The Impact of External Debt on Human Capital Development and GDP Growth in HIPCs: a Comprehensive Approach

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Abstract

The growth theorists argue that human capital development/accumulation (HCD/A) is vital for economic growth. However, the level of external debt accumulation determines HCA and its effect on economic growth. Besides, the impact of external debt on growth is still debatable. Further, the external debt-growth relationship could be non-linear instead of linear, and external debt can affect growth through the HCD channel. Therefore, this study aims to look at the impact of foreign debt on HCD and growth in heavily indebted poor countries (HIPCs) employing seemingly unrelated regressions (SUR) and other alternative simultaneous equations models (SEMs) from 1990–2017. The result indicates the link between foreign debt and HCD is negative and non-linear, but only non-linearity is observed between foreign debt and growth. Besides, external debt affects HIPCs growth through the HCD channel. Therefore, the study recommends essentializing solid macroeconomic policies, strengthening institutional performance, appropriate debt management strategies, and investing borrowed funds in productive projects.

Keywords	***DOI***	***JEL code***
External debt, HCD, economic growth, HIPCs	*https://doi.org/10.54694/stat.2023.10*	*F34, H63, O47*

INTRODUCTION

The Organisation for Economic Cooperation and Development (OECD, 2001: 18) broadly defined human capital by saying that "the Knowledge, skills, competencies and attributes embodied in the individuals that facilitate the creation of personal, social, and economic well-being". However, due to the demerits

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of conventional measurement of human capital, a new measurement approach is proposed by the United Nations Development Program (UNDP) and the International Labour Organization (ILO; Kwon, 2009). Hence, since 1990 UNDP has developed a new and more comprehensive measure of human capital called the human development index (HDI; Ivanova et al., 1999; Kwon, 2009). Therefore, according to UNDP (2019), HDI is a comprehensive measure of average performance in important areas of key human development, such as healthy and long life, knowledge, and decent living standards.

Human capital has been a topic of discussion in economics since the late 17th century. Smith (1776) and Farr (1853) argue that human beings and their acquired abilities were considered the primary input for national wealth. Besides, after the works of Schultz (1961), Becker (1964) and Mincer (1974), the concept of human capital regained recognition and began to apply to various economic issues. Even since the new millennium, the two main development plans, Millenium Development Goals (MDGs) and Sustainable Development Goals (SDGs), broadly focus on achieving either of the three-elements of HDI.

Besides, the endogenous growth models emphasized the role of endogenous factors (i.e., human capital stock and research & development activities) as the main engines of economic growth. According to Lucas (1993), human capital accumulation is an engine of growth. Countries vary in their quality of life because of the differences in their accumulated human capital. Further, Mankiw (1992) argues that the rise in human capital accumulation directly increases the growth rate (Hasan and Butt, 2008). The two broad categories of studies that investigate the link between economic growth and human capital accumulation are: (a) the growth accounting framework theorist (Baumol, 1986; Barro and Lee, 1993), argues that human capital accumulation through education, increases individuals' productivity and a pillar for growth, and (b) endogenous growth theorists like Lucas (1988), Romer (1990), and Grossman (1991), argue that human capital creates new ideas which are transformed into scientific knowledge and ultimately leads to accelerating the process of economic growth. Human capital is an important source of long-term growth because it directly inputs research (Romer, 1990) or because it shows positive externalities (Lucas, 1988). The integration of human capital variables in endogenous growth models is intended to capture quality differences in the labour force, as non-physical capital investment increases the productivity of the existing labour force (Barro and Lee, 1993).

However, the effect of human capital accumulation on GDP growth depends on foreign debt accumulation. According to Pattillo et al. (2004), foreign borrowing increases investment in human capital at low debt levels, hence boosting growth. However, if the debt burden is very high, debt overhang and crowding out effect conditions may happen, adversely affecting human capital and growth. Concerning this, evidence shows that the high external debt level was one of the causes of the failure to achieve the MDGs because debt servicing absorbs resources that could be used for essential spending on poverty reduction and diverts resources away from investment in education and health.

There is a contradictory school of thought concerning the impact of external borrowing on growth – the Keynesians and Classical economists. The Keynesians argue that external debt positively contributes to growth, but the classical postulates the reverse. Besides, based on the type of functional model, empirical findings concerning the impact of foreign debt on GDP growth can be broadly categorized into two groups. The first group considered a linear relationship between external borrowing and growth, while the second group used a non-linear model. However, similar to the theories, empirical studies about external debt's impact on growth are mixed and inconclusive. Besides the direct effect of foreign debt on growth, scholars noted that there were channels through which external debt was transmitted to the economy and affects nations' economic growth.

