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Editorial

Greetings from the Editorial Board of Business Spectrum, a bi-annual peer-reviewed journal of the Indian Accounting Association South Bengal Branch. For the issue of January-June 2021, we have published five interesting articles from academics and research scholars. The *first* article by Rahul Nandi and Pradipta Banerjee describes the determinants of the financial leverage and financial risk of the top ten retail firms listed in BSE in India. The study examines the determinants of capital structure of select retail firms listed on the Bombay Stock Exchange (BSE) using data for the five-year from 2015-16 to 2019-20. The study concludes that NDTS, the size of the firm, ROA, and tangibility are the main determinants of the retail firms listed in BSE. The *second* article by Mahasweta Roy (Dutta) examines the Economic Value Added (EVA) power of stock returns over traditional performance measures in the IT industry in India during the period 2014 to 2020. The focus of the study is to investigate the relative and incremental explanatory power of EVA in the context of stock returns over net income (NI), operating income (OI), and residual income(RI) in the IT industry in India. The study concludes that EVA is more correlated with stock market returns than traditional profitability measures in the Computer industry. The *third* article by Paritosh Chandra Sinha and Pooja Agarwal describes the behavior of investors in the stock markets. This study has empirically explored the proposition of possible assimilation of the prospect theory and the theory of mental accounting with the use of investors' multiple decision references. The objective of the *fourth* article by Mohua Das Mazumdar is to identify whether there is a variation in the perception level of virtual and traditional modes of teaching exists among students of urban and rural areas during the pandemic period. The study has conducted a comparative analysis of virtual and traditional modes of teaching by selecting the students from both PG and UG levels of the University of Burdwan. The *last* article by Parimalendu Bandyopadhyay, Tilak Nath Ghosh, and

Sourav Sarkar describes the major problems and level of challenges confronted by dairy farmers belonging to different socioeconomic characteristics. The study finds a significant impact on the size of the farm, social participation, and the nature of the occupation of the farmers.

We hope that you enjoy reading these articles. Kindly email us and submit your article to editor.businessspectrum@gmail.com.

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Determinants of Capital Structure: Empirical Evidence from select Retail Firms Listed in BSE in India.

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Abstract

Purpose – The paper empirically examines the determinants of capital structure of select retail firms listed on the Bombay Stock Exchange (BSE) using data during the five-year period from 2015-16 to 2019-20.

Methodology – The study is empirical in nature and collected secondary data for analysis. The study employed balanced panel data for regression using three-estimation models namely, Pooled Regression Model (PRM), Fixed Effect Model (FEM), and Random Effect Model (REM). The regression equation has been estimated using debt-equity and debt to total assets ratios as the dependent variables and firm size, tangibility, growth, return on assets, non-debt tax shield, and liquidity as the independent variables. The Hausman test has been applied to select the appropriate model to be employed for the analysis.

Findings – The results of the Hausman test suggest that REM and FEM are appropriate models for estimating the regression equations using the debt-equity ratio and debt to total assets ratio as the dependent variable respectively and the value of the Durbin-Watson test statistic indicates that the independent variables are free from the problem of autocorrelation. The coefficient values of the first equation reveal a significant positive association among leverage and non-debt tax shields, while the remaining coefficients are statistically insignificant. The results also indicate that the REM could explain only thirty percent of the variation in the values of independent variables while the second equation explained eighty-four percent of the variability in the values of independent variables as evident from the value of R-squared. The variables, size of the firm, and ROA have a negative effect on leverage whereas, tangibility has a positive effect on leverage. Therefore, the study demonstrates that the variables non-debt tax shield, size of the firm, return on assets, and tangibility are the important determinants of capital structure of the retail firms listed in BSE in India.

Keywords: *Capital structure, Leverage, Panel regression analysis, Firm size, ROA.*

Determinants of Capital Structure: Empirical Evidence from Select Retail Firms Listed in BSE in India.

