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EXPORT-IMPORT LED ECONOMIC GROWTH IN SOUTH CAROLINA:
Evidence from ARDL Bound, Dols, GMM and Vector Error Correction Models

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Abstract: This paper investigates the impact of imports and exports on economic growth. To achieve this objective, ARDL Bounds Test, Vector Error-Correction (VECM) models, Dynamic OLS (DOLS), GMM, Granger Causality and Impulse Response are applied. ARDL bound test reveals the existence of long-run relationship among economic growth, export and import. The vector- error-correction model (VECM) indicates export has negative and import has positive effect on economic growth. The dynamic OLS (DOLS) results shows import has significant positive and export positive but not significant effect on economic growth. The GMM estimate indicates export has significant positive and import has negative (not significant) impact on growth. Impulse response analysis shows growth of gross state product has positive response to export shocks. Also, import has positive response to export. Overall results indicate the evidence of complementarity between exports and imports implying that they play pivotal role in propelling South Carolina's economic growth both in the short and in the long run. South Carolina development policy makers should remain pro-active in trade.

Key words: *Import, Export, Economic growth, ARDL*

JEL classification codes: O10; O11; O12; O40

1. INTRODUCTION

The economy of South Carolina grew by 3.88 % in the last twenty years (1998-2017). The most dominant sectors in the state are service, finance related, manufacturing and government. The top industrial sector, service grew at the highest rate (5.13%). In 2017, the State was ranked 26th in Gross State Product in the US which amounted to inflation unadjusted value of $221 billion. In most recent years the advent of BMW, Boeing, Volvo and other manufacturing firms has made manufacturing vital industrial sector that is enhancing the economy of the state.

Historical data, as shown in Figure 1 for the State of South Carolina for the last 39 years since 1980 indicates exports grew at an average of 7% while imports grew at an average of 9%.

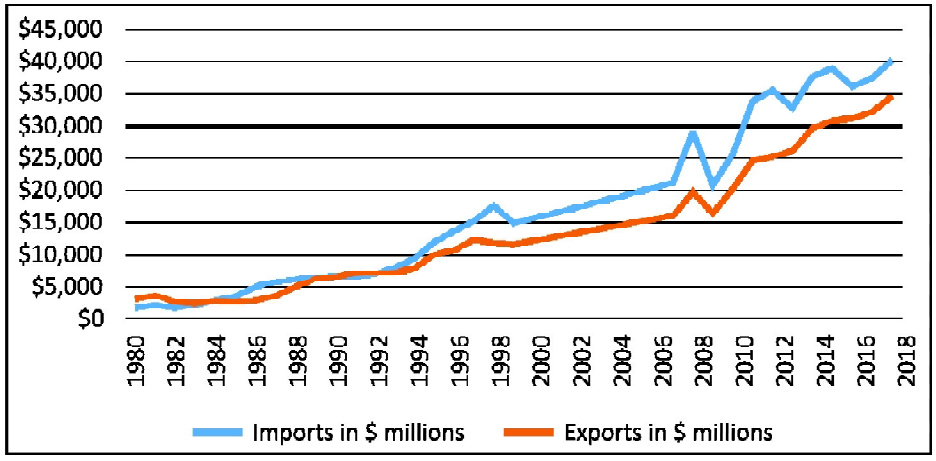

Figure 1: Historical Values of South Carolina Imports and Exports of Goods and Services

According to the report of SC Department of Commerce, the total exports increased from 24.7 billion in 2011 to 32.2 billion in 2017, an annual growth rate of 3.86%. Twenty five destination countries seem to be dominant in the value of exports as indicated in Figure 2. The top five export items in 2017 were vehicles, aircraft, machinery, rubber, and electrical machinery. As shown in Figure 3, the top five destinations were China, Canada, Germany, Mexico, and UK. There is noticeable faster growth of export activities to China.

