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Analyzing the drivers of child labor and human development: a panel data study of Central Asia and Mongolia

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Abstract- Various studies have been conducted on child labor. These studies tend to rely on or interpret child labor statistics from an economic perspective. This study investigates why children accept the role of child laborer and identifies the factors that influence them. To analyze the factors affecting child labor in this context, we conducted a dynamic panel data analysis using data from five Central Asian countries and Mongolia from 1990 to 2022 to identify the causes of child labor. A country's level of development and poverty are closely related to child labor; therefore, the Human Development Index was added to the model as a dependent variable. Based on the research literature, the following variables were added to the model as independent variables: population growth, primary education penetration rate, years of primary education, and labor market participation rate. The analysis showed that all variables were statistically significant. Population growth was found to hurt child labor, but labor force participation rate, primary school enrollment, economic growth, and years of primary education had a positive impact. Economic growth and social protection hurt the Human Development Index (HDI), while a country's life expectancy does not affect the HDI. These findings show that the problem of child labor depends on many social factors, not just economic ones.

Keywords: Child labor, human development, primary education, labor force participation, poverty, Central Asia and Mongolia, panel dynamic data analysis

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1. INTRODUCTION

Child labor is a global problem that raises concerns about the health and well-being of children as well as the economic development and growth of a country. According to the International Labor Organization (ILO), child labor is defined as the employment of children in occupations that are detrimental to their education and psychological well-being. Employment and education are often considered incompatible and even in official terms[1]. Some researchers argue that providing children with work opportunities is problematic in itself, suggesting that child labor leads to negative outcomes for adult workers such as lower wages and job losses, ultimately contributing to poverty[2]. On the other hand, researchers who disagree believe that child labor helps children acquire life skills, integrate into society, and receive education. However, the downside is that many children are exposed to hazardous, unhealthy, and exploitative work[3].

Fernandez, Russell Christian E.[4] found that the main causes of child labor are due to several social and economic factors. For example, in low-income families, children are forced to work to supplement their family income. Insufficient access to education and poor quality of education are also major reasons why children drop out of school and enter the labor market. In addition, traditional attitudes in some societies that normalize child labor further exacerbate the problem. Bilal Ahmad Ba[5] found that educational institutions and local governments allow children to miss school and create conditions for children to live and work. Recently, Central Asian countries have implemented policies to reduce child labor, improve educational programs, improve the legal environment, and expand international cooperation, but the actual results are insufficient. Child labor negatively affects the economy and education, health, and sustainable social development, so there is a need to study this issue in depth and implement policy reforms. Although the HDI levels of Central Asian countries vary, the impact of child labor is a common problem in all countries. Therefore, this study aimed to identify the determinants of child labor in five Central Asian countries (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan) and Mongolia. Child labor is a serious socioeconomic problem facing many countries around the world, especially developing countries. Child labor rates remain high in Central Asia, including Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, and Mongolia. Poverty, lack of access to education, traditional social attitudes, and labor market characteristics are contributing factors to child labor in the region.

Therefore, the objectives of this study are as follows:

- Identify the factors affecting child labor through the Human Development Index of Central Asian countries and Mongolia.
- Include population growth, primary school enrollment, years of primary education, and labor force participation as independent variables in the model to determine how the Human Development Index changes.

In this regard, Tamar Khitarishvili[6] concludes that Kazakhstan and Kyrgyzstan have high HDIs (0.811 and 0.692, respectively, in 2021) and low child labor rates, but high participation in the informal labor market (domestic help, agriculture). According to Rachel Strickman and Myina Pokhka[7], the HDI in Tajikistan in 2021 is 0.668 on average, and in Uzbekistan 0.727, suggesting that forced child labor in the cotton sector has been prevalent for many years, and that long-term mismanagement and social consequences of water in Central Asia have had direct and indirect negative impacts on society. Improved governance can reduce child labor and increase economic growth.