The existing empirical studies regarding the impact of foreign debt on human capital/welfare can be categorized into two groups. The first group used a composite HDI as a dependent variable (Egungwu, 2018; Zaghdoudi, 2018). The other group examined the effects of external debt on either of the three

components of the HDI such as health, education and living standards (poverty; Pattillo et al., 2004; Fosu, 2007, 2010; Eduardo and Mauricio, 2007; Shabbir and Yasin, 2015; Zaghdoudi and Hakimi, 2017; Saungweme and Mufandaedza, 2013). However, there are no empirical studies about the impact of external borrowing on HCD in HIPCs though the countries experienced a bad history of external debt accumulation and its adverse effect on macroeconomic variables since the 1970s debt crisis.

Besides, except for Pattillo et al. (2004) and Zaghdoudi (2018), all other studies neglected the optimal threshold beyond which external debt can positively or negatively affect human capital, which means that previous studies examined the linear relationships between the variables. Also, except for Zaghdoudi (2018) and Egungwu (2018), all others narrowly investigated the effect of foreign debt on health, education, or living standards. Further, most of previous studies evaluated the direct impact of external debt on economic growth rather than an indirect effect through the HCD channel. Also, except for a few studies, most of previous findings did not consider a non-linear relationship between external debt and growth and neglected the most concerned countries – HIPCs. For example, only Pattillo et al. (2004) examined the human capital channel through which external debt affects growth using a non-linear model for 61 developing countries from 1969–1998. This implies empirical studies that analysed the non-linear impact of external debt on growth, considering the human capital channel is not found in HIPCs.

Therefore, unlike others, this study focuses on the most concerned countries. Hence, investigating the impact of foreign debt on HCD and growth in the case of HIPCs is vital to provide policy recommendations that help overcome the adverse effect of debt accumulation. Besides, since the 1970s external debt crisis, HIPCs experienced external debt accumulation, making their debt unsustainable and qualified for repeated debt cancellation and relief. Therefore, examining the effect of external debt HCD and growth is an important research area for HIPCs. Also, unlike other studies, this study uses a more comprehensive measurement called HDI to measure HCD. Further, in recent times, an essential feature of the research in this area indicates that the impact of external debt on HCD and growth could be non-linear rather than linear; therefore, this study considers the non-linear relationship. Also, previous studies did not show the HCD channel through which foreign debt affects growth and consider the cross-sectional dependence (CD) in the errors in their methodologies. Therefore, this study's primary objective is to examine the impact of foreign debt on HCD and GDP growth in HIPCs using the SUR model from 1990–2017.

1 LITERATURE REVIEW

1.1 External debt, human capital and growth

Since human capital can be measured using HDI, which considers better achievements in education, health, and living standards, any activities that hinder these elements adversely affect countries' human capital. Besides, HDI's scope is broad and sometimes considered human welfare.

The debt overhang and crowding out effect hypotheses are the two basic arguments for the relationship between increasing foreign debt and human capital (welfare) and growth. According to the debt overhang theory, increasing foreign debt has a negative impact on both growth and welfare. When there is an excessive build-up of external debt, both domestic and international investors believe that the government would finance the debt by unfavourable measures, such as high taxes, seigniorage, or a reduction in useful public investment. Investors would thus decide to hold back, spend less, or invest abroad, negatively impacting growth and welfare-related investments (education and health).

On the other hand, the crowding out argument contends that excessive external debt accumulation results in huge debt payments and diverts resources away from the social sector, particularly health and education (Fosu, 2008). According to Shabbir and Yasin (2015), government spending is a key driver of economic growth, and governments in emerging nations must make wise social sector investments. However, countries' budgetary allocations may suffer due to debt payments. The fundamental purpose of foreign borrowing, which is to support growth and development, is undermined by the cost of servicing

debt, which takes a significant portion of the limited resources generated through exports and/or foreign remittances and leaves little to finance growth.

1.2 Theoretical framework of the study

This study considers endogenous growth models and adopts Zaghdoudi's (2018), Cunningham's (1993), and Mallick and Moore's (2008) theoretical models to examine the relationship between external borrowing, human capital, and GDP growth.

Zaghdoudi (2018) illustrated how external debt affects human development. On the other hand, to investigate the effect of external debt on economic growth, Cunningham (1993) introduced debt burden into the production function.

However, Mallick and Moore (2008) comprehensively established an endogenous growth model and demonstrated how human capital affects growth. Additionally, they looked at the significance of foreign capital in supporting growth and investments in both human and physical capital.

Given country's production can be characterised by the augmented aggregate production function (Y), homogenous of degree one with respect to physical and human capital, as:

$$Y_t = A(K_t^{\gamma})\,(HL)_t^{\eta} \text{ and } HL = E^{\delta} \Rightarrow \frac{Y}{E} = A\left(\frac{K^{\gamma}}{E^{1-\delta\eta}}\right) \Rightarrow y = Ak^{\gamma} \text{ if } \gamma = 1 - \delta\eta\,, \tag{1}$$

where y is real output per unit of human capital, K is capital, L is raw labour input, HL is the average level of human capital, which is more likely to improve productivity, A is technical progress or TFP, which is exogenous and different across countries, that is, low in low-income countries, E is the measure of education level, δ is the return to education.

