Modelling and assessment of the effect of income on service exports in Ghana

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Abstract

The effect of income on service export have been modelled and assessed in a trivariate model using time series annual data for Ghana for the period 2005-2013. The analysis is based on ordinary least square (OLS) method of regression. The results seem to suggest that income is positively associated with service export. The findings support theories on income and trade. The implication of the findings is that income is a policy variable to influence service trade. Future study should use larger sample size to ensure there is more external validity of the findings. Causal studies should be considered in future studies.

Keywords: Service Trade, Technology, Income,
Jel Codes: F10, F11, F14, F43

Introduction

The role of export on the economic growth of an economy is well researched in the literature (Bokosi, 2015; Mukherji & Pandey, 2014; Alimi & Muse, 2013; Kalaitzi, 2013; About-Stait, 2005; Gunter, Taylor, &Yeldan, 2005; Glies & Williams, 2000; Ukpolo, 1998; Yaghmaian, 1994). The increased interest results from the fact that increase in exports leads to technology transfer, increase in the productivity capacity of local industries as well as reduction in balance of payment deficit, and creation of employment (poverty reduction) in an economy.

Theoretically, export is expected to influence output (income) positively in an economy (Esfahani, 2001; Helpman, & Krugman, 1985; Bernard & Jensen, 1999; Lawrence & Weinstein, 1999; Yu, 1998; Coe & helpman, 1995).Yet the empirical verification of the effect of export on growth has resulted in mixed findings whereby exports influences output in some studies whereas in other studies it is rather output that influences exports. For example researchers such as Iqbal, Hamed, and Devi (2012) indicated that income explains the changes in export for Pakistan; Lorde (2011) reported for Mexico in the long run and not in the short run; Safdari, Mahmoodi, and Mahmoodi (2011) reported for 13 Asian developing countries; Mishra (2011) for India; Nain and Ahmad (2010) for India; and Ukpolo (1998) for South Africa.

Some studies failed to support the thesis that income explains changes in export. For example, Ramos (2001) study failed to establish any link between export and income for Portugal; Dodaro (1993) for India; and Jung and Marshall (1985) for India.

In a similar study, evidence have been found to support the thesis that export explains the changes in income. For example, Bokosi (2015) for Malawi; Mukherji and Pandey (2014) for India; Sahni and Atri (2012) for India; Narayan (2010) for India; Nidugala (2001) for India

Others empirical studies indicate that exports explain changes in income and at the same time income explains changes in exports. The findings are found in the works of researchers such as Tsen (2010) for Middle China and Asia; Li, Chen, and San (2010).

Few studies have evaluated the effect of income on service exports in the literature, though there are many studies on the effect of aggregate exports on income with mixed findings. The findings of the few studies are found in the works of previous studies such as

Mann (2004), Ansari and Ojemakinde (2003), van Welsum (2003), Deardorff et al. (2000), Montenegro (1999); Wren-Lewis and Driver (1998), Huang and Viana (1995). The findings of these studies provided evidence that income positively influence service export. The income elasticity of service export is greater than unity (1).

The review of the literature reveals that few works have been done on the effect of income on service sector productivity in various economies. This has motivated the current study to add to the literature. The findings of the paper provide further understanding on the theories of trade and growth by providing answers to the research questions asked. Policy makers are also provided with a policy guide on how to improve service export in the economy. Researchers are also provided with reference material on service export and income in future studies.

The paper contributes to the body of knowledge in the area of international trade by examining the effect of income on service export from 2005 to 2013 using annual data for Ghana. The study specifically model and assesses (a) the nature of shock to income and service exports to determine whether the effect is permanent or temporary, and (b) the nature of effect of income on service export to determine whether there is positive, negative, or neutral effect of income on service export.

The paper provides answers to three main questions which are: (a) what is the nature of effect of shock on service export, and income? (b) What is the nature of the effect of income on service exports? (c) What is the nature of the effect of technology on service exports? Three main assumptions are tested. They are: (a) There is permanent and not temporary effect of shock to service export, technology, and income; (b) There is positive effect of income on service export; (c) There is negative effect of technology imports on service exports.

The study deals with the modelling and assessment of the link between service exports, and income of the Ghanaian economy. Commodity exports and total exports are not considered in the current study. Causality issues are not considered in the present study. The study describes the link between income and service exports. The analysis is based on secondary data and as such errors inherent in the use of secondary data might affect the results. The data span is short which might affect the external validity of the findings.

