THE CAUSAL RELATIONSHIP BETWEEN EXPORTS AND ECONOMIC GROWTH IN THE NINE PROVINCES OF SOUTH AFRICA: EVIDENCE FROM PANEL-GRANGER CAUSALITY TEST*

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Abstract

This paper examines the causal relationship between exports and growth in nine provinces of South Africa for the period 1995-2011, using panel causality analysis, which accounts for cross-section dependency and heterogeneity across regions. Our empirical results support unidirectional causality running from economic growth to exports for Mpumalanga only; a bi-directional causality between exports and economic growth for Gauteng; and no causality in any direction between economic growth and exports for the rest of provinces. This suggests that export expansion might not be an efficient strategy to improve provincial economic performance in South Africa as neither exports nor economic growth is sensitive to each other in almost all provinces.

Keywords: Exports; Economic Growth; Dependency and Heterogeneity; Panel Causality Test

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1. Introduction

In the development literature, export expansion has been advocated as one of the effective strategies to improve the economic performance of the developing countries. There are however two main conflicting views about the relationship between export and economic growth. One strand of the literature is favourable to the export-led growth hypothesis while the other supports the growth-driven export model. The export-led growth hypothesis is derived from the comparative advantage theory which asserts that trade expansion results in more productive and efficient allocation of resources favourable to economic growth. On the other hand, the growth-driven export model emphasizes that increasing economic activity through human capital and technology improvements stimulates export growth since producers need new foreign markets to absorb the subsequent increase in supply. The ambiguous state of the literature may reveal the cross-country heterogeneities in the composition of exports, therefore requiring the export-growth nexus to be investigated empirically.

Number of studies have examined the relationship between export and economic growth in both developed and developing countries with their different results confirming the unclear theoretical link between the two variables. Studies that are favourable to the export-led-growth hypothesis include Mickaely (1977), Balassa (1978, 1985), Tyler (1981), Feder (1982), Ram (1987), Chow (1987), Giles *et al.* (1992), Thornton (1996), Doyle (1998), Xu (1996), Erfani (1999), Balaguer (2002), Shirazi (2004), Jordaan and Eita (2007), Naghshpour (2012), Saad (2012) and Tsaurai and Odhiambo (2012). In contrast to these authors, Jung and Marshall (1985), Shan and Tian (1998), Oxley (1993), Giles and Williams (2000), Safdari *et al.* (2011), Tang and Lai (2011), and Abbas (2012) report empirical evidence of growth-driven exports hypothesis. Though number of empirical studies fall in the first two categories, few authors, including Kwan and Cotsomitis (1991), Amoateng and

Amoako-adu (1996), Sun and Shan (1999), Hatemi-J (2002), Mah (2005), Awokuse (2007), Jordaan and Eita (2009), Ray (2011) and Balcilar and Ozdemir (2013) have documented the evidence of a bi-directional causality between exports and economic growth. Fall apart these three categories, are studies which find no evidence of causality in any direction between the two variables. These include: Hsiao (1987) Ahmad and Kwan (1991) Jin and Yu (1996) Ahmed *et al.* (2000), Ramos (2001) Ribeiro, (2001), Mishra (2011) and Pazim (2009).

Most of these studies are either based on cross-sectional methodology or standard time series models. Unlike the latter body of work, results from cross-sectional studies are generally favourable to the export-led growth hypothesis. However, the positive correlation interpreted as evidence of export-led growth hypothesis is also compatible with the feedback effects, thus raising some econometric issues such as spurious correlation and endogeneity (Giles and Williams, 2000). As a result of these limitations, the time series studies emerge that explicitly focus on the causality analysis; Granger causality test being the most prevalent approach. Because Ganger causality test is built on arbitrary choice of the lag length, some studies emphasize the use of Error Correction Model (ECM) with proper selection methods of the lag length[1]. However, the conclusions regarding the direction of the causality between the two variables remain sensitive to information set, lag order and non stationarity (Giles and Williams, 2000). In light of these considerations, the aim of this paper is therefore to re-investigate the causal relationship between exports and economic growth in South Africa using a more robust methodology which combines the advantages of cross- section data and time series analysis as discussed below.

