How does the health sector benefit from trade openness? Evidence form panel data across sub-Saharan Africa countries.

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Abstract

The linkages between international trade integration and economic performance has received significant attention from both policy makers and researchers. There seem to be consensus in the literature to suggest that improved trade openness corresponds to improved economic growth. A missing link in the literature is how trade openness affects specific sectors of the economy. Here we argue that trade openness has significant impact on population health and health financing. The study employed panel data for forty-two (42) Sub-Saharan African (SSA) countries over the period 1995-2013. Population health status was measured by total life expectancy at birth, infant mortality rate and under-five mortality rate. Three main estimation procedures were used; (i) Fixed effect (FE), (ii) Random Effect (RE) and (iii) the Generalized Method of Moments (GMM) models were employed in estimating the relationships. The results showed a positive and significant relationship between trade openness and life expectancy, negative and significant relationship between trade openness and infant mortality rate and negative relationship between trade openness and under-five mortality rate. A positive relationship between trade openness and health financing. The findings of the study support international trade integration across countries in SSA and emphasizes the need for countries to be conscious of gains from trade within sub-sectors of the economy.

Keywords: International trade, health status, health financing, SSA

1. Introduction

Economic theory and evidence generally affirm that trade openness is essential for economic growth and this is expected to trickle down to specific sectors of the economy (Levine and Rothman, 2006). Panda (2014), argue that a country's openness to trade affects the macro economy by influencing economic growth. The macroeconomic benefits of trade openness are expected to translate to various sector of the economy including the health sector (WHO, 2013).

The nexus between the health sector and trade openness has been conceptualized in many ways. For instance, Serrano et al., (2002) opined that "openness facilitate the spread of knowledge and the adoption of more advanced and efficient technologies, which hastens total factor productivity growth and, hence, per capita income." Also, Deaton (2014) argued that openness to trade enhances the consumption of medical goods and international spillovers of medical knowledge.

In line with various structural reforms implemented across Sub-Saharan African countries, available evidence suggest that the SSA region is ranked second among other regions in the world. Average trade openness in SSA is estimated to be 61.04%, significantly higher than the world average of 59.20% in 2014. However, the improved trade openness performance has not translated into the health sector. The SSA region has continually seen a slow progress in population health status (Economist Intelligence Unit, 2012). Sub-Saharan African countries continue to face high HIV prevalence with the region accounting for over 69% of adults living with HIV (WHO, 2012). Moreover, under-five mortality in SSA was estimated to be 89.2 per 1,000 live births in 2013 (World Bank 2014). Similarly, infant mortality in the region was 59.6 per 1,000 live births in the same year (World Bank 2014). Furthermore, majority of countries in the region missed the Millennium Development Goal (MDG) targets on health.

Moreover, there exists significant financing gap in the health sector in SSA and this has constrained the performance of the sector over the years (Economist Intelligence Unit, 2012). Available evidence indicates that although SSA account for 11% of world's population and 24% of global disease burden, the region commands less than 1% of global health finance (Economist Intelligence Unit, 2012). In 2011 for instance, public health expenditure as a percentage of GDP for SSA was only 2.9% compared to world average rate 6.0%. Private health expenditure as a percentage of GDP accounted for 3.6% which is below the world average of 4.1% (World Bank 2014).

The foregoing discussion raises questions about whether opening the boarders of a country to international trade can translate to improved population health and health financing. The current study set out to find solutions to this question with emphasis on SSA. To this effect, we sought to estimate the effect of trade openness on population health status and health financing in Sub-Sahara Africa. Specifically, there are two questions that we set out to answer; (i) does trade openness affect population health in SSA? (ii) does trade openness affect health financing in SSA?

2. Literature review

2.1 Conceptual framework

While very limited theoretical models exist on the linkages between international trade, health and health financing, Herzer (2014) provided a conceptual model that highlights the transmission mechanisms for the trade-health nexus and suggests that there is a bi-directional relationship between international trade and health. Herzer (2014) proposed six mechanisms[1] through which trade openness could influence population health. These are the income mechanism, inequality, access, insecurity, pollution and aid mechanisms.

While this model is closely related to the current study, they did not capture the linkages between trade openness and health financing. We therefore modify Herzer's conceptual model to include health financing. Directly, health financing influence trade through the purchase and sale of healthcare goods and services. Thus, as healthcare spending increases, trade in medical equipment, drugs and movements of healthcare professionals are enhanced to improve population health. On the other hand, trade can also impact health financing. When countries open up to trade they tend to integrate with other countries through which benefits in the form of grants, aids and donations are directed to the health sector. These linkages are clearly shown in Figure 1.