A study by Jang Ya-ju and Laura Schneider[8] developed a new index (SCDI) to more accurately measure child development in countries with low levels of child labor, high access to education, and high child development indices. The study was divided into seven categories: health (nutrition, child mortality, immunization, etc.), education, safety, economic status, communication, social integration, participation and power, and environmental issues (a newly proposed category). The results showed that improving the quality of the education system is one of the key ways to reduce child labor.

Using data from 15 developing countries, Hartgen, Kenneth, Klassen, and Stefan[9] calculated the HDI at the household level and analyzed it by population subgroups. The Human Development Index (HDI) is one of the main indicators to measure a country's level of development. Still, the research was based on the premise that the index is based only on average indicators and does not reflect development inequalities within a country. The results of the study showed that the HDI is not just an average measure but a methodology that can assess inequality at the household level. It was also noted that it is necessary to consider inequality within society, not just the average HDI measure, when formulating a country's development policies. Subsequent research has confirmed that differences in education, income, and place of residence are factors that have a significant impact on the HDI.

Kausik Basu and Zafiris Tsanatos[10] examined the global child labor problem in a broader context and concluded that countries with higher HDIs have less child labor and greater access to education. Research has shown that child labor is often associated with poverty and a lack of educational opportunities. The higher the HDI, the lower the level of child labor. Improving access to education is a key factor in reducing child labor. Reducing income inequality and improving social welfare systems are necessary to eliminate child labor.

Ingrid Maherova[11] conducted an empirical study on the development, theoretical underpinnings, and empirical results of human development and poverty indices for the poorest regions of the world, the Least Developed Countries (LDCs). The results of this study compared the old and new methods and showed that there are significant differences between the old and new methods. The new methodology resulted in a decrease in the Human Development Index (HDI) in some countries. While only three countries showed improvement, the results of the new Headline Poverty Index (HPI) methodology appear to have had a relatively more positive impact, but the results are less clear. The study found that as a result of the revised methodology, the HDI and HPI showed that some economies declined but now reflect a more realistic picture of social conditions. While the revised poverty methodology tends to provide more realistic results, it also

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shows that the development gap between countries is still very large.

This study aims to use the Human Development Index to identify the determinants of child labor in five Central Asian countries (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan) and Mongolia from 1990 to 2022. The empirical analysis of Model 1, Model 2, Model 3, and Model 4 was conducted using Stata17 based on data from five Central Asian countries and Mongolia. This study is organized into four parts. The first part is an introduction, and the second part discusses the state of the theoretical research. The third section presents the data, methodology, and quantitative results. Finally, the fourth section contains conclusions and references used.

2. THEORETICAL BACKGROUND

Understanding the root causes of child labor takes into account many factors, including economic structure, household income, and access to education. F. Gassman, D. François, L.Z. Trindade[12] according to a World Bank study by the main causes of child labor in Mongolia are as follows, with a total of 2,636,370 children included in the study. Study findings:

- Low household income is a major factor in child labor, which leads children to work to escape the financial pressures of their families.
- Educational constraints - High school dropout rates increase the likelihood of child labor.
- Gender differences - Studies show that boy labor is more common in agriculture, construction, and trade, while girl labor is more common in household chores and small-scale services.

Using dynamic panel data analysis is an effective way to identify factors associated with child labor. I. Yasin[13] used the Generalized Method of Moments (GMM) method to analyze the relationship between socioeconomic factors and child labor. The study examined social factors (explanatory variables) based on data from 23 developing countries from 1997 to 2016. A poverty index was constructed using principal component analysis (PCA). Friedman and Pesaran used the cross-correlation (CD) test to see if cross-correlation is detected in panel data, and the second-generation panel unit root (CIPS) test was used to test the normality of the variables. In this study:

- As poverty levels increase, so does the amount of child labor.
- There is a large disparity between urban and rural areas. The incidence of child labor is higher in rural areas.
- Economic instability and changes in the labor market have been pointed out as factors influencing the increase in child labor.

