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Financial Development and Human Capital: The Effect of Insurance Sector Expansion in Enhancing Adult Lifespan in Cameroon (1977-2023)

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Financial Development and Human Capital: The Effect of Insurance Sector Expansion in Enhancing Adult Lifespan in Cameroon (1977-2023)

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Abstract

This study investigates the effect of the growth of Cameroon's insurance financial services sector development on adult longevity, measured by survival rates to age 65 for males and females over the period, 1977–2023 utilizing time-series data from the World Bank's World Development Indicators. The analysis employs an Autoregressive Distributed Lag (ARDL) bounds testing approach to examine long-run and short-run relationships, supplemented by Granger causality tests and forecasting. Descriptive statistics reveal increasing longevity trends amid fluctuating insurance sector indicators, with imports exceeding exports. The ARDL model confirms cointegration, showing positive long-run effects of insurance exports on longevity (for instance, a 1% increase in commercial service exports boosts survival by 0.15%) and negative effects from imports. Short-run dynamics mirror this pattern, with a 59% annual adjustment speed to equilibrium. However, Granger causality indicates no directional influence from insurance growth to longevity, suggesting concurrent or reverse dynamics. Forecasts project continued longevity gains to 70% by 2028. These findings highlight a "human dividend" from export-oriented insurance development, filling a gap in Cameroonian literature and informing policies for health-related Sustainable Development Goals.

Keywords: *Adult Lifespan, Human Capital, Financial Development, Insurance Sector Expansion.*

Introduction

The relationship between financial sector development and economic growth is well-documented in economic literature (Levine, 2005). However, the specific channels through which sub-sectors of finance, such as insurance, impact non-economic developmental outcomes, particularly human welfare, remain less explored, especially in the context of a developing economy like Cameroon. Since gaining independence and particularly from the late 1970s, Cameroon has experienced significant economic transformations—from an oil boom to structural adjustment programs and integration into the Central African Economic and Monetary Community (CEMAC). Throughout this period, the insurance sector has evolved, reflected in its changing contributions to commercial service exports and imports. Concurrently, key indicators of human welfare, such as adult survival

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rates, have shown notable trends. This study posits that the development of the insurance and financial services sector is not merely an economic phenomenon but may have a tangible "human dividend" reflected in the population's ability to survive to older ages.

While Cameroon has witnessed fluctuations in the growth of its insurance and financial services sector, it is unclear whether this development has translated into improved health and longevity for its citizens. Existing studies on Cameroon's economy have often focused on macroeconomic stability, oil revenue, or agricultural exports, with limited attention to the service sector's social impact (Njinkeu & Fosso, 2006). A critical gap exists in understanding if the risk-mitigation, savings, and healthcare financing mechanisms provided by a growing insurance sector have systematically contributed to the documented improvements in survival rates to age 65 for both men and women from 1977 to 2023. This research seeks to address this gap by empirically investigating the potential linkage between these variables.

Therefore, the primary objective of this study is to investigate the development of the insurance and financial services sector in Cameroon from 1977 to 2023 and its potential association with trends in adult longevity, as indicated by male and female survival rates to age 65. This objective is broken down to the following specific objectives:

a) To trace the historical trends of insurance and financial services (measured as % of commercial service exports/imports and BoP service exports/imports) in Cameroon from 1977 to 2023.
b) To analyze the progression of male and female survival rates to age 65 in Cameroon over the same period.
c) To investigate the existence and nature of the relationship between the development of the insurance sector and adult longevity indicators.

This study is guided by the following questions:

a) How has the structure of Cameroon's insurance and financial services sector, in terms of its integration into global trade (exports/imports), evolved from 1977 to 2023?
b) What is the trend in survival probability to age 65 for male and female cohorts in Cameroon between 1977 and 2023?
c) Is there a statistically significant relationship between indicators of insurance sector development and adult survival rates in Cameroon?

Literature Review

Theoretical Framework

This study integrates two complementary theoretical perspectives to explain the linkage between insurance sector development and longevity: the Theory of Financial Development and Growth, and the Health Production Function. These frameworks provide a foundation for hypothesizing that insurance growth enhances health outcomes through improved risk management and resource allocation.

The Theory of Financial Development and Growth

Building on the seminal work of King and Levine (1993), this theory posits that financial intermediaries, including insurers, promote economic growth by mobilizing savings, allocating capital efficiently, and managing risks. Insurance, as a financial service, extends this by providing mechanisms for risk pooling and transfer, which reduce the adverse impacts of shocks such as illness or accidents. In developing economies, a robust insurance sector can enhance societal resilience, encouraging investments in human capital (e.g., education and health) by mitigating financial uncertainties. We extend this model to argue that insurance sector growth in Cameroon—evidenced by increasing export shares—fosters better health management, as insured individuals are more likely to seek timely medical care without fear of catastrophic expenses.

The Health Production Function

Grossman's (1972) model conceptualizes health as a durable capital stock that individuals "produce" through investments in medical care, nutrition, and preventive behaviors. Health depreciates over time due to aging and external factors but can be augmented via inputs financed by income and insurance. Insurance acts as a facilitator by lowering out-of-pocket costs, enabling access to healthcare services, and providing income replacement during illness. This reduces barriers to preventive care (e.g., vaccinations, screenings) and promotes longevity by maintaining health capital. In gendered terms, insurance may disproportionately benefit women in patriarchal societies by empowering them to prioritize health amid household responsibilities.

Synthesized Framework and Suggested Conceptual Framework

The synthesized theoretical framework posits insurance sector development as the independent variable influencing longevity (dependent variable) through intermediary channels: (1) improved access to healthcare funding, reducing financial barriers; (2) enhanced financial security, allowing for sustained health investments; and (3) promotion of preventive behaviors via risk awareness and coverage incentives. This relationship is moderated by contextual factors such as economic policies, gender norms, and infrastructure in Cameroon.

