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*Research Article*

# Determinants of Human Capital Development in Ethiopia: Implications to Education Policy

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The role of human capital development in the era of globalization, knowledge-based economy, and technological development cannot be underestimated. This is mainly attached to the creative and adaptive capacity of human capital (HC) in bringing multidimensional changes and developments for the individual, organization, and the country at large. However, the scenario of HC in Sub-Saharan Africa and specifically in Ethiopia remains the lowest compared to the world standard. With this premise, this study is meant to analyze the macroeconomic determinants of HC development in Ethiopia using the Autoregressive Distributed Log (ARDL) model. Time series data from 1981 to 2018 was considered for the study. The empirical result of the study revealed that GDP per capita, openness, and education policy variables were found to have a positive and significant effect on human capital development in the short and long run. On the contrary, inflation has a negative effect on human capital development only in the short run. On the other hand, no evidence was found on whether the government's expenditure and capital-labor ratio have significant effects on human capital development. Therefore, the Ethiopian government is strongly advised to investigate its educational investment strategies in such a way that it can promote the development of HC.

## 1. Introduction

There exists ample literature on the importance of human capital (HC) for the development of a given nation [1–6]. Globally, countries with a high-level human development index (HDI), mainly attributed to education, are also with a high level of economic development measured in their per capita income (PPI). This is mainly attached to the creative and adaptive capacity of HC in bringing multidimensional changes and developments for the individual, organization, and the country at large [7].

The strong justification for advocating HC is its contribution to sustained economic growth as the key ingredient for development [7]. Emphatically, there is a strong argument that, without adequate investment in human capital, development becomes a mere wish than a reality. This elucidates the importance and centrality of investment in HC. Investment in education benefits society as it is justified in light of its likely return in the form of economic growth [2]. Strengthening this, Simeonova [5] contends that HC stocks are considered as a major production factor in the enterprise as well as the economy. This accumulation again determines efficiency and productivity by significantly contributing to growth at micro- and macroeconomic levels [5].

The other worth noting issue of investment in HC is attached to its significant role in poverty reduction, especially in developing countries. This is embedded in the idea

that the accumulation of HC increases labor productivity, increases return to capital, improves technological innovations, and makes sustainable development a reality by contributing to poverty reduction [8].

In addition, education as a major contributor to HCD has great spillover or externality effects that transcend from generation to generation. The noneconomic benefits are not normally captured in measuring national economic growth. Such spillovers and externalities can be technological, social, or environmental and economic to noneconomic. This contributes immensely to the social and economic transformation of society.

In Ethiopia, the government gave due attention to HC development evidenced through its education policy promulgation, increasing the allocation of financial resources, and building several educational institutions. Allocation of the government expenditure to the education sector has been increased from year to year, despite the geometric expansion of the sector especially in the student enrolment almost at all echelons. However, policy changes [9], the financial commitment by the government, and changes in per capita income of the citizens remained the point of contention whether it has significantly contributed to HC development in Ethiopia. The dearth of research evidence showing the existence of relationships of these variables with HC took the prime attention of the researchers. Therefore, this study used 38 years of time series data to identify the determinants of HC in Ethiopia.

## 2. Literature Review

*2.1. Conceptual and Theoretical Framework.* Ample literature loudly voiced the importance of human capital as it plays a pivotal role in the holistic development of the nation [10–17]. As a theory, HC has got broader acceptance with the contribution of scholars like Sheltuz, Mencer, and Beker, who shifted the thinking philosophy of policymakers by emphasizing the centrality of HC in the development process in the 1960s [1, 2, 18]. In addition, Mincer [19] further emphasized the importance of human capital (HC) for the growth and development of society. With the contribution of these pioneers, HC has been receiving more and more attention all over the world at both the individual and organizational levels [1].

This was, in fact, with the inherent capacity of human beings to acquire new knowledge, skills, and attitudes and his ability to adapt to new technologies and take part in creating innovative ways of doing things. In this regard, education plays a pivotal role in realizing this potential [11, 15]. This actually remains the base for HC discourses among researchers and policymakers [7, 20].

Conceptually, HC is the stock of knowledge, habits, and social and personality attributes, including creativity, embedded in the ability to perform labor to produce economic values [21–23]. It was further argued that HC is the collection of resources including knowledge, talents, skills, abilities, experience, intelligence, training, judgment, and wisdom possessed individually and collectively by individuals in the population [21].

In the process of HC development, many scholars attribute education as a key ingredient [2, 23, 24]. It took a central stage in human capital development, which in turn plays an unparallel role for economic success [25]. Conversely, the way we perceive HC context varies as it may have a broader meaning. It is nested in the broader view of human capital development which may include human freedoms: freedoms to realize the full potential of every human life, not just a few or most of them, but all lives in every corner of the world now and in the future. Such comprehensiveness gives the human development approach uniqueness [6].