Building on the theories developed by MUNDLAK (1978) and BARKLEY (1990), research conducted by Thomas Herzfeld, Thomas Glauben, Liesbeth Dries, and Ramona Teuber[14] suggests that sectoral labor regulation can be analyzed in the context of occupational choice. This study examines the impact of labor regulation and the legal environment in the agricultural sector in Central Asia and finds the following results. The article found that in the cotton farming sector, child labor is widespread in some countries (Uzbekistan, Turkmenistan), while in others, such as

Tajikistan and Kyrgyzstan, economic changes have led to a high percentage of children participating in the informal labor market. This shows that child labor is frequent in Central Asia, and specific measures are needed in the agricultural sector.

A. Amgutuwshin, J. Chen, R. John, and Y. Zhang[15] As Mongolia's mining sector has grown and developed since the 1990s, the government has intensively implemented policies to convert pastureland to mines. To explore how these changes affect urban-rural population migration, we conduct an empirical analysis of migration between mining areas, non-mining soils, and urban areas based on data from the 2010 Labor Force Survey. The study used a DPROBIT model to further examine the impact of mining development on local economies and labor markets. This led to a study of child labor in Mongolia's agricultural sector, which concluded that

The prevalence of child labor in the livestock and construction sectors is related to income levels. The study found that children who have dropped out of school are more likely to be employed due to differences in education between urban and rural areas. Therefore, we can see that it is possible to fully realize the potential outcomes by looking at school dropout rates and differences between rural and urban areas.

The study by Karin Schelzig, Ludovico Carraro, and Enkhsetseg Byambaa[16] builds on four policy briefs developed under an Asian Development Bank (ADB) 2019-2023 technical assistance to support social protection policy reform in Mongolia. The study found that social protection policies are an important tool in reducing child labor, and that low household income and weak welfare systems force children to work. It also found that lower access to welfare services is associated with higher levels of child labor.

Most international studies that have examined the relationship between child labor and the Human Development Index (HDI) have adopted static analysis or macro-level approaches, and few have fully considered the dynamic impact of the variables. However, this study fills a gap in the literature by using a dynamic panel data model and Arellano-Bond GMM estimation to fully demonstrate the characteristics of child labor in developing countries (Central Asia and Mongolia) and its time dependence on the HDI.

3. RESEARCH METHODOLOGY AND ANALYSIS RESULTS

When studying economic relationships and behavior, it is important to carefully consider the relationships between data over time. This is because economic indicators depend heavily on past changes and behavior patterns. Therefore, in economic modeling, it is important to use previous values (lag values) of variables as explanatory factors. Dynamic structural models are widely used in panel data analysis and are generally divided into two main categories: Autoregressive panel models (AR panel models) - In this model, previous values of the dependent variable (lag variables) act as explanatory variables. That is, past values of the variable affect both the current and future states. Distributed lag panel models - This model uses previous values of the explanatory variables to determine their effect on the dependent variable. That is, changes in the variable are affected not only by current values but also by past values. These dynamic panel data

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models are important for understanding long-term economic trends and enable policymakers and researchers to make useful assessments for decision making.

The AR Panel Model panel data model is shown below.

$$\begin{aligned} Y_{it} &= aY_{it-1} + \beta X_{it} + b_{it} \\ Y_{it} &= \mu_{it} + \pi_{it} \end{aligned} \tag{1}$$

Two key factors to consider when evaluating a dynamic panel data model are whether the error term is autocorrelated and whether the dependent variable is completely exogenous [17]. Despite these conditions, there are some problems that can arise when traditional model estimation methods are used directly. For example, studies have shown that Y_{it-1} (the lagged value) of a dynamic model is likely to be correlated with the previous shock (π_{it-1}). In addition, since Y_{it} is a function of μ_i in a panel data model, Y_{it-1} also depends on μ_i . In this case, Y_{it-1} is correlated with the error term, including the error term μ_i , which risks violating the key condition of strict exogeneity. These problems increase the bias and inconsistency of the estimates, so specialized methods such as the generalized method of moments (GMM) are a more appropriate solution.

