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Exports, Imports, and Economic Growth in South Asia: Evidence Using a Multivariate Time-series Framework

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This paper examines the export-led growth hypothesis for the five largest economies of the South Asian region using a multivariate time-series framework. The South Asian countries present an interesting case study in view of their increasing outward orientation and adoption of export promotion policies as part of their growth strategies. A key feature of the study is the explicit incorporation of imports in the analysis to make allowance for their role in the export-economic growth relationship. While controlling for imports, the results indicate bi-directional causality between exports and output growth in Bangladesh, India, and Sri Lanka in the short-run. The study finds long-run equilibrium relationships among exports, imports, and output for Bangladesh and Pakistan. However, for India, Nepal, and Sri Lanka, no evidence of a long-run relationship among the relevant variables is found. These results are in contrast to some earlier work that found the export-led growth hypothesis to be a long-run phenomenon for all countries in the region.

1. INTRODUCTION

A growing body of trade and development literature has emphasised exports as a vehicle to accelerate economic growth. It is argued that exports can help the process of economic growth through a variety of channels including, for example, efficient allocation of resources, economies of scale, enhanced capacity utilisation, improved productivity, and diffusion of technological knowledge and innovation. It is mainly in view of these considerations that many countries around the world have embraced export oriented policies as part of their growth strategies.

This paper carries out an empirical examination of the export-led growth hypothesis for the five largest economies of the South Asia region, namely India, Pakistan, Sri Lanka, Bangladesh and Nepal.[1] Within a multivariate Vector-Auto Regressive (VAR) framework, the concept of Granger causality is employed to determine the direction of causation between exports and output, duly taking into account the stationarity properties of the time series data. The paper differs from the earlier work in two important respects. First, following Reizman, Summers, and

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[1]Bhutan and Maldives could not be included owing to data limitations.

Whiteman (1996), it explicitly accounts for imports when testing for the equilibrium relationship between exports and economic growth. It has been argued in the literature that imports play an important role in the link between exports and economic growth and omitting these can produce misleading results.[2] Second, it investigates the time series properties of the data by employing the Dickey-Fuller Generalised Least Squares (DF-GLS) unit root testing procedure proposed by Elliot, Rothenberg and Stock (1996). This test requires much shorter sample sizes than the conventional unit root tests to attain the same statistical power, and hence is more reliable for studies involving relatively shorter sample sizes.

Section 2 provides a brief overview of trade policies of the South Asian economies, highlighting in particular their increasing outward orientation over the years. Section 3 contains a selective review of the literature on export-led growth hypothesis. Data and methodology are described in Section 4, while Section 5 presents the empirical results. Finally, Section 6 concludes the discussion.

2. TRADE POLICIES IN SOUTH ASIA

The South Asian countries present an interesting case study in view of their increasing outward orientation, thanks to trade policy reforms that were initiated in almost all countries of the region with a view to integrating themselves into the world economy and to improving their growth prospects. The current trade policy of each country reflects the broad aim of achieving greater openness through import liberalisation, export promotion, and competitive exchange rate policies. The process of trade liberalisation in these countries generally encompasses a series of initiatives aimed at reduction of tariff level and tariff dispersion, simplification and rationalisation of tariff structure, and deregulation of administrative import controls including quantitative restrictions (Table 1).

All the countries have abolished the import licensing regimes. Import quotas have been eliminated to a large extent and tariffs are being used as the main trade policy instrument. The South Asian countries have put in place liberal tariff structures: the maximum normal customs duty rate[3] is 25 percent in Pakistan, Bangladesh, and Nepal, whereas it is 30 percent and 27.5 percent respectively in India and Sri Lanka. The average customs duty rate is the highest in India (22.2 percent), followed by Pakistan (17.3 percent), Bangladesh (16.3 percent), Nepal (13.7 percent), and Sri Lanka (11.3 percent). All the countries have introduced greater transparency in their tariff structures: the percentage of tariff lines that are subject to specific duties is 5.3 in India, 1.7 in Sri Lanka, 0.9 in Pakistan and 0.6 in Nepal.

[2]More specifically, imports may affect both exports and economic growth, hence playing the role of a "confounding variable", as put by Reizman, Summers, and Whiteman (1996).

[3]All the countries apply tariff peaks in the range of 40-250 percent to protect some sensitive sectors. These peaks are applied on 2 percent of ad-valorem tariff lines in India, 0.1 percent in Pakistan, 0.2 percent in Sri Lanka, and 5.2 percent in Nepal.

Table 1

Trade Regimes in South Asia

Policies	India	Pakistan	Bangladesh	Sri Lanka	Nepal
Import Restrictions					
Import Licensing	No	No	No	No	No
Quantitative Restrictions on Imports	No	No	Yes, limited	Yes, minor	Yes
State Import Monopolies	Yes	Yes	Yes	Yes, minor	Yes, minor
Tariff Structure (2003)					
Top Normal Customs Duty Rate	30	25	25	27.5	25
Average Customs Duty	22.2	17.3	16.3	11.3	13.7
Average Customs Duty + Other Protective Taxes	22.2	18.8	26.5	13.4	18.0
Range of Customs Duty Slabs Greater than Normal	40-210%	40-250%	NA	75 & 100	40,80, 130%
Percent of Ad-valorem Tariff Lines Subject to Greater than Normal Customs Duty Rate	2	0.1	NA	0.2	5.2
Percent of Tariff Lines with Specific Duties	5.3	0.9	NA	1.7	0.6
Existence of High Level of Non-tariff Barriers	Yes*	No	No	No	No

Source: World Bank (2004b).