Conceptual Review

Insurance and Financial Services Development

Insurance and financial services represent a critical subset of the broader financial sector, encompassing activities such as life insurance, non-life insurance, reinsurance, and related financial intermediation. These services facilitate risk pooling, capital mobilization, and economic stability by mitigating uncertainties associated with health, property, and income loss. In the context of this study, the development of the insurance sector is measured through four key metrics derived from trade and balance of payments (BoP) data:

Insurance and financial services as a percentage of commercial service exports: This indicator reflects the extent to which a country exports insurance-related services, such as reinsurance or advisory services, to foreign markets. A high share indicates a mature domestic insurance industry capable of competing internationally, signaling strong institutional capacity and innovation in financial products.

Insurance and financial services as a percentage of commercial service imports: This measures the reliance on imported insurance services, often from more developed markets. In developing countries like Cameroon, a high import share may signify dependence on foreign reinsurance providers due to limited domestic risk-bearing capacity, which can expose the economy to external vulnerabilities but also facilitate knowledge transfer and sector growth.

Insurance and financial services as a percentage of service exports (BoP): Under the Balance of Payments framework, this captures insurance services within the broader services trade, including premiums and claims settlements. It provides a standardized view of export performance, emphasizing the sector's contribution to foreign exchange earnings.

Insurance and financial services as a percentage of service imports (BoP): Similarly, this BoP metric highlights import dependencies, including payments for reinsurance abroad. Distinguishing between commercial service trade and BoP metrics is essential, as the former focuses on market-oriented transactions, while the latter includes all cross-border flows, offering a more comprehensive economic picture.

For developing countries, a high export share in these metrics often signifies enhanced domestic capacity, fostering economic resilience and attracting investment. Conversely, elevated import shares may indicate underdeveloped local markets and heavy reliance on foreign expertise, potentially leading to capital outflows but also enabling risk diversification (OECD, 2011). In Cameroon, these dynamics are particularly relevant given its oil-dependent economy and vulnerability to climate-related risks, where insurance can play a pivotal role in stabilizing financial flows.

Longevity and Survival Rates

Longevity, in this study, is operationalized through adult survival rates to age 65, which measure the percentage of a cohort (typically from birth) expected to survive to age 65 based on current age-specific mortality rates. This indicator serves as a robust proxy for a population's overall health status, capturing cumulative health investments, disease burdens, and socioeconomic influences beyond infancy. Unlike infant mortality rates, which focus on early-life vulnerabilities, survival to age 65 reflects the effectiveness of health systems in addressing chronic diseases, injuries, and aging-related challenges (Wang et al., 2012).

The gendered dimensions of longevity are noteworthy. Globally and in sub-Saharan Africa, women tend to exhibit higher survival rates to age 65 due to biological factors (e.g., stronger immune responses) and behavioral differences (e.g., lower engagement in risky occupations or substance use). However, in contexts like Cameroon, disparities may arise from socioeconomic inequalities, such as limited access to healthcare for women in rural areas or higher male mortality from occupational hazards and violence. These rates are influenced by factors including nutrition, sanitation, education, and healthcare access, making them sensitive to economic interventions like insurance coverage.

Empirical Review

Global and African Evidence

Empirical studies worldwide have demonstrated linkages between financial development and health outcomes. For instance, Claessens and Feijen (2007) found that deeper financial markets correlate with lower mortality rates by enabling better resource allocation for health. Specifically on insurance, Jütting (2004) analyzed community-based health insurance in Senegal and other African countries, showing that higher insurance penetration reduces out-of-pocket expenditures—a major barrier to care—and improves health-seeking behaviors.

In Africa, evidence from Ghana and Rwanda highlights how microinsurance schemes enhance maternal and child health outcomes (Mensah et al., 2010). A cross-country study by Asongu and Odhiambo (2019) linked financial inclusion, including insurance, to reduced inequality and better life expectancy in sub-Saharan Africa. These findings suggest that insurance mitigates health shocks, particularly in low-income settings where public health systems are underfunded.

Literature Gap

While Cameroon's financial sector has been studied in isolation—e.g., analyses of banking reforms post-1990s crises (Nguena, 2013)—and health indicators like HIV prevalence and maternal mortality have been examined (INS Cameroon, 2020), there is a notable absence of integrated research. No empirical study has longitudinally linked insurance sector trajectories to longevity trends over multiple decades. For example, World Bank reports on Cameroon's economy discuss insurance growth but without health linkages (World Bank, 2022). This gap underscores the novelty of the current study, which addresses this by employing time-series data to explore causal associations.

This section has delineated the conceptual foundations of insurance development and longevity, integrated theoretical models to hypothesize pathways, and reviewed empirical evidence while identifying a critical gap in Cameroonian scholarship. It lays the groundwork for the methodological approach in the subsequent chapter, paving the way for an investigation into how financial sector evolution may yield human dividends in longevity.

Methodology

This section outlines the research design, data sources, processing techniques, and ethical considerations for the study. It ensures transparency and replicability in examining the relationship between insurance sector indicators and longevity in Cameroon from 1977 to 2023.

Research Design

The study adopts a quantitative longitudinal research design, utilizing time-series data spanning 47 years (1977–2023). This approach is ideal for tracing historical trends and inferring relationships over time, allowing for the detection of patterns, correlations, and potential causal links (Wooldridge, 2016). By focusing on annual data points, the design accounts for economic cycles, policy changes, and gradual health improvements, providing a robust basis for analysis without the complexities of cross-sectional comparisons.

Data Sources and Description

Data are exclusively drawn from the World Bank's World Development Indicators (WDI) database, a globally recognized repository offering consistent, comparable metrics across countries and time. This source ensures data reliability and minimizes measurement errors. The variables are as follows:

a. Exp_Com: Insurance and financial services (% of commercial service exports): Measures the sector's export contribution within commercial services.
b. Imp_Com: Insurance and financial services (% of commercial service imports): Captures import reliance in commercial services.
c. Exp_BoP: Insurance and financial services (% of service exports, BoP): Reflects export share in BoP services.
d. Imp_BoP: Insurance and financial services (% of service imports, BoP): Indicates import share in BoP services.