The influence of policy to attract investors plays crucial role. For example, Miley and Associates (2010) make a note of the great impact of Boeing and BMW's

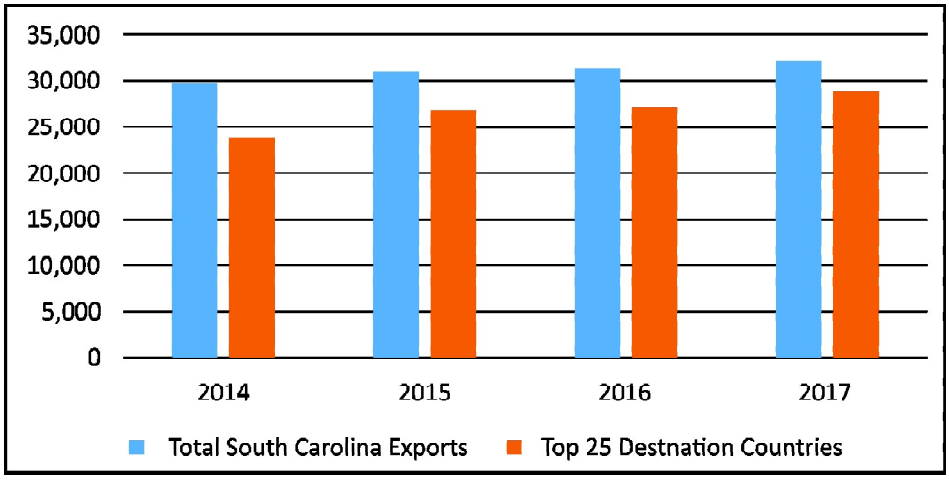

Figure 2: Total Value of South Carolina Exports and Value of the Top 25 Destination Countries

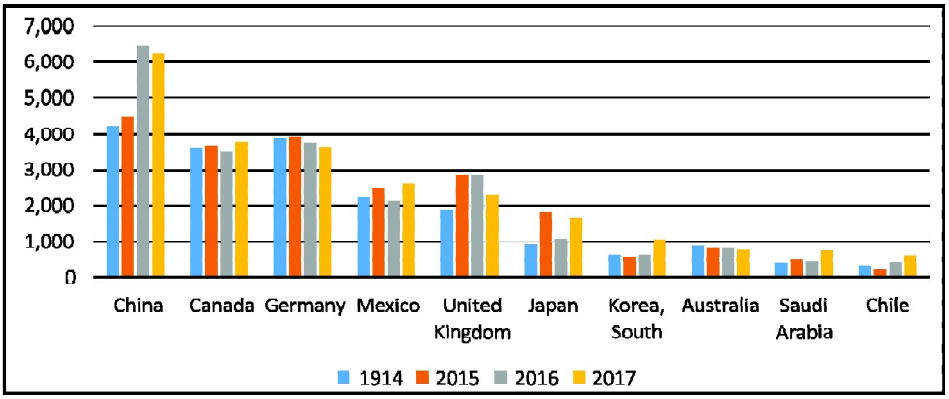

Figure 3: The top ten export destinations of South Carolina (2014-2017)

investments on manufacturing employment and gross state product. The study indicates that these two investments have significant impact on South Carolina's manufacturing jobs, and incomes of the people. Similarly, Kuker (2011) offers an analysis of incentives to the Boeing Company of South Carolina such as the House Bill 3130 that provides benefits including tax exemptions and economic development invectives enjoyed by the Airbus SAS and Boeing.

Public debates and academic writings on free trade, protectionism, trade barriers such as tariffs, quotas, and export promotions such as subsidies abound. Exports and imports have been targets of policy makers in the making of international trade policies. Therefore, it is vital for policy makers to clearly understand the positive and/or the negative impacts of exports and imports on economic development before contemplating policies that may affect the well-being of its citizens.

2. BRIEF SURVEY OF DIRECTLY RELATED LITERATURE

The body of knowledge and empirical analysis that focus on the impact of imports on gross domestic product is not as abundant as those studies that deal with the impact of exports on economic development. Review of the theory of economic growth and development suggests that the short and long term growth of an economy in terms of gross domestic product is dependent on the growth of macroeconomic variables such as capital investment, the productivity of human resources, government expenditure, new business establishments, the level of export activities and other economic activities. The focus in the literature as to the role of imports in the growth of an economy seems to be neglected. Analysis by Elmendorf and Mankiw (1998) show reduced domestic investment coupled with reduced net foreign investment over a period of time will result in a smaller domestic capital stock, which in turn implies lower output and income.

Bakari and Mabrouki (2017) analyzed the relationship between exports, imports, and economic growth in Panama using Johansen co-integration, Vector Auto Regression Model and Granger-Causality tests. Even though they find no relationship between exports, imports and economic growth in Panama, they find strong evidence of bidirectional causality from imports to economic growth and from exports to economic growth which led to the conclusion exports and imports can be the source of economic growth in Panama.

