PER CAPITA INCOME AND HEALTH OUTCOME CONVERGENCE IN THE ECONOMIC COMMUNITY OF WEST AFRICAN STATES

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ABSTRACT

Whether trade policy agreements within Africa lead to income and also health outcome convergence is unknown. The role of governance quality in this regard is also not commonly explored. Using data from the Economic Community of West African States (ECOWAS), this study provides empirical evidence to find out whether countries within the ECOWAS trade bloc exhibit convergence in per capita income and health with focus on the role of governance quality. Data were obtained from the World Development Indicators and World Governance Indicators provided by the World Bank. Estimates are presented using the Generalized Method of Moments and the Pooled Least Squares. The results showed existence of β-convergence in per capita income and health with faster rates in income relative to health. There were also indications of σ-convergence in health outcome except for life expectancy. σ-convergence results however, showed divergence in per capita income. The results suggest strong influence of governance quality in attaining convergence not only for per capita income but also health outcome. Findings for convergence, strongly suggest that economic policy agreements in developing economies such as those of the ECOWAS engender sustainable development in income and health. Policy focus on improving economic performance in Africa should pursue actions that encourage trade bloc operations within the region. Efforts should also be targeted at improving the quality of governance.

JEL classification: H118, H118, O47, R11, R58

1. Introduction

Theoretical underpinnings of the neoclassical growth model predict an inverse relationship between initial per capita income and subsequent growth in income as a country transits to its long-run steady state (Solow, 1956; Marques and Soukiazis 1998; Hoyo, Dorrucci, Ferdinand, & Muzikarova, 2017). With diminishing returns to capital as it rises with output, countries with higher initial per capita income would grow quite slowly compared to countries with lower initial per capita income so that in the long run countries will converge to identical income level (Aboagye and Turkson 2014).

There are indications that an open border policy enhances the process of convergence across countries (Aboagye and Turkson 2014). This follows from the free flow of technology and other production techniques that influence the rate of economic outcomes. In developed economies, the operation of open border policy is shown to have strong influence on income convergence particularly in the European Union (EU) (Marques and Soukiazis 1998; Rivas and Villarroya 2017; Schönfelder and Wagner, 2019). Studies in this regard for developing countries are quite limited. The results from the few existing ones only show the effect of trade liberalization inducing faster rates of income convergence in Asia and Latin America and divergence in Africa, except where trade is with high-income countries (Parikh and Shibata, 2004; Baafi, 2018). Studies on the influence of trade bloc operations on convergence are also scarce for sub-Saharan Africa (SSA) where there are existing trade policy agreements, such as those of the Economic Community of West African States (ECOWAS) (Wolassa, 2011; Aboagye and Turkson 2014).

The ECOWAS treaty came into existence in 1975 with the aim to integrate markets of members through the free movement of goods, capital and labour. With this policy agreement, member countries could advance harmoniously as one region to attain sustained economic growth and development (ECOWAS, 2004). One of the key features of the ECOWAS policy is the trade liberalization programme. This policy was meant to progressively establish a customs union among member states that would bring about the total elimination of customs duties and taxes of equivalent effect (ECOWAS, 2004). Whether economic activities under ECOWAS actually boost technology flows and consequently promote convergence in real income or induce divergence by encouraging investment for stronger economies and a fall in investment for countries with

poor capita endowment is still unknown (Parikh and Shibata, 2004).

On a general note, studies examining the convergence hypothesis in the literature mainly provide findings in relation to per capita income and health spending and neglect other areas of interest such as health status (Zhang, 2001; Hitiris and Nixon 2001; Basil, 2002; Parikh and Shibata 2004; Ghosh, 2007; Latif 2010; Te Velde, 2011; Lau and Fung 2013; Aboagye and Turkson 2014; Odhiambo, Wambugu, & Kiriti-Ng'ang'a, 2015; Nghiem and Connelly 2017; Zezza, 2019). Neither has much attention been given to the role of governance in attaining convergence. However, relating the convergence ideology to health indices is of interest given the key role of health in determining income levels. The argument in this case is that better health outcomes, such as higher life expectancy and less infant deaths, are observed in rich countries relative to poor and hence as countries grow in income values the disappearance of the income gap will likely reflect in the disappearance of differences in health status (Deaton, 2006). The indication therefore is that policies that promote economic convergence further the process of economic growth and improvement in health, alongside other variables that reflect the level of development. Arguments for considering the role of governance as a driver for convergence follow from its key function in determining economic and social economic conditions (Kaufmann, Kraay, & Mastruzzi, 2009; Reidpath and Allotey, 2006; Beecroft et al., 2020). Findings in the literature provide unanimous support for the key role of governance quality on income growth and also health status (Olafsdottir, Reidpath, Pokhrel, & Allotey, 2011; Hu and Mendoza; 2013; Ahmad and Hasan, 2016; Kraipornsak, 2018; Tharanga, 2018, Osakede, 2020). The quality of governance influences decision making in several key areas that are fundamental to economic and social economic activities. For instance, decisions regarding the volume and type of investment, organizational operations, human rights and labour returns in the public and even the private sector are in some ways related to the quality of governance in an economy (Kaufmann, Kraay, & Mastruzzi, 2011).

In line with the identified gaps in the literature, this study focuses on examining whether ECOWAS countries exhibit convergence not only in per capita income but also health outcome. Findings are also extended to account for the role of governance in this regard. Thus, this study contributes to the literature in three ways: First, it provides findings for the test of the convergence

hypothesis in ECOWAS for which studies are yet to explore. Second, it gives consideration to convergence in health outcome which has, over time, received less attention and third is that it controls for the role of governance in reaching convergence.