The rest of the study looks at the methodology, the empirical results, the discussions, the conclusions, and policy implications of the findings.

2. Research Methodology

2.1 The Research Design

The paper is based on time series quantitative modelling of the link between service export and income. The effect of income on service export is quantified and explained in the study.

2.2 Data

The study uses annual time series data from period 2005-2013 for Ghana. The period is chosen since that is the period data exist. World Development Indicators (WDI-2013) is the source of the data. Data sources, description, and proxies are shown in Table 1.

Table 1 Description of Data, Proxies, and Sources

Data Description	Proxy	Source
Income (Y)	Gross Domestic Product (GDP)	World Bank World Development Indicator (WDI)
Service export (SX)		World Bank Development Indicator (WDI)
Technology (T)	Information and Communications Technology Imports	World Bank Development Indicator (WDI)

2.3 Conceptual Framework and Empirical Model

The paper models the effect of income on service export with information and communications technology import as an independent variable. Trivariate modelling is used and the model is specified as in equation (1). The dependent variable in the model is the service export (SX) whereas the independent variable is income (Y), with technology (T) as the control variable. Previous studies (Liu & Nath, 2016; Liu & Nath, 2013; Choi, 2010; Freund & Weinhold, 2002) have reported that technology influences service trade and as such technology is used in the current mode as a control variable.

$$\ln SX_t = a + b\ln Y_t + c\ln T_t + e_t \quad \text{.....(1)}$$

2.4 Estimation Methods

The Augmented Dickey-Fuller (1981) (ADF); Kwiatkowski et al. (1992, KPSS), and the Ordinary Least Square (PLS) regression methods were used for the estimation. The ADF test is based on the null assumption (H_0) that the data are non-stationary in levels, against the alternative assumption (H_a) that the data used are stationary in levels. The KPSS test is based on the null assumption (H_o) that the data used are stationary in levels against the alternative hypothesis (H_a) that the data used are not stationary in levels. The Ordinary Least Square method (OLS) of regression method is used to model the effect of income on service export in a log-linear relationship form.

2.5 Diagnostic Methods

The diagnostic tools are based on the adjusted R^2, R-Square (R^2), Joint significance test, ARCH LM test, J-B Normality test, Breusch-Godfred LM test, Ramsey RESET, and White Heteroskedasticity test. The cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ) are also used to examine the stability of the coefficients of the estimated model are assessed using the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ).

3 Empirical Results

3.1 Descriptive Results

Table 2 shows the results of the descriptive statistics. The maximum and minimum values of SX, Y, and T indicate that SX varies between 3.25968e+009 and 1.10649e+009; Y varies between 3.22370e+010 and 0.0000; and T varies between 48.7443 and 0.0000. The results show more variation in Y follow by SX, and then T. The values of the standard deviation of SX and Y are larger than their mean values and as such they do indicate more spread (dispersion) of the data from their means, whereas the value of the standard deviation of T is not larger than the mean which means there is more spread in the data. The values of the

coefficient of variation of the variables (C.V) indicate that T is more volatile followed by Y, and then SX since the value of T (0.4729) is larger follow by that of Y (0.4321), and then SX (0.3389). The values of the coefficient of skewness indicate that the value of SX (1.0827) is positively skewed, whereas the values of Y (-1.3343) and T (-0.9119) are both negatively skewed. The coefficient values of kurtosis indicate that SX, and T are more flat-topped distribution since they are all less than zero, whereas the value of Y (1.3700) is more than one and indicate less flat-topped distribution.

Table 2 Summary of Descriptive Statistics

Summary Statistics, using the observations 1905/05/23 - 1905/07/05			
Variable	SX	Y	T
Mean	1.88377e+009	2.16918e+010	30.9483
Median	1.80090e+009	2.23364e+010	33.5683
Minimum	1.10649e+009	0.000000	0.000000
Maximum	3.25968e+009	3.22370e+010	48.7443
Std. Dev.	6.38487e+008	9.37319e+009	14.6345
C.V	0.3389	0.4321	0.4729
Skewness	1.0827	-1.3343	-0.9119
Ex. Kurtosis	0.5075	1.3700	0.2459

Source: Author's Computation, June, 2016

3.2 Stationarity Tests

3.2.1 Time Series Plots

Figures 1, 2, 3, 4, 5, and 6 indicate the results of the time series plot. The results in figures 1, 3, and 5 show that SX, T, and Y are not stationary in levels. However, the results of the plots in figures 2, 4, and 6 show that SX, T, and Y attained stationarity on first differenced. This calls for further investigation using The ADF and KPSS tests are used for further examination of the stationarity property of the variables in the next section.

