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GAZDÁLKODÁS- ÉS SZERVEZÉSTUDOMÁNYI FOLYÓIRAT

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IMPACT OF SOCIO-ECONOMIC FACTORS ON UNDERNOURISHMENT IN CENTRAL ASIA

A TÁRSADALMI-GAZDASÁGI TÉNYEZŐK HATÁSA AZ ALULTÁPLÁLTSÁGRA KÖZÉP-ÁZSIÁBAN

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ABSTRACT

The Global Hunger Index reports a troubling rise in the global number of undernourished people, increasing from 572 million in 2017 to 735 million in 2023, highlighting persistent global challenges. In Central Asia, undernourishment poses a serious threat to public health and impedes both economic and social progress for millions. This study emphasizes the critical roles of political stability and remittances as primary determinants influencing undernourishment in the region. Utilizing a fixed-effects panel data model, we analyze the impact of these key factors, alongside other economic and social indicators, on food security. Our findings indicate that higher remittance inflows are inversely related to undernourishment, suggesting that increased household income from remittances greatly enhances food access and security. Furthermore, the analysis highlights that political stability plays a crucial role in mitigating undernourishment, with more stable governance correlating with lower rates of food insecurity. These insights emphasize the necessity for targeted policies that foster political stability and encourage remittance flows while ensuring inclusive food access and local production.

ABSZTRAKT

A globális éhínségindex az alultáplált emberek számának aggasztó növekedéséről számol be, amely a 2017-es 572 millióról 2023-ra 735 millióra emelkedett, rávilágítva a tartós globális kihívásokra. Közép-Ázsiában az alultápláltság komoly veszélyt jelent a közegészségügyre, és milliók gazdasági és társadalmi fejlődését akadályozza. Ez a tanulmány hangsúlyozza a politikai stabilitás és a hazautalások kritikus szerepét, melynek a régióban az alultápláltságot befolyásoló elsődleges meghatározó tényezői. Egy fix hatású paneladat-modell segítségével elemezzük e kulcsfontosságú tényezők hatását az élelmezésbiztonságra, más gazdasági és társadalmi mutatókkal együtt. Eredményeink azt mutatják, hogy a magasabb pénzátutalások fordítottan arányosak az alultápláltsággal, ami arra utal, hogy a háztartások pénzátutalásokból származó jövedelmének növekedése

nagymértékben javítja az élelmiszerhez való hozzáférést és az élelmezésbiztonságot. Az elemzés rávilágít továbbá arra, hogy a politikai stabilitás döntő szerepet játszik az alultápláltság mérséklésében, mivel a stabilabb kormányzás alacsonyabb élelmiszer-biztonsági rátával jár együtt. Ezek a felismerések hangsúlyozzák a politikai stabilitást elősegítő és a hazautalások áramlását ösztönző célzott politikák szükségességét, miközben biztosítják az élelmiszerekhez való inkluzív hozzáférést és a helyi termelést.

INTRODUCTION

According to the Global Hunger Index, the number of undernourished people has risen from 572 million in 2017 to 735 million in 2023 and remains one of the main issues in the world (Von Grebmer et al., 2023). The problem of undernourishment in Central Asia (CA) represents a significant obstacle to the health and well-being of millions of people in the region and poses a substantial barrier to economic and social progress. This problem not only threatens the physical and psychological well-being of people but also slows down societal development as a whole. Limited access to food for a significant part of the population requires attention and needs a comprehensive study of this problem.

In recent decades, research in the field of economic development and labor has increasingly focused on the relationship between economic indicators and the level of undernourishment (Adeyeye et al., 2017; Nugroho et al., 2022; Soriano & Garrido, 2016; Zakaria et al., 2016). These studies aim to identify key factors determining the level of malnutrition and to develop strategies for solving it. Special attention is paid to socio-economic indicators such as remittance (REM), GDP, unemployment (UNP), and food production index (FoodPI) as they have the potential to significantly impact access to food and resources.

Understanding these relationships is crucial for the development and implementation of effective strategies to solve the problem of malnutrition in the region of CA, as emphasized (FAO, 2023a). Only through the analysis and understanding of the economic factors influencing the spread of malnutrition can

targeted measures be developed to improve the quality of life and ensure sustainable development.

Economic aspects play a key role in shaping and mitigating the problem of undernourishment in CA. REM, GDP, UNP, and political stability (POLST) can directly influence access to food and the well-being of the population. However, as noted by several researchers (Eini-Zinab et al., 2020; Islam, 2021; Mulyo et al., 2023; Nugroho et al., 2022; Soriano & Garrido, 2016; Zakaria et al., 2016), solving this problem requires consideration not only of economic factors but also of social and cultural characteristics of the region. This emphasizes the importance of comprehensive analysis and collaboration between different levels of society and organizations in developing and implementing effective strategies to fight against malnutrition.