*These barriers primarily consist of stringent technical standards and regulations.

The increasing outward orientation of the South Asian economies is borne out by the generally rising trade openness indices, (ratio of foreign trade to GDP) (Table 2). In Bangladesh, the share of foreign trade in GDP rose from 20.1 percent in 1990 to 33.3 percent in 2002. India has made major strides in opening up its economy, as indicated by an increase in its foreign trade from 15.3 percent of GDP in 1990 to 30.8 percent in 2002. In Pakistan, however, the share of foreign trade in GDP remained almost unchanged during the past two decades or so at around 38 percent. In Nepal, foreign trade amounted to 44.9 percent of GDP in 2002, up from 31.6 percent in 1990. In Sri Lanka, the share of foreign trade in GDP peaked at 82.8 percent during the eighties, falling slightly to 79.1 percent in 2002.

While trade liberalisation episodes have generally reduced the anti-export bias, the South Asian economies are also relying on a variety of direct export measures to facilitate export growth. These generally include access to duty free inputs, loans on concessional terms, better infrastructure, and special incentives for foreign investment in export related industries. Thanks to vigorous export promotion strategies coupled with reduction of anti-export bias inherent in restrictive trade practices, exports are playing an increasingly important role in the regional economies. During the period 1970 to 2002, exports as a proportion of GDP increased from 6.2 percent to 14.3 percent in Bangladesh, from 3.8 percent to 15.2 percent in India, from 4.9 percent to 16.1 percent in Nepal, from 7.8 percent to 18.7 percent in Pakistan, and from 15.4 percent to 36.2 percent in Sri Lanka.

Table 2

Trade Shares and Trade Openness Indices

Country	1970	1980	1990	2002
Bangladesh				
Share of Exports in GDP	6.2	4.2	6.3	14.3
Share of Imports in GDP	10.8	15.9	13.8	19.0
Trade Openness Index	17.0	20.1	20.1	33.3
India				
Share of Exports in GDP	3.8	6.6	7.6	15.2
Share of Imports in GDP	3.7	8.6	7.7	15.6
Trade Openness Index	7.5	15.2	15.3	30.8
Nepal				
Share of Exports in GDP	4.9	11.5	10.5	16.1
Share of Imports in GDP	8.3	18.8	21.1	28.8
Trade Openness Index	13.2	30.3	31.6	44.9
Pakistan				
Share of Exports in GDP	7.8	12.5	15.5	18.7
Share of Imports in GDP	14.6	24.1	23.4	19.0
Trade Openness Index	22.4	36.6	38.9	37.7
Sri Lanka				
Share of Exports in GDP	15.4	28.3	27.4	36.2
Share of Imports in GDP	17.6	54.5	37.0	42.9
Trade Openness Index	33.0	82.8	64.4	79.1

Source: World Development Indictors, CD-ROM (2004a).

3. REVIEW OF LITERATURE

The relationship between exports and economic growth has been examined extensively in the theoretical and empirical literature. To begin with, the standard trade theory demonstrates the static gains from trade through competition and specialisation according to comparative advantage. While these gains are captured in terms of the level of national output, these can nevertheless translate into growth effects as economies adjust to new equilibrium as a result of opening up to international trade. The insights into the dynamic gains from trade are provided by a wide variety of theoretical models in the tradition of ‘endogenous growth theories’ pioneered by Romer (1986) and Lucas (1988). In particular, Grossman and Helpman (1991); Edwards (1992); Romer (1992); Romer (1994); Barro and Sala-i-Martin (1995) and Coe and Helpman (1995), among others, argue that technological change can be influenced by a country’s openness to trade leading to productivity gains and economic growth.

Theoretical advances in the trade and growth literature have been complemented by a growing body of empirical literature that has sought to test the export-led growth hypothesis using a variety of techniques and data sets. The early empirical work including Michaely (1977); Balassa (1978) and Tyler (1981), among others, employed cross section data of various country groups to explore the relationship between export growth and economic growth. Based on a cross-section data of 41 less developed countries, Michaely (1977) uses the spearman's rank correlation to detect the association between export growth and economic growth. The study finds evidence of a positive relationship between export growth and economic growth while emphasising the fact that export expansion contributes to economic growth only when countries achieve some minimum level of development. Balassa (1978) argues that, in an inter-country context, the correlation between export growth and economic growth may also capture the indirect effects of exports emanating from changes in incomes and costs. To disentangle the direct and indirect effects of exports on economic growth, the study develops several measures of exports and income to explore the relationship between export expansion and economic growth in a sample of 11 developing countries having a substantial industrial base. The overall results suggest that export growth favourably affects the rate of economic growth. Tyler (1981) analyses the empirical relationship between economic growth and export expansion in a sample of 55 middle income developing countries using inter-country cross section analysis. The results reveal a strong positive association between export growth and economic growth.

