Causality between Export and Growth: Evidence from South Asian Countries

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Abstract

Strong economic growth accompanied with robust export performance leads many people to conclude that export sector of a country has pivotal role in the economic growth of that country. Empirical evidence on export growth nexus has been mixed and inconclusive. This study examined whether there was any time series support for such export-led growth hypothesis for South Asian Countries. Engle-Granger's Error Correction Model (ECM) was used to test the Granger causality between export and output. The study had produced fairly mixed results, and did not find any conclusive evidence in favor of export-led growth for South Asian Countries. While Pakistan, Srilanka and Bhutan were the cases of export-led growth, India, Nepal, and Maldives show the opposite result of growth-led exports. In one country, namely Bangladesh, the data had failed to detect any causality in either direction which is attributed in low value addition in export.

Key Words: Export-led growth hypothesis, Granger causality test, Unit Root Tests, Error Correction Model.

I. Introduction:

The export-led growth hypothesis (ELGH) postulates that export expansion is one of the main determinants of economic growth. It holds that the overall growth of countries can be generated not only by increasing the amounts of labor and capital within the economy, but also by expanding exports. Economists behind export-led growth hypothesis consider exports can perform as an “engine of growth". This type of advocacy has been generated from the following reasons: First, expansion in demand for the country’s output through export growth facilitates the exploitation of economies of scale for small open economies. Second, exports expansion may

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relax a foreign exchange constraint which makes it easier to import inputs to meet domestic demand, and so enable output expansion. Third, expansion in exports may promote specialization in the production of export products, which in turn may boost the productivity level and may cause the general level of skills to rise in the export sector. This may then lead to a reallocation of resources from the (relatively) inefficient non-trade sector to the higher productive export sector. The productivity change may lead to output growth. Finally, an outward oriented trade policy may also give access to advanced technologies, learning by doing gains, and better management practices that may result in further efficiency gains Thus, international trade and development theory suggests that export growth due to export-oriented policies contributes positively to economic growth (measured by output growth). It should be noted that the theory also suggests that output can affect export. A one-way causality from output to exports is justified by, for instance, Kaldor (1967), Lancaster (1980), and Krugman (1984). They argue that output growth has a positive impact on productivity growth and improved productivity or reduced unit cost is expected to facilitate exports. It could be interesting, from a policy making point of view, to study the causal nexus of exports and output in South Asian Countries. Though, scatter plots in appendix A show solid relationships between log of real export and log of real GDP among South Asian countries. Is there any time series support for the export-led growth hypothesis in South Asian Countries? Does any causality exist between exports and outputs? These are the main questions addressed in this study concerning India, Bangladesh, Pakistan, Srilanka, Nepal, Bhutan, and Maldives. Thus the purpose of this paper is to explore the causal nexus of export and output in south Asian countries. In examining these issues, the study had been used Granger causality tests approach through cointegration and error-correction modeling.

The relationship between exports and growth has been explored extensively in the literature. Most of the early studies, including Michaely (1977), Balassa (1978), Tyler (1981), Feder (1983), Kavoussi (1984), Ram (1985), Sheehey (1990), Lopez (1991), Edwards (1993), and Ngoc et. al. (2003), were based on the Cross-section approaches and remarkably evidenced that exports have significant causal effect on economic growth. But these cross section studies contain an inbuilt drawback that these studies assume, rather than establish, that causality runs from export growth to GDP growth, while successful growth episodes in an economy can exhibits high export growth. These leads the authors, such as Sheehey (1990) and Pritchett (1996), to raise questions about the validity of conclusions based on cross-country studies. Sheehey (1990) has been found that other production categories besides exports whose growth has a similar relationship to GDP growth.