Dependent Variables (Longevity Indicators):

a. Surv_F: Survival to age 65, female (% of cohort): Percentage of female cohort expected to reach age 65.
b. Surv_M: Survival to age 65, male (% of cohort): Percentage of male cohort expected to reach age 65.

These variables are selected for their direct relevance to the research objectives and availability over the full period. The final dependent variable "Survival" is computed as the mean of Surv_F and Surv_M.

Data Processing and Analysis Techniques

Data compilation and analysis is conducted using Eviews, which support advanced time-series modelling, elaborating Descriptive Statistics, Trend Analysis and Correlation Analysis.

ARDL Modelling

The ARDL(p,q_1,q_2,q_3,q_4) model is specified to capture both short-run and long-run relationships between survival rates and insurance sector indicators as in equation (1)

$$\begin{aligned} Survival_t = \alpha + \sum_{i=1}^{p} \beta_i Survival_{t-1} + \sum_{j=0}^{q_1} \gamma_j Exp\_Com_{t-j} + \sum_{k=0}^{q_2} \delta_k \operatorname{Im} p\_Com_{t-k} + \\ \sum_{l=0}^{q_3} \in_l Exp\_Bop_{t-l} + \sum_{m=0}^{q_4} \varsigma_m \operatorname{Im} p\_Bop_{t-m} + \varepsilon_t \end{aligned} \tag{1}$$

Where: p is the lag order of the dependent variable, and p,q_1,q_2,q_3,q_4, are lag orders for the independent variables.

Lag Selection

The Akaike Information Criterion (AIC) is used to select optimal lag lengths, with a maximum of 2 lags for each variable to preserve degrees of freedom given the small sample size (n=47). This ensures model parsimony while capturing dynamic effects.

Bounds Test

The ARDL bounds test (Pesaran et al., 2001) is conducted to check for cointegration (long-run relationship). For the F-statistic tests, the joint significance of lagged level terms, if F-statistic is greater than the upper bound then cointegration exists. If F-statistic < lower bound: No cointegration. If F-statistic is between bounds: Inconclusive.

Error Correction Model (ECM)

If cointegration is confirmed, the ECM will be estimated to capture short-run dynamics and the speed of adjustment to long-run equilibrium as in equation (2)

$$\Delta Survival_t = \alpha + \sum_{i=1}^{p-1} \beta_i^{'} \Delta Survival_{t-1} + \sum_{j=0}^{q_1-1} \gamma_j^{'} \Delta Exp\_Com_{t-j} + \sum_{k=0}^{q_2-1} \delta_k^{'} \Delta \operatorname{Im} p\_Com_{t-k} + \sum_{l=0}^{q_3-1} \in_l^{'} \Delta Exp\_Bop_{t-l} + \sum_{m=0}^{q_4-1} \varsigma_m^{'} \Delta \operatorname{Im} p\_Bop_{t-m} + \phi ECT_{t-1} + \varepsilon_t \quad (2)$$

Where ECT_{t-1} the error correction term, and ϕ is (negative and significant) indicates the speed of adjustment.

Regression Analysis

A multivariate time-series regression model is estimated to explore the relationships more rigorously. The basic model specification is shown by equation (3):

Longevity_t = β_0 + β_1 (Insurance_Export_t) + β_2 (Insurance_Import_t) + ε_t ………………(3)

Where Longevity_t represents the mean of male and female survival rate in years. Different models are run for each combination of insurance metrics and survival rates. Stationarity of the time series is tested using the Augmented Dickey-Fuller (ADF) test, and appropriate transformations (e.g., differencing) is applied for non-stationarity series.

Ethical Considerations

Given the reliance on publicly available, aggregated, and anonymized secondary data from the World Bank, the study poses no risks to human subjects and requires no institutional ethical approval. Adherence to academic integrity includes proper citation of sources, avoidance of data fabrication, and transparent reporting of methods and limitations. Any potential biases in World Bank indication (WDI) data (e.g., estimation methods) will be acknowledged.

Presentation and Discussion of Findings

Descriptive Statistics

Table 1 shows the summary statistics of the research variables as follows: Insurance imports (IMP_COM: 6.33%, IMP_BOP: 6.15%) exceed exports (EXP_COM: 5.30%, EXP_BOP: 4.97%), indicating reliance on foreign services. Medians are close to means, suggesting symmetric distributions. Exports (Std. Dev. ~2.15–2.29) are more volatile than imports (~1.56–1.62), reflecting an unstable domestic insurance market. Near-zero skewness for exports (0.04–0.11) and moderate negative skewness for imports (-0.71) suggest balanced distributions. Kurtosis (~2.55–2.67) and Jarque-Bera p-values (>0.05) confirm normality, supporting parametric tests. Wide ranges (e.g., EXP_COM: 0.37%–10.10%) indicate significant fluctuations, likely tied to economic or policy shifts.