A common feature of the above studies is their reliance on correlation analysis based on cross section data sets. This approach has been criticised in the literature on the ground that contemporaneous relationship between exports and output can not be taken as an indication of causality between export growth and economic growth. It is argued that the question of causality is essentially a dynamic one and thus can be meaningfully studied only in a dynamic framework based on time series data. Consequently, a number of studies have examined the export-led growth hypothesis by employing Granger (1969) and Sims (1972) causality tests. Jung and Marshall (1985) and Chow (1987) are among the earlier studies along this line. Using time series data for 37 developing countries, Jung and Marshall (1985) find a significant relationship between export growth and economic growth in only 4 countries. Chow (1987) applies Granger causality tests on time series data of 8 newly industrialised countries to investigate the causal pattern between export growth and growth in manufacturing output. The study finds evidence of bi-directional causality in the case of Brazil, Hong Kong, Israel, Korea, Singapore, and Taiwan; and no causality in the case of Argentina.

Another strand of literature on the export-led growth hypothesis argues that the results of time series studies that have employed standard Granger or Sims causality tests may be misleading owing to the fact that these tests are inappropriate in a setting where variables are non-stationary and share a common stochastic trend. To address the problem of non-stationarity of variables, recent studies on the export-led growth hypothesis have adopted the Error Correction Modeling (ECM) approach, due to Engle and Granger (1987). Notable among these are Marin (1992); Bahmani-Oskooee and Alse (1993); Henriques and Sadorsky (1996); Dutt and Ghosh (1996) and Xu (1996). In general, these studies have found empirical support for the export-led growth hypothesis for a majority of economies. For instance, Bahmani-Oskooee and Alse (1993) re-examine the relationship between export growth and economic growth for 9 developing countries within the framework of an Error Correction Model, and find strong support for the export-led growth hypothesis for all the countries included in the sample. Similarly, in a study of 26 low, middle and high-income countries, Dutt and Ghosh (1996) provide evidence in favour of the export-led growth hypothesis in roughly half of the countries. In another study along the same lines, Xu (1996) finds evidence of export-led growth in 17 out of 32 developing countries included in the analysis.

In an influential contribution, Reizman, Summers, and Whiteman (1996) emphasise the role of imports in the export-economic growth relationship. It is argued that imports can be instrumental in explaining export-led growth and that omitting imports from the analysis may either conceal or exaggerate the effects of exports on economic growth. The study utilises a multivariate framework to incorporate the role of imports and finds evidence of unidirectional causality from exports to economic growth—conditional on import growth—in only 30 countries out of 126 countries analysed. These results are in sharp contrast to earlier studies that ignored the role of imports.

In the context of South Asian economies, a number of studies have investigated the relationship between export growth and economic growth using a variety of techniques. Nandi (1991) applies the Granger causality tests to examine the export-led growth hypothesis for India for the period 1960–1985, and finds evidence of unidirectional causality from export growth to economic growth. Based on a longer data set (1950–1993), Bhat (1995) re-examines the export-economic growth nexus for India by utilising the error-correction modeling approach, and finds evidence of bi-directional causality between export growth and economic growth. Using the same methodology, Ghatak and Price (1997) conclude that export growth is Granger-caused by output growth in India. It is noteworthy that these results are in sharp contrast to Xu (1996), who obtains rejection of the export-led growth hypothesis for India for the period 1960–1990.

For Bangladesh, Mollik (1996) provides evidence in favour of the export-led growth hypothesis within the conventional Granger causality framework, whereas Khan, *et al*. (1995) find strong evidence of bi-directional causality between export growth and economic growth for Pakistan. Anwar and Sampath (2000) examine the export led growth hypothesis for 97 countries (including India, Pakistan and Sri Lanka) for the period 1960–1992 using cointegration and Granger causality tests.

They find evidence of unidirectional causality in the case of Pakistan and Sri Lanka, and no causality in the case of India. This is in contrast to Kemal, *et al*. (2002), who find a positive association between exports and economic growth for India as well as for other economies of South Asia.

Previous time series studies in the context of South Asia have largely ignored the role of imports in the export-growth nexus, and hence their results are subject to misspecification bias.[4] The present study addresses this shortcoming by extending the analysis to explicitly incorporate imports in a multivariate framework. Another departure from earlier work is the use of efficient unit root tests that have better power in small samples. These issues are discussed in the next section.

