



EXPORT GROWTH AND DIVERSIFICATION OF SRI LANKA'S MAJOR PRODUCT SECTORS

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Abstract: Growth rate is one of the most common indicators use to assess the progress of an economy in any area of economic activity. In export sector, growth rates are widely employed to identify 'dynamic sectors' as they have important policy implications. However, a drawback to the existing methods is that, most do not measure the statistical significance of these results, while others measure statistical significance making some unrealistic assumptions. The first phase of this study was therefore dedicated to undertake a new approach based on bootstrap methodology to test the significance of export growth rates of major product sectors. The second phase of the study reveals that Sri Lanka has increasingly diversified its export markets by moving from exports of traditional commodity to exports of processed goods and manufactures.

Keywords: Export Sector, Growth Rate, Bootstrap Method, Destinalional Concentration Index

I. INTRODUCTION

Export sector of Sri Lanka plays a vital role in fostering the socio-economic development of the country. The export development effort is a long term and a continuous process. Therefore, it is important to ascertain the current performance of the export sector in formulating future export development strategies.

Export growth rate is one of the most commonly used indicators to assess the development of the sector. Comparison of such indicators over many countries might be of interest to producers, exporters, trade associations, investors, policymakers and trade negotiators.

Unfortunately, sometimes loose statements are made about rising or falling or constancy over time of export growth rates. In a few cases, these statements are based on fitting a particular growth curve without examining its empirical appropriateness. Another drawback to these studies is that most do not measure the statistical significance of these results, while others measure statistical significance making some unrealistic assumptions on distribution of parameters. To avoid these drawbacks, this study employed a novel approach, based on bootstrap methodology, to test the significance of export growth rates of major product sectors. Further, analysis of exports by country of destination, results in a number of useful insights relating to Sri Lanka's exports.

II. METHODOLOGY

The basis used to assess performance in the current year is particularly important. At one extreme, the current year's performance could just be measured against that of the previous year. Such an assessment is not particularly useful since the previous year may have been an unusually good or bad one. At another extreme, the current year performance could be assessed against the average performance in the previous 20 or more years. But this again is unsatisfactory as various structural and other changes could have occurred during such a long period, making the 20 year averages not particularly meaningful. Therefore the approach used in the present study is an intermediate one where the current year's performance is measured against the performance during the nine years immediately preceding it.

Compounded Annual Growth Rate (CAGR) which is a geometric mean growth rate on an annualized basis is one of the most commonly used models for computing growth rate in export sector in many countries.

If continuous compounding of the series is assumed (i.e. the compounding period is infinitesimally small), then we have

$$Y_t = Ae^{Bt}$$

where A is a constant and B is the CAGR (also called exponential growth rate) during the period under review. Y_t is the value of exports in t^{th} time point.

Taking natural logarithms on both sides, we get

$$\ln(Y_t) = \ln(A) + Bt$$

Taking $Y = \ln(Y_t)$ and $C = \ln(A)$, we get

$$Y = Bt + C$$

B and C can be estimated by Ordinary Least Square (OLS) method used in Regression Analysis.

Then the Average Growth rate = $(B \times 100) \%$

The most important statistical test in Simple Linear Regression is the test of whether or not the slope parameter, B, is equal to zero. If we conclude any particular case that the true regression slope is “not statistically significant”, this means that the estimated growth rate is not reliable and the “true” growth rate in that case could very well be zero.

There is an extremely close relationship between confidence intervals and hypothesis testing. When a 95% confidence interval is constructed, all values in the interval are considered plausible values for the parameter being estimated. Values outside the interval are rejected as relatively implausible. If the value of the parameter specified by the null hypothesis is contained in the 95% confidence interval then the null hypothesis cannot be rejected at the 0.05 level. If the value specified by the null hypothesis is not in the interval then the null hypothesis can be rejected at the 0.05 level. If a 99% confidence interval is constructed, then values outside the interval are rejected at the 0.01 level.

There are three basic assumptions underlying parametric tests should hold, as described by Johnson *et al.* [2]. First, the tests require data that can be treated as at least in interval scale; second, data should be normally distributed or closely so, and third, the amount of random, or error variance should be equally distributed among the different analyses. If these assumptions are violated, then non-parametric tests can be used to analyze the data [3], as non-parametric or distribution-free tests do not specify conditions about the shape or character of the distribution of the population from which samples are drawn.

