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Econometric evaluation of Economic freedom and Health outcomes in East African community

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Abstract

Economic freedom encompasses a range of mechanisms that influence the health outcomes in economies worldwide. Decreasing the size of the government and implementing lower taxes, both of which are elements of economic freedom, could potentially lead to a reduction in government spending on healthcare, so putting health outcomes at risk. Despite improvements in health outcomes in East African countries like Kenya, Uganda, Tanzania, and Rwanda, including decreased newborn death rates and increased life expectancy, the East African Community still falls behind its Asian counterparts. This research aims to ascertain the connection between health outcomes and economic self-sufficiency in the East African Community. The study purpose was to look at the relationship between economic independence and both life expectancy and the rate of newborn mortality in the East African Community. The selected study design was descriptive, using secondary quantitative data obtained from world development indices. A variety of tests were performed and it was determined that fixed effects regression was suitable on the panel data generated from the 4 countries of East Africa between1997 to 2021. The study established that Carbon emissions have positive relationship with mortality rates per 1000 live births. Similarly, actions of government such as increase in consumption expenditure, gross domestic product percapita, labour force, trade all had significant p values at 0.05 level and therefore any increase in these variables result to minimal infant fatality rates and also increases probability of life expectancy. This study also confirmed that urbanization has no significant influence on life expectancy as well as mortality rates per 1000 lives.

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Introduction

Health outcomes in a nation, including indicators such as life expectancy and infant mortality, demonstrate the impact of healthcare quality, socioeconomic determinants, lifestyle choices, and environmental factors (Lee & Leung, 2014; Anand et al., 2022). Increasing life expectancies in affluent nations, frequently surpassing 80 years, underscore progress in healthcare, living standards, and socioeconomic determinants (Roser et al., 2013; WHO, 2021). Economic freedom, as delineated by indices from organizations such as the Fraser Institute and Heritage Foundation, correlates with health outcomes due to its impact on governmental healthcare expenditure and citizen conduct (Gwartney & Lawson, 2013; Miller & Kim, 2006). For example, life expectancy in Sub-Saharan Africa increased markedly from 41 in 1960 to 60 by 2021, although it continues to

fall short of the world norm, partially due to discrepancies in economic and healthcare resources (UN, 2023; WHO, 2021).

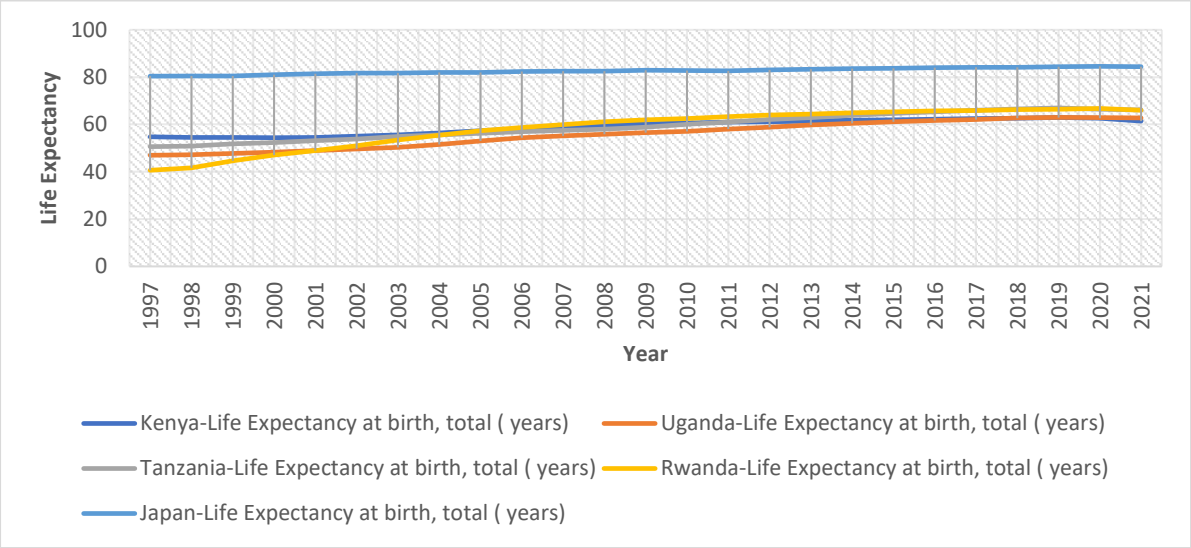

Figure 1.1: Life Expectancy Rate in EAC and Japan 1997-2021.
Source: *World bank (2022).*

From 1997 to 2021, life expectancy significantly improved in East African countries: Kenya climbed from 55 to 61 years, Uganda from 47 to 63, Tanzania from 51 to 66, and Rwanda from 41 to 66, indicating considerable advancements in public health (World Bank, 2022). Notwithstanding these advancements, these nations continue to lag behind Japan, where life expectancy attained 84 years in 2021, an increase from 80 in 1997, highlighting a considerable disparity in longevity measurements between East Africa and Asia..