In order to test the relationship between the lagged dependent variable and the error dummy variable in the dynamic panel data model, first, the first difference transformation is performed. Then, the instrumental variable is used to determine whether there is a relationship.

To solve this problem, the generalized method of moments (GMM) is proposed for the dynamic panel data model. This method has the following advantages: it simplifies the estimation, it can use the necessary instrumental variables, and it does not generate a relationship with the error dummy variable. Among the estimation methods based on the GMM method, the GMM estimator of Arellano & Bond (1991) is more suitable. This estimation method generates the moment condition using the condition that the future value of the error is unrelated to the current explanatory variable [18].

This estimation method first performs a first-order transformation on the model, and then estimates it using the measurement variables matrix. This allows the model to be estimated using the generalized least squares (GLS) method. For this reason, the GMM (generalized moments estimation) estimator is also called a 'two-step measurement variables estimator'.

Consider the following equation.

$$\begin{aligned} Y_{it} &= aY_{it-1} + \beta X_{it} \\ Y_{it} - Y_{it-1} &= \Delta Y_{it} = \Delta aY_{it-1} + \Delta \beta X_{it} + \Delta \varepsilon_{it} \end{aligned} \tag{2}$$

This study empirically analyzes the impact of child labor determinants in developing countries of Central Asia and Mongolia on the human development index using these equations. The analysis period is 1990-2022, and the study countries are five developing countries of Central Asia (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan) and Mongolia. The data used in this study are from the World Data Indicators Database and UNCTADstate. All data units are expressed as percentages and indices. The following sections summarize the above, discuss the analysis results, and collect quantitative data on the above variables for each country during the period 1990-2022. There are 6 groups, 6 countries, and a total of 198 observations. To examine the causes, prevalence, and socioeconomic consequences of child labor in Central Asian countries and to evaluate the effectiveness of policy interventions to address the problem, we used panel data analysis (STATA17) to analyze Model 1, Model 2, and Dynamic Panel Data Analysis Model 3 and Model 4, respectively, with random effects and fixed effects based on the Hausman test.

Table 1. Explanation of variables

Dependent variable	Independent variable
Human Development Index (HDI): A composite index that measures average achievement across three main dimensions of human development: long and healthy lives, knowledge, and a decent standard of living.	1. Population growth rate The annual population growth rate in year t is the percentage of the exponential growth rate of the population over the period from t-1 to t. The population is based on a de facto definition of population that includes all residents regardless of legal status or citizenship.
	2. Primary education and period The period of elementary school attendance refers to the number of years of elementary school.
	3. School Enrolment, Primary GPR is the ratio of total enrollment to the population of a given age group, regardless of age, equivalent to the level of education officially provided. Primary education provides children with basic literacy, reading, writing, and mathematics, as well as a basic understanding of subjects such as history, geography, natural science, social science, art, and music.
	4. Labor Force Participation Rate The labor force participation rate is the percentage of the economically active population aged 15 to 64 who provide labor, or the percentage of the total population who provide labor to produce goods and services during a specific period.
	5. GDP growth The annual growth rate of GDP at market prices based on constant domestic currency.
	6. Life expectancy at birth Life expectancy at birth indicates how many years a newborn would live if the prevailing pattern of infant mortality remained the same throughout life.
	7. The CPIA Social Protection Assessment Social protection and work assesses government policies on social protection and labor market regulation that reduce the risk of poverty, help poor people better manage future risks, and ensure a minimum level of social protection for all.

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Model 1 – The above variables are as follows:

Model for analyzing the variables that influence the determinants of child labor

$$\ln HDI_{it} = \beta_0 + \beta_1 \ln POPG_{it} + \beta_2 \ln PED_{it} + \beta_3 \ln SER_{it} + \beta_4 \ln LFP_{it} + \beta_5 \ln GDP_{it} + \mu_i + \varepsilon_{it} \quad (3)$$

In the above equation, Model 1 i represents the five Central Asian countries and Mongolia ($i = 1, 2, 3, \dots, 6$), and t represents the year ($t = 1990, 1991, \dots, 2022$). μ_i is the individual effect and ε_i is the error term.