*2.2. Theoretical Framework.* An endogenous growth model provides the theoretical framework for our study of human capital development in Ethiopia. In this framework, the production of new knowledge is the function of socioeconomic activities that create opportunities and incentives to produce human capital. Endogenous growth models put human capital and its development processes at the center stage of economic growth, which exhibits increasing returns to scale. It indicates that new knowledge is more important than existing knowledge in the economic development process.

Romer [26] criticized the failure of neoclassical growth models to make an endogenous technological change and human capital development that arises from intentional investment decisions by economic agents on education and training. Similarly, Ucak [27] stated that endogenous growth models include the variables that affect endogenous technological change such as human capital, research and development, education, training, government policies, physical structure, spillover effects, externalities, and institutional factors. Perhaps, the return to education and national economic policies regarding trade, competition, education, taxes, expenditure, and intellectual property rights jointly influences human capital development. Furthermore, the increase in physical capital accumulation induces productivity of human capital, which incentivizes rational agents to invest more in human capital production.

The standard endogenous growth model, $Y_{(t)} = f(K_{(t)}, H_{(t)}, L_{(t)}, A_{(t)})$, relates $Y$ (per capita GDP growth) to $K$ (capital accumulation in the economy), $H$ (human capital development), $L$ (labor force), and $A$ (proxy for technological progress). As Lucas [28], Grossman and Helpman [29], and Romer [26] described, the level of output depends on the level of endogenously generated human capital. As they stated, human capital is the knowledge that can be produced through education and training. Existing human capital is considered crucial for creating new knowledge and increasing future human capital. Higher productivity in the education and knowledge sector increases the marginal productivity of the labor force, higher earning, and output growth. The increase in human capital may also accelerate innovation and technological change, essential for long-term sustainable development.

Suppose that the current level of aggregate output $(Y_{(t)})$ is produced according to the following Cobb–Douglass production function:

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$$Y_{(t)} = H_{(t)}^{\varphi} K_{(t)}^{\alpha} \left(A_{(t)} L_{(t)}\right)^{1-\alpha}, \tag{1}$$

where $H_{(t)}$ is the stock of human capital, $K_{(t)}$ is the stock of physical capital, $L_{(t)}$ is the labor employment in the economy, $A_{(t)}$ is the economy level of technology, $\varphi$ measures human capital elasticity of aggregate production, and $\alpha$ is the share of capital. By taking natural logarithm on both sides and rearranging, the above model can be respecified as follows:

$$\begin{aligned} \ln\left(Y_{(t)}\right) = \varphi \ln\left(H_{(t)}\right) + \alpha \ln\left(K_{(t)}\right) \\ + (1-\alpha)\left(\ln\left(L_{(t)}\right) + \ln\left(A_{(t)}\right)\right). \end{aligned} \tag{2}$$

According to Acemoglu et al. [30], human capital depends on the schooling decision of individuals who face exogenously given prices in the capital markets. Schooling decisions itself determined by the net present value of the individuals and other socioeconomic and institutional factors. He stated that individuals are born with some level of human capital (i.e., $h(0) \geq 0$), and human capital evolves according to the following modified differential equation:

$$\dot{H}_{(t)} = F\left(t, H_{(t-1)}, S_{(t)}, X_{(t)}\right), \tag{3}$$

where $S_{(t)}$ is the fraction of resources devoted to education, and $F_{(t)}$ determines how human capital changes as a function of time, the existing stock of human capital, schooling decisions, and other socioeconomic factors ($X_{(t)}$). However, as Papageorgiou and Perez-Sebastian [31] showed, the evolution of schooling over time depends on the proportion of people in education and population growth. By combining equations (2) and (3), the human capital growth model can be respecified by the following equation:

$$\dot{H}_{(t)} = F\left(t, H_{(t-1),} Y_{(t)}, K_{(t)}, L_{(t)}, S_{(t)}, X_{(t)}\right), \tag{4}$$

where $K_{(t)}$ captures the externality effect of physical capital accumulation on human capital. The household decision about education determines the supply of human capital, while technological change determines the demand side of human capital. The technological change increases the demand for a skilled workforce, increasing return to education and consequently inducing human capital growth. The increased demand for skilled labor may increase the return of education and hence causes human capital growth. On the other hand, in a country like Ethiopia with a vast resource gap, human capital and physical capital may compete for limited funds. Perhaps, this implies that investing more in physical infrastructure reduces funds for investment in education.

