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Pakistan Export Earnings -Analysis 2009 -2011

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ABSTRACT

Statistical year books have published the data on export revenue in dollars earned for each item for 2009 to 2011. In all 48 items have been recorded, which include Agricultural as well as manufactured items. Some items, which are mostly Agricultural earn a significantly large amount of earnings compared to the non-agricultural items. However the number of items of non-agricultural items is quite large. Some manufactured items which have an important position as export item are the petroleum products.

In this paper a probability model has been developed, called the Exponential and in order to asses the variation in export earnings a Lorenz curve is calculated .From it the Gini Index is obtained. The variability in earnings is measured by Gini Index and forecast in this variation has been made .The items which have small variation from the ideal variation are selected,which are : Rice , Cotton ,Cotton added value items .

INTRODUCTION

The export of items from different sectors is very important for a country like Pakistan. Export is an important source of income , in dollars. The income by export items in an important factor to improve Balance Of Payments (BOP) of a country. A good export policy generates a handsome amount of income, growth in industries, agricultural

production, live stock etc and provides employment to people . In this paper we examine export distribution of revenue for the year 2009-10 and 2010-11. Appling theoretical concepts and applications.

We find our variable of interest X: income by export revenue in dollars follows an exponential distribution . Which is highly positive skewed distribution. The exponential distribution gives a good (albeit not perfect) description of the export revenue data. We also examined associated measures of inequalities, Lorenz curve and Gini's coefficient of inequality in context of income inequality.

The exponential distribution is a decay model , and shows high inequality , which is not a good indication for export policy. Policy makers have to do to much to improve our export policy.

1 The Exponential Distribution

The distribution has many areas of scientific investigation **[3,6].** If X is export revenue income then proposed probability distribution function (pdf) is given by

$$f(x) = \frac{1}{\lambda} Exp(-\frac{x}{\lambda}) \quad x > 0, \lambda > 0 \qquad (1)$$

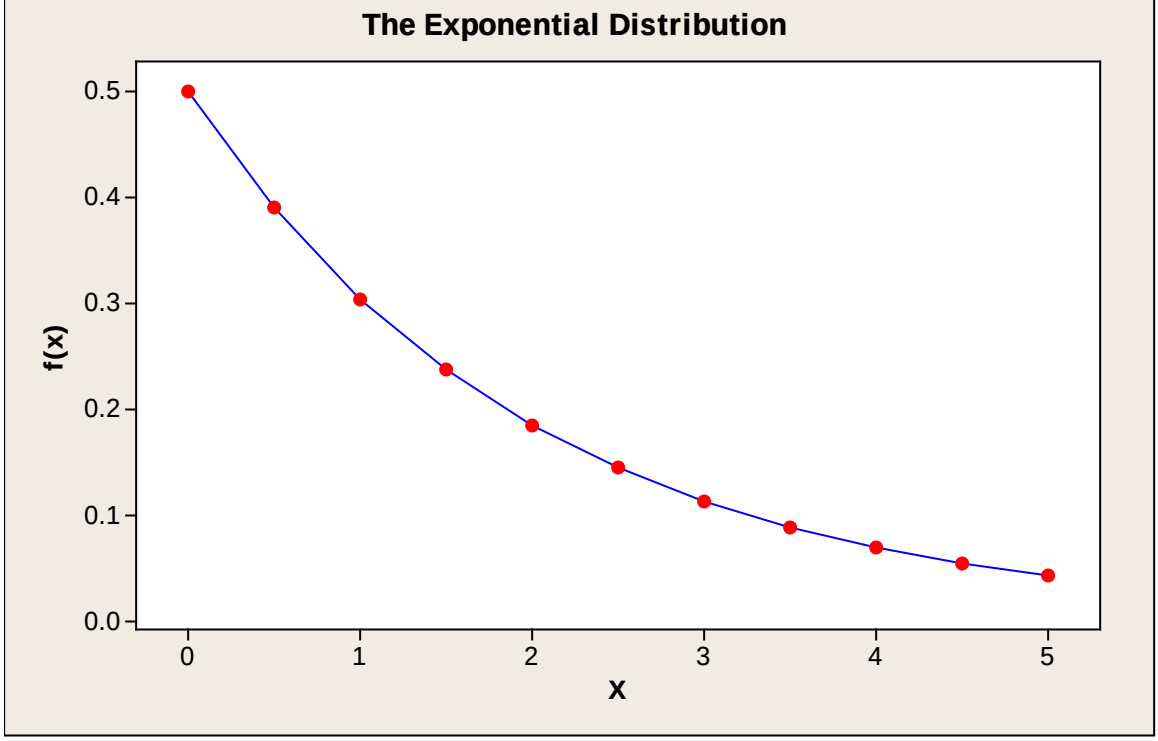

Figure-1. The Exponential Distribution

Which is highly positively skew (inequality) distribution see figure (1).

The function (1) is maximal at x=0, contains one parameter λ, and equal to average $\mu = \lambda$.

The maximum likelihood estimator (MLE) of this parameter is sample $\overline{X}$.

The income below x, p= $P(X \le x) = F(x)$ is the cumulative distribution function

$$F(x) = 1 - e^{\frac{-x}{\lambda}}$$

Associated well known measures of inequalities of this model are Lorenz Curve of Concentration and Gini coefficient (for an introduction of Lorenz curve and Gini coefficient , see book **[4,5]**).

