A comparative study of the role of imports and exports on service sector productivity in Ghana

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18 December 2015

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Abstract

In this paper the author examine the effect of imports, and exports on service sector productivity of Ghana for the period 1970-2013, using annual time series data. The Augmented Dickey-Fuller test (ADF), and the KwiatKowski (KPSS) test were used for the assessment of the effect of external shock on imports, exports, and service sector productivity whereas the ordinary least square method (OLS) was used to examine the role of import, and export on service sector productivity. The results indicate that the effect of external shock to imports, exports, and service sector productivity are permanent and not temporary. There is negative significant effect of export and positive effect of import on service sector productivity in Ghana during the period of discussion. The results suggest that policy makers can rely on import to influence service sector productivity and not export. Future studies should examine the effect of import of goods and services on the service sector productivity to determine whether the current findings will be replicated since the current study used export and import volumes.

Keywords: Export, Import, Service Sector Productivity
Jel Classification: F14, L25, L80

1.1 Introduction

The effect of imports and exports on the aggregate productivity development on the sectors of an economy has attracted attention in the literature in recent time following the work of Bernard and Jensen (1995), and previous researchers works (Malchow-Møller, Munch, Skaksen, 2014; Bernard et al., 2012; Breinlich and Criscuolo, 2011; Jensen, 2008; Temouri et al., 2008; De Loecker, 2007; Wagner, 2007; Bernard and Jensen, 2004; Girma et. al., 2004; Melitz, 2003; Bernard and Jensen, 1999).

According to Malchow-Møller et al. (2014) exports or imports influence service sector productivity. Temouri et al. (2012) reported that firms that export are more productive (proxied by value added per employee) and pay higher (average) wages than non-exporting firms in the economies such as Germany, United Kingdom, and France. Breinlich and Criscuolo (2011) study on British firms established a positive relationship between productivity and exports of producer services. Other researchers who have documented significant positive effect of export on firm's productivity are Jensen (2008); De Loecker (2007), and Girma et al. (2004).

Theoretically, the effect of export and import on sectorial productivity is a function of the productivity development of individual firms as well as the reallocation of resources between firms with different productivities.

In recent years, internationalisation of the various sector of the economies has attracted attention in the literature. The internationalisation of the sectors is a function of exchange of goods, and exchange of services. Few empirical works exist on examination of the simultaneous effect of the direction of trade (proxied by export and import) on service sector productivity in an economy that is small but open such as Ghana in the literature. To close this gap, this paper contributes to the literature by investigating the effect of export volume and import volume on service sector productivity in Ghana.

The findings of the work provide policy makers with a policy guide on the effective way of influencing service sector productivity using import and export. The findings in addition provide reference material to researchers interested in similar research. The general objective of the work is to contribute to the body of knowledge in the area of determinants of sectorial sector productivity. The paper specifically examines the effect of import and export on the service sector productivity, and the nature of shock to the export, import and service sector performance.

The questions underlying the research paper are: what is the nature of external shock to import, export, and service sector productivity; (b) what is the effect of import and export on service sector productivity? The work tests the hypotheses that: (a) there is significant permanent effect of external shock to import, export, and service sector productivity; (b) there is significant effect of import, and export on service sector productivity.

The work focuses on the association among import, export, and the service sector productivity of the Ghanaian economy. However, other sectors such as the manufacturing sector, and agricultural sector are not dealt with in the current paper. Panel studies are not used in the current paper. Secondary data are use and as such various challenges (data massage, errors in variables) with the use of such data may be encountered.

The rest of the paper is organised as follows. Section 2 discusses the methodology. Section 3, considers the empirical results, Section 4 looks at the discussions, and section 5 deals with conclusions and policy implications of the findings.

2. Research Methodology

2.1 The Research Design

The work is based on quantitative research design using time series data. The relationship between direction of trade, and service sector productivity is described and quantified in the paper.

2.2 Data, Sources and Proxies

The paper used annual time series data for the period 1970-2013 for Ghana. This period is chosen since there is enough data for the study, with a sample size of 43. Data for the study was obtained from World Development Indicators (WDI-2013). The descriptions of the data and the sources are reported in Table 1.