*2.3. Empirical Literature Review.* Through education, a country can build its human capital, such as skills, talent, and experience, which in turn serve as building blocks for economic development. According to Awe and Ajay [32], human capital accounts for more than 64 percent of the total wealth of the globe, while the remaining percent accounts for physical and natural capital. Given the undeniable importance of human capital in development endeavors, many scholars in the area are concerned about the constituents and their measurement. Regarding the measurement of human capital, some evidence from empirical analysis relied on proxy measures like literacy rates, enrolment rates, average years of schooling, and health of people (which is proxied by life expectancy, fertility rates, or mortality rates). Among other scholars, Cohen and Soto [33] and de la Fuente and Doménech [34] came to use average years of schooling as a proxy measure for human capital development. One of the underlying justification forwarded by the authors for using this measure as a proxy is the large dataset availability. Similarly, educational attainment such as accumulated years of schooling is used as a proxy measure of stock human capital [35, 36] also used. They state that the average years of schooling are meant to measure human capital stock as a proxy [37]. On the other hand, unlike years of schooling, enrolments of schools ranging from primary to tertiary have been used as proxy measures to human capital stock. The study conducted by Itoro Praise and George-Anokwuru [38] on the determinants of economic growth made the use of primary, secondary, and tertiary education enrolments.

In addition to education, the health of the people proxies human capital. Better health of the labor force means higher productivity, higher income, and higher investment in human capital.

Although empirical studies are minimal concerning the determinants of human capital, many scholars agree that education and training matter for accumulating skill, knowledge, experience, and talents. In contrast, some other scholars yet tend to focus on health and income-related variables. Still, undeniable numbers of scholars seek to incorporate the hybrid of social and economic factors. Itoro Praise and George-Anokwuru [38] used expenditure on education, spending on health, life expectancy, mortality rate, and school enrolments to determine human capital stock factors. The study mainly revealed that health expenditures had a bidirectional positive and significant relationship with human capital formation. Education expenditures had a bidirectional negative and significant relationship with growth despite the fact that the education sector experienced growth in spending over the years. The finding concerning education expenditure makes it possible to conclude that the expenditure was not adequate in transforming the system because increments were observed over time. The author boldly underlined that the expenditure scenario had negative consequences in determining effective and efficient human capital formation in the economy. Heylen et al. [39] had also sought into the effects of inflation on human capital formation. Accordingly, the finding revealed inflation encourages human capital.

Similarly, Tsaurai [40] scrutinized that inflation positively impacts human capital development in emerging markets. However, a high level of inflation hurts human capital development since it increases the cost of capital for investment in education and health.

Tsaurai [40], in his study, again considered economic openness as a determinant factor for human capital

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development and examined that it has a positive and significant influence on human capital development. On per capita income, a study by Chevalier et al. [41] claimed that parents' income was found to have the most significant effect on educational spending. This spending, therefore, has a positive contribution to the development of human capital, as mentioned above. The basic assumption considered is that whenever per capita income gets raised, they advance the investment in their children's education, which has a positive contribution to human capital development.

## 3. Methodology and Data

*3.1. Empirical Models.* In this study, we employed quantitative data analysis techniques. The detailed analysis of macroeconomic determinants of human capital development in Ethiopia is addressed by using the autoregressive distributed lag (ARDL) bounds test approach for cointegration. This model was developed by Pasaran, Shin, and Smith [42] which have some advantages over the traditional methods of Engle and Granger [43], Johansen's [44], and Johansen and Juselius [45] cointegrating analysis which requires all variables to be $I$ (1) and relatively large sample size. However, the ARDL approach can be applied irrespective of whether the variables are $I$ (1) or $I$ (0) and provides statistically unbiased and valid estimates of the long-run coefficients even when some of the regressors are endogenous and time series observation is relatively small. Moreover, the ARDL procedure employs only a single reduced form equation commonly used in applied econometric research.

Pesaran and Shin also note that, unlike other methods of estimating cointegrating relationships, the ARDL representation does not require the symmetry of lag lengths; each variable can have a different number of lag lengths. Furthermore, the ARDL approach allows the inclusion of dummy variables in the analysis of cointegration relationships, which is not the case in the traditional cointegration methods. Therefore, in this research, we employed the ARDL model to study macroeconomic determinants of human capital formation in Ethiopia.