The Lorenz Curve

The Lorenz Curve is a graphical device used to demonstrate the equity of distribution of a given variable such as income, wealth, assets etc. A Lorenz curve provides complete in

formation on the whole distribution of incomes relative to mean. A typical Lorenz curve is shown in figure (2) which explain relationship between cumulative % of population/items and cumulative % of income/export value e.g . one fourth of population/items provides 5% of income due to exports.

Usually the Lorenz curve generated by a theoretical distribution function is defined in terms of two equations [1], and the income distribution is assumed to have a density function. The standard definition [5] of the Lorenz curve is in terms of two equations. First one solves (for x),

$$p = F(x) = \int_0^x tf(t)dt \qquad (2a)$$

and then written as

$$L(p) = \phi(x) = \frac{1}{\mu}\int_0^x tf(t)dt \qquad (2b)$$

$\phi(x)$ exists, of course , only if μ exists. Just as *F(x)* varies from 0 to 1, $\phi(x)$ varies from 0 to 1 provided x≥0.

An easy, alternative and popular form of Lorenz curve is given by **[1]**

$$L(p) = \frac{1}{\mu}\int_0^p F^{-1}(t)dt \qquad 0 \le p \le 1 \qquad (2c)$$

As usual L(p) is the fraction of total income that the holders of the lowest pth fraction of incomes possess.

The Lorenz curve for the exponential distribution by (2c) is

$$L(p) = p + (1-p)\ln(1-p)$$

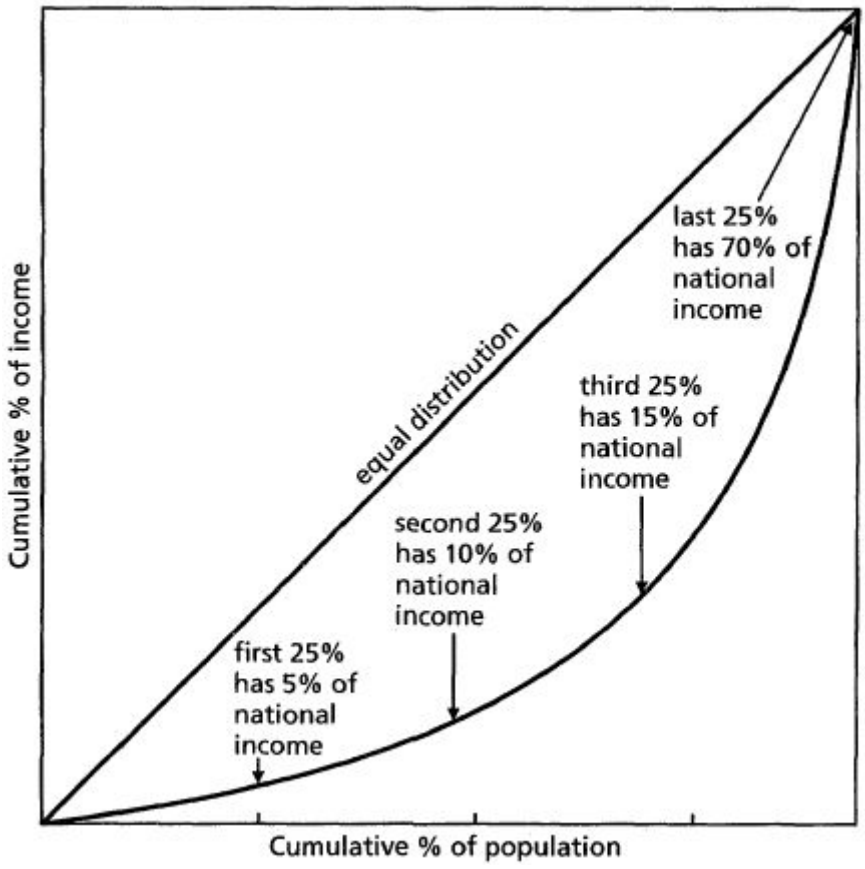

Figure-2a .A typical Lorenz Curve.

Gini Coefficient

The Gini's coefficient (also known Lorenz concentration ratio) is a measure the of inequality (degree of concentration) of a variable in a distribution of its elements and, scale 0 to 1.

Geometrically it is one minus twice the area between the Lorenz curve and the identity function (equal distribution) $\phi(x) = F(x)$ see figure (2b) .

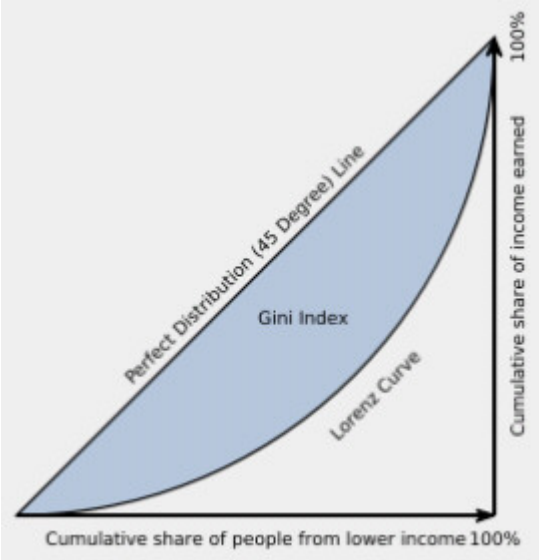

Figure-2b .A typical Lorenz Curve and Gini index.

$$G = 1 - 2\int_0^1 \phi(x)dx \qquad 0 \le G \le 1 \quad (3)$$

Where G=0.0 means no inequality (total equality, every one has same amount)
G=1.0, shows complete inequality (no equality, one person has everything).
It can also be shown that the Gini coefficient of mean difference for (1) is

$$G = \frac{1}{2}$$

2 **Export Data**

The source of data for this study is ( ).