[1] Detailed discussion of these mechanisms is available in Herzer (2014)

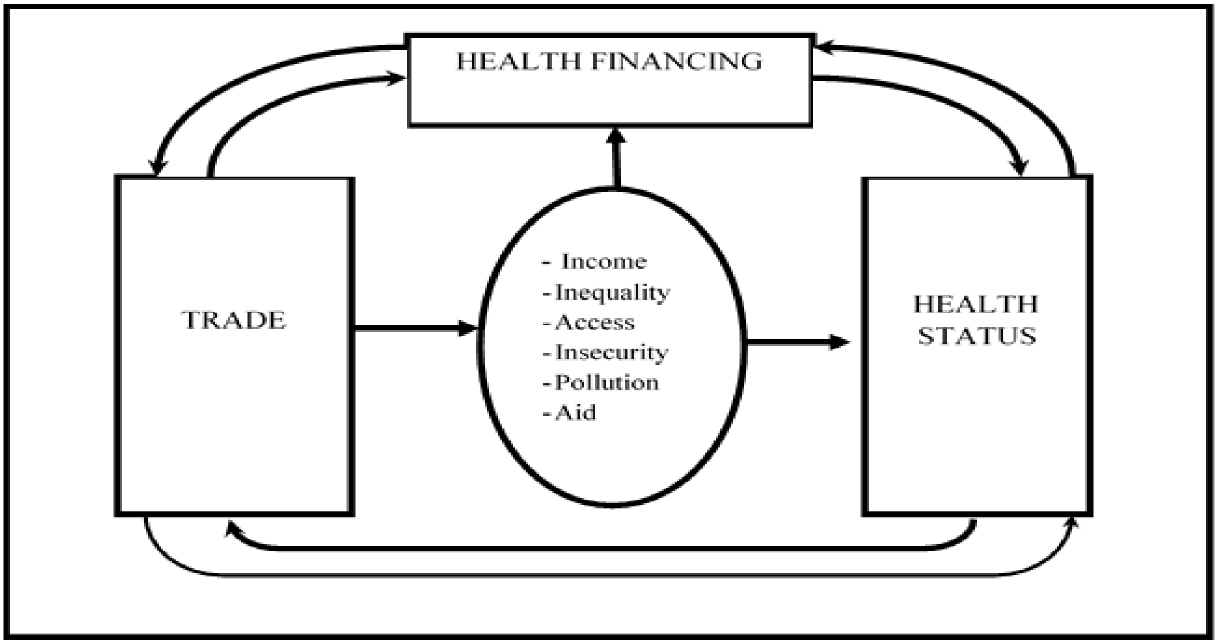

Figure 1: Link between trade, population health and health financing
Source: Author's modification from Herzer (2014)

Figure 1 also suggests that trade can influence health financing through Herzer's mechanisms (income, inequality, access, insecurity, pollution and aid mechanism). As countries open up to trade, gains in the form of income and aid boost both private and public spending on health. Similarly, access to different kinds of health products improves population health which is associated with increased labour supply and productivity. On the contrary, health financing impacts trade indirectly through population health. That is, as both private and public expenditure on health increases, population health improves. The development associated with population health increases labour supply and improves productivity.

2.2 Empirical evidence

The relationship between trade openness, population health and health financing has received limited attention in the empirical literature. Existing studies have mostly focused on the trade-health status nexus while the link between trade and health financing has been largely ignored. For instance, Owen and Wu (2002) used a panel data of 139 developed and developing countries from 1960 to 1995. Results from the fixed effects estimation procedure showed a significant positive relationship between international trade and population health (measured by infant mortality and life expectancy). Interestingly, the authors showed that while population health in both rich and poor countries benefited from international trade openness, poor countries benefited more relative to their rich counterparts. Similar findings were reported by Ramzi (2012) who used panel data from oil rich countries between 1980 and 2009. Using the fixed effect estimation method, the author reported a positive and significant relationship between trade openness and life expectancy while a significant negative relationship was reported between trade openness and infant mortality. Further, using panel data from 134 developed and developing countries and the two-stage least square regression (2SLS) technique, Levine and Rothman, (2006) focused on the impact of trade openness on child health. The authors reported a coefficient of -0.63, which implies that a 1% increase in trade openness would lead to about more than half a year reduction in infant mortality.