Table 1 Data Description, Proxies and Sources

Data Description	Proxy	Source
Trade direction (TD)	Export (EX) and Import (IM)	World Bank World Development Indicator (WDI)
Service Sector Productivity (SP)	Service sector Value Added	World Bank Development Indicator (WDI)

2.3 Conceptual Framework and Empirical Model

The work empirically investigates the theoretical conceptualization of the effect of trade direction on the service sector productivity. The research paper is based on a trivariate modelling which is specified in equation (1). The dependent variable in the model is the service sector performance (SP) (proxied by service sector value added) whereas the explanatory variables are export (EX), and import (IM).

$$\ln SP_t = a + b\ln EX_t + c\ln IM_t + e_t \quad \text{.....(1)}$$

2.4 Estimation and Diagnostic Methods

The work uses the following estimation methods: (a) Augmented Dickey-Fuller (1981) (ADF). The ADF test is based on the null hypothesis (H_0) that there is a unit root or the data is non-stationary in levels against the alternative hypothesis (H_a) that the data is stationary in the series; (b) Kwiatkowski et al. (1992, KPSS) tests to examine the effects of shocks to service sector productivity, export (X), and import (I). The KPSS test is based on the null hypothesis (H_o) that the data set are stationary in levels against the alternative hypothesis (H_a) that the data set used are not stationary; (c) The Ordinary Least Square method (OLS) of regression method is used to estimate the association among service sector productivity, import and export in log-linear relationship form.

The diagnostic tests used to investigate the goodness of fit of the model are: R-Square (R^2), the adjusted R^2, Joint significance test, J-B Normality test, Breusch-Godfred LM test, ARCH LM test, White Heteroskedasticity test, and Ramsey RESET. 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 estimated.

3 Empirical Results

3.1 Descriptive Results

The results of the descriptive statistics are depicted in Table 2. The maximum and minimum values of SP, IM, and EX indicate that SP varies between 49.3647 and 0.0000; IM varies between 335.7800 and 0.0000; and EX varies between 348.4760 and 0.0000. The results show more variation in EX follow by IM, and then SP. The values of the standard deviation of IM, SP, and EX are not larger than their mean values and as such they do not indicate more spread (dispersion) of the data from their means. The values of the coefficient of variation of the variables (C.V) indicate that IM is more volatile followed by EX, and then SP since the value of IM is larger follow by that of EX, and then SP. The values of the coefficient of skewness indicate that the value of IM is positively skewed, whereas the values of EX, and SP are both negatively skewed. The coefficient values of kurtosis indicate that the distribution of IM is more flat-topped distribution since the value is less than zero, whereas the value of EX and SP are 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	SP	IM	EX
Mean	33.0327	104.0510	95.0254
Median	32.1015	74.8960	86.4397
Minimum	0.0000	0.0000	0.0000
Maximum	49.3647	335.7800	348.4760
Std. Dev.	9.4373	98.3475	88.6170
C.V	0.2857	0.9452	0.9326
Skewness	-0.4560	0.8825	-0.1782
Ex. Kurtosis	2.0270	-0.1782	1.1535

Source: Author's Computation, January, 2016

3.2 Stationarity Tests

3.2.1 Time Series Plots

The results of the time series plots are shown in figures 1, 2, and 3. The results in figures 1, 2, and 3 indicate that import, export, and service sector productivity are unit root (not stationary) in levels. The results of the plots in figures 4, 5, and 6 indicate that import, export, and service sector productivity became stationary on first differenced. This calls for further investigation using the ADF and KPSS tests.