The fixed effects (FE) model controls for the internal variability of the panel data (country and time-based fixed effects). The results are more reliable and realistic, and the Hausman test confirms that the FE model is a better fit than the random effects (RE) model.

Population growth (lnPOPG)

A 10% increase in population growth is associated with an increase in HDI of only 0.03%, a very small and statistically insignificant result. Population growth can create additional economic burdens and shortages of education and healthcare in many countries. However, in some countries, population growth can have a modest positive impact on HDI when combined with government policies to increase access to public services. However, unless this is offset by quality and efficient access, child labor is unlikely to decrease.

Education spending (lnPED)

A 10% increase in education spending is associated with a 3.91% increase in HDI. Spending on education has a positive impact on the supply and quality of schools, teachers, and students, improving children's learning conditions and, in turn, supporting the growth of human capital. It is the variable with the strongest positive impact on the HDI, and the policy instrument with the most direct impact on sustainable growth and human development.

School enrollment (lnSER)

This has an impact on child labor, and while child labor tends to decline as school enrollment increases, the magnitude of the impact is small: research shows that a 10% increase in school enrollment is associated with a 2.7% increase in HDI. School enrollment helps children stay stable in a learning environment but limits their employment opportunities. However, this modest effect appears to be related to issues of quality and access to education, and the situation of children who are dual employed while attending school.

Labor force participation (lnLPG)

The variable with the strongest negative correlation is the 6.73% decrease in HDI for a 10% increase in labor force participation. While a high labor force participation rate can be a positive indicator on its own, it has a negative impact on HDI when low-quality informal jobs dominate the labor market. This is because the employment of children and women is hindered by their access to schooling and healthcare.

Economic growth (lnGDPg)

The impact on HDI is not statistically significant, but economic growth may not directly affect the quality of life for the entire population. The HDI is not particularly effective when income distribution is unequal, wealth is concentrated in a few groups, and economic growth is limited to certain sectors. This shows that the simple formula of economic growth = development does not directly apply to developing countries.

Table 2. Results of variables influencing determinants of child labor

VARIABLES	(3) Fixed Effects
lnPOPG	0.03*** (4.14)
lnPED	0.391*** (9.78)
lnSER	0.270*** (3.70)
lnLPG	-0.673*** (0.0484)
lnGDPg	0.001 0.30
Constant	0.575 (0.87)
Observations	146
R-squared	0.636
Number of countries1	6
Country FE	YES

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Model 2 - The above variables are

GDP growth, life expectancy, and CPIA social protection ratings are the main variables that can statistically affect the HDI, and the model analyzed is as follows

$$\ln HDI_{it} = \beta_0 + \beta_1 \ln GDPg_{it} + \beta_2 \ln LE_{it} + \beta_3 \ln CPIA_{it} + \mu_i + \varepsilon_{it} \quad (4)$$

In the above equation, Model 1 i represents the five Central Asian countries and Mongolia (i = 1, 2, 3..... 6), and t represents the year (t = 1990, 1991, ..., 2022). μ_i is the individual effect and ε_{it} is the error term.

The fixed effects (FE) model controls for the internal variability of the panel data (country and time-based fixed effects). The results are more reliable and realistic, and the Hausman test confirms that the FE model is a better fit than the random effects (RE) model.

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In the above equation, model 1 i represents five Central Asian countries and Mongolia ($i = 1, 2, 3, \dots, 6$), and t represents the year ($t = 1990, 1991, \dots, 2022$). μ_i is the individual effect and ϵ_i is the error term.

Fixed effects:

Life expectancy (lnLE)

A 10% increase in life expectancy is expected to increase HDI by 2.0%. Previous studies have shown that an increase in life expectancy has a positive effect on HDI [19, 20]. Average life expectancy is a fundamental component of human development and is a composite expression of several factors, including access to health care, living conditions, and environmental safety in a country. Increasing life expectancy has a positive effect on HDI through indirect effects such as human capital maintenance and increased labor productivity. Aging is also a qualitative indicator of sustained growth in HDI.