Like many developing countries, South Africa has embarked in the trade liberalization since 1980s on the premise that trade openness enhances economic growth. While poverty remains the biggest development challenge in South Africa, understanding the relationship between export and economic growth may provide policymakers with information as to

[1] Such as Akaike information criteria, Schartz information criteria, log-likelihood ratio among others.

whether the country is better served by orienting trade policy to export promotion or to import substitution. Consistent with the contradictory results from the literature, empirical evidence on the export-growth nexus in South Africa remains controversial. Rangasamy (2009) and Ziramba (2011) find a unidirectional Granger-causality from exports to GDP based on an ECM while Dodaro (1993) and Ukpolo (1998) report a unidirectional causality running from growth to export expansion in South Africa using Granger causality approach. Bahmani-Oskooee and Alse (1993) and more recently, Cipamba Wa Cipamba (2013) establish the existence of a bidirectional causal effect between South African export and economic growth based on an ECM. Similar method is further employed by Dutt and Ghosh (1996) to provide evidence of no causal relationship between the two variables. Given the above mentioned shortcomings associated with the methodology used in these studies, the observed difference may be attributed to methodological flaws. Moreover, being at the national level, results from these studies are questionable as they failed to account for cross-province socio-economic discrepancies which are likely to affect the export-growth relationship[2].

South Africa consists of nine heterogeneous provinces in terms of economic development, urbanization, sectoral wealth and human capital among others. After two decades of trade liberalization policy, different patterns emerge from the export trend relative to GDP across provinces. Gauteng appears to be the leading province in terms of total export as a percentage of GDP since 1997. In Limpopo, Free State and Mpumalanga, the trend in exports relative to GDP seems constant over the period of 1995-2011; thus implying that their GDP may be less dependent on the manufacturing sector. The remaining provinces show significant fluctuations in their export trend during the sixteen years sample period. The evolution of Exports and GDP in real terms depicted in Figure 1 confirms the unclear

[2] This line of reasoning is consistent with Fosu (1990), Giles *et al*. (1992), Boltho (1996), Ghatak *et al*. (1997) and Tuan and Ng (1998) who provide different conclusions on the export-growth relationship based on sectoral analysis.

Figure 1: Real exports and real GDP across provinces: 1995-2011

Notes: Real GDP (solid line, scale on the left axis), Real Exports (dotted line, scale on the right axis).

relationship between the two variables across provinces. Although all provinces are subject to the same monetary and fiscal policies, political and legal environments, as well as financial market conditions, it is worth noting that the effects of macroeconomic policies might be different across provinces. For instance, GDP in the rural provinces are likely to depend more on the agricultural sector while the manufacturing sector is expected to be the main driving force of the GDP in the urban provinces. This may result in different conclusions on the relationship between export and economic growth, hence providing the rationale to investigate such relationship at a less aggregated level.

Against this backdrop, we apply the bootstrap panel Granger causality approach on provincial level data in South Africa to assess the causal link between export and growth over the period of 1995-2011. Unlike previous studies, our methodology combines the benefits of panel and time series techniques by treating all the variables as endogenous and allowing for unobservable individual heterogeneity. Moreover, it controls for cross-sectional dependency, hence accounting for possible economic interrelations across provinces provided they are highly integrated. As pointed out by Pesearan (2006), ignoring cross-section dependency leads to substantial bias and size distortions; thus suggesting that testing for the cross-section dependence is crucial for panel data analysis. The next section presents the methodology. Section 3 discusses the empirical results including the data description and section 4 concludes.

2. Methodology and data

2.1. Preliminary Analysis

One important issue in a panel causality analysis is to take into account possible cross-section dependence across regions. This is because high degree of economic and financial integrations makes a region to be sensitive to the economics shocks in other region with a country. Cross-sectional dependency may play important role in detecting causal linkages of housing activity for South Africa.