Assuming the capital stock depreciates at the rate Ψ, the evolution of k (K/E) is given by the following:

$$\dot{k} = \frac{I}{E} = \Psi k - kh, \text{ where } h = \frac{\dot{E}}{E}\,. \tag{2}$$

In the long-run $\dot{k} = 0$. This long-run relation implies that as human capital growth increases, physical capital stock per unit of human capital remains constant. Now substituting the steady-state level of K in the production function, we write:

$$Y_t = A\left(\frac{I}{\Psi + h}\, I_t^{\gamma}\right)(E^{\delta})_t^{\eta}\,, \tag{3}$$

There are two sources of financing this domestic investment (I) (physical and human capital). One is domestic savings[3] and foreign savings.[4] Since foreign debt is one source of inflow of foreign capital, it can contribute to growth by relaxing financing constraints (saving, foreign exchange, and fiscal gaps) and financing investment in physical and human capital (Morrissey, 2004; Mallick and Moore, 2008).

1.3 Empirical literature

Even though there are several empirical studies concerning the linear impact of external debt on growth, this section focuses on non-linear[5] ones for the interest of scope and space. Furthermore, it reviews findings on the impact of external debt on HDI or its element(s).

[3] Part of the gross national disposable income that is not consumed.
[4] Complementary source of financing investment outlays.
[5] Pattillo et al. (2004), Checherita-Westphal and Rother (2012), Senadza et al. (2017), and Zaghdoudi (2018).

There are only two empirical studies that used the comprehensive measure of human capital or human development or welfare: Egungwu (2018) and Zaghdoudi (2018). Zaghdoudi (2018) found an inverted U-shape relationship between external debt and human development. Besides, Egungwu (2018) found that external debt stock and external debt servicing adversely affected HCD. However, Egungwu (2018) study is only for Nigeria, but the country is not found in the current IMF list of HIPCs. It also neglected the optimal threshold beyond which external debt can positively or negatively affect human capital. Further, it used conventional estimation techniques and included I(0), I(1) and I(2) variables in its estimations, and it neglected the cointegration test. Hence, its policy recommendations may not be appropriate and represent HIPCs. Therefore, this study overcomes Egungwu's (2018) limitations by considering the most concerned countries, the non-linear relationship, and better estimation technique that considers basic steps in econometrics such as CD, unit root, and cointegration tests.

Zaghdoudi (2018) used HDI to measure human development, considered the non-linear relationship between external debt and HDI, used a good estimation technique, and many countries. However, the study mixed countries suffering from massive & unsustainable external debt with others. That means around 70% of sampled countries are not in the list of HIPCs; hence, its results and policy recommendations may not represent HIPCs. Besides, the study neglected two basic tests – CD and panel cointegration. However, ignoring CD tests leads to biased estimates and spurious inferences. Further, the CD test determines the type of panel unit root, cointegration tests, and estimation techniques the study should follow. Therefore, unlike Zaghdoudi (2018), this study focuses on the most concerned countries that experienced accumulated & unsustainable external debt and repeated debt cancellations & relief and conducting basic econometric tests before estimation. Moreover, our study is relatively latest (until 2017).

Unlike the above studies, Pattillo et al. (2004), Fosu (2007), Eduardo and Mauricio (2007), Fosu (2010), Saungweme and Mufandaedza (2013), Shabbir and Yasin (2015), and Zaghdoudi and Hakimi (2017) examined the relationship between external debt on either of three HDI elements.[6] This implies these studies did not use a comprehensive measurement of HCD, which can limit their scope of analysis.

Concerning empirical studies on the debt-growth relationship, Pattillo et al. (2004), Checherita-Westphal and Rother (2012), Abdelaziz et al. (2019), and Silva (2020) examined the channels through which external debt is transmitted to the economy and affects the economic growth of nations. However, among channel studies, only Pattillo et al. (2004) investigated the human capital channel through which external debt affects growth using a non-linear model for 61 developing countries. This implies that, to the best of the writer's knowledge, no study shows the non-linear effect of external debt on HCD and growth in the case of HIPCs. Also, the HCD channel through which external debt affects growth is not investigated in HIPCs, leading to a literature gap.

2 METHODOLOGY OF THE STUDY

2.1 Data type and sources

This study uses secondary panel data and all, except for institutional quality (INSQ) and HDI, were collected from the World Development Indicator (WDI) (see Table 1).