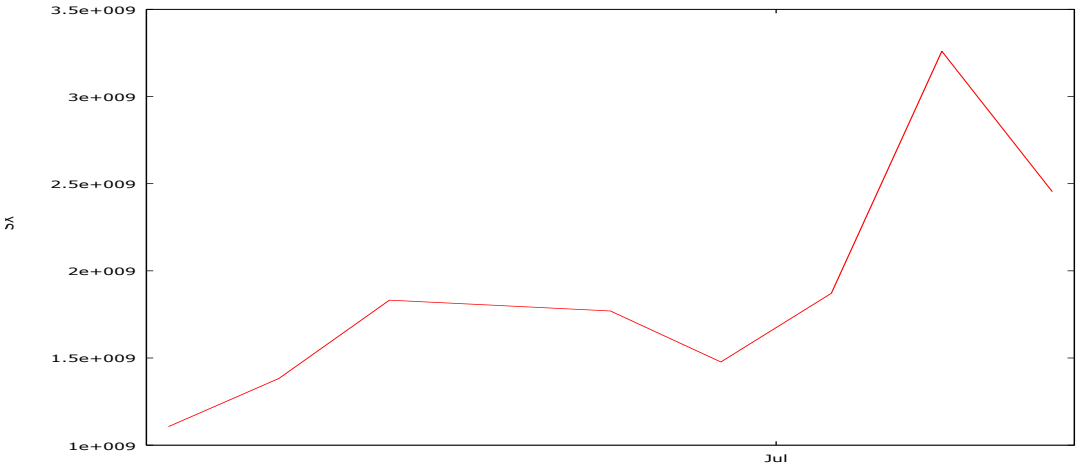

Figure 1. Time series Plot of SX in levels

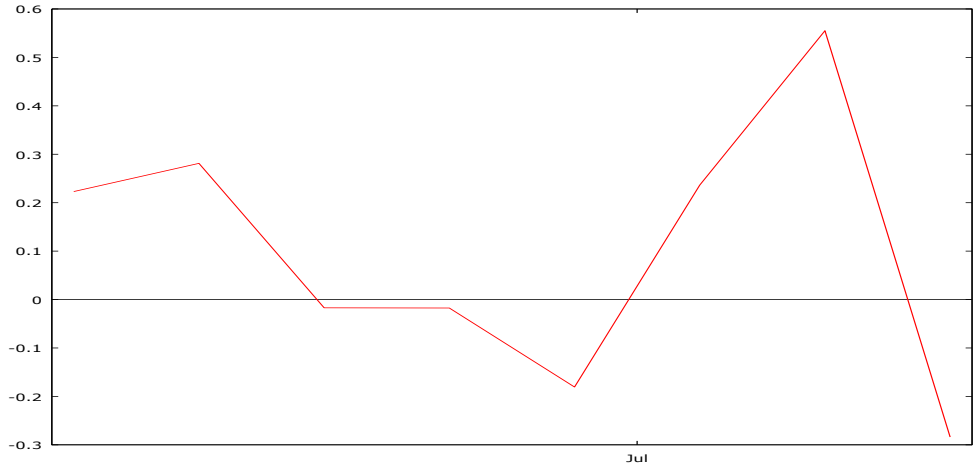

Figure 2. Time series Plot of SX in 1st difference

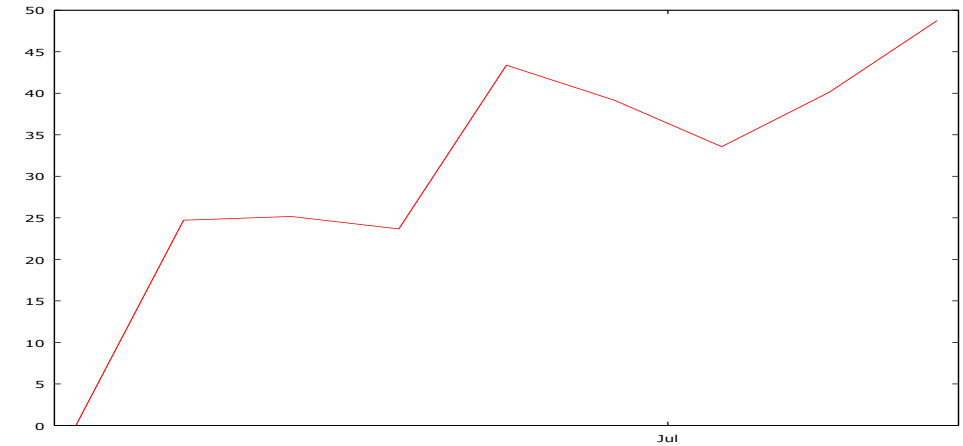

Figure 3. Time series Plot of T in levels

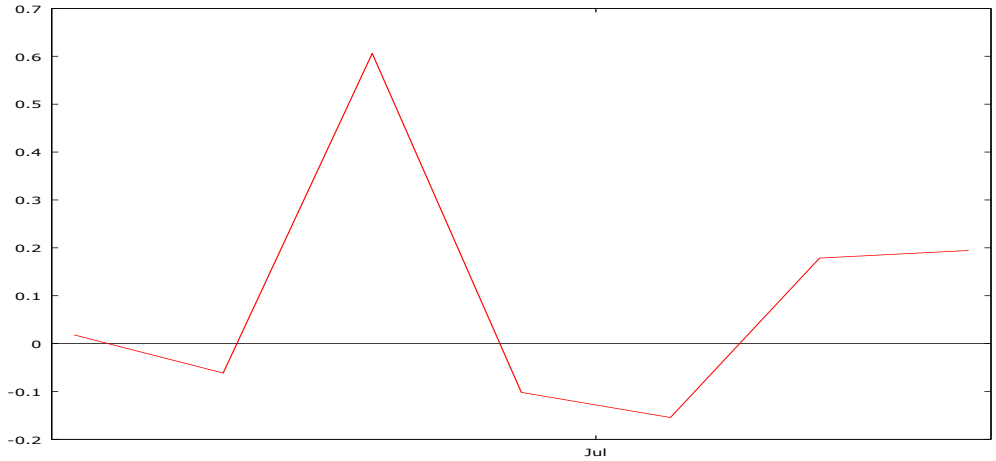

Figure 4. Time series Plot of T in 1st difference

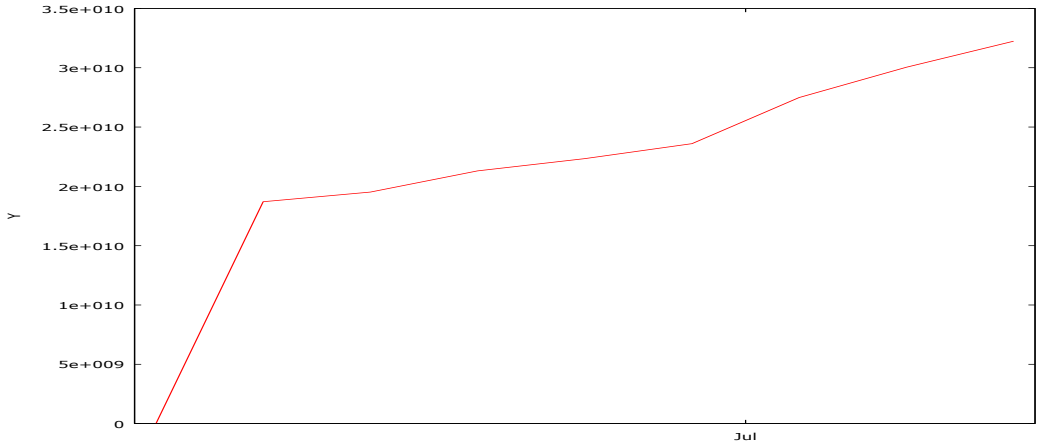

Figure 5. Time series Plot of Y in levels

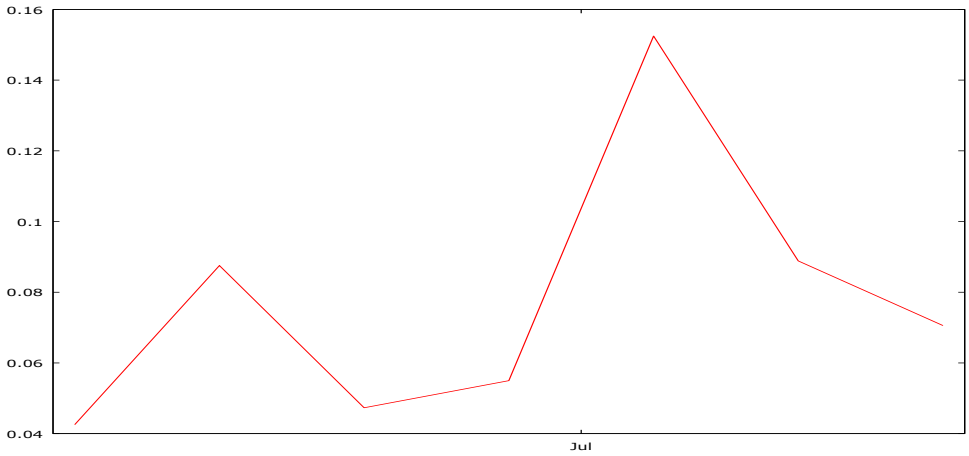

Figure 3. Time series Plot of Y in 1st difference

3.2.2 The ADF/KPSS Tests for Stationarity

Table 3 report of the ADF test results. The results indicate some of the variables are stationary in levels whereas some are not. Some attained stationarity on first differenced.

Table 3 ADF Stationarity Test Results with a Constant and Trend

Variables	Coefficients	T-statistics	ADF/P-Value	Results	Max lag length
SX (levels)	-2.7588	-3.6775	0.0238	Stationary at 5%	1