In this study to estimate the commodity wise average export growth rates, only 10 data points were considered. However the basic assumptions were violated for some product sectors. As a result, usual parametric t test could not be used in such situation to test the significance of the parameters. Further, to use parametric approach there should be sufficient sample size to assess the form of the distribution.

So, to overcome these problems, nonparametric bootstrap confidence limits for the parameter estimates were used to test the significance of the parameters as it imposes only few assumptions about the shape of the distribution and therefore it is more flexible than usual parametric approaches. "Coconut Fiber & Shell production" of the country during 2002 to 2011 is considered for illustration purpose.

As there is no software package available for the purpose, computer programs are developed in R version 2.13.2 (2011-09-30) for this specific task and the same is appended in Annexure-I. In addition MINITAB 14 was also used for the analysis.

The second phase of the study; analysis of exports by country of destination, results in a number of useful insights relating to Sri Lanka's exports.

One approach to analyzing destination data on exports is to assess whether exports, by individual sector and for all sectors together, are distributed over a large number of countries or not. Ideally markets should be widely distributed to reduce the vulnerability of exports to the loss, or reduction of a single country's market or that of a few countries.

The index of destination concentration is a statistical parameter which serves as a measure of how dispersed a country's exports are. The higher the index of concentration, the less distributed are the export markets, and lower the index of concentration, the more widely distributed are the same markets. At one extreme, if all exports go to a single country, the concentration index would be 1 (or 100%). At the other extreme, the concentration index would be 0 (or 0%) if exports were distributed among an infinite number of countries.

The degree of destination concentration of a country's total exports can be measured using a Destination Concentration Index defined by,

$$\text{Destination Concentration} = \left[\left(\frac{X_i}{X} \right)^2 + \left(\frac{X_j}{X} \right)^2 + \dots + \left(\frac{X_n}{X} \right)^2 \right]^{1/2}$$

Where X_i = total exports to country i, (i=USA, UK, Italy, ...)

X_j = total exports to country j, (j=USA, UK, Italy, ...)

.....

X_n = total exports to country n, (n=USA, UK, Italy, ...) where $(i \neq j \neq \dots \neq n)$

and X = total exports of all exporting countries = $X_i + X_j + \dots + X_n$

The same formula can also be used to calculate the destination concentration index for a single sector or a sub-sector, where the terms X_i , X_j , ..., X_n and X can be reinterpreted as:

X_i = sector's exports to country i,

X_j = sector's exports to country j,

.....
 X_n = sector's exports to country n, and
 X = total sector's exports of all exporting countries.

III. RESULTS AND DISCUSSION

A. Export Growth Rates of Major Product Sectors

Table 3.1 depicts Sri Lanka's CAGR estimates for major product sectors.

Table 3. 1: Export Growth Rates of Major Product Sectors 2002 – 2011

Index	Product Description	% Contribution to Total Export	2002- 2011 Average Growth (%)	2010- 2011 Growth (%)
1	Agricultural Products	23.23	10.76***	10.69
1.1	Tea	13.98	9.89***	2.57
1.2	Natural Rubber	1.96	21.46***	19.14
1.3	Coconut	4.01	11.69***	52.65
1.4	Other Export Crops	3.29	9.79***	6.34
2	Fisheries Products	1.85	10.71***	-3.43
3	Industrial Products	74.84	7.07***	27.57
3.1	Diamonds, Gems & Jewellery	5.03	5.23**	30.04
3.2	Textiles & Garments	39.51	5.02***	24.85
3.3	Manufacturers	25.05	10.31***	21.29
3.4	Petroleum Products	5.24	18.92***	110.27
4	Product Unclassified	0.08	-26.79**	-34.96
	Total Merchandise Exports	100	7.75***	22.41
Notes: 1. Estimates in the table are developed using the data presented in "Export performance by Major Product Sectors 2002 -2011". 2. ***, ** denotes that the estimate is statistically significant at 1% and 5% level respectively.				