2. Literature Review

2.1 Conceptual framework of the Convergence Hypothesis

Four main groupings of the convergence hypothesis are shown in economic literature. (Weddige-Haaf and Kool, 2017). One of such is the beta (β) convergence. The β-convergence is obtained by estimating the growth of per capita income over a certain period of time on the initial level of per capita income usually captured using the one period time lag. The regression coefficient of β with a negative sign indicates that regions with lower initial level of per capita income grow more rapidly than regions with higher initial level of per capita income (Barro, 1984; Boyle and McCarthy, 1997; Marques and Soukiazis, 1998; Narayan, 2007; Hoyo et al., 2017; Schönfelder and Wagner, 2019). Two types of β-convergence are recognized in the literature. These are unconditional (absolute) and conditional convergence. The underlying assumption of an absolute β-convergence is that all countries converge to the same steady state point. This is because it is presumed that economies do not differ significantly in their levels of technology, savings rate, population growth, industrial structure, human capital and other structural factors. In this context, it is more likely to find unconditional convergence when the model is tested for cross sections of regions which are more homogeneous. Hence for absolute β-convergence, the parameter for β is obtained without considering a set of control variables in the estimation (Marques and Soukiazis, 1998; Barro and Sala-i-Martin, 2004; Weddige-Haaf and Kool, 2017). On the other hand, when economies have different structures then each unit will converge to a different steady state point. In this case, convergence is said to be conditional and β is obtained by considering in the estimation a set of conditioning structural factors which are supposed to influence the growth rate of per capita income. Given that the speed of convergence depends on the distance of an economy from its own steady state, it is likely that poorer economies will grow slower than rich ones if they are closer to their own steady state (Weddige-Haaf and Kool, 2017).

There is also an alternative concept of measuring convergence known as the

sigma approach (Baumol, 1986; Barro and Sala-i-Martin, 1992). The convergence measures the dispersion of real per capita income between economies in a region based on either the standard deviation or the coefficient of variation of the cross-section series. A fall in the standard deviation or the coefficient of variation shows that the differences in per capita income between entities in a region decrease with the passage of time, which is an indication of convergence (Marques and Soukiazis, 1998; Hitiris and Nixon, 2001; Wolassa, 2011). Where the standard deviation or the coefficient of variation of the series in terms of per capita income increases over time then divergence exists. In the case where the standard deviation or the coefficient of variation increases or decreases alternatively, a mixed process of convergence and divergence is taking place (Marques and Soukiazis, 1998; Hitiris and Nixon, 2001; Wolassa, 2011). The existence of σ-convergence can also be examined by regressing time as a variable on the coefficient of variation or the standard deviation of income across countries. If the parameter of the time variable is negative and statistically significant, σ-convergence exists, whereas a positive parameter value suggests divergence (Matkowski, Próchniak and Rapacki, 2016). It is shown that the existence of β-convergence does not necessarily imply that countries will display convergence (Johnson and Papageorgiou, 2018).

Another consideration for examining the existence of convergence is the stochastic convergence approach (Benard and Durlauf, 1995; Carrion-i-Silvestre and German-Soto, 2009; Prochniak and Witkowski, 2015; Chapsa, Athanasenas, & Tabakis, 2018; Pan and Maslyuk-Escobedo, 2019). In this case, the conclusion for existence of convergence follows from the stationarity of per capita income. When per capita income is stationary in one country relative to that of a reference country, convergence is said to occur. This is because the stationarity of income leads to a steady state in income level (Carrion-i-Silvestre, 2005; Jewell, Lee, Tieslau, & Strazicich, 2003). Another concept that has gained prominence over time is the club convergence (Dowrick and Delong, 2003; Johnson and Papageorgiou, 2018; Beylunioğlu, Yazgan, & Stengos, 2020). In this case, convergence occurs in a multiple steady state. This is because it is conditional on differences in income, productivity, or living standards for a group of countries. That is, convergence occurs for countries with similar income groupings so that high-income countries are likely to experience high spending and vice versa. Ben-David (1994) identified two forms of club convergence which are the upward and downward convergence clubs. The

upward convergence club consists of high-income countries where the members catch up with the richer ones. The downward convergence club comprises extremely poor countries. This form of convergence reduces disparities between high- and low-income countries (Ben-David, 1994).

2.2 Empirical evidence

In examining the convergence hypothesis, empirical findings are commonly provided using the β or σ approach. Weddige-Haaf and Kool (2017) for instance examined β-convergence of per capita income in a panel of sixteen states in Germany with the results showing existence of convergence and strong influence of internal migration in reaching this conclusion. A more recent study by Johnson and Papageorgiou (2018) also made use of the absolute β-convergence approach to determine if there is any evidence of per capita income closure gap for developing economies. Findings showed that developing economies do not experience income convergence. Similar results were earlier obtained by Wolassa (2011) showing evidence of no β or σ convergence in income among the Southern African Development Community (SADC). Findings by Aboagye and Turkson (2014) also suggest existence of income divergence in SSA with the level of divergence increasing even with the inclusion of control variables such as foreign direct investment (FDI), trade openness and government spending. Findings for income convergence in Africa, strengthen arguments that African economies are less likely to experience convergence than developed economies. This is commonly attributed to the weak financial environment that characterizes these economies with the consequential effects of hindering deeper economic integration (Wolassa, 2011). Existing differences in macroeconomic indicators such as exchange rate, debt-to-GDP ratio, and monetary growth also explain this possibility (Wolassa, 2011).