The second issue to decide before carrying out causality test is to find out whether the slope coefficients are treated as homogenous and heterogeneous to impose causality restrictions on the estimated parameters. As pointed out by Granger (2003), the causality from one variable to another variable by imposing the joint restriction for the panel is the strong null hypothesis Furthermore, as Breitung (2005) contends the homogeneity assumption for the parameters is not able to capture heterogeneity due to region specific characteristics. In the exports and economic growth nexus – as in many economic relationships – while there may be a significant relationship in some regions, vice versa may also be true in some other regions.

Given the above consideration before we conduct tests for causality, we start with testing for cross-sectional dependency, followed by slope homogeneity across regions. Then, we decide to which panel causality method should be employed to appropriately determine the direction of causality between exports and economic growth in nine province of South Africa countries. In what follows, we outline the essentials of econometric methods used in this study.

2.1.1. Testing cross-section dependence

To test for cross-sectional dependency, the Lagrange multiplier (LM hereafter) test of Breusch and Pagan (1980) has been extensively used in empirical studies. The procedure to compute the LM test requires the estimation of the following panel data model:

$$y_{it} = \alpha_i + \beta_i' x_{it} + u_{it} \quad \text{for} \quad i = 1, 2, ..., N \,; \quad t = 1, 2, ..., T \qquad (1)$$

where i is the cross section dimension, t is the time dimension, x_{it} is $k \times 1$ vector of explanatory variables, α_i and β_i are respectively the individual intercepts and slope coefficients that are allowed to vary across states. In the LM test, the null hypothesis of no-cross section dependence- $H_0 : Cov(u_{it}, u_{jt}) = 0$ for all t *and* $i \neq j$ - is tested against the alternative hypothesis of cross-section dependence $H_1 : Cov(u_{it}, u_{jt}) \neq 0$, for at least one pair of $i \neq j$. In order to test the null hypothesis, Breusch and Pagan (1980) developed the LM test as:

$$LM = T\sum_{i=1}^{N-1}\sum_{j=i+1}^{N} \hat{\rho}_{ij}^2 \tag{2}$$

where $\hat{\rho}_{ij}$ is the sample estimate of the pair-wise correlation of the residuals from Ordinary Least Squares (OLS) estimation of equation (1) for each *i*. Under the null hypothesis, the *LM* statistic has asymptotic chi-square with $N(N-1)/2$ degrees of freedom. It is important to note that the LM test is valid for N relatively small and T sufficiently large.

However, the *CD* test is subject to decreasing power in certain situations that the population average pair-wise correlations are zero, although the underlying individual population pair-wise correlations are non-zero (Pesaran *et al.*, 2008, p.106). Furthermore, in stationary dynamic panel data models the CD test fails to reject the null hypothesis when the factor loadings have zero mean in the cross-sectional dimension. In order to deal with these problems, Pesaran *et al.* (2008) propose a bias-adjusted test which is a modified version of the LM test by using the exact mean and variance of the LM statistic. The bias-adjusted LM test is:

$$LM_{adj} = \sqrt{\left(\frac{2T}{N(N-1)}\right)}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N} \hat{\rho}_{ij} \frac{(T-k)\hat{\rho}_{ij}^2 - \mu_{Tij}}{\sqrt{v_{Tij}^2}} \tag{3}$$

where μ_{Tij} and v_{Tij}^2 are respectively the exact mean and variance of $(T-k)\hat{\rho}_{ij}^2$, that are provided in Pesaran *et al.* (2008, p.108). Under the null hypothesis with first T→∞ and then N→∞, LM_{adj} test is asymptotically distributed as standard normal.

2.1.2. Testing slope homogeneity

Second issue in a panel data analysis is to decide whether or not the slope coefficients are homogenous. The causality from one variable to another variable by imposing the joint restriction for whole panel is the strong null hypothesis (Granger, 2003). Moreover, the homogeneity assumption for the parameters is not able to capture heterogeneity due to region specific characteristics (Breitung, 2005).

