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Linear trend forecast and stability assessment regarding to some export bound food items

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Abstract

It is well known that statistics and its mathematically derived and established methods are always reliable and applicable to explore past records in a way that many future decisions derived from, are very important for future planning for finance, marketing, and planning of production. In this paper the past export records of three successive years have been analyzed and studied to give better insight for decision making.

The content has been divided in two parts. The first part in which linear regression techniques help us derive future trends and the second one in which the coefficient of variations is used to measure consistency in export units of foods from different ports accounted in the records, are both of ultimate importance in term of future projection.

Keywords: linear trend, forecast, ports, foods, stability

1. Introduction

The content of this paper, as said earlier in abstract, has been classified in two parts.

The paper targets at

1. Analyzing the export data of three years, 2014, 2015 and 2016. The data shows the units of different food items (F_1, F_2, F_3, and F_4) exported from different active ports (P_1, P_2, and P_3). The data is shown in the annexure.

The first part of the data which is used for fitting a linear regression model is extended for estimating the amount in the near future years.

In the first part, we have fixed a port and a food item exported from the port. What has been changing is the export quantity from January of a year to December of the same year. The years considered are 2014, 2015, and 2016. At the end, we get average units of one item exported from a particular port in a particular year. This, when subjected to statistical treatment helps derive linear trend. The same process is repeated for each food item and from each active port.

The second part of the data is analyzed that aims at measuring the stability / consistency of amount of foods on the basis of coefficient of variation. To put the same in procedural form, we have taken bi-monthly average for each food item. Thus, we get for a fixed food, year of export, exporting port and the destination port. We have six observations of bi-monthly averages and by using a unit free measure-coefficient of variation we shall be able to assess the stability of sales over a period of three years. It is known that the lowest positive value of the C.V. indicates consistency/stability of the item over the variability of other items. We can use this figure for comparison with C.V. of other foods items over the same period of time.

2. Part 1

In the following section, for a given port and for a given food as indicated below by the notation (P_1, F_1), we assume a linear trend and find a linear regression of different years over the annual average of export units. This will help us predict future trend also.

2.1 For the port P_1 and food F_1

(P_1, F_1) where p_1 = Noida dadri (ICD) and F_1 = Naan and

Let X indicate year then using following notation

The year 1 = 2014, 2 = 2015, 3 = 2016, 4 = 2017

Then the averages of these years $\overline{A_1}$ = 58.42, $\overline{A_2}$ = 60.42 and $\overline{A_3}$ = 68.45 and then find the $\overline{A_4}$

Table 1

Year X	Avg. of item Y	X Y	X_i^2
1	58.42	58.42	1
2	60.42	120.84	4
3	68.42	205.35	9
ΣX_i = 6	ΣY_i = 187.29	$\Sigma X_i Y_i$= 384.61	ΣX_i^2 =14

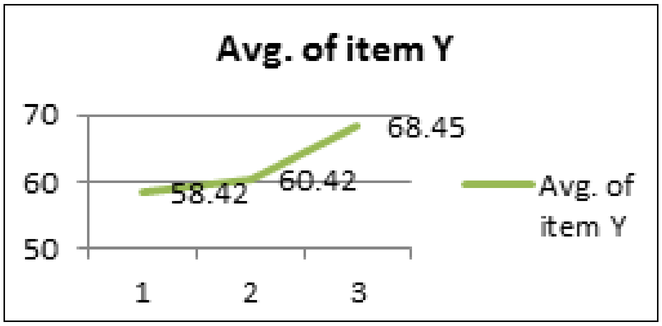

Fig 1: Linear trend showing Average export

Here, we can use liner trend equation y = ax + b then,

$\Sigma Y_i = a \Sigma X_i + 3b \ \Sigma X_i Y_i = a \Sigma X_i^2 + b \Sigma X_i$

i.e. 187.29 = 6a + 3b …. (1) 384.61 = 14a + 6b …..(2)

To solve the equations 1 and 2 and get the value of a and b then,

a = 5.015 and b = 52.4 and if x = 4 then Y = 5.015 X + 52.4

We use the above linear trend equation to find the forecast of the export for the year 2017 (x = 4). Putting x = 4 in the above equation we get export forecast for the year 2017; Y = 72.46 units

2.2 For the port P_1 and food F_2

(P_1, F_2) where P_1 = Noida dadri (ICD) and F_2 = paratha and
A IS The different year then
The year 1 = 2014, 2 = 2015, 3 = 2016, 4 = 2017

Then the averages of these years $\bar{A}_1$ = 197.84, $\bar{A}_2$ = 217.08 and $\bar{A}_3$ = 316.63 and then find the $\bar{A}_4$