This study employs a sample of 15 HIPCs[7] (which achieved a post-completion-point)[8] from 1990 to 2017 due to a lack of pertinent data, and its scope (sampled nations (N) and period (t)) is sufficient to describe all HIPCs. In other words, the study's $N \cdot t = 420$ observations satisfy Kennedy's (2008) suggestion about the significance of a high sample size. The findings and policy suggestions from this

[6] They found that high level of external debt or its service negatively affects either of the three elements of HDI.

[7] Benin, Burundi, Cameron, Central Africa Republic, Mauritania, Mozambique, Niger, Rwanda, Senegal, Sierra Leone, Tanzania, Togo, Honduras, Bolivia, and Nicaragua.

[8] Countries that completed the HIPC initiative process (a program aimed to reduce the debt burden of developing countries) and obtained 100% debt relief from international communities (creditors).

Table 1 Definitions, measurement and sources

Variables	Definition	Source
HCD	Human capital development proxied by human development index (HDI). HDI is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and having a decent standard of living	UNDP
GDPGR	The annual GDP growth rate (%)	WDI
ED	External debt (% of GDP)	WDI
ED^2	External debt (% of GDP)2	WDI
DSR	Debt service (% of GDP)	WDI
INF	Inflation, GDP deflator (annual %)	WDI
INSQ	Institutional quality proxies as Polity 2, which is measured as the country's elections competitiveness and openness, the nature of political involvement in general, and the degree of checks on administrative authority. The estimate gives the country's score on the aggregate indicator, in units of standard normal distribution, ranging from –10 to +10	Polity 2 data series from Polity IV
OPPN	Trade as a proxy variable for openness and measured the sum of exports and imports of goods and services (% of GDP)	WDI
EXCH	Official exchange rate (LCU per US$, period average)	WDI
POP	Population growth (annual %)	WDI
NBTOT	Net barter terms of trade index (2000 = 100)	WDI
LAB	Labour force (% of total population)	WDI

Source: Authors construction

study can thus reflect and used for the other HIPCs. Additionally, the study's time frame is relevant since it covers a variety of global development programs and occasions connected to the title.

2.2 Model specification

This study considers HCD and GDPGR as dependent variables. Additionally, the study treats the dependent variables as independent because of their reciprocal interaction. Therefore, the estimated models specified as:

$$HCD_{it} = \alpha_0 + \alpha_1 ED_{it} + \alpha_2 ED^2{}_{it} + \alpha_3 DSR_{it} + \alpha_4 GDPGR_{it} + \alpha_5 POP_{it} + \alpha_6 NBTOT_{it} + \alpha_7 INSQ_{it} + \eta_{it}\,, \quad (4)$$

$$GDPGR_{it} = \beta_0 + \beta_1 HCD_{it} + \beta_2 ED_{it} + \beta_3 ED^2{}_{it} + \beta_4 DSR_{it} + \beta_5\, LAB_{it} + \beta_6 OPPN_{it} + \beta_7 INF_{it} + \beta_8 EXCH_{it} + \eta_{it}\,, \quad (5)$$

where, α_0 is an intercept term, η_{it} is a stochastic error term, and (+) α_1, (–) α_2, (–) α_3, (+) α_4, (–) α_5, (+) α_6, and (+) α_7 are the long-run coefficients of Formula (4). For Formula (5), β_0 is an intercept term, and (+) β_1, (+) β_2, (–) β_3, (–) β_4, (+) β_5, (+) β_6, (–/+) β_7, and (–/+) β_8 are the long-run coefficients. The signs in the parenthesis refer to the hypothesised signs.

2.3 Basic panel econometric tests

All countries are susceptible to the effects of financial and economic crises (Pesaran, 2006). As a result, the cross-sectional unit, its explanatory variables, and the error terms are often subject to CD. Therefore, disregarding the CD in panel data results in distorted estimations and erroneous results (De Hoyos and Sarafidis, 2006; Pesaran, 2007). As a result, it is crucial and the first step in panel data econometrics to examine the CD. There are several tests for CD in the

literature; however, among the CD tests currently in use, this study uses Friedman (1937), Frees (1995), and Pesaran (2021).

Following the CD test, doing the panel unit root (UR) and cointegration tests is a usual practice. First-generation and second-generation panel UR tests are the two different varieties. However, O'Connell (1998), Pesaran (2007), Baltagi (2008), Chudik and Pesaran (2015), and Eberhardt and Presbitero (2015), among others, have criticized the first-generation tests for assuming cross-sectional independence. Consequently, second-generation tests have been suggested to account for CD; hence, this study uses the 2nd generation of Pesaran (2007) cross-sectional augmented panel UR (CIPS) test.