A number of studies including Jung and Marshall (1985), Chow (1987), Darrat (1987), Hsiao (1987), Bahmani-Oskooee et al. (1991), Kugler (1991), Dodaro (1993), Van den Berg & Schmidt (1994), Greenaway and Sapsford (1994), and Islam (1998) had adopted time series analysis for exploring the causal liaison between export growth and output growth. Using the Granger (1969), Sims (1972), and Hsiao (1987) causality procedures, these studies were failed to provide a uniform conclusion about the export-led growth hypothesis. However, these time series studies were not free from disparagement. Although standard Granger or Sims tests are only valid if the original time series are not cointegrated, none of these studies checked the cointegrating properties of the time-series variables involved. When time series are cointegrated, inferences based on traditional time-series modeling techniques will be misleading, as pointed out by Granger (1988), this is because traditional causality tests would miss some of the "forecastability" and, hence, reach incorrect conclusions about causality. Moreover all the

stuedies reviewed above used growth of GDP and that of exports which is akin to first differencing and filters out long-run information. In order to remedy this situation cointegration and error-correction modeling have been recommended to combine the short-term as well as long run information. Bahmani-Oskooee and Alse (1993) took all these issues into account and employed quarterly instead of annual data for the eight countries studied. They found strong empirical support for two-way causality between export growth and GDP growth in eight out of nine countries.

However, very few empirical studies have been done in the recent past to investigate the export-led growth (ELG) hypothesis for South Asian countries (Jung and Marshall 1985; Bahamani, Oskooe and Alse 1993, Dodaro 1993; Khan and Saqib 1993; Chandra 2000, 2002 and Begum and Shamsuddin (1998). The available evidence in relation to export-led growth in South Asia appears rather mixed. In case of India, Chandra (2000, 2002) found bidirectional causal relationship between export growth and GDP growth which is short-run causal relation, as cointegration between export growth and GDP growth was not found. In case of Pakistan, Bahamani-Oskooee and Alse (1993) and Khan and Saqib(1993) had done an exercise and found bi-directional causality between export growth and output growth, while Jung and Marshall (1985) observed that output growth had a perverse effect[*] on export growth and Dodaro (1993) failed to find any significant relationship in either direction. Both studies, Jung and Marshall (1985) Dodaro (1993), had failed to find any causal relation in either direction for Sri Lanka. Abhayaratne (1996) confirmed the previous finding by using cointegration. Dodaro (1993) failed to find any causality either from export growth to income growth or vice versa for Nepal, while he found that export growth causes GDP growth. Begum and Shamsuddin (1998) had found positive support for the export-led growth hypothesis for Bangladesh.

[*] The sign of the causality from output growth to export growth was negative

The motivation for undertaking this study is thus threefold. First, by covering the entire South Asian region, it fills an important gap in the literature. Second, it tries to confirm the validity or otherwise of the mixed results obtained in the empirical literature for South Asian as well as other countries. The causality directions between economic growth and exports have very crucial policy implications. Therefore, this study is conducted to investigate the relationship between output and export in the case of South Asia by using the recent econometric methodology, Engle-Granger Error Correction Model Granger causality test. Our specific objectives are as follows: (1) to examine the short run and long run causality relationship between output and exports; and (2) to suggest some policy implications .

II. Methodology:

2.1. *Cointegration, Error-Correction Modeling and Granger Causality Tests*

Before cointegration is applied, it is essential to test a time series for stationarity. A time series is stationary (in the sense of weak stationarity) if its mean, variance and covariance remain constant overtime. At a formal level, stationarity can be tested by determining whether the data contain a unit root. This can be done by the Dickey and Fuller (1979), Augmented Dickey-Fuller (ADF) and Phillips and Perron (1988) tests. The ADF test is used here for testing for stationarity as well as for the order of integration of a series. The logs of variables are taken so that the first differences can be interpreted as growth rates. If two variables LX (the log of real exports) and LGDP (the log of real GDP) are integrated to the order one, i.e. I(1), then the next step is to find whether they are cointegrated. This can be done by estimating the following cointegrating equations by OLS and testing their residuals for stationarity.

$$LGDP=\theta+\eta LX+u \quad \text{..... (5)}$$

$$LX=\delta+\lambda LGDP+e \quad \text{..... (6)}$$

If LGDP and LX are both I(1), then for them to be cointegrated u and e should be stationary or I(0). To check whether there is valid long-run/cointegrating relationship among the variables, we need to test the stationarity of residuals (i.e. linear combination of variables) employing the ADF test, which is given in (7). The ADF test statistics is the t-ratio on the term .The critical values for the test is given by McKinnon (1991).

$$\Delta E_t=\rho E_{t-1}+\gamma \Delta E_{t-1}+v_t \quad \text{..... (7)}$$

Where Δ is the first difference, E_t is the residual from cointegrating regressions and v_t is the white noise.