Pakistan had exported 48 items to other countries in 2009- 10, earning a total revenue in $ (19290034). The major export from Textile Group were (13805469) While items of significant earning value from Food Group were (4481178) in thousand dollars.
The data available was transformed ,since some of the agricultural items ere merged to squeeze as one item and corresponding earnings were also combined ; the same transformation was done to some of the non-agricultural items. The net result is that we

have 48 items to classify . It is noted that the variation in earnings varies from as little as (33) to as long as (3283835) thousand dollars. Consequently classification was performed in a frequency table having (6) subintervals ,each of length (30000) .
A similar classification and modeling has been done for export earnings for the year 2010-11.

3 Empirical analysis of income by export revenue

The objective of this section is to determine how well the exponential distribution fits the distribution of income by export revenue.
The empirical analysis is performed using Minitab, for available data for the years 2009-2010 and 2010-2011.

Variable	N	N*	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3
2009-10	48	0	479765	99134	686822	33.0	37006	229689	598226
2010-11	48	0	621771	129090	894359	135	49083	309698	663033

Variable	Maximum
2009-10	3283835
2010-11	4481178

Table -1. The data summary statistics of Export Revenues.

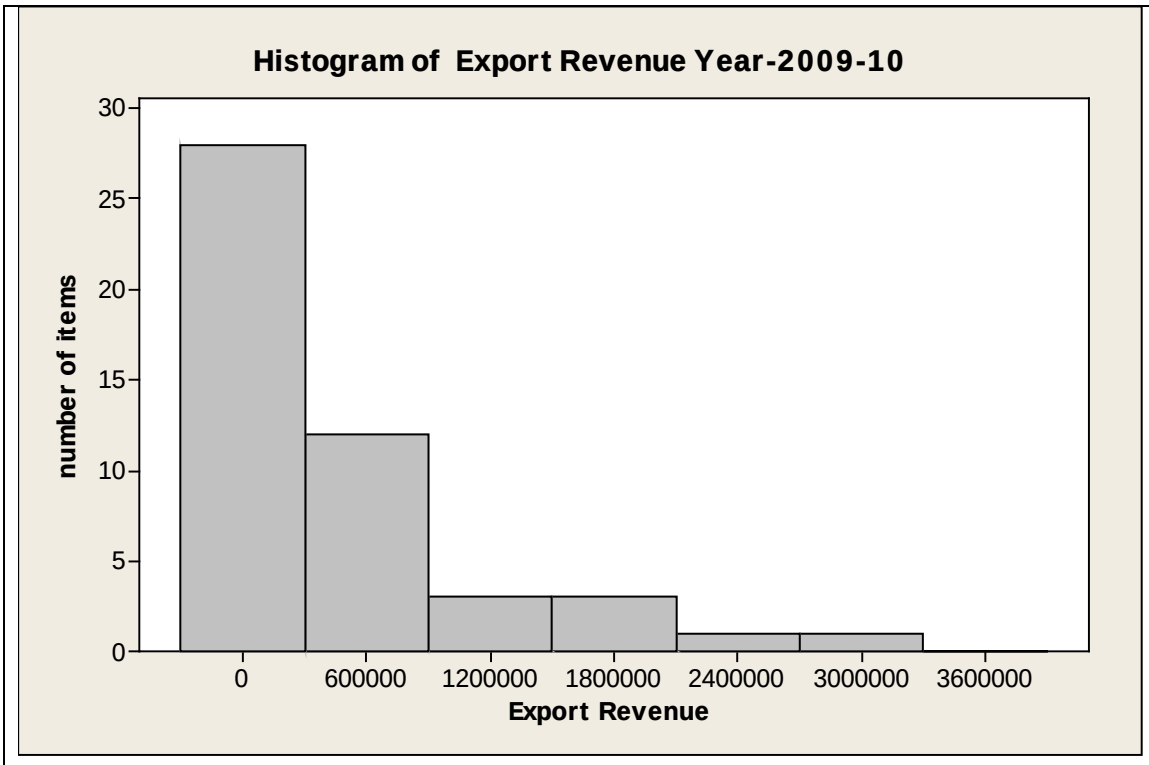

Figure-3. The distribution of Export Revenue.