The most familiar way to test the null hypothesis of slope homogeneity- $H_0 : \beta_i = \beta$ for all *i*- against the hypothesis of heterogeneity- $H_1 : \beta_i \neq \beta_j$ for a non-zero fraction of pair-wise slopes for $i \neq j$ - is to apply the standard *F* test. The *F* test is valid for cases where the cross section dimension (N) is relatively small and the time dimension (T) of panel is large; the explanatory variables are strictly exogenous; and the error variances are homoscedastic. By relaxing homoscedasticity assumption in the *F* test, Swamy (1970) developed the slope homogeneity test on the dispersion of individual slope estimates from a suitable pooled estimator. However, both the *F* and Swamy's test require panel data models where *N* is small relative to *T* [24]. Pesaran and Yamagata (2008) proposed a standardized version of Swamy's test (the so-called $\tilde{\Delta}$ test) for testing slope homogeneity in large panels. The $\tilde{\Delta}$ test is valid as $(N,T) \rightarrow \infty$ without any restrictions on the relative expansion rates of N and T when the error terms are normally distributed. In the $\tilde{\Delta}$ test approach, first step is to compute the following modified version of the Swamy's test:

$$\tilde{S} = \sum_{i=1}^{N} \left(\widehat{\beta}_i - \tilde{\beta}_{WFE} \right)' \frac{x_i' M_\tau x_i}{\tilde{\sigma}_i^2} \left(\widehat{\beta}_i - \tilde{\beta}_{WFE} \right) \tag{4}$$

where $\widehat{\beta}_i$ is the pooled OLS estimator, $\tilde{\beta}_{WFE}$ is the weighted fixed effect pooled estimator, M_τ is an identity matrix, the $\tilde{\sigma}_i^2$ is the estimator of σ_i^2.[3] Then the standardized dispersion

[3] In order to save space, we refer to Pesaran and Yamagata (2008) for the details of estimators and for Swamy's test.

statistic is developed as:

$$\tilde{\Delta} = \sqrt{N}\left(\frac{N^{-1}\tilde{S}-k}{\sqrt{2k}}\right) \tag{5}$$

Under the null hypothesis with the condition of $(N,T)\to\infty$ so long as $\sqrt{N}/T\to\infty$ and the error terms are normally distributed, the $\tilde{\Delta}$ test has asymptotic standard normal distribution. The small sample properties of $\tilde{\Delta}$ test can be improved under the normally distributed errors by using the following bias adjusted version:

$$\tilde{\Delta}_{adj} = \sqrt{N}\left(\frac{N^{-1}\tilde{S}-E(\tilde{z}_{it})}{\sqrt{\mathrm{var}(\tilde{z}_{it})}}\right) \tag{6}$$

where the mean $E(\tilde{z}_{it})=k$ and the variance $\mathrm{var}(\tilde{z}_{it})=2k(T-k-1)/T+1$.

2.2. Panel Causality Test

Once the existence of cross-section dependency and heterogeneity across South Africa is ascertained, we apply a panel causality method that should account for these dynamics. The bootstrap panel causality approach proposed by Kónya (2006) is able to account for both cross-section dependence and region-specific heterogeneity. This approach is based on Seemingly Unrelated Regression (SUR) estimation of the set of equations and the Wald tests with individual specific region bootstrap critical values. Since region-specific bootstrap critical values are used, the variables in the system do not need to be stationary, implying that the variables are used in level form irrespectively of their unit root and cointegration properties. Thereby, the bootstrap panel causality approach does not require any pre-testing for panel unit root and cointegration analyses. Besides, by imposing region specific restrictions, we can also identify which and how many states exist in the Granger causal relationship.

