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Export (Foods) related queries answered by fitting statistical distribution

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Abstract
The global economy of each country is a function of several parameters and one of them is its global trade and foreign exchange as its outcome. Its study lies in identifying demand of commodities that arise from the global market during a given period and that can possibly earn higher exchange value through timely export; may be road-rail transport, air cargo or sea shipment. Export activities which can fetch relatively more profit depend on well planned production linked to proper logistics on one end and timely completion of import routines at the other end. Handling the multivariate data applying standard techniques of statistical methods help us derive useful results which can serve as basic guidelines to manufacturers to schedule production setups that in turn helps meet demand without shortage and partial replenishment on their side.

Keywords: export, foreign trade, data analysis

Introduction

As said earlier, in this note, we analyze the past records of different export of frozen food having the highest demand and so in turn pass higher probabilities of export orientedness. We have selected three items and collected (Samosa, Paratha, Naan) corresponding export (units) data from different ports (Nahva sheva and Noida dadri) to some selected countries. The data ranges from 2014 up to 2016 spread over all 12 months for each year. This allows us to prepare 3 different tables. [Export data from a given port, for a given item in each one of the years 2014, 2015 and 2016 which range over all the months from January to December].

A step towards our objective is to make graphical presentation of data encompassing in each one of the different table.

Using the past records in tabular form and graphical presentation, we are able to derive statistical facts. In some cases it is important and highly necessary to enhance the results to real life situation problem. Its importance is only preserved when its application can be in vast area.

We thought on the same lines and searched for its application orientedness. During the same period we were confronted by source likely question aroused from management authorities of some export units. The problems they faced and finally arrived to our desk were about the production of the items on hand. We faced their problems about the units of production of the three frozen food items (Samosa, Paratha, Naan).

Some frozen export oriented foods that fall in frozen foods class items are being exported by different food industries from different ports of India to different countries.

The related questions were about

i) Likely/probable demand that arise from time to time in different months from different ports that we have selected for the study purpose and they form a marginable segment of total quantum during a given time zone.
   It was required to answer the question as in the link, for the producers, it was the question of purchase of raw material, setup of machineries, and employment of labor force in stipulated time frame.
   At the same time, required as per packing specifications directed by buyers' packing and in addition, following the corresponding legal formalities and logistics to be followed as per the condition specified in the L.C (letter of credit) was an associated problem. All these factors were highly necessary as to meet with buyers' line up with different vessels schedules from different ports.
   All these factors when taken on account, frame a highly attainable problem and hence the proper technical analysis is necessary to provide guidance considering all possible angles.
ii) The next question confronted by us was to search for enhancing on export capability in a given period of time that helps plan production in the successive time zone.
   In the case where the buyers' does not specify with his order, the dispatch instructions, the responsibility is a part of exporter or to the export division of the company.
   All these points have inspired us to work on in a direction that is able to answer to all questions pertaining to this area.

Graphical presentation and Comprehensive Deduction

We have sufficient data to be classified as we have many variables and sub variables that show up at a time in the data. Source of the main variables on hand are: (1) Export item (2) Port of export (3) a list of companies involved in export business (4) Share of individual company in the total export (5) month and year (6) Importing country.

In fact exhaustive classification and the technique of PCA (Principle Component Analysis) can help us arrive at major decision, may be without loss of generality, in such cases.

We have, as discussed above, three main points/ variables.

1. (Export) Foods: Samosa, Paratha and Naan
2. (Export) quantity:
3. Time / year: January to December and 2014, 2015 and 2016

As discussed in above units the export quantity (in terms of '000 units) is a gross which is the total amount of export units made by different companies operating in the same business. To analyze further, we have worked further on in the same line. This work shall appear very shortly.

As derive from semi-official sources, there are four major companies engage in this business. Just in order to preserve privacy we code them in alphabetical order. In order not to diverge more from the current topic, in brevity, we analyze the export details for a particular month of a particular year described below.

1) Item: Samosa

Highest Export: March 2014, Sep. 2015, and March 2016

Export Amount: 59 units, 50 units, 56 units

Table 1

Companies↓ \Year→	2014	2015	2016
A_1	20	12	18
A_2	15	13	12
A_3	14	12	20
A_4	10	13	6
Total	59	50	56

The export data for each item has been tabulated below and for the classical deduction have been formatted in graphical mode of presentation. In our case three different tables and corresponding

Graphs have considered. Tables and graphs have been coded.

