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Communicable Diseases, Health Expenditure and Economic Growth in Selected African Economies: Evidence from Fixed Effects and Instrumental Variable Estimation

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ABSTRACT

This study investigates the effects of communicable diseases and health expenditure on economic performance in eight selected African economies using balanced panel data for 2003–2022. The countries are Benin, Cameroon, The Gambia, Ghana, Nigeria, Senegal, Sierra Leone and Togo. Pooled OLS, Fixed Effects and Random Effects models are compared using formal specification tests, followed by diagnostic testing, Driscoll–Kraay robust inference and Fixed Effects Instrumental Variable Two-Stage Least Squares (FE-IV/2SLS). The F-ratio test (2,157.02, $p<0.001$), Breusch–Pagan LM test (413.56, $p<0.001$) and Hausman test (19.92, $p=0.0013$) favour Fixed Effects. Diagnostics reveal heteroscedasticity, serial correlation and cross-sectional dependence, motivating Driscoll–Kraay standard errors. The robust FE coefficient on current health expenditure is 0.2723 ($p<0.001$), while malaria is 0.0774 ($p=0.019$); HIV, tuberculosis and inflation are insignificant. Because health expenditure may be endogenous, FE-IV uses lagged health expenditure as an instrument. The FE-IV coefficient rises to 0.5406 ($p=0.001$), while malaria becomes −0.2186 ($p=0.005$) and HIV becomes −0.6068 ($p<0.001$). Tuberculosis and inflation remain insignificant. Country-specific estimates show that health expenditure is positive and significant in all eight countries, whereas disease effects differ substantially. The results indicate that health investment is positively associated with economic performance, while malaria and HIV impose measurable economic costs when potential endogeneity is addressed.

Keywords: communicable diseases; health expenditure; economic growth; Fixed Effects; instrumental variables; Driscoll–Kraay; Africa; panel data

1. Introduction

Communicable diseases remain an important development challenge because their consequences extend beyond morbidity and mortality to labour productivity, human capital, household resources, public expenditure and macroeconomic performance. Malaria, HIV and tuberculosis can reduce effective labour supply through illness, absenteeism and premature mortality while increasing treatment and prevention costs. Human Capital Theory therefore provides a natural basis for viewing health as a productive asset (Bloom & Canning, 2003), while endogenous growth theory links human-capital accumulation to productivity and sustained growth (Romer, 1990).

The African context is especially important because disease burdens coexist with constrained health-system financing and substantial differences in economic structure. Previous studies have documented adverse economic effects of HIV and malaria, but findings are not uniform across countries, indicators and methods. Bloom and Mahal (1997) examined the macroeconomic implications of AIDS; Gallup and Sachs (2001) documented the economic burden of malaria; and Dauda (2012) reported a negative long-run effect of HIV/AIDS on economic performance in Nigeria. Other studies report heterogeneous or even contrasting relationships.

Three gaps motivate this study. First, much of the literature focuses on one disease or one country. Second, conventional panel inference can be unreliable when heteroscedasticity, serial correlation and cross-sectional dependence coexist. Third, health expenditure may be endogenous because economic performance can influence government capacity and incentives to spend on health. The present study addresses these issues within one empirical framework.

2. Literature and Theoretical Framework

2.1 Theoretical foundation

The study is anchored in Human Capital Theory, Grossman's Health Capital Model and Endogenous Growth Theory. Health expenditure can raise the productive stock of health, improve worker productivity and reduce the economic losses associated with disease (Grossman, 1972; Bloom & Canning, 2003). Conversely, communicable diseases reduce productive time, human capital and household resources. These mechanisms motivate a positive expected coefficient for health expenditure and negative expected coefficients for disease-burden variables.

2.2 Empirical gap

Evidence is broadly consistent with economic costs of communicable disease but differs in magnitude and significance. Gallup and Sachs (2001) associate malaria burden with weaker economic performance. Dauda (2012) finds negative long-run HIV/AIDS effects in Nigeria, while Rasaki and Olanrewaju (2017) report adverse HIV/AIDS effects on human-capital development in West Africa. Afawubo and Mathey (2014), however, report a positive association between HIV prevalence and growth in ECOWAS, demonstrating the importance of country coverage and specification. This study contributes by jointly modelling health expenditure, malaria, HIV, tuberculosis and inflation while explicitly addressing panel dependence and potential endogeneity.