The system to be estimated in the bootstrap panel causality approach can be written as:

$$
\begin{aligned}
y_{1,t} &= \alpha_{1,1} + \sum_{i=1}^{ly_1} \beta_{1,1,i} y_{1,t-i} + \sum_{i=1}^{lx_1} \delta_{1,1,i} x_{1,t-i} + \varepsilon_{1,1,t} \\
y_{2,t} &= \alpha_{1,2} + \sum_{i=1}^{ly_1} \beta_{1,2,i} y_{2,t-i} + \sum_{i=1}^{lx_1} \delta_{1,2,i} x_{2,t-i} + \varepsilon_{1,2,t} \\
&\vdots \\
y_{N,t} &= \alpha_{1,N} + \sum_{i=1}^{ly_1} \beta_{1,N,i} y_{N,t-i} + \sum_{i=1}^{lx_1} \delta_{1,N,i} x_{1,N,t-i} + \varepsilon_{1,N,t}
\end{aligned} \tag{1}
$$

and

$$
\begin{aligned}
x_{1,t} &= \alpha_{2,1} + \sum_{i=1}^{ly_2} \beta_{2,1,i} y_{1,t-i} + \sum_{i=1}^{lx_2} \delta_{2,1,i} x_{1,t-i} + \varepsilon_{2,1,t} \\
x_{2,t} &= \alpha_{2,2} + \sum_{i=1}^{ly_2} \beta_{2,2,i} y_{2,t-i} + \sum_{i=1}^{lx_2} \delta_{2,2,i} x_{2,t-i} + \varepsilon_{2,2,t} \\
&\vdots \\
x_{N,t} &= \alpha_{2,N} + \sum_{i=1}^{ly_2} \beta_{2,N,i} y_{N,t-i} + \sum_{i=1}^{lx_2} \delta_{2,N,i} x_{N,t-i} + \varepsilon_{2,N,t}
\end{aligned} \tag{2}
$$

where *y* denotes real income, *x* refers to exports, *l* is the lag length. Since each equation in this system has different predetermined variables while the error terms might be contemporaneously correlated (i.e. cross-sectional dependency), these sets of equations are the SUR system.

In the bootstrap panel causality approach, there are alternative causal linkages for each country in the system that (i) there is one-way Granger causality from *x* to *y* if not all $\delta_{1,i}$ are zero, but all $\beta_{2,i}$ are zero, (ii) there is one-way Granger causality running from *y* to *x* if all $\delta_{1,i}$ are zero, but not all $\beta_{2,i}$ are zero, (iii) there is two-way Granger causality between *x* and *y* if neither $\delta_{1,i}$ nor $\beta_{2,i}$ are zero, and finally (iv) there is no Granger causality in any direction between *x* and *y* if all $\delta_{1,i}$ and $\beta_{2,i}$ are zero.

The annual data used in this study covers the period from 1995 to 2011 for nine provinces of South Africa. The variables include real GDP and real Export. Real GDP is measured in constant 2005 Rand and comes from the Statistic South Africa (SSA). Nominal export is obtained from the RSA Provincial Trade Indicators (Quantec). We use the consumer price index (CPI) drawn from the International Monetary Fund database to obtain the real

Table 1. Summary Statistics of Real GDP

Province	Mean	Max.	Min.	Std. Dev.	Skew[a].	Kurt[b].	J.-B[c].
Eastern Cape	1.19E+11	1.49E+11	9.50E+10	1.85E+10	0.320	1.619	1.640
Free State	7.80E+10	9.40E+10	6.52E+10	9.88E+09	0.317	1.555	1.764
Gauteng	5.09E+11	6.72E+11	3.79E+11	1.00E+11	0.264	1.600	1.585
KwaZulu-Natal	2.42E+11	3.13E+11	1.84E+11	4.36E+10	0.284	1.617	1.585
Limpopo	9.77E+10	1.21E+11	7.33E+10	1.60E+10	-0.013	1.623	1.342
Mpumalanga	9.88E+10	1.21E+11	7.66E+00	1.43E+10	0.131	1.624	1.388
North West	9.62E+10	1.15E+11	8.01E+00	1.21E+10	0.316	1.514	1.846
Northern Cape	3.28E+10	3.80E+10	2.72E+10	3.53E+09	0.092	1.658	1.299
Western Cape	2.17E+11	2.83E+11	1.65E+11	4.05E+10	0.304	1.595	1.660

Note: 1. The sample period is from 1995 to 2011

2. a, b, c refer to Skewness, Kurtosis and Jarque Bera statistics respectively.