The ARDL model provides helpful insight into the long-run and short-run dynamic effects of some selected macroeconomic variables on human capital development in Ethiopia. It is a standard least square specification that contains indicator variables and lagged values of both dependent and independent variables as regressors. ARDL model specification of human capital development equation is

$$H_t = \sum_{j=1}^{p} \gamma_j H_{t-j} + \sum_{j=1}^{k} \sum_{i=1}^{q} \beta_{j,i} y_{j,t-i} + u_t, \quad (5)$$

where $H$ represents human capital proxied by average years of schooling, $y$ is a vector of explanatory variables (per capita GDP, inflation, public expenditure on education, openness of the economy, capital-labor ratio, and educational policy change), and $u_t$ is the random stochastic term. Error correction representation of equation (5) can be expressed as follows:

$$\Delta H_t = \sum_{j=1}^{p} \gamma_j \Delta H_{t-j} + \sum_{j=1}^{k} \sum_{i=1}^{q} \beta_{j,i} \Delta y_{j,t-i} + \alpha \varepsilon_{t-1} + u_t, \quad (6)$$

where $\varepsilon_{t-1}$ represents error correction term, which captures selected macroeconomic variables' long-run effect on aggregate human capital development. The sign and significance of the coefficient of error correction term are very important in time series analysis.

Besides, we applied causality analysis as a robustness check and insight into Ethiopia's HCD issues. We used statistical packages such as Eviews 9 to estimate ARDL model analysis.

*3.2. The Data.* Human capital development, the dependent variable, is measured by average years of schooling. This indicator is widely used in empirical work as a proxy for human capital. This study makes use of Ethiopian annualized macroeconomic time series data spanning from 1981 to 2018. From both theoretical framework and previous empirical literature reviews, six variables were identified as determining factors of human capital development at an aggregate level in Ethiopia. These variables were obtained from World Development Indicators [46] database, which is publicly available. Based on the availability of data, we use average years of schooling and life expectancy as a proxy for human capital and both variables obtained from WDI.

Similarly, except for physical capital accumulation and education policy dummy, all explanatory variables were obtained from World Development Indicators [46]. The first explanatory variable is real per capita GDP measured by constant 2010 US$ and expressed as natural log form (logGDPPC). The second variable is inflation measured by annualized consumer price index and converted into a natural logarithm of CPI (logCPI). Besides, the openness of the economy proxied by export plus import to GDP ratio (OPN) is used as a covariate for human capital development. This variable may capture the effect of globalization on human capital development through knowledge transfer and increased demand for skilled labor. Another critical determinant of human capital development in developing countries like Ethiopia is public expenditure on education and training. In Ethiopia, the government provides education free of charge except for higher education. In higher education, the students are expected to cover some portion of their study costs after graduation from university. Considering this, we used government expenditure on education as a percent of total government expenses (Edu_exp_Gov) as an explanatory variable. The growth rate of capital-labor ratio (K/Lgrowth) is another crucial variable in explaining human capital development. The physical capital stock is obtained from Penn World Table version 9.1, while labor force data is collected from World Development Indicators [46]. Lastly, to quantify the effect of educational policy reform which took place in 1994 (policy), we defined education policy as a dummy variable that is 1 for the period from 1994 to 2018 and 0 otherwise.

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## 4. Results and Discussion

*4.1. Descriptive Analysis.* Human capital in Ethiopia has been grown unevenly since 1981 (see Figure 1). The lowest growth rate of human capital was recorded from 1990 to 1994, during which the country undergoes a transitional government and faced political turmoil. The highest growth rate was recorded between 1995 and 2006, and since then, the lowest growth rate was recorded from 2016 to 2018. As one can observe from the figures, there is a tendency for the human capital growth rate to move with an openness of the economy, per capita GDP, and growth capital-labor ratio. However, the relationship between human capital growth and government expenditure on education is not visible. Inflation and human capital measured by years of schooling (YS) growth may move in opposite directions.

*4.2. Time Series Properties of the Series.* To determine the unit root properties of selected variables, we employed both the standard Augmented Dickey–Fuller (ADF) and unit root test with structural beak testing procedures. The results are reported in Table 1. It is relevant to examine the time series properties of selected macroeconomic variables before estimating the long-run and short-run coefficients. All selected variables in the system are only stationary after the first differences (integrated of order one) at a 5% significance level. In other words, we cannot reject the nonstationary hypothesis for all variables at a level while rejecting it at first difference. The optimal lag length for the ARDL model is determined based on Akaike Information Criteria (AIC) by setting the maximum lag to 2.

Furthermore, we conducted a bound test for cointegration to determine the long-run relationship between human capital development and its covariates (Table 2). The calculated $F$-statistics based on the Wald test (5.88) is significantly higher than the upper bounds of 4.01 and 5.06 at 5% and 1% levels, respectively. This result indicates strong evidence for the existence of a cointegrating relationship between human capital growth and its covariates in the model.