SX (1st diff.)	-1.2604	-2.1118	0.4576	Not stationary	1
T (levels)	-1.1241	-3.8428	0.07694	Stationary at 10%	1
T (1st diff.)	-2.5347	-3.2634	0.0724	Stationary at 10%	1
Y (levels)	-1.1115	-13.2754	0.0001	Stationary at 1%	1
Y (1st diff.)	-3.2169	-10.1744	0.0000	Stationary at 1%	1

Source: Author's Computation, June, 2016

The results of the KPSS test are reported in Table 4. The variables are stationary in levels, and on first differenced.

Table 4 KPSS Stationarity Test Results with a Constant and Trend

Variables (levels)	T-statistics	Results	Max lag length
SX (levels)	0.0832647	Stationary	1
SX (1st diff.)	0.0886653	Stationary	1
T (levels)	0.117733	Stationary	1
T (1st diff.)	0.0946727	Stationary	1
Y (levels)	0.116803	Stationary	1
Y (1st diff.)	0.0988992	Stationary	1

Source: Author's computation, June, 2016

Critic=al values at 10% (0.130); 5% (0.152); 1% (0.192%) significant levels for levels

Critical values: 10% (0.132) 5% (0.152) 1 %(0.188) for 1st difference

3.3. Regression Results

Table 5 reports of the regression results on the effect of income on service export. The results show that there is significant positive influence of income on service export at 1% significant level. The results indicate that 1% increase in income leads to about 137.17% increase in service export. The results suggest that there is significant negative influence of technology import on service export at 10% significant level. The results show that 1% increase in technology import leads to about 28.50% decrease in service export. The value of the adjusted R^2 (0.4794) for the goodness of fit of the estimated model as reported in Table 5, indicate the estimated model does not perform well. The value of the adjusted R^2 shows that only about 47.94% of the changes in service export are accounted for by the estimated model.