3. The Jarque Bera test tests the null hypothesis of normality against the alternative of non normality. None of the J-B statistics is significant indicating that the null of normality cannot be rejected.

Table 2. Summary Statistics of Real Export

Province	Mean	Max.	Min.	Std. Dev.	Skew[a].	Kurt[b].	J.-B[c].
Eastern Cape	1.94E+08	3.55E+08	5.11E+07	9.05E+05	-0.336	2.207	0.125
Free State	1.54E+07	2.80E+07	7.60E+06	6.40E+06	0.218	1.867	1.045
Gauteng	1.92E+09	3.25E+09	1.07E+09	7.04E+08	0.706	2.192	1.876
KwaZulu-Natal	4.17E+08	6.00E+08	2.71E+08	1.06E+08	-0.013	1.830	0.969
Limpopo	4.28E+07	1.06E+08	1.86E+07	3.27E+07	1.036	2.427	3.272
Mpumalanga	5.60E+07	9.49E+07	2.74E+07	1.99E+07	0.265	2.113	0.757
North West	1.07E+08	2.63E+08	1.90E+07	6.96E+07	0.446	2.569	0.694
Northern Cape	4.61E+07	1.49E+08	3.25E+06	4.32E+07	0.887	3.051	2.232
Western Cape	3.12E+08	4.80E+08	1.66E+08	1.01E+08	-0.258	1.837	0.768

Note: 1. The sample period is from 1995 to 2011

2. a, b, c refer to Skewness, Kurtosis and Jarque Bera statistics respectively.

3. The Jarque Bera test tests the null hypothesis of normality against the alternative of non normality.

None of the J-B statistics is significant indicating that the null of normality cannot be rejected.

export. Tables 1 and 2 show the summary statistics of real GDP and real export for nine provinces, respectively. Based on Tables 1 and 2, we find that Gauteng and Northern Cape have the highest and lowest mean real GDP of R509 billions and R32.8 billions, respectively, and Gauteng and Free State have the highest and lowest mean real export of R1.9 billion and R15.4 millions, respectively. The data series are approximately normal as the Jarque-Bera test could not reject the null of normality for all the nine provinces.

3. Empirical findings

Before we test for causality we first test for both cross-sectional dependency and region-specific heterogeneity as we believe that these nine provinces in South Africa are highly integrated in their economic relations. To investigate the existence of cross-section dependence we carried out four different tests (LM, CD_{lm},CD, LM_{adj}). Secondly, as indicated by Kónya (2006), the selection of optimal lag structure is of importance because the causality test results may depend critically on the lag structure. In determining lag structure we follow Kónya (2006)'s approach that maximal lags are allowed to differ across variables, but to be same across equations. We estimate the system for each possible pair of ly_1, lx_1, ly_2 and lx_2 respectively by assuming from *1* to *4* lags and then choose the combinations which minimize the Schwarz Bayesian Criterion.

Tests for cross-sectional dependency and heterogeneity are presented in Table 3. As can be seen from Table 3, it is clear that the null hypothesis of no cross-sectional dependency and slope heterogeneity across the countries is strongly rejected at the conventional levels of significance. This finding implies that a shock that occurred in one of these provinces seems to be transmitted to other provinces. Furthermore, the rejection of slope homogeneity implies that the panel causality analysis by imposing homogeneity restriction on the variable of

Table 3. Cross-sectional Dependence and Homogeneous Tests

Test	
LM	216.658***
CD_{LM}	21.291***
CD	13.444***
LM_{adj}	19.62***
Swamy's Test	16.568**
$\tilde{\Delta}$	1.783**
$\tilde{\Delta}_{adj}$	0.101

Note: *** and * indicate significance at the 0.01 and 0.1 levels, respectively.

interest results in misleading inferences.[4] In this respect, the panel causality analysis based on estimating a panel vector autoregression and/or panel vector error correction model by means of generalized method of moments and of pooled ordinary least square estimator is not appropriate approach in detecting causal linkages between housing activity and economic growth in nine provinces of South Africa.