Several panel cointegration tests allow CD; however, except for a few, most are not coded in Statistical Software (STATA) or Econometrics Views (EViews). Besides, some of them suffer from insufficient observation and cannot accept many regressors in their model. For example, even though Westerlund and Edgerton (2007) do not take many regressors, it is based on the McCoskey and Kao (1998) Lagrange Multiplier (LM) test. Thus, we can use a residual-based cointegration test in the heterogeneous panels' framework proposed by McCoskey and Kao (1998) using an efficient estimation technique, such as fully modified OLS (FMOLS) and dynamic OLS (DOLS) (Barbieri, 2008). However, relatively the DOLS is better than FMOLS (Kao and Chiang, 2000); thus, this study uses DOLS. Further, Banerjee and Carrion-i-Silvestre (2017) cointegration test is a residual-based one that allows a CD (for more detail, see Dajčman, 2019); thus, this study also employs it.

2.4 Estimation techniques and justifications

Several panel data estimation techniques allow CD; however, most require many observations over groups and periods. For instance, Driscoll and Kraay (1998) standard error estimates need a large number of countries (N) than period (t) (Hoechle, 2007). However, panel-corrected standard error (PCSE), feasible generalised least squares (FGLS), and SUR need more t than N (Hoechle, 2007; Breitung and Pesaran, 2008). Unlike others, the SUR approach is SEM; therefore, this study employs it. The SUR model was developed by Zellner (1962) and later adopted by Abdelaziz et al. (2019).

In contrast to conventional panel data methods (pooled OLS, Least Square Dummy Variable (LSDV), or fixed effect (FE) and random effect (RE), the SUR model captures the dynamic characteristics of the data. The correlation among equations is not taken into account by the pooled OLS estimate, FE, or RE. However, the SUR-generalized least squares (GLS) estimator presupposes the cross-equation correlation (Baltagi and Pirotte, 2011). Moreover, the SUR technique estimates the parameters of all equations together (simultaneously), allowing each equation's parameter to take into consideration the data supplied by the other equations. Consequently, the parameter estimations are more accurate since the system is described using more information. Additionally, if t>N, the SUR technique is feasible (Coakley et al., 2006; Breitung and Pesaran, 2008). Additionally, the SUR method's motivation came from the effectiveness in estimating it provides by combining data from many equations. The SUR model is more effective than OLS estimators, the two-stage generic least square, and Maximum Likelihood (ML) estimators (Abdelaziz et al., 2019). Thus, the SUR estimation technique is more effective in preventing erroneous findings than conventional panel data techniques since this research considers the data's dynamic behaviour and has a greater number of t than N. Therefore, this study estimated Formula (4) and (5) together (simultaneously) under the SUR approach. However, even though this study primarily uses the SUR approach, it employs other alternative SEMs, FGLS, and RE methods with alternative variables for robustness checks.

3 EMPIRICAL RESULTS AND DISCUSSION

3.1 Descriptive statistics and basic econometric tests

This study conducts descriptive statistics of all variables and CD tests for both models. Unfortunately, all the CD tests fail to accept the H0 of no CD (to save space, we do not report the results, but they are

available from the authors). However, the Pesaran (2007) unit root result confirms that all the variables are highly significant (at 1% level) at the first difference.

Table 2 Panel UR test

Variables	CIPS (intercepts only)				Critical values		
	HCD model		Growth model				
	Levels	1st diff.	Levels	1st diff.			
	Statistic	Statistic	Statistic	Statistic	10 %	5 %	1 %
HCD	–2.073	–3.656 ***	–2.073	–3.656 ***	–2.14	–2.25	–2.45
ED	–2.086	–4.691***	–2.086	–4.691***			
ED2	–1.785	–4.149***	–1.785	–4.149***			
DSR	–2.678***	–5.731***	–2.678***	–5.731***			
INF	–	–	–3.968 ***	–5.897***			
GDPGR	–4.584***	–3.533***	–4.584***	–3.533***			
INSQ	–2.661***	–5.175***	–	–			
OPPN	–	–	–2.266**	–4.650***			
EXCH	–	–	–1.748	–3.460***			
LAB	–	–	–0.996	–0.996***			
POP	–1.91	–3.533***	–	–			
NBTOT	–1.925	–5.167***	–	–			

Banerjee and Carrion-i-Silvestre (2017)

Models	All variables without a square of external debt	All variables with a square of external debt	Critical values		
	Levels statistic	Levels statistic			
HCD	–4.228***	–4.289***	–2.14	–2.25	–2.45
Growth	–5.763***	–5.887***			

DOLS residuals test

Models	Tests		All variables without a square of external debt		All variables with a square of external debt	
			Statistics	p-value	Statistics	p-value
HCD	LLC	unadjusted t	–9.3433	0.0003***	–11.7954	0.0000***
		adjusted t*	–3.4687		–6.7374	
	IPS	t-bar	–3.2916	0.0000***	–3.1347	0.0000***
		t-tilde-bar	–2.4246		–2.4563	
		Z-t-tilde-bar	–4.8895		–5.0458	
Growth	LLC	unadjusted t	–25.6571	0.0000***	–54.7585	0.0000***
		adjusted t*	–26.8490		–58.8967	
	IPS	t-bar	–1.1821	0.9777	–1.7133	0.4850
		t-tilde-bar	–1.0250		–1.4402	
		Z-t-tilde-bar	2.0091		–0.0377	