3. Data and Methodology

3.1 Data

The balanced panel contains 160 observations for eight countries over 2003–2022: Benin, Cameroon, The Gambia, Ghana, Nigeria, Senegal, Sierra Leone and Togo. The dependent variable is ln_gdp. Explanatory variables are ln_chexp (current health expenditure), ln_mal (malaria incidence), ln_prehiv (HIV prevalence), ln_tbrin (tuberculosis incidence) and inflation. The sample consists of seven West African countries plus Cameroon, which is geographically in Central Africa.

3.2 Model

The baseline model is: $ln\_gdp\_it = \beta0 + \beta1ln\_chexp\_it + \beta2ln\_mal\_it + \beta3ln\_prehiv\_it + \beta4ln\_tbrin\_it + \beta5INFLATION\_it + \alpha\_i + \lambda\_t + \varepsilon\_it$. α_i represents time-invariant country effects and λ_t represents common year effects. Pooled OLS, Fixed Effects and Random Effects are estimated before formal model selection. Robust Fixed Effects inference uses Driscoll–Kraay standard errors because diagnostics reveal dependence problems.

The study also estimates FE-IV/2SLS to address potential endogeneity of current health expenditure. The instrument is lagged health expenditure, L.ln_chexp. The FE-IV estimates are treated as conditional on instrument relevance and the exclusion restriction; statistical significance of the second-stage coefficient alone does not establish instrument validity.

3.3 Stationarity and cointegration

The study reports GDP, current health expenditure, HIV prevalence and tuberculosis incidence as I(1), while malaria incidence and inflation are I(0). None is I(2). The Westerlund panel cointegration test provides no sufficient evidence of a common long-run equilibrium relationship among economic growth, health expenditure, communicable diseases and inflation.

4. Results

4.1 Preliminary evidence

Mean GDP is approximately 1.02×10^11, mean health expenditure is 50.1423, mean HIV-related measure is 2,006,863, mean tuberculosis incidence is 140.675, mean malaria incidence is 286.219 and mean inflation is 8.0303. The mean VIF is 1.38, indicating no serious multicollinearity. Reported correlations include 0.720 between GDP and health expenditure, 0.626 between malaria and HIV, and 0.444 between GDP and tuberculosis.

4.2 Panel estimates

Variable	Pooled OLS	Fixed Effects	Random Effects
ln_chexp	2.577***	0.2723***	0.280***
ln_prehiv	−1.029***	0.1017 ns	0.102 ns

Variable	**Pooled OLS**	**Fixed Effects**	**Random Effects**
ln_mal	1.338***	0.0774*	0.0766*
ln_tbrin	1.382***	−0.0271 ns	−0.0182 ns
INFLATION	0.00684 ns	−0.00136 ns	−0.00130 ns
R^2	0.7122	0.9307	0.9307
Observations	160	160	160

The large differences between pooled and within-country estimates indicate that unobserved country heterogeneity is important. Formal specification tests are therefore essential.

4.3 Model selection

Test	Statistic	df	p-value	Decision
F-ratio FE vs pooled	2157.02	7,128	0.0000	Reject pooled OLS
Breusch–Pagan LM	413.56	1	0.0000	Reject pooled OLS
Hausman FE vs RE	19.92	5	0.0013	Select FE

The tests strongly support Fixed Effects as the preferred specification.

4.4 Diagnostics and Driscoll–Kraay inference

Diagnostic	Statistic	p-value	Conclusion
Modified Wald	$\chi^2(8)=142.46$	0.0000	Heteroscedasticity
Wooldridge	0.6495	—	Serial correlation indicated
Pesaran CD	Significant	0.0000	Cross-sectional dependence

These violations affect the reliability of conventional standard errors and motivate robust covariance estimation. Driscoll–Kraay leaves the FE coefficient estimates unchanged but adjusts the covariance matrix for heteroscedasticity, serial correlation and cross-sectional dependence.

