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Agro-based Food Processing Industries and their Financial Viability: A Time Series Analysis in Assam, India

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A B S T R A C T

The agro-based food processing industries is one of the thrust areas for industrial development of Assam being a prominent agri-horti spot of India. But the tangible condition of these industries can be realized in terms of their performance. This work explores the financial viability of industries of Assam in terms of financial ratios from 1998 to 2017. A poor performance was encountered for these industries. Moreover, a long-term association is found between these ratio series. Finally, a forecasting is done to predict the future behavior of these ratios using VAR approach.

Key words: Agro-based food processing, Financial viability, Financial ratios forecasting, VAR approach

"Food" - an indispensable part of human life. Problems like food shortages and food security are one of the hot topics in the world today. Processing food for longer than normal storage periods can help people or the economy increase the availability of different foods. The "food industry" is a major industrialization area in India, as it is traditionally rich in agriculture and its allied activities. The Ministry of Food Processing Industries of India has identified food processing industries as those in which there are two processes: manufacturing processes in which the raw materials of agriculture and related activities are transformed and the processed product is edible and has commercial value. Secondly, when there is significant added value without going through any manufacturing processes. Dairy products, fruit and vegetable processing, wheat processing; Meat and poultry processing; Fishing and consumer foods, including packaged foods, beverages and bottled drinking water, are included under the domain of food processing industry.

Assam, one of the main northeastern states of India, has an agro-climatic zone favorable for the cultivation of agricultural and horticultural crops. According to information from the Assam Economic Survey, 2018, the total area of the state with vegetable crops is 13.33% of the gross cultivated area, which produces 21.04 million tons of fruit, 54.24 lakh of tons. of vegetables and 3.89 lakh tons of spices every year in addition to flowers, nuts grow. Over the past ten years, the plants have grown by 40.48%. But in terms of operations it is only 39.2% (ASI 2017-18). Once again, the establishment of one mega food park and one food processing industrial park in the state is a milestone in the food processing industry. However, at the same time, it is also essential to study the financial sustainability of the sector over a period of time. In this way, various gaps and possibilities can be explored. On this backdrop this piece of work has tried to assess the financial viability of these industries on a number of aspects such as its resourcefulness and ability to earn a fair return on investment, its ability to meet its current obligations effectively etc. (Barthwal 2010).

From the existing literature survey, it has been observed that for Indian food processing industries the financial performance analysis is there. But most of them are theoretical one or confined only one or two agro based industries. But at macro level studies of financial performance on the basis of time series analysis is very few or negligible. Issues like rural development, employability, Foreign direct investment (FDI) inflows has gained importance in researchers eyes. But financial potentiality and position as a whole for these industries is also necessary to find out the ways to develop and problems facing by these industries. Having this backdrop this study tries to discuss the financial performance as a whole for the state of Assam.

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MATERIALS AND METHODS

The study is based on secondary data. Data are collected basically from the "Annual survey of Industries" reports of the Central Statistical Office; Government of India. The data has been collected from 1998 to 2017, which is the latest one. The time period considered in the study is from 1998-99 to 2016-17. This is because from Annual Survey of Industries (ASI) 1998-99 to ASI 2003-04, National Industrial Classification (NIC)-1998 has been followed. From ASI 2004-05, NIC-2004 classification has been introduced. But in both the classification code-15 (i.e. 2-digit level) represents the Manufacture of Food products and Beverages. Again from the year 2008 a new series of classification, NIC-2008 has been adopted. National Industrial Classification (NIC)-2008 has newly introduced 3-digit level classification the food processing industry, codes having 101 to 110. In this study five financial ratios have been used to analyzed which are represented in the (Table 1). The whole process of calculation has been adopted from (Dutta and Borah 2016).