Note: *** refers to significant at a 1% level.
Source: Authors calculation using STATA 15

The study conducts the residual-based cointegration (long-run relationship) tests using the DOLS of McCoskey and Kao (1998) and Banerjee and Carrion-i-Silvestre (2017). The Banerjee and Carrion-i-Silvestre (2017) result strongly rejects H0 of no cointegration at a 1% significance level for both models, implying a long-run relationship among the variables. Similarly, the DOLS result of the HCD model rejects the H0 of no cointegration while mixed for the growth model. This difference might be the LLC is more restrictive than IPS because it does not allow for heterogeneous coefficients. Since the DOLS result partially rejects the H0, this study uses Banerjee and Carrion-i-Silvestre's (2017) cointegration for further investigation. The result strongly rejects the H0 of no cointegration in the growth model. Therefore, we can conclude that a long-run relationship exists among the variables (see Table 2).

3.2 Long-run estimation results

Table 3 shows the estimated results (but to the interest of space, this section discusses only the target variables). The finding confirms the theory that foreign debt negatively affects HCD computed as HDI. In other words, a percentage change in foreign debt lowers HCD by 0.18%. This implies that when HIPCs increase their external debt, their HCD declines relative to prior years. This inverse relationship supports the debt overhang and crowding out effect hypotheses. This outcome is also in line with Egungwu (2018).

Even though their relationship defies the theoretical notion of an inverted U-shape, the link between external debt and HCD is non-linear, as represented by the quadratic term of the external debt coefficient. The findings show that the relationship between foreign debt and HDC is negative up to 236% of the external debt to GDP, but positive above this threshold. However, they do not have a U-shaped relationship. This is because, in most periods, 98% of the studied HIPCs' foreign debt remained below the threshold; as a result, the relationship is predominately negative. Therefore, in HIPCs, the link between foreign debt and HCD is negative and non-linear. Moreover, the individual country estimation results show that the relationship between external debt and HCD is inverted U-shape (in four countries), U-shape (in two countries), positive and non-linear (in one country), only non-linear (in three countries), only linear (in one country), and insignificant (in four countries).

This outcome contrasts with Zaghdoudi's (2018) inverted U-shape conclusion. Likely, 70% of the sampled countries in Zaghdoudi's (2018) study were not HIPCs; some were European and emerging nations with more effective debt management plans. Additionally, Zaghdoudi (2018) computed the square of foreign debt differently than we did, calculating it as (foreign debt · growth of external debt), which might account for the discrepancy in the estimated findings.

The finding in Table 3 further supports the notion that, over time, servicing foreign debt significantly raises the HCD of HIPCs. The HCD rises by 2.2 percentage points for every percentage point increase in debt service. In this regard, Fosu (2007; 2010) independently looked into the effect of actual and predicted debt service on social expenditures, such as those for education and health, and concluded that the expected debt service reflects the debt burden compared to actual debt service exhibits negative impact on social expenditure. Therefore, our analysis uses the actual debt service rather than the predicted debt service. Therefore, potential investors prefer to invest more if the government pays its obligation in the long term, which benefits investments connected to welfare (education and health).

The result of the growth model demonstrates that foreign debt has a negligible impact on HIPCs' GDP growth, contradicting both the debt overhang and crowding out effect theories. However, the external debt quadratic factor, which is positive and significant, suggests that the relationship between foreign debt and GDP growth is not linear. Furthermore, a single-country estimation result reveals that the relationship between external debt and GDP growth is U-shape (in two countries), insignificant (in 12 countries), and only non-linear (in one country). The reciprocal association between HCD and GDP growth is the other important result. A one-point rise in HCD leads to a boost in GDP growth by 9.6 percentage points, and a one-point increase in GDP growth leads to an increase in HCD of 0.31 percent. Higher levels of

HCD impact the economy by improving individuals' capabilities, creativity and production. Various studies contend that persons possessing either of the HDI components indirectly contribute more to the economy through better exports, improved technology, more investment from abroad, and higher labor productivity. This finding is thus compatible with the traditional theories of economic growth, the growth accounting framework, and endogenous growth theorists that assert the crucial importance of human capital as a production component.