Table 5 OLS Regression Results

Model 24: OLS, using observations 1905/06/28-1905/07/05 (T = 8)
Dependent variable: lnSX
HAC standard errors, bandwidth 1 (Bartlett kernel)

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
Const	-10.4103	5.6371	-1.8468	0.1241	
lnT	-0.2850	0.1311	-2.1740	0.0817	*
lnY	1.3717	0.2484	5.5218	0.0027	***

Mean dependent var	21.3714	S.D. dependent var	0.2752
Sum squared resid	0.1972	S.E. of regression	0.1986
R-squared	0.6282	Adjusted R-squared	0.4794
F(2, 5)	16.7470	P-value(F)	0.0061
Log-likelihood	3.4611	Akaike criterion	-0.9222
Schwarz criterion	-0.6839	Hannan-Quinn	-2.5297
Rho	-0.3062	Durbin-Watson	2.5653

Source: Author's computation, June, 2016: Note *, and *** denote significance at 1%, and 10% levels of significance

Table 6, figures 7, and 8 report of the results of the diagnostic test of the estimated model. The estimated model passed all the tests performed on the model. The results seem to suggest that the model specification is adequate, there is no heteroskedasticity, the estimated residuals are normally distributed, there is no autocorrelation in the model, and the estimated coefficients are stable.

Table 6 Diagnostic Test Results of the OLS Regression

Test	Results
RESET test for specification Null hypothesis: specification is adequate Test statistic: F(2, 3) = 0.3726 P-value = P(F(2, 3) > 0.3726) = 0.7169	The model pass this test. The specified model is adequate
White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present Test statistic: LM = 6.4259 P-value = P(Chi-square(5) > 6.4259) = 0.2669	The model passed this test. There is no heteroskedasticity in the estimated model
Test for normality of residual - Null hypothesis: error is normally distributed Test statistic: Chi-square(2) = 0.2128 P-value = 0.8991	The model passed this test. The residuals are normally distributed in the estimated model
LM test for autocorrelation up to order 1 Null hypothesis: no autocorrelation Test statistic: LMF = 0.4287 P-value = P(F(1,4) > 0.4287) = 0.5484	The model passed this test. There is no autocorrelation in the estimated model
CUSUM test for parameter stability Null hypothesis: no change in parameters Test statistic: Harvey-Collier t(4) = -0.1181 P-value = P(t(4) > -0.1181) = 0.9117	The model passed this test. The estimated parameters are stable.