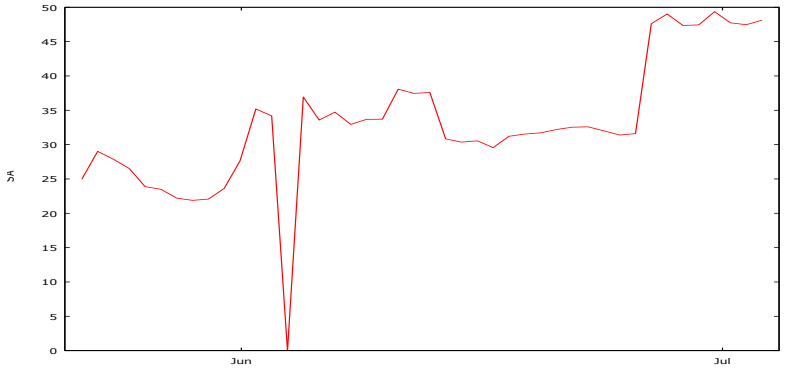

Figure 1 Time series Plot of Service Sector Productivity (SP) in levels

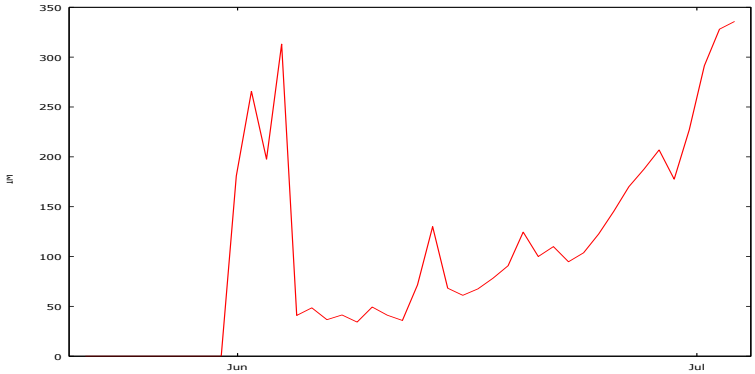

Figure 2 Time series Plot of Import (IM) in levels

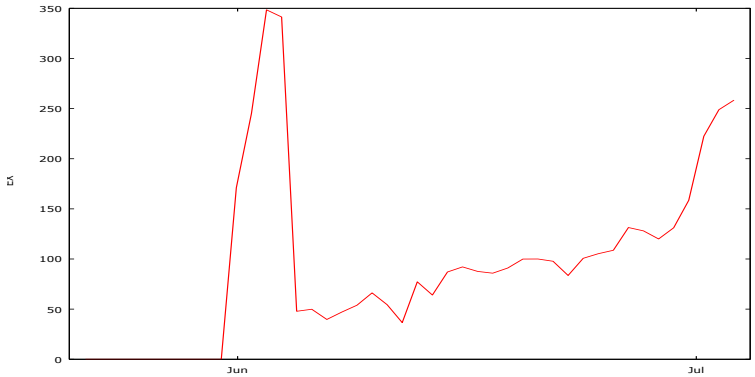

Figure 3 Time series Plot of Export (EX) in levels

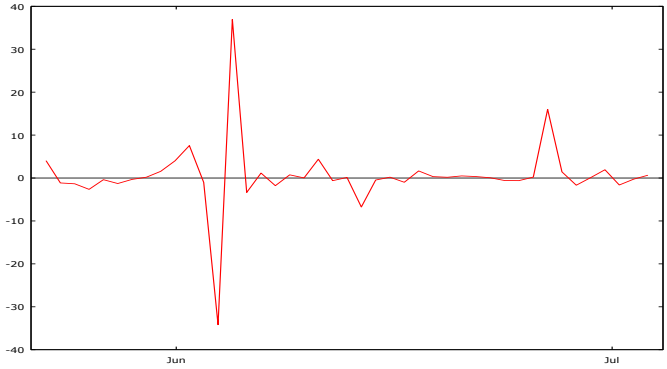

Figure 4 Time series Plot of Service Sector Productivity (SP) in first difference