Introduction

The stiff competition among businesses is causing serious threats within the business environment. To cope with the competition companies are aggressively restructuring their strategies by analysing the various aspects of the businesses. In financial management, there are three important decisions namely, investment decision, financing decision and dividend decision. Among these three, the most vital area of decision making is financing decision which mainly deals with the capital structure of a firm. It utilizes a proper mix of capital which minimizes cost and risk and maximizes the return to a firm. The cost of capital is a significant determinant of the profitability of firms and therefore companies try to optimize the capital structure. There are many sources for procuring capital but companies mostly relied on equity and debt capital for financing as the optimum mix of capital can be achieved by judicious use of equity and debt capital. Debt is a cheaper source of capital compared to equity capital hence, trading on equity is used as a tool to leverage the earnings of a firm. But unlike equity, debt attracts interest payment so it becomes a fixed financial expenditure to a company in spite of any situation. Therefore, in adverse conditions like decreasing sales or dropping market share etc., excessive use of debt triggered risk in the form of non-payment of interest and further leads to bankruptcy due to lack of liquidity.

Leverage is of two types, operating leverage and financial leverage. Operating leverage refers to investment or asset procurement activities while financial leverage refers to activities related to financing or obtaining funds. Degree of Operating Leverage (DOL) describes the effect on Earnings before Interest and Taxes (EBIT) due to change in sales. On the other hand, Degree of Financial Leverage (DFL) explains the effects of change in Earnings per Share (EPS) due to the change in EBIT. Hence, total or combined leverage deals with fixed costs of a firm and summarizes the effect of change of EPS due to change in sales. Leverage is good for a firm when the return on investment is sufficiently large and a large margin of income is available to meet the fixed financial charges whereas leverage is worse when the firm is in lack of liquidity and unable to meet the fixed financial obligations.

The relationship between leverage and profitability is explored much but it is still a researchable topic due to the inconsistency in the capital structure theories. It is still unclear what are the determinants of capital structure. So, the study tries to find out some consistency or at least some determinants that have wide acceptability in determining the capital structure of the firm. The present paper deals only with financial leverage and therefore discussion and analysis are confined only to financial leverage and financial risk. The study investigates the determinants of financial leverage of the top ten retail firms listed in BSE in India.

II. Literature Review

Capital structure theories have a positive impact on profitability as can be evident from Modigliani and Miller's theory, trade-off theory etc. while pecking order theory postulates a negative relationship between leverage and profitability. Therefore, capital structure theories describe inconsistent relationships and it is difficult to say about the changing relationship between leverage and profitability. In order to gain some more insights about the study, a few notable kinds of research that investigated the impact of leverage on firms' profitability for diverse sectors of the economy in the Indian backdrop are discussed below:

Pandey. K. and Sahu, T. (2017) articulated that financial leverage has a significant negative impact on the performance and value of the firms for Indian manufacturing firms listed and traded on BSE during the period 2011 to 2016.

Khedkar (2015) analyzed the impact of leverage on profitability for Dr. Reddy's Laboratories, a pioneer pharmaceutical company of the country, and documented that degree of operating leverage is significantly and negatively associated with the Return on Investment (ROI), degree of financial leverage is positively associated with the ROI and the degree of combined leverage is positively associated with ROI though for the latter two the observed relationship was not statistically significant.

Silambarasan (2015), investigated the effect of financial leverage on the profitability of IT firms using twenty-eight firms as samples from the IT sector. The study revealed that operating and financial leverage have a significant impact on the profitability of sample firms. The study also found that operating leverage has a negative impact while financial leverage bears a positive relationship with profitability. However, no significant impact of combined leverage on Return on Net Worth was found may be due to the significant negative effect of operating leverage on profitability.

Kalpana (2014), studied the influence of leverage on profitability using data of select steel companies that are listed in BSE and found that DOL is negatively associated with earnings per share (EPS); DFL and EPS; and DCL and EPS.

In a research article Karunaiathal (2014), examined the relationship between leverage and profitability through multiple regression analysis using ten large-scale paper companies operated in India for the period from 1997-98 to 2009-10. The study found that seven out of ten companies had a significant positive relation between leverage and return on equity whereas leverage has a significant negative relationship with return on equity for the remaining companies.