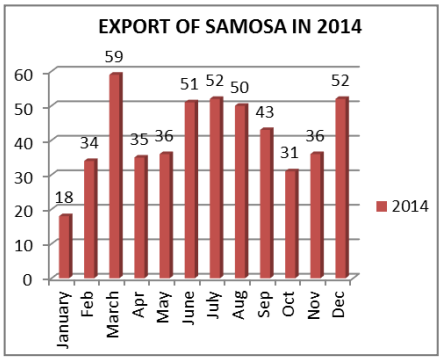
Table 1.1

Export in terms of '000 units

Item: Samosa **Port: Nahva Sheva**

	X1	X2	X3
	2014	2015	2016
January	18	25	23
Feb	34	26	30
March	59	42	56
Apr	35	40	54
May	36	49	38
June	51	48	40
July	52	33	36
Aug	50	42	41
Sep	43	50	47
Oct	31	44	42
Nov	36	18	18
Dec	52	44	35
Σx(Total)	497	461	460
monthly avg.	41.42	38.42	38.33
Grand total	1418		
Grand avg.	39.39		

Graphical presentation of Export



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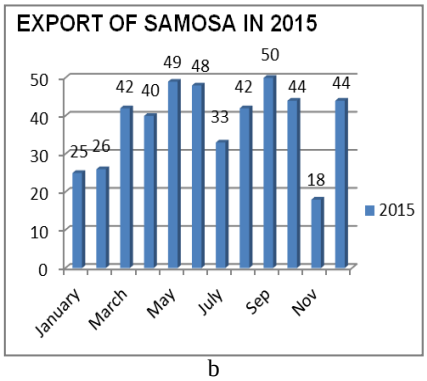

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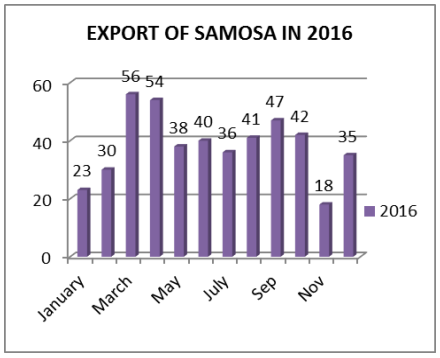

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Graph 1

Some important Deductions from the Graphs

1. In each year there are, on an average, three to four months where in the export quantities exceed that of in the remaining months.
2. Export quantities fluctuate in each successive year and this appears in corresponding months of each year. Three main components (1) Export year, (2) Export on a given month, and (3) Export Quantity are independent variables.

2) Item: Paratha

Highest Export: Dec. 2014, Sep. 2015, and Oct. 2016

Export Amount: 248 units, 299 units, 373 units

Table 2

Companies↓ \Year→	2014	2015	2016
A_1	85	80	76
A_2	78	70	92
A_3	50	90	109
A_4	35	59	96
Total	248	299	373

The export data for each item has been tabulated below and for the classical deduction have been formatted in graphical mode of presentation. In our case three different tables and

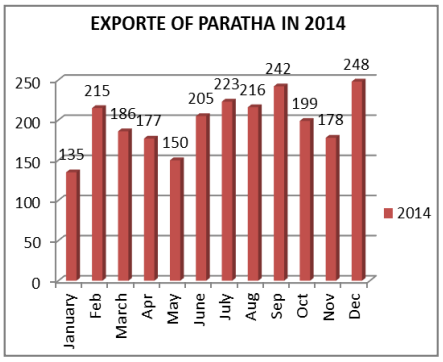
corresponding Graphs have considered. Tables and graphs have been coded.

