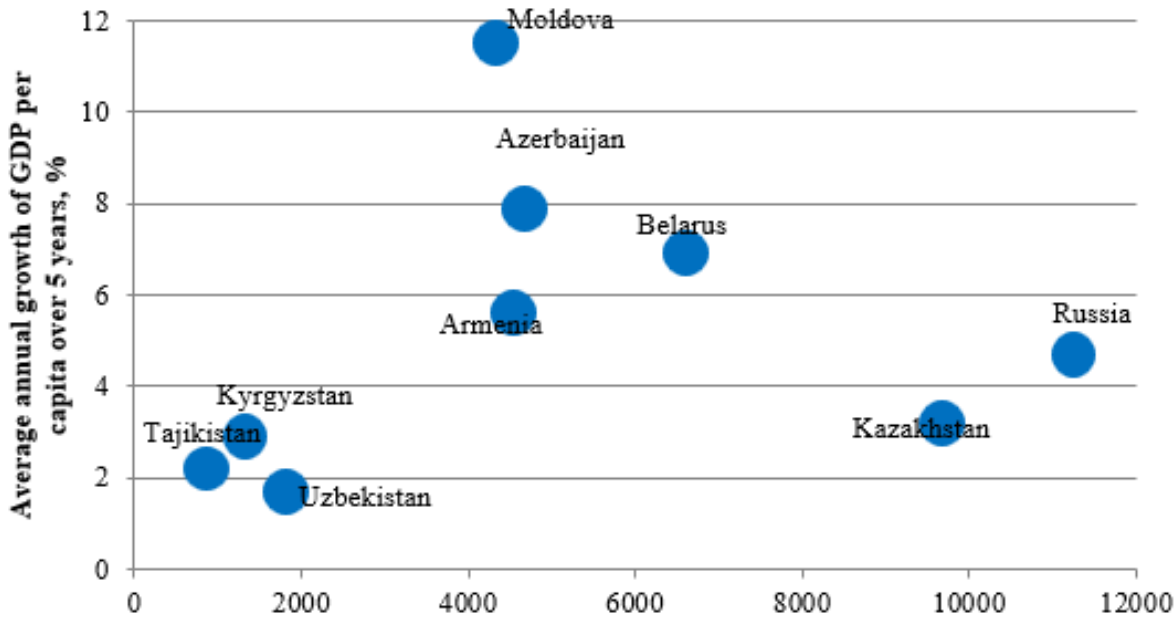

Figure 2. The results of clustering countries by the level of economic welfare

Due to their relatively high GDP per capita and lower unemployment and poverty rates, the countries in this cluster are the primary recipients of migration from other countries. The number of workers in this cluster accounts for approximately 72.7% of the total workforce of the participating countries. However, in five years, this indicator decreased by 714.3 thousand people. In Russia, the labor force decreased by 894.4 thousand people, while in the Republic of Kazakhstan, it increased by almost 180 thousand people.

The labor force participation rate in the cluster decreased by 5.5 percentage points, reaching 65.85% in 2021. It was higher in Kazakhstan than among the selected countries. At the same time, the average annual unemployment rate in this cluster is the lowest among all clusters and tends to decrease.

The unemployment rate is at a relatively low level. Still, its dynamics are mixed: in Russia, this indicator decreased from 5.2% to 4.72% over five years, while in the Republic of Kazakhstan, unemployment increased from 4.9% to 5.2%.

The average monthly wages in the cluster are the highest among other countries, amounting to more than 643 USD by the end of 2021. This represents a 24% increase over the five years.

The initial data for constructing a panel regression model for the countries of the first cluster are presented in Table 3.