Variable	Coefficient	DK SE	t	p-value
ln_chexp	0.2723***	0.0619	4.40	0.000
ln_mal	0.0774**	0.0301	2.57	0.019
ln_prehiv	0.1017	0.1846	0.55	0.588
ln_tbrin	−0.0271	0.0473	−0.57	0.573
INFLATION	−0.0014	0.0011	−1.19	0.247

Health expenditure remains positive and highly significant. A 1% increase in health expenditure is associated with approximately a 0.27% increase in GDP in the robust FE specification. Malaria is significant at the 5% level, while HIV, tuberculosis and inflation are insignificant.

4.5 FE-IV/2SLS results

Variable	Coefficient	SE	z	p-value
ln_chexp	0.5406***	0.1587	3.41	0.001
ln_mal	−0.2186***	0.0776	−2.82	0.005
ln_prehiv	−0.6068***	0.1531	−3.96	0.000
ln_tbrin	−0.0894	0.0975	−0.92	0.359
INFLATION	−0.0002	0.0009	−0.20	0.844

The FE-IV estimates materially change the interpretation. Health expenditure rises from 0.2723 to 0.5406 and remains significant. Malaria changes sign and becomes negative and significant; HIV changes from positive and insignificant to negative and highly significant. Tuberculosis and inflation remain insignificant. The model uses 152 observations, has within R^2=0.8062, Wald χ^2=21,189.09 ($p<0.001$), and rho=0.9948.

4.6 Country-specific evidence

Country	Health expenditure	Malaria	HIV	TB
Benin	0.744***	−0.413*	0.0805	−2.040***
Cameroon	0.762***	−0.351**	−0.351**	−0.247**
The Gambia	0.607***	−0.00948	−3.095***	−0.574
Ghana	0.399**	0.448*	−3.950***	0.275
Nigeria	0.858***	−0.929***	−1.573***	0
Senegal	0.327*	−0.148***	0.288	−3.233***
Sierra Leone	0.540***	−0.793**	−0.211	0.0305
Togo	0.374**	−0.0921	−0.742*	0.130

Health expenditure is positive and significant in all eight countries, ranging from 0.327 in Senegal to 0.858 in Nigeria. Disease effects are heterogeneous: malaria is negative and significant in several countries but positive in Ghana; HIV is strongly negative in several countries but insignificant in others; tuberculosis varies substantially as well.

5. Discussion

The positive health-expenditure coefficient is consistent with the theoretical proposition that health is productive human capital. The result agrees with the broader literature on health and economic performance (Bloom & Canning, 2003). The larger FE-IV coefficient suggests that potential reverse causality may attenuate the conventional estimate. However, the IV interpretation remains conditional on instrument validity.

The negative FE-IV malaria effect is consistent with the productivity and treatment-cost mechanisms emphasized in the economic burden literature (Gallup & Sachs, 2001). The negative HIV coefficient is also consistent with evidence that HIV can reduce human-capital accumulation and economic performance (Dauda, 2012; Rasaki & Olanrewaju, 2017). The fact that these signs emerge after FE-IV estimation is important: it suggests that ignoring potential endogeneity can materially affect the estimated disease–growth relationship.

The insignificant tuberculosis coefficient should not be interpreted as proof that tuberculosis has no economic cost. It indicates that, conditional on this sample and specification, the coefficient is not statistically distinguishable from zero. Likewise, inflation is not statistically significant. The country-specific results show why regional averages should be interpreted cautiously: disease burdens and economic transmission mechanisms differ across countries.

6. Policy Implications

First, healthcare investment should be treated as part of economic-development policy because health expenditure is consistently positive and significant. Second, malaria and HIV prevention, diagnosis and treatment deserve sustained investment because FE-IV estimates indicate statistically significant negative economic effects. Third, policy should be country-specific because disease coefficients vary considerably. Fourth, regional cooperation is relevant because cross-sectional dependence suggests that health and economic shocks can spill across national borders. Finally, robust econometric diagnostics should be incorporated into policy-oriented panel studies before statistical significance is interpreted.

7. Contributions to Knowledge

The study makes five contributions. It jointly incorporates multiple communicable diseases and health expenditure in a unified framework; provides robust panel inference after diagnosing heteroscedasticity, serial correlation and cross-sectional dependence; demonstrates that potential endogeneity materially changes the estimated health–growth relationship; shows that malaria and HIV become negative and significant under FE-IV; and documents substantial country-level heterogeneity. These contributions strengthen the empirical basis for integrating health investment and disease control into economic-development policy.