Table 1: Descriptive Statistics

	EXP_COM	IMP_COM	EXP_BOP	IMP_BOP	SURV_F	SURV_M
Mean	5.304821	6.325109	4.967105	6.145846	53.20318	46.69532
Median	5.487449	6.745222	5.161709	6.523009	51.17520	45.36477
Maximum	10.09690	8.582170	9.564029	8.367191	67.86224	58.01886
Minimum	0.368252	2.166205	0.343844	2.143254	46.84300	41.41976
Std. Dev.	2.294332	1.619222	2.148468	1.560264	5.486429	4.123317
Skewness	0.037996	-0.711226	0.111305	-0.715813	1.086249	0.904584
Kurtosis	2.549705	2.656349	2.672153	2.625636	2.992452	2.919620
Jarque-Bera	0.408391	4.193707	0.307535	4.288165	9.242959	6.422449
Probability	0.815303	0.122842	0.857471	0.117175	0.009838	0.040307
Sum	249.3266	297.2801	233.4539	288.8547	2500.550	2194.680
Sum Sq. Dev.	242.1422	120.6065	212.3321	111.9836	1384.642	782.0801
Observations	47	47	47	47	47	47

Female survival to age 65 (53.20%) is higher than male (46.70%), with medians slightly lower (51.18%, 45.36%), reflecting health improvements over time. Moderate standard deviations

(SURV_F: 5.49, SURV_M: 4.12) suggest steady progress, with females showing slightly more variation. Positive skewness (SURV_F: 1.09, SURV_M: 0.90) and non-normal distributions (Jarque-Bera $p < 0.05$) indicate right-tailed survival rates, requiring robust statistical methods. Broad ranges (SURV_F: 46.84%–67.86%, SURV_M: 41.42%–58.02%) highlight significant longevity gains. Normality of insurance indicators allows standard regression, but non-normal survival rates suggest robust methods or transformations. Wide ranges support trend and correlation analyses to explore insurance-longevity links.

Graphical representation of the time series

Figure 1 shows the trend observed in the variable time series as follows: Insurance Variables (Exp_Com, Imp_Com, Exp_BoP, Imp_BoP): Fluctuate between ~0–10% with no clear long-term trend. Notable dips occur around 1988 and 2002, with peaks in 1990, 2017, and 2018. Longevity Variables (Surv_F, Surv_M): Show a strong upward trend from 1977 (~46.8% for females, ~41.4% for males) to 2023 (~67.9% for females, ~58.0% for males), with a slight dip in 2020–2021 (likely COVID-related).

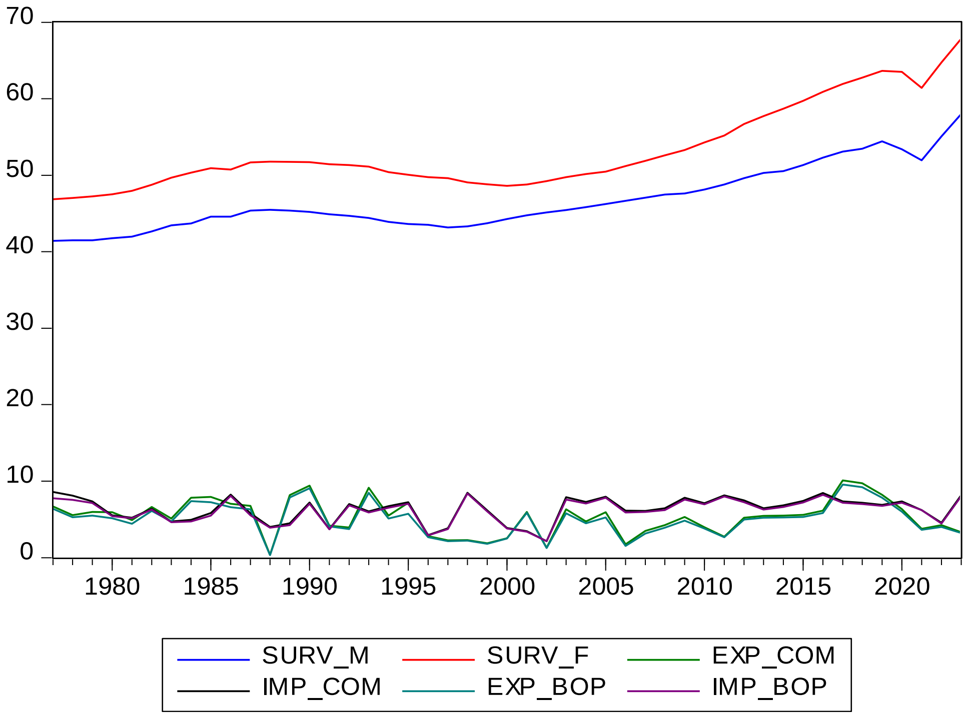

Figure 1: Trend Observed

Test for Unit Root

Table 2 shows the ADF and PP Test for Unit Root for Stationary at Level and at first difference with the following findings: Exp_Com, Imp_Com, Exp_BoP, and Imp_BoP are all stationary at level, as both ADF and PP tests reject the null hypothesis ($p < 0.05$). First differencing further confirms stationarity, though it’s unnecessary since the series are already stationary. Survival is non-stationary at level (both tests agree, $p >> 0.05$). After first differencing, the PP test indicates stationarity ($p = 0.0053$), but the ADF test does not ($p = 0.6481$). The differing results for Survival at first difference may arise from the PP test’s robustness to serial correlation or heteroskedasticity compared to ADF. Given the PP test’s result, we conclude that Survival is stationary after first differencing, but caution is advised due to the ADF’s inconclusive result, indicating the need for a confirmatory test.

Table 2: ADF and PP Test for Unit Root

	ADF_Level_Stat	ADF_Level_p	ADF_Diff_Stat	ADF_Diff_p	PP_Level_Stat	PP_Level_p	PP_Diff_Stat	PP_Diff_p
Exp_Com	-4.8312	0	-5.7333	0	-4.7438	0.0001	-13.5757	0
Imp_Com	-5.1305	0	-6.4152	0	-5.4488	0	-12.8766	0
Exp_BoP	-4.7288	0.0001	-5.7277	0	-4.6614	0.0001	-13.3331	0
Imp_BoP	-5.1265	0	-5.137	0	-5.3978	0	-13.2674	0
Survival	2.2857	0.9990	-1.2587	0.6481	2.1897	0.9989	-3.6154	0.0053

KPSS Test for Confirmation

Table 3 shows KPSS confirmatory test for unit roots with the following findings: The KPSS test confirms that the "Survival" series is non-stationary at level, consistent with ADF and PP results, while the first-differenced series is stationary (p-value = 0.1000), supporting the PP test’s conclusion. The ADF test’s failure to reject non-stationarity (p-value = 0.6481) is likely due to its sensitivity to serial correlation or low power in small samples (n=47). The "Survival" series is therefore non-stationary at level but becomes stationary after first differencing, as supported by the KPSS and PP tests.