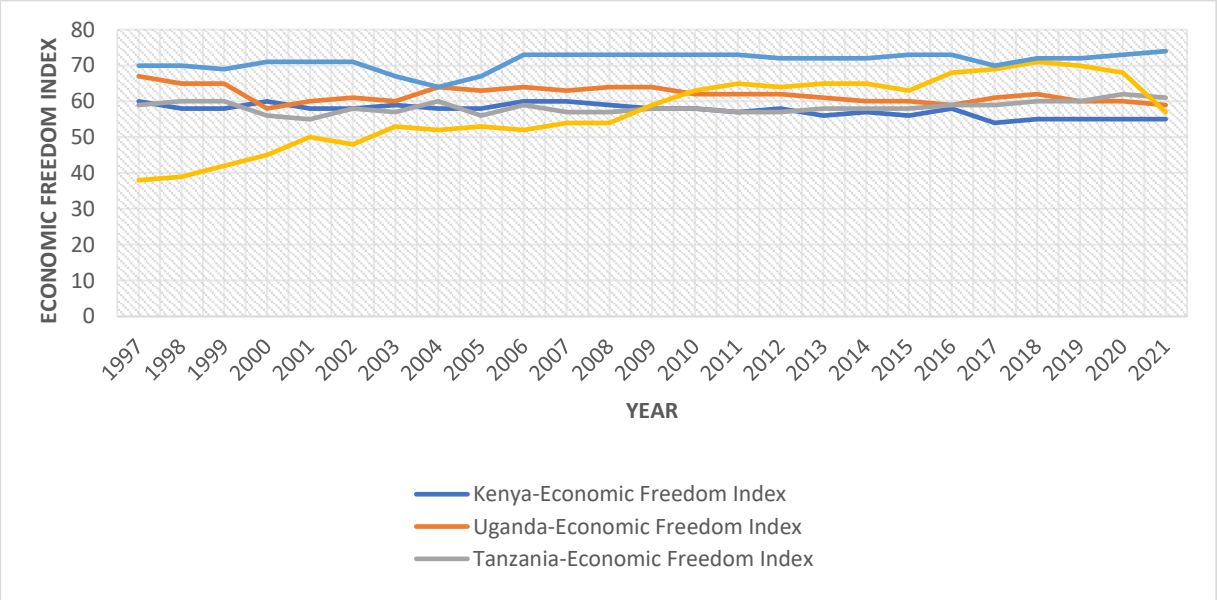

Figure 1.2: Trend of Economic Freedom Index in EAC and Japan 1997-2021.
Source: *The Heritage Foundation (2023).*

Economic freedom within East African Community (EAC) nations shows varying trends from 1997 to 2021, with Kenya, Uganda, and Rwanda experiencing declines or modest improvements, reflecting predominantly unfree statuses by 2021 (The Heritage Foundation, 2023). Tanzania notably improved to a moderately free status with 61 index points, while Japan advanced from

70 to 74 index points, signifying a mostly free economy, underscoring a persistent gap between EAC nations and Asian counterparts in economic freedom.

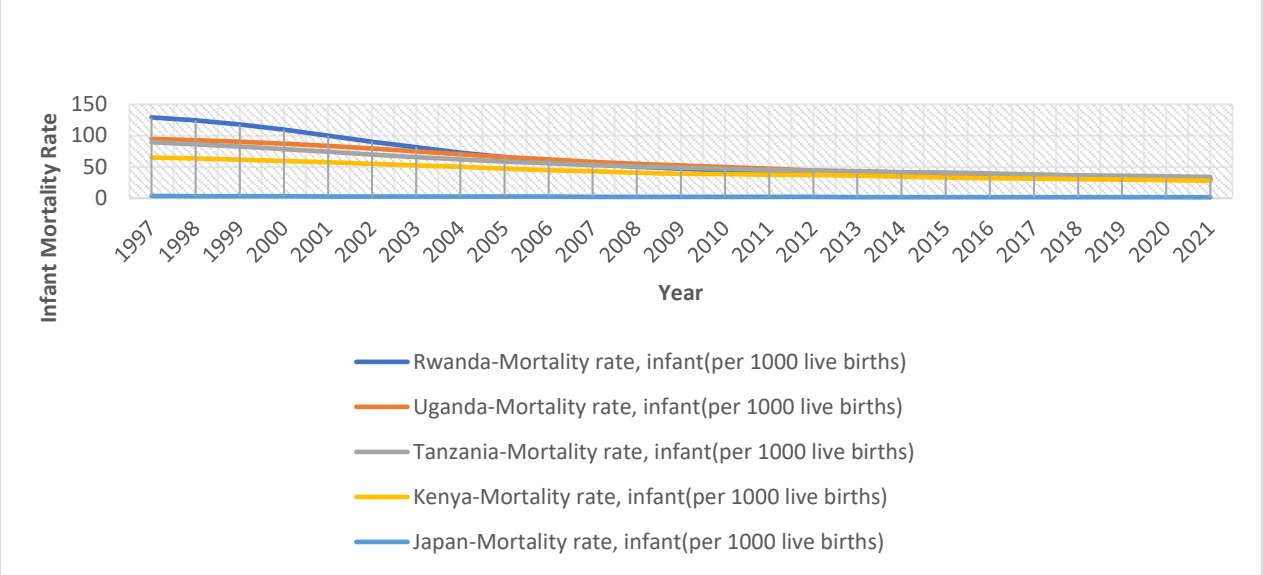

Figure 1.3: Infant mortality rate trend in EAC and Japan 1997-2021.
Source: *World Bank (2022).*

Between 1997 and 2021, child mortality rates in East African nations, including Kenya, Uganda, Tanzania, and Rwanda, significantly declined—from 65, 95, 90, and 129 deaths per 1000 live births to 28, 31, 34, and 30 deaths, respectively—though these rates remain notably higher than in Japan, where the rate dropped from 4 to 2 per 1000 live births (World Bank, 2022). Despite advances in life expectancy and reduced child mortality, East African Community (EAC) nations continue to trail behind Asia in both economic freedom and health outcomes, presenting a compelling case for examining how economic independence impacts health in diverse contexts (Hall, Humphreys & Ruseki, 2018; Sharma, 2020). From 1997 to 2021, the East African Community (EAC) countries—Kenya, Uganda, Tanzania, and Rwanda—saw marked improvements in health outcomes, with significant reductions in infant mortality rates (e.g., Kenya from 65 to 28 per 1,000 live births) and increases in life expectancy (e.g., Rwanda from 41 to 66 years). Concurrently, economic freedom scores varied, with some improvements, yet these nations remain below global averages, particularly when compared to Japan. Research by Sharma (2020), Miladinov (2020), and others links economic autonomy positively to health outcomes, highlighting the need for region-specific analysis of this relationship to capture the unique dynamics within the EAC.

Objectives of the study

The main objective of this paper was to ascertain the relationship between economic freedom and health outcomes in EAC. It was guided by the following specific objectives:

i. To establish the relationship between economic freedom and infant mortality rate in EAC
ii. To determine the relationship between economic freedom and life expectancy in EAC.