The results also show that HIPCs' GDP growth positively impacts their HCD. This implies governments will have enough funds to invest in public health and education when the economy expands. Additionally,

Table 3 Results of SUR model

Variables	Dependent variable HCD			
	HIPCs		HIPCs in SSA	
	Coef.	Std. err.	Coef.	Std. err.
ED	–0.0018***	0.00035	–0.0018***	0.00031
ED^2	3.80e-06***	1.39e-06	3.89e-06**	1.27e-06
DSR	0.0225***	0.00272	0.0091***	0.00267
GDPGR	0.0031***	0.00082	0.003***	0.00064
POP	–0.0096**	0.0040	0.011***	0.0033
NBTOT	0.00023**	0.00011	–0.0001	0.00011
INSQ	0.0057***	0.0009	–0.0027***	0.00084
Constant	0.4302***	0.0226	0.428***	0.0197

Other statistics

	Obs.	Parms	RMSE	R-sq	Chi2	P
HIPCs	420	7	0.0920	0.328	220.72	0.0001***
HIPCs in SSA	336	7	0.07117	0.27	157.74	0.0000***

Dependent variable GDPGR

HCD	9.601***	3.190	22.159***	5.320
ED	–0.0303	0.0223	–0.0302	0.0277
ED^2	0.00016*	0.00008	0.00024**	0.00001
DSR	–0.1508	0.1887	0.0081	0.247
LAB	0.0882*	0.0468	0.090*	0.054
OPPN	0.02075	0.0140	0.022	0.0196
INF	–0.0012	0.00090	–0.0284	0.0261
EXCH	0.0005	0.00035	0.00055	0.00039
Constant	–4.1454	2.6565	–9.258***	3.443

Other statistics

	Obs.	Parms	RMSE	R-sq	Chi2	P
HIPCs	420	8	5.661	0.044	68	0.0046***
HIPCs in SSA	336	8	6.223	0.048	47.58	0.0000***

Note: *** significant at 1% level; ** significant at 5% level; * significant at 10% level.
Source: Authors calculation using STATA 15

ceteris paribus, a country's GDP growth improves its residents' per capita income, enhancing their standard of life. Mulligan and Sala-i-Martin (1992), using the endogenous growth model, argue that economic growth can enhance the return rate on human capital and people can invest more. The two-chain model of Ranis and Stewart also explains the powerful connection between human capital and economic growth (2005). They contend that economic expansion offers the means to enable long-term advancements in human development.

3.3 Robustness checks

To assure the validity of results in Table 3, this study splits the dataset into HIPCs in sub-Saharan Africa (SSA) and HIPCs in non-SSA. However, the estimation was only done for 12 HIPCs in SSA due to only three HIPCs in non-SSA. According to Kennedy (2008), large sample size determination in econometrics has some important implications for the asymptotic properties of an estimator. Therefore, the results of HIPCs in SSA coincide with HIPCs.

For further robustness checks, this study employs alternative SEMs (there-stage least squares (3SLS) and multivariate multiple regression estimates (MVREG)). Besides, it uses the RE to compare the SUR results with other standard approaches. Except for the impact of external debt on growth under RE for HIPCs in SSA, all robustness checks support SUR results (see Table 4).

Table 4 3SLS+, MVREG++, RE+++ estimation results of target variables

Variables	Dependent variable HCD+		HCD++		HCD+++	
	HIPCs	HIPCs in SSA	HIPCs	HIPCs in SSA	HIPCs	HIPCs in SSA
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
ED	–0.0018***	–0.0018***	–0.0018***	–0.0018***	–0.00187***	–0.00181***
ED^2	3.80e-06***	2.89e-06**	3.80e-06***	2.89e-06***	3.52e-06***	2.61e-06***
DSR	0.0225***	0.0092***	0.0225***	0.0092***	0.0015	0.00067
Dependent variable GDPGR						
HCD	9.602***	22.1597***	9.608***	22.178***	7.704*	10.165*
ED	–0.0303	–0.0302	–0.0303	–0.03021	–0.0375	–0.0522*
ED^2	0.00016*	0.00024**	0.00016*	0.00024**	0.00016*	0.00027**
DSR	–0.151	0.008	–0.151	0.0079	–0.0504	0.1307

Note: *** significant at 1% level; ** significant at 5% level; * significant at 10% level.
Source: Authors calculation using STATA 15

In Tables 3 and 4, the proxy variable for HCD is HDI, which is a combination of three indices (health, education, and income), but the contribution of the income index is not substantial. Moreover, the income index measures the economic well-being of the people and its impact on GDP growth may be insignificant and create some correlation with GDP growth. Therefore, this study calculates and uses HDI without income index (HCDWoI) and employs SEMs for robustness checks. The result supports the findings in Tables 3 and 4 (see Table 5).

Furthermore, this study employs a non-SEM and non-conventional model called FGLS to test the validity of SUR results and found similar results with SUR and other SEMs. However, the impact of external debt on growth is significant under FGLS. This might be because the FGLS estimates the models separately (see Table 6).