Once it is established that two variables are cointegrated, the next issue is that of which variable "causes" the other. Before the advent of cointegration and error-correction modeling, the standard Granger tests were used widely to determine the direction of causality. However, as noted earlier, the standard Granger method is likely to be misleading if variables are cointegrated since the standard tests do not contain an error-correction term. The error-correction representation of the Granger causality model with two variables is formulated as follows:

$$\Delta LGDP_t = C_1 + \sum_{m=1}^{p_1} \phi_{1m} \Delta LX_{t-m} + \sum_{m=1}^{q_1} \varphi_{1m} \Delta LGDP_{t-m} + \lambda_1 u_{t-1} \quad \text{..... (8)}$$

$$\Delta LX_t = C_2 + \sum_{m=1}^{p_{21}} \phi_{2m} \Delta LX_{t-m} + \sum_{m=1}^{q_{21}} \varphi_{2m} \Delta LGDP_{t-m} + \lambda_2 e_{t-1} \quad \text{..... .... (9)}$$

Where the error-correction terms u_{t-1} and e_{t-1} are stationary residuals from the cointegrating equations. By introducing error-correction terms in the above equations, an additional channel is opened up through which causality is tested. For example, in equation (8), growth of real exports (ΔLX) is said to Granger cause real income growth (ΔLGDP) either when the coefficients of lagged ΔLX are positive and jointly significant through the F-test or if λ_1 is significant or both. If

income growth causes export growth, either the coefficients of the lagged ΔLGDP are positive or jointly significant (F-test) or λ_2 is significant or both (equation (9)). Thus error-correction models allow for the fact that causality can manifest through the lagged changes of the independent variable or through the error-correction term or through both.

In the above analysis, the inclusion of the error-correction terms makes it possible to distinguish between short-term and long-term causality. The lagged changes in the independent variables represent the short-run causal impact whilst the significance of the error-correction term gives the information on long-run causality.

Before implementing the Granger Causality test one has to chose the order of lag (i.e. p_i and q_i, where i=1, 2) appropriately. There is evidence that the causality tests are often sensitive to the choice of the lag lengths. In the literature there exist a number of suggested methods for choosing the lag orders. Here "simple to general" recommended by Engle and Granger (1987) has been followed. They favored starting with fewer lags and then testing for added lags. The idea is that if non-autocorrelated residuals are achieved by smaller number of lags then that model is preferred to the one with larger number of lags in the interests of parsimony. Moreover, this method has the added advantages of not over parameterising the model and of preserving the degrees of freedom particularly if the sample size is relatively small. Given these considerations the third method of simple to general search is followed here.

2.2. *Data Issues*

The study uses annual time-series data from the IMF's International Financial Statistics (1995, 1999, 2004, 2006). Exports are in domestic currencies deflated by unit export values where available and the consumer price index if the unit export value index is unavailable. Only in the

case of Srilanka, unit value indices of exports is available continously; therefore, the consumer price indices are used instead for the other countries. All indices take 2000 as the base period (2000=100).

Jung and Marshall (1985) also make use of the export price index or the consumer price index and point out that there are difficulties with both price indices. The consumer price index fails to pick up changes in terms of trade while the export price index is frequently not a constant basket index but a unit value index, the composition of which varies. They also find that where exports are deflated by the consumer price index, the results are less favourable to the export-led growth hypothesis. It is important, therefore, to keep these considerations in mind while interpreting the results of the present study.

Furthermore, all of the series are transformed into log form. Log transformation can reduce the problem such as heteroscedasticity because it compresses the scale in which the variables are measured, thereby reducing a tenfold difference between two values to a twofold difference (Gujarati 1995). The period for each country is different and is dictated by the availability of data. The longest period is for India (1965-2005) ,Nepal (1965-2005), Sri Lanka (1965-2005), Pakistan (1965-2005), followed by Bangladesh (1980-2005), Maldives (1980-2005) and Bhutan (1980-2004).