Sangho, Lim, and Park (2007) explored the relationship between exports, imports, and economic growth using quarterly data from 1980 to 2003 for the Republic of Korea. Their findings show that imports have a significant positive effect on productivity growth but exports do not. Other findings indicate that the productivity-enhancing impact of imports is due to competitive pressures arising from consumer goods imports and technological transfers embodied in capital goods imports from developed countries. Most of the study's results still hold using gross domestic product growth rather than productivity growth as the measure of economic growth.

Vardari (2015) used Granger causality technique to analyze the causality between exports, imports and economic growth in Kosovo. The results show 1) bidirectional Granger causality between GDP and export, 2) unidirectional Granger causality that runs from import to exports, and 3) unidirectional causality running from exports to import.

Trembley (1990) suggests that improvements in productivity and growth are a result of increased exports and imports, especially in the manufacturing sector. Furthermore, the author argues that sustainable increases in growth can only emerge through industrial diversification and trade liberalizations between Canada and the United States. Thirunavukkarasu and Achchuthan (2014) investigate exports and imports and the extent of their influence on economic growth in Sri Lanka. This study finds that export and import have the significant positive relationship with each other and at the same time both export and import have the significant impact on the economic growth. The authors' findings also reveal that export and import have been associated by 98 percent, which denotes that, there is strong positive association between export and import which is consistent with our results.

Zang and Baimbridge (2011) explore the relationships between exports, imports and economic growth for South Korea and Japan. They used Vector Autoregression (VAR) model and examine causality real Gross Domestic Product (GDP), real exports and real imports. The finding show that the three variables considered are cointegrated for both countries implying a long run steady state exists. In addition, there was evidence of bidirectional causality between imports and economic growth for both countries. Moreover, Japan seems to experience export-led growth, while GDP growth in South Korea has a negative effect on export growth.

The general policy tendencies are to promote exports and restrain imports because of the belief that exports generate more to economic growth while imports reduce jobs and economic growth. Studies on the impact of imports on gross state product is limited. The main purpose of this study is to explore empirically the short-run and long-run interconnection of imports and exports with economic growth. This paper attempts to answer the following four questions. First, what is the impact of import on economic growth? Second, what is the impact of exports on economic growth? Third, does import affect export or vice versa? Fourth, what are the short run and long run elasticity of exports and imports with respect to changes in economic growth?

3. EMPIRICAL METHODOLOGIES, DATA AND RESULTS

Annual data from 1980 through 2018 are employed. Gross State Product (GSP) is obtained from Bureau of Economic Analysis, U.S. Department of Commerce and the department of Labor and workforce development. South Carolina exports (EXP) and imports (IMP) are collected from the website *http://www.census.gov*, by navigating to Business & Industry, Foreign Trade, and U.S. International Trade Data.

3.1. Cointegration - ARDL Bounds Testing Procedure

This study applies the ARDL bound testing approach to investigate the co-integration relationship among gross state product (GSP), export and import. Also, this study applies Dynamic OLS, and GMM methodology. The following base equations in double-log are specified:

$$LGSP_t = \alpha_0 + \alpha_1 LEXPt + \alpha_2 LIMPt + \varepsilon_t \quad (1)$$

$$LEXP_t = \beta_0 + \beta_1 LIMPt + \mu_t \quad (2)$$

$$LIMPt_t = \gamma_0 + \gamma_1 LEXPt + \mu_t \quad (3)$$

Where, LGSPt = Natural Log of Gross State Product; $LEXP_t$ = Natural Log of South Carolina Exports; $LIMP_t$ = Natural Log of South Carolina Imports. A priori, expected signs of α_1, α_2, β_1 and γ_1 are greater than zero.