The aim of this study is to examine how socio-economic factors influence the prevalence of undernourishment (NoUP). While many studies focus on economic and agricultural factors, this research includes political stability and remittances as key determinants. The significant impact of POLST on undernourishment emphasizes its crucial role, providing new insights into how governance and political environments contribute to food security. The novelty of our study is the comprehensive analysis of multiple socio-economic determinants of undernourishment, the inclusion of POLST, and the use of fixed-effects regression analysis to capture both within-country and between-country variations. These contributions offer valuable insights and extend the existing literature on food security.

The remainder of this study is organized as follows. Section 2 discusses previous studies, Section 3 describes the data and methodology, Section 4 explains the results and discussion part, and Section 5 discloses the conclusions, policy implications, and limitations of this study.

LITERATURE REVIEW

Undernourishment remains a significant threat to global food security. Since the COVID-19 pandemic, the NoUP has risen sharply, increasing from 7.9% in 2019 to 9.2% in 2022, which means the number of people facing hunger has increased to 122 million (UN, 2023). Within Asia, Southern Asia faces the highest rates of undernourishment, with a prevalence rate of 15.6%, followed by Western Asia and Southeastern Asia with rates of 10.8% and 5.0%, respectively. In contrast, Central and Eastern Asia depict relatively lower ranges of NoUP, ranging from 3.0% to less than 2.5% (FAO, 2023b).

CA, comprising Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan has made significant efforts to reduce undernourishment over the past two decades. Before the COVID-19 pandemic, many CA countries faced substantial reduction in the level of NoUP. For instance, Kazakhstan made significant progress, reducing its NoUP from 6.5% in 2002 to 2.5% by 2019 (Duisenbekova et al., 2024). Tajikistan achieved substantial results as well, with NoUP decreasing from 18.5% in 2013 to 8.6% in 2019, highlighting a concerted effort toward improving food security during this period. Although progress in Kyrgyzstan and Uzbekistan was more gradual, these countries also saw a slight decline in undernourishment rates, contributing to a positive regional trend in reducing food insecurity (FAO, 2023a). These reductions in NoUP reflect how targeted interventions, including improvements in agricultural productivity and poverty reduction measures, helped make food more accessible. However, despite these successes, food security in CA remained insecure, especially in economically vulnerable households.

The COVID-19 pandemic had severe impact on CA, reversing much of the pre-pandemic progress in reducing undernourishment. Between 2019 and 2020, the region's NoUP increased from 2.8% to 3.3%, marking a setback in food security advancements (Duisenbekova et al., 2024; FAO, 2023a). Economic slowdowns during the pandemic led to income declines and increased poverty rates, which made it even more difficult for low-income households to afford nutritious food. The pandemic highlighted the significant role that income and employment play

in food security, as decreasing in purchasing power quickly translated into reduced food access (Junussova et al., 2024; Rabbi et al., 2021)

In addition to economic factors, income inequality can further degrade food security and nutritional value (Zakaria et al., 2016). Increases in GDP have a positive effect on per capita calorie and nutrient availability, enabling people to purchase food more easily, especially during periods of scarcity (Erokhin et al., 2021). Social protection programs implemented by countries with high GDPs can help mitigate food insecurity among the poor, but such measures were less accessible in CA during the crisis (Krawinkel, 2012).

Employment also plays a critical role in ensuring access to food and other basic needs. Increases in UNP are associated with higher levels of food insecurity, as households may struggle to afford sufficient food (Smith et al., 2017). For example, India implemented the Mahatma Gandhi National Rural Employment Guarantee Act to improve livelihood security in rural areas, aiming to provide employment opportunities to alleviate poverty and food insecurity (Smith et al., 2017). However, challenges remain in ensuring stable employment and income levels, particularly in regions with high poverty rates.

Furthermore, various studies show that good governance or a good political situation in a country influences and reduces NoUP and decreases food insecurity (Abdullah et al., 2022; Cassimon et al., 2022; Mulyo et al., 2023). According to Mulyo et al. (2023), POLST was a reason for reducing NoUP in developing countries from 1.4% in Latino-American Countries to 2.5% in Asian and African regions. Moreover, the study by Abdullah et al. (2022) showed that political risk was one of the key factors that decreased food security levels.