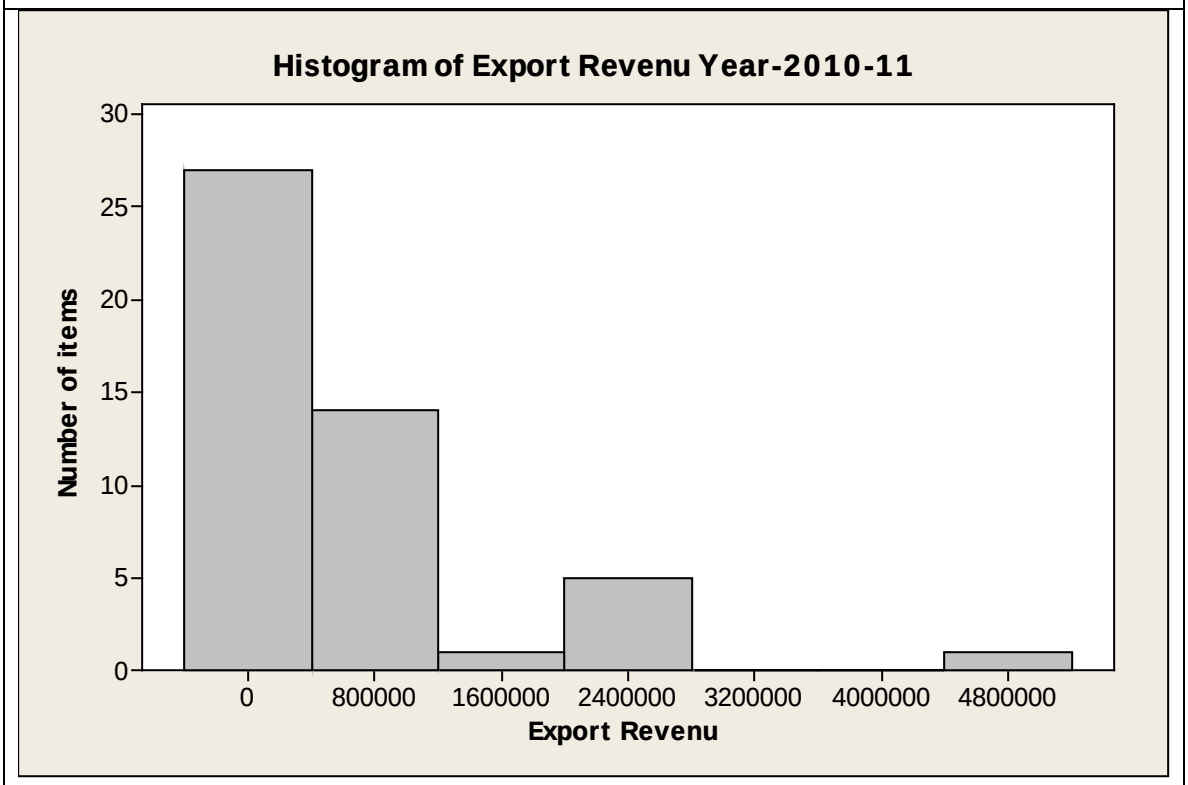

Figure-4. The distribution of Export Revenue.

For these data sets summary statistics Table(1) ,and the elementary data analysis (say) histograms are shown in , figure 2 and 3. The histograms of distribution of export revenue suggest that data have come from a highly skewed distribution with large variation . That is small export of earring items are more as compared to large earning items. The shape looks like exponential distribution. Therefore we fit exponential distribution using maximum likelihood estimator (MLE) of parameter λ .

The MLE for parameter λ in (1) for export of earnings X_1 : Year-2009-10 and export of earnings X_2 : Year-2010-11 are $\hat{\lambda}_1 = 479765$ and $\hat{\lambda}_2 = 621771$

respectively. We use MLE to fit Exponential distribution and relevant results using Minitab.