Besides, other relevant diagnostic test results were conducted, and the results are reported in Table 3. Both Lagrange multiplier (LM) and $F$statistic results indicate that the null hypotheses of each diagnostic test cannot be rejected at a 5% significance level. There is no evidence for residual serial correlation problems in the model. In addition, Ramsey's RESET tests by using the square of the fitted values show that the model is correctly specified, and the null hypothesis of no omitted variable cannot be rejected at a 5% level. Similarly, the normality hypothesis of the distribution of residuals based on skewness and kurtosis of residuals cannot be rejected at the 5% level. Furthermore, there is no evidence for heteroskedasticity problems based on the regression of squared residuals on squared fitted values. Therefore, the specified ARDL model would provide reliable regression results for the determinants of human capital development in Ethiopia.

In the case of short-term deviations from the long-run equilibrium path, the ARDL model provides a consistent evaluation mechanism to deal with dynamic adjustment toward the equilibrium path. The results of short-run and long-run coefficient estimates are reported in Tables 4–7, respectively. The negative and statistically significant coefficients of the error correction term in Tables 4 and 5 provide supportive evidence for the cointegrating relationship between human capital growth proxied by average years of schooling and health and some selected macroeconomic variables. In other words, the result indicates that all explanatory variables of the model fulfill weak exogeneity conditions.

As the table depicts, the increment of CPI by 1 percent decreases the average years of schooling (human capital) by about 13.1 percent in the short run, holding other factors constant (Table 4). Similarly, 1 percent rise in inflation reduces average life expectancy by about 0.5 percent in the short run (Table 5). However, the impact of inflation on human capital, in the long run, is ambiguous. The sign of the long-term coefficient of CPI is negative for both indicators, but it is only significant for the life expectancy variable. In conclusion, D (logCPI) has a negative relationship with human capital, but the effect is insignificant in the long run. This finding is partly contrary to the study conducted by Heylen [39] and Tsaurai [40]. In the case of the former study, inflation has a positive effect on human capital, and negative effects were observed only at a condition where very high inflation rates of more than 15% were recorded. All authors concluded that the rise of inflation has a less significant effect on human capital development. Likewise, Tsaurai [40] scrutinized that inflation was found to yield some positive impact on human capital development with particular reference to emerging markets.

Regarding GDP per capita, the estimated coefficient implies that an increase in GDPPC by 1% is likely to increase the development of human capital in short run by 11% provided that all other factors keeping fixed. The $P$ value ($P = 0.0992$) also revealed that GDP significantly affects humans capital development in the short run and no valid evidence was found to accept the null hypothesis. The long-run consequence was also found to be observed more positively and significantly. In this regard, it is evidenced that an increase in the per capita income of parents let them allow investing in the education of their children, which in turn affects human capital development. This implies that GDP per capita income has a positive and significant effect on both the short- and long-run performance of human capital development. Like this finding, a study by Chevalier et al. [41] concluded that the income of parents was found to have the most significant effect on educational spending, and this spending, therefore, has a positive contribution to the development of human capital. Similarly, the coefficient associated with the economic openness variable denotes that an increase of 1% in the difference of export to import enables human capital to increase by 0.2% and 0.28 in the short and long run, respectively. The effect happens to be substantial with a probability value of $P = 0.0728$ in the short run and

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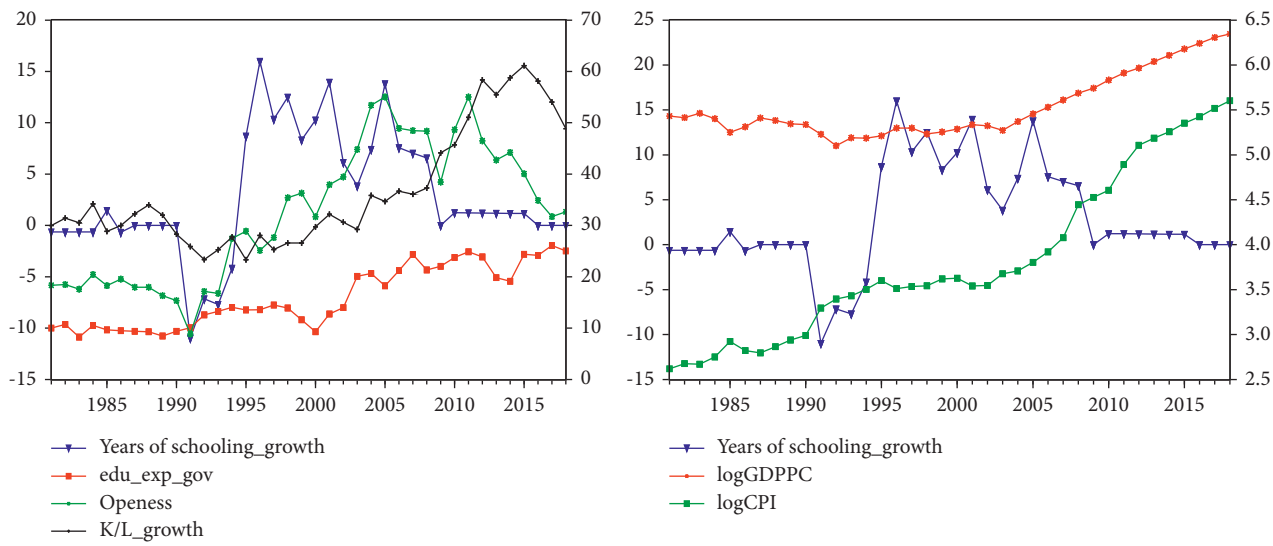