As can be seen in the Table3.1 Sri Lanka's exports are dominated by Industrial products which account for about three quarter of overall weight of the total exports. Examined more closely, the growth performance of textile and garments sector which was the largest single major export sector of the country was nearly five times better in 2011 compared with the corresponding compound annual growth rate during the period under review (2002 - 2011)

In order to reduce dependence on traditional commodity exports, Sri Lanka has been moving into exports of processed goods and manufactures. Recorded growth of manufactures sector which makes the second highest contribution to the total exports in 2011 (~10%) is just over twice than the corresponding average annual growth rate (~21%).

Diamonds, gems and jewellery sector grew at a high amount of over 30% in 2011. This is approximately 6 times higher than the corresponding compound annual growth rate of that sector during the period under review.

Petroleum products which performed the best in terms of export growth showed a phenomenal increase in exports in 2011 compared to corresponding compound annual growth rate of that sector during the ten year period considered.

As a whole in 2011 the agriculture product sector increased at approximately the same rate as it did in the corresponding compound annual growth for the last ten year period. However, as the table shows, the performance is very uneven in terms of major sectors under agriculture products.

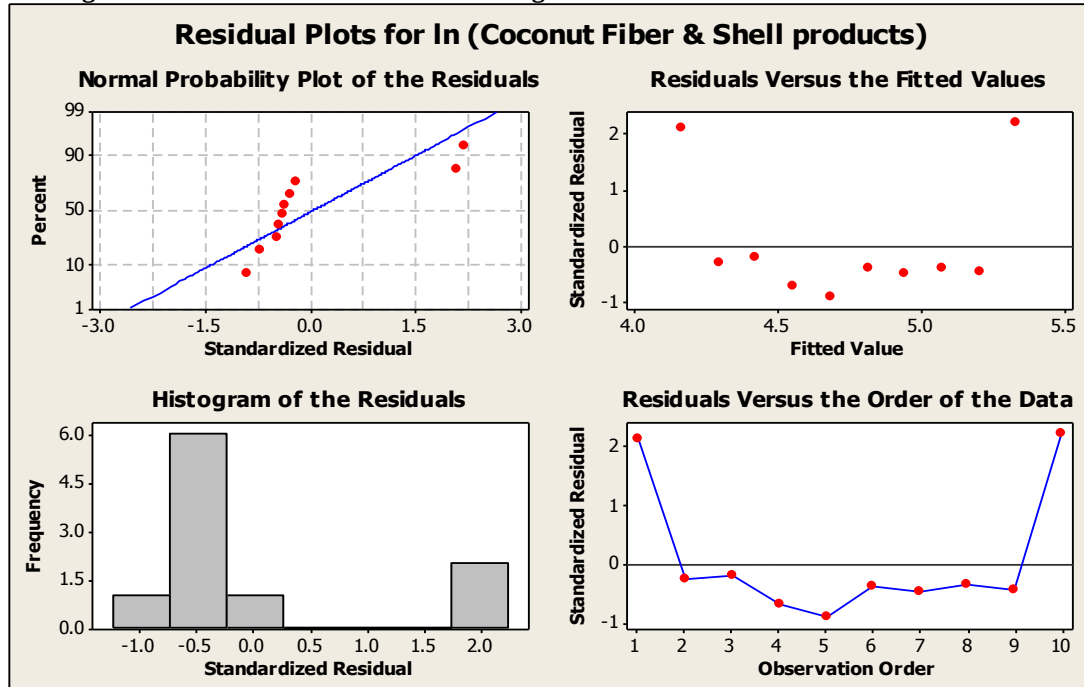
Although the agriculture sector as a whole exhibited no significant change in growth in 2011 from its average annual growth rate, the coconut sector did exhibit a strong growth in 2011 compared to the corresponding average annual growth rate. However except for coconut sector all the other subsectors, tea, natural rubber and other export crops showed a significant turn down in their export performance in 2011 compared with average annual growth performance.

The export performance of the fisheries product sector worsened in 2011, compared with its average annual growth rate during the period considered. The sector slipped from positive average growth rate to negative growth in 2011. However since the sector only accounted for nearly 2% of Sri Lanka's total exports in 2011, the decline did not make that much influence to the country's economy.