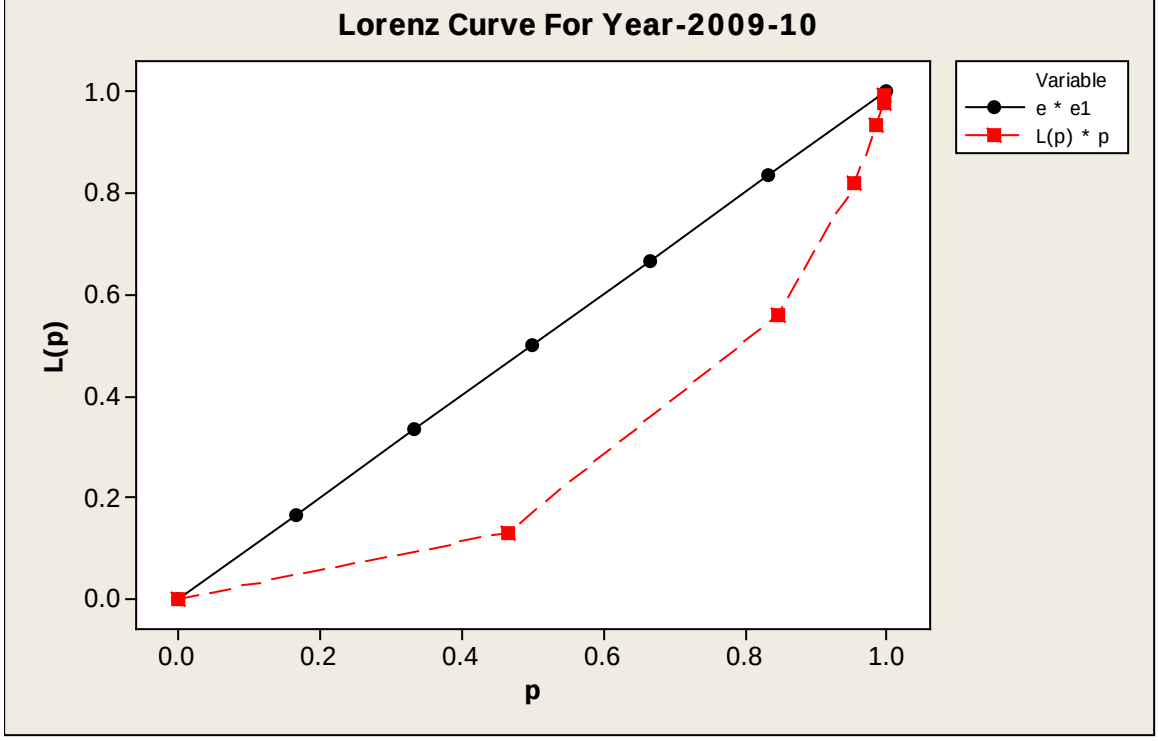

Figure-5. The Lorenz curve of distribution of Export Revenue.

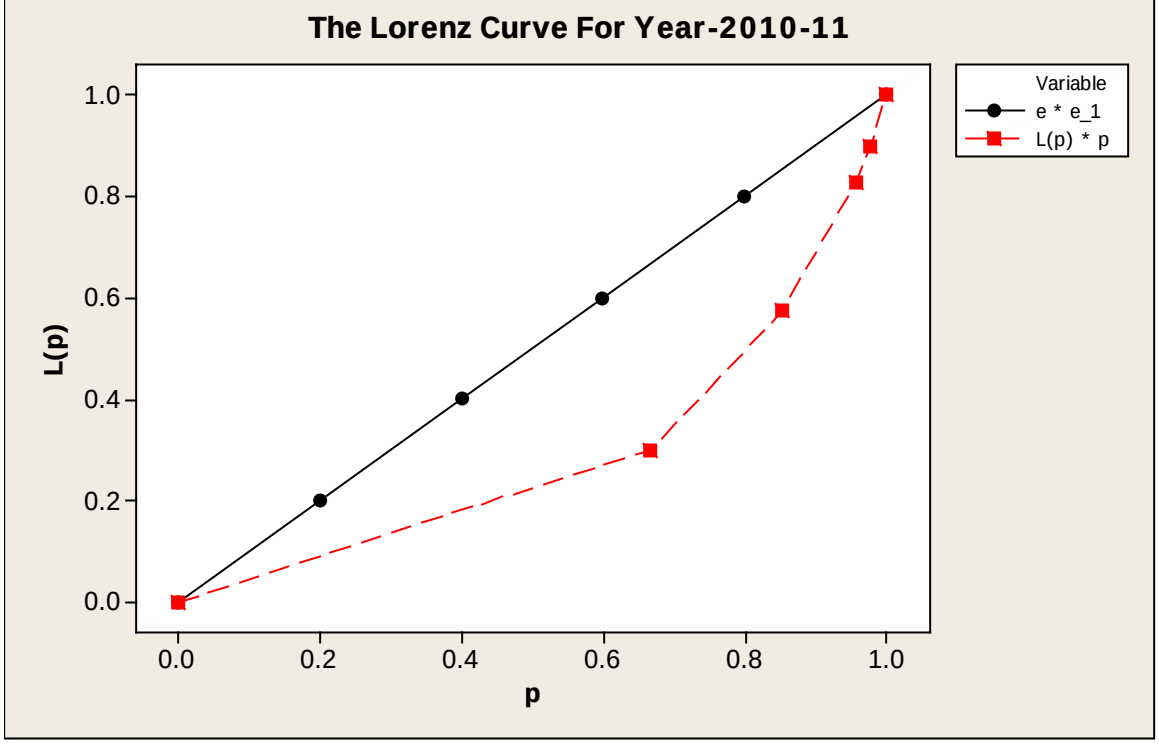

Figure-5. The Lorenz curve of distribution of Export Revenue.

The figures 4 and 5 show fitted Lorenz curve to the data and serious inequality is obvious from both curves and estimated Gini coefficients for the two curves $\hat{G}_1 = 0.6431,\ \hat{G}_2 = 0.5618$ respectively.