Though this study mainly employed the SUR approach and cleared up, the SUR method is efficient. However, since it uses the dependent variables as independent variables in each other's specifications,

Table 5 SUR+, 3SLS++, MVREG+++ estimation results of target variables

Variables	Dependent variable HCDWoI+		HCDWoI++		HCDWoI+++	
	HIPCs	HIPCs in SSA	HIPCs	HIPCs in SSA	HIPCs	HIPCs in SSA
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
ED	–0.0021***	–0.0022***	–0.0023***	–0.0022***	–0.0023***	–0.0022***
ED^2	5.06e-06***	4.47e-06***	5.06e-06***	4.47e-06***	5.06e-06***	4.48e-06***
DSR	0.0234***	0.0088***	0.0234***	0.0088***	0.0234***	0.0088***
Dependent variable GDPGR						
HCD	9.111**	19.259***	9.111***	19.259***	9.117***	19.276***
ED	–0.0269	–0.0266	–0.0267	–0.0267	–0.027	–0.027
ED^2	0.00014*	0.00021*	0.00015*	0.00021*	0.000148*	0.00021*
DSR	–0.1598	0.0258	–0.1598	0.0258	–0.16	0.0256

Note: *** significant at 1% level; ** significant at 5% level; * significant at 10% level.
Source: Authors calculation using STATA 15

Table 6 FGLS estimation results of target variables

Variables	Dependent variable HCD		Dependent variable HCDWoI	
	HIPCs	HIPCs in SSA	HIPCs	HIPCs in SSA
	Coef.	Coef.	Coef.	Coef.
ED	–0.0021***	–0.0022***	–0.0023***	–0.0022***
ED^2	5.06e-06***	4.47e-06***	5.06e-06***	4.48e-06***
DSR	0.0234***	0.0088***	0.0234***	0.0088***
Dependent variable GDPGR				
HCD	5.453***	8.633***	–	–
HCDWoI	–	–	3.439***	3.959*
ED	–0.0251**	–0.0291*	–0.0292***	–0.0367**
ED^2	0.00013***	0.000197***	0.00014***	0.000212***
DSR	0.0398	0.068	–0.0375	0.0478

Note: *** significant at 1% level; ** significant at 5% level; * significant at 10% level.
Source: Authors calculation using STATA 15

endogeneity can be a problem. Thus, the SEM can overcome the problem of endogeneity (Li and Xu, 2021). Further, this study tested endogeneity after estimation, but the test is not valid under the SUR estimation.

CONCLUSION

Human capital development is essential for economic growth, according to both the growth accounting model and proponents of endogenous growth. However, human capital development and its impact on economic growth depend on the amount of external debt. In addition, since Keynesian and Classical economists disagree on this point, the effect of foreign debt on growth is still up for debate. Scholars have pointed out that the link between foreign debt and growth could not be linear but somewhat non-linear and that foreign debt might influence growth via the HCD. However, HIPCs pay little attention to empirical studies regarding the ways and effects of foreign debt on the development of HIPCs. Therefore,

using the SUR and alternative SEMs from 1990 to 2017, this study examines the effect of external debt on HCD and growth by focusing on the HCD channel via which external debt influences the growth of HIPCs. According to the findings, external debt significantly and negatively affects HCD. Additionally, the correlation between external debt and HCD is negative and non-linear, although the correlation between external debt and growth is just non-linear. Additionally, the outcome demonstrated that the HCD channel was the mechanism through which external debt impacts HIPCs development.

The research also suggests HIPCs establish strong macroeconomic policies, improve institutional performance, and put in place appropriate debt management tools to manage the accrued external debt and minimize its detrimental effects on HCD and growth. External debt hurts HCD, implying borrowed funds are neither properly allocated nor efficiently used for productive activities. Hence, HIPCs need to invest and efficiently use the borrowed funds on education, health, and growth-driven activities. Moreover, creditors should give loans to feasible and development projects, and they have to follow up on their implementations. By examining the status of HIPCs projects, creditors should provide the funds step by step. In addition, improving the skill and knowledge of HIPCs concerning debt-related issues is crucial. Furthermore, HIPCs must prioritize and fund the three components of HDI. Finally, since the threshold value of external debt-HCD is 236% of GDP, creditors need to cancel some portion of HIPCs debt.

Even though this study attempts to fill the existing gaps such as measurement, literature, scope, and methodology, it has also limitations. For instance, due to the lack of data on some important variables, this study is constrained to 15 HIPCs. Besides, for the sake of scope, this study focused on the HCD channel and did not include other channels. Moreover, this study did not employ a panel threshold model due to the unique characteristics of our model (data) and several limitations of the threshold model (Seo and Shin, 2016; Seo et al., 2019). Therefore, future research can broaden their scope by considering these aspects.

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