Table 2

Year X	Avg. of item Y	X Y	X_i^2
1	197.84	197.84	1
2	217.08	434.16	4
3	316.63	949.89	9
ΣX_i = 6	ΣY_i = 731.56	$\Sigma X_i Y_i$ = 1581.89	ΣX_i^2 =14

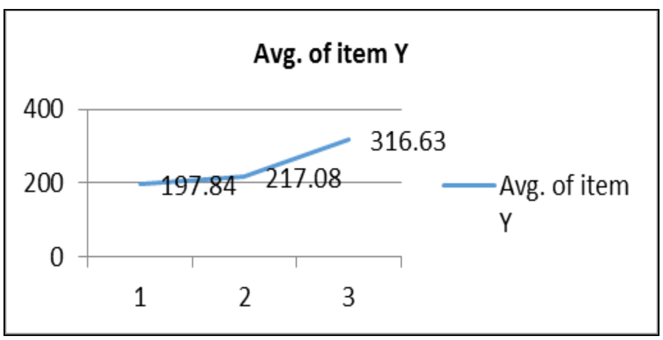

Fig 2: Linear trend showing Average export

Here, we can use liner trend equation y = ax + b then,
$\Sigma Y_i = a \Sigma X_i + 3b \quad \Sigma X_i Y_i = a \Sigma X_i^2 + b \Sigma X_i$

i.e. 731.56 = 6a + 3b……. (1) 1581.89 = 14a + 6b …..(2)

To solve the equations 1 and 2 and get the value of a and b then,

a = 127.61 and b = -34.1 and if x = 4 then Y =127.61X – 34.1

We use the above linear trend equation to find the forecast of the export for the year 2017 (x = 4). Putting x = 4 in the above equation we get export forecast for the year 2017; Y = 476.34 units

2.3 For the port P_1 and food F_3

(P_1, F_3) where P_1 = Noida dadri (ICD) and F_3 = samosa and
A IS the different year then

The year 1 = 2014, 2 = 2015, 3 = 2016, 4 = 2017

Then the averages of these years $\bar{A}_1$ =65.25, $\bar{A}_2$ =64.33 and $\bar{A}_3$ = 81.09 and then find the $\bar{A}_4$

Table 3

Year X	Avg. of item Y	X Y	X_i^2
1	65.25	65.25	1
2	64.33	128.66	4
3	81.09	243.27	9
ΣX_i = 6	ΣY_i = 210.67	$\Sigma X_i Y_i$= 437.18	ΣX_i^2 =14

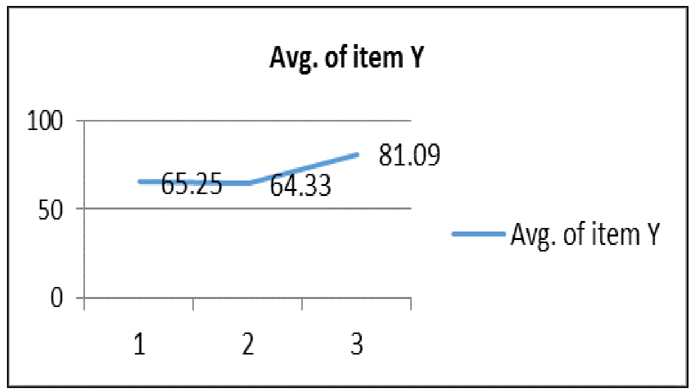

Fig 3: Linear trend showing Average export

Here, we can use liner trend equation y = ax + b then,
$\Sigma Y_i = a \Sigma X_i + 3b \quad \Sigma X_i Y_i = a \Sigma X_i^2 + b \Sigma X_i$

i.e. 210.67 = 6a + 3b ……. (1) 437.18 = 14a + 6b ….. (2)

To solve the equations 1 and 2 and get the value of a and b then,

a =7.92 and b =86.06 and if x = 4 then Y = 7.92 (4) + 86.06

We use the above linear trend equation to find the forecast of the export for the year 2017 (x = 4). Putting x = 4 in the above equation we get export forecast for the year 2017; Y = 117.74 units

2.4 For the port P_1 and food F_4

(P_1, F_4) where P_1 = Noida dadri (ICD) and F_4 = Idli and A IS The different year then

The year 1 = 2014, 2 = 2015, 3 = 2016, 4 = 2017

Then the averages of these years $\bar{A}_1$=10.5, $\bar{A}_2$ = 19and $\bar{A}_3$ =22.82 and then find the $\bar{A}_4$

Table 4

Year X	Avg. of item Y	X Y	X_i^2
1	10.5	10.5	1
2	19	38	4
3	22.82	68.46	9
$\sum X_i = 6$	$\sum Y_i = 52.32$	$\sum X_i Y_i = 116.96$	$\sum X_i^2 = 14$