Table 1 Financial ratios for the study

Broad category	Ratio under consideration	Formula	Calculation of different variables from ASI data
Structural ratio	Debt-equity ratio	$\frac{\text{Fixed capital+working capital−outstainding loan}}{\text{outstanding loan}}$	--
Profitability ratio	Rate of return on investment ratio	1. Rate of gross return on Net Asset = $\frac{\text{Gross profit}}{\text{Net Asset}} \times 100$ 2.Rate of net return on Net Asset = $\frac{\text{Net profit}}{\text{Net Asset}} \times 100$	Gross profit = R-D R = (Total output + Changes in the value of stock of finished goods) D = (Total Input + Total Emolument) Net Asset = K K = Total productive Capital Net profit = R-C C = (Rent paid+ Interest Paid) + (Total Input + Total Emolument)
Liquidity ratio	Current ratio	$= \frac{\text{Current Assets}}{\text{Current Liabilities}}$	Current Asset = (Working capital + Physical Working Capital) Current Liabilities = Outstanding Loan
Activity ratio	Inventory cost turn-over ratio	$= \frac{\text{Cost of good sold}}{\text{Average Inventory}}$	Cost of goods sold = (Income – Profit) Avg. Inventory = {Beginning PWC of the year (i.e. the ending of the previous year) + Ending PWC of the year} / 2

Using STATA 13.0 this study has conducted a time series analysis of financial ratios. In first instance a general overview of the ratios is given with the help of tables and time series graphs. Secondly the stationarity of the four series of ratios are checked with the help of Augmented Dicky Fuller Test (ADF). Moreover, to find out the presence of association between financial ratios Johansen test of Co-Integration is applied. Finally using the VAR model performance of financial ratios was predicted for future 4 years.

RESULTS AND DISCUSSION

Structural ratio: DER

To analyze the structural position of the FPIs of the state the DER has been calculated as it is one of the most common ratios under this category. DER is an important index for the evaluation of the credit- worthiness of a firm. From operational size of the firm the DER is also important. If the earnings of a firm are high and stable, it may go for higher debt equity ratio, otherwise not as it may lead to insolvency due to poor earnings and high interest charges.

The trend of DER is not very much satisfactory for Assam (Table 2). In the year 2014-15 the DER in Assam was the highest. This is because in that particular year the outstanding loans of FPI in Assam were the lowest (i.e. ₹ 36921 lakh). The low DER indicates the poor earnings and high interest charges of the FPI in Assam. It also reflects the picture of the lack of credit-worthiness of the FPI which is not a good sign. In 2014-15 the ratio is highest as because of high earnings as well as low amount of liability. But from 2015-16 onwards it was again very low portraying again low credibility of FPIs of Assam.

Table 2 Debt-equity ratio of Assam

Year	Debt-equity ratio (Assam)
1998-99	1.881305
1999-00	1.969445
2000-01	0.731798
2001-02	1.147299
2002-03	0.940558
2003-04	0.886121
2004-05	0.663432
2005-06	0.45366
2006-07	0.564203
2007-08	0.648852
2008-09	0.601007
2009-10	0.602169
2010-11	1.065853
2011-12	4.73
2012-13	1.760735
2013-14	2.158211
2014-15	**20.62238**
2015-16	17.09688
2016-17	0.100473

Calculated from ASI data from 1998 to 2017

Profitability ratio: Rate of return on investment ratio

Profitability ratio reflects the long-term profitability of a firm. The profitability ratios show the overall performance of a firm measured in different ways. Normally for any

profitability index, higher the ratio greater the efficiency of the firm judge by it. (Table 3) shows the values of the Ratio of Return on investment ratio for the respective years.

Table 3 Rate of return on investment ratio for FPI of Assam

Year	Gross return on net asset	Net return on net asset
1998-99	59.89541432	54.65391909
1999-00	50.12403422	44.77842574
2000-01	31.05932094	25.17477575
2001-02	26.27538874	21.14015631
2002-03	22.55466466	17.043654
2003-04	19.75123113	13.98804707
2004-05	28.21878053	22.40230295
2005-06	27.08168479	21.6301906
2006-07	26.12978488	18.9928539
2007-08	27.52718807	19.77632964
2008-09	0.53019453	0.450065529
2009-10	0.367772927	0.323316392
2010-11	0.39495787	0.349186201
2011-12	2.220112664	0.596286251
2012-13	0.309435806	0.266021636
2013-14	0.317966982	0.272456738
2014-15	**-0.996766961**	**-1.027298577**
2015-16	0.368408435	0.326793049
2016-17	0.821879665	0.68862105

Calculated from ASI data

Depending upon the general perception about the profitability ratio we can say that the performance of FPI under the profitability criteria is worsening after 2008-09 (Table 3). This is because the value of the Ratio of Return on investment ratio is low in several years. Even in the year 2014-15, it is negative. This is because in those years' income and profit level both are negative for some categories of FPI of the state. It reflects the low long-term profitability of the FPI.