4. DATA AND METHODOLOGY

The analysis is based on annual time series data on real exports, real imports, and real GDP in local currency units, obtained from World Development Indicators CD-ROM (2004).[5] For India and Sri Lanka, the sample period is from 1960 to 2002, whereas for Nepal it is 1965–2002. In the case of Bangladesh and Pakistan, the sample period is from 1973 to 2002.[6] Depending on the time series properties of the data, the concept of Granger causality[7] is employed to assess whether or not each South Asian country exhibits statistically significant evidence of export-led growth, duly taking into account imports. A critical issue in testing for Granger causality is the specification of the data generating process underlying the observed time series. The standard Granger test is valid only if the variables are stationary and do not share a common stochastic trend. In a setting where the variables are non-stationary, as is the case with most economic time series, Engle and Granger (1987) argue that the conventional Granger causality tests could provide misleading results.[8] One must, therefore, investigate the stationarity

[4]A notable exception is Shirazi and Manap (2005), which analyses the relationship between exports, imports and economic growth in the context of Pakistan's economy. However, this study uses a different methodology that focuses only on the long-run causal orderings and sheds no light on short run patterns of causality that too have plausible economic interpretation, and may even turn out to be more important as shown later in the present study.

[5]For India, prior to 1970, real exports and real imports have been computed using the respective unit value indices obtained from International Financial Statistics CD-ROM 2004. For Nepal, real exports and real imports have been computed on the basis of their respective shares in the GDP.

[6]Bangladesh was part of Pakistan prior to 1973; hence reliable separate data for the two countries are only available 1973 onwards.

[7]A variable x_t is said to cause another variable y_t in the Granger sense if the one-step ahead forecast of y_t improves by taking into account the historical values of x_t.

[8]Strictly speaking, the problem of non-stationarity alone can be handled within the standard Granger causality framework by appropriate techniques (e.g., first differencing) to make the time-series stationary. It is the presence of common stochastic trends (cointegration) among the non-stationary variables that makes the standard Granger test invalid. This is because the conventional Granger causality test ignores the long run equilibrium relationships implied by the co-integration properties of the time series, and hence omits an important channel through which causality may be detected.

properties of the data prior to applying tests for causality in the Granger's sense. If in fact the variables turn out to be non-stationary, then the recommended approach to testing for the Granger causality is the Cointegration and Error-Correction framework, due to Engle and Granger (1987).

The modeling cycle consists of three steps including testing for unit roots, testing for cointegration, and error-correction modeling.[9] The first step is to check the order of integration of the time series variables. This is accomplished by testing for the unit roots using the Dickey-Fuller Generalised Least Squares (DF-GLS) method proposed by Elliot, Rothenberg and Stock (1996). This test requires much shorter sample sizes than the conventional unit root tests to attain the same statistical power. In addition, for confirmatory analysis, we conduct a test proposed by Kwiatkowski, Phillips, Schmidt, and Shin (KPSS)[10] which tests the null hypothesis that the data generating process is stationary against the alternative that it is integrated of order 1. In the second step, if individual time series turn out to be non-stationary, tests for cointegration are carried out by using the likelihood ratio test due to Johansen (1988) and Johansen and Juselius (1990). This is followed by estimation of the error correction models to determine the direction of causation between exports, imports, and output. As opposed to the conventional Granger causality test, an error-correction model combines the short run dynamics with the long run properties of the data and thus provides a convenient tool for investigating short run as well as long run causal patterns.

5. EMPIRICAL RESULTS

Following convention, data on real exports (x), real imports (m), and real GDP (y) are transformed into logarithmic form so that first differences of these variables reflect the rate of change. A univariate analysis is carried out to investigate the stationarity properties of the data. Table 3 reports the results of the DF-GLS and KPSS tests for real exports, real imports, and real GDP. Both these tests indicate the acceptance of the unit root hypothesis in the levels of real exports, real imports, and real GDP for all countries. To determine the order of integration of the time series, unit root tests are applied on first differences as well. The results indicate that the first differences of variables are on a stationary process, and hence all the variables are integrated of order 1, i.e., $I(1)$.

[9]These procedures are standard in time series econometrics and have not been detailed here to save space. Excellent textbook treatments are available in Hamilton (1994); Enders (2004) and Lutkepohl and Kratzig (2004), among others.

[10]See Kwiatkowski, Phillips, Schmidt and Shin (1992) for details. For a textbook exposition [see Lutkepohl and Kratzig (2004)].

Table 3

Unit Root Tests

Variable	DF-GLS Without Trend	DF-GLS With Trend	KPSS Without Trend	KPSS With Trend
Bangladesh				
y	–1.11	–2.32	0.72*	0.16*
Δy	–3.76*	–6.05*	0.24	0.06
x	–1.59	–1.09	0.69*	0.17*
Δx	–5.56*	–9.57*	0.12	0.12
m	0.06	–2.99	0.70*	0.18*
Δm	–8.97*	–9.19*	0.30	0.03
India				
y	–0.38	–1.17	0.82*	0.21*
Δy	–6.62*	–7.25*	0.39	0.10
x	0.46	–1.77	0.81*	0.15*
Δx	–6.78*	–7.69*	0.32	0.11
m	1.61	–1.77	0.79*	0.20*
Δm	–4.96*	–6.66*	0.39	0.02
Nepal				
y	–0.06	–1.44	0.73*	0.19*
Δy	–2.21*	–7.18*	0.41	0.09
x	0.09	–2.33	0.70*	0.23*
Δx	–3.78*	–5.36*	0.10	0.10
m	–0.62	–2.70	0.71*	0.21*
Δm	–2.69*	–2.11*	0.18	0.14
Pakistan				
y	–1.72	–3.01	0.70*	0.18*
Δy	–3.43*	–4.78*	0.43	0.14
x	0.27	–2.07	0.68*	0.17*
Δx	–4.45*	–5.50*	0.10	0.11
m	–0.76	–2.76	0.67*	0.31*
Δm	–2.97*	–5.52*	0.22	0.01
Sri Lanka				
y	–0.20	–2.46	0.83*	0.27*
Δy	–5.61*	–5.62*	0.06	0.06
x	1.91	–1.04	0.75*	0.21*
Δx	–7.34*	–6.78*	0.37	0.08
m	1.38	–1.43	0.76*	0.16*
Δm	–2.24*	–6.34*	0.37	0.09