After the selected long run model is estimated, then the short run dynamic elasticity of the variable within the framework of the errors-correction representation of the ARDL model is estimated as follows in equation 4. The ARDL representation of equation (1) is shown below:

$$\Delta LGSP_t = \beta_0 + \sum_{i=1}^{p} \beta_2 \Delta LGSP_{t-i} + \sum_{i=1}^{p} \beta_3 \Delta LEXP_{t-i} + \sum_{i=1}^{p} \beta_4 \Delta LIMP_{t-i} + \gamma_1 LGSP_{t-1} + \gamma_2 LEXP_{t-1} + \gamma_3 LIMP_{t-1} \quad (4)$$

Where Δ is the first difference, the parameters β_{ij} are the short-run parameters and γ_{ij} are the long run multipliers respectively in equation (4). The null and alternative hypotheses are:

$$H_0 : \gamma_1 = \gamma_2 = \gamma_3 = 0$$

$$H_1 : \gamma_1 \neq \gamma_2 \neq \gamma_3 \neq 0$$

Once the selected long run model is estimated, then the short run dynamic elasticity of the variable within the framework of the unrestricted error-correction representation of the ARDL model is estimated as follows in equation 5.

$$\Delta LGSP_t = \beta_0 + \beta_1 \Delta LGSP_{t-i} + \sum_{i=0}^{p} \beta_2 \Delta EXP_{t-i} + \sum_{i=0}^{p} \beta_3 \Delta LIMP_{t-i} + \Phi ECM + \mu_t \quad (5)$$

Where Φ_i is the speed of adjustment and ECM_{t-i} is the residual obtained from equation (5)

3.2. Dynamic OLS (DOLS)

We will complement the ARDL co-integration test with the dynamic OLS (DOLS) estimates. The panel Dynamic Ordinary Least Squares (DOLS) methodology will provide the estimation of the statistic long-run relation augmented by leads and lags. This will improve the efficiency of the long-run estimates but does not provide guidance on the short-run behavior. The following model is estimated:

$$LGSP_t = \delta_0 + \delta_1 LEXP_t + \delta_2 LIMP_t + \varepsilon_t \quad (6)$$

3.3. GMM method

To find the short-run relationships, the GMM methodology developed by Arellano and Bond (1991) and Arellano and Bover (1995) is applied. The advantage of this methodology is that it points out the econometric problems caused by unobserved effects and endogeneity of the independent variables in lagged–dependent-variable models such as income growth. This methodology allows the relaxing of strong erogeneity of the explanatory variables by allowing them to be correlated with current and previous realizations of the error term. The following model is estimated:

$$\Delta LGSP_t = \alpha_0 + \alpha_1 \Delta LEXP_t + \alpha_2 \Delta LIMP_t + \varepsilon_t \quad (7)$$

3.4. Stationarity Tests

In order to examine the integrating level of variables, DF-GLS, Philips–Peron, and Ng-Parron tests are applied. The results are reported in Table 1.

Table 1
Stationarity Test for all Variables

Variable	*Log Level*		*Log Differences*	
	Without Trend	*With Trend*	*Without Trend*	*With Trend*
DICKEY-FULLER-GLS				
LGSP	-0.10683	-0.72802	-1.4084	-5.2519***
LEXP	-2.16925	0.83115	-5.1731	-5.5408***
LIMP	-0.32656	-1.7733	-6.2322	-7.25224***
PHILIPS-PERRON				
LGSP	5.9116*	-3.4416	-4.1952***	-5.59043***
LEXP	-0.42199	-2.3105	-4.1952**	-5.6667****
LIMP	-2.27113	-6.79318***	-2.0507	-7.1095***
Ng-PERRON				
LGSP	-3.9092	-1.5778	-3.96551	-11.118**
LEXP	1.28844	7.54383	-17.9488***	-18.2093***
LIMP	-0,9977	-4.9319	-18.3476***	-23.8037***

Note 1: *, **, *** denote stationarity at 10%, 5%, and 1% significance level;

Note 2: LGSP= Natural Log of Gross State Product, LEXP= Natural Log of Export, LIMP=Natural Log of Import

These results in Table 1 indicate that after differencing the variables, all variables were confirmed to be stationary. The ARDL test does not require the pretesting of variables, the test gives guidance as to whether ARDL is applicable or not. ARDL is applicable to the analysis of variables which are integrated of order zero {1(0)} or one {1(1)}. It is clear from the tests that variables are stationary after first difference. So, the ARDL bounds test can be done satisfactorily.

3.5. Unrestricted ARDL Model Estimates

Table 2 presents the unrestricted ARDL model estimates of equation (2). The model in equation 2 is referred to as unrestricted equilibrium correction model. We estimated the long-run parameters and respective standard errors using OLS. Table 2 shows values of long-run (σ) and short run (α) with their t-statistics. The coefficients of gross state product growth lagged 1period (LGSP) is positive and significant. Log of export, LEXP (lag 2), log import, and one period log of imports (LIMP) are all positive and significant.