Literature review

Theoretical frameworks such as the Household Production Function Model, Preston Curve, and Life History Theory offer foundational insights into the economic and environmental determinants of health outcomes. Rosenzweig and Schultz's (1993) model on birthweight emphasizes the role of household-specific factors in health, illustrating how variations in resources and preferences among households influence birth outcomes. This model identifies economic resources and health-related investments as critical factors for effective, targeted

health interventions. Through this lens, differences in economic investments and health behaviors across households contribute significantly to health disparities, suggesting that targeted policies could reduce inequalities in early life health outcomes. Preston's (1975) curve further enriches this understanding by correlating GDP per capita with life expectancy. The Preston Curve demonstrates that income growth, particularly in low-income nations, has historically driven gains in life expectancy by improving access to affordable medical advancements and healthcare services. As income increases, populations benefit from enhanced healthcare access, higher-quality nutrition, and improved living conditions, which collectively contribute to longer life expectancy. This relationship implies that economic growth is not only central to development but also essential for sustaining public health improvements, especially in regions with limited healthcare infrastructure. Additionally, Life History Theory (Roff, 2022) examines how adaptability to environmental conditions and the strategic allocation of resources across an individual's lifespan influence life expectancy. This theory posits that ecological factors and lifestyle choices play substantial roles in shaping human longevity. By examining how individuals and communities allocate resources for survival, growth, and reproduction, Life History Theory provides a framework to understand how environmental and lifestyle factors contribute to health outcomes. This theory suggests that in settings where resources are scarce or environmental pressures are high, life expectancy may be lower, indicating that policies promoting resilience and resource access could improve longevity. Empirical research complements these theoretical models by analyzing specific health and economic dynamics across diverse contexts. Sede and Ohemeng's (2015) research on Nigeria, for instance, finds that conventional socioeconomic indicators, such as income and healthcare spending, do not fully account for variations in life expectancy in developing countries. Their study suggests that factors beyond income and healthcare investment—such as social support systems, education, and access to basic utilities—can have significant impacts on longevity. This implies that a comprehensive approach to public health, which incorporates social determinants beyond mere economic indicators, may be more effective in improving life expectancy in low-income settings.
Research in Sub-Saharan Africa (SSA) offers further insights into these dynamics. Sharma's (2020) study highlights the role of economic independence in health outcomes, finding that greater economic autonomy correlates with lower mortality rates and higher life expectancy. These findings imply that economic empowerment, through employment and financial independence, may enhance access to healthcare and improve health outcomes. Additionally, Miladinov's (2020) research on EU candidate countries demonstrates that rising GDP per capita and reduced infant mortality are strongly associated with increased life expectancy, reinforcing the importance of socioeconomic growth as a foundation for longevity. However, Miladinov also notes that factors like education and healthcare access play critical roles, suggesting that economic growth alone is insufficient to achieve optimal health outcomes without investments in education and healthcare infrastructure.

Recent studies also emphasize the substantial role of education in health. Rogoz, Sart, Bayar, and Gavriletea (2022) find that educational attainment has a more profound effect on life expectancy than economic freedom, underscoring education's critical role in improving health outcomes. Education provides individuals with the knowledge and skills necessary to make informed health choices, which can lead to healthier lifestyles and better health management. These findings highlight the importance of investing in education as a means of improving public health, as higher educational attainment is linked to lower mortality rates and longer life expectancy. Education thus emerges as a key social determinant of health, with impacts that extend beyond income and access to healthcare services. The literature review reveals a significant gap in research focused specifically on the East African Community (EAC). While substantial research has examined health and economic dynamics in other regions, such as the European Union and broader SSA, relatively few studies have targeted the unique challenges faced by EAC countries. Given the EAC's distinctive economic and healthcare landscape, which includes varying levels of infrastructure, economic development, and healthcare access, a focused investigation in this

region could provide crucial insights into the interconnections between economic freedom, healthcare accessibility, and health outcomes. Current findings from other regions underscore the importance of understanding these socioeconomic and health interdependencies in their specific contexts. Therefore, a dedicated analysis of the EAC could inform tailored health policies and interventions that address the unique conditions of these countries, ultimately contributing to more effective and sustainable public health improvements in the region.

Methodology

The approach used to model the factors that determine life expectancy is based on the hypotheses proposed Rosenzweig and Schultz (1993) by offering a foundational framework for understanding the determinants of birthweight. It posits that birthweight, as a medical result, which depends on number variables that are household-level inputs as shown in equation 3.1:

$HO = f(NU, HC, \varepsilon)$ ……3.1

Where:

HO: Health Outcomes

NU: is Nutrition, represents the dietary intake and nutritional status.

HC: is Household Conditions, includes factors like household income, education, and location.

ε: An error term capturing unobserved heterogeneity across households.

Further exploration of the relationship between household inputs, health outcomes, and broader population health indicators such as life expectancy can be shown in equation 3.2:

$LE = f(NU, HC, OF, \varepsilon)$ ……3.2

Where:

LE= Life Expectancy

OF: is other factors affecting life expectancy education, income, environmental factors, and access to healthcare services.

Further exploration of the association between household inputs, health outcomes, and broader population health indicators such as Infant Mortality Rate can be shown in equation 3.3:

$IMR = f(NU, HC, OF, \varepsilon)$ ……3.3

Where:

IMR= Infant Mortality Rate.

Empirical Model Specification

The relationship between household-level factors, mother and infant medical and broader population health outcomes is complex and multifaceted.. Below is the mathematical equation for life expectancy in equation 3.4:

$$LE_t = \alpha_0 + \alpha_1 PGDP_t + \alpha_2 URB_t + \alpha_3 CO_{2t} + \alpha_4 LF_t + \alpha_5 GE_t + \alpha_6 PR_t + \alpha_7 TF_t + \varepsilon_t \quad \text{.....3.4}$$

LE_t- Life expectancy over time

$PGDP_t$- Per capita Gross Domestic product over time

URB_t- Urbanization Over time

CO_{2t} - CO_2t emission in kilo tons over time

LF_t- Labour Freedom over time

GE_t - Government Expenditure over time

PR_t - Property rights over time

TF_t – Trade freedom over time

ε_t - Error Term

Scrutinizing determinants of these outcomes, we learn that factors influencing the health of a population and inform the development of effective health policies. Below is the mathematical equation for Infant Mortality Rate in equation 3.5:

$$IMR_t = \alpha_0 + \alpha_1 PGDP_t + \alpha_2 URB_t + \alpha_3 CO_{2t} + \alpha_4 LF_t + \alpha_5 GE_t + \alpha_6 PR_t + \alpha_7 TF_t + \varepsilon_t \quad \text{.....3.5}$$

IMR_t- Infant Mortality Rate over time

$PGDP_t$- Per capita Gross Domestic product over time

URB_t- Urbanization Over time

CO_{2t} - CO_2t emission in kilo tons over time

LF_{t-} Labour Freedom over time
GE_{t} - Government Expenditure over time
PR_{t} - Property rights over time
TF_{t} – Trade freedom over time
ε_{t} - Error Term

Empirical findings

Descriptive Statistics for Variables

Summary statistics of key variables used in this study has been presented in the table 4.1.