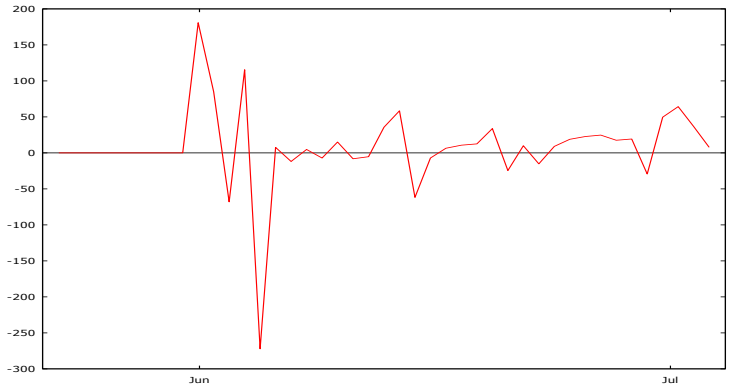

Figure 5 Time Series Plot of Import (IM) in first difference

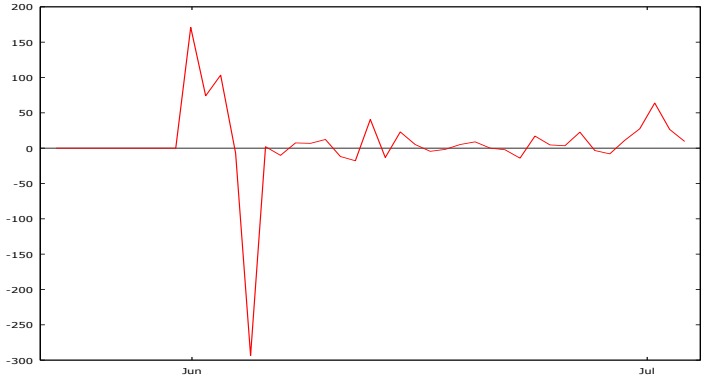

Figure 6 Time Series Plot of Export (EX) in first difference

3.2.2 The ADF/KPSS Tests for Stationarity

The ADF test results are reported in Table 3 to Table 8. The results indicate the series variables are non-stationary in levels (Table 3 to Table 5). However, the variables achieved stationarity on first differenced (Table 6 to Table 8). The results show that external shock to the variable are permanent.

Table 3 ADF Stationarity Test Results with a Constant and Trend

Dickey-Fuller test for SP sample size 43 unit-root null hypothesis: a = 1	
with constant and trend model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + e 1st-order autocorrelation coeff. for e: -0.029 estimated value of (a - 1): -0.775512 test statistic: tau_ct(1) = -5.02371 p-value 0.001012	Results Stationary at 1% and 5% levels of significance

Source: Author's Computation, January, 2016

Table 4 ADF Stationarity Test Results with a Constant and Trend

Augmented Dickey-Fuller test for dSA including one lag of (1-L)dSA (max was 9) sample size 41 unit-root null hypothesis: a = 1	
with constant and trend model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + ... + e 1st-order autocorrelation coeff. for e: -0.084 estimated value of (a - 1): -1.91121 test statistic: tau_ct(1) = -7.22775 asymptotic p-value 5.312e-010	Results Stationary at 1% and 5% levels of significance

Source: Author's Computation, January, 2016

Table 5 ADF Stationarity Test Results with a Constant and Trend

Dickey-Fuller test for IM sample size 43 unit-root null hypothesis: a = 1	
with constant and trend model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + e 1st-order autocorrelation coeff. for e: -0.036 estimated value of (a - 1): -0.301513 test statistic: tau_ct(1) = -2.48593 p-value 0.3332	Results Not stationary at 1% and 5% levels of significance

Source: Author's Computation, January, 2016

Table 6 ADF Stationarity Test Results with a Constant and Trend

Augmented Dickey-Fuller test for dIM including 3 lags of (1-L)dIM (max was 9) sample size 39 unit-root null hypothesis: a = 1	
with constant and trend model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + ... + e 1st-order autocorrelation coeff. for e: -0.064 lagged differences: F(3, 33) = 1.412 [0.2567] estimated value of (a - 1): -1.54966 test statistic: tau_ct(1) = -4.1335 asymptotic p-value 0.005554	Results Stationary at 1% and 5% levels of significance

Source: Author's Computation, January, 2016

Table 7 ADF Stationarity Test Results with a Constant and Trend

Augmented Dickey-Fuller test for EX including one lag of (1-L)EX (max was 9) sample size 42 unit-root null hypothesis: a = 1	
	Results
with constant and trend model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + ... + e 1st-order autocorrelation coeff. for e: -0.057 estimated value of (a - 1): -0.364964 test statistic: tau_ct(1) = -3.14219 asymptotic p-value 0.09651	Not stationary at 1% and 5% levels of significance

Source: Author's Computation, January, 2016

Table 8 ADF Stationarity Test Results with a Constant and Trend

Augmented Dickey-Fuller test for dEX including 3 lags of (1-L)dEX (max was 9) sample size 39 unit-root null hypothesis: a = 1	
with constant and trend model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + ... + e 1st-order autocorrelation coeff. for e: 0.022 lagged differences: F(3, 33) = 2.189 [0.1079] estimated value of (a - 1): -1.48668 test statistic: tau_ct(1) = -4.76247 asymptotic p-value 0.0005066	Results Stationary at 1% and 5% levels of significance

Source: Author's Computation, January, 2016

The results of the KPSS test (Table 9 to Table 14) support the findings of the ADF test results. The variables attained stationarity on first differenced.