3.6. Co-integration and ARDL-ECM Model

To check the long-run relationship among the variables in the general model, ARDL bounds testing procedure is applied. The results of the bounds F-test are reported in Table 3.

Table 2
Estimates of ARDL Model (1, 2, 2)
Dependent Variable: LGSP; Independent Variable: LEXP, LIMP; Model: Schwarz criterion (SIC)

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.**
LGSP(-1)	0.925599	0.048892	18.93147	0.0000
LEXP	0.089770	0.041758	2.149776	0.0404
LEXP(-1)	-0.178113	0.050339	-3.538236	0.0014
LEXP(-2)	0.115589	0.032775	3.526701	0.0015
LIMP	0.003040	0.031077	0.097836	0.9228
LIMP(-1)	0.078682	0.037273	2.110960	0.0438
LIMP(-2)	-0.073468	0.028813	-2.549844	0.0165
C	0.574019	0.259318	2.213573	0.0352
R-squared	0.999308	Adjusted R-squared		0.999134

Table 3
ARDL Error Correction Short-run and Bound Test
Dependent Variable: Δ(LGSP); Independent Variables: Δ(LEXP), Δ(LIMP)

ECM Regression
Case 3: Unrestricted Constant and No Trend

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
C	0.574019	0.104110	5.513581	0.0000
Δ LEXP)	0.089770	0.030189	2.973657	0.0060
Δ (LEXP(-1))	-0.115589	0.029292	-3.946033	0.0005
Δ (LIMP)	0.003040	0.025181	0.120746	0.9048
Δ (LIMP(-1))	0.073468	0.023136	3.175516	0.0036
Φ(ECM)	-0.074401	0.014713	-5.056964	0.0000
R-squared	0.677478	Adjusted R -Squared		0.623724

Error-correction and Long Run Form and Bounds Test

F-Bounds Test		*Null Hypothesis: No levels relationship*		
Test Statistic	*Value*	*Signif.*	*I(0)*	*I(1)*
F-statistic	7.956010	10%	3.17	4.14
k	2	5%	3.79	4.85
		2.5%	4.41	5.52
		1%	5.15	6.36

Akanke Information Criterion (AIC) is used to obtain the order of lags on the first differenced variables in equations (2). Next, bound F-test is applied to equation (2) to establish a long-run relationship between the variables under study.

Also, in Table 3, the estimated ARDL short-run error-correction model result is presented. The coefficients of Δ LEXP and Δ LIMP are positive and significant

at 1 percent level. The coefficient of error-correction term Φ(*ECM*) is negative as expected and significant at 1 percent level.

The result of the ARDL Bounds Test is significant at 1 percent level and it suggests that there exists a long- run relationship among LGSP, LEXP, and LIMP. Therefore, the empirical findings lead to the conclusion that a long run relationship exists among growth of state product, export and import. The computed F-value at 7.956 being above the upper-bound F-value in 2 columns in Table 3, reject the null hypothesis of no- cointegration at 1 percent level of significance. Thus, the evidence lends clear support in favor of cointegrating relationship among LGSP, LEXP and LIMP. The presence of a cointegrating relationship among economic growth, export, and import requires the estimation of the short-run dynamic model of the ARDL. Table 3 also reports the results of the short-run dynamic coefficients. Export is significant at 1 percent level and import lagged 1 period is positive and significant at 1 percent at level. The results indicate both export .and import have positive significant impact on economic growth. However, export lagged 1 period has negative effect on economic growth. The error-correction term is negative, as expected, and significant at the 1% level. Besides confirming the existence of cointegration based on the ARDL Error- Correction model, the result shows that 7.4 % of the disequilibria in the growth arising out of past shocks will be corrected in the current period, the speed of adjustment is relatively low. Table 4 presents the unrestricted ARDL model estimates of equation (2).