Hudak, (2014) explored the relationship between trade openness and differential health outcomes, considering a panel data set for thirty (30) low and high income countries from 1960 to 2012. Using the random effect estimation technique, result from the study indicate that at 10% significance level, an increase in trade openness leads to 14.09% increase in life expectancy. Stevens, Urbach, and Wills, (2013) studied the relationship between free trade and health. Their empirical findings revealed that free trade is correlated with better health and this becomes clearer when dealing with low income countries. Using the Synthetic Control Method to estimate the effect of trade liberalization on health outcomes for the periods 1960 to 2010 in South Africa, Olper et al., (2014) found a significant short run and long run reduction in child mortality. Herzer, (2014) also estimated the long run relationship between trade and population health using a panel time series data from 1960-2010 for seventy-four (74) developed and developing countries. The study found a positive relationship between life expectancy and trade openness while a negative relationship between infant mortality and trade openness. The study therefore concluded that trade openness has positive and significant impact on population health. The study also found a long-run causality running from both directions.

In terms of the relationship between trade openness and health financing, Maryam and Hassan, (2013) who used time series data between 1976 and 2011 with the Autoregressive distributed lag (ARDL) Bound test to examine the long and short run relationship between trade openness and health financing in Pakistan. The study showed that per capita health expenditure had positive relationship with trade openness both in the short and long runs.

From the discussions so far, it can be observed that the focus has been mostly on trade openness and health status while the link with health financing has been absent. Also, no study explicitly explains the link in the context of Sub-Saharan Africa. Further, studies on the relationship between trade openness and population health have ignored the possible endogeneity problems, with most of them only using basic panel data estimation techniques. This study deviates from previous studies in two ways; (i) we attempt to solve the potential endogeneity problem using generalized method of moments estimation approach (ii) estimate the linkage between trade openness and health financing, following theoretical evidence.

3. Methods

3.1 Theoretical Framework

We adapt the framework presented by Fayissa and Gutema (2008) and used in Novignon and Lawanson, (2016) based on the theoretical health production function developed by Grossman (1972). Similar to Grossman (1972), Fayissa and Gutema (2008) took into consideration social, economic and environmental factors as inputs for the health production system. The theoretical health production function is stated as:

$$H = f\left(X\right) \qquad (3.1)$$

Where H = Individual health output, X = Vector of individual inputs to the health production function, f. The elements of the vector include nutrient intake, income, consumption of public goods, education, time devoted to health related procedures, initial health stock and the environment.

The above model presents the micro (individual) health production analysis. To account for the macro level health production, Fayissa and Gutema (2008) presented a macro level specification of equation (3.1) by representing the elements of the vector **X** as per capita variables and then regrouped them into sub-sectors vectors of social, economic and environmental factors. The macro level health production function is represented in the equation (3.2)

$$h = f\left(Y, S, V\right) \qquad (3.2)$$

Where **h** is the aggregate population health status outcome, **Y** is a vector of per capita economic variables, **S** is a vector of per capita social variables and **V** is also a vector of per capita environmental factors. By transforming the above equation (3.2) to its scalar form, we have,

$$h = f\left(y_1, y_2, ..., y_n; s_1, s_2, ..., s_m; v_1, v_2, ..., v_l\right) \qquad (3.3)$$

Where **h** is population health status (life expectancy, infant mortality rate and under-five mortality), $\left(y_1, y_2, ..., y_n\right) = Y$; $\left(s_1, s_2, ..., s_m\right) = S$; $\left(v_1, v_2, ..., v_l\right) = V$.

Assuming a Cobb-Douglas production function involving inputs and outputs, equation (3.3) can be stated as

$$h = \Omega \Pi_{y_i}^{\alpha_i} \Pi_{s_j}^{\beta_j} \Pi_{v_k}^{\gamma_k} \qquad (3.4)$$

Where α_i, β_j and γ_k are the elasticities.

From equation (3.4) the term Ω estimates the initial health stock as it measures the health status that would have been observed if it is considered that there was no depreciation in health or health improvement due to changes in social, economic and environmental factors used in the production process. In the same way, $\left(\Pi_{yi}^{\alpha i} \Pi_{sj}^{\beta j} \Pi_{vk}^{\gamma k} - 1\right) \times 100\%$ estimates the percentage change in health status by reason of social, economic and environmental factors.

Taking the logarithm of equation (3.4) and rearranging yields equation (3.5) as presented below.

$$Inh = ln\Omega + \sum \alpha_i \left(lny_i\right) + \sum \beta_j \left(lns_j\right) + \sum \gamma_k \left(lnv_k\right) \qquad (3.5)$$

Where $i = 1,2,...,n;\ j = 1,2,...,m;\ \ k = 1,2,...,l$ and Ω is an estimate of the initial health stock. In this study we introduce the trade openness variable as a component of the economic variable in the theoretical formulation.