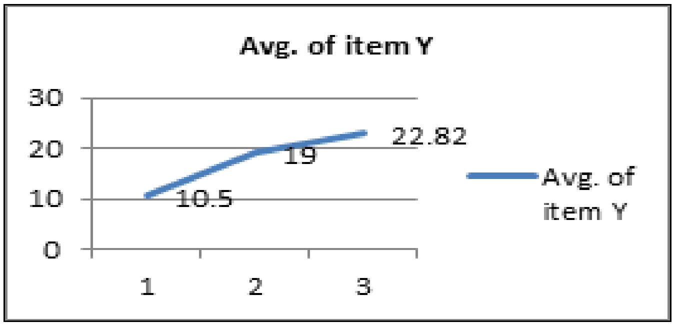

Fig 4: Linear trend showing Average export

Here, we can use liner trend equation y = ax + b then,

$\sum Y_i = a \sum X_i + 3b \qquad \sum X_i Y_i = a \sum X_i^2 + b \sum X_i$

i.e. 52.32 = 6a + 3b …. (1) 116.96 = 14a + 6b ….. (2)

To solve the equations (1) and (2) and get the value of a and b then,
a =5.84 and b =5.76 and if x = 4 then Y = 5.84 X + 5.76
We use the above linear trend equation to find the forecast of the export for the year 2017 (x = 4). Putting x = 4 in the above equation we get export forecast for the year 2017; Y = 29.12 units
Similarly we have considered the different ports P_2 (Mundra) and P_3 (Nahva Sheva).
We have found the linear trend of forecast of each of the foods (F_1, F_2, F_3, and F_4) exported from each of the ports (P_1, P_2, and P_3). This helps us find the linear forecast of each food. To represent the output in the compact form we put it in the tabular form as follows. [Please refer to Annexure.

2.5 Predicted of different foods in the year span-2017

Table 5

Foods↓ /→Ports	Port 1-Noida dadri	Port 2- Mundra	Port 3- Nahva Sheva
F_1-Naan	72.46	162.45	32.53
F_2 –Paratha	476.34	163.43	48.38
F_3-Samosa	117.74	102.99	49.51
F_4-Idli	29.12	29.77	-0.04*

*Negative values show downward trend if the uniform pattern is maintained.

3. Part-2

Here we have taken bi-monthly averages of the data and have find out the Coefficient of variations.
Here we have taken three different ports (P1: Noida dadri, P_2: Mundra, P_3: Nahva Sheva)
And four different foods: (F_1: Nan, F2: Paratha, F_3: Samosa, F4: Idli)
e.g. (P_1,F_1) where P_1 = Noida dadri (ICD) and F_1 = Naan

Table 6

Bimonthly avg.	Jan, Feb	Mar, Apr	May, June	July, Aug	Sep, Oct	Nov, Dec	Total
2014	58.5	50.5	53.5	64.5	67.5	56	350.5
2015	63.5	57	62	55.5	68	56.5	362.5
2016	75.5	70	69.5	66.5	86	34	401.5

Now, we find C.V. for the year 2014. Here, $\bar{x}$ = 58.42

Table 7

	Bi-monthly Average x_i	$xi - \bar{x}$	$(xi - \bar{x})^2$
1	58.5	0.08	0.0064
2	50.5	-7.92	62.73
3	53.5	-4.92	24.21
4	64.5	6.08	36.97
5	67.5	9.08	82.45
6	56	-2.42	5.86
Total	350.5		$\sum(xi - \bar{x})^2$ = 212.2264

We find the average of these bi-monthly averages.
Here, n = 6, $\sum x$ = 350.5, ∴ $\bar{x} = \frac{350.5}{6}$ = 58.42 units
Now we find standard deviation using the formula

$s = \sqrt{\frac{\sum(xi - \bar{x})^2}{6}}$ = 5.94units

Using the above values of $\bar{x}$ and s, we find C.V.$_1$ = $\frac{s}{\bar{x}}$ = 0.1016
[CV_1: This indicates coefficient of variation for the year 2014, keeping the port –1 and food-1 fixed. In the same way we find coefficient of variations for the year 2015 and 2016 under the same condition. We denote them as CV_2 and CV_3. These CV's are calculated on the basis of bi-monthly averages for each year.]
So, from above data the CV_2 =0.01474 and CV_3 = 0.2391

3.1 For the remaining data we have found the C.V. which is as follow,

The cells in the following table shows CV under the case of three variables; P –ports (P_1, P_2, P_3), Food (F_1,F_2, F_3, F_4)and years – 2014, 2015, 2016.

The data of the table help us take multiple decisions for consistency in exploring ports, food and different years.

The table given below has proved very important in deriving multiple decisions.
C.V.$_1$ = 2014 C.V.$_2$ = 2015 C.V.$_3$ =2016.