Liquidity ratio: CR

The current condition of business or trade is indicated by the CR. It is the ratio between current assets and current liabilities. The CR position of the state also reveals a. As per the norm the CR of 2:1 is considered as a good sign.

But from the (Table 4) it is seen that except the year 2008-09 when the CR is 2.76:1, FPI industry of the state has not been possessed a good liquidity position. It indicates that the FPI of Assam has been highly dependent on short term or long-term borrowings to meet the current obligations. But throughout the years the position of Assam is not good at all. In the year 2011-12, 2014-15 and 2015-16, the CR of FPI of the state in a good liquidity position. But in the year 2016-17 it has again fallen to 1.98 indicating worsening situation.

Activity ratio: ICTOR

The ratio shows the frequency with which the average level of inventory investment has been "recouped" or "turned over" through operations. A high turnover from smaller average level of inventory investment is an indication of better performance. A high turnover from smaller average level of inventory investment is an indication of better performance.

Table 4 Current ratio of FPI of Assam

Year	Current ratio (Assam)
1998-99	1.911708094
1999-00	1.838522529
2000-01	1.1162299
2001-02	1.19516483
2002-03	1.185322272
2003-04	1.148982328
2004-05	1.069744808
2005-06	0.940208287
2006-07	0.851087323
2007-08	0.906765995
2008-09	0.867893607
2009-10	0.856772317
2010-11	1.506648503
2011-12	**40.08366058**
2012-13	1.23928866
2013-14	1.517442416
2014-15	**17.77102462**
2015-16	**11.66750176**
2016-17	1.982814525

Calculated from ASI data

Table 5 Inventory-cost turnover ratio for Assam

Year	In-Cs turnover ratio (Assam)
1998-99	8.53
1999-00	8.18
2000-01	7.95
2001-02	7.21
2002-03	7.06
2003-04	7.85
2004-05	7.88
2005-06	7.57
2006-07	7.59
2007-08	7.77
2008-09	0.48
2009-10	0.44
2010-11	0.38
2011-12	0.05
2012-13	0.96
2013-14	0.54
2014-15	0.31
2015-16	0.34
2016-17	0.45

Calculated from ASI data

In case of Assam it is seen that since 1998-99 to 2011-12 the average inventory has been increasing with almost the same trend of ICTOR on an average of 7.5 times. But as per the norm it will be an indication of better performance if the level of average inventory is smaller over the years. From the year 1998 to 2007-08 the value of average inventory was smaller and hence it was reflected in the ratio. The ICTOR is very high in the year 2001-02 and 2002-03 again. This is because in these two years the average level of

inventories is low and it is better for the industry as a whole. Except these periods ICTOR is although low since the level of average inventory is increasing over the years.

Long term association between the financial ratios

Among various financial ratios, the study of long-term association is needed. This should be done to see whether in the long run they will move together. This exploration is important because of future policy or business strategy formation. The preliminary step in a time series analysis is to check the presence of unit root in each individual time series over the sample period. ADF unit root test has been applied to investigate it. If there is a unit root then the series will be termed as non- stationary otherwise stationary. The ADF unit root test estimates the following regression model:

$$X_t = \alpha + \beta t + \rho X_{t-1} + u_t$$

Where, α is the intercept, β is the co-efficient of lagged term, ρ is the number of lagged term and u is the error term where u_t is a white noise. The optimal lag length is chosen by using the Akaike Information Criteria (AIC). The hypotheses of the test are:

H_0: the time series is non-stationary

H_1: the time series is stationary

The results are presented in (Table 6)

Table 6 Unit root test results for financial ratios

Series	ADF test statistics	Critical Values	Accept/ Reject	Stationarity	Order of integration
Structural ratio	-3.373**	-3.000	Reject	Stationary	I (0)
Profitability ratio	-2.342**	-3.000	Accept	Non-Stationary	I (0)
Liquidity ratio	-3.047 **	-3.000	Reject	Stationary	I (0)
Activity ratio	-1.024**	-3.000	Accept	Non-Stationary	I (0)

**Significance at 5% level. The figures in the brackets are lag length. The leg selection is compliance with Akaike Information Criteria