Table 4.1: Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Life Expectancy (years)	100	59.189	19.536	29.7	129.1
Infant Mortality rate (per 1000 live births)	100	52.972	12.878	28	89.5
Government Expenditure (Index)	100	12.396	3.159	5.705	18.131
Property Rights (Index)	68	3.279	.316	2.5	3.5
Labor Freedom (Index)	100	13360911	7390766.9	2374650	28746124
Trade Freedom (Index)	100	40.856	9.835	23.989	64.479
Percapita GDP ($US)	100	713.285	416.458	234.822	2069.661
CO2emissions (Kt)	100	6113.744	5580.795	480.02	20097.2
Urbanization (PU)	100	7707386.4	5255916.8	955735	22862550

According to table 4.1 the mean for life expectancy overtime was 59.189 years within the four countries of the study with the minimum years 29.7 recorded in Rwanda in 1997and a maximum of 129.1 years recorded in Kenya in 2012. The standard deviation of life expectancy was 19.53 about the mean. According to the summary table above, the mortality rate per 1000 births had an average of 52.97 with standard deviation of 12.878. Minimum value for mortality rate was 28 and maximum value was 89.5. This is comparable to Getayane et al.,(2022) Burundi, Ethiopia, Comoros, Uganda, Rwanda, Tanzania, Mozambique, Madagascar, Zimbabwe, Kenya, Zambia, and Malawi, who found child fatality rate in East Africa to be 41.41 per 1000 live births. Total government spending on consumption goods and services had an average value of 12.396 with standard deviation of 3.159. The minimum value of government spending within the 4 countries was (5.70%) and a maximum of (18.131%). Similarly, the property rights index had an average of 3.279 and 0.316 deviations about the mean. The minimum value for this variable was 2.5 and a maximum of 3.5. Moreover, the analysis from table 4.1 displays the average value of labor freedom as 13360911 with 7390766.9 as standard deviations. Trade freedoms, GDP percapita, Carbon emissions and urbanization had averages of 40.856, 713.285, 613.744 and 7707386.4 and standard deviations of 9.835, 416.578, 5580.795 and 525591.8 respectively. The minimum values of persons migrating to urban centers was 955735 which was in Kenya in 2000 with a maximum number of 22862550 recorded in Tanzania in 2009.

Diagnostic test

This test was conducted to check the correlation of each explanatory variable used in the regression model. Results have been presented as follows.

Table 4.2: Variance inflation factor

	VIF	1/VIF
CO2 emissions	5.896	0.170
Labor Freedom	5.033	0.199
GDP percapita	4.46	0.224
Property rights	1.86	0.538
Government Expenditure	1.956	0.511
Trade freedom	1.005	0.995
Urbanization	1.001	0.999
Mean VIF	3.0301	.

From table 4.2, the mean for variance inflation factor (VIF) is 3.03 which is less than 10 meaning there was no serious multicollinearity between the explanatory variables. according to Pavan et al., (2016), low correlations or low values of VIFs (less than 10) are considered to be indicative that collinearity problems are negligible or non-existent. All the variables had VIF between 1 and 5 indicating low correlation except for CO2 emissions and labor force which had VIF above 5 indicating presence of high multicollinearity. Heteroskedasticity is more common in cross-sectional data because cross-sectional data usually includes observations from different groups, regions, or categories that may have different levels of variability in the dependent variable (Gujarati, 2022). Heteroskedasticity can lead to incorrect statistical tests in regression analysis and biased variance estimates in regression analysis. This is because ordinary least squares (OLS) method assumes that the variance of the dependent variable is constant across all observations. When this assumption is violated, OLS estimator may produce biased covariance estimates. The Breusch–Pagan/Cook–Weisberg test was used to test for heteroscedasticity. The assumption under this test is normal error terms.
H0: Constant variance
Chi^2 (1) = 0.73
Prob > chi^2 = 0.3938
The probability (p) value is greater than 0.05 hence we fail to reject the null hypothesis meaning the fitted values have constant variance signifying absence of heteroscedasticity.

Normality refers assumption that the residuals (error terms) in a regression model follow a normal distribution. This assumption is crucial for many statistical tests, including hypothesis tests and confidence intervals, as these procedures rely on the normality of error terms for valid inferences (Wooldridge, 2020). If the normality assumption is violated, it can lead to unreliable p-values and confidence intervals, affecting the interpretation of the regression results. To assess normality, the Shapiro-Wilk test was applied, which is particularly sensitive for all sample sizes and is widely considered one of the most powerful tests for detecting deviations from normality (Shapiro & Wilk, 1965). The null hypothesis of the Shapiro-Wilk test is that the residuals follow a normal distribution. If the test rejects the null hypothesis, it indicates that the residuals deviate from normality. The test results are represented in Table 4.4. From the results the p value is greater than 0.05 hence we fail to reject the null hypothesis of normality. This means that the residuals of the fitted values follow a normal distribution.

The Hausman test is used to determine the most appropriate model between random effects model or a fixed effects model in panel data regression. The random effects model assumes that the unobserved individual-specific effects are uncorrelated with the explanatory variables, while the fixed effects model assumes that these effects are correlated with the regressors (Baltagi, 2021). The Hausman test assesses this assumption by comparing the estimates from both models. The null hypothesis of the test is that the random effects model is appropriate, meaning there is no correlation between the individual-specific effects and the regressors. If the null hypothesis is rejected, it indicates that the fixed effects model should be used, as the random effects model would produce biased estimates (Hausman, 1978). The Hausman test was employed to select the most appropriate model for the analysis and the results are represented in table 4.4 below.
H_o: random effects model was appropriate
H_1: fixed effects model was effective

Table 4.4: Hausman (1978) specification test

	Coef.		Coef.
Chi-square test value	45.597	Chi-square test value	18.374
Dependent variable (Life expectancy)		Dependent variable (Mortality rate)	
P-value	0.00	P-value	.001

From table 4.4, the probability (p) value was less than 0.05 for both dependent variables meaning the null hypothesis was rejected and hence the fixed effect model was appropriate for estimating the dependent variables.

Empirical Findings

The relationship between economic freedom and infant mortality rate in EAC

The regression results of this objective is represented in table 4.5 as follows.