3.2 Econometric specification

To be able to provide estimates for the parameters of the study, an econometric specification of the model to be used is necessary. To this effect, the study follows Baltagi (2008) which serves as the starting point for estimating the relationship between trade openness and population health status as well as trade openness and health financing outcomes in a panel regression as specified in equation (3.6).

$$y_{it} = \alpha + \beta X_{it} + \varepsilon_{it} \qquad (3.6)$$

Where $i = 1,2,...,N$ is the country index, $t = 1,2,...,T$ is the time index, α is the scalar, β is $k \times l$ vector and X_{it} is the i^{th} observation on k^{th} explanatory variables.

From the theoretical model, population health status and health financing function for this study takes the reduce form as follows:

Population health and trade openness

$$PHS = f\left(TO, TOSQ, HF, GDPG, S, URBN, EDU, FR\right) \qquad (3.7)$$

Equation (3.7) become estimable in a natural logarithm form as

$$\begin{aligned} lnPHS_{it}^{l} &= \alpha_i + \lambda_1 lnTO_{it} + \lambda_2 lnTOSQ_{it} + \lambda_3 \ln HF_{it} + \lambda_4 GDPG_{it} + \lambda_5 lnS_{it} + \\ &\lambda_6 lnUBN_{it} + \lambda_7 lnEDU_{it} + \lambda_8 lnFR_{it} + \varepsilon_{it} \end{aligned} \qquad (3.8)$$

Where

$lnPHS^l$ = different population health status (that is life expectancy, infant mortality and under-five mortality); TO = Trade openness; $TOSQ$ = Square of trade openness; HF = Health finance; $GDPG$ = Gross domestic product growth rate; S = Sanitation facilities; UBN = Urbanizatiion; EDU = Education; FR = Total fertility rate; ε = Error term.

Health finance and trade openness

$$HF = f\left(TO, TOSQ, GDPG, S, URBN, EDU, FR\right) \tag{3.9}$$

In the same way, equation (3.9) becomes estimable in a natural logarithm form as

$$\begin{aligned}\ln HF_{it} = \alpha_i + \lambda_1 lnTO_{it} + \lambda_2 lnTOSQ_{it} + \lambda_3 GDPG_{it} + \lambda_4 lnS_{it} + \lambda_5 lnUBN_{it} + \\ \lambda_6 lnEDU_{it} + \lambda_7 lnFR_{it} + \varepsilon_{it}\end{aligned} \tag{3.10}$$

From equation (3.8) and (3.10), α_i represent a country specific intercept, $\lambda_i .....\lambda_n$ (where $i = 1, 2, ..., n$) are the elasticity coefficient and ε_i is the white noise term (which is assumed to be identically and independently distributed with mean zero and homoscedastic variance) that is not correlated with the independent variables.

3.3 Data Source

The study employed annual panel data from 1995 to 2013 for forty-two (42) Sub-Saharan Africa countries[2]. With the exception of educational data which was sourced from UNDP database, all

[2] Countries included in the study are as follows: Angola, Benin, Botswana, Burundi, Burkina Faso, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, Congo Dem. Rep, Congo Rep, Cote d'Ivoire, Equatorial Guinea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Seychelles, Sierra Leone, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda and Zambia.

other variables used in the study were sourced from the World Bank's World Development Indicators (WDI).

4. Results

4.1 Descriptive statistics

Table 1 below provides summary statistics of variables included in the study. The mean, standard deviation, minimum and the maximum values of the variables are reported. The statistics show that average life expectancy for the period was 55 years with minimum and maximum values of 31.6 and 74.0 years, respectively. The average infant mortality rate was 73.9 per 1000 live births, with a minimum of 12.1 and a maximum of 158.3 per 1000 live births. Average under-five mortality was 117.6 per 1000 live births with minimum and maximum values of 14 and 279.5 live births, respectively.