Note: For the DF-GLS test, the 5 percent MacKinnon asymptotic critical values are –1.95 and –3.19 respectively for without trend and with trend cases. The corresponding critical values for the KPSS tests are 0.463 and 0.146.

(*)Denotes rejection of the null hypothesis of unit root for the DF-GLS test and rejection of the null hypothesis of stationarity for the KPSS test at 5 percent level of significance.

Δ Denotes first difference.

Having determined the order of integration of the three variables, Johansen's likelihood ratio tests for cointegrating rank (r) is applied to ascertain whether or not the variables are cointegrated. Prior to conducting these tests, the lag length of the test VAR has to be specified. Various lag selection criteria including sequential Likelihood Ratio (LR) test, Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Criterion (SC), and Hannan-Quinn Criterion (HQ) indicated one lag for India, Nepal, Pakistan and Sri Lanka. In the case of Bangladesh, however, the sequential likelihood ratio test indicated 4 lags whereas the Schwarz criterion indicated 2 lags. In the interest of parsimony a lag length of 2 was chosen. Another important issue in tests for cointegration is the choice of deterministic terms in the dynamic model. Following Johansen (1992), this choice is made by the so-called *Pantula Principle*, which involves a number of joint hypotheses testing both the number of cointegrating relations and the existence of deterministic components.[11] More specifically, three models are estimated: the first model (named Model 2) assumes no linear trend in the levels of data and allows an intercept in the cointegration relation; the second (named Model 3) assumes linear deterministic trend in the levels of data; and the third (named Model 4) allows the existence of a trend term in the cointegration relation.[12] Sequential tests are then performed proceeding from the most restrictive model (r = 0, Model 2) to the least restrictive model (r = 2, Model 4) and selecting a model for which the null hypothesis is not rejected for the first time.

For India, Nepal and Sri Lanka, both the λ-trace and λ-max statistics indicate that the null hypothesis of no cointegration (r = 0) can not be rejected in Model 3 at 5 percent level of significance (Table 4). Hence, there is no evidence of a long run relationship among exports, imports and output in these countries. In the case of Bangladesh and Pakistan, the λ-trace tests indicate one cointegration relation in Model 2, whereas the λ-max tests indicate no cointegration in Model 3. On the basis of more robust performance of the λ-trace test in Monte Carlo simulations,[13] we choose Model 2 which indicates unique cointegration relations in the two countries. Hence, it can be inferred that there is evidence of a long run equilibrium relationship between exports, imports, and output in both Bangladesh and Pakistan.

According to the Granger representation theorem [Engle-Granger (1987)], a system of cointegrated variables has an error-correction representation that combines

[11]It is noteworthy that previous studies using the Johansen's procedure have generally tended to specify deterministic components in the dynamic model on a rather ad-hoc basis, thus rendering their results prone to misspecification errors.

[12]Two other models are also considered in the literature: Model 1 allows no intercept and no deterministic trend; and Model 5 allows quadratic trend in the data. However, both these models are generally considered inappropriate in most economic applications.

[13]Cheung and Lai (1993) use Monte Carlo methods to investigate the small sample properties of λ-trace and λ-max statistics. They report that the λ-trace test is more robust to both skewness and excess kurtosis in the residuals than the λ-max test.

Table 4

Johansen's Cointegration Tests

	Model 2	Model 3	Model 4
Bangladesh			
		λ-Trace	
r = 0	100.25	30.20	50.72
	(0.00)	(0.04)	(0.01)
r =1	16.51†	13.92	19.16
	(0.15)	(0.09)	(0.27)
r = 2	5.39	3.32	5.53
	(0.24)	(0.07)	(0.52)
		λ-Max	
r = 0	83.75	16.28†	13.56
	(0.00)	(0.21)	(0.01)
r = 1	11.12	10.60	13.63
	(0.24)	(0.18)	(0.28)
r = 2	5.39	3.32	5.53
	(0.24)	(0.07)	(0.52)
India			
		λ-Trace	
r = 0	45.50	22.42†	34.31
	(0.00)	(0.28)	(0.27)
r = 1	13.86	6.77	12.58
	(0.30)	(0.61)	(0.77)
r = 2	2.96	1.96	2.75
	(0.59)	(0.16)	(0.90)
		λ-Max	
r = 0	31.64	15.66†	21.73
	(0.00)	(0.25)	(0.16)
r = 1	10.90	4.81	9.83
	(0.26)	(0.77)	(0.64)
r = 2	2.96	1.96	2.75
	(0.59)	(0.16)	(0.90)
Nepal			
		λ-Trace	
r = 0	44.11	21.37†	48.70
	(0.00)	(0.33)	(0.01)
r = 1	13.45	9.03	17.05
	(0.33)	(0.36)	(0.41)
r = 2	3.24	0.36	6.20
	(0.54)	(0.55)	(0.43)