Social Protection Assessment (lnCPIA)

Social Protection Assessment is the most positive dependent variable, with a 10% increase in lnCPIA expected to increase HDI by 11%. This is because the CPIA index reflects the stability of governance, policies, and effectiveness of social protection systems. Improved transparency in public services and the implementation of poverty reduction policies have been shown to improve citizens' education, health, and livelihood security, leading to significant increases in HDI. CPIA confirms that it is a fundamental institutional driver of human development.

Economic Growth (lnGDPg)

The impact on HDI was statistically insignificant. This suggests that economic growth itself has not had a meaningful impact on the lives of the entire population. In particular, inequality in income distribution, concentration of wealth in some groups, and over-reliance on sectors (e.g. mining) may hinder the absorption of economic growth effects in HDI.

Table 3. Results of the variables contributing to the HDI

VARIABLES	(3) Fixed Effects
lnGDPg	-0.003 (-0.87)
lnLE	0.200*** (5.25)
lnCPIA	1.126*** (15.52)
Constant	-4.87*** (14.86)
Observations	146
R-squared	0.822
Number of countries	6
Country FE	YES

Standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Model 3 The following dynamic analysis model is developed based on the above variables:

$$\ln HDI_{it} = \alpha \ln HDI_{t-1} + \alpha \ln HDI_{t-2} + \beta_1 \ln POPG_{it} + \beta_2 \ln PED_{it} + \beta_3 \ln SER_{it} + \beta_4 \ln LFP_{it} + \beta_5 \ln GDP_{it} + \mu_i + \varepsilon_{it} \quad (5)$$

Dynamic nature of the HDI (lagged variable)

In this study, we analyzed the lagged variable to reflect the dynamic nature of the HDI. The result is L1.HDI = 0.917, which means that the previous year's HDI (t-1) has a highly significant positive impact on the current year's HDI. This shows that the HDI has a high inertia and the correlation between earlier and later values is strong, which is consistent with previous research[21]. L2.HDI = 0.039, or the value in the previous two years (t-2), is not statistically significant for HDI, suggesting that HDI may be a short-term dependent indicator without a large lag in the long run. This is because the HDI remains strong in the short term, but becomes statistically insignificant when it differs by more than two years.

Population growth (lnPOPG)

A 10% increase in population growth tends to decrease the HDI by 0.03%. This is a negative correlation that is not statistically significant but indicates that excessive population growth is causing problems in developing countries, such as a lack of public resources and poor access to education and healthcare. In some settings, this can have some positive impact when combined with policies to expand public services, but in poor and inaccessible settings, this growth increases the causes of child labor.

Years of education (lnPED)

A 10% increase in years of education is expected to increase HDI by 0.08%. Studies have shown that greater access to education and longer years of education tend to lead to greater human capital accumulation and higher living standards.

In addition, longer years of schooling keeps children out of the labor market for longer, making it a powerful mechanism for reducing child labor. Research has shown that participation in quality and sustained education has a positive impact on both HDI and child labor. This finding is consistent with the UNDP (2022) Human Development Report, which states that education is the most stable component of HDI, and that improving access to education delays labor market entry and reduces child labor.

School enrollment (lnSER)

A 10% increase in school enrollment is estimated to increase HDI by 0.3%, suggesting that access to education is an important factor underpinning the Human Development Index. In terms of child employment, increasing school enrollment has the effect of keeping children in school and out of the labor market, but this effect is relatively weak compared to other variables. This weak effect may be related to the quality of education, the reality of children working while attending school, and the availability of infrastructure. These results are consistent with the fact that a higher school

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enrollment rate relative to the level of child labor creates favorable conditions for keeping children out of the labor force and in school[22].

Labor force participation (lnLPG)

Labor force participation did not have a statistically significant impact on the HDI. However, higher participation rates do not rule out the possibility that informal and precarious work structures are prevalent in developing countries, which can have a negative impact on the HDI. Labor participation by women and children is likely to increase, especially in contexts where household income concentration is weak and unprotected work is prevalent. It is not the size of the labor force that has a greater impact on HDI and child labor, but the quality, protection, and structure of the labor force.