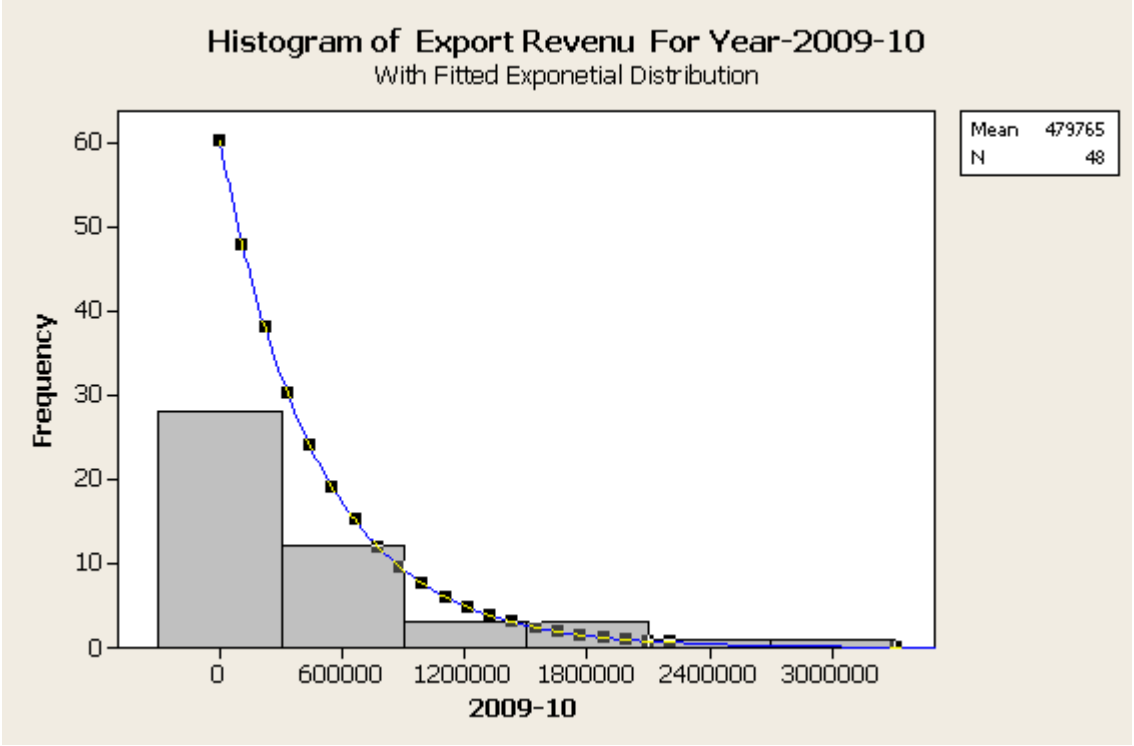

Figure-6. Histogram: Probability distribution of individual items export revenue 20090-10.

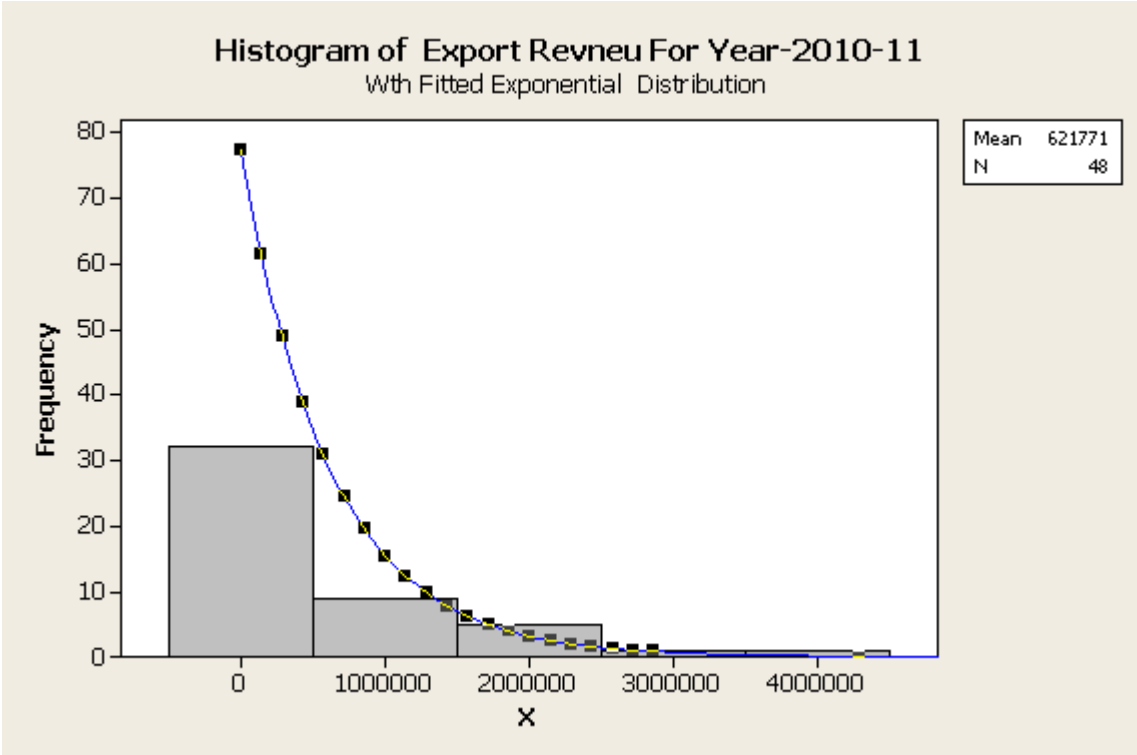

Figure-7. Histogram: Probability distribution of individual items export revenue 2010-11.

The figures 6 and 7, show observed and fitted exponential distributions.

Appling χ^2-chi-squares goodness of fit test (violating some assumptions) which gives p-value = 0.04. The exponential distribution gives a good (albeit not perfect) description of the export revenue data. Which in not a good singe for export policy makers.

SELECTION OF MAJOR EXPORT VALUE ITEMS:

The FBS has classified major exports by groups /commodities into three groups, I) Primary commodities, II) Textile Manufactures and III) Other Manufactures . We selected most earning item from each group which are Rice (X_1) , Petroleum and petroleum products (X_2) and Cotton fabrics(X_3) respectively for analysis . The trend and behavior over the last eights years data is given in table below. We use Minitab to analysis data.