For developed economies, lower regional disparities are observed due to deeper economic integration, such as monetary integration and a common currency use, particularly in the United States and the European Union (EU). Literature findings testing the convergence hypothesis in developed economies abound in the literature with results extended beyond income convergence to the health sector. Findings for developed economies commonly show that these economies experience income convergence, however, findings for convergence in health vary (Marques and Soukiazis, 1998; Rivas and Villarroya, 2017). In

examining convergence in health, Nixon (2000) made use of the σ and β approach, with evidence showing that European countries experience convergence in health outcome specifically in life expectancy and infant mortality rates. Findings by Hitiris and Nixon (2001) also showed evidence of conditional and absolute convergence of per capita health spending in EU countries. Zezza (2019) showed similar evidence of convergence in health, specifically for health care spending of counties in New York. In the EU, results provided by Lau and Fung (2013) showed the reverse with evidence of divergence of health care expenditure per capita. The result in this case is provided using the panel unit root test which is sometimes applied in examining existence of convergence. The unit root test procedure for convergence was introduced and applied by Narayan (2007) for examining convergence of health spending in the EU. Findings by Narayan (2007) showed that univariate and panel tests without incorporating structural breaks had no evidence of convergence while univariate and panel LM tests with use of structural breaks showed strong evidence of convergence of per capita health expenditures. Findings provided by Nghiem and Connelly (2017) also revealed no evidence of convergence in health expenditures of countries in the Organization for Economic Corporation and Development (OECD). Evidence provided by Noy and Sprague-Jones (2016) for convergence in OECD countries however, showed mixed processes of convergence and divergence. Besides findings in Europe, Kumar (2015) provides findings for South Asian countries with evidence of no convergence in health outcome.

In Africa, Odhiambo et al. (2015) showed that there is absolute and conditional convergence of health expenditure in SSA. Literature findings for income convergence in SSA are uncommon and results in this regard for health outcome are also rare. There are established positions that governance is a key determinant of health conditions in any country via policies governing the organization and use of health care delivery (Olafsdottir et al., 2011; Farag et al., 2012; Hu and Mendoza, 2013; Farag et al., 2013; Ahmad and Hasan, 2016; Zezza, 2019, Osakede, 2020). The indication therefore is that countries with similar governance quality will commonly experience convergence in health conditions. Good governance quality is also shown to facilitate growth and enhancement in the economic performance of a country (Hoyo et al., 2017). Taking governance quality into account in reaching convergence is vital, yet not many studies have considered this variable in investigating the convergence

hypothesis. The scarcity of findings for convergence in income and health indices particularly in Africa creates the need for examining this hypothesis in the region. The interest in what obtains in this regard for ECOWAS is also motivating as it provides a basis for comparison of results with what was found for developed economies like the EU.

3. Methodology

3.1 Model specification

This study examined the convergence hypothesis using the β and σ convergence approaches. These measures are commonly used in economic literature hence use of these approaches gives room for comparison of findings. We examine β-convergence using both the absolute and conditional convergence tests. The absolute convergence hypothesis provides results with only the outcome variable and its one period lag. Using a log-linearized version of the neoclassical growth model, the model for absolute β-convergence is specified as:

$$\log(Y_t/Y_{t-\tau}) = \alpha + \beta(logY_{t-\tau}) + \mu_t \quad (1)$$

where , $\tau > 0$, α and β are parameter estimates and μ is the error term. A test of the hypothesis $\beta = 0$ against the alternative $\beta < 0$ is then construed as a test for convergence. If parameter β is negative and statistically significant, then β-convergence exists. Specification of equation (1) taking cognizance of cross sections and time trend for a panel study is stated as:

$$\log(Y_{it}/Y_{it-1}) = \alpha + \beta(logY_{it-1}) + \mu_{it} \quad (2)$$

where, $Y_{i,t}$ is real gross domestic product (GDP) and $Y_{i,t-1}$ is its lagged or otherwise initial value. Similarly, the specification for absolute convergence in health outcome can be stated as:

$$\log(H^j_{it}/H^j_{it-1}) = \alpha + \beta(logH^j_{it-1}) + \mu_{it} \quad (3)$$

where: $H^j_{i,t}$ is health outcome *j* for country *i* in yea$H^j_{i,t-1}$ is its lagged specification also capturing its initial level. Three health outcome variables are considered in this study; infant mortality per 1,000 live births, maternal mortality

ratio and life expectancy at birth. Following Barro (1991) and Mankiw, Romer, and Weil (1992), equation (3) is augmented with conditioning variables that determine the steady state value of income per capita. These variables are similar to those used by Aboagye and Turkson (2014) and Wolassa, (2011). The empirical model for conditional β-convergence for income is stated as:

$$\log(Y_{it}/Y_{it-1}) = \alpha + \beta(logY_{it-1}) + \delta Open_{it} + Gov'_{it}\theta + \mu_{it} \quad (4)$$

Model specification for conditional convergence of health outcome is also given as:

$$\log\left(\frac{H^j_{it}}{H^j_{it-1}}\right) = \alpha + \beta(\log H^j_{it-1}) + \delta Open_{it} + Gov'_{it}\theta + \mu_{it} \quad (5)$$

In equations (4) and (5) $Open_{it}$ is trade openness and Gov_{it} is a matrix of governance indicators. Six governance indicators are used in this study; voice and accountability, political stability, government effectiveness, regulatory quality, rule of law and the control of corruption. In equation (4), we expect $\beta < 0$ where there is convergence in per capita income and $\beta > 0$ if there is divergence. Similar results are expected in equation (5) for the health model. We expect $\delta > 0$ in equation (4). In equation (5), we expect $\delta > 0$ for life expectancy and $\delta < 0$ for infant and maternal mortality. This is because more open economies have better inflow of new technology, innovation and production techniques translating to income growth and improved health conditions. The expected sign of parameter values for governance indicators cannot be explicitly stated. The sign will depend on whether there are improvements in a given indicator.

