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EXPORTS AND ECONOMIC GROWTH IN SOUTH AFRICA: EVIDENCE FROM COINTEGRATION AND GRANGER-CAUSALITY TESTS

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Abstract

This short note applies the Granger causality test to empirically determine the relationship between exports and economic growth in South Africa during the period 1964-1993. Our evidence fails to verify the export-led hypothesis but supports the existence of reverse causality.

Introduction

The causal relationship between exports and growth in developing economies has been of considerable interest among development economists because of its tremendous policy implications. Obviously, if it can be shown that export growth does not cause income growth but instead, a reverse causal relationship exist, policy-makers would therefore not need to promote export expansion policies with the aim of achieving income growth. It may, instead, be necessary for policy-makers to concentrate their resources on the production of non-export goods and services, which could eventually cause growth in exports. Many empirical studies have attempted to test for the existence of a causal relationship between exports and economic growth. The results have been mixed. The existing empirical evidence ranges from support for the bi-directional causal relationship to one-way directional causal relationship, either from exports to economic growth or from economic growth to exports and to non-causal relationship between exports and economic growth [see, Chow, 1987; Jung and Marshall, 1985; Ahmad and Kwan, 1991; Hutchinson and Singh, 1992; Behmani-Oskooee et al, 1991; and Oxley, 1993].

Many of the above mentioned empirical studies were conducted with the implicit assumption that the time-series data used were stationary in their levels and thus integrated of the order zero, I (0). But, it has recently been shown that many macroeconomic series are non-stationary in their levels and thus would

lead to spurious results if the OLS technique is used. To avoid this shortcoming, this paper uses the cointegration technique
e - which allows us to use the non-stationary data for estimation of cointegrating parameters, on the condition that the data series are stationary after first-differencing and thus, integrated of the order one, I(1). A necessary requirement for the use of the cointegration technique, however, is that the variables under consideration must be integrated of the same order. Then, we can surmise that both variables are cointegrated, if a linear combination of the variable is stationary. Cointegration in this context therefore confirms that the variable series will not drift far apart over the lone run, which implies the existence of Granger-causal relationship in at least one direction [see, Oxley, 1993].

In testing for causality, many of the previous studies have incorporated arbitrary numbers of lags. But, the optimal number of lags can be determined by using a two-step procedure, which requires combining the Granger causality test with the Final Protection Error (FPE) [see Akaike, 1969; Ahmad and Kwan, 1991; and Hutchinson and Singh, 1992].

The objective of this research note is to apply the Granger causality test to determine the relationship between export growth and economic growth in the South African economy during the period 1964-1993. The data are obtained from various issues of International Financial Statistics published by the World Bank. We will, first, attempt to establish, with the use of cointegration technique, whether a long run relationship exists between exports and economic growth in the south African economy during the period under study. If cointegration is found, we will, then, attempt to identify the direction of causality between the two variables with the use of the Granger causality tests procedure. In doing so, the FPE criterion is adopted to specify the optimal lags necessary in explaining the causal relationship that may exist.

Methodology

The export-led hypothesis can be specified as the following bivariate linear model:

$$lnRGDP_t = \alpha_0 + \alpha 1nRX_t + e_t \qquad (1)$$

where RGDP represents level of real GDP, RX refers to the level of real exports, e_t is the error term and t indicates the time period. All variables are expressed in natural logarithms. The unit-root test procedure developed by Dickey and Fuller (1979) is used in testing the null-hypothesis that the variables in equation (1) are non-stationary, I(1), versus the alternative hypothesis that they are stationary, I(0). If we can show that, although, the two variables are non-stationary in their levels but, as a linear combination, they are stationary after first-differencing [i.e., I (1)], then the two series are said to be cointegrated. We will present the results, using the recently formulated and more powerful maximum likelihood (MLE) procedure [see, Johansen (1988); and Johansen and Juselius 1990].