Before we proceed further let us note a few methodological problems of the present study arising out of data availability. Firstly, it can be argued that export-growth models based on a bivariate framework may be misspecified as besides exports other important variables such as terms of trade are omitted. If the objective is to have a comprehensive study for the entire region, in view of the data limitations, there is no escape from the bivariate methodology adopted here.

Finally, as noted in the previous section, the unit value index as well as the consumer price index is both problematic, but in the absence of any better alternative, one is left with no option but to use them. In the literature, therefore, a variety of indices including the consumer price index, the unit value index for exports and the GDP deflator have been used, sometimes all within the same study.

III. The Results

3.1. *Time Series Properties of the variables*

First, the Augmented Dickey-Fuller (ADF) tests, the popular tests for unit roots, have been performed for variables based on the following equation:

$$\Delta Y_t = \alpha + (\psi - 1)Y_{t-1} + \eta T + \gamma \Delta Y_{t-1} + e_t \quad \text{..... (9)}$$

The ADF test for unit root is based on equation (9) with the null hypothesis of (Ψ-1)=0 (i.e. the Y_t is non-stationary) against the alternative of (Ψ-1)<0 (i.e. Y_t is stationary).The t-test on the estimated coefficient of Y_{t-1} provides the ADF test for the presence of a unit root. Since the data are annual in nature, following the usual practice of unit root test we have used only one lag in equation. This is done to ensure that the error process in the estimating equation is residually uncorrelated. The t-ratio on (Ψ-1) provides the ADF statistics. Now-a-days, Phillips-Perron (PP) test for Unit root has widely been used in light of the fact that often economic time series exhibit heteroscedasticity and non-normality in raw data, which the ADF test does not consider. The PP test is, in fact, an adjusted t-ratio on (Ψ-1) in equation (9). There seems to be a concensus in the cointegration literature that the PP test is preferable to ADF. In Table 1 we report the, ADF and PP test results to see the order of integration of the related variables. A time series is integrated of order d [usually denoted as ~I(d)] with d is the number of times the series needs to be

differenced in order to become stationary. The econometric software Eviews3.0 and Microfit 4.0 version were used for the respective tests.

The results of the ADF and PP tests at level and first differences are reported in Table 1, by taking into consideration of trend variable and without trend variable in the regression respectively. Based on Table 1, the t-statistics for all series from both ADF and PP tests are statistically insignificant to reject the null hypothesis of non-stationary at 0.05 significance level. This indicates that these series are non-stationary at their level form. Therefore, these variables are containing a unit root process or they share a common stochastic movement. When the ADF test is conducted at first difference of each variable, the null hypothesis of non-stationary is easily rejected at 0.05 significance level as shown in Table 1. This is consistent with some previous studies that have been demonstrated the most of the macroeconomics and financial series expected to contain unit root and thus are integrated of order one, I(1).

Table 1: ADF and PP tests for unit roots of the variables

Country	ADF and PP test for Unit Root					
	Variables	ADF		PP		Data Period
		Levels (Including Trend)	First Differences (Without Trend)	Levels (Including Trend)	First Differences (Without Trend)	
Bangladesh	LX	-2.513	-5.250781*	1.0678	-7.448242*	1980-2005
	LGDP	-.15879	-2.492007	-1.008	-8.502124*	1980-2005
India	LX	-1.75645	-3.441201*	-1.5986	-6.182824*	1965-2005
	LGDP	-2.235277	-5.240954*	-2.0806	-5.68900*	1965-2005
Pakistan	LX	-2.034234	-4.793305*	-2.3881	-5.982747*	1965-2005
	LGDP	-2.745713	-7.571700*	-2.548	-14.44017*	1965-2005
Sri Lanka	LX	-2.045990	-5.499558*	-2.4805	-7.977382*	1965-2005
	LGDP	-2.271914	-4.914921*	-1.8815	-4.646443*	1965-2005
Nepal	LX	-2.211793	-5.890446*	-2.7423	-7.885375*	1965-2005
	LGDP	-2.839404	-8.361529*	-2.7954	-8.184567*	1965-2005
Bhutan	LX	-2.195905	-2.684100	-1.6698	-3.070442*	1980-2004
	LGDP	-1.222375	-2.402688	-1.0633	-3.461317*	1980-2004
Maldives	LX	-2.592781	-2.484502	-1.8436	-3.006366*	1980-2005
	LGDP	-2.515069	-3.639671*	-2.34701	-4.308454*	1980-2005
Note: 1. * denotes significant at 5 percent level						

A similar conclusion has been drawn from PP test. Therefore, we can conclude that the series are integrated of order one, and a higher order of differencing is not required to execute. The number of lag is set equal to one in order to avoid the problem of autocorrelation that is to ensure the error terms are uncorrelated and enhance the robustness of the results.