Three linear models were fitted separately for examining β-convergence in per capita income and health outcome. The first model measured the strength of the association between the dependent variable and its one period lag without considering other covariates. The second model determined the extent of adjustment in the coefficient for convergence after including openness as a covariate in the absence of the measures of governance to examine any differences in the result. The third model measured the strength of the association between the dependent variables and governance still with openness

as a predictor.

Following Matkowski et al. (2016), we verify the existence of σ-convergence by estimating the trend line of dispersion in income levels between countries. The specification is given as:

$$sd(\ln Y_{it}) = \alpha_0 + \alpha_1 t + \in_{it} \quad (6)$$

The dependent variable is the standard deviation of log GDP per capita between the economies, the explanatory variable is time *t* from the period 1996 to 2017. $\in$ is the error term. If parameter α_0 is negative and statistically significant, convergence exists. Otherwise, a positive parameter value for α_1 suggests a case of divergence. Similarly, the existence of a σ-convergence for health outcome is examined using the equation:

$$sd(\ln H_{it}^{j}) = \alpha_0 + \alpha_1 t + \in_{it} \quad (7)$$

The dependent variable in this case is the standard deviation of health outcome *j*, *t* and $\in$ are as previously defined. The interpretation for σ-convergence is the same as for previous equations.

3.2 Technique of estimation

The model for β-convergence is estimated using the generalized method of moments (GMM) to account for the inherent autocorrelation that exists in a dynamic panel model. The approach also provides consistent results with the existence of endogeneity in the model by internal transformation of the data (Wintoki, Linck, & Netter, 2012; Ullah, Akhtar, & Zaefarian, 2018). This transformation is done by subtracting a variable's past value from its present value (Roodman, 2009). This statistical process reduces the number of observations and enhances the efficiency of the GMM model (Wooldridge, 2012). The GMM estimates can be derived using the one-step (first difference) or two-step (second difference) transformation. The one-step GMM can result in the loss of too many observations if a variable's recent value is missing (Roodman, 2009). In order to circumvent this problem, Arellano and Bover (1995) recommended the use of the two-step GMM. The two-step GMM subtracts the average of all future available observations of a particular variable instead of subtracting the previous observation of a variable from its current

value (Roodman, 2009). Hence a two-step GMM model provides more efficient and consistent estimates (Arellano and Bover, 1995). The GMM model, whether for one or two steps, can be done using the difference GMM (DGMM) by Arellano and Bond (1991) or the system GMM (SGMM) by Blundell and Bond (1998). Oftentimes, the Arellano and Bond technique for dynamic panel data models is used particularly when the number of cross sectional units is small with long time periods. This approach differences the dynamic model to get rid of any time invariant regressor but requires rejection of the null hypothesis for first order autocorrelation (AR1) and non-rejection of the null hypothesis for second order autocorrelation (AR2) arising from using lagged values of the dependent variable. In cases where there is no rejection of the null hypothesis for AR2, the SGMM is more appropriate. The DGMM excludes equations at levels in the statistical process using lagged values of the dependent variable as instruments for equations in first difference only. On the other hand, the SGMM allows use of lagged differences of the dependent variable as instruments for equations at levels in addition to using lagged levels of the dependent variable as instruments for equations in first differences (Baltagi, 2008). In either case, the Hansen and Sargan statistics are commonly used to test the validity of the choice of instruments. The choice of relying on Hansen's J or Sargan test of exogeneity of instruments depends on whether heteroscedasticity or autocorrelation is suspected in the errors. Under the assumption of homoscedasticity, the Sargan's test statistic is considered a special case of Hansen's J and hence for robust GMM, the Sargan test statistic is inconsistent (Roodman, 2009). In the GMM estimation, lagged values of the dependent variable are used as instruments to control for endogeneity (Roodman, 2009). We made use of the two-step GMM, given that it provides better efficient estimates.

The models for convergence were examined using pooled ordinary least squares (OLS). This technique is simply a linear regression procedure for panel data using the OLS estimation technique. Pooled analysis combines time series for several cross-sections. That is, it combines cross-sectional data on N spatial units and T time periods to produce a data set of N ×T observations. When the cross-section units are more in number than the temporal or otherwise time units (N>T), the pool is conceptualized as "cross-sectional dominant". Likewise, when the temporal units are more than the cross sectional units (T>N), the pool is called "temporal dominant" (Stimson, 1985; Podestà, 2002). One major

advantage of using the pooled OLS analysis is that it captures not only the variation of occurrence through time or cross sections, but the variation of these two dimensions simultaneously. This is because, instead of testing a cross-section model for all countries at one point in time or testing a time series model for one country using time series data, a pooled model is tested for all countries through time (Pennings, Keman, & Kleinnijenhuis, 1999; Podestà, 2002). Although the pooled technique often violates the standard OLS assumptions about the error process basically for autocorrelation and heteroskedasticity issues, this is not a concern in this study because the technique was simply used to estimate the trend line of dispersion in income levels between countries.