Table 1: Descriptive statistics

Variables	Mean	Standard deviation	Minimum	Maximum
Life Expectancy	55.05185	7.166296	31.63451	74.46
Infant Mortality	73.9381	28.80783	12.1	158.3
Under-five mortality	117.654	52.06193	14	279.5
Trade Openness	77.36844	52.61439	14.77247	531.7374
Health finance	5.451303	2.105236	1.446244	14.15385
GDP growth	5.362847	8.867792	-36.0471	149.973
Sanitation Facilities	32.24173	22.72838	3	98.4
Urbanization	36.90741	15.08526	7.211	86.658
Education	0.37625	0.136053	0.09762	0.795511
Fertility rate	5.280016	1.302044	1.44	7.749

Source: Authors' computation

Health finance, comprising of both public and private recorded an average of 5.5 percent with minimum value of 1.4 percent and a maximum value of 14.2 percent. Average openness is 77.34 percent with minimum of 14.8 percent and maximum of 531.74 percent. Average gross domestic product growth rate is 5.36. It ranged between a minimum value of -36.0 percent and a maximum value of 149.97 percent. The average population with good sanitation facility over the period is 32.24 percent, with a minimum of 3 percent and a maximum of 98.4 percent. Average secondary school enrolment expressed as a percentage of the population of official secondary education age over the period is 38 percent, with a minimum of 10 percent and a maximum of 80 percent. Average fertility rate in the region over the study period is 5.28 percent. The minimum and maximum values of 1.44 percent and 7.75 percent were recorded over the period.

4.2 Econometric results

Three main estimation techniques were used in the econometric analysis. Various diagnostic tests and remedies were also applied to ensure that the estimated results are valid.

4.2.1 Life expectancy and trade openness

Table 2 below shows the effect of trade openness on life expectancy. The F-test statistics for the fixed effect and Wald chi-square test for the random effect models were used to test whether all the coefficients are different from zero. In testing for heteroscedasticity, the modified Walt test for GroupWise heteroscedasticity was performed. The Wald test was based on the null hypothesis that there is the presence of constant variance (homoscedasticity). The test strongly confirmed the presence of heteroscedasticity by rejecting the null hypothesis at 5 percent level of significance. To control for heteroscedasticity, robust standard errors were reported throughout the estimation. Also, the Hausman test failed to reject the fixed effect estimation for all the models. The test for autocorrelation confirmed the absence of autocorrelation in the second order for all the regressors. The Sargan test for over identification failed to reject the null hypothesis that over identification restrictions are valid.

Table 2: Life expectancy and trade openness

Variables	Fixed Effect (FE)	Random Effect (RE)	GMM
LnLE (-1)			0.7720***
			(0.1137)
LnTO	0.1135*	0.1272**	0.3807***
	(0.0967)	(0.0976)	(0.1430)
LnTOSquare	-0.0114*	-0.0130*	-0.0389***
	(0.0106)	(0.0108)	(0.0143)
LnTHE	0.0298***	0.0350***	0.0404**
	(0.0231)	(0.0238)	(0.0174)
GDPG	-0.0004	-0.0004	-0.0004
	(0.0003)	(0.0004)	(0.0007)

LnS	0.0289***	0.0302***	0.0274
	(0.0184)	(0.0175)	(0.0173)
LnURBN	0.1688***	0.1441***	0.0026
	(0.0566)	(0.0416)	(0.0213)
LnEDU	0.1141***	0.1043***	0.0105
	(0.0287)	(0.0247)	(0.0199)
LnFR	-0.0941***	-0.0899***	-0.003
	(0.0727)	(0.0622)	(0 .0324)
Constant	2.7416***	2.8136***	
	(0.3329)	(0.3084)	
Within R^2	0.4730	0.4720	
Between R^2	0.2828	0.2851	
Overall R^2	0.2998	0.3033	
Probability>F	0.0000	0.0000	0.000
No. of Observations	798	798	756
No of Countries	42	42	42
Hausman (Chi^2)	280.39***	280.39	
	(0.0000)	(0.000)	
Wald test (Chi^2)	1.40E+05		
	(0.0000)		
Sargan (Prob> Chi^2)			0.288
Arellano–Bond [AR(2) Prob>z]			0.157

Notes: LnLE is the dependent variable. **, ** and *** indicate statistical significance of the estimates at 10%, 5% and 1% respectively. Robust standard errors are reported in parentheses. GMM represents one step system GMM.*

Source: Authors' computation

Results from Table 2 show a significant and positive relationship between trade openness and life expectancy. The relationship was consistent across all the three estimation techniques used. However, the estimated elasticity was higher in the GMM model relative to the fixed and random effects models. An elasticity of 0.11 was estimated for the fixed effects model, 0.13 for the random effects model and 0.38 for the GMM model. This implies that a 10 percent increase in trade openness leads to a 1.1, 1.3 and 3.8 percent increase in life expectancy, for FE, RE and GMM models, respectively. Other variables that showed positive and significant with life expectancy include health financing, sanitation, urbanization and education

4.2.2 Infant mortality and trade openness

Table 3 provides estimates of the effect of trade openness on infant mortality in SSA. The probability values from both the FE and

RE models confirm the joint significance of the models at 1 percent level. From the diagnostics test as presented in table 4.5, the Wald test for heteroscedasticity confirmed the presence of heteroscedasticity which necessitated the report of robust standard errors. The Hausman confirms the use of FE estimation. The Sargan test showed no problem of over identification, implying that over identification restrictions are valid.