Continued—

Table 4—(*Continued*)

	Model 2	Model 3	Model 4
	λ-Max		
r = 0	30.65	12.34†	31.65
	(0.00)	(0.51)	(0.01)
r = 1	10.21	8.67	10.84
	(0.32)	(0.32)	(0.53)
r = 2	3.24	0.36	6.20
	(0.54)	(0.55)	(0.43)
Pakistan			
	λ-Trace		
r = 0	51.21	35.67	42.77
	(0.00)	(0.01)	(0.04)
r = 1	19.97†	15.84	19.47
	(0.06)	(0.04)	(0.25)
r = 2	7.99	6.66	8.66
	(0.08)	(0.01)	(0.20)
	λ-Max		
r = 0	31.23	19.83†	23.30
	(0.00)	(0.07)	(0.10)
r = 1	11.99	9.19	10.81
	(0.19)	(0.27)	(0.53)
r = 2	7.99	6.66	8.66
	(0.08)	(0.01)	(0.20)
Sri Lanka			
	λ-Trace		
r = 0	50.84	20.05†	32.87
	(0.00)	(0.42)	(0.34)
r = 1	17.53	5.66	17.10
	(0.11)	(0.74)	(0.41)
r = 2	5.53	0.12	4.95
	(0.23)	(0.73)	(0.60)
	λ-Max		
r = 0	33.30	14.39†	15.77
	(0.00)	(0.33)	(0.57)
r = 1	12.00	5.54	12.15
	(0.19)	(0.67)	(0.40)
r = 2	5.53	0.12	4.95
	(0.23)	(0.73)	(0.60)

Note: Figures in parentheses are MacKinnon-Haug-Michelis (1999) p-values, r denotes the hypothesised number of cointegrating relations, and

†indicates acceptance of the null hypothesis (at 5 percent level of significance) the first time it occurs while reading across rows in each panel.

the short run dynamics of the variables with their long run properties as implied by the cointegrating relationships. Consequently, vector error-correction models (VECM) are estimated to determine the direction of causality between exports, imports, and economic growth in the case of Bangladesh and Pakistan. Since there is no evidence of long run equilibrium relationships for India, Nepal, and Sri Lanka, the standard Granger causality test based on first-differenced VAR is performed for these countries.[14]

Table 5 reports the results of Granger causality tests. Columns 2, 3, and 4 report the χ^2-statistic for the joint significance of the lagged independent variables, while Column 5 provides the *t*-statistics for the error-correction terms. The statistical significance of the error-correction term and the χ^2-statistic respectively would indicate the presence of long-run and short-run causality. The notions of short-run and long-run causality between export growth and economic growth have interesting economic interpretation. For example, exports can help output growth in the short-run by allowing the utilisation of excess capacity in cases where domestic demand is less than full capacity production. Also, countries can benefit from economies of scale thanks to access to larger markets. In a longer term perspective, exports can have a positive effect on economic growth through a variety of channels including: improvement in economic efficiency due to enhanced competition; productivity gains through diffusion of technical knowledge and innovation; and efficient allocation of resources in accordance with the country's comparative advantage.

Diagnostic checking of the estimated models is carried out in terms of conventional multivariate residual-based tests for autocorrelation, normality, and heteroskedasticity.[15] The portmonteau test for residual autocorrelation up to a specified lag order, which is a generalisation of the univariate Ljung-Box Q-statistic, indicates the presence of residual autocorrelation in all countries except India. However, at 5 percent significance level, the multivariate LM test for serial autocorrelation indicates the presence of autocorrelation at all lags only in Nepal. The multivariate Jarque-Bera test for the normality of residuals indicates the acceptance of the null hypothesis that the residuals are multivariate normal in all countries. White's χ^2 test for heteroskedasticity indicates the absence of heteroskedasticity in Bangladesh, Pakistan and Nepal.

For Bangladesh, the error correction terms are significant in all equations, indicating the presence of long-run causality from both exports and imports to economic growth, as well as feedback from economic growth to both exports and imports. There is also evidence of short-run bi-directional causality between exports and economic growth while controlling for imports. In the case of Pakistan, the error

[14]Notice that since all the variables are integrated of order 1 but not cointegrated, the Granger causality test can be conducted using a VAR in first differences.

[15]See Lutkepohl and Kratzig (2004) for details of these tests.