Figure 1: Trends of selected variables.

Table 1: ADF unit root test with a structural break.

| Variable | Test statistics at level | | Test statistics at first difference | |
|---|---|---|---|---|
| | Without break | With break | Without break | With break |
| AYS | −2.469450 | −3.148137 | −5.869503** | −7.139841** |
| logGDPPC | −0.803437 | −2.571375 | −6.170942** | −6.688668** |
| logCPI | −1.814107 | −3.271185 | −4.796481** | −5.540961** |
| OPN | 1.246060 | −2.763985 | −6.101540** | −6.984649** |
| Edu_exp_Gov | −0.803612 | −5.187285 | −6.087612** | −6.649145** |
| K/L_growth | −0.639353 | −3.297147 | −5.743961** | −7.685240** |
| Life expectancy | −2.597568 | −4.154113 | −3.3920869** | −6.657450** |
| Critical value at 5% level | −2.948404 | −4.859812 | −2.948404 | −4.859812 |

*Note.* ** indicates the variable is stationary at a 5% level of significance.

Table 2: ARDL bounds test to cointegration.

| Test statistic | Value | *k* |
|---|---|---|
| *F*-statistic | 5.883400 | 4 |
| *Critical value bounds* | | |
| Significance | *I*0 bound | *I*1 bound |
| 10% | 2.45 | 3.52 |
| 5% | 2.86 | 4.01 |
| 2.5% | 3.25 | 4.49 |
| 1% | 3.74 | 5.06 |

Table 3: Diagnostic tests.

| Test statistics | LM version | | F version | |
|---|---|---|---|---|
| | CHSQ value | Prob. chi-square (2) | *F* value | Prob. F |
| Serial correlation[a] | 1.3022 | 0.254 | 1.0133 | 0.323 |
| Functional form[b] | 0.94803 | 0.330 | 0.73025 | 0.400 |
| Normality[c] | 1.0845 | 0.581 | | |
| Heteroscedasticity[d] | 1.3867 | 0.239 | 1.3621 | 0.251 |

a: Lagrange multiplier test of residual serial correlation; b: Ramsey's RESET test using the square of the fitted values; c: based on a test of skewness and kurtosis of residuals; d: based on the regression of squared residuals on squared fitted values.

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Table 4: Short-run coefficients: the dependent variable is the years of schooling.

| Variable | Coefficient | Std. error | $t$ statistic | Prob. |
|---|---|---|---|---|
| D (LOGCPI) | −13.094526 | 6.234747 | −2.100250 | 0.0448 |
| D (LOGGDPPC) | 11.101560 | 6.510155 | 1.705268 | 0.0992 |
| D (OPENESS) | 0.206409 | 0.110710 | 1.864413 | 0.0728 |
| D (K_L_GROWTH) | −0.460207 | 0.362575 | −1.269274 | 0.2148 |
| D (EDUEXPGOV) | −0.445670 | 0.273987 | −1.626610 | 0.1150 |
| D (POLICY) | 8.598088 | 3.551707 | 2.420833 | 0.0222 |
| CointEq (−1) | −0.730435 | 0.127128 | −5.745656 | 0.0000 |

Table 5: Short-run coefficients: dependent variable is log of life expectancy at birth (years).

| Variable | Coefficient | Std. error | $t$ statistic | Prob. |
|---|---|---|---|---|
| D (LOGCPI) | −0.004907 | 0.001908 | −2.571993 | 0.0178 |
| D (LOGGDPPC) | −0.002263 | 0.003188 | −0.709693 | 0.4857 |
| D (OPENESS) | 0.000046 | 0.000030 | 1.507302 | 0.1466 |
| D (K_L_GROWTH) | −0.014970 | 0.009269 | −1.615044 | 0.1212 |
| D (EDUEXPGOV) | 0.000153 | 0.000066 | 2.314241 | 0.0309 |
| D (POLICY) | 0.000409 | 0.000903 | 0.453214 | 0.6550 |
| CointEq (−1) | −0.317765 | 0.062217 | −5.107367 | 0.0000 |