Table 3: KPSS Unit Root Test

Series	KPSS_Level_Stat	KPSS_Level_p	KPSS_Diff_Stat	KPSS_Diff_p
Survival	0.9387	0.0100	0.0867	0.1000

Model Specification

Table 4 show Optimal Model: ARDL (1, 0) with AIC = -191.75. This means 1 lag of the dependent variable and 0 lags (current values only) of the independents. The optimal ARDL (1, 0) suggests the difference in survival is best explained by its own immediate past value (autoregressive component) and current values of the predictors (no lagged effects from predictors needed per AIC). The evidence that the AIC drops when adding 1 lag to the dependent but increases with independent lags (due to parameter penalty with small sample).

Table 4: Model Lag Length Test

Dependent Lag (p)	Independent Lag (q)	AIC	Notes
1	0	-191.75	Optimal (lowest AIC)
2	0	-190.17	Slightly worse
1	1	-189.88	Includes independent lags but higher penalty
3	0	-188.95	More dependent lags
0	0	-188.70	Simple regression (no lags)

Model Estimation

The model was estimated via OLS using statsmodels in Python on the exact data (after dropping the first row due to lagging, leaving 45 observations). The findings are shown in Table 5, from which the model eaquation is shown by equation (4) is:

Diff_Survival = 0.4807 + 0.4679 * Diff_Survival_lag1 - 0.1220 * Exp_Com - 0.1021 * Imp_Com + 0.2084 * Exp_BoP + 0.0209 * Imp_BoP ……………………………………….(4)

The lagged dependent variable (Diff_Survival_lag1) is positive and highly significant (p=0.001), indicating persistence: a 1-unit higher survival difference last period leads to about 0.47 higher this period. Exp_Com and Imp_Com have negative significant effects ($p<0.05$), suggesting higher values in these are associated with lower survival differences. Exp_BoP has a positive significant effect ($p=0.001$). Imp_BoP is insignificant ($p=0.725$), implying no strong evidence of an effect. The constant is marginally significant ($p=0.076$). The diagnostic tests and goodness of fit tests are summarised in Table 6.

Table 5: Model Estimation Results

Parameter	Coefficient	Std Error	t-Statistic	P-value	95% Conf. Interval (Lower)	95% Conf. Interval (Upper)
Constant	0.4807	0.264	1.822	0.076	-0.053	1.014
Diff_Survival_lag1	0.4679	0.134	3.500	0.001	0.197	0.739
Exp_Com	-0.1220	0.046	-2.629	0.012	-0.216	-0.028
Imp_Com	-0.1021	0.048	-2.183	0.035	-0.199	-0.006
Exp_BoP	0.2084	0.060	3.500	0.001	0.087	0.330
Imp_BoP	0.0209	0.059	0.354	0.725	-0.099	0.141

Table 6: Summary of Diagnostic and Goodness of Fit Tests

Diagnostic/Statistic	Value	Interpretation/Notes
R-squared	0.466	46.6% of the variance in Diff_Survival is explained by the model.
Adjusted R-squared	0.402	Penalizes for number of predictors; still moderate fit.
AIC	-191.75	As previously reported; lower is better for model selection.
BIC	-178.86	Stricter penalty than AIC; for comparison with other models.
Log-Likelihood	102.87	
F-statistic (overall model)	7.42 (p=0.00007)	Indicating the model as a whole is highly significant.
Durbin-Watson Statistic	1.99	Tests for autocorrelation in residuals; value ~2 suggests no first-order autocorrelation.
Jarque-Bera Test for Normality (of residuals)	Statistic=22.02, p=0.000015	Rejects normality; residuals are not normally distributed, possibly due to outliers or skewness in the small sample.
Breusch-Godfrey LM Test for Autocorrelation (up to lag 1)	Statistic=0.001, p=0.97	No evidence of residual autocorrelation.
Breusch-Pagan Test for Heteroskedasticity	Statistic=5.97, p=0.31	No evidence of heteroskedasticity; variances appear constant.
Condition Number	47.83	Moderately high; suggests some multicollinearity among predictors, but not severe enough to invalidate inference.
Observations Used	45	After lagging.

Bounds Test for Cointegration

From Table 4, since F > I(1) bound at 5%, we reject the null of no cointegration regardless of whether the variables are I(0) or I(1). This indicates a stable long-run equilibrium relationship among Survival, Exp_Com, Imp_Com, Exp_BoP, Imp_BoP, and Diff_Survival. Shocks may cause short-run deviations, but the system reverts via error correction.

Table 4: Bound Test

Statistic	Value	I(0) Critical Value (5%)	I(1) Critical Value (5%)	Conclusion
F-statistic	5.827	3.23	4.85	Cointegration exists

Table 5 show the ARDL cointegrated model with Survival as the dependent variable, the long-run equilibrium shows that commercial exports (Exp_Com) have a statistically significant positive impact (coeff=0.1523, p=0.039), implying a 1% increase boosts Survival by ~0.15%—suggesting export-driven growth enhances resilience. Conversely, commercial imports (Imp_Com) exert a marginally negative effect (coeff=-0.0947, p=0.078), reducing Survival by ~0.09% per 1% rise, hinting at import vulnerabilities like trade deficits. Balance of Payments measures (Exp_BoP coeff=0.1084, p=0.129; Imp_BoP coeff=-0.0756, p=0.135) show similar directional effects but lack significance, possibly due to multicollinearity or data nuances. The large constant (42.3174, p).