The results of ADF unit root test show that the null hypotheses of the presence of a unit root is rejected for structural and liquidity ratio. Whereas the Profitability Ratio and Activity Ratio has a unit root. To eliminate the unit root we have taken the first difference of them and then applied ADF test. The results are like this-

Table 7 Results of ADF test

Series	ADF test statistics (First difference)	Critical Values	Accept/ Reject	Stationarity	Order of integration
Profitability ratio	-3.175**(0)	-3.000	Reject	Stationary	I (1)
Activity ratio	-4.258(0)	-3.000	Reject	Stationary	I (1)

**Significance at 5% level. The figures in the brackets are lag length. The leg selection is compliance with Akaike Information Criteria

When they are transformed into their first differences, i.e. both the series are stationary on first differencing. Therefore, profitability ratio and liquidity ratio are integrated of order one, i.e. they are I (1). Unit root test after taking first difference of these two series confirms elimination of it. After confirming stationarity of the two series, next step is to conduct co-integration test to examine that the variables are co-integrated.

Secondly, we are investing that whether the financial ratios have an association overtime. Johansen co-integration test is applied to measure the level of co-integration. For the test the Null hypothesis is-

H_0: No co-integration between the financial ratios

The alternative hypothesis is-

H_a: There is co-integration between the financial ratios

Conduction of Johansen co-integration test gives us the following results-

Table 8 Results of the Johansen's test of co-integration (Assuming intercept constant) (Trace and max statistics)

Maximum rank	Parms	LL	Eigen-value	Trace statistic	5% critical value	Max statistic	5% critical value
0	20	196.30	0.70	47.56	47.2	29.41	27.07
1	27	-186.59	0.55	28.15	29.68	12.86	20.97
2	32	-180.16	0.42	15.18	15.4	8.84	14.07

Johansen co-integration test shows that when maximum rank 0 the trace statistic is greater than 5% critical value (Table 8). Therefore, null hypothesis of no co-integration is rejected and alternative hypothesis is accepted. It means that there is a long-term association between the ratios and in the long run they will move together. While in case of max statistics also the 5 percent critical value is less than it at maximum rank 0. Which means rejection of null hypothesis, i.e., there is co-integration among the variables.

In the third step we try to forecast the behavior of the financial ratios of the FPI of Assam for upcoming 3 years. Time series forecasting is done with the help of VAR model. Forecasting in VAR requires initially that all variables under study should be stationary. Although we got stationary time series as per ADF test. Apart from this VAR requires two diagnostics-first presence of Autocorrelation in each series and normality of the residuals. Presence of Autocorrelation is checked by applying Lagrange Multiplier test with the

null hypothesis- H_0: No Autocorrelation in lag order. When the diagnostics is done it is found that after differencing all the series became free from serial auto-correlation. The results are presented in the following (Table 9).

Table 9 Results of L-M test for residual autocorrelation

Series	Order of difference	LAG	Prob>chi*	d.f	Result
Structural ratio	2	1	0.1086	1	No autocorrelation
		2	0.2958	1	
Profitability ratio	3	1	0.62457	1	No autocorrelation
		2	0.34278	1	
Liquidity ratio	2	1	0.04358**	1	No autocorrelation
		2	0.08429	1	(when lag is 2)
Activity ratio	2	1	0.24516	1	No autocorrelation
		2	0.23079	1	

**Means rejection of null hypothesis, i.e. presence of serial correlation. Here second lag order is considered for further analysis

Table 10 Results of Jarque-Bera test of residual normality

Series (Third differencing)	Chi square	d.f	Prob>chi*
Structural ratio	.294	2	0.8634
Profitability ratio	.403	2	0.8175
Liquidity ratio	.896	2	0.639
Activity ratio	2.904	2	0.234

*5 percent level of significance

L-M test gives the conformity that other than liquidity ratio (second difference), all other financial ratios don't have serial correlation in residuals in lag order 1 and 2. Means in these three series we have no auto-correlation as a whole. While only in lag order 2, the liquidity ratio after second differencing has free from serial correlation problem. Therefore, the lag order 2 model for liquidity ratio has been adopted for further analysis. Second criteria of forecasting in VAR is to test the normality of the residuals of the variables this study applies Jarque-Bera test. Null hypothesis of the test is-