The results also show a negative and significant relationship between trade openness and infant mortality. The estimated elasticities suggest that a 10 percent increase in trade openness reduces infant mortality by 4.5 percent, 4.9 percent and 1.29 percent using the FE, RE and GMM estimators, respectively. A negative and significant (at 1 percent) relationship is observed between health finance and infant mortality for both FE and RE models. Also, GDP growth rate across the alternative estimators is significant and positively correlates with infant mortality. Sanitation, urbanization and education for all the estimators showed a negative and highly significant relationship with infant mortality.

Table 3: Infant Mortality and Trade Openness

Variables	Fixed Effect (FE)	Random Effect (RE)	GMM
LnIMR (-1)			0 .6279***
			(0.2199)
LnTO	-0.4517***	-0.4987***	-1.2945*
	(0.3495)	(0.3583)	(0.7430)
LnTOSquare	0.0392**	0.0449**	0.1395*
	(0.0395)	(0.0406)	(0.0791)
LnTHE	-0.0779***	-0.0964***	-0.1237**
	(0.0586)	(0.0563)	(0.0515)
GDPG	0.0018***	0.0019***	0.0018
	(0.0007)	(0.0007)	(0.0022)
LnS	-0.2311***	-0.2286***	-0.0799

	(0.1163)	(0.1072)	(0.0503)
LnURBN	-0.4222***	-0.3383***	-0.0342
	(0.1278)	(0.0906)	(0.0792)
Ln EDU	-0.2730***	-0.2538***	-0.0890
	(0.1023)	(0.1024)	(0.0905)
LnFR	0.6330***	0.6503	0.3043
	(0.2224)	(0.1903)	(0.2948)
Constant	7.6878***	7.4127***	
	(1.1436)	(1.0653)	
Within R^2	0.6038	0.6020	
Between R^2	0.5463	0.5729	
Overall R^2	0.5450	0.5679	
Probability>F	0.0000	0.0000	0.000
No. of Observations	798	798	756
No of Countries	42	42	42
Hausman (Chi^2)	65.75***	65.75	
	(0.0000)	(0.0000)	
Wald test (Chi^2)	83111.42		
	(0.0000)		
Sargan (Prob> Chi^2)			0.629
Arellano–Bond [AR(2),Prob>z]			0.188

Notes: LnIMR is the dependent variable. **, ** and *** indicate statistical significance of the estimates at 10%, 5% and 1% respectively. Robust standard errors are reported in parentheses. GMM represents one step system GMM.*

4.2.3 Under-five mortality and trade openness

Table 4.6 below shows the estimation results for under-five mortality and trade openness. Similar to diagnostic tests presented earlier, the presence of heteroscedasticity was again detected and remedied using robust standard errors. Again, the Hausman test confirmed the fixed effect estimates over the random effect estimates. The diagnostic test further revealed no problem of over identification with the Sargan test probability value of 0.704.

The result reveals a negative and significant relationship between trade openness and under-five mortality. The estimated elasticities imply that a 10 percent increase in trade openness reduces under-five mortality by 5.29 percent, 5.79 percent and 12.04 percent for FE, RE and GMM estimators, respectively. Negative and significant relationships were found between health financing, sanitation, urbanization and under-five mortality across all the estimators. Education was only negatively related with under-five mortality in the FE and RE models.