Table 3. Initial data for constructing a panel regression model for the first cluster of countries

Cluster Countries	Years	Y	X2	X3	X4	X5	X6	X7
	2017	9,247.58	54.73	70.2	22.98	4.90	462.7	0.34
	2018	9,812.63	56.23	70.1	22.70	4.85	471.9	0.34
Republic of Kazakhstan	2019	9,812.60	57.65	70.1	22.43	4.80	488.1	0.28
	2020	9,121.64	58.95	69.2	21.27	4.89	515.8	0.22
	2021	10,373.79	59.95	69.5	20.66	5.16	587.7	0.16
	2017	10,720.33	46.39	62.6	5.27	5.21	672	0.52
	2018	11,287.35	47.38	62.6	5.37	4.85	699.0	0.56
Russian Federation	2019	11,536.26	48.30	61.9	6.61	4.50	740.0	0.62
	2020	10,194.44	49.22	61.6	5.40	5.59	712.0	0.66
	2021	12,532.05	49.95	62.2	5.25	4.72	777.0	0.53

Cluster 2 is a group of countries with an average level of GDP per capita, but demonstrating faster growth rates of this indicator. This cluster includes Armenia, Azerbaijan, Belarus, and Moldova.

The cluster's average GDP per capita increased from 4,357 USD over five years to 5,786 USD. There is a positive trend in the total GDP of this cluster, with an average per capita GDP growth rate of almost 8% over the past five years. The Republic of Moldova demonstrated the highest economic growth rate, with an average annual growth rate of GDP per capita over five years of 11.5%.

The largest economy in this cluster is the Republic of Belarus, a country with an export-oriented economy, a developed industry, and a strong service sector, as well as a thriving agricultural sector. The average annual GDP per capita in Belarus over the five years amounted to 6,603 USD. This represents an increase of almost 30% from 5,786 USD in 2017 to 7,490 USD.

The second economy of the cluster in terms of GDP per capita (the economy of the Republic of Azerbaijan, which is based on revenues from the oil and gas sector) was in a low growth zone during the period under review. In 2020, in addition to the COVID-19 pandemic, the decline in oil prices and the armed conflict with neighboring Armenia became significant challenges for the Azerbaijani economy. Kyrgyzstan's economy is heavily dependent on international money transfers, as personal remittances received account for approximately 30% of the country's GDP.

The economies of Armenia and the Republic of Moldova are relatively small, and these countries have the smallest populations, with decreases of 2.1% and 5.8%, respectively, in the permanent population over the past five years.

Approximately 24.8 million people reside in the countries included in this cluster, accounting for 10% of the total permanent population of all participating countries in the study. The demographic situation in the countries of this cluster remains quite challenging. The cluster's average population outflow rate increased from 0.336 to 0.603 over five years. Of the four countries included in this cluster, population growth is noted only in Azerbaijan, but it tends to decrease.

The demographic decline in the Republic of Moldova is becoming catastrophic: the outflow rate ranges from 1.5 to 1.7, which is the highest indicator among the countries.

At the same time, the countries in this cluster are characterized by a low age dependency coefficient compared to other countries selected for the study, which nevertheless increased from 45.5 to 48.7 over the five years. The lowest level of dependency burden on the working population is observed in Azerbaijan and Armenia.

Table 4. Initial data for the panel regression model for the second cluster of countries

Cluster Countries	Years	Y	X1	X2	X3	X4	X5	X6
	2017	4,042.00	-0.487	45.59	61.8	39.12	12.94	368.4
	2018	4,391.92	-0.540	46.69	61.7	34.70	13.21	357.6
Republic of Armenia	2019	4,828.50	-0.564	47.77	62.9	31.76	12.20	380.2
	2020	4,505.87	-0.533	48.70	62.1	29.97	12.18	388
	2021	4,972.78	-0.523	49.63	62.7	29.07	12.73	405
	2017	4,147.20	0.981	43.70	65.2	55.21	4.96	307.1
	2018	4,739.79	0.866	43.96	65.7	55.47	4.94	320.4
Republic of Azerbaijan	2019	4,805.75	0.847	44.21	68.5	54.34	4.85	373.6
	2020	4,229.91	0.684	44.29	67.5	55.13	7.16	416.3
	2021	5,408.05	0.441	44.18	68.2	54.46	5.95	430.6
	2017	5,785.53	-0.110	47.49	65.0	3.48	5.65	421.7
	2018	6,360.05	-0.214	48.39	64.9	3.29	4.76	470.3
Republic of Belarus	2019	6,837.77	-0.202	49.32	64.8	3.39	4.16	521.1
	2020	6,542.86	-0.423	50.13	64.7	3.04	4.05	523.4
	2021	7,489.72	-0.828	50.76	64.8	2.95	3.90	565.4
	2017	3,454.95	-1.727	45.29	68.3	34.48	3.89	302
	2018	4,156.96	-1.757	46.74	67	25.45	2.91	373
Republic of Moldova	2019	4,404.95	-1.600	48.10	69.3	21.82	5.10	411.6
	2020	4,376.24	-1.098	49.26	69.7	21.50	3.82	458.6
	2021	5,274.74	-1.503	50.18	72.5	21.25	3.23	507.9