Table 9 KPSS Stationarity Test Results with a Constant and Trend

KPSS regression OLS, using observations 1905/05/23-1905/07/05 (T = 44) Dependent variable: SP	
KPSS test for SP (including trend) T = 44 Lag truncation parameter = 3 Test statistic = 0.108272 10% 5% 1% Critical values: 0.122 0.149 0.212	Results Stationary at 1% and 5% levels of significance

Source: Author's Computation, January, 2016

Table 10 KPSS Stationarity Test Results with a Constant and Trend

KPSS regression OLS, using observations 1905/05/24-1905/07/05 (T = 43) Dependent variable: dSA	
KPSS test for dSA (including trend) T = 43 Lag truncation parameter = 3 Test statistic = 0.0511433 10% 5% 1% Critical values: 0.122 0.149 0.212	Results Stationary at 1% and 5% levels of significance

Source: Author's Computation, January, 2016

Table 11 KPSS Stationarity Test Results with a Constant and Trend

KPSS regression OLS, using observations 1905/05/23-1905/07/05 (T = 44) Dependent variable: IM	
KPSS test for IM (including trend) T = 44 Lag truncation parameter = 3 Test statistic = 0.118164 10% 5% 1% Critical values: 0.122 0.149 0.212	Results Stationary at 1% and 5% level of significance

Source: Author's Computation, January, 2016

Table 12 KPSS Stationarity Test Results with a Constant and Trend

KPSS regression OLS, using observations 1905/05/24-1905/07/05 (T = 43) Dependent variable: dIM	
KPSS test for dIM (including trend) T = 43 Lag truncation parameter = 3 Test statistic = 0.0561007 10% 5% 1% Critical values: 0.122 0.149 0.212	Results Stationary at 1% and 5% levels of significance

Source: Author's Computation, January, 2016

Table 13 KPSS Stationarity Test Results with a Constant and Trend

KPSS regression OLS, using observations 1905/05/23-1905/07/05 (T = 44) Dependent variable: EX	
KPSS test for EX (including trend) T = 44 Lag truncation parameter = 3 Test statistic = 0.0795132 10% 5% 1% Critical values: 0.122 0.149 0.212	Results Stationary at 1% and 5% levels of significance

Source: Author's Computation, January, 2016

Table 14 KPSS Stationarity Test Results with a Constant and Trend

KPSS regression OLS, using observations 1905/05/24-1905/07/05 (T = 43) Dependent variable: dEX	
	Results
KPSS test for dEX (including trend) T = 43 Lag truncation parameter = 3 Test statistic = 0.0497697 10% 5% 1% Critical values: 0.122 0.149 0.212	Stationary at 1% and 5% levels of significance

Source: Author's Computation, January, 2016

3.3. Regression Results

The OLS regression results on the effect of export volume and import volume on service sector productivity are shown in Table 15. The results indicate statistical significant negative effect of export volume on service sector productivity for the period under consideration (at 1% significant level). However, there is statistical significant effect of import volume on service sector productivity (at 1% significant level). The results show that 1% increase in export volume leads to about 41.19% decrease in service sector productivity. On the other hand, 1% increase in import volume leads to about 42.37% increase in service sector productivity.

The values of the R^2(0.3718) and the adjusted R^2(0.3299) for the goodness of fit of the model estimated as shown in Table 15, show the estimated model does not perform well. The value of the adjusted R^2 shows that only about 32.99% of the changes in service sector productivity are accounted for by the estimated model, whereas about 67.01% of the changes in the model are unexplained by the model.