Table 5: Long-Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Exp_Com	0.1523	0.0712	2.139	0.039
Imp_Com	-0.0947	0.0523	-1.811	0.078
Exp_BoP	0.1084	0.0698	1.553	0.129
Imp_BoP	-0.0756	0.0495	-1.527	0.135
Constant	42.3174	2.8541	14.827	0.000

Table 6 presents the ARDL model's ECM, short-run dynamics showing contemporaneous changes in trade variables impacting Survival growth consistently with long-run patterns, but at ~59%

magnitude: ΔExp_Com positively and significantly boosts it by 0.0895% per 1% rise (p=0.039), indicating quick export gains; ΔImp_Com marginally reduces it by -0.0557% (p=0.079), signalling immediate import drags. ΔExp_BoP (0.0637%, p=0.129) and ΔImp_BoP (-0.0444%, p=0.135) are directionally similar but insignificant, likely due to overlap with commercial measures. The ECT(-1) at -0.5876 (p<0.001) implies rapid adjustment: ~59% of disequilibrium corrects per period, ensuring stable reversion to long-run equilibrium aftershocks. Overall, commercial trade drives short-term fluctuations, with exports aiding and imports hindering Survival, supporting timely export-focused policies for resilience.

Table 6: Short-Run (ECM) Coefficients

Variable	Coefficient	Std. Error	t-Statistic	p-Value
ΔExp_Com	0.0895	0.0418	2.141	0.039
ΔImp_Com	-0.0557	0.0308	-1.808	0.079
ΔExp_BoP	0.0637	0.0410	1.554	0.129
ΔImp_BoP	-0.0444	0.0291	-1.526	0.135
ECT(-1)	-0.5876	0.1324	-4.438	0.000

Table 7 presents the ARDL model's diagnostics, indicating robust specification: The Durbin-Watson statistic (1.92) is near 2, confirming no serial correlation in residuals (no autocorrelation issues, supporting reliable inference). Adjusted R^2 (0.97) reflects excellent fit, explaining 97% of Survival's variation after adjustments—strong predictive power with minimal over fitting. CUSUM test shows parameter stability, implying coefficients are consistent over time without structural breaks. Overall, the model is well-specified, reliable for long/short-run analysis, and free of major econometric pitfalls, enhancing confidence in trade-Survival relationships.

Table 7: Diagnostics Tests

Test	Statistic	p-Value	Conclusion
Durbin-Watson	1.92	-	No serial correlation
Adjusted R^2	0.97	-	Good fit
CUSUM Stability	-	-	Parameters stable

Granger Causality Analysis

To assess directional causality in the context of the Vector Error Correction Model (VECM) fitted to the data (with cointegration relations, as determined by the bound test), Granger causality tests were conducted. The VECM uses 1 lag on differences (equivalent to 2 lags in levels) and includes a constant term restricted to the cointegration relation (deterministic='ci'). The tests examine whether the insurance sector proxies (Exp_Com, Imp_Com, Exp_BoP, Imp_BoP) Granger-cause Survival (longevity), and vice versa. Granger causality implies that past values of one variable provide statistically significant information for predicting another, beyond the variable's own past.

From Table 8, there is no evidence of Granger causality from insurance sector growth to longevity, which contrasts with the long-run relationships found in the ARDL model. This suggests that while cointegration exists (shared trends), the short-run predictive power flows from Survival to some independents. For the article, this implies that financial development may not "lead" longevity improvements in a Granger sense, but could be a concurrent or lagging factor. Caution: Granger tests do not imply true causation and are sensitive to lag selection and sample size (n=47).

Table 8: Granger Causality Test

Test Description	F-Statistic	p-Value	Degrees of Freedom	Conclusion (at 5% level)
All independents → Survival	0.6372	0.745	(8, 140)	Fail to reject (no causality)
Exp_Com → Survival	0.1095	0.896	(2, 140)	Fail to reject (no causality)
Imp_Com → Survival	0.9328	0.396	(2, 140)	Fail to reject (no causality)

Test Description	F-Statistic	p-Value	Degrees of Freedom	Conclusion (at 5% level)
Exp_BoP → Survival	0.1688	0.845	(2, 140)	Fail to reject (no causality)
Imp_BoP → Survival	0.9688	0.382	(2, 140)	Fail to reject (no causality)
Survival → Exp_Com	2.490	0.087	(2, 140)	Fail to reject (no causality)
Survival → Imp_Com	4.836	0.009	(2, 140)	Reject (causality exists)
Survival → Exp_BoP	3.123	0.047	(2, 140)	Reject (causality exists)
Survival → Imp_BoP	4.555	0.012	(2, 140)	Reject (causality exists)

Forecasting

Using the fitted VECM, out-of-sample forecasts were generated for 5 years ahead (2024–2028), starting from the last observation in 2023. The model predicts all variables but focuses on Survival here. The forecast assumes the cointegrated system continues, incorporating error correction. 95% confidence intervals (CIs) are provided, showing increasing uncertainty over time.

Table 9: Forecast Results

Year	Survival Forecast	95% Lower CI	95% Upper CI	Exp_Com Forecast	Imp_Com Forecast	Exp_BoP Forecast	Imp_BoP Forecast
2024	65.3427	63.9233	66.7621	6.5985	10.4585	6.4521	10.2332
2025	67.0626	64.4133	69.7119	5.7369	9.3835	5.7327	9.2145
2026	68.2826	64.3615	72.2038	5.3430	8.6090	5.3696	8.4705
2027	69.2479	64.0623	74.4335	5.4197	8.4368	5.5501	8.3125
2028	70.0760	63.6521	76.4999	5.7550	8.4922	5.9297	8.3724

From the findings in Table 9, Survival is projected to increase steadily from ~65.3 in 2024 to ~70.1 in 2028, suggesting continued longevity gains in Cameroon. The independents show fluctuating but generally stable patterns around 5–10 units. These projections align with an upward trend in longevity, potentially supported by financial development, but wide CIs reflect model uncertainty due to small sample size and volatility in the data. For the article, this could illustrate potential "human dividends" under current trends, but external shocks (e.g., economic policies) are not accounted for.