Kumar (2014), using data of Bata India Ltd. for the period from 2005-06 to 2012-13 examined the impact of leverage on profitability. The study found that the degree of operating leverage has a significant positive impact on ROI, the degree of financial leverage has a positive and insignificant effect on ROI, and the degree of combined leverage has a positive and insignificant impact on ROI.

Patel (2014) examined the relationship between Return on Capital Employed (ROCE), Return on Equity (ROE), Return on Asset (ROA), and EPS with operating, financial and combined leverage using data of Sabar Dairy co-operative society for the period from 1985-86 to 2013-14. The results indicate that the overall model is statistically significant where all the profitability measures are positively associated with the three measures of leverage except ROA which is negatively connected with DFL.

Chisti et. al. (2013), investigates the influence of financial leverage on profitability of automobile companies listed in India. The study documented that measure of financial leverage i.e., debt to assets ratio and interest coverage ratio has a positive and significant impact on the profitability of firms, another measure of leverage such as the debt o equity ratio has a negative and significant impact on the profitability of firms.

Pachori and Totala (2012) examined the effect of financial leverage on shareholder's return and market capitalization using seven major automotive public companies in Pithampur, M.P. The study revealed financial leverage has no significant relationship with shareholder's return and market capitalization and there might be some more non-quantitative factors.

Bhayani, S. (2009) investigated the influence of financial leverage on the cost of capital and firm value using data from the cement industry in India but didn't observe any significant linear relationship between them.

After the review of the literature, the study found some determinants from the capital structure theories and tries to inculcate those variables for analysis which is discussed in the database and methodology section.

Significance of the study

The retail industry is capital intensive and registered tremendous growth in the past few years in India. The highest number of people are engaged in this sector therefore in terms of employability the retail sector is important. The reason for the rapid expansion of the retail sector may be due to the entry of new players, the advent of foreign direct investment in the economy, and the growing middle class. As the decision of leverage is market-driven and industry-specific, an attempt is made to explore empirically the influence of leverage as well as some other determinants of capital structure on retail sector firms operating and listed in India. Therefore, the paper stresses Indian retail firms due to their untouched area of interest among the researchers in India.

III. **Objectives of the Study**

The objective of the study is to investigate the determinants of capital structure of the retail firms operating and listed in India. Briefly, the objectives are outlined below:

1. To find out empirically the determinants of capital structure of the retail firms listed in BSE.
2. To analyse the volume of debt and its impact on retail firms.
3. To investigate the impact of financial leverage on profitability in retail firms.

IV. **Database and Methodology**

The study is empirical in nature and all the data are collected mainly from secondary sources. The study employed the data of the top ten retail firms based on market capitalization on BSE as of 10th September 2020 from the website of www.moneycontrol.com. The study employed five-year data during the period from 2015-16 to 2019-20. The data of select firms are sourced from the annual report of the concerned companies as well as from the website of www.moneycontrol.com, screener.in and from BSE. Besides, a

few key financial ratios are calculated using the audited consolidated data from the balance sheet and income statement of the relevant companies collected from the annual reports.

The study used the debt-equity ratio and debt-to-total assets ratio as the dependent variable. The study employed various determinants of capital structure like firm size, tangibility, growth, return on assets (ROA), non-debt tax shield (NDTS), and liquidity of the firm as independent variables.

The results and discussion have been primarily carried out with the help of descriptive statistics to understand the spread of the data. Further, the study used panel data regression analysis to find out the empirical relationship among the dependent and independent variables using balanced panel data. Additionally, various tests have been performed to select the best model among pooled regression model (PRM), fixed effect model (FEM), and random effect model (REM). Finally, few diagnostic tests were conducted to look for any sampling error.