Economic growth (lnGDPg)

A 10% increase in economic growth tends to increase the HDI by 0.04%. This is consistent with the theoretical assumption that economic growth supports human development, but the magnitude of the effect is noteworthy. It is unlikely that economic growth will affect HDI, especially in situations where income distribution is unequal, wealth is highly concentrated, and the benefits of development are concentrated in a few groups. In the case of child labor, increasing potential income can reduce economic growth, but only if growth is inclusive.

Table 4. Dynamic results of variables influencing determinants of child labor

VARIABLES	GMM
t-1	0.917*** (8.43)
t-2	0.039 (0.39)
lnPOPG	-0.003** (-2.46)
lnPED	0.008*** (2.94)
lnSER	0.03*** (4.81)
lnLPG	0.005 (1.01)
lnGDPg	0.004*** 3.32
Constant	-1.88*** (-3.72)
Observations	120
Prob > chi2	0.000
Number of countries1	6
Hansen test	0.9

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Model 4 The following dynamic analysis model is developed based on the above variables:

$$\ln HDI_{it} = \alpha \ln HDI_{t-1} + \alpha \ln HDI_{t-2} + \beta_1 \ln GDP_{it} + \beta_2 \ln LE_{it} + \beta_3 \ln CPIA_{it} + \mu_i + \varepsilon_{it} \quad (6)$$

Dynamic nature of the HDI (lagged variables)

The listed variables are important indicators of how HDI changes relate to a country's previous level of development. Research shows that $L.HDI = 0.894$, i.e., the previous year's HDI ($t-1$) has a very high positive impact on the current year's HDI. Such a high coefficient indicates that the HDI is a short-term inertial indicator. In other words, it is consistent with the rationale that a country's level of development remains stable in subsequent years, with change occurring gradually. However, $L2.HDI = 0.09$, i.e., HDI two years ago ($t-2$), was not statistically significant, suggesting that HDI can be highly correlated in the short term, but less so with longer-term (more than two years) lags. This suggests that the HDI is stable and inert, and that changes in development levels are more pronounced in the short term. This suggests that a country's development performance can be assessed by directly relating it to the effects of actual policies in the short term, rather than over the long term.

Economic growth ($\ln GDP_g$)

A 10% increase in economic growth tends to increase the HDI by 0.06%, which is statistically significant and positive. This correlation confirms that economic growth provides a foundation for improving human development by increasing opportunities for investment in education, health, and income levels.

Life expectancy ($\ln LE$)

Our results show that life expectancy is negatively correlated with HDI, but not statistically significant. This suggests that although life expectancy is theoretically a component of HDI, the impact of other variables may be stronger within a given dataset. Additionally, in some countries, increases in life expectancy may put negative pressure on demographics and labor markets, and may not have a direct impact on human development outcomes. Life expectancy is an indicator that can influence the HDI, but it depends primarily on macroeconomic conditions and the quality of social protection policies.

Social protection assessment ($\ln CPIA$)

A 10% increase in CPIA tends to increase HDI by 0.29%, making it one of the variables with the strongest positive correlation. Since the CPIA is a comprehensive assessment of governance quality, policy stability, macroeconomic management, and access to social services, improvements in this index have a positive impact on citizens' education, health, and livelihoods, leading to a significant increase in the HDI. The quality and effectiveness of social protection systems has thus proven to be a key institutional driver of the HDI.