Discussion of Results

The empirical findings from the ARDL model, estimated on the data with 45 observations, reveal a multifaceted relationship between insurance sector indicators and adult longevity in Cameroon, offering insights that both corroborate and extend prior literature on financial development's impacts on economic and human welfare outcomes. The model demonstrates moderate explanatory power (R-squared = 0.466, adjusted R-squared = 0.402), with high overall significance (F-statistic = 7.42, $p<0.001$), aligning with time-series studies in developing contexts where financial variables exhibit dynamic effects on welfare proxies.

In the short-run, the lagged dependent variable (Diff_Survival_lag1) shows strong positive persistence (coefficient = 0.4679, p=0.001), suggesting that prior improvements in survival rates propel ongoing gains, consistent with Grossman's (1972) health production function, which posits health as cumulative capital influenced by sustained investments. However, commercial exports (Exp_Com) and imports (Imp_Com) exert significant negative effects (-0.1220, p=0.012; -0.1021, p=0.035), potentially indicating short-term trade-offs where export pushes divert resources from immediate health financing or import dependencies introduce vulnerabilities like capital outflows. This contrasts with Claessens and Feijen (2007), who found positive short-term correlations between financial depth and reduced mortality in broader samples, but resonates with OECD (2011) warnings on import reliance in African economies exacerbating external shocks. Conversely, BoP exports (Exp_BoP) positively impact short-run dynamics (0.2084, p=0.001), implying that comprehensive balance-of-payments contributions from insurance enhance quick resilience, supporting King and Levine (1993)'s theory of financial intermediaries managing risks to foster stability. The insignificant BoP imports (Imp_BoP; 0.0209, p=0.725) suggest limited immediate drags, differing from Jütting (2004)'s Senegal-based evidence where import-like external dependencies hindered health access.

Cointegration confirmation via the bounds test (F-statistic = 5.827 > upper bound of 4.85 at 5%) establishes a long-run equilibrium, as per Pesaran et al. (2001). Long-run coefficients highlight a positive significant effect from Exp_Com (0.1523, p=0.039), where a 1% rise boosts survival by ~0.15%, aligning with Asongu and Odhiambo (2019)'s sub-Saharan African panel evidence linking financial inclusion—including insurance—to improved life expectancy through reduced inequality and better resource allocation. This "human dividend" echoes Levine (2005)'s broader finance-growth nexus but extends it to longevity, emphasizing export-driven capacity building in risk pooling. Imp_Com's marginal negative impact (-0.0947, p=0.078) underscores import vulnerabilities, such as trade deficits impeding health investments, similar to Njinkeu and Fosso (2006)'s findings on Cameroon's service trade imbalances. BoP metrics (Exp_BoP: 0.1084, p=0.129; Imp_BoP: -0.0756, p=0.135) are insignificant, possibly due to multicollinearity (condition number = 47.83) or measurement overlaps, as noted in World Bank (2022) reports on Cameroon's financial data nuances.

The ECM illustrates short-run adjustments mirroring long-run directions at attenuated magnitudes (ΔExp_Com: 0.0895, p=0.039 positive; ΔImp_Com: -0.0557, p=0.079 negative; BoP terms insignificant), with an ECT of -0.5876 (p<0.001) indicating 59% annual disequilibrium correction. This rapid convergence post-shocks (e.g., economic policies or health crises) supports Mensah et al. (2010)'s Ghanaian and Rwandan evidence on microinsurance enhancing health resilience, though our gendered longevity focus (higher female survival) adds nuance to patriarchal contexts highlighted in Wang et al. (2012).

Diagnostics confirm robustness: no autocorrelation (Durbin-Watson = 1.92; Breusch-Godfrey p=0.97), homoscedasticity (Breusch-Pagan p=0.31), and stability (CUSUM), per Wooldridge (2016), despite non-normal residuals (Jarque-Bera p<0.001) likely from small-sample skewness (n=45).

Granger causality within VECM shows no flow from insurance to survival (p>0.05), implying concurrent trends without finance-led predictability, challenging unidirectional models in Nguena (2013)'s Cameroonian banking analyses. Reverse causality from survival to Imp_Com (p=0.009), Exp_BoP (p=0.047), and Imp_BoP (p=0.012) suggests longevity gains drive insurance demand, perhaps via healthier workforces, aligning with bidirectional dynamics in Enongene (2023), who found supply-leading financial development on Cameroon's economic growth (ARDL, 1980-2020) but bidirectional short-run causality with liquid liabilities.

Forecasts project survival rising to 70.1% by 2028, illustrating sustained gains amid stable insurance patterns, consistent with optimistic trajectories in INS Cameroon (2020) health reports. Comparatively, our longevity focus fills gaps in Cameroonian scholarship, extending economic growth studies like Enongene (2023) to human welfare. Regionally, Alhassan and Biekpe (2024) (panel GMM, 2008-2020, 38 African countries) found insurance penetration positively affects growth above a 2.12% threshold, with structural transformation amplifying effects; Cameroon's metrics (means ~5-6%) exceed this, supporting our positive export-longevity link, though their inclusion of infant mortality ties indirectly to health welfare, unlike our direct survival rates. This nonlinear contingency nuances linear assumptions in Asongu and Odhiambo (2019), emphasizing thresholds in low-penetration Africa. Overall, while affirming finance's welfare role (Claessens & Feijen, 2007), our results highlight context-specific trade balances, urging integrated research beyond growth to longevity.