Table 4
ARDL(1, 0) Estimate

Dependent Variable: LEXP; Independent Variable: LIMP
Model selection method: Schwarz criterion (SIC)

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.**
LEXP(-1)	0.652454	0.065193	10.00798	0.0000
LIMP	0.310756	0.057686	5.387061	0.0000
C	0.327584	0.170699	1.919067	0.0632
R-squared	0.988499	Adjusted R-squared		0.987842

Table 5
ARDL Error Correction Regression and F-Bound Test

Dependent Variable: Δ(LEXP)
ECM Regression

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
C	0.327584	0.050090	6.539928	0.0000
CointEq(-1)*	-0.347546	0.063268	-5.493207	0.0000
R-squared	0.455991	Mean dependent var		0.063151
Adjusted R-squared	0.440879	S.D. dependent var		0.114147

F-Bounds Test			*Null Hypothesis: No levels relationship*	
Test Statistic	*Value*	*Signif.*	*I(0)*	*I(1)*
F-statistic	14.66856	10%	4.04	4.78
K	1	5%	4.94	5.73
		2.5%	5.77	6.68
		1%	6.84	7.84

Table 5 presents the results of error-correction and F-Bound test. Error-correction term is significant at 1 percent level and F-Bound test (14.66856) is significant at 1 percent level. Results reject the null hypothesis of no-cointegration at 1 percent level of significance. Also, F-Bound Test is significant at 1 percent level. This evidence lends clear support in favor of cointegrating relationship and long-term relationship between LIMP and LEXP.

The results of ARDL estimates, short-run error correction and ARDL Bound test of the model where, LIMP is dependent and LEXP is independent variable, are presented in Tables 6 and 7 respectively. The error- correction term is significant at 1 percent and computed F-value for bound test - 4.604 - is significant at 10 percent. This evidence lends clear support in favor of long-term cointegrating relationship between LIMP and LEXP.

Table 6
ARDL (1, 1)Dependent Variable:
LIMP; Independent Variable: LEXP

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.**
LIMP(-1)	0.814857	0.093171	8.745836	0.0000
LEXP	0.807843	0.169600	4.763218	0.0000
LEXP(-1)	-0.645537	0.155956	-4.139223	0.0002
C	0.270438	0.238271	1.135005	0.2643
R-squared	0.986983	Adjusted R-squared		0.985835

Table 7
ARDL Error Correction Regression and F-Bound Test

Dependent Variable: Δ(LIMP)

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
C	0.270438	0.077826	3.474891	0.0014
Δ(LEXP)	0.807843	0.155101	5.208485	0.0000
CointEq. (-1)*	-0.185143	0.060130	-3.079034	0.0041
R-squared	0.464412	Adjusted R-squared		0.433807

F-Bounds Test			*Null Hypothesis: No levels relationship*	
Test Statistic	*Value*	*Signif.*	*I(0)*	*I(1)*
F-statistic	4.604789	10%	4.04	4.78
k	1	5%	4.94	5.73
		2.5%	5.77	6.68
		1%	6.84	7.84

To complement the ARDL co-integration test, the dynamic OLS (DOLS) estimate is applied. The Dynamic Ordinary Least Squares (DOLS) estimates provide statistic long-run relation augmented by leads and lags. This will improve the efficiency of the long-run estimates but does not provide guidance on the short-run behavior. The estimated results are reported in Table 8. The coefficients of export (0.17055) is positive but it is not significant and coefficient of import (0.4914) is positive and significant at 1% level, suggesting that they will lead the growth rate in the long run.

Table 8
Dynamic Least Squares (DOLS)
Dependent Variable: LGSP; Independent Variable: LEXP, LIMP

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
LEXP	0.170553	0.106595	1.600018	0.1212
LIMP	0.491416	0.095187	5.162622	0.0000
C	5.308163	0.147517	35.98330	0.0000
R-squared	0.991515	Mean dependent var		11.51796
Adjusted R-squared	0.989000	S.D. dependent var		0.537909

This paper also applies the GMM method developed by Arellano and Bond (1991) and Arellano and Bover (1995). The advantage of this methodology is that it points out the econometric problems caused by unobserved effects and endogeneity of the independent variables in lagged–dependent-variable models such as gross state product growth. This methodology allows the relaxing of strong endogeneity of the explanatory variables by allowing them to be correlated with current and previous realizations of the error term.

The results are reported in Table 9. The J-Statistics is significant at 1% level which indicates the model is correctly specified. The coefficients of export is positive and significant at 1% and the coefficient of import is negative and significant at 9 percent level suggesting that export has positive and import has negative effect in the short run on the gross state product growth rate.