The establishment of the existence of cross-sectional dependency and heterogeneity across nine provinces suggests the suitability of the bootstrap panel causality approach. Results of the bootstrap causality tests are presented in Tables 4 and 5. Our empirical results support unidirectional causality running from economic growth to exports for Mpumalanga only; a bi-directional causality between exports and economic growth for Gauteng; and no causality in any direction between economic growth and exports for the rest of provinces. In Gauteng, there was a bidirectional causality between exports and economic growth thus supporting the feedback hypothesis where exports and GDP serve as complements to each other. Consequently, reducing exports may lead to adverse effects on economic growth in

[4] Though $\tilde{\Delta}_{adj}$ fails to reject the null hypothesis of slope homogeneity, both $\tilde{\Delta}$ and $\tilde{S}$ reject the null hypothesis of slope homogeneity.

Gauteng.

Table 4: Exports does not Granger Cause GDP

	Wald Statistics	Bootstrap Critical Value		
		10%	5%	1%
Eastern Cape	16.258	26.268	40.450	90.489
Free State	3.306	25.661	42.846	106.794
Gauteng	**26.259****	21.964	32.711	67.100
KwaZulu-Natal	0.0001	26.991	39.956	85.634
Limpopo	0.093	13.343	20.863	44.682
Mpumalanga	13.754	28.446	43.537	93.088
North West	0.976	21.216	34.226	76.985
Northern Cape	6.326	20.525	31.550	73.178
Western Cape	6.376	27.802	42.985	89.384

Notes: 1. ** indicates significance at the 0.05 level.

2. Bootstrap critical values are obtained from 10,000 replications.

Table 5: GDP does not Granger Cause Exports

	Wald Statistics	Bootstrap Critical Value		
		10%	5%	1%
Eastern Cape	0.064	9.417	14.175	29.339
Free State	3.814	12.784	19.497	40.539
Gauteng	36.715**	14.158	21.041	43.897
KwaZulu-Natal	2.832	10.640	16.987	34.632
Limpopo	17.275	30.31	45.006	89.542
Mmpumalanga	11.108*	8.526	13.238	25.796
North West	1.754	11.685	17.523	33.148
Northern Cape	0.202	9.873	15.355	30.552
Western Cape	0.067	12.859	20.719	41.913

Notes: 1. *** and ** indicate significance at the 0.01 and 0.05 respectively.

2. Bootstrap critical values are obtained from 10,000 replications.

Consistent with the different conclusions reported for sectoral analysis of the export-growth nexus (Fosu ,1990; Giles *et al*., 1992; Boltho, 1996; Ghatak *et al*., 1997 and Tuan and Ng, 1998), our results confirm the intuition put forward that heterogeneity in the spatial composition of exports play an important role in driving the export-growth relationship. It appears that economies that mainly export manufactured products are likely to support a bidirectional relationship between export and growth. This is the case for Gauteng which is the leading province of South Africa in terms of economic development. Conversely, economies whose exports mostly depend on agricultural products or raw materials tend to exhibit no causal effect in any direction between economic growth and exports. Most provinces in South Africa fall in this category. The growth-led export hypothesis tends to be most prevalent at the early stage of the development. This interpretation is in line with the case of Mpumalanga where the estimated unidirectional causality runs from economic growth to exports.

4. Conclusions

This study applied the bootstrap panel Granger causality approach to test the causal link between exports and economic growth using data from the nine provinces of South Africa over the period of 1995-2011. Regarding the export-economic growth nexus, our empirical results support growth causes exports for Mpumalanga; a feedback hypothesis for Gauteng. However, a neutrality hypothesis was found for the rest of provinces indicating neither exports nor economic growth is sensitive to each other in these provinces.

Our findings provide important policy implications for export-growth policies and strategies in South Africa. Except in Gauteng, it might not be efficient to consider export expansion as a strategy to improve provincial economic performance. We conclude that provincial factors drive the export-growth nexus in South Africa and hence, policy implications based on national-level studies might be misleading since they hide important differences in export composition among provinces.

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