Table 4.5: Regression results 1

Infant Mortality rate	Coef.	Std.Error	t-value	p-value	[95% Conf	Interval]	Sig
Government Expenditure (GE)	-4.227	.252	-16.77	.002	-1.741	-8.288	
Property Rights (PR)	6.172	2.411	2.56	.013	1.345	10.998	**
Labor Freedom (LF)	-3.025	2.02	-1.49	.002	-.000	-4.000	***
Trade Freedom (TF)	-2.081	.162	12.84	.199	-.044	5.205	
GDP percapita (GDP)	-2.002	.412	4.85	.000	-.01	-3.005	
CO2emissions (CO2)	5.002	.000	5.07	.000	-.003	-6.001	***
Urbanization (URB)	-.002	.201	-0.01	.123	.000	-.0001	***
Constant	28.748	9.041	3.18	.002	10.651	46.846	***

Mean dependent var	50.719	SD dependent var	12.292
R-squared	0.664	Number of observations	68
F-test	19.136	Prob > F	0.000
Akaike crit. (AIC)	352.623	Bayesian crit. (BIC)	368.159

**** p<.01, ** p<.05, * p<.1*

Source: *Author's own compilation (2024)*

From the table above, the estimated equation can be represented as:

IMR=28.748−4.227(GE)+6.172(PR)−3.025(LF)−2.081(TF)−2.002(GDP)+5.002(CO2)−0.002(URB)

The results of this regression research about the correlation between economic freedom, certain economic parameters, and baby mortality in the East African Community (EAC) offer a detailed comprehension of the variables that substantially influence infant mortality rates. This document provides a comprehensive analysis of each critical component grounded in empirical findings, together with contextual insights that elucidate why certain variables display counterintuitive or unforeseen correlations with infant mortality. The coefficient for Government Expenditure (GE) is -4.227, statistically significant at the 5% level (p = 0.002). This suggests that a rise in government spending correlates with a reduction in the infant mortality rate of around 4.23 deaths per 1,000 live births. This discovery corresponds with the existing literature on public health investment: augmented government expenditure, particularly in healthcare and social services, is frequently associated with enhanced health outcomes. Rajkumar and Swaroop (2008) support this viewpoint, indicating that government expenditure, especially in healthcare, might reduce death rates and enhance social welfare. A remarkable and paradoxical finding is the positive correlation between Property Rights (PR) and infant mortality, with a coefficient of 6.172 (p = 0.013), significant at the 5% level. This suggests that enhancing property rights correlates with an increase in infant mortality by roughly 6.17 deaths per 1,000 live births. While enhanced property rights are generally viewed as beneficial for economic stability and progress, their correlation with infant mortality in this case may indicate underlying socioeconomic factors that disfavor specific populations. Acemoglu and Robinson (2012) contend that property rights, when implemented to intensify inequality, can aggravate social divisions and restrict resource access for vulnerable groups. Enhanced property rights may, in certain instances, elevate affluent or land-owning factions while limiting access to essential resources such as healthcare, clean water, or food for low-income communities. In developing nations characterized by significant economic disparity, strengthened property rights may unintentionally benefit existing asset holders, perhaps resulting in land consolidation or the displacement of underprivileged populations. This

phenomena highlights that property rights, although crucial for stability, can inadvertently exacerbate social inequality, affecting public health and infant death rates.

The Labor Freedom (LF) coefficient is -3.025, statistically significant at the 1% level ($p = 0.002$), indicating that an increase in labor freedom correlates with a reduction in infant mortality by around 3.03 deaths per 1,000 live births. Labor freedom, indicative of labor market flexibility, may enhance employment access and increase income levels, hence contributing to improved health and living standards. This finding corresponds with the OECD (2021) report, which suggests that labor market flexibility might enhance economic resilience, hence advancing social and health-related outcomes. An unencumbered labor market may diminish unemployment and underemployment, thereby enhancing families' capacity to afford healthcare, healthy food, and secure living conditions. This illustrates how labor flexibility can enhance economic mobility, subsequently contributing to improved health outcomes, such as reduced newborn mortality rates.

The Trade Freedom (TF) variable exhibits a negative albeit statistically insignificant correlation with infant mortality (coefficient = -2.081, $p = 0.199$). Although trade liberalization is frequently linked to economic growth, the absence of statistical significance indicates that, within the EAC context, trade freedom alone may not directly affect infant mortality rates. The potential health advantages of trade may be indirect and influenced by other economic policies or infrastructure advancements. Geafjan (2020) suggests that the impact of trade freedom on wellbeing and health outcomes may be contingent upon cultural and policy contexts, with domestic policy serving as a critical moderating influence. Trade liberalization may add to overall economic growth; yet, in this location, such gains may not promptly result in health enhancements. This outcome suggests that trade liberalization must be paired with effective health policy to significantly influence newborn mortality rates. The value of -2.002 ($p < 0.01$) indicates that GDP per capita exerts a robust and statistically significant negative impact on infant mortality. As economic levels increase, infant mortality rates generally decline, with each unit increase in GDP per capita correlating with a drop of approximately 2 deaths per 1,000 live births. This corroborates established data that elevated income levels facilitate enhanced access to healthcare, superior nutrition, and safer living environments. Bloom and Canning (2000) shown how income growth enhances investment in healthcare services and infrastructure, hence enhancing general public health. This discovery underscores the vital importance of economic growth in diminishing infant mortality, as it facilitates significant investments in health, cleanliness, and child welfare by families and governments. The research indicates a statistically significant positive correlation between CO_2 emissions and infant mortality, with a coefficient of 5.002 ($p < 0.01$). This indicates that elevated CO_2 emissions are associated with a rise in infant mortality, with each unit increase in emissions related to roughly 5 extra deaths per 1,000 live births. Increased CO_2 concentrations signify environmental contamination, which frequently impacts vulnerable communities, especially in economically disadvantaged regions. Exposure to pollution can result in respiratory and other health complications that increase mortality rates in newborns and young children.

The World Health Organization (2018) has indicated that pollution and environmental degradation provide significant health hazards, particularly in developing areas. This discovery indicates an urgent necessity for environmental management and pollution control to enhance public health outcomes and decrease infant mortality in these situations. Urbanization (URB), exhibiting a coefficient of -0.002 and a p-value of 0.123, demonstrates a negative albeit statistically negligible impact on infant mortality. Despite urban areas typically offering enhanced healthcare access and infrastructure, the absence of statistical significance may suggest that rapid urbanization has not evenly benefited all citizens in the EAC. Urban poverty, congested living circumstances, and the pressure on healthcare services may undermine certain advantages linked to urban development. The United Nations (2018) observed that unregulated urbanization in underdeveloped areas might provide difficulties for public health systems. This outcome

suggests that although urbanization might enhance healthcare access, it necessitates sufficient health services and infrastructure development to ensure uniform advantages for the entire population. The R-squared value of 0.664 signifies that approximately 66.4% of the variation in infant mortality rates is elucidated by the independent variables in the model, indicating a relatively robust fit. This indicates that the model identifies significant factors affecting infant mortality, although some variation remains unexplained. This unexplained segment may be ascribed to other socio-economic, political, or healthcare-specific factors not incorporated in the analysis. The findings offer significant insights into the intricate links between economic conditions and infant mortality in the EAC. Although government expenditure, GDP per capita, and labor freedom demonstrate anticipated negative correlations with infant mortality, the positive correlation with property rights highlights the necessity for prudence. Policymakers must evaluate these economic liberties concerning equality, as improved property rights without equitable income distribution may unintentionally elevate health risks among marginalized groups. The findings emphasize the significance of environmental and urban planning policies in alleviating the detrimental impacts of pollution and urbanization, indicating that economic growth and liberalization should be accompanied by specific health and social policies to achieve substantial enhancements in infant mortality rates.