H_0: The disturbance terms are normally distributed

The results of the said test are as follows-

The test statistic shows that probability values for each series of ratios more than 5 percent critical values. Which means that null hypothesis cannot be rejected. That is residuals are normally distributed. Therefore, it is the desired results. Now the VAR model can be estimated for the series of financial ratios and the results are like as follows-

Table 11 Results of VAR model

VAR	Chi square	Parms	R-square	Lag order	Prob>chi*
Profitability ratio (Third difference)	40.55	9	0.7434	L1	0.000
Liquidity ratio (second difference)	53.26	9	0.7919	L2	0.000
Debt-equity ratio	416.67	9	0.675	L1	00000
Activity ratio	29.13	9	0.6754	L1	0.000

*5 percent level of significance

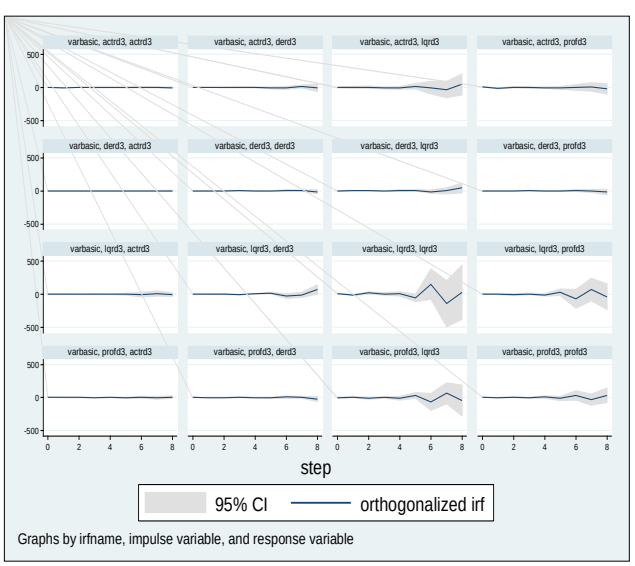

Fig 1 VAR specification of each series of financial ratios

The graphs of the VAR specification of each series are presented in the (Fig 1). As the model is significant at 5 percent level with a good measure of fitness, predictions can be done.

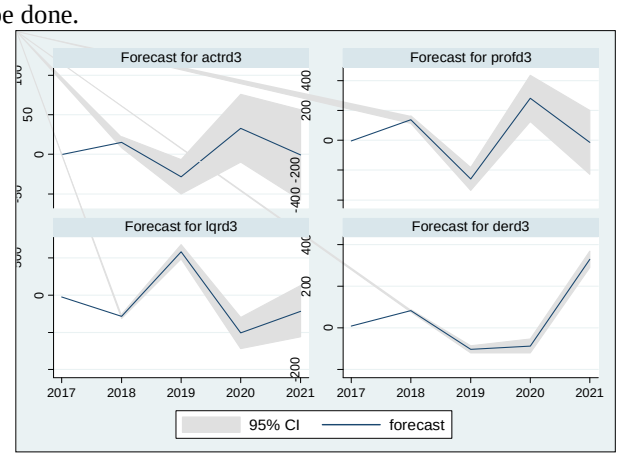

Fig 2 Forecasting of financial ratios

The forecasting graphs after computing the forecasting for future four years of the four series are presented in figure II. The forecast graphs of the ratios don't show a pleased pattern in upcoming four year. Activity and profitability ratio has a the tendency to fall further or may have a worsening pattern.

Whereas the liquidity ratio may take a slow upward turn indicated by the flatter part after 2020. It is a matter of concern. Only the debt equity ratio is showing a positive rise which is desirable.

The discussion confirms one thing that the behavioral pattern of financial ratios are fluctuating. The results of the co-integration test shows that the ratios have a long-term relationship, therefore it is suggested that the position of FPIs of the state should be made favorable as the ratios will move together with each other. In this study the causes of the unfavorable status of the financial ratios couldn't be find out. It may be because of some specific categories of industries are not able to perform well or becoming sick which affects the whole food processing industries (FPI) of Assam in a bad manner. Therefore, it is need of the hour to categorize the well and worse performing industries and also make effective measures to tackle the existing problems. Future research may carried out on different categories of food processing industries (FPI) to have a distinct idea that which one is performing badly and which one is in a position of better performance. It will help to identify the units to be operated in near future in the state.

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