Table 6: Long-run coefficients: the dependent variable is the years of schooling.

| Variable | Coefficient | Std. error | $t$ statistic | Prob. |
|---|---|---|---|---|
| LOGCPI | −4.749147 | 3.469753 | −1.368728 | 0.1820 |
| LOGGDPPC | 15.198557 | 8.373988 | 1.814972 | 0.0803 |
| OPENESS | 0.282584 | 0.149146 | 1.894679 | 0.0685 |
| K_L_GROWTH | −0.630044 | 0.489641 | −1.286747 | 0.2087 |
| EDUEXPGOV | −0.610143 | 0.367610 | −1.659756 | 0.1081 |
| POLICY | 11.771186 | 4.350514 | 2.705700 | 0.0115 |
| $C$ | −67.111181 | 42.655707 | −1.573322 | 0.1269 |

Table 7: Long-run coefficients: the dependent variable is the log of life expectancy at birth (years).

| Variable | Coefficient | Std. error | $t$ statistic | Prob. |
|---|---|---|---|---|
| LOGCPI | −0.007799 | 0.002224 | −3.506512 | 0.0021 |
| LOGGDPPC | −0.002167 | 0.003569 | −0.607042 | 0.5503 |
| OPENESS | 0.000441 | 0.000098 | 4.485175 | 0.0002 |
| K_L_GROWTH | −0.085090 | 0.050185 | −1.695534 | 0.1048 |
| EDUEXPGOV | 0.000586 | 0.000244 | 2.401045 | 0.0257 |
| POLICY | −0.002062 | 0.002259 | −0.912729 | 0.3717 |
| $C$ | 0.032568 | 0.014120 | 2.306475 | 0.0314 |

*Note.* ** indicates the rejection of the null hypothesis at a 5% significance level. * indicates the rejection of the null hypothesis at a 10% significance level.

Table 8: :The pairwise Granger causality results.

| Null hypothesis | Obs | $F$-statistic | Prob. |
|---|---|---|---|
| LOGGDPPC does not Granger cause LOGSCHOOL | 37 | 7.11847 | 0.0116 |
| LOGSCHOOL does not Granger cause LOGGDPPC | | 8.62859 | 0.0059 |
| LOGCPI does not Granger cause LOGSCHOOL | 37 | 0.00024 | 0.9877 |
| LOGSCHOOL does not Granger cause LOGCPI | | 5.11529 | 0.0302 |
| OPENESS does not Granger cause LOGSCHOOL | 37 | 36.2665 | $8.E-07$ |
| LOGSCHOOL does not Granger cause OPENESS | | 0.17387 | 0.6793 |
| EDUEXPGOV does not Granger cause LOGSCHOOL | 37 | 3.48501 | 0.0431 |
| LOGSCHOOL does not Granger cause EDUEXPGOV | | 3.06471 | 0.0610 |
| LOGK_L_RATIO does not Granger cause LOGSCHOOL | 37 | 8.18041 | 0.0072 |
| LOGSCHOOL does not Granger cause LOGK_L_RATIO | | 69.9190 | $9.E-10$ |
| POLICY does not Granger cause LOGSCHOOL | 37 | 68.5474 | $1.E-09$ |
| LOGSCHOOL does not Granger cause POLICY | | 0.42279 | 0.5199 |

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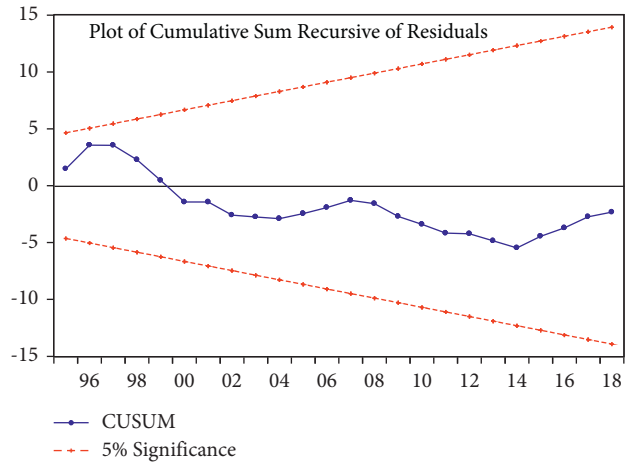


Figure 2: Model stability check.