A.1 An Illustration

Coconut Fiber & Shell production of the country during 2002 to 2011, as given in Exports performance indicators 2002- 2011[2], is used for the study.

Figure 3.1.1: Residual Plots for natural logarithm of Coconut Fiber and Shell Products



Hypothesis to be tested:

H0: Errors are normally distributed Vs H1: Errors are not normally distributed

Since p value < 0.005 we can reject the null hypothesis (H0) at 0.05 level of significant. That is we can conclude that the errors are not normally distributed. In addition to that, according to the plot of “residuals versus fitted values” the residuals are not fluctuated around zero within a horizontal constant band. Since the basic assumptions are violated for the product sector, usual parametric t test could not be used to test the significance of the parameter.

Table 3.1.1: Results obtain from Bootstrap Method

lower.limit	upper.limit	B	Alpha level	No. of Bootstrap samples
0.1115	0.1478	0.1302	0.05	1000

Hypothesis to be tested : H0: B=0 vs H1: B ≠ 0

Since the value specified by the null hypothesis is not in the confidence interval, (0.1115, 0.1478) the null hypothesis can be rejected at the 0.05 level. That is we can conclude that the parameter B is significant.

Then the Average growth rate of Coconut Fiber & Shell products sector = $B \times 100 = 13.02\%$

B. Diversification of Major Product Sectors

The analysis of destination concentrations of Sri Lanka’s major products reveals that the destination concentration of Sri Lanka’s total exports declined from 41% in 2002 to 27% in 2011, suggesting that Sri Lanka has increasingly diversified its export markets over the period under review.

The largest single major export sector: Textiles and garments which accounted for nearly 40% of the country’s exports in 2011, has a significantly high destination concentration in 2011 although its’ concentrations have decline at a great deal from a higher 65% in 2002 to 46% in 2011.

The destination concentration of manufactures which makes the second highest contribution to the total exports was nearly 27% in 2011 and this was a decline from a higher 33% in 2002.

The destination concentration of diamonds, gems and jewellery sector, which accounted for only 5% of the total exports in 2011 remain almost unchanged between the years 2002 to 2011.

Petroleum Products have demonstrated an increase in concentration from 82% in 2002 to 92% in 2011. This trend highlights the vulnerability of the sector.

The destination concentration of the agricultural products which accounted for 23% of the total exports in 2011 remained almost unchanged between the years 2002 and 2011.

On the positive side, the low concentration of the fisheries products in 2011 and the large declines in these concentrations from 2002 to 2011 is a desirable trend. However since the sector only accounted for nearly 2% of Sri Lanka's total exports in 2011, the concentrations are not too important.

IV. CONCLUSIONS

The growth performance of Sri Lanka's total exports in the year under review (2011) was far superior to the corresponding compound annual growth rate for 2011 and the nine years immediately preceding it. This change in export growth is a good sign for the country's economy.

Further, it is hoped that this study will simulate further research into this important phenomenon which enable continuous improvement and ensure the continuous success of the country's economy.

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R Code

```
function(rep.num, alpha)
{
  #rep.num - number of replicates
  library(MASS) # load MASS packages
  # Read data file
  data=read.table("data.txt",header=TRUE)
  attach(data)

  data.lm <- lm(lny~t,data=data)
  resample <- function(data)
  { sample(data,size=length(data),replace=TRUE) }
  resample.data <- function()
  {
    sample.rows <- resample(1:nrow(data))
    return(data[sample.rows,])
  }

  # define the estimator
  estYonT <- function(data)
  {
    fit <- lm(lny ~ t, data=data)
    return(coefficients(fit))
  }
  data.lm.cis <- function(rep.num, alpha)
  {
    tboot <- replicate(rep.num,estYonT(resample.data()))
    B=mean(tboot[,2,])
    low.quantiles <- apply(tboot,1,quantile,probs=alpha/2)
    high.quantiles <- apply(tboot,1,quantile,probs=1- alpha/2)
    lower.limit <- 2*coefficients(data.lm) - high.quantiles
    upper.limit <- 2*coefficients(data.lm) - low.quantiles
    cis <- rbind(lower.limit,upper.limit, B)
    return(cis)
  }

  signif(data.lm.cis(rep.num,alpha)[,2],4)
}
```