The relationship between economic freedom and life expectancy rate in EAC

The second objective of the study was to establish the relationship between economic freedom and life expectancy. The regression table 4.6 below represents the findings.

Table 4.6: Regression results 2.

Life Expectancy	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Government Expenditure (GE)	.718	.000	7453403.66	.000	.718	.718	***
Property Rights (PR)	.632	.000	1805924.01	.000	1.632	1.632	***
Labor Freedom (LF)	.031	.000	1088593.26	.000	.000	0.00	***
Trade Freedom (TF)	.277	.000	11885332.76	.000	277	.277	***
GDPpercapita (PGDP)	.032	.000	22346280.29	.000	.032	.032	***
CO2emissions (CO2)	-.013	.000	-16809942.05	.000	-.003	-.043	***
Urbanization(URB)	.102	.301	.339	.181	.000	.201	***
Constant	65.48	.000	19326609.96	.000	65.48	65.48	***

Mean dependent var	52.316	SD dependent var	10.335
R-squared	0.797	Number of observations	68
F-test	232469004128161.813	Prob > F	0.000
Akaike crit. (AIC)	-1663.774	Bayesian crit. (BIC)	-1652.676

**** p<.01, ** p<.05, * p<.1*

Source: *Author's own compilation (2024)*

The estimated equation can be expressed as:

$$LE = 65.48 + 0.718GE + 0.632PR + 0.031LF + 0.277TF + 0.032PGDP - 0.013CO2 + 0.102URB$$

The relationship between economic freedom and life expectancy in the East African Community (EAC) is multifaceted, with each component of economic freedom impacting health and longevity in distinct ways. The regression analysis in Table 4.6 highlights the effects of government expenditure, property rights, labor freedom, trade freedom, GDP per capita, CO_2 emissions, and urbanization on life expectancy. These findings underscore the importance of well-rounded policies that support economic freedoms, environmental health, and social welfare to maximize public health benefits. The coefficient for Government Expenditure (GE) is 0.718, indicating that for each one-point increase in government spending, life expectancy increases by approximately 0.72 years. This relationship is statistically significant ($p = 0.000$), underscoring the positive role of government investment in extending life expectancy. In developing regions, government spending on healthcare, social services, and infrastructure can directly reduce mortality rates and

enhance quality of life. Public investments are often essential for establishing robust healthcare systems, particularly in regions where private healthcare may be inaccessible to lower-income populations. For instance, increased government spending could translate to more hospitals, better-equipped clinics, and programs focused on preventative care, such as vaccination campaigns, maternal health services, and nutritional support. The importance of public health investment is supported by Rajkumar and Swaroop (2008), who found that targeted government spending is crucial for improving health outcomes. In the EAC, where access to private healthcare can be limited, government funding fills a critical gap, ensuring that vulnerable populations have access to basic health services that can significantly improve life expectancy. Moreover, beyond healthcare, government spending on sanitation, clean water access, and education indirectly supports life expectancy. Improved sanitation reduces the incidence of waterborne diseases, which are major contributors to child mortality. Similarly, access to education, particularly for women, has been linked to better health outcomes, as educated mothers are more likely to engage in preventative health behaviors for their families.

The Property Rights (PR) variable has a coefficient of 0.632, indicating that an increase in property rights by one index point is associated with a 0.63-year increase in life expectancy. This positive relationship is statistically significant ($p = 0.000$), illustrating how secure property rights contribute to overall economic stability and public health. When property rights are secure, individuals and businesses are more likely to invest in long-term assets, including property improvements, healthcare, and education, that promote sustainable living standards and health. In the EAC, stronger property rights can promote investments in both urban and rural areas, supporting better housing, improved access to clean water, and sanitation facilities. Acemoglu and Robinson (2012) highlight that secure property rights are a fundamental building block for economic development, as they encourage individuals to invest confidently in their future without the fear of property confiscation or legal uncertainties. When individuals can secure property and land, they have greater economic stability, which allows them to focus on improving their living standards and health, such as building safer homes, accessing better nutrition, and investing in healthcare. Furthermore, secure property rights also foster community development. In regions where property rights are recognized and enforced, communities are more likely to establish local health initiatives, educational facilities, and cooperative businesses that collectively enhance the well-being of the population. Thus, property rights not only contribute to economic growth but also support a stable environment where health improvements can thrive. The coefficient for Labor Freedom (LF) is 0.031, indicating that an increase in labor freedom correlates with a 0.03-year rise in life expectancy. While this effect might appear modest, it is statistically significant ($p = 0.000$) and suggests that labor market flexibility can contribute to better health outcomes. Labor freedom typically involves reducing regulatory barriers, making it easier for businesses to hire and manage their workforce. Flexible labor markets may increase employment opportunities, which in turn improves income levels and economic security—two important determinants of health. OECD (2021) findings indicate that labor market flexibility can drive economic growth by enhancing productivity and enabling quicker adaptation to economic changes. In the EAC, where unemployment and underemployment are high, greater labor freedom could provide more individuals with stable jobs, allowing them to afford healthcare, nutritious food, and safe housing. This economic stability directly impacts life expectancy, as people with stable employment are more likely to access preventive healthcare, maintain better diets, and live in healthier environments. Additionally, labor freedom can improve work conditions by allowing businesses to innovate and invest in workforce health and safety. For instance, companies in labor-flexible economies may be more inclined to offer health benefits, invest in safer work environments, and promote wellness programs that directly benefit employees' health, thereby positively affecting life expectancy.