Table 9
Generalized Method of Moments
Dependent Variable: LGSP; Independent Variable: LEXP, LIMP

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
LEXP	1.911518	0.393130	4.862306	0.0000
LIMP	-0.659881	0.385373	-1.712319	0.0957
R-squared	0.453661	J-statistic		30.26034
Adjusted R-squared	0.438051	Prob (J-statistic)		0.000000

3.7. Vector Error correction Estimates

On the evidence of co-integration, Vector-Error model is implanted. The estimated results are reported in Table 10. The coefficient of error-correction term (ö) has expected negative sign for convergence toward long-run equilibrium. However, its low magnitude indicates very slow pace of adjustment for convergence toward long-

Table 10
Vector Error Correction Estimates
t-statistics are in [ ]

Error Correction:	*Δ(LGSP)*
φ	-0.006459
	[-1.38962]
Δ(LGSP(-1))	0.461975
	[2.67349]
Δ(LGSP(-2))	-0.28091
	[-1.64412]
Δ(LGSP(-3))	0.302426
	[2.19132]
Δ(LEXP(-1))	-0.105428
	[-3.12044]
Δ(LEXP(-2))	0.032853
	[0.83060]
Δ(LSEXP(-3))	-0.071049
	[-1.81953]
Δ(LIMP(-1))	0.080635
	[2.86277]
Δ(LIMP(-2))	-0.006476
	[-0.19250]
Δ(LIMP(-3))	0.092498
	[3.01849]
C	0.021516
	[2.59120]
R-squared	0.735992
Adj. R-squared	0.621206
Akaike AIC	-5.3287

run equilibrium. The lagged 1 and 3 coefficients of export indicate negative and lagged 1 and 3 period's coefficients of import have positive and significant impacts on economic growth. The R2 for the model shows 62.12 percent of the current change in gross state product is accounting by the explanatory variables. The negative AIC value indicates good fit of the model with minimum loss of information.

3.8. Elasticity

Short-term elasticity (from GMM Estimates – Table 11A) indicates export elasticity with respect to LGSP is 1.91, which is very high. Long-term-elasticity Table 11(B) (DOLS) estimates. Short-term elasticity (GMM Estimates) with respect to GSP is 0.17, which is relatively low. Import elasticity with respect to LIMP in DOLS estimate is -0.659881 which is low. Import elasticity in short-run (GMM) estimates is 0.49, which is positive.

Table 11A
Short-run Elasticity Estimates with Respect to LGSP

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
LEXP	1.911518	0.393130	4.862306	0.0000*
LIMP	-0.659881	0.385373	-1.712319	0.0957**

Note: *, ** Show significance levels at the 1% and 10% levels

Table 11B
Long-run Elasticity Estimates with Respect to LGSP

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
LEXP	0.170553	0.106595	1.600018	0.1212
LIMP	0.491416	0.095187	5.162622	0.0000*

Note: * Show significance levels at the 1% levels

3.9. Granger Causality Test and Impulse Response

The Granger Causality (Table11) shows unidirectional causality from GSP to export and import, and import to export.

The Granger causality test indicates unidirectional causality runs from gross state product to export and import. Also, unidirectional causality runs from import to export.

The Impulse Response analysis indicates similar results. Impulse response indicates the growth of gross state product has positive response to export and import has positive response export. Results imply complementary relationship between export and import. Impulse response analysis shows growth of gross state product (LGSP) has positive response to export. Also, import indicates positive response to export.

3.9. Parameter stability tests

We examined the stability of the parameters since model misspecification may arise as a result of unstable parameters. Pesaran and Pesaran (1997) suggest that one should always employ the cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMQ). In Figures 4.1 and 4.2, the stability test, the model uses LGSP as the dependent variable run against LEXP and LIMP as independent variables.

It can be seen from Figures 4.1 and 4.2 that the plot of CUSUM and CUSUM SQ stay within the critical 5% bounds that confirms the long-run relationships among variables and thus indicates the stability of coefficients.