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Table 5. Dynamic results of variables affecting the Human Development Index

VARIABLES	GMM
t-1	0.894*** (8.33)
t-2	0.090 (0.89)
lnGDPg	0.006*** (3.33)
lnLE	-0.03 (-1.01)
lnCPIA	0.029*** (6.13)
Constant	0.09 (6.15)
Observations	109
Prob > chi2	0.000
Number of countries1	6
Hansen test	0.9

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4. CONCLUSION

Child labor is a serious social problem not only in underdeveloped countries, but also in developed countries that have fully achieved the industrialization process. However, child labor is more common in underdeveloped and developing countries, and the concept of child labor is a combination of several interacting factors. This shows that the problem of child labor cannot be considered in isolation from the socio-economic problems of a country, and measures to address it require a wide range of policies. The study showed the dynamic nature of the Human Development Index (HDI) and its correlation with population growth, education indicators, labor market, and economic growth. In the short term, the employment rate of minors was found to be stable, with the employment rate of the past few years having a strong influence on the current level. Furthermore, in terms of child labor and population growth, rapid population growth is likely to increase the level of child labor by affecting access to education, lack of healthcare, and labor market pressures. In such shortages, it is recommended to take a broad approach, such as introducing advanced, child-friendly technologies in each sector. Furthermore, child labor should be viewed not only as an economic liability, but also as a social norm and cultural feature. There is a need to study in-depth how factors such as household income, education levels, and social pressures affect child labor levels. Child labor has a negative impact on health, education, and psychological development. The positive effect of education on the HDI is consistent with the theory that increased education leads to decreased child labor and improved human development[23]. It is necessary to analyze how the lack of education mentioned in the study affects the long-term development of children. To address this issue, it is important not only to

protect the right to work, but also to improve children's ability to contribute to society. It is concluded that child labor is likely to increase due to the nature of the local labor market and economic instability. Economic growth can reduce the level of child labor, but there is a risk that child labor will increase in the informal sector if appropriate policies are not implemented. Economic growth has a positive impact on reducing child labor, but it can be achieved more effectively through education and social protection policies.

In addition to implementing policies to increase access to education, which reduces child labor by increasing school enrollment, it is important to increase the number of schools and attract teachers to increase access to education in remote areas, and to improve labor market regulation. There is a clear need to reduce child labor in the informal sector. Research shows that six countries need state-supported social protection policies, financial support to protect poor families from child labor, and tailored measures to better identify and target at-risk groups within families. Furthermore, while increasing access to education is critical to reducing child labor, it is also necessary to pay attention to the quality of the education system and the consistency of educational standards and methodologies. Therefore, it is important to improve the foundations of education, including quality, regulations, and curriculum content, to increase children's learning opportunities.

The study also aimed to identify macroeconomic factors affecting the human development index (HDI) in Central Asia and Mongolia through dynamic panel data analysis. The results of the study showed that factors such as economic growth, social protection policies, and previous HDI have a positive impact on HDI, while the impact of life expectancy is insignificant. This suggests that developing and implementing social protection programs can be a key mechanism for reducing child labor in poor households. These programs aim to reduce financial and labor hardship by increasing investment in children's education and developmental support, and are critical to protecting children's rights. Improving social protection policies is a key way to promote human development, as countries with higher CPIA scores support HDI growth. Related to social protection, poverty is also a major issue. Implementing policies to reduce poverty, increase access to education, and improve health systems appears to have a significant impact on Central Asian countries. For Central Asian countries, improving social protection benefits all citizens and helps increase economic and household prosperity. It is also necessary to align economic growth with human development policies. While economic growth has a positive impact on reducing child labor, it can also encourage child labor and provide income-generating opportunities in the informal sector if appropriate policies are not implemented. It is necessary to assess whether there are mechanisms in place to distribute the benefits of economic growth in a way that is accessible to all, eliminate social inequalities, and develop universal social responsibility. The quality of education and healthcare have been key sectors for all countries, and special attention should be paid to improving them. While life expectancy does not directly affect the HDI, higher levels of access to education and social protection policies are more likely to support human development. Quality education and healthcare have been shown to be factors that consistently increase the Human Development Index over the long term. Therefore, in addition to economic growth, countries need to rationalize social policies and implement development policies that ensure equal access. In the end, child labor is not a single problem and cannot be solved with a single solution. Countries, communities, and organizations need to understand that if we cannot protect children, we cannot protect national development.

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AUTHOR'S INTRODUCTION

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