Following Oxley (1993), after the confirmation of the existence of cointegration between the variables in equation (1), the Granger causality test can simply be represented by the following regression equations:

$$DlnRGDP_t = \alpha + \sum_{I=1}^{m} \alpha_i DlnRGDP_{t-I} + \sum_{j=1}^{n} \gamma_\iota DlnRX_{t-I} + \delta EXT_{t-1} + \xi_\tau \qquad (2)$$

$$DlnRX_t = a + \sum^{q} b_i \, DlnRX_{t-I} + \sum^{r} c_i DlnRGDP_{t-I} + dECT_{t-1} + \Phi_t \qquad (3)$$

where DlnRGDP and DlnRX denote the first-differences of the level of exports and GDP, respectively, expressed in natural logarithms. ECT_{t-1} is the error correction term, lagged by one period, obtained from the Johansen cointegrating regression of equation 1. ξ_τ and Φ_t represent the error terms of each of the respective equations above. If the Wald F-statistic are significantly different from zero in both equations (2) and (3), we can conclude that the causality implied by the existence of cointegration between exports and economic growth is bidirectional. However, if the Wald F-statistics of any of the two models is shown to be insignificantly different from zero, then we cannot reject the null hypothesis that the lagged independent variable does not Granger-cause the dependent variable. For example, if the Wald statistics is statistically insignificant in equation (2), we can conclude that exports do not Granger-cause economic growth.

Empirical Results

The unit root test results are presented in Table 1. The DF and ADF results confirm that the variable series in our model are non-stationary in their levels. However, after first differencing, the DF and ADF results show that they are stationary.

Table 1

Unit Root Tests[a]

		Variable	Level	First Diff.	Lag	
	DF	lnRGDP lnRX	-1.075 (-3.573) -0.773 (-3.573)	-4.879 (-3.579) -3.846 (-3.579)	0 0	
	AD F	DlnRGDP DlnRX	-0.822 (-3.579) -1.650 (-3.579)	-4.432 (-3.587) -3.801 (-3.587)	1 1	

[a] tests were conducted for the series with trend. 95% critical values are presented in parentheses.

The Johansen's MLE test results for cointegration are presented in Table 2. The calculated Ljung-Box statistic for the dependent variable revealed that a maximum lag of 1 in the VAR model is appropriate. The actual maximal eigenvalue statistic, $\lambda_1$max, rejects the null hypothesis that there is no cointegration between the variables, i.e., r=0, at the 95% confidence level, in favor of the alternative hypothesis that there is one cointegrating vector, i.e., r=1. The observed trace statistic, λ_2 trace, also confirms this finding at the 95% confidence level. The existence of cointegration implies that there is a long-run relationship between the variables in our model. Using FPE criteria, we were able to determine that the optimal lag for the causality test are m=1, n=2 for equation (2) and q=1, r=4 for equation (3).

Table 2
Results of Johansen's Maximum Likelihood Procedure

Null Hypothesis		Critical Values			Critical Values		
	$\lambda_1$max	95%	90%	$\lambda_2$trace	95%	90%	
r=0	21.60	14.07	12.07	24.33	15.41	13.33	
r≤1	2.73	3.76	2.69	2.73	3.76	2.69	

Variables in the cointegrating vectors: lnRGDP and lnRX.
Maximum lag in VAR = 1.

The results of the Granger-causality test are reported in Table 3. The Wald F-statistic for equation (2) is 1.31, which is statically insignificant at the 5% level. The indication is that the null hypothesis that past exports do not Granger-cause economic growth cannot be rejected. For equation (3), however, the Wald F-statistic is 13.16, which is significant at the 5% level. This implies that the null hypothesis that past economic growth variable does not Granger-cause export growth can be rejected. Therefore, we can conclude that economic growth Granger-causes export in the South African economy during the period studied.

Table 3
Granger-Causality Tests

Equation	Wald-test Statistic		Causal Relationship
(2)	1.31	(.519)	No
(3)	13.16*	(.011)	Yes

* Indicates significance at the 5% level. Figures in parenthesis are probability values.

Conclusion

This paper examined the Granger-causality relationship between exports and economic growth for the South African economy using the cointegration technique and the Granger-causality tests. The evidence presented here indicates that exports and economic growth are cointegrated, which confirms the existence of a long run relationship between the two variables. In addition, our evidence seems to verify the notion that economic growth Granger-causes export growth, but fails to support the export-led hypothesis that export growth causes economic growth for the South African economy for the period under study.

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