3.3 Data sources and measurement

Data for the study were obtained from the World Development Indicators and World Governance Indicators provided by the World Bank (2018). The study covered 15 countries that make up ECOWAS for the period 1996 to 2017. The choice of selected time period is based on availability of data, particularly for the governance indicators. The ECOWAS member countries are: Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. The description, source and measurement of the variables used in the study are shown in table 1.

Table 1. Variable Description, Source and Measurement

S/N	Variable	Description	Source	Measurement
1.	*Y*	Real gross domestic product per capita	WDI	Purchasing Power Parity (PPP) at constant 2011 international $
2.	*H*	Health outcome	WDI	
	Life expectancy	Life expectancy at birth, total		Years
	Maternal mortality	Maternal mortality ratio		Modelled estimate, per 100,000 live births
	Infant Mortality	Mortality rate, infant		Per 1,000 live births
3.	*Open*	Openness	WDI	Ratio of the sum of imports and exports to GDP at PPP and at constant 2011 international $

S/N	Variable	Description	Source	Measurement
4.	*Gov*	Governance Indicators	WGI	Governance estimates for an indicator range from approximately -2.5 (weak) to 2.5 (strong) governance performance)
	Rule of law [e]	Perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence		
	Regulatory Quality [c]	Perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development		
	Voice and Accountability [a]	Perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.		
	Control of Corruption [f]	Perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by the elite and private interests		
	Political Stability [b]	Perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism		
	Government Effectiveness [d]	Perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures; the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.		

Source: Authors' computation.

Note: Description of governance indicators were extracted from Kaufmann et al. (2011). [a] and [b] represent the process by which governments are selected, monitored, and replaced; [c] and [d] represent the capacity of the government to effectively formulate and implement sound policies; and [e] and [f] represent the respect of citizens and the state for the institutions that govern economic and social interactions among them.

4. Results and Discussion of Findings

The findings of the study are presented, beginning with the descriptive statistics of variables. The results for the descriptive statistics of the variables used are shown in table 2.

Table 2. Descriptive Statistics

Variable	Mean	SD	Min	Max
GDP Per Capita	1,998.99	1,245.19	262.53	6,074.76
Life Expectancy	55.47	6.72	35.98	72.80
Maternal Mortality	724.82	467.10	42.00	2,890.00
Infant Mortality	76.15	27.55	18.20	153.70
Openness	0.72	0.35	0.20	2.36
Rule of Law	-0.67	0.57	-2.01	1.04
Regulatory Quality	-0.63	0.41	-2.02	0.13
Voice and Accountability	-0.38	0.62	-1.55	0.99
Control of Corruption	-0.62	0.53	-1.70	1.14
Political stability	-0.50	0.84	-2.44	1.22
Government Effectiveness	-0.79	0.47	-1.88	0.37

Source: Authors' computation from WDI and WGI (World Bank, 2018).

As seen in the table, average macroeconomic income per capita for ECOWAS countries for the period of the study was about 1998.99 United States dollars (USD). The deviation of income values from the mean was somewhat high at about 1, 245.19 USD, but this is expected given the heterogeneous nature of country cross sections. Average life expectancy in the region was about 56 years with a maximum of 73 years. The standard deviation of life expectancy of approximately 7 years shows that life expectancy figures were quite close to mean values. Average maternal mortality rates were about 725 per 100,000 live births. This is quite high and far from reaching the global sustainable development target of 70 per 100 000 live births (WHO, 2018). On the average, infant deaths were approximately 76 per 1,000 live births. This is also high compared to global average figures of 39 per 1,000 live births in 2017 and also far from the sustainable development target of 25 per 1,000 live births (UNDP, 2018). On the average, openness measure was about 0.72, showing higher income values relative to the sum of imports and exports. Average values of the variables for measuring governance indicators have negative signs suggesting

that the region is generally characterized by poor governance. The results for convergence are shown in tables 3, 4, 5 and 6.

Table 3. Regression Results for Absolute β-Convergence in Per Capita Income and Health Outcome

Variables	Model 1 GDP	Model 2a Life expectancy	Model 2b Life expectancy	Model 3 Maternal Mortality	Model 4 Infant Mortality	β-convergence
Log of initial GDP Per Capita	-0.880***					
	(-0.00755)					Yes
Log of initial life expectancy		-0.0226***	-0.0185***			Yes
		(-9.94E-05)	(-0.00054)			
Log of initial maternal mortality				-0.00154***		Yes
				(-0.00011)		
Log of initial infant mortality					-0.0176***	Yes
					(-0.0011)	
Constant			1.024***			
			(-0.0289)			
Observations	273	273	294	260	273	
Number of Year	21	21	21	20	21	
Hansen_test	21	21	21	20	21	
H_0:over-identifying restrictions are valid						
Hansen Prob	1	1	1	1	1	
AR(1)_test	-4.561	-4.373	-4.379	-4.183	-3.757	
$H_{0:}$ no first order autocorrelation						
AR(1)_P-value	5.09E-06	1.23E-05	1.19E-05	2.87E-05	0.000172	
AR(2)_test	4.474	3.859	4.205	4.068	0.668	
$H_{0:}$ no second order autocorrelation						
AR(2)_P-value	7.67E-06	0.000114	2.61E-05	4.74E-05	0.504	
No. of Instruments	92	91	105	92	92	

Source: Author's computation.

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Estimates are provided using the DGMM. Model 2b presents results for life expectancy using the SGMM due to significant AR2 for life expectancy in the DGMM model 2a.