Table 15 OLS Regression Results

OLS, using observations 1905/06/03-1905/07/05 (T = 33) Dependent variable: lnSA				
	Coefficient	Std. Error	T-ratio	P-value
Const	3.5073	0.2351	14.9205	<0.0000***
$lnEX_{-1}$	-0.4119	0.1237	-3.3309	0.0023***
$lnIM_{-1}$	0.4237	0.1036	4.0890	0.0003***
Mean dependent var	3.5743	S.D. dependent var		0.2008
Sum squared resid	0.8104	S.E. of regression		0.1644
R-squared	0.3718	Adjusted R-squared		0.3299
F(2, 30)	8.8768	P-value(F)		0.0009
Log-likelihood	14.3352	Akaike criterion		-22.6706
Schwarz criterion	-18.1810	Hannan-Quinn		-21.1599
Rho	0.5197	Durbin-Watson		0.9611

Source: Author's Computation, January, 2016

The results of the diagnostic test are reported in Table 16, figures 7, and 8. The estimated model passed the normality test, and the autocorrelation test. However, the estimated model did not pass the specification test, the heteroskedasticity test, and the stability test.

Table 16 Diagnostic Test Results of the OLS Regression

Test	Results
RESET test for specification - Null hypothesis: specification is adequate Test statistic: F(2, 28) = 2.7329 P-value = P(F(2, 28) > 2.7329) = 0.0824	The model did not pass this test. The specified model is not adequate
White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present Test statistic: LM = 24.0632 P-value = P(Chi-square(5) > 24.0632) = 0.0002	The model did not pass this test. There is heteroskedasticity in the estimated model
Test for normality of residual - Null hypothesis: error is normally distributed Test statistic: Chi-square(2) = 2.9573 P-value = 0.2279	The model pass this test. The residuals are normally distributed in the estimated model
LM test for autocorrelation up to order 7 - Null hypothesis: no autocorrelation Test statistic: LMF = 1.5494 with p-value = P(F(7, 23) > 1.5494) = 0.2007	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(29) = 2.3231 with p-value = P(t(29) > 2.3231) = 0.0274	The model did not passed this test. The estimated parameters are not stable