Trade Freedom (TF) has a coefficient of 0.277, showing a statistically significant positive impact on life expectancy ($p = 0.000$). This suggests that for each one-point increase in trade freedom,

life expectancy rises by about 0.28 years. Trade freedom allows countries to engage more openly in the global market, accessing a wider range of goods, including healthcare products, medicines, and medical technology. The ability to trade freely can stimulate economic growth, which indirectly contributes to health improvements. According to Rodrik (2000), trade liberalization offers multiple welfare benefits, such as increased variety and affordability of products, including essential medications and medical equipment. In the EAC, trade freedom can facilitate the import of advanced medical technologies and affordable pharmaceuticals, both of which are vital for improving healthcare outcomes. Moreover, trade openness encourages foreign investment, which can lead to infrastructure developments, including hospitals and clinics, as well as health-related initiatives that bolster public health. The economic growth resulting from trade freedom can improve income levels, which allows individuals and families to afford better healthcare and living conditions. For example, access to international markets can lead to job creation, empowering people with incomes that enable them to invest in healthier lifestyles, better nutrition, and preventive care, all of which support longer life expectancy. The GDP per capita (PGDP) variable has a coefficient of 0.032, indicating that as GDP per capita rises, life expectancy increases by approximately 0.03 years. This statistically significant positive effect ($p = 0.000$) reflects the close link between economic prosperity and health. As income levels rise, people have greater financial resources to invest in healthcare, better diets, safer housing, and overall improved living standards. Bloom and Canning (2000) highlight that economic growth facilitates access to quality healthcare, sanitation, and nutrition, which directly contribute to life expectancy improvements. In the EAC, higher GDP per capita suggests that both individuals and governments can allocate more resources to health-related areas. With increased government revenue from economic growth, countries can improve healthcare infrastructure, invest in medical training, and subsidize healthcare services, all of which can help to reduce mortality and boost life expectancy. Higher GDP per capita also enables individuals to spend more on personal health needs. For example, families with higher income can afford health insurance, reducing their vulnerability to health-related financial shocks and ensuring they have access to quality healthcare services. Additionally, increased spending power enables individuals to access healthier food, safer housing, and educational opportunities, which all indirectly support longer life expectancy. CO_2 emissions, with a coefficient of -0.013 ($p = 0.000$), exhibit a negative and statistically significant effect on life expectancy. This suggests that for every one-unit increase in CO_2 emissions, life expectancy decreases by 0.01 years. Pollution, particularly air pollution, has been shown to exacerbate respiratory diseases, cardiovascular problems, and other health risks that reduce life expectancy. The World Health Organization (2018) notes that pollution and environmental degradation are major public health challenges, particularly in developing regions with limited environmental protections. In the EAC, rising industrialization and urbanization have likely increased CO_2 emissions, leading to greater exposure to air pollutants that can impair public health. Children, the elderly, and low-income populations are particularly vulnerable to pollution-related health issues, as they may have limited access to healthcare and live in areas with higher exposure to pollutants. This finding suggests a need for policies that address environmental health risks, such as enforcing emission standards, promoting clean energy, and improving air quality monitoring. Reducing CO_2 emissions can have immediate and long-term benefits for life expectancy by minimizing exposure to harmful pollutants and fostering a healthier environment. For instance, clean air initiatives, green spaces, and pollution reduction measures can lower the incidence of respiratory conditions, thereby supporting longer, healthier lives. Urbanization (URB) has a coefficient of 0.102, suggesting a positive relationship with life expectancy, though the effect is statistically insignificant ($p = 0.181$). Urbanization often brings better healthcare facilities, enhanced infrastructure, and economic opportunities, which can support health improvements. However, unplanned or rapid urbanization can result in overcrowded living conditions, inadequate sanitation, and stretched healthcare resources, which may negate some of these benefits. The United Nations (2018) has cautioned that poorly managed urbanization can lead to negative health outcomes, especially in developing regions. In the EAC, urbanization may bring both opportunities and challenges: while it can improve access to

healthcare, education, and economic opportunities, it can also create urban poverty, overcrowding, and limited access to sanitation. Therefore, the benefits of urbanization on life expectancy are likely conditional upon the quality of urban planning and investment in public health infrastructure. The R-squared value of 0.797 indicates that about 79.7% of the variation in life expectancy is explained by the model, which suggests a robust fit. However, there remains approximately 20% of the variation unaccounted for, likely due to factors not included in the model, such as cultural aspects, disease prevalence, healthcare quality, and lifestyle factors. The regression analysis demonstrates that multiple facets of economic freedom positively impact life expectancy, with government spending, property rights, labor freedom, trade freedom, and GDP per capita all showing significant contributions. Conversely, CO_2 emissions are detrimental to life expectancy, emphasizing the need for environmental protections in the EAC. Policymakers in the EAC should take a balanced approach, promoting economic freedoms that stimulate growth and investment while ensuring environmental regulations to minimize health risks from pollution. Government investment in healthcare, secure property rights, labor market flexibility, and trade liberalization can collectively foster economic resilience and public health advancements. Simultaneously, the challenges posed by urbanization and CO_2 emissions require targeted interventions to ensure sustainable urban growth and cleaner air, fostering an environment where economic and health outcomes can be jointly optimized for the long-term wellbeing of the population.

Conclusions

This study explored the relationship between economic freedom and health outcomes in East African Community (EAC) countries, focusing on infant mortality and life expectancy from 1997 to 2021. By analyzing the effects of government expenditure, property rights, labor freedom, trade freedom, GDP per capita, CO_2 emissions, and urbanization, the study provides valuable insights into the multifaceted impact of economic policies on public health. Through Fixed Effects regression models, it was found that government spending, secure property rights, labor freedom, trade openness, and higher GDP per capita positively influenced health outcomes, while CO_2 emissions posed significant risks to life expectancy. These results underscore the importance of a balanced policy approach that promotes both economic freedom and environmental health protections to foster sustainable improvements in health within the EAC. The findings indicate that increased government expenditure on health and related services has a significant positive effect on life expectancy, reinforcing the critical role of public health investment. In low-income regions, public spending is often essential to provide accessible healthcare services, especially to vulnerable populations who may lack access to private healthcare. In the EAC, government investment in healthcare infrastructure and programs such as maternal health services, vaccination initiatives, and nutrition support could have a transformative effect on public health. Allocating more resources to community-based healthcare systems and rural health clinics, especially in underserved areas, would improve healthcare access, contributing directly to reductions in infant mortality and overall improvements in life expectancy. Further, preventive healthcare strategies—such as public health campaigns on nutrition, hygiene, and disease prevention—would be valuable in minimizing healthcare costs and reducing preventable illnesses, creating long-term health benefits.