$P = 0.068$ in the long run. From the statistical evidence, we can infer that the openness of the economy has a positive and significant effect on the development of human capital. The finding has got to be consistent with many studies conducted so far. For example, a very recent investigation entitled "Investigating the Determinants of Human Capital Development in Emerging Markets," carried out by Tsaurai [40], analyzed that openness of the economy has a positive and significant effect on human capital development.

On the other hand, the capital-labor ratio and the government's expenditure on education are less likely to affect the development of human capital. More specifically to the government's expenditure on education, the probability values $P = 0.115$ in the short run and $P = 0.108$ in the long run confirm that no statistical evidence was observed of whether the government's expenditure on education contributes to human capital development. However, the literature largely recognizes that government spending on education positively contributes to the development of human capital. Several research findings revealed and come up with different perspectives. Itoro Praise and George-Anokwuru [38] had conducted a study on the determinants of human capital and applied education expenditure, health expenditure, life expectancy, and mortality rate and school enrolments as explanatory variables for human capital stock. Provided that all other factors remain constant, the study mainly revealed that education expenditure had a bidirectional negative and significant relationship with HCD despite the fact that the public expenditure has grown from time to time.

The study has considered education policy as a dummy variable to see whether significant statistical variations were observed before and after the promulgation of the education and training policy during 1994. The statistical tests assured that the effect of the policy was positive and significant in both the short and long run and made the development of human capital importantly got improved.

*4.3. Causality Analysis and Model Checking.* To identify the direction of causality between the dependent variable (HC) and some selected explanatory variables in the system, a pairwise Granger causality testing procedure was used. The results reported in Table 8 show that per capita income, openness of the economy, government expenditure on education, growth of capital-labor ration, and educational policy reform Granger cause human capital growth in Ethiopia at a 5% significance level. This implies that impulse in one or more of these variables would help to forecast human capital growth, and this supports the results of dynamic coefficient estimates of the ARDL model obtained in Tables 4–7. However, there is no evidence for the causal relationship between inflation and human capital growth in Ethiopia.

To test the stability of the parameters of the model, the plot of the cumulative sum of recursive residuals is used (see Figure 2). Since the plot of CUSUM recursive residuals statistically falls within the critical bounds of 5% significance level, we can conclude that the estimated coefficients are stable over time. This shows that our econometric model is correctly specified, and the results can be used for further analysis and inferences.

## 5. Conclusions

In this study, the average years of schooling was used as a proxy measure of human capital development in Ethiopia. One of the methods in the indicator-based approach to measuring human capital based on educational output is the average years of schooling. Several measures, including adult literacy, school enrolment rates, and average school years, have been used in this approach. Unlike the others, this method is based on a number of indicators, each of which contains a massive amount of data. Many conventional measures of a country's human capital are based on the population's average number of years of schooling. According to Botev et al. [47], years of schooling is a new measure of human capital which exhibits a strong and robust positive correlation with economic growth. It is built on recent findings on U-shaped returns to years of education and allows for variation across countries and over time [47]. However, it was revealed that the measure lacks a common

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metric which includes the drawback that an individual's years of schooling can be slightly related to individual productivity [48]. To bridge this gap, hence, the study suggests further investigations on the country's human capital development using other possible measures.

The study empirically scrutinized the determinants of human capital development in Ethiopia for the past 38 years. Among other variables treated in the analyses, the empirical result revealed that GDP per capita, economic openness, and education policy variables were found to have a positive and significant effect on the efforts exerted in human capital development. By implication, the findings, with reference to GDP per capita and openness of the economy, entail that the activities performed in the economic sector have made a tremendous contribution to the development of human capital stock. The education and training policy was also significantly contributing to the HCD meaning that it allows many people to have the access to education that laid down the platform for human capital development as measured in terms of years of schooling.

On the other hand, no statistical evidence was found whether the government's expenditure on education influences human capital development. Irrespective of the huge spending on the education sector from time to time, the empirical finding depicts that education expenditure is less likely to affect the development of human capital. This implies that the amount of funds comes to be insignificant when measured in terms of unit cost per student although the sum seems very big in terms of total volume. The result might also mean that there are problems entangled with planning, utilization, and management of financial issues resulting in wastage of financial resources in different administrative structures of the education system. Therefore, the Ethiopian government is strongly advised to look into its educational investment strategies in such a way that it can promote the development of human capital.

## Data Availability

The dataset of this research is available from the corresponding author.

## Disclosure

The university will not take any responsibility for the results beyond reporting purposes.

## Conflicts of Interest

The authors declare no conflicts of interest.

## Authors' Contributions

The authors thoroughly read and approved the manuscript to be submitted for publication.

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