Source: Author's Computation, January, 2016

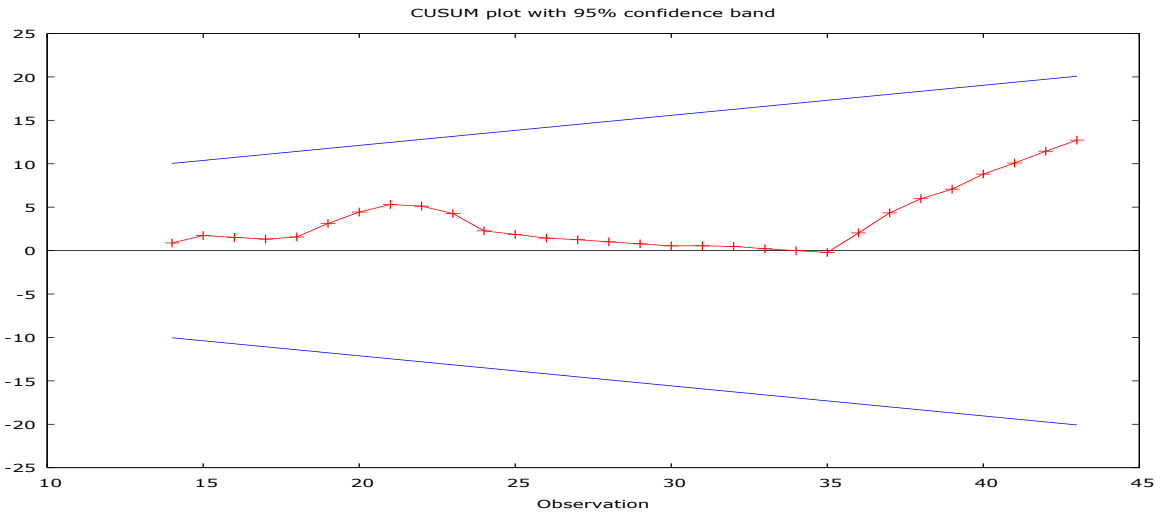

Figure 7 Plot of CUSUM

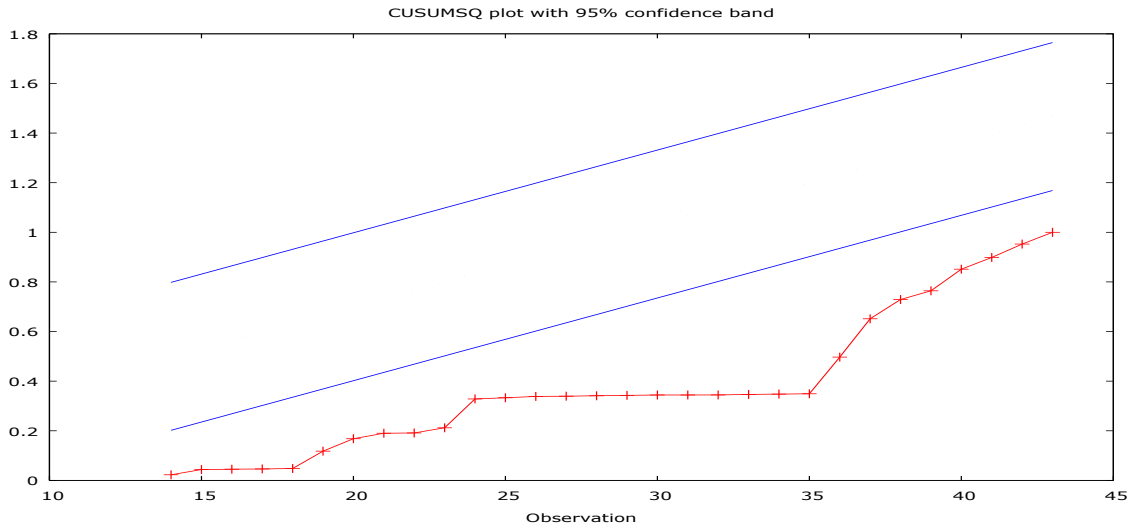

Figure 8 Plot of CUSUMSQ

4 Discussions

The findings of the research on the effect of external shock to imports, exports, and service sector productivity suggest that the effect is permanent and not temporary. The findings are consistent with the works of previous authors such as Okoroafor, Obaji, and Nwabueze (2013), Sondermann (2012), Li (2010), and KÓNYA, L. (2004). The findings support theories of unit root in time series research. The theory indicates that secondary data use in time series research must be account for to ensure the findings are robust. The policy implication is that policies to influence imports performance, exports performance, and service sector productivity will have permanent effect.

The findings of the study shows that export volume have negative effect on service sector productivity whereas, import volume have significant positive effect on service sector productivity. The findings of the study is inconsistent with the findings of previous studies such as Malchow-Møller et al. (2014), Breinlich and Criscuolo (2011) Jensen (2008); De Loecker (2007), and Girma et al. (2004) who reported that exports have positive effect on service sector productivity. The positive findings of imports and service sector productivity support the theoretical proposition that imports influence sectorial productivity whereas the finding of negative effect of exports on sectorial productivity is not in support of theories on exports and sectorial productivity.

5 Conclusions, and Policy Implications

The objective of the paper have been achieved. The effect of import volume and export volume on service sector productivity have been modelled and assessed. The findings indicate that external shock to import, export, and service sector productivity is not temporary but permanent. This show that policies designed to influence these variables will have lasting effect on them. The findings of the study show that export volume and import volume both significantly influence service sector productivity. However, whereas export volume negatively affect service sector productivity, import volumes positively affect service sector productivity.

The negative effect of export on service sector productivity do not support theory and empirical works that indicate positive effect between service sector productivity and export volume. The positive effect of import on service sector productivity support theory and empirical works that indicate same link between service sector productivity and import volume. The findings seem to suggest that policies to reduce import volumes might have deleterious

effect on service sector productivity, whereas policies to reduce export might not negatively influence service sector productivity.

Future study should consider the effect of export and import of goods and services on service sector productivity to determine if the current findings will be replicated. The long run and short run effects should be examine in future studies to be able to isolate short run effect from long run effects. Causal studies should be examine in future studies since the current studies did not consider causal issues.

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