Table 2.1

Export in terms of '000 units
Item: Paratha **Port: Noida-Dadri**

	X1	X2	X3
	2014	2015	2016
January	135	244	259
Feb	215	199	346
March	186	208	260
Apr	177	153	272
May	150	150	268
June	205	217	354
July	223	190	234
Aug	216	217	349
Sep	242	299	185
Oct	199	256	373
Nov	178	205	136
Dec	248	267	259
Σx(Total)	2374	2605	3295
monthly avg.	197.83	217.08	274.58
Grand total	8274		
Grand avg.	229.83		

Graphical presentation of Export



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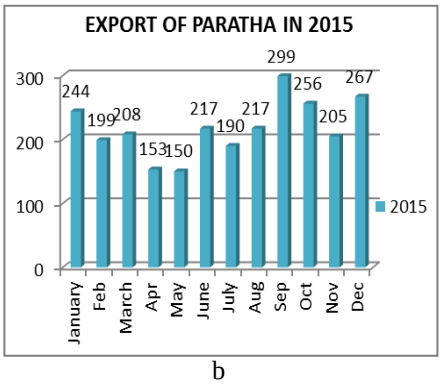

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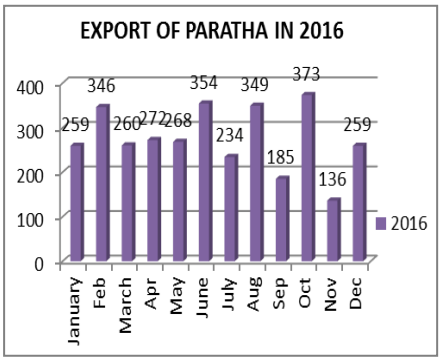

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Graph 2

Some important Deductions from the Graphs

1. In each year there are on an average three to four months where in the export quantities increase and decrease that of the remaining months.
2. Export quantities fluctuate in each successive year and this appears in corresponding months of each year.

3) Item: Naan

Highest Export: Sep. 2014, Sep. 2015, and Feb. 2016
Export Amount: 74 units, 74 units, 81 units

Table 3

Companies↓ \Year→	2014	2015	2016
A_1	18	10	22
A_2	24	15	30
A_3	19	25	12
A_4	13	24	17
Total	74	74	81

The export data for each item has been tabulated below and for the classical deduction have been formatted in graphical mode of presentation. In our case three different tables and corresponding

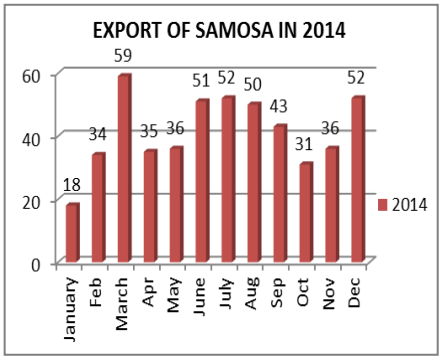
Graphs have considered. Tables and graphs have been coded.

Table 3.1

Export in terms of '000 unit
Item: Naan **Port: Noida-Dadri**

	X1	X2	X3
	2014	2015	2016
January	50	66	70
Feb	67	61	81
March	52	57	76
Apr	57	57	64
May	44	56	59
June	65	68	80
July	64	57	57
Aug	65	54	76
Sep	74	74	80
Oct	61	62	75
Nov	52	50	58
Dec	60	63	52
Σx(Total)	711	725	828
monthly avg.	59.25	60.416	69
Grand total	2264		
Grand avg.	62.88		

Graphical presentation of Export



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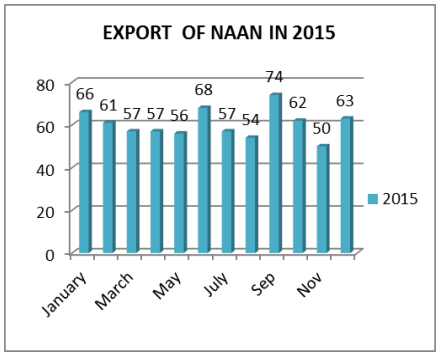

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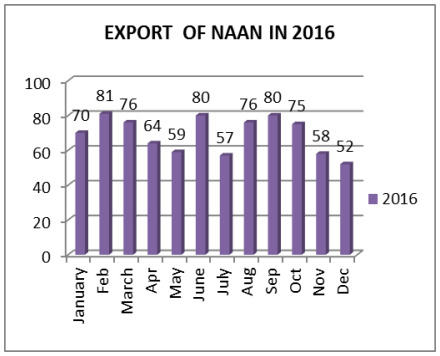

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Graph 3

Some important Deductions from the Graphs

1. In each year there are, on an average, three to four months where in the export quantities attan the peak values and keeps on showing minor changes in the remaining months.
2. Export quantities fluctuate in each successive year and this appears in corresponding Months of each year also.