In conclusion, reducing NoUP requires holistic strategies that consider economic, social, and political factors. Efforts to improve food security must focus on increasing access to food, reducing poverty and UNP, promoting trade, and attracting foreign investment. By addressing these challenges collectively, countries can make significant progress in reducing malnutrition and improving

the well-being of their populations. However, continued efforts and investments are needed to ensure sustainable and equitable access to food for all.

MATERIALS AND METHODS

Data and Variables

This study employed annual time series data. The secondary data were collected from four Central Asian countries (Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan) from 2002 to 2021. Based on availability these data ranges were selected. Turkmenistan is omitted from the analysis because of the lack of data. These data were obtained from various websites of international institutions (Table 1).

This study used six explanatory variables: personal remittances (REM), food production index (FoodPI), GDP per capita (GDP), unemployment rate (UNP), inflation (consumer prices) (INF), and political stability and absence of violence/terrorism (POLST). The dependent variable was the prevalence of undernourishment (NoUP) in this research work.

Table 1. Variables and data sources for the study

Variable	Symbol	Source
Prevalence of Undernourishment (%) (3-year average)	NoUP	FAOSTAT
Personal Remittances, received (current US$, mln)	REM	WORLD BANK
Food Production Index (2014-2016=100)	FoodPI	WORLD BANK
GDP per capita (US$)	GDP	FAOSTAT
Unemployment, total (% of the total labor force)	UNP	WORLD BANK
Inflation, Consumer Prices (annual %)	INF	IMF
Political Stability and Absence of Violence/Terrorism (percentile rank)	POLST	WORLD BANK

Source: *own editing*

Each variable's predicted relationship with undernourishment is discussed below.

Remittances. REMs represent a vital source of income for households in many developing countries. According to World Bank/KNOMAD (2024) REM increases disposable income, which can improve food security, by allowing households to afford better-quality and more reliable food sources. Therefore, a negative relationship between REM and NoUP is expected, as increased remittance inflows should decrease the NoUP.

Food Production Index. FoodPI measures changes in domestic food production, which directly impacts food availability and, potentially, food prices. According to FAO (2023b), greater food production is associated with better access to affordable food, particularly in low-income countries where food imports may be cost-prohibitive. Thus, higher FoodPI values are anticipated to correlate with lower NoUP, suggesting that there is a negative relationship between FoodPI and NoUP.

Unemployment. High UNP can exacerbate food insecurity by reducing household income and limiting access to adequate food. UNP is therefore hypothesized to have a positive association with NoUP, as economic hardships reduce individuals' ability to afford essential goods, including food. This aligns with economic theories on the direct impact of employment on household food security.

Inflation, Consumer Prices. INF, particularly in consumer prices, erodes purchasing power and can make food less affordable, especially for low-income households. Theoretical and empirical literature suggests a positive relationship between INF and food insecurity. Hence, a positive association between INF and NoUP is expected, as higher inflation rates are likely to increase undernourishment by making food less affordable.

Political Stability and Absence of Violence/Terrorism. POLST is essential for creating an environment where economic growth and effective food distribution systems can thrive. Stability is associated with reduced violence, reliable infrastructure, and consistent governance, all of which are conducive to food

security. Thus, POLST is hypothesized to be negatively associated with NoUP, as more stable political environments facilitate better food access and distribution.

Data Analysis

The first step of the research work is testing the stationarity of the variables to avoid spurious regressions. The authors used the Levin Lin Chu (LLC) to evaluate the stationarity (Hill et al., 2011). Following Nugroho et al. (2021), the Hausman test was conducted to compare the fixed-effects model with the random-effects model to determine the most suitable model for our analysis. Based on the result fixed-effects model was appropriate to our analysis. We analyzed the panel data using the fixed-effects regression analysis. This model helps us to control unobserved heterogeneity across countries and account for individual variations [Equation (1)].

$$NoUP_{it} = \beta_0 + \beta_1 REM_{it} + \beta_2 FoodPI_{it} + \beta_3 GDP_{it} + \beta_4 UNP_{it} + \beta_5 INF_{it} + \beta_6 POLST_{it} + \alpha_t + \eta_i + \varepsilon_{it} \quad (1)$$

where: *NoUP* – prevalence of undernourishment; *REM* – personal remittances; *FoodPI* – food production index; *GDP* – GDP per capita; *UNP* – unemployment rate; *INF* – inflation, consumer prices; *POLST* – political stability and absence of violence/terrorism; α_t – NoUP time-specific fixed effect; η_i – country-specific effect; ε_{it} – error term.

The regression coefficients (β) quantify the change in the NoUP for a unit change in the corresponding independent variables, holding other variables constant. By using the fixed-effects model, we could control for time-invariant characteristics specific to each country (for instance, geographical factors) that could potentially bias the result. This gives us to focus on how changes within each country over time are associated with changes in NoUP and other variables. Additionally, to examine potential heteroskedasticity in the model, the Modified Wald test was employed (Gujarati, 2004).