The results for absolute β-convergence are presented in table 3. Findings are shown for per capita income and health outcome in models 1 to 4. The analysis for life expectancy was repeated as shown in model 2b. Life expectancy results were initially presented in model 2a using the DGMM. However the results showed non rejection of the null hypothesis for AR(2) requiring use of the SGMM results presented in model 2b. The results in table 3 provide evidence supporting the convergence hypothesis for not only income but also health outcome for countries in the ECOWAS region. This is shown by the negative sign of the log of the initial values of income, life expectancy, maternal mortality and infant mortality rates. The result is suggestive that macroeconomic incomes in these countries are getting closer. Health outcome indicators are also converging. The convergence rate was however higher for per capita income than all health outcome variables. The rate of convergence for health outcome was approximately the same for life expectancy and infant mortality (approximately 0.02%). Convergence in maternal mortality rates (0.001%) was relatively smaller compared to other health indicators. Findings for income and health outcome suggest that similar to developed economies, economic integration in developing economies improves economic performance and hence should be encouraged. There are, therefore, strong indications that trade liberalization in the ECOWAS region facilitates the transfer of technology from one country to another, promotes investment, and encourages member countries to achieve improvements in per capita income and health variables. The result showing existence of convergence in per capita income differs from that of Aboagye and Turkson (2014) which showed income divergence for SSA economies even with trade liberalization. Differences in findings can be linked to examining convergence within a particular trade bloc. Trade bloc policy agreements thus promotes convergence and is key in making entities similar over time.

Table 4 presents the result for conditional β- convergence with inclusion of openness as a covariate. Findings are shown for per capita income and health outcome in models 1 to 4. The results for maternal mortality are presented in models 3a and 3b. Model 3a shows the results using DGMM and 3b the SGMM results. We present the results for repeated analysis for maternal mortality using the SGMM based on the DGMM results showing existence of AR (2). The results for maternal mortality are approximately the same for the DGMM and SGMM in terms of the parameter for convergence but the variable for openness

is shown to be significant only in the SGMM model. Findings for maternal mortality are interpreted using the SGMM.

Table 4. Regression Results for Conditional B-Convergence in Per capita Income and Health Outcome Controlling for Openness

Variables	Model 1 GDP	Model 2 Life expectancy	Model 3a Maternal Mortality (a)	Model 3b Maternal Mortality	Model 4 Infant Mortality	β-convergence
Log of initial GDP	-0.908***					
	(-0.03)					Yes
Log of initial life expectancy		-0.0274***				Yes
		(0.00)				
Log of initial maternal mortality			-0.00185***	-0.00124***		Yes
			(0.00)	(0.000114)		
Log of initial infant mortality					-0.0242***	Yes
					(-0.00106)	
Log of Openness	-1.802***	0.0827***	0.11	-0.285***	0.05	
	(-0.17)	(-0.02)	(-0.11)	(0.0804)	(-0.04)	
Observations	141	141	135	200	141	
Number of Year	21	21	20	20	21	
Hansen_test	21	20.99	20	20	21	
H_0:over-identifying restrictions are valid						
Hansen Prob	1	1	1	1	1	
AR(1)_test	-3.23	-3.298	-2.739	-3.056	-2.746	
$H_{0:}$ no first order autocorrelation						
AR(1)_P-value	1.24E-03	0.000972	6.16E-03	0.00224	0.00603	
AR(2)_test	-1.46	0.406	2.256	2.972	1.272	
$H_{0:}$ no second order autocorrelation						
AR(2)_P-value	0.144	0.685	0.0241	0.00296	0.204	
No. of Instruments	83	76	83	97	83	

Source: Author's computation.

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Estimates are provided using the DGMM. Model 3b presents results for maternal mortality using the SGMM due to significant AR2 in the DGMM model 3a.

The results for the existence of a conditional β-convergence complement the results presented in table 3. Findings in table 4 suggest that the inclusion of openness in the models enhanced the rate of convergence. The rate of convergence in per capita income increased by about 2% more in table 4 relative to table 3. Similarly the convergence rate in life expectancy rose by about 1% more in table 4 than in table 3. The rate of convergence in maternal and infant deaths also rose marginally in table 4 compared to 3. The results showed that openness as a variable does not enhance income growth but improves life expectancy and reduces maternal mortality rate. A 1% rise in openness reduces income growth by about 1.8%. On the other hand, a 1% rise in openness increases life expectancy by about 0.1% and reduces maternal deaths by approximately 0.29%. The negative effects of openness on per capita income growth can be explained by the fact that the competitiveness of each country in producing goods for exports are not the same, hence, income in some countries will not increase as much as others with open border operations. In addition, in African economies, imports comprised more of consumer than capital goods and such transactions do not promote economic growth. For the ECOWAS region, intra-regional imports have been increasingly of food items (Torres and Seters, 2016). Findings for enhancement of health outcome, specifically life expectancy with openness, suggest that inter-border migration of health care resources promotes long life in the region. Hence open border operations of health care policy should be highly prioritized.

The results for conditional β-convergence with inclusion of openness and governance indicators as covariates are shown in table 5. Findings are shown for per capita income and health outcome in models 1 to 4. The results for infant mortality were initially presented in Model 4a using the DGMM. However the results showed non rejection of the null hypothesis for AR(2) requiring use of the SGMM results presented in Model 4b. Findings for infant mortality are presented using the SGMM result.