Search for a distribution

Now to face basic questions that arose while continuing with our work, we thought of applying a theoretical distribution and the best in this situation is the 'Uniform Distribution' within the given range of each item our proceedings are as follows.

$$E(x^r) = \sum_{x=a+1}^{b} x^r \cdot (1/(b-a)) \qquad (1)$$

Where r = 1, 2, 3..……..
For r =1 we get E(x) = Population Mean

$= 1/(b-a) * [(a+1) + (a+2) + \ldots\ldots b] = \frac{1}{b-a} [(\frac{b-a}{2})(b+a+1)]$

$\therefore E(x) = \frac{1}{b-a} [S_n]$

The given bracketed expression is an A.P. with a = a+1, d = 1, and n= b-a

Using summation formula we have, $S_n = \frac{n}{2}$ (2a+ (n-1) d)

$= (\frac{b-a}{2})(2(a+1) + (n-1)(1)) = (\frac{b-a}{2})(a+b+1) \quad \therefore S_n = (\frac{b-a}{2})(b+a+1)$

$\therefore$ Substituting this value, we get $E(x) = \frac{1}{b-a} [(\frac{b-a}{2})(b+a+1)]$

$$\therefore \mu_1' = \textbf{Population Mean} = \frac{b+a+1}{2} \qquad (2)$$

$$\mu_2' = E(x^2) = \frac{\sum_{x=a+1}^{b} \frac{x^2}{b-a}}{} = \frac{1}{b-a}\sum_{x=a+1}^{b} x^2$$

second row moment

$$\sum_{x=a+1}^{b} x^2 = \sum_{x=1}^{b} x^2 - \sum_{x=1}^{b} x^2$$

$$= \frac{b(b+1)(2b+1)}{6} - \frac{a(a+1)(2a+1)}{6} \quad (3)$$

Replacing population moment by sample moment using (2) & (3)

$$\bar{x} = m_1' = \frac{a+b+1}{2}, \text{ and so } \mathbf{b = 2\bar{x} - a - 1,} \quad (4)$$

Where a & b are parameters

$$E(x^2) = \frac{\sum x_i^2}{36}$$

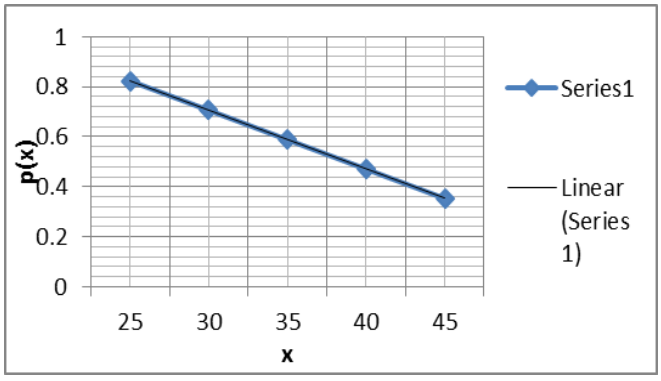
$$P(x) = \frac{1}{b-a} * (b-x) \quad P(x) = x > k_1$$

For v_1, v_2 & v_3 fixed k_1 & k_2 say the distribution of units exported is rectangular distribution
P(X=x) = p(x) (Discrete uniform distribution)
X = a+1, a+2 ……., b where a & b are the parameters of distribution.

SAMOSA
Probability of export

Table 4

A	B	x	P(x)
17.5	60	25	0.823529
17.5	60	30	0.705882
17.5	60	35	0.588235
17.5	60	40	0.470588
17.5	60	45	0.352941

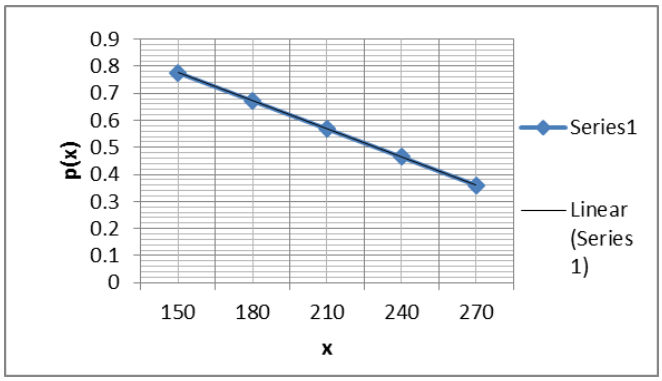


Graph 4: Graphical presentation for probability of Export (Samosa)