Source: Author's computation, June, 2016

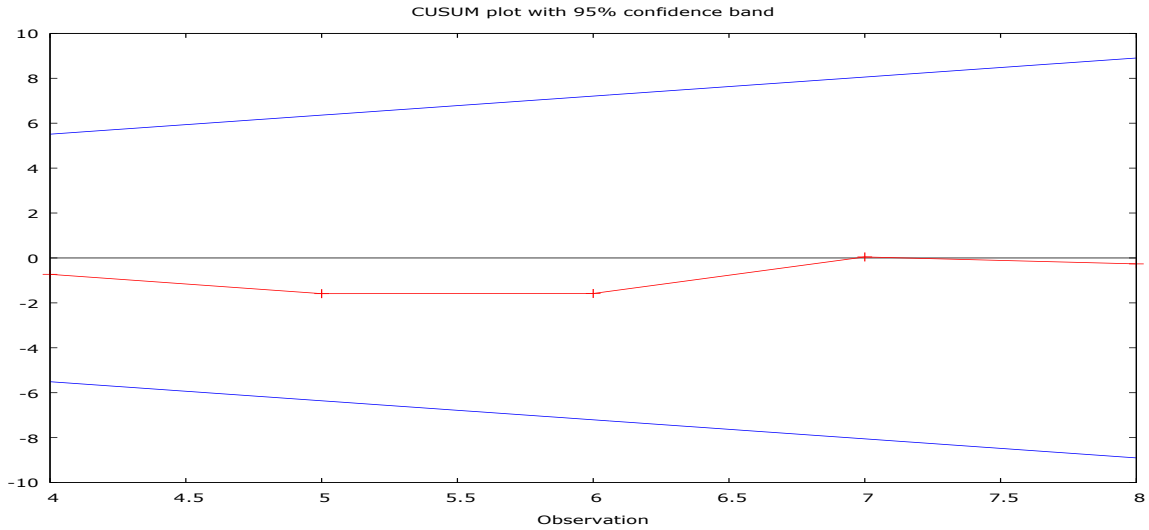

Figure 7 Plot of CUSUM

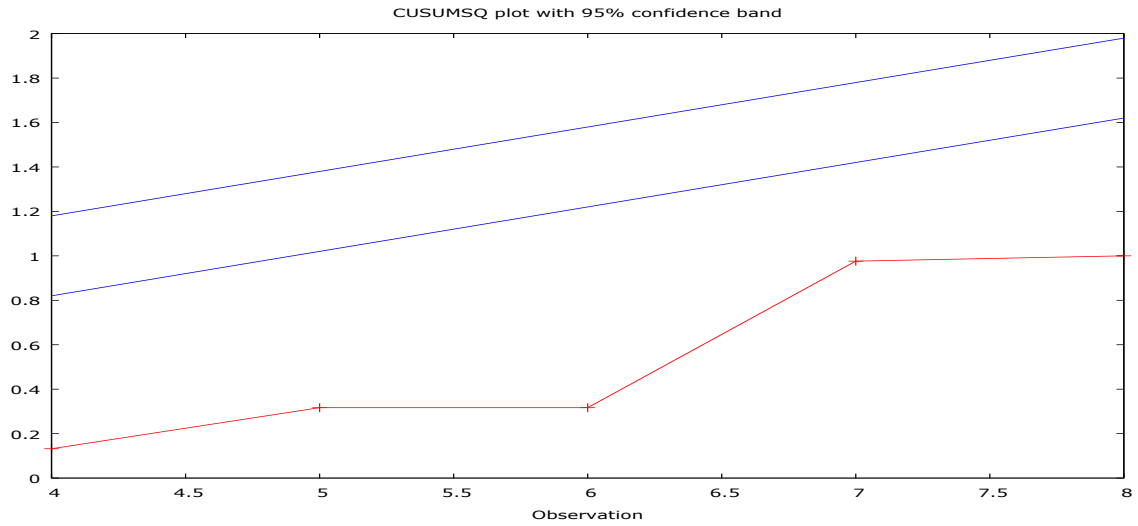

Figure 8 Plot of CUSUMSQ

4 Discussions of Findings

The findings of the paper seem to suggest that the effect of external shock to income, service export, and technology imports is not permanent. The findings on service export are not in support of that of previous studies such as Lee - 2014 for China; Verma and Jayaraman (2010) for Fiji; Ito and Krueger (2007) for Taiwan; Singh (2005) for India. Kónya (2004) for twenty-five OECD countries. The findings on income are not in support with that of Lee and Lee (2009) for 109 countries; Hatemi and Irandoust (2005) for Botswana, Ethiopia, India, Kenya, Sri-Lanka, and Tanzania; Libanio (2005) for Latin American countries.

The findings on the effect of technology on service trade are not in support with previous studies such as Young (2015) for China, United States, Korea, and Japan; Khalili, Lau, and Cheong (2013) for Asia-Pacific Countries. The findings are not in line with these studies, and that may reflect the fact that the sample size is very small. The findings do not support theories of unit root in time series analysis that stationarity properties should be accounted for in estimation. Policies to improve service export performance, income, and technology imports will not have permanent effect but temporary.

The findings of the research indicate that income have positive effect on service export. The findings of the study is in support with that of previous studies such as Mann (2004), Ansari and Ojemakinde (2003), van Welsum (2003), Deardorff et al. (2000) who reported of positive effect of income on service export. The findings support theories on growth and trade. Income seems to be a Policy tool to influence service trade.

The findings of the research show that technology (proxied by ICT imports) influence service trade negatively. The findings are contrary to that of previous findings (Liu & Nath, 2016; Liu & Nath, 2013; Choi, 2010; Freund & Weinhold, 2002) that reported of significant positive effect of technology on service trade. The findings are not in support of the thesis on the effect of technology on trade. The findings suggest that technology (proxied by ICT import) is not a policy tool to influence service export positively.

5 Conclusions, and Policy Implications

The aim of the research have been accomplished. The influence of income on service export have been modelled and investigated in a trivariate model. The findings of the study shows that external shocks to service export, technology, and income is temporary. This does not support the theories of stationarity in time series analysis. Policies to influence growth in service export, growth in income levels, and growth in technology will not have lasting effect.

The findings of the research in addition, shows that income positively influence service export. The findings support theories on trade in relation to income. The findings seem to suggest that income is a policy tool to influence service trade. Technology according to the findings of the study do not impact positively on service trade, which is not in agreement with theories on trade and technology. The findings suggest technology is not a policy tool to influence service trade positively.

Future studies should consider modelling and assessment of the effect of income on service export in both short run and long run as well as causality issues, since the current study did not consider these issues. Larger sample size should be used in future studies to determine whether the current findings will be supported.

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