The average level of economic activity in the cluster exceeds that of other clusters and has increased from 65% to 67% over the past five years. Even though the average level of registered unemployment in the cluster is one of the highest, a

decrease in this indicator has been observed over the analyzed period. The highest official unemployment rate was registered in the Republic of Armenia, reaching 12.7% by the end of 2021. In contrast, the lowest unemployment rate in the region was noted in the Republic of Moldova, where Figure 2 did not exceed 3.2%.

The initial data for constructing a panel regression model for the countries of the second cluster are presented in Table 4.

Cluster 3 comprises three Central Asian countries with low levels of economic prosperity and low GDP growth per capita: Kyrgyzstan, Uzbekistan, and Tajikistan. The average per capita GDP growth for the cluster over the five years was insignificant, at 2.3%. At the same time, Tajikistan and Uzbekistan maintained positive GDP per capita dynamics, even against the backdrop of a slowdown in economic growth in most countries in 2020.

The countries in this cluster have significant growth potential, driven by a young and growing population. By the end of 2021, the total permanent population of the countries of this cluster reached 66.7 million people, which is more than a quarter of the population of all countries. The population growth rate of the countries in this cluster over five years was more than 2%.

A high demographic burden and low economic activity characterize the countries in this cluster. Thus, the age dependence coefficient increased from 58.4% to 61.2%. The population of the Republic of Tajikistan experiences the highest level of social burden. Every working person must provide 65.9% more goods and services than would be necessary to support themselves (in Kyrgyzstan, this figure is 63.5%, and in Uzbekistan, it is 54%). At the same time, in terms of age, a progressive type of age pyramid is observed in the countries of the third cluster, i.e., the proportion of children aged 0-14 years is 30%–36.5% of the country's total population. For comparison, in the Russian Federation, this indicator stands at 17.4%, in Belarus at 16.7%, and in Moldova at 18%. At the same time, the proportion of the old population (over 65 years old) is 3.4%-5.3%, which is almost three times higher than the similar indicators of the Russian Federation, the Republic of Belarus, and the Republic of Moldova.

The economies of the countries included in this cluster are oversupplied, as evidenced by the steady growth in labor resources compared to the increase in the number of employed people, due to the limited potential of the economy to generate an appropriate amount of labor demand [44].

Tajikistan has one of the lowest levels of economic activity and average monthly wages among the selected countries. In addition, the vulnerable employment rate in these countries remains one of the highest among all countries.

The average monthly accrued wages in the cluster have increased by only 4% over the past five years, reaching 222 USD per person. However, there is a significant differentiation in this indicator within the cluster, ranging from 136 USD in Tajikistan to 303 USD in the Republic of Uzbekistan.

The quality of labor resources remains low, with employers noting a lack of qualified skills and poor education among job applicants, as well as a shortage of competent specialists in technical fields, among other issues [45].

The countries in this cluster are migration donors because they lack sufficient employment opportunities and stable earnings, resulting in their economically active population migrating to countries in need of labor and demographic resources [46]. On the one hand, migration exchange is mutually beneficial and contributes to maintaining socioeconomic stability [47]. On the other hand, these countries remain vulnerable to external shocks due to their high dependence on money transfers from citizens working abroad and low economic diversification [48]. Thus, the average annual rate of money transfers in the GDP of Kyrgyzstan and Tajikistan reaches 30% and 29%, respectively.

The initial data for constructing a panel regression model for the countries of the third cluster are presented in Table 5.