Table 5. Regression Results for Conditional β-convergence in Per capita Income and Health Outcome Controlling for Openness and Governance Indicators

Variables	Model 1 GDP	Model 2 Life Expectancy	Model 3 Maternal Mortality	Model 4a Infant Mortality	Model 4b Infant Mortality	Convergence
Log of initial GDP	-0.922***					
	(-0.0737)					Yes
Log of initial life expectancy		-0.0255***				Yes
		(-0.00091)				
Log of initial maternal mortality			-0.00254***			Yes
			(-0.00018)			
Log of initial infant mortality				-0.0240***		Yes
				(-0.00071)		
Log of initial infant mortality					-0.0110***	Yes
					(-0.00161)	
Log of openness	-0.457	0.104***	0.671***	0.157***	-0.259***	
	(-0.3)	(-0.0232)	(-0.117)	(-0.0389)	(-0.0732)	
Rule of law	0.36	-0.133**	0.0524	0.346*	-0.258	
	(-1.34)	(-0.0608)	(-0.531)	(-0.184)	(-0.166)	
Regulatory quality	3.338***	0.0507	1.581***	0.392***	0.0443	
	(-1.009)	(-0.0347)	(-0.356)	(-0.0879)	(-0.147)	
Voice and accountability	1.384***	0.0131	0.157	0.192***	0.278***	
	(-0.294)	(-0.0163)	(-0.152)	(-0.0695)	(-0.0667)	
Control of	-3.093***	0.0525	-1.516***	-0.774***	-0.471***	
corruption	(-0.718)	(-0.0364)	(-0.452)	(-0.092)	(-0.15)	
Political stability	-1.521***	0.0192*	0.0668	-0.0711**	0.0790***	
	(-0.294)	(-0.00993)	(-0.0777)	(-0.0296)	(-0.0292)	
Government effectiveness	-0.117	0.183***	-1.146***	-0.571***	-0.0726	
	(-0.684)	(-0.0299)	(-0.252)	(-0.0728)	(-0.0805)	
Constant					0.351***	
					(-0.0993)	
Observations	131	131	125	131	188	
Number of Year	18	18	17	18	18	
Hansen_test	16.26	15.98	15.34	13.21	17.18	
H_0:over-identifying restrictions are valid						
Hansen Prob	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1	

Variables	Model 1 GDP	Model 2 Life Expectancy	Model 3 Maternal Mortality	Model 4a Infant Mortality	Model 4b Infant Mortality	Convergence
AR(1)_test	-2.482	-3.362	-1.406	-2.714	-2.704	
$H_{0:}$ no first order autocorrelation						
AR(1)_P-value	0.0131	0.000773	0.16	0.00664	0.00684	
AR(2)_test	-0.44	-0.25	0.854	-2.511	1.406	
$H_{0:}$ no second order autocorrelation						
AR(2)_P-value	0.66	0.802	0.393	0.0121	0.16	
No. of Instruments	89	80	89	89	103	

Source: Author's computation

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Estimates are provided using the DGMM. Model 4b presents results for infant mortality using the SGMM due to significant AR2 in the DGMM model 4a.

The result for the existence of conditional β-convergence in table 5 complements the results presented in tables 3 and 4. Findings in table 3 show higher convergence rates with the inclusion of additional covariates, specifically governance indicators in the models relative to use of only openness as a covariate. The rate of convergence in income increased by about 4% in table 5 relative to table 3. Similarly the convergence rate in life expectancy rose by about 1% more in table 5 than in table 3. The rate of convergence in maternal and infant deaths also rose marginally in table 5 compared to table 3. Findings showing that inclusion of additional controls promotes convergence suggest that countries in the ECOWAS region have different structures and hence each unit will converge to different steady state points (Weddige-Haaf and Kool, 2017).

The results in table 5 show that openness enhances life expectancy but does not improve maternal and child health outcome except in the model with the SGMM for infant mortality rate. A 1% rise in openness increases life expectancy by about 0.10% and also raises maternal and infant deaths by approximately 0.67% and 0.16% respectively. In the SGMM model, a rise in openness by 1% reduces infant deaths by about 0.26%. The results are suggestive of poor health policy measures for mother and child in the region. In terms of governance indicators, it can be seen that the rule of law does not promote health outcome.

In most African countries, there is no strict adherence to legislative rules. Legislations and practices are commonly contrary to human rights obligations and hostile to public health goals and this explains the negative effect of the rule of law on health outcome. Similarly, the result for regulatory quality showed negative effect on maternal and infant health. Regulatory quality in the region however promotes macroeconomic income. It is possible that the enforcement of quality health care provision is not strong enough to produce positive effects on health conditions in the region. However, regulation of products and production techniques was effective for realizing positive effects on overall macroeconomic income. Similar findings were observed for voice and accountability, which is also suggestive of poor implementation of policies to observe any desired effect on health outcome. Findings for the control of corruption show that it limits growth in the region but enhances health outcome. The enforcement of anti-corruption laws should ordinarily improve aggregate income. However, it can constitute a strong constraint to growth when cumbersome bureaucratic bottlenecks encourage entrepreneurs to seek ways to bypass regulations, especially when a country's institutions are weak and function poorly (Acemoglu and Verdier, 1998; Meon and Weill, 2010; Beecroft et al., 2020). In such an instance, the control of corruption will limit economic growth. On the other hand, the control of corruption in the ECOWAS region promotes health condition. This is suggestive that the control of corruption induces better delivery of health care and health systems that promotes health indices. A similar finding was obtained by Osakede (2020) for Nigeria, an ECOWAS member country, showing that the control of corruption improves health, especially maternal health status.