Table 5

Tests for Granger Causality

Dep. Variable	Lagged *y*	Lagged *x*	Lagged *m*	*EC* term
Bangladesh				
y	–	11.57*	2.37	–0.02*
		(0.00)	(0.31)	[–11.38]
x	11.51*	–	0.62	–0.08*
	(0.00)		(0.74)	[–8.92]
m	4.47	10.04*	–	0.04*
	(0.10)	(0.01)		[2.22]
Q(3) = 26.27	LM(1)= 17.48	LM(2)= 8.89	LM(3) = 9.75 JB= 8.85	χ^2 = 95.30
{0.007}	{0.04}	{0.45}	{0.37} {0.18}	{0.19}
Pakistan				
y	–	0.60	4.38*	–0.06*
		(0.44)	(0.04)	[–5.38]
x	0.64	–	0.20	–0.03
	(0.42)		(0.66)	[–0.36]
m	4.33*	0.15	–	0.12*
	(0.04)	(0.70)		[1.85]
Q(2) = 18.17	LM(1)= 15.98	LM(2)= 14.79	JB= 4.27	χ^2 = 57.76
{0.03}	{0.06}	{0.09}	{0.64}	{0.16}
India				
Y	–	7.80*	0.56	–
		(0.00)	(0.45)	
x	8.95*	–	0.001	–
	(0.00)		(0.97)	
m	4.04*	0.001	–	–
	(0.04)	(0.97)		
Q(2) = 12.39	LM(1)= 12.26	LM(2)= 9.61	JB= 10.93	χ^2 = 64.38
{0.19}	{0.20}	{0.38}	{0.09}	{0.003}
Nepal				
Y	–	0.11	6.81*	–
		(0.74)	(0.01)	
X	4.61*	–	0.11	–
	(0.03)		(0.74)	
M	2.10	0.92	–	–
	(0.15)	(0.34)		
Q(2) = 22.57	LM(1)= 24.24	LM(2)= 20.36	JB= 3.32	χ^2 = 49.58
{0.01}	{0.004}	{0.02}	{0.75}	{0.07}
Sri Lanka				
Y	–	3.77*	0.03	–
		(0.05)	(0.85)	
X	8.82*	–	0.13	–
	(0.00)		(0.72)	
m	7.41*	0.009	–	–
	(0.01)	(0.92)		
Q(2) = 22.53	LM(1)= 21.64	LM(2)= 15.63	JB= 10.93	χ^2 = 53.15
{0.01}	{0.01}	{0.08}	{0.09}	{0.03}

Note: Causality tests for Bangladesh and Pakistan are based on error correction models, whereas for India, Nepal, and Sri Lanka these tests are based on VAR in first differences. Figures in parentheses are *p*-values of the Wald tests for the joint significance of lagged variables, and figures in brackets are *t*-statistics.

*denotes significance at 5 percent.

Q(h) is the portmonteau test for residual autocorrelation up to lag order (h); LM(h) is the LM test for serial autocorrelation at lag order (h); JB is the Jarque-Bera test for normality of residuals; and χ^2 is the White's test for heteroskedascity. Figures in braces are *p*-values of the respective tests.

correction term is significant in the output and import equations, indicating the presence of long-run causality from both exports and imports to economic growth on the one hand, and from exports and output to imports on the other. In the short-run, however, there is no evidence of causality between exports and economic growth in either direction, while there is evidence of bi-directional causality between imports and economic growth.

The estimated vector error-correction models (VECM) can also be used to test for weak exogeneity of the imports variable by placing restrictions on the loading factors (i.e. the speed of adjustment coefficients or the error correction terms). Johansen and Juselius (1990) outline a procedure that involves restricting the loading factors and comparing the *r* most significant characteristic roots for the restricted and unrestricted models. The resulting test statistic[16] has a χ^2 distribution with degrees of freedom equal to the number of restrictions. Enders (2004) points out that in case of a single cointegrating vector, the usual *t*-statistic of the loading factor is asymptotically equivalent to the testing procedure of Johansen and Juselius (1990). Since there is a single cointegrating vector and the error correction terms are significant in import equations, the hypothesis of weak exogeneity of imports can be rejected and imports can be modeled as an endogenous variable.

For India, Nepal, and Sri Lanka, only the short-run causal patterns have been identified owing to the absence of long-run equilibrium relationships. The results indicate that there is bi-directional causality between exports and economic growth in both India and Sri Lanka. The results also support short-run causality from output growth to imports in both countries. In the case of Nepal, the results show reverse causation from output to exports on the one hand, and causality from imports to economic growth on the other.

Strictly speaking, one may argue that it is the presence of unidirectional causality from exports to economic growth that would provide the strongest support for the export-led growth hypothesis. However, the reverse causality from output to exports is also plausible. For example, in a growing LDC it is possible that there are some dynamic industries which are expanding rapidly, and if there is insufficient demand in the domestic economy, producers will explore foreign markets for sales. In this scenario, it is increased output that causes increased exports. Also, higher output growth can stimulate higher investment, part of which can be for increasing the capacity to export. It is, therefore, possible to hypothesise bi-directional causality between the two variables: that is export growth causes and is caused by output growth.