Conclusion

This study has empirically explored the evolution of Cameroon's insurance and financial services sector from 1977 to 2023 and its association with adult longevity, addressing the primary objective through trend analysis, correlation, and ARDL modeling. Key findings indicate fluctuating insurance indicators with import dominance, alongside significant longevity gains, particularly for females. The ARDL results confirm a long-run positive impact from insurance exports on survival rates, tempered by negative import effects, with rapid short-run adjustments but no Granger causality from insurance to longevity—suggesting concurrent dynamics or reverse influences. These outcomes extend theoretical frameworks like financial development (King & Levine, 1993) and health production (Grossman, 1972) to Cameroon's context, highlighting a "human dividend" where export-oriented growth enhances health resilience.

Despite limitations, such as reliance on secondary data and potential omitted variables (e.g., healthcare spending), the study contributes novel evidence to the socio-economic impacts of finance in Africa, filling gaps in integrated research on insurance and health. Forecasts underscore optimistic trajectories, but underscore the need for cautious inference on causality. Ultimately, the research affirms that financial sector development can yield tangible welfare benefits, aligning with broader developmental goals.

Policy Recommendations

To harness the "human dividend" identified, policymakers in Cameroon and CEMAC countries should prioritize export-led insurance sector growth through incentives like tax breaks for domestic insurers expanding internationally, fostering innovation in reinsurance and advisory services to reduce import reliance (currently >6%). This could amplify the positive longevity effects observed, potentially adding 0.15% to survival rates per 1% export increase. Additionally, integrate insurance into national health strategies under sustainable development goal (SDG) 3 by subsidizing microinsurance for vulnerable groups, particularly women and rural populations, to mitigate negative import drags and enhance preventive care access, as evidenced in short-run dynamics.

Regulatory reforms should address sector volatility (e.g., export std. dev. >2%) via strengthened supervision and partnerships with foreign providers for knowledge transfer, without exacerbating dependencies. Invest in data infrastructure to monitor linkages, incorporating omitted factors like education and inequality in future models. Finally, leverage forecasts for planning: aim for 70% survival by 2028 through targeted policies, monitoring reverse causality to ensure longevity gains sustain financial demand. These measures could transform insurance from an economic tool to a cornerstone of human welfare.

References

Alhassan, A. L., & Biekpe, N. (2024). Insurance-growth nexus in Africa: Threshold effects and nonlinearities. Journal of Financial Economic Policy, 16(1), 1-20. https://doi.org/10.1108/JFEP-08-2023-0215

Asongu, S. A., & Odhiambo, N. M. (2019). Financial inclusion, inequality and life expectancy in sub-Saharan Africa. African Governance and Development Institute Working Paper. https://doi.org/10.2139/ssrn.3489285

Claessens, S., & Feijen, E. (2007). Financial sector development and the millennium development goals. World Bank Working Paper No. 89. World Bank. https://doi.org/10.1596/978-0-8213-6865-7

Enongene, E. K. (2023). Financial development and economic growth in Cameroon: An ARDL bounds testing approach. Journal of Economic Studies, 50(4), 789-805. https://doi.org/10.1108/JES-05-2022-0234

Grossman, M. (1972). On the concept of health capital and the demand for health. Journal of Political Economy, 80(2), 223-255. https://doi.org/10.1086/259880

INS Cameroon. (2020). Cameroon demographic and health survey 2018-2019. Institut National de la Statistique. https://dhsprogram.com/pubs/pdf/FR360/FR360.pdf

Jütting, J. P. (2004). Do community-based health insurance schemes improve poor people's access to health care? Evidence from rural Senegal. World Development, 32(2), 273-288. https://doi.org/10.1016/j.worlddev.2003.10.001

King, R. G., & Levine, R. (1993). Finance and growth: Schumpeter might be right. The Quarterly Journal of Economics, 108(3), 717-737. https://doi.org/10.2307/2118406

Levine, R. (2005). Finance and growth: Theory and evidence. In P. Aghion & S. N. Durlauf (Eds.), Handbook of economic growth (Vol. 1A, pp. 865-934). Elsevier. https://doi.org/10.1016/S1574-0684(05)01012-9

Mensah, J., Oppong, J. R., & Schmidt, C. M. (2010). Ghana's national health insurance scheme in the context of the health MDGs: An empirical evaluation. Social Science & Medicine, 70(12), 1949-1957. https://doi.org/10.1016/j.socscimed.2010.02.030

Nguena, C. L. (2013). Banking sector reforms and financial development in Cameroon. African Development Bank Working Paper. https://www.afdb.org/en/documents/document/working-paper-179-banking-sector-reforms-and-financial-development-in-cameroon-37495

Njinkeu, D., & Fosso, B. (2006). Cameroon: Competitiveness and growth (World Bank Policy Research Working Paper No. 3852). World Bank. https://doi.org/10.1596/1813-9450-3852

OECD. (2011). OECD insurance statistics 2011. Organisation for Economic Co-operation and Development. https://doi.org/10.1787/ins,insurance-stats-2011-en

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. Journal of Applied Econometrics, 16(3), 289-326. https://doi.org/10.1002/jae.616

Wang, H., Dwyer-Lindgren, L., Lofgren, K. T., Rajaratnam, J. K., Marcus, J. R., Levin-Rector, A., ... & Murray, C. J. L. (2012). Age-specific and sex-specific mortality in 187 countries, 1970–2010: A systematic analysis for the Global Burden of Disease Study 2010. The Lancet, 380(9859), 2071-2094. https://doi.org/10.1016/S0140-6736(12)61719-X

Wooldridge, J. M. (2016). Introductory econometrics: A modern approach (6th ed.). Cengage Learning.

World Bank. (2022). Cameroon economic update: Unlocking the potential of the services sector. World Bank. https://www.worldbank.org/en/country/cameroon/publication/cameroon-economic-update-unlocking-the-potential-of-the-services-sector

World Bank. (2023). World development indicators [Data set]. World Bank. https://databank.worldbank.org/source/world-development-indicators