Table 5. Initial data for building a regression model for the third cluster of countries

Cluster Countries		Y	X1	X2	X3	X4	X5	X6
Republic of Kyrgyzstan	2017	1,242.77	1.934	59.46	63.2	33.98	3.59	227.5
	2018	1,308.14	1.990	60.72	64.1	33.36	3.67	238.6
	2019	1,451.52	2.088	61.97	64.2	32.68	4.25	246.9
	2020	1,256.93	1.898	62.92	64.7	32.25	4.63	244.9
	2021	1,365.51	2.898	63.53	65	31.59	4.77	228.4
Republic of Tajikistan	2017	844.37	2.269	65.64	42	26.10	6.95	134
	2018	850.67	2.245	65.71	41.6	25.32	7.00	135.0
	2019	889.02	2.262	65.85	41.2	24.50	7.04	140.0
	2020	852.33	2.184	65.92	40.8	23.83	7.49	135.0
	2021	916.69	2.144	65.94	40.6	23.18	7.74	136.0
Republic of Uzbekistan	2017	1,916.76	1.684	50.06	56.8	35.22	5.83	281.2
	2018	1,604.26	1.737	50.88	56.7	34.83	5.86	225.8
	2019	1,795.20	1.876	51.91	56.5	34.38	5.86	262.8
	2020	1,759.31	1.922	52.99	55.6	34.38	5.29	265.6
	2021	1,993.42	1.976	53.97	55.8	34.06	6.02	303.0

4.2 The impact of labor market factors on the welfare of countries

At the first stage of the analysis, we identified the regression models that reflected the contribution of labor market indicators to the welfare of each cluster's economy and the economy as a whole (Table 6).

The correlation analysis of 6 characteristics of the labor market of the countries revealed closely interrelated indicators.

In the panel regression model of the first cluster, a high linear correlation is observed between the following:

- Population growth with age dependence coefficients, economic activity, average monthly wages, and vulnerable employment.
- The level of dependency burden with the labor force participation rate, the level of vulnerable employment, and average wages.

Table 6. Regression models of the labor market impact on the welfare of the economy in clusters

	Cluster 1	Cluster 2	Cluster 3	All
Const coefficient	-56,671.1 (29,932.6)	10,416.6 (5,869.38)*	2,261.06 (1,376.11)	-8,576.90 (3,499.08)**
X1 coefficient	-1,783.04 (1,903.01	385.002 (189.902)*	176.247 (53.8563)**	339.799 (252.949)
X2 coefficient	-100.266 (112.406)	9.30065 (112.440)	-35.2236 (11.0614)**	51.0273 (48.3793)
X3 coefficient	1,068.45 (476.139)	-133.535 69.8094*	-0.857085 (5.47391)	24.5110 (33.4596)
X4 coefficient	-170.714 (168.456)	-12.0695 13.6816	-18.6212 (24.4495)	4.45866 (22.0034)
X5 coefficient	-1,019.69 (501.517)	-91.7029 53.6548	32.3462 (36.8072)	87.2574 (76.1792)
X6 coefficient	17.0786 (5.94066)*	9.86434 2.73619***	5.84529 (0.583776)***	21.7530 2.04099***

In the panel regression model of the second cluster, a high linear correlation is observed between the age dependence coefficient (as a percentage of the working-age population) and the level of vulnerable employment, as well as the accrued average monthly wages.

In the constructed panel regression model of the third cluster, we noted the presence of a close correlation between:

- population growth rates and age dependence,
- labor force participation rate and vulnerable employment rate,
- the amount of the accrued average monthly wages and the level of vulnerable employment.

Since these features are strongly interrelated, their simultaneous presence is perceived as redundancy. The sequential exclusion of variables, using a two-way p-value of 0.05, enabled the removal of redundant variables and allowed for the final model specifications to be obtained for each cluster and as a whole (Table 7).

Quality control of these models has shown that they are well interpreted, and the statistical characteristics presented in Table 8 confirm their adequacy, reliability, and significance of the selected parameters.

Table 7. Summary regression panel models

	Coefficient	St. error	t-Statistic	p-Value
Regression analysis results for the first cluster				
Const	11,538.8	2,391.02	4.826	0.0019***
X5	-1,196.22	467.389	-2.559	0.0376**
X6	7.90542	1.16972	6.758	0.0003***
Regression analysis results for the second cluster				
Const	13,353.7	3,287.27	4.062	0.0010***
X1	235.599	106.280	2.217	0.0425**
X3	-187.261	45.1331	-4.149	0.0009***
X5	-121.684	36.9065	-3.297	0.0049***
X6	11.8579	1.28105	9.256	0.000000137***
Regression analysis results for the third cluster				
Const	3,530.91	285.841	12.35	0.000000222***
X1	190.950	46.8706	4.074	0.0022***
X2	-44.6001	3.46039	-12.89	0.000000149***
X4	-39.3387	6.92078	-5.684	0.0002***
X6	6.00793	0.487422	12.33	0.000000227***
Regression analysis results for countries in total				
Const	-3,576.67	548.729	-6.518	0.0000000714***
X1	422.342	154.653	2.731	0.0092***
X6	21.2126	1.17619	18.03	2.17e-021***