Table 8

Food items	F_1			F_2			F_3			F_4		
Port↓/year→	(2014) cv_1	(2015) cv_2	(2016) cv_3	(2014) cv_1	(2015) cv_2	(2016) cv_3	(2014) cv_1	(2015) cv_2	(2016) cv_3	(2014) cv_1	(2015) cv_2	(2016) cv_3
P_1	0.1016	0.07414	0.2391	0.1013	0.2461	0.3023	0.1463	0.1201	0.2725	0.2380	0.3527	0.2435
P_2	0.5642	0.5255	0.2399	1.008	0.6097	0.2223	0.3735	0.3754	0.1893	0.6065	0.6952	0.1890
P_3	0.1408	0.2860	0.2480	0.3102	0.2730	0.2879	0.2055	0.2188	0.2668	0.7197	0.6647	0.7524

Case- I: Here, we keeping food and ports as a constant the contents of the table help us predict the year in which consistent export has been achieved. To illustrate what we exactly want to convey, here is an example.
For the port –P_1, and food- F_1, the year 2015 has proved consistent as its c.v, is the least among the three different c.v.s [(year – cv) (2014-0.1016 , 2015-0.07414 , 2016-0.2391)]
In the same way we can decisions for each food and for each year.
We have on list 9 such results. We can derive further conclusion also.
In the same reference we can have;

Case-II: Here, we keep food and year as a constant and we check the stability for the different ports:
For the Year-2014, and food- F_1, the port -1(P_1) has proved consistent as its c.v, is the least among the three different c.v.s [(ports– CV) (P_1-0.1016, P_2 -0.5642, P_3 -0.1408)]

Case-III: Here, we keep port and year as a constant and we check the stability for the different foods:
For the port –P_1, and year- 2014, the food –2(F_2) has proved consistent as its c.v, is the least among the four different c.v.s [(food – CV) (F_1 -0.1016, F_2 – 0.1013, F_3 – 0.1463, F_4 -0.2380)

4. Conclusion

The contain of these paper which use the past records of three years in export related data of Particular food items has focused attention to two major conclusion that the manufacturing units Which are in the vicinity of the port of export has wider scope to better scopes of export and their Stability in export area either remains steady or increases over a period of time.

5. Annexure

For (P_1,F_1,) where P_1 = Noida dadri (ICD) and F_1, = Naan

Table 9

Year/Month	January	February	March	April	May	June	July	August	September	October	November	December	Total	Average
2014	50	67	44	57	42	65	64	65	74	61	52	60	701	58.42
2015	66	61	57	57	56	68	57	54	74	62	50	63	725	60.42
2016	70	81	76	64	59	80	57	76	97	75	18	68	821	68.42

For (P_2,F_1,) where P_2 = Mundra and F_1, = Naan

Table 10

Year/Month	January	February	March	April	May	June	July	August	September	October	November	December	Total	Average
2014	1	2	2	4	3	4	5	0	5	7	0	4	37	3.08
2015	8	0	17	60	91	87	127	92	114	123	71	114	904	75.33
2016	72	111	97	126	81	98	147	129	146	113	30	104	1254	104.5

For (P_3,F_1,) where P_3= Nahva sheva and F_1, = Naan

Table 11

Year/Month	January	February	March	April	May	June	July	August	September	October	November	December	Total	Average
2014	24	21	22	20	17	22	32	27	21	28	20	23	277	23.08
2015	8	20	29	15	17	22	14	29	42	28	14	43	281	23.42
2016	34	27	39	39	30	44	22	20	24	43	9	30	361	30.09

6. Notations and Abbreviations

Ports: P_1: Noida-dadri, P_2: Mundra P_3: Nahva Sheva
Name of Foods: F_1: Naan, F_2: Paratha, F_3: Samosa, F_4: Idli
Assumptions: The followings are the assumptions logically accepted to be followed in the procedure of handling current export data.

1. The demand pattern of different countries for importing considered in the data remains within a normal limit of fluctuation.
2. The export plans of different vendors exporting from selected ports to selected destinations (as the orders are received) do not change on a large scale.

7. References

1. Gould, Grahame. New methods of Food preservation. New York NY: Chapman & Hall, 2000.
2. Bianchi, M. Boyle M, Hollingsworth D. A Comparison of methods for trend estimation. Applied Economics Letters. 1999; 6(2):103-109. Doi:10.1080 /135048599353726.
3. Frei C, Schar C. Detection probability of trends in rare events: theory and application to heavy precipitation in the alpine region. J. Clim. 2001; 14:1568-1584.
4. Week 10: Reference class Forecasting".
5. Conceptually. Retrieved, 2017.
6. Philip Holmes, Eric T. Shea-Brown (Ed.). "Stability" Scholrpedia.