PARATHA
Probability of export

Table 5

A	b	X	P(x)
85.4	374	150	0.776161
85.4	374	180	0.672211
85.4	374	210	0.568261
85.4	374	240	0.46431
85.4	374	270	0.36036

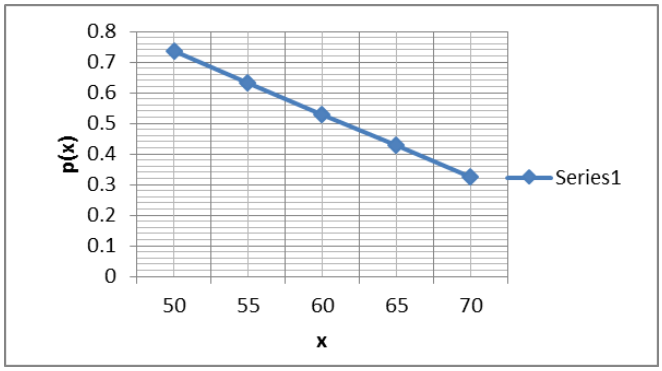


Graph 5: Graphical presentation for probability of Export (Paratha)

NAAN
Probability of export

Table 6

a	b	X	P(x)
37	86	50	0.73469
37	86	55	0.63265
37	86	60	0.53061
37	86	65	0.42857
37	86	70	0.32653



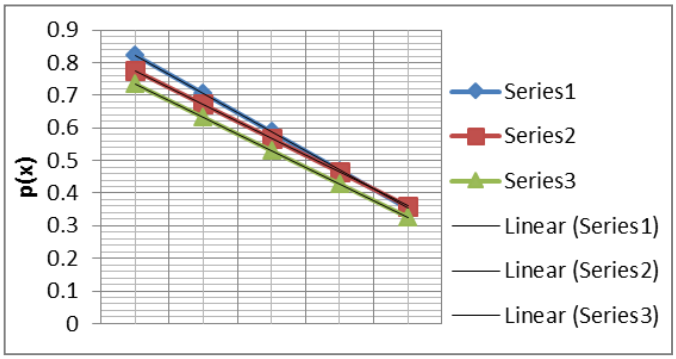
Graph 6: Graphical presentation for probability of Export (Naan)

2.3 Comprehensive Study
Simultaneous movements of graphs imposed on one graph sheet help us derive better decisions from comparative studies of different graphs drawn for each item on agenda. It is our

basic purpose to make prediction regarding export of certain items and counseling export merchants. The following tables and graphs establish our efforts.

Table 7: Combined Graph all food items

No.	P(x)1 samosa	P(X)2 Paratha	P(X)3 Naan
1	0.823529	0.776161	0.734694
2	0.705882	0.672211	0.632653
3	0.588235	0.568261	0.530612
4	0.470588	0.46431	0.428571
5	0.352941	0.36036	0.326531



Graph 7: Combined graph of probability for all food items

Important Deduction

The above depicted tabular data and its corresponding graph help us derive important conclusions regarding suggestions of likely movements in export.

1. Each one of the graph shows decreasing probabilistic trend as the item quantity increases.
2. That the trend in decline of export in Samosa, Paratha and Naan is closer to each other and they show constant decremented rate.
3. At the one point graph showing probability of Samosa, Paratha coincide and then decrease sympathetically while decreasing trend in Naan keeps constant pacing with respect to two previous items.

These findings above help us in production activities and resolving export related queries.

Conclusion

The contents in the proceedings above have constructively helped us derive important inferences related to data analysis and the different types of queries raised by different vendors engaged in the export area. The queries related to actually real life situations have proved useful and constructive in applications in the area that we work in.

Vision

That what we have learnt from the findings above has inspired us to continue in the same direction keeping focus on exports made from different ports of varied items to major countries.

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