Table 8. Statistical characteristics of panel models

	Cluster 1	Cluster 2	Cluster 3
Mean dependent Variables	10,463.87	5,037.778	1,336.46
Residual sum of squares	1,260,207	2,147,443	13,826.33
R-square	0.878607	0.899958	0.994112
F	25.33198	33.73426	422.0959
Log. Likelihood	-72.91039	-144.2193	-72.48118
Schwarz criterion	152.7285	303.4173	158.5026
the rho parameter	-0.233740	-0.511914	0.250088
Standard deviation Dependent Variable	1,073.997	1,062.901	409.5504
St. model error	424.2990	378.3687	37.18377
Corrected R-square	0.843923	0.873280	0.991757
P-value (F)	0.000623	0.000000246	0.0000000000423
Akaike criterion	151.8208	298.4387	154.9624
Hannan-Quinn criterion	150.8250	299.4105	154.9246
Durbin-Watson statistic	1.720247	2.179779	2.241189

The results of our study show that the unemployment rate and the amount of accrued wages have the most noticeable impact on the level of GDP per capita in the countries of the first cluster.

For the countries included in the second cluster, in addition to unemployment and accrued wages, the population growth

rate and the level of economic activity of the population are also significant factors.

For the third cluster, the factors that have a significant impact on the economy's welfare are population growth, levels of age burden and vulnerable employment, and nominal average monthly wages.

As a result of factor decomposition, it is worth noting that, in general, across countries, the contribution of factors such as population growth rates and accrued average monthly wages prevails over other labor market factors.

5. DISCUSSION

Our study reveals that, despite overall growth in GDP per capita, income inequality persists as a significant challenge for countries. Significant differences in the income levels of countries are primarily attributed to their demographic situations.

Our results confirm the conclusions of earlier studies that population growth is a positive factor in stimulating sustainable economic growth for most countries. At the same time, we did not find convincing evidence that unequivocally confirms the existence of an unambiguous inverse relationship between population growth and GDP per capita [16, 49].

The conducted study suggests that population growth, on the one hand, contributes to an increase in the supply of labor and the potential size of domestic markets. On the other hand, the impact of population growth on the level of economic welfare of the economy depends on various factors [50], including the age composition of the population, the level of education [51], and the availability of resources.

For example, in the countries belonging to the second cluster, there was a negative population growth rate. However, the GDP growth rate per capita was the highest relative to other clusters [52]. Other countries, such as Kyrgyzstan, Tajikistan, and Uzbekistan, have experienced relatively rapid population growth; however, their GDP per capita remains the lowest among the countries selected for the study.

The contradictory findings of various studies on the impact of population growth on economic growth can be explained by multiple contextual factors. Our study demonstrates that the positive effects of demographic growth emerge under the following conditions: (1) a favorable age structure of the population, with the working-age population prevailing over dependent groups (the demographic dividend); (2) a sufficient level of economic development and the availability of jobs for the expanding labor force; and (3) investments in human capital, particularly in education and healthcare.

Conversely, in countries characterized by a high dependency burden, limited employment opportunities, and low-quality human capital (as observed in cluster 3 countries), rapid population growth may lead to increased unemployment, especially vulnerable employment, and a decline in GDP per capita [49, 50].

Thus, the impact of demographic factors on economic growth is not linear but conditional, depending on the structural characteristics of the economy and the country’s demographic profile.

Our results confirm the conclusions of Maitah et al. [25] on the existence of an inverse relationship between GDP per capita and the unemployment rate. For countries with high and medium levels of GDP per capita, the general unemployment rate is the most significant factor affecting economic growth.