3.2 *Tests for Co-integration: The Engle-Granger Procedure*

Since pre-testing suggests all variables in our model are to be I(1), we compute what is known as the first step of Engle–Granger procedure. To check whether there is valid long-run/cointegrating relationship among the variables, we need to test the stationarity of residuals (i.e. linear combination of variables) employing the ADF test. The ADF test statistics is the t-ratio on the term .The critical values for the test is given by McKinnon (1991).The results of the residual based test for cointegration is presented in table 2.

Table 2: Residual based test for Cointegration

Country	Residual based test for cointegration				
	Cointegrating Regression	$\overline{R}^2$	Slope	ADF of Residuals (without intercept)	95 percent Critical value[1]
Bangladesh	LX=*f*(LGDP)	0.937036	2.369555	-3.4558	-2.986
	LGDP=*f*(LX)	0.937036	0.396511	-3.9422	-2.986
India	LX=*f*(LGDP)	0.97736	1.594127	-2.2426	-2.934
	LGDP=*f*(LX)	0.97736	0.61566	-2.2326	-2.934
Pakistan	LX=*f*(LGDP)	0.744790	1.089993	-4.7980	-2.934
	LGDP=*f*(LX)	0.744790	0.689152	-5.7548	-2.934
Srilanka	LX=*f*(LGDP)	0.827810	1.256932	-2.1560	-2.934
	LGDP=*f*(LX)	0.827810	0.662020	-2.1825	-2.934
Nepal	LX=*f*(LGDP)	0.908242	1.535593	-3.4581	-2.934
	LGDP=*f*(LX)	0.908242	0.592954	-2.8966	-2.934
Bhutan	LX=*f*(LGDP)	0.819568	1.526124	-0.97324	-2.986
	LGDP=*f*(LX)	0.819568	0.541952	-0.34950	-2.986
Maldives	LX=*f*(LGDP)	0.649632	1.183149	-1.5722	-2.986
	LGDP=*f*(LX)	0.649632	0.560916	-0.95801	-2.986
1. The critical values are calculated based on McKinnon(1991)					

From Table 2 it may be seen that the estimated ADF statistics in both the cointegrating regressions are less than the corresponding 95 percent critical values indicating that real exports and real income are cointegrated in Bangladesh, Pakistan; and Nepal. While other countries have no evidence of cointegration between real exports and real income.Table2 also reports the slope coefficients of the cointegrating regressions; the signs of the slope coefficients are positive in all cases, indicating that the relationship between real exports and real GDP is positive.

Thus, the results suggest that real exports and real GDP in Bangladesh, Pakistan; and Nepal are cointegrated implying a long-term relationship between the two variables.

3.3 *Granger Causality Tests*

As seen earlier, there are two ways in which causality can express itself: through the F-test of joint significance of the lagged differenced terms, and through the error-correction term. The results are reported in Table 3. It can be seen that in both the cases of Bangladesh F-statistics for $x \rightarrow y$ and $y \rightarrow x$ are insignificant at 95 percent level of confidence. Thus, the data suggest that there is no short-term causality in either direction. If one looks at the error-correction terms, they appear insignificant in both equations for Bangladesh (Table 3), implying that there is no long-term causality runs from growth of real income to growth of exports. This is in contrast with Dodaro's study mentioned earlier, which finds evidence of export-led growth for Bangladesh (although the causality is short-term in nature).