Table 4: Under-five Mortality and Trade Openness

Variables	Fixed Effect (FE)	Random Effect (RE)	GMM
LnU5M (-1)			0.7536***
			(0.1768)
LnTO	-0.5293***	-0.579***	-1.2042*
	(0.4133)	(0.4270)	(0.6248)
LnTOSquare	0.0456**	0.0517**	0.1274*
	(0.0465)	(0.0481)	(0.0662)
LnTHE	-0.0873 ***	-0.1129***	-0.119**
	(0.0673)	(0.0628)	(0.0516)
GDPG	0.0019**	0.0019**	0.0017
	(0.0007)	(0.0007)	(0.0016)
LnS	-0.2850***	-0.2782 ***	-0.1309
	(0.1392)	(0.1255)	(0.0813)
LnURBN	-0.5371***	-0.4185***	-0.1370
	(0.1589)	(0.1072)	(0.0872)
Ln EDU	-0.3802 ***	-0.3510***	0.0701
	(0.1173)	(0.1168)	(0.0666)
LnFR	0.6580 ***	0.6995***	0.2052
	(0.2498)	(0.21403)	(0.2113)
Constant	9.2623***	8.7939***	
	(1.345)	(1.2503)	
Within R^2	0.6225	0.6198	
Between R^2	0.5939	0.6271	
Overall R^2	0.5873	0.6154	
Probability >F	0.0000	0.0000	0.000
No. of Observations.	798	798	756
No of Countries	42	42	42
Hausman (Chi^2)	88.22***	88.22	
	(0.0000)	(0.0000)	
Wald test (Chi^2)	58245.97		
	(0.0000)		

Sargan (Prob> Chi^2)	0.704
Arellano–Bond [AR(2),Prob>z]	0.203

Notes: LnU5M is the dependent variable. **, ** and *** indicate statistical significance of the estimates at 10%, 5% and 1% respectively. Robust standard errors are reported in parentheses. GMM represents one step system GMM.*

Source: Authors' computation

4.2.4: Health finance and trade openness

Table 4.8 shows the regression results of the effect of trade openness on health finance. The Wald test confirm the presence of heteroscedasticity which was remedied using robust standard errors. The Hausman test also confirms the use of fixed effect estimation relative to the random effect model. The Sargan test failed to reject the null hypothesis of over identification restrictions. This shows that the instruments used were valid.

The results show that there exist a positive and statistically significant relationship between trade openness and health finance in SSA. Even though the relationship was not significant under the fixed effect model, the expected sign (positive) was met. The estimated elasticities imply that a 10 percent increase in trade openness increases health finance by about 3.29 percent (for FE estimation), 3.81 percent (for RE estimation) and 5.23 percent (for GMM estimation). A significant relationship was established between urbanization and health financing under FE and GMM estimations. Results on sanitation shows a negative and significant relationship with health finance for all the models.

Table 5: Health finance and trade openness

Variables	Fixed Effect (FE)	Random Effect (RE)	GMM
LnTHE (-1)			0.8558***
			(0.1049)
LnTO	0.3294	0.3818*	0.5230**
	(0.4753)	(0.4845)	(0.2591)
LnTOSquare	-0.0311	-0.0386	-0.0473
	(0.0588)	(0.0599)	(0.0321)
GDPG	0.0008	0.0008	0.0005

	(0.0010)	(0.0010)	(0.0032)
LnS	-0.0604	-0.0506	-0.1533*
	(0.1057)	(0.0830)	(0.0835)
LnURBN	0.1565***	0.0613	-0.1151*
	(0.1828)	(0.1201)	(0.0644)
Ln EDU	0.2624***	0.2559***	0.0340
	(0.1018)	(0.0974)	(0.0755)
LnFR	-0.3275***	-0.2274**	-0.1998***
	(0.2057)	(0.1619)	(0.1256)
Constant	0.0428	0.1198	
	(1.2358)	(1.1984)	
Within R^2	0.1482	0.1441	
Between R^2	0.0706	0.0536	
Overall R^2	0.0186	0.0104	
Probability>F	0.0000	0.0000	0.000
No. of Observations	798	798	756
No of Countries	42	42	42
Hausman (Chi^2)	62.83***	62.83	
	(0.0000)	(0.0000)	
Wald test (Chi^2)	5520.92		
	(0.0000)		
Sargan (Prob> Chi^2)			0.142
Arellano–Bond [AR(2),Prob>z]			0.624

Notes: LnTHE is the dependent variable*, ** *and* *** *indicate statistical significance of the estimates at 10%, 5% and 1% respectively. Robust standard errors are reported in parentheses. GMM represents one step system GMM.*

Source: Authors' computations

5. Discussion

The findings of the study suggest a positive and significant relationship between trade openness and life expectancy at birth. Similarly, a negative and significant relationship was observed between trade openness and under-five mortality as well as infant mortality. These relationships were consistent with a-priori expectations as well as findings from existing literature. For instance, Ramzi (2012) and Levine and Rothman, (2006) both provided evidence to show that increased trade openness improves population health.

The findings imply that SSA countries could gain from opening up for international trade. While existing evidence suggest that there are general macroeconomic gains from trade in SSA, the current study emphasize specific gains in the health sector. As discussed earlier in the study, some conceptual justification has been provided for this relationship. Herzer (2014) opined that as a country opens up to international trade, it enables the flow of medical equipment, drugs and health professionals which directly influence health care and ultimately population health status. This shows that both health capital and human resource could significantly be enhanced as a result of improved trade openness.