RESULTS AND DISCUSSION

The LLC unit root test was used in our analysis to determine the data's stationarity. Table 2 shows that all variables are stationary, or the null hypothesis is rejected at the 5% significance level.

Table 2. Levin Lin Chu (LLC) unit root test results

Variable	Stage	Statistic
Prevalence of Undernourishment (NoUP)	at level	-4.437***
Personal Remittances (REM)	1st difference	-4.064***
Food Production Index (FoodPI)	2nd difference	-5.318***
GDP per capita (GDP)	at level	-2.368**
Unemployment, total (UNP)	2nd difference	-3.576***
Inflation, Consumer Prices (INF)	at level	-2.800***
Political Stability and Absence of Violence/Terrorism (POLST)	1st difference	-3.665***

*,**,*** significant at 0.05, 0.01, and 0.001 level, respectively.

Source: *Author's computation using STATA 16.0*

Consequently, the next steps of our analysis were to perform a Hausman test to choose the appropriate regression model and to utilize the Modified Wald test to check for the potential heteroskedasticity of the model which is shown in Table 3. According to the Hausman test, since the p-value is less than 0.005, the null hypothesis is rejected, and this supports the conclusion that the fixed-effects model is the appropriate choice for the analysis. Additionally, the p-value of the Modified Wald test is greater than 0.05, and the rejection of the null hypothesis has failed, which means there is no significant evidence of heteroskedasticity in the regression model, and ready for further analysis.

Table 3. The Hausman test and Modified Wald test results

Name of the test	Chi Sqr	df	Prob.
Hausman test	253.02	6	0.0000
Modified Wal test	2.85	4	0.5834

Source: *Author's computation using STATA 16.0*

The results of a fixed-effects regression analysis that examined the relationship between NoUP and economic variables are presented in Table 4. Based on the key results of our analysis, NoUP decreases with the growth of some economic factors such as REM, FoodPI, GDP, and POLST.

POLST in the analysis has been shown to reduce NoUP (-0.244%). This indicator emphasized that stable political environments contribute to reducing hunger. This result coincides with the findings of previous researchers (Abdullah et al., 2022; Cassimon et al., 2022; Mulyo et al., 2023). POLST in any country is important and often leads to better governance, more effective policy implementation, and a better environment for economic activities. This finding shows us the importance of POLST in any country to decrease the level of NoUP by playing a positive role in sustained economic growth and development, moreover, creating a better condition for food security. For policymakers, the findings suggest improving governance, reducing conflict (in the case of border conflicts between some countries), and stabilizing institutions for better food security as these factors create a foundation for sustained economic development and effective social support systems.

According to the findings, UNP plays a vital role in decreasing NoUP. If the population is provided with sufficient job places, then fewer people suffer from hunger. An increase in the UNP by one percent is associated with a 2.039 percent increase in undernourishment. This finding did not coincide with the study by Nugroho et al. (2022), where UNP was not one of the determinant factors. Higher UNP generally leads to lower household incomes and reduced access to sufficient and nutritious food. This finding emphasizes the critical importance of job creation and economic policies that promote stable employment. Such policies can directly impact food security by ensuring households have a reliable income source. Targeted programs, such as workforce development, education, and training initiatives, may also help reduce the NoUP by addressing both immediate employment needs and longer-term economic resilience.

The fixed-effects regression analysis has shown a significant negative relationship between REM and NoUP. According to the results, each unit increase in REM decreases NoUP by approximately 0.0011 percent. REM often directly affects household income. They provide better access to food and other essentials. This finding can be consistent with existing literature (Murodova, 2018; Poghosyan, 2020) which suggests that REM plays a crucial role in fighting hunger, improving food security, and reducing poverty in developing countries. Furthermore, the finding highlights the value of supporting policies that facilitate remittance flows, such as reducing transaction costs and supporting reliable remittance transfer systems. Recognizing REM as a critical income stream, especially in CA countries, is essential for food security strategies. Programs that support migrants and their ability to send remittances, along with financial literacy initiatives for recipients, could enhance the positive impact of REM on reducing NoUP.

Table 4. Fixed effects regression model results

Variable	Coef.	Std. Error	t-Statistic
REM	-0.0011***	0.0002	-5.97
FoodPI	-0.0408*	0.0186	-2.19
GDP	-0.0004**	0.0001	-3.12
UNP	2.3943***	0.1347	17.78
INF	0.0237	0.0810	0.29
POLST	-0.2437***	0.0288	-8.45
_cons	9.2052***	2.2257	4.14

*, **, *** significant at 0.05, 0.01, and 0.001 level, respectively.