Following the same approach in each of the given cases, it can be seen that in only three countries, India, Nepal and Maldives are cases of growth-led exports. This is in contrast with, in case of India, Chandra (2000, 2002) found that there is a two-way relationship between export growth and GDP growth, but this relationship is short term in nature as real exports and real GDP do not exhibit cointegration or a long-term relationship. But we have found unidirectional

causality runs from growth to export in case of India, even it is short term in nature. Pakistan and Sri Lanka show evidence of export-led growth. In case of Bhutan, it is seen that there is a long-term causality of runs from export to GDP, although there is no evidence of short-run causality.

Table 3: Granger Causality Test Results

Country	Granger Causality Tests				
	Dependent Variable	E(-1) P values in brackets	No. of lags	F(LX→LGDP)	F(LGDP→LX)
Bangladesh	DLX	-0.13(0.50)	1		1.25 [0.32]
	DLGDP	-0.16 (0.12)	2	1.15 [0.37]	
India	DLX	-0.20 (0.09)	2		2.53[0.05]
	DLGDP	-0.06(0.47)	1	1.08 [0.37]	
Pakistan	DLX	-0.12(0.22)	1		0.53 [0.66]
	DLGDP	-0.85 (0.00)	2	6.76 [0.00]	
Sri Lanka	DLX	0.09(0.11)	1		1.75[0.18]
	DLGDP	-0.33 (0.01)	1	3.77 [0.02]	
Nepal	DLX	-0.39(0.03)	1		2.47 [0.08]
	DLGDP	0.06(0.50)	1	1.09 [0.36]	
Bhutan	DLX	-0.18(0.12)	1		2.73 [0.07]
	DLGDP	0.11 (0.06)	1	2.21 [0.12]	
Maldives	DLX	-0.35 (0.01)	1		5.09[0.01]
	DLGDP	0.04(0.67)	1	0.22 [0.88]	

The results for all South Asian countries, summarized in Table 4, show that the evidence for export-led growth in South Asia appears rather mixed. The mixed nature of results, irrespective of the period taken, is hardly surprising for the countries of South Asia. Firstly, lack of conclusive evidence in favor of export-led growth reflects the inward-looking nature of these economies, where, for most of the relevant periods, trade was not considered even a handmaiden of growth, let alone an engine of growth. Thus lack of much success on export-led growth is only to be expected. Secondly, the mixed nature of the results reported in this study is in line with the literature on the subject. Indeed, as we have noted, the earlier literature on the subject does not report any conclusive evidence in favor of export-led growth in South Asia or in general.

Table 4: Summary of results

Results	Countries
Export-led growth	Pakistan, Sri Lanka, Bhutan
Growth-led export	India, Nepal, Maldives
No causality	Bangladesh

IV. Conclusion and Policy Implications

This paper has studied the possibility of Granger causality between the logarithms of real exports and real GDP in seven South Asian countries for different time period. The study findings suggest that real exports and real GDP are cointegrated only in Bangladesh, Pakistan and Nepal. While Pakistan, Srilanka and Bhutan are cases of export-led growth either short-term or long-term, India, Nepal, and Maldives show the opposite result of growth-led exports. In the Bangladesh's case, the problem is that the actual structure of exports proved to be not capable of generating a feed-back ELG relation. This means that exports do not bring enough value added for providing relevant information of GDP. Thus the results, in line with the current status of the literature on the subject, are quite mixed, and do not give any overwhelming support to the export-led growth thesis. The mixed nature of the results is not surprising as these economies, by and large, have been characterized by inward-orientated planning which gave primacy to import substitution over export promotion. Perhaps the effect of this strategy has been so deeply rooted that liberal regimes of the 1980s and 1990s are yet to be manifest in export-led growth for the South Asian region as a whole. The aim of this paper was to comprehensively examine the relationship between exports and output growth in the South Asian economy. Advanced econometric methodologies have been applied in order to investigate the short- and long-run causality relationship between export and growth. This is the first comprehensive study on export-led growth hypothesis covering entire South Asian region. Thus this study tried to fill an important gap in economic literature.