The varying impact of the unemployment rate on GDP in countries of different clusters is explained by the structural features of their economies. In the countries of the first cluster (Russia and Kazakhstan) with a more developed formal economy, official unemployment more accurately reflects the underutilization of labor resources and is directly linked to production volumes. Additionally, these countries have more developed social protection systems for the unemployed, making official unemployment an economically significant factor that affects government spending and aggregate demand. In contrast, in the countries of the third cluster (Kyrgyzstan, Tajikistan, and Uzbekistan), a significant portion of the working-age population is employed in the informal sector, rendering official unemployment statistics less representative. For these countries, vulnerable employment (X5) is a more significant indicator, as it better reflects the real labor market situation and job quality. Thus, selecting key labor market indicators for analyzing economic development should account for the degree of economic formalization and the structural features of each country.

To reduce the unemployment rate, the International Labor Organization recommends that governments actively apply social partnership mechanisms, develop incentive measures to promote self-employment, create conditions for the expansion of public works, and provide support for employers [53, 54].

For the countries in the third cluster, the high level of vulnerable unemployment has a significant impact on the decline in economic welfare [55]. The scale of the informal economy in many low- and middle-income countries, along with the slow pace of labor market transformation towards sectors with competitive specialization and high productivity, remains a problem [56-58].

An analysis of third-cluster countries makes it possible to identify the key barriers hindering economic formalization: (1) high administrative costs associated with business registration and operation, including complex bureaucratic procedures and corruption; (2) a high tax burden on formal employment, which makes the informal sector economically more attractive for both employers and workers; (3) limited access to financial services and credit for micro- and small enterprises; (4) insufficient legal protection of formal labor relations and weak labor market institutions; and (5) a low level of workforce skills that does not meet the requirements of the formal sector [59, 60]. These structural constraints call for a comprehensive approach to formalization policy.

Thus, an urgent task for countries with medium and low GDP per capita is to stimulate activity in the formal sector, rather than fighting the informal economy as such or harassing its participants.

One of the practical tools for stimulating formal employment is active labor market programs (ALMPs), which, when combined with national higher education and social protection systems, are crucial for promoting the continuous professional development of the workforce and enhancing job matching mechanisms between employees and employers [61].

The analysis carried out in this work confirms the conclusions that there is a close direct relationship between GDP per capita and the average monthly wages for all the groups of countries under consideration [62].

According to the theory of human capital, the effectiveness of the education system (vocational training, on-the-job training, retraining, etc.) has a positive impact on income, employment, and labor force participation.

Considering the results obtained, it can be generally stated that an improvement in the labor market situation will have a positive impact on enhancing the welfare of countries' economies and achieving the principles of sustainable development [63]. National labor market development policies should aim to create jobs in line with employers' demand, which includes government employment programs, wage subsidies, and employment support, as well as the expansion and improvement of labor market services, and measures to support self-employment and microenterprises. These activities will contribute to achieving the principles of sustainable development [64].

6. CONCLUSIONS

Our estimates indicate a statistically significant impact on GDP per capita in the selected countries, influenced by factors such as population growth and the size of accrued average monthly wages.

In countries with higher levels of welfare, unemployment, and average monthly wages have a significant impact on GDP per capita.

Among the group of countries with an average level of GDP per capita but faster growth rates, the most significant factors are population growth, the level of economic activity among the population, unemployment, and average monthly wages.

High levels of age dependence and vulnerable employment hurt the welfare of countries such as Kyrgyzstan, Uzbekistan, and Tajikistan. At the same time, these countries have enormous demographic potential, including significant population growth, which has a positive impact on GDP growth per capita at the expense of the younger generation, and a high-quality workforce that will enter the labor market in the short term.

We would like to highlight the main limitations of the study, namely that the results are interpreted as pre-war structural dependencies and serve as a basis for a valid comparison with the post-crisis period in future works. Therefore, it is essential to continue researching socio-economic development planning to understand which indicators and dependencies (between the labor market, demographics, and GDP) remain stable and which change following external shocks. To do this, our study has allowed us to identify 2018-2021 as a "baseline scenario" and in the future we plan to compare it with data from 2022-2026 to assess the scale of the structural shift and help us understand which indicators are the most sustainable, thereby making it possible to make a scientific contribution to research on achieving the principles of sustainable development.

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