Years	2000-01	2000-02	2000-03	2000-04	2000-05	2000-06	2000-07	2000-08
X1	30849.3	27509.5	32432.8	36534.7	55392.3	69325.1	68285.9	117088.1
X2	10832.9	11763.8	14506.7	16958.0	28281.0	49438.4	52042.9	79335.8
X3	60485.6	69296.9	78665.4	98542.2	110578.8	126195.4	122872.8	126172.6

Table Income from Rice, Petroleum and petroleum products and Cotton fabrics in million rupees.

The income from rice shows a non-linear trend, so a quadratic model fits well for these data as shown in the figure . Similar pattern is observed in incomes form Petroleum and petroleum products, and Cotton fabrics which is obvious from figures 8, 9 and 10.

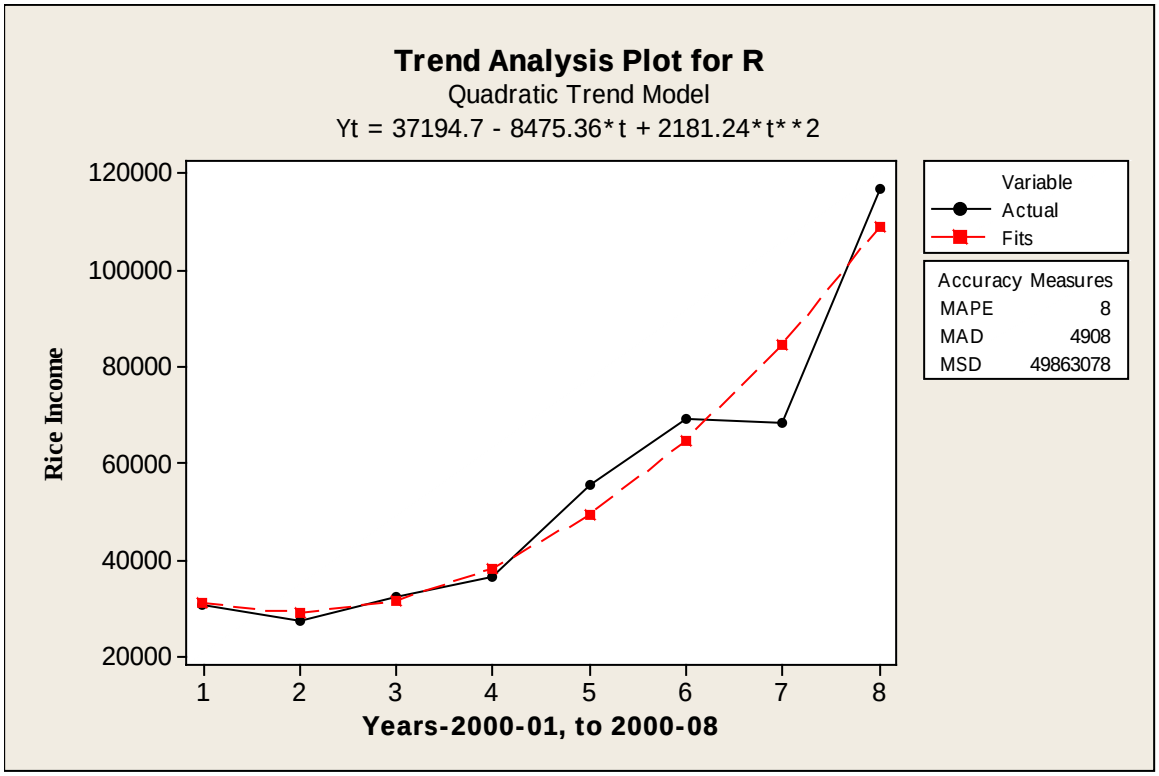

Figure-8. Plot showing original and fitted model for mean of Rice for the period 2000-2008

Conclusion

(1) The income from Rice was increasing at a slow rate but during 2007 – 2008 , its rate of increase was much higher than the years from 2004 to 2006. It may be due to the high cost of rice in the international market, and also due to a change of policy of the government.

(2) The growth curve of Petroleum products shows that the export earnings are increasing at a constantly inceasing rate attaining a value of 80,000 plus in 2009 -2010, and upto 105,0000 in 2010 – 2011.

(3) The growth curve for Cotton fabrics shows a slightly decreasing trend from 2001 – 2008. And it is expected to keep the same decreasing trend during 2008 to 2011.