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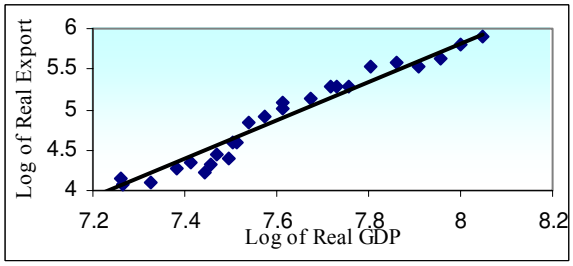
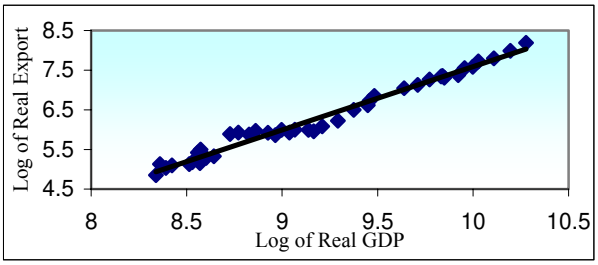
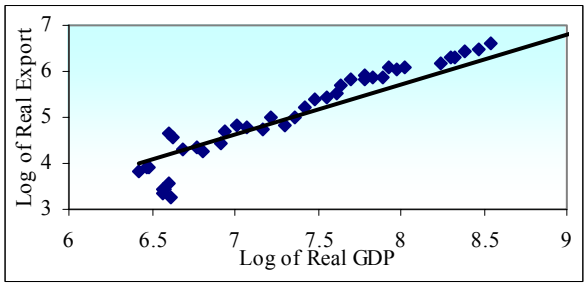
Appendix A: Scatter plot between log of real export and log of real GDP in south Asian countries



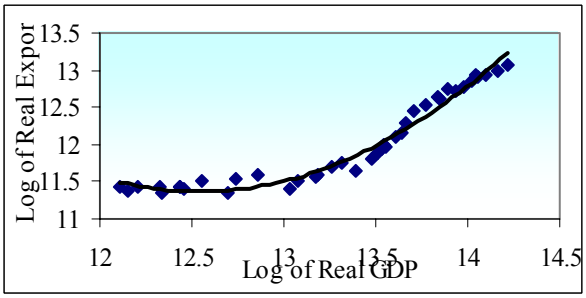
A. Bangladesh



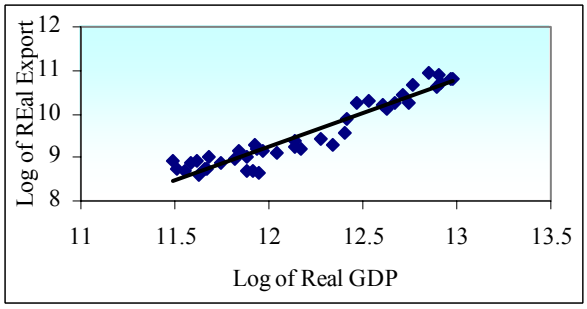
B. India



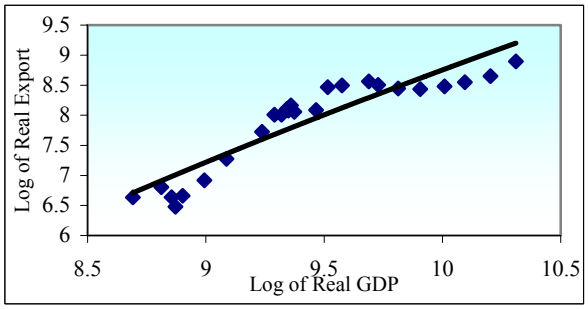
C. Pakistan



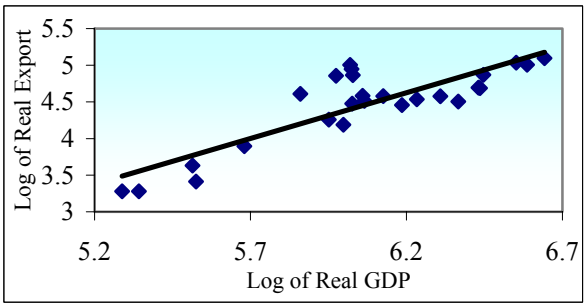
D. Sri Lanka



E. Nepal



F. Bhutan



G. Maldives

Data Source: IFS, Various Issues, IMF, Washington D.C. USA.