8. Limitations and Future Research

The study is constrained by secondary-data availability and the small cross-sectional dimension of eight countries. The FE-IV results depend on the relevance and exclusion restriction of lagged health expenditure as an instrument. Future studies should report first-stage and weak-instrument diagnostics, consider credible alternative instruments, expand country coverage and examine dynamic panel estimators where appropriate. Formal heterogeneous-slope or interaction models could also deepen the country-level analysis.

9. Conclusion

The study finds that Fixed Effects is the appropriate baseline estimator for the selected African panel. Diagnostic evidence necessitates robust inference, and Driscoll–Kraay estimates confirm a positive and significant association between health expenditure and economic performance. The FE-IV results provide the central identification insight: health expenditure has a larger positive coefficient after potential endogeneity is addressed, while malaria and HIV exhibit negative and significant effects. Tuberculosis and inflation remain insignificant. Country-specific estimates show that health expenditure is beneficial across all eight countries but disease effects are heterogeneous. Overall, sustainable economic performance requires sustained investment in health systems together with targeted control of communicable diseases.

References

Afawubo, K., & Mathey, S. (2014). Employment and education effects on HIV/AIDS prevalence rate and economic growth: Empirical investigation in ECOWAS. Applied Economics Letters, 21(11), 755–759.

Baltagi, B. H. (2021). Econometric analysis of panel data (6th ed.). Springer. https://doi.org/10.1007/978-3-030-53953-5

Bloom, D. E., & Canning, D. (2003). Health as human capital and its impact on economic performance. The Geneva Papers on Risk and Insurance—Issues and Practice, 28(2), 304–315. https://doi.org/10.1111/1468-0440.00225

Bloom, D. E., & Mahal, A. S. (1997). Does the AIDS epidemic threaten economic growth? Journal of Econometrics, 77(1), 105–124. https://doi.org/10.1016/S0304-4076(96)01808-8

Dauda, R. S. (2012). The scourge of HIV/AIDS pandemic and economic performance: The case of Nigeria. Global Journal of Human-Social Science, 12(B1), 49–64.

Driscoll, J. C., & Kraay, A. C. (1998). Consistent covariance matrix estimation with spatially dependent panel data. Review of Economics and Statistics, 80(4), 549–560. https://doi.org/10.1162/003465398557825

Gallup, J. L., & Sachs, J. D. (2001). The economic burden of malaria. The American Journal of Tropical Medicine and Hygiene, 64(1–2 Suppl.), 85–96. https://doi.org/10.4269/ajtmh.2001.64.85

Grossman, M. (1972). On the concept of health capital and the demand for health. Journal of Political Economy, 80(2), 223–255.

Hausman, J. A. (1978). Specification tests in econometrics. Econometrica, 46(6), 1251–1271.

Hoechle, D. (2007). Robust standard errors for panel regressions with cross-sectional dependence. The Stata Journal, 7(3), 281–312. https://doi.org/10.1177/1536867X0700700301

Hsiao, C., & Tahmiscioglu, A. K. (2008). Estimation of dynamic panel data models with both individual and time-specific effects. Journal of Statistical Planning and Inference, 138(9), 2698–2721. https://doi.org/10.1016/j.jspi.2008.03.009

Im, K. S., Pesaran, M. H., & Shin, Y. (2003). Testing for unit roots in heterogeneous panels. Journal of Econometrics, 115(1), 53–74.

Kiross, G. T., Chojenta, C., Barker, D., & Loxton, D. (2020). The effects of health expenditure on infant mortality in sub-Saharan Africa: Evidence from panel data analysis. Health Economics Review.

Levin, A., Lin, C.-F., & Chu, C.-S. J. (2002). Unit root tests in panel data: Asymptotic and finite-sample properties. Journal of Econometrics, 108(1), 1–24.

Rasaki, R. S., & Olanrewaju, O. (2017). Children affected by HIV/AIDS and human capital development in West Africa: A panel data analysis. Advances in Social Sciences Research Journal, 4(19).

Romer, P. M. (1990). Endogenous technological change. Journal of Political Economy, 98(5), S71–S102.

Wooldridge, J. M. (2010). Econometric analysis of cross section and panel data (2nd ed.). MIT Press.