It is worth noting that the relationship between heath status and trade openness was largely consistent across all the three estimation approaches employed in this study. However, the elasticities of impact were higher in the GMM estimates relative to the FE and RE estimates. This can be attributed to the fact that the GMM controls for potential endogeneity problems which is absent in the FE ad RE estimates. This also emphasizes the contributions of the current study as previous studies have ignored this endogeneity problem.

With regards to trade openness and health financing, the findings of the study suggest a strong positive relationship. The relationship was consistent across the various estimation techniques employed. This relationship implies that improved trade openness also increases resources committed to the health sector. This is particularly relevant in the context of SSA as majority of countries in the region have significant resource constraints that limit their commitment to the health sector. The relationship can be explained by the fact that trade openness enhances economic growth that could provide additional fiscal space for the health sector. Also, trade openness improves international integration which brings along benefits in the form of grants and aid to the health sector.

6. Conclusion

The study set out to examine the relationship between international trade openness, population health status and health financing in Africa. Panel data from 42 SSA countries, spanning from 1995 to 2013, was sourced for the analysis. Three panel data estimation procedures were employed in the analysis, namely; fixed effect, random effect and generalized method of moments. The findings of the study suggest that international trade openness significantly improves both population heath status and financing. The relationship was significant across the various estimation techniques employed. It is however worth noting that the GMM elasticity estimates were relatively higher than those from the fixed and random effects. The findings from the study emphasize the need for SSA countries to improve international trade.

References

Deaton, A. (2004). *Health in an age of Globalization*. Center for Health and Welbeing, Princeton University.

Dollar, D. (2001). Is globalization good for your health ? *Bulletin of the World Health Organization*, *79*(01), 827–833.

Economist Intelligence Unit. (2012). *The future of healthcare in Africa*. The Economic Intelligence Unit.

Fayissa, B. and Gutema, P. (2008) 'A health production function for sub-Saharan Africa', Department of Economics and Finance Working Paper Series, August. Middle Tennessee State University

Grossman, M. (1972). On the Concept of Health Capital and the Demand for Health. *Journal of Political Economy*, *80*(2), 223–255.

Herzer, D. (2014). The long-run relationship between trade and population health: evidence from five decades. Germany Economic Association Annual Conference, Humburg. Retrieved from http://hdl.handle.net/10419/100441

Hudak, K. M. (2014). Differential Health Outcomes and Trade: Does openness to trade affect childhood underweight and overweight?

Huynen, M. M. T. , Martens, P., and Hilderink, H. B. (2005). The health impacts of globalisation: a conceptual framework. *Global Health*, *14*(1), 1–12.

Levine, D. I., and Rothman, D. (2006). Does trade affect child health ? *Journal of Health Economics*, *25*, 538–554.

Maryam, A., and Hassan, M. S. (2013). Human Capital : Is it Beneficial for Trade Openness in Pakistan ? *Middle-East Journal of Scientific Research*, *17*(7), 965–975.

Novignon, J., and Lawanson, A. O. (Forthcoming). Health expendiiture and child health outcomes in Sub-Sagarab Africa. *African Review of Economics and Finance*.

Olper, A., Curzi, D., and Swinnen, J. (2014). Food Security , Health and Trade Liberalization. Department of Economics Management and Quantitative Methods, University of Milan

Owen, A. L., and Wu, S. (2002). Is Trade Good for your Health? *Review of International Economics*, 15(4), 660-682.

Papageorgiou, C., Savvides, A., and Zachariadis, M. (2007). International medical technology diffusion. *Journal of International Economics*, *72*(2), 409–427.

Razmi, M. J. (2012). Reviewing the effect of Trade Openness on Human Development. *Interdisciplinary Journal of Contemporary Research in Business*, *4*(6), 970–978.

Serrano, G., Lopez-Bazo, E., and Garcia-Sanchis, J. R. (2002). *Complementarity between human capital and trade in regional technological progress.* European Regional Science Working Paper No. ersa02p013 in Economics).

Stevens, P., Urbach, J., and Wills, G. (2013). Healthy Trade: The Relationship Between Open Trade and Health. *Foreign Trade Review*, *48*(1), 125–135.

WHO. (2012). *World health statistics*. Geneva, World Health Organisation.

WHO. (2013). *World health statistics*. Geneva, World Health Organisation.

World Bank (2014). *World Development Indicators (WDI)*. Washington, DC: World Bank.