The results further showed that political stability does not promote economic growth. A politically-stable economy should ordinarily promote economic growth by creating a conducive environment for work, and encourage savings and investment (Aisen and Veiga, 2013; Hussain 2014). However, most African economies are characterized by political unrest because the political process commonly undermines legitimacy, aggravates factionalism, tension and conflict over distribution of resources and security (Lewis, 2011). Political stability also has negative effect on health outcome, specifically infant mortality rate. However, improved health outcome is associated with political stability for life expectancy, but at 10 percent level of significance, suggesting a weak positive effect. The result hence gives more credence to negative effects of political

stability on health outcome. With the African region characterized by poor politically-stable environments, resulting in crisis and violence, the chance of loss of lives, particularly for infants, will be higher. Findings for government effectiveness show that it improves health outcome by raising life expectancy, and reducing maternal and infant deaths. This result is suggestive that government effectiveness is key among all measures of governance in achieving desirable public outcomes, particularly in relation to health. The variable is however not significant for economic growth in the region.

The results for σ-convergence are presented in table 6. Findings are shown in models 1 to 4 for GDP per capita, life expectancy, maternal mortality and infant mortality.

Table 6. Pooled Regression Results for Convergence in Per capita Income and Health Outcome

Variables	Model 1 GDP per capita Convergence: No	Model 2 Life expectancy Convergence: No	Model 3 Maternal mortality Convergence: Yes	Model 4 Infant mortality Convergence: Yes
Time	0.0446***	0.472***	-20.02***	-2.513***
	(-0.0141)	(-0.0566)	(-4.539)	(-0.214)
Constant	-67.11**	-891.6***	40,870***	5,118***
	(-28.34)	(-113.6)	(-9,103)	(-429)
Observations	315	315	300	315
Number of Years	21	21	20	21

Source: Authors' Computation

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Findings in table 6 show no evidence of σ-convergence in per capita income and life expectancy. Convergence are however noticed for maternal mortality and infant mortality, with higher rates of convergence for maternal than infant mortality rate. The result for σ-convergence in income and life expectancy suggests that there are still significant differences in per capita income and the indicator for life expectancy among countries in ECOWAS. As shown by Wolassa (2011), existing differences in the macroeconomic income of African countries can be associated with variations in the factors that drive productivity. Some of these factors include differences in debt profile relative to output

growth, exchange rates, monetary growth and the prevalence of conflict. Other possible reasons for divergence in income relate to the fact that African countries, as is the case with most developing economies in the globe, are unequally endowed with institutional, political, geographical, cultural and historical environments. Inequality in these factors can induce divergent growth performances, if they hinder technological advancement (Banerjee & Somanathan , 2007; Huillery, 2009; Dufrénot, Mignon & Naccache, 2009).

The result for divergence in income gives an inkling of the existing disparity in life expectancy of countries in the ECOWAS region. This is because differences in income suggest that there is variation in access to basic needs such as food, clothing and shelter, which in turn influences longevity (Permanyer & Scholl, 2019). In this case, some countries in the region have more disadvantaged groups of individuals than others. Findings for divergence in life expectancy can also be related to huge differences in socioeconomic status in Africa. This is mainly reflected in differences in educational attainment, work-related hazards, access to health services and information as well as medical treatment (Permanyer and Scholl, 2019).

Findings showing convergence for maternal and infant mortality can be explained by global effects to reduce maternal and infant deaths through the use of foreign aid. In this regard, financial support received as interventions in most African countries in the effort to end preventable maternal and child deaths can induce disappearance in health differences for maternal and infant health (United Nations, n.d). It is also possible that global interventions in maternal and child health in Africa provide room for technological advancement in reproductive health that is made available in other countries in the ECOWAS region through an open border policy. Such efforts can lead to convergence in maternal and infant health figures.

Although findings for σ-convergence showed divergence in income and life expectancy, the results for β-convergence suggest that on the average income and health variables of countries in the ECOWAS region are moving towards regional mean values. This result is in line with the position that countries can experience β-convergence even when σ-convergence results show existing divergence (Gluschenko. 2012).

Conclusion

In examining the convergence hypothesis in per capita income and health outcome (life expectancy, infant and maternal mortality), taking cognizance of the role of governance quality in the ECOWAS region, findings showed the existence of β-convergence in all variables used in the study, with σ-convergence shown only for maternal and infant health. The results for β-convergence showed that income and all three measures of health outcome were indeed converging with faster rates of convergence in per capita income relative to health. Findings for σ-convergence showed divergence in income and life expectancy suggesting existing differences in income and health values for longevity. The results obtained suggest the key role of governance in per capita income growth and health indices. Significant positive effects of regulatory quality and voice and accountability were observed on income growth with the control of corruption and political stability showing negative effects. On health outcome, negative effects were associated with the rule of law, regulatory quality, voice and accountability, while the control of corruption and government effectiveness improved health measures. The results for the effect of political stability and openness on income and health were inconsistent.

Overall, findings for β-convergence in income and health suggest that open border policy operations enhance the free flow of technology across countries in the ECOWAS region and hence promote income growth and health status. Even with existing differences in income and health indices in the region as reflected in the results for σ-convergence, income and health values for countries in the region are moving towards regional mean values. The indication therefore is that trade bloc operations within Africa create an avenue for improvement of weaker economies in the region. There are also indications of the key role of governance quality in attaining convergence. These findings are relevant for SSA where the level of governance is poor and health as well as economic performance are also poorly rated. Efforts geared towards advancing African economies, particularly in reaching sustainable development in income and health, should consider trade bloc operations within the region and also pursue avenues for improving governance quality.

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