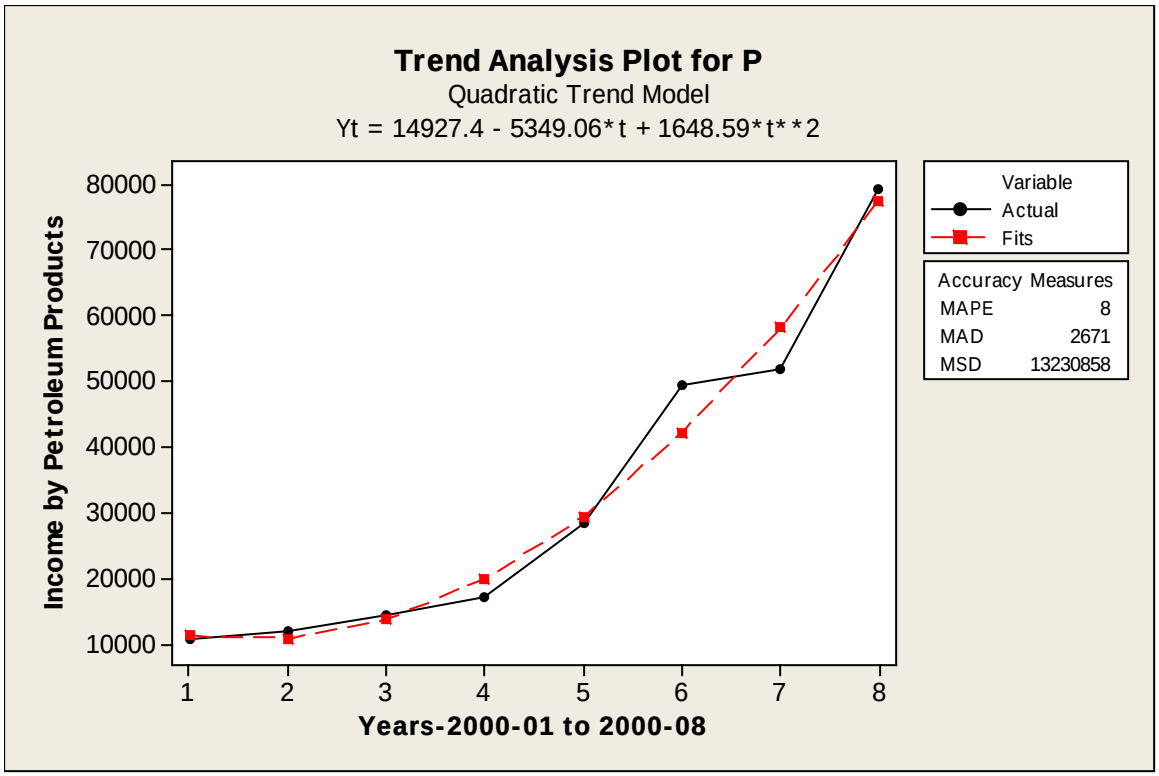

Figure-9. Plot showing original and fitted model for mean of Petroleum for the period 2000-2008

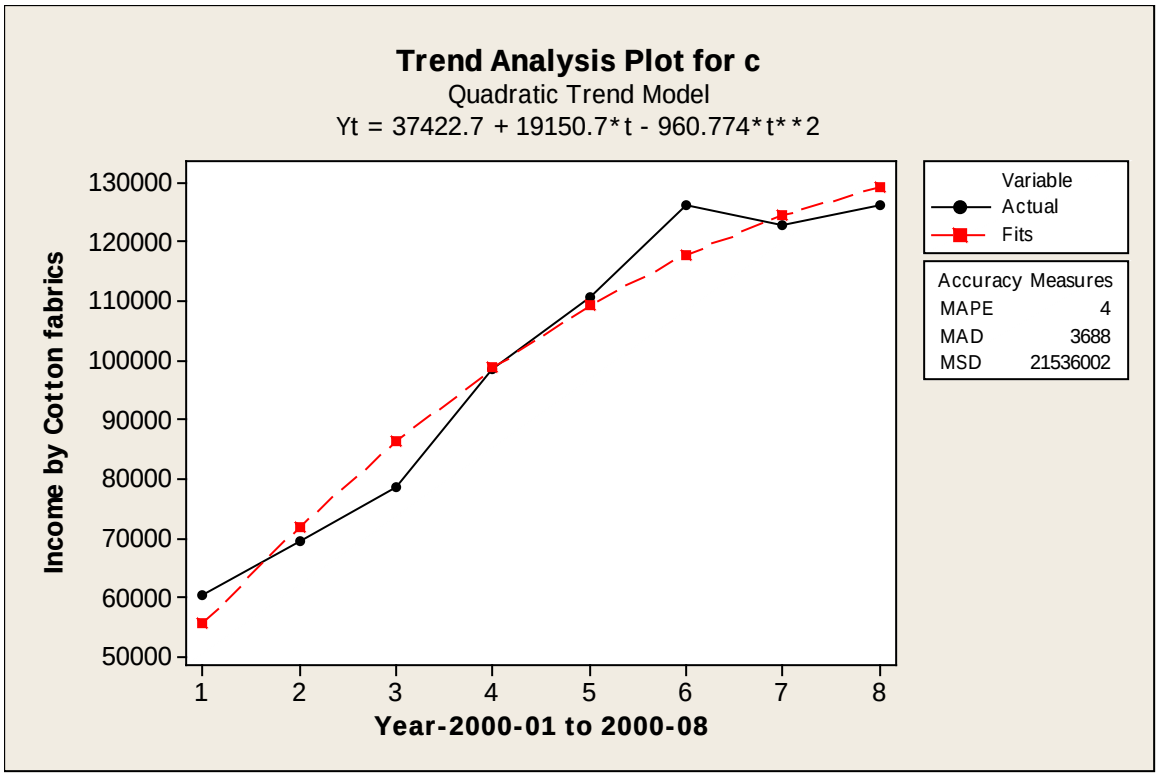

Figure-10. Plot showing original and fitted model for mean of Cotton for the period 2000-2008

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