Property rights were shown to have a positive impact on life expectancy, likely due to the economic stability and opportunities they afford individuals and communities. Secure property rights encourage investments in health, education, and long-term living conditions. In contexts where property ownership is protected, individuals are more likely to invest in safe housing, sanitation facilities, and community resources that collectively enhance health outcomes. This effect is particularly relevant in the EAC, where establishing enforceable property laws and reducing bureaucratic barriers could foster economic growth and stability. Strengthened property rights can also attract healthcare investments from both domestic and foreign investors, helping to establish healthcare facilities, pharmaceutical companies, and training institutions that

contribute to the broader healthcare ecosystem. By promoting clear and enforceable property laws, EAC countries can create an environment conducive to economic and health improvements, as individuals are empowered to invest confidently in their futures.

Labor freedom was also found to have a positive association with life expectancy, though the effect size was modest. Labor market flexibility enhances job accessibility and provides more stable income opportunities, which in turn allow individuals to afford healthcare, nutritious food, and safe housing. Economic stability achieved through secure employment enables families to invest in healthier lifestyles and access preventive healthcare, contributing to better health outcomes and increased life expectancy. The findings are in line with research indicating that labor market flexibility improves economic resilience, job security, and working conditions. In the EAC, where unemployment and underemployment are pervasive, policies that promote labor freedom could encourage job growth, which indirectly improves health by elevating household income and enabling access to essential health services.

Trade freedom demonstrated a significant positive impact on life expectancy, suggesting that trade openness contributes to economic growth, access to essential goods, and health improvements. Trade liberalization enables countries to import medical equipment, pharmaceuticals, and other critical health resources, which are otherwise limited in availability. For the EAC, reducing trade barriers could improve access to medicines and healthcare technology, helping to lower healthcare costs and make treatments more affordable. By fostering intra-EAC trade, member countries could enhance regional economic integration, which would facilitate the sharing of resources, including healthcare expertise and supplies, ultimately contributing to better health outcomes. Policies aimed at promoting health-focused trade partnerships could further amplify these benefits, as trade expansion allows EAC nations to access a more diverse range of health-promoting goods and services that directly impact life expectancy.

GDP per capita was also positively associated with life expectancy, underscoring the relationship between economic prosperity and health. As GDP per capita increases, both individuals and governments gain greater financial resources to invest in healthcare, nutrition, and better living standards, all of which are essential for public health. Economic growth, as evidenced by rising income levels, allows for greater healthcare expenditure, improved access to health services, and enhanced living conditions, which collectively contribute to reductions in mortality rates. In the EAC, increased GDP per capita could enable governments to build and maintain healthcare facilities, provide medical training, and support essential public health initiatives. For individuals, higher income levels increase their ability to afford private healthcare services, health insurance, and preventive health measures, creating a more resilient population with longer life expectancy. The analysis found that CO_2 emissions had a significant and negative impact on life expectancy, underscoring the adverse health effects of pollution. Higher CO_2 levels, often a byproduct of industrialization and urban growth, exacerbate respiratory illnesses, cardiovascular conditions, and other health risks, particularly in vulnerable communities. In the EAC, environmental degradation and pollution present major health challenges, especially as urbanization intensifies. To address these issues, policies focused on emission reductions and air quality improvements are necessary. EAC countries could implement stricter environmental regulations, promote renewable energy sources, and invest in sustainable urban planning to mitigate the negative effects of pollution. For instance, enforcing emission standards on industries and vehicles, expanding green spaces, and increasing public transportation options would improve urban air quality and reduce pollution-related health risks. Public health campaigns that raise awareness about the dangers of pollution and provide resources such as air filters for households in high-risk areas would also protect vulnerable populations.

Urbanization was positively associated with life expectancy, though the relationship was statistically insignificant. While urbanization has the potential to improve health outcomes by providing access to healthcare services, better infrastructure, and economic opportunities, unplanned or rapid urban growth can create significant public health risks. Overcrowding, inadequate sanitation, and stretched healthcare resources in urban areas can negate the potential health benefits of urbanization. In the EAC, managing urbanization through strategic planning and investment in public health infrastructure is critical. Policies focused on improving healthcare access in urban centers, expanding sanitation and water infrastructure, and promoting affordable housing are essential for ensuring that urbanization contributes positively to life expectancy. Additionally, investments in public health facilities, affordable healthcare options, and urban planning that prioritizes green spaces and pollution control can create healthier urban environments that support long-term health improvements.

The study's data sources and model were selected with a focus on variables that reflect key aspects of economic freedom and environmental health. The use of Fixed Effects models allowed for a robust analysis of within-country effects, ensuring that the findings reflect true within-country relationships between economic freedom and health outcomes. The chosen independent variables, such as government expenditure, property rights, and GDP per capita, were selected based on established theoretical and empirical links to health, providing a comprehensive analysis of the economic factors that influence public health. However, the study has several limitations that should be noted. Potential omitted variables, such as healthcare quality, disease prevalence, and educational attainment, may influence health outcomes but were not included in this model. Additionally, the assumption of linear relationships may not fully capture the complexity of the interactions between variables. For instance, urbanization's impact on health may vary depending on the stage and quality of urban development, and non-linear models could provide more insights into these relationships. Limited data availability for certain variables, such as property rights, may also affect the accuracy and generalizability of the results. Finally, while the Fixed Effects model controls for unobserved heterogeneity across countries, differences in culture, history, and institutions could still influence the findings.

Future research could build on these findings by examining specific pathways through which economic freedom components impact health. For instance, further exploration of the relationship between property rights and healthcare access, or the effects of labor freedom in informal economies, could offer a more nuanced understanding of how economic freedom influences health. Studies that focus on the moderating effects of urbanization and targeted healthcare investments would provide additional insights into how policy interventions can maximize health benefits. Non-linear models and longitudinal datasets with finer granularity could address some of the limitations identified in this study, providing a more comprehensive view of the economic freedom-health nexus.

In conclusion, this study underscores that economic freedom positively impacts health outcomes in the EAC, but these benefits are maximized when balanced with environmental protections and public health investments. For policymakers, the findings highlight the importance of health-focused government spending, secure property rights, labor flexibility, trade liberalization, and measures to control pollution. By integrating these insights into policy design, EAC countries can promote a healthier, more resilient population and ensure that economic growth is inclusive and sustainable.

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