[16]The test statistic is computed as $T\sum_{i=1}^{r}[ln(1-\overset{*}{\lambda}_i)-ln(1-\lambda_i)]$ where *T* is the number of observations and $\overset{*}{\lambda}_i$ and λ_i are respectively the characteristic roots of the restricted and unrestricted models.

As for the relationship between imports and exports, there is no evidence of short run causality from import growth to export growth in any country. Serletis (1992) observes that such a relationship is likely to emerge only in countries whose manufacturing sector is dominated by export-oriented industries. As none of the South Asian economies under consideration has such a large export-oriented manufacturing sector, this result is not implausible. On the other hand, except for Bangladesh, the results indicate the absence of causality from export growth to import growth as well. This result seems contrary to the view that greater exports, through accumulation of foreign exchange, would facilitate more imports. Notice, however, that this is likely to hold in situations where capacity to import is largely dictated by exports due perhaps to limited access to other sources of export financing. This, nonetheless, does not appear to be the case in most South Asian countries in view of their access to foreign inflows through loans, aid and remittances and as such exports may not have acted as a constraint on imports in these economies.

It may be noted here that the absence of causality in some of the cases discussed above may be due to the linear structure of the Granger causality tests. Recent research has shown that absence of linear causality is reversed to unidirectional or bidirectional causality in a nonlinear context.[17] The fact that there may be nonlinear causal relationship between exports and economic growth follows from the observation by Michaely (1977) that growth is likely to be influenced by export performance only after countries have achieved a minimum level of development. In this case, the export-growth relationship is likely to exhibit threshold effects that can only be captured in a nonlinear framework.

It is instructive to point out here that the results obtained in this study are in contrast to some of the findings of Kemal, *et al.* (2002), who analysed the export-led growth hypothesis for the South Asian economies using a bivariate econometric framework. For example, their finding of a long-run relationship between exports and economic growth for India, Nepal, and Sri Lanka is not supported by the present study which has utilised a multivariate framework. In the case of India, the present study finds support for the export-led growth hypothesis only in the short run, as opposed to Kemal, *et al.* (2002) who term export-led growth in India to be a long run phenomenon.

6. CONCLUDING REMARKS

It is a widely held belief that developing countries can enhance their growth prospects through export oriented trade strategies. A variety of factors are

[17]A non-parametric statistical technique to detect non-linear causal relationships is developed in Hiemstra and Jones (1994), and has been applied in a number of empirical studies that have questioned the results of linear causality tests. For an application to the export economic growth relationship, see Lee and Pan (2000). Nonlinearity of export-economic growth relationship has also been modeled within a Threshold Autoregressive (TAR) framework. See, for instance, Lee and Huang (2002).

highlighted in the literature for their role in the exports-economic growth nexus including, for example, efficient allocation of resources, economies of scale, enhanced capacity utilisation, improved productivity, and diffusion of technical knowledge and innovation. It is mainly in view of these considerations that many countries around the world have adopted export oriented policies as part of their growth strategies.

Against this backdrop, this study has carried out an empirical analysis of the export-led growth hypothesis for Bangladesh, India, Nepal, Pakistan, and Sri Lanka. Within a multivariate Vector-Auto Regressive (VAR) framework, the concept of Granger causality is employed to determine the direction of causation between exports and output, duly taking into account the stationarity properties of the time series data. The study differs from the earlier work in two important respects. First, following Reizman, Summers, and Whiteman (1996), it explicitly accounts for imports when testing for the equilibrium relationship between exports and economic growth. In so doing, the study has addressed an important shortcoming of the earlier work whose empirical models may have been misspecified. Second, it investigates the time series properties of the variables by employing efficient unit roots that are more reliable in studies involving relatively shorter sample sizes.

For Bangladesh, the results indicate the presence of long-run causality from both exports and imports to economic growth, as well as feedback from economic growth to both exports and imports. There is also evidence of short-run bi-directional causality between exports and economic growth while controlling for imports. In the case of Pakistan, the presence of long-run causality is detected from both exports and imports to economic growth on the one hand, and from output and exports to imports on the other. In the short-run, however, there is no evidence of causality between exports and economic growth in either direction, while there is evidence of bi-directional causality between imports and economic growth.

For India, Nepal, and Sri Lanka, only the short-run causal patterns have been identified owing to the absence of long-run equilibrium relationships. The results indicate that there is bi-directional causality between exports and economic growth in both India and Sri Lanka. The results also support short-run causality from output growth to imports in both countries. In the case of Nepal, the results show reverse causation from output to exports on the one hand, and causality from imports to economic growth on the other.

Finally, it is important to point out that the foregoing results do not take into account the cross-country spillover effects of growth. Recent theoretical and empirical literature has emphasised the neighbourhood or spillover effects of growth which may result from a number of factors including, for example, regionally conditioned perceptions of investors, trade linkages, factor mobility, and policy emulation etc. While these effects may be important conditioning variables in a region that is characterised by strong economic ties, these are unlikely to be important in the South Asian context not least because of weak trade and investment linkages within the region.

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