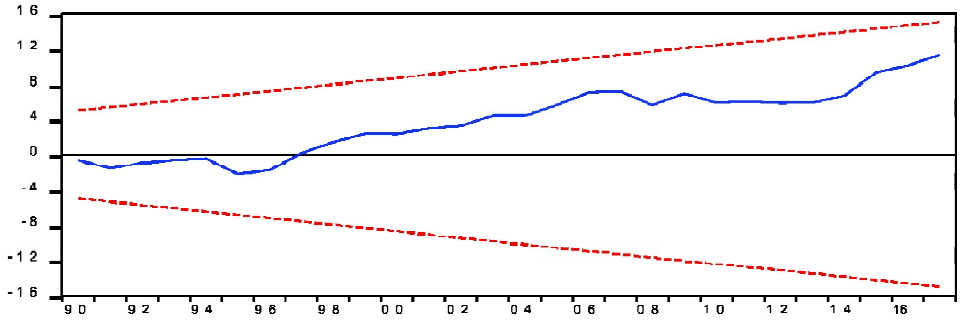

Figure 4.1: Cumulative Sum (CUSUM) of Recursive Residuals

Dependent variable: LGSP; Independent variables LEXP and LIMP

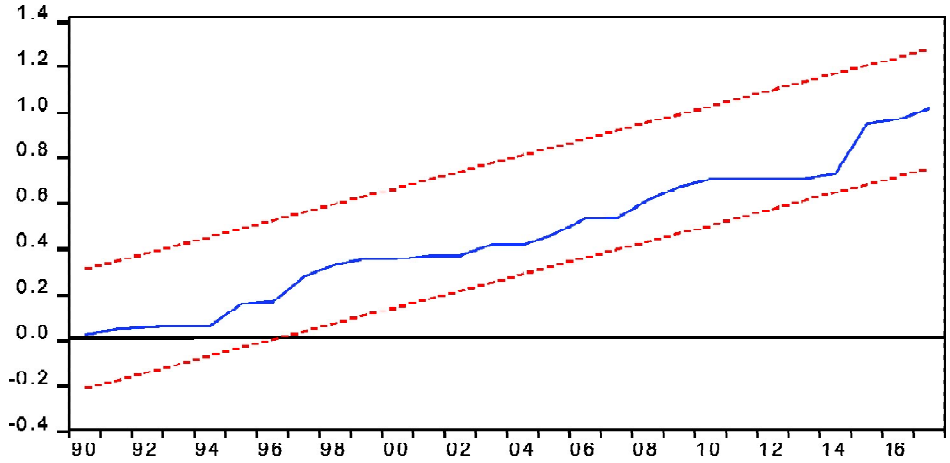

Figure 4.2: Cumulative Sum of Squares (CUSUMSQ) of Recursive Residuals

Dependent variable: LGSP, Independent variables LEXP and LIMP

Table 12
Pairwise Granger Causality Tests

Lags: 1

Null Hypothesis:	*Obs*	*F-Statistic*	*Prob.*	*Conclusion*
LEXP does not Granger Cause LGSP	38	0.70780	0.4059	Fail to reject
LGSP does not Granger Cause LEXP		9.82338	0.0035	Reject
LIMP does not Granger Cause LGSP	38	0.10616	0.7465	Fail to reject
LGSP does not Granger Cause LIMP		7.52104	0.0095	Reject
LIMP does not Granger Cause LEXP	38	8.34569	0.0066	Reject
LEXP does not Granger Cause LIMP		0.30063	0.587	Fail to reject

4. SUMMARY AND CONCLUSION

This paper investigates the dynamic impact of export and import on economic growth, measured by growth of gross state product of South Carolina for the period 1980-2018. The results of the ARDL bound test and the coefficient of error-term, which is negative and significant at 1 percent, indicate there exists significant long-run relationship among growth, export and import. The results of vector- error model (VECM) show export has negative and import has positive effect on economic growth. The dynamic OLS (DOLS) estimates (which provide long-term impact) indicate that import has highly significant positive and export positive but not significant effect on economic growth. The GMM estimate (short term) shows that export has significant positive and import has negative (not significant) impact on economic growth of South Carolina. The coefficient of the error-term (ECM (t-1)) is negative, as expected and ARDL F-bound test is significant at 1 percent level. Results indicate there exists long-rum equilibrium relationship among the variables with reinforcing feedback effects. Impulse response analysis shows growth of gross state product (LGSP) has positive response to export. Also, import has positive response to export. There is evidence of complementarity between exports and imports. Results imply that export and import play pivotal role in propelling South Carolina's economic growth both in the short and in the long run. South Carolina development policy makers should remain pro-active in trade.

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