Source: *Author's computation using STATA 16.0*

An increase in the FoodPI by one unit reduces NoUP by 0.040 percent. This result shows the importance of agricultural productivity and food availability in reducing famine. This finding emphasizes the importance of supporting agricultural

production as a core component of food security strategies. Investments in agricultural infrastructure, technology, and training, along with policies that stabilize food prices, can directly impact NoUP. Furthermore, supporting smallholder farmers and strengthening local food systems can increase resilience, reduce food insecurity, and enhance self-sufficiency.

Economic development and income growth are also one of the reasons for the reduction in NoUP. GDP per capita has a coefficient of -0.0004 which indicates a higher economic output per person is associated with a lower level of NoUP. This result emphasizes the importance of the economic development of countries, higher employment rates, and better access to resources, all of which contribute to improved food security. The finding suggests that targeted policies are needed to ensure that economic growth benefits all segments of the population. Inclusive growth policies, social safety nets, and investments in rural and agricultural development can help ensure that the benefits of growth reach the vulnerable populations most affected by undernourishment. Policymakers may need to implement additional measures focused on equitable distribution, poverty reduction, and support food access to mitigate malnutrition as economies grow.

According to the results, INF indicates that there is no strong direct impact on NoUP. While the expectation was that higher INF would increase food prices and reduce access to food, the lack of significance in this study could be due to the varying impacts of INF in different contexts. In the context of food security, INF can decrease the purchasing power of households. As prices for food increase households can buy less amount of food for the same amount of money. This makes it harder for families to afford sufficient and nutritious food. Moreover, higher prices force households to substitute some products with cheaper ones which leads to a reduction in dietary quality and increase NoUP.

Malnutrition remains a critical global challenge, particularly in regions like Central Asia, where NoUP threatens food security. Our literature review underscores the severity of the issue, highlighting Asia as the epicenter of NoUP, with Southern Asia exhibiting particularly high prevalence rates. Despite efforts to address

undernourishment in Central Asia, the region continues to face significant challenges, with poverty emerging as a major driver of malnutrition. Economic downturns and ineffective food security programs further exacerbate the problem, emphasizing the need for comprehensive strategies.

Overall, our findings highlight the complex interaction between socio-economic factors and NoUP in Central Asia. Addressing malnutrition requires multifaceted approaches that tackle poverty, unemployment, and economic inequalities. By implementing targeted policies aimed at promoting economic development, reducing unemployment, and enhancing food production, Central Asian countries can make significant strides towards alleviating undernourishment and improving the well-being of their populations. Continued efforts and investments in sustainable development initiatives are imperative to ensure equitable access to food and combat malnutrition effectively.

CONCLUSION

Our study sheds light on the multifaceted nature of NoUP in Central Asia and the critical role of socio-economic factors in shaping food security outcomes. Through a comprehensive literature review and empirical analysis, we uncover the complex relationships between NoUP, economic indicators, and employment dynamics in the region.

Central Asia, like many other regions globally, faces a persistent problem of undernourishment, despite concerted efforts to address food insecurity.

The novelty of our study is the comprehensive analysis of multiple socio-economic determinants of NoUP, the inclusion of POLST, and the use of fixed-effects regression analysis to capture both within-country and between-country variations. These contributions offer valuable insights and extend the existing literature on food security.

Our findings highlight the significance of economic prosperity, as reflected in indicators such as GDP and employment rates, in mitigating undernourishment. Moreover, regression analysis highlights the subtle relationships between food

production, economic growth, unemployment, and undernourishment, highlighting the need for holistic strategies to effectively combat malnutrition.

Our research shows that poverty and unemployment are key drivers of undernourishment in Central Asia. Therefore, policies aimed at poverty reduction, employment generation, and economic development are paramount to addressing food insecurity in the region. Furthermore, investments in agriculture, social protection programs, and trade facilitation initiatives are needed to stimulate food production, increase access to nutritious food, and promote sustainable development.

While our research provides a wide range of socio-economic factors, other potentially influential variables, such as education levels, healthcare access, and climate change impacts, are not included. Further research should incorporate these variables in order to cover a more detailed picture of the determinants of undernourishment.

In conclusion, reducing the number of undernourished people needs action at the local, national, and international levels. Moreover, it should be guided by evidence-based policies that prioritize economic growth, social equity, and environmental sustainability. By working together to achieve these goals, we can strive to create a future in which everyone has access to adequate and nutritious food.

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