Table I: The top ten retail companies according to their market capitalization

Sl. No.	Company name	Market Cap. (in Cr. Rs.)
1.	Avenue Supermart Ltd.	139210.02
2.	Trent Ltd.	24244.24
3.	Aditya Birla Fashion Ltd.	10989.68
4.	Future Retail Ltd.	5439.11
5.	V-Mart Retail Ltd.	3886.15
6.	Future Lifestyle Ltd.	2090.39
7.	Shoppers Stop Ltd.	1491.87
8.	Arvind Fashions Ltd.	1305.75
9.	Spencer's Retail Ltd.*	763.42
10.	Future Enterprises Ltd.	711.08
11.	V2 Retail Ld.	180.25

Source: moneycontrol.com

Table I represents the lists of the select sample companies for the study from the retail sector according to the market capitalization on BSE as of 10th September 2020 from the website of www.moneycontrol.com.

The largest company according to market capitalization is Avenue Supermart Ltd. and the V2 Retail Ltd. being lowest in the chart. Spencer's Retail Ltd. marked with asterisk (*) was excluded from the study due to the non-availability of data.

Table II: List of variable and basis of calculation

Sl. No.	Variable	Basis of calculation
1.	Size	Natural log of total assets
2.	Tangibility	Ratio of net fixed assets divided by total assets
3.	Growth	Percentage change in total assets on a year-to-year basis
4.	Profitability (ROA)	Ratio of EBIT to total assets
5.	Non-debt tax shield (NDTS)	Ratio of depreciation to total assets
6.	Liquidity	Current assets divided by current liabilities
7.	D_E	Total debt to total capital
8.	D_TA	Total debt to total assets

Table II describes the variables employed for analysis and the method of calculation of those variables. All the key financial ratios have been calculated using consolidated audited data from the annual reports of the select companies using a statistical package.

The determinants of capital structure are estimated using the following two regression equations:

$$D\_E_{it} = \beta_0 + \beta_1 Size_{it} + \beta_2 Tangibility_{it} + \beta_3 Growth_{it} + \beta_4 ROA_{it} + \beta_5 NDTS_{it} + \beta_6 Liquidity_{it} \quad \text{.....(i)}$$

$$D\_TA_{it} = \beta_0 + \beta_1 Size_{it} + \beta_2 Tangibility_{it} + \beta_3 Growth_{it} + \beta_4 ROA_{it} + \beta_5 NDTS_{it} + \beta_6 Liquidity_{it} \ldots\ldots\ldots\ldots\ldots\ldots (ii)$$

V. Data analysis and empirical findings

Table III: Descriptive Statistics

Variables	Mean	Maximum	Minimum	Std. Dev.
Size	8.1410	9.9776	5.4019	1.1684
Tangibility	0.5215	0.8056	0.0924	0.1795
Growth	43.9242	1118.8069	-45.1836	158.4220
ROA	4.9982	21.6359	-42.7371	9.5066
NDTS	0.0434	0.1104	0.0047	0.0234
Liquidity	1.4387	3.4959	0.5971	0.6946
D_E	0.7665	2.3331	0	0.6930
D_TA	0.1963	0.4974	0	0.1525

Source: Authors' own calculation

Table III reveals descriptive information on the variables undertaken for the study. The mean size of the sample firms revealed assets size with an average value of 8.14 and less dispersed from the mean. The mean value of tangibility is very less i.e., only 0.52 implies lower fixed assets compared to total assets. The average growth of the sample firms is very high at a mean value of 43.92 with a high value of standard deviation. Also, the values of growth are extremely scattered from 1118 to -45. The average value of ROA is much dispersed from the mean having high data points from 21 to -42 registering only 5% return on assets. The sample retail firms have managed their liquidity very well and also are less levered as evident from mean values with lower standard deviation.

Table IV: Parameter estimates (Dependent variable: D_E)			
Variables	**PRM**	**FEM**	**REM**
Size	0.2722196 (0.001)*	-0.3643766 (0.234)	0.1815068 (0.143)
Liquidity	-0.1767144 (0.166)	-0.182150 (0.282)	-0.2396078 (0.066)
ROA	-0.0059077 (0.546)	-0.0132248 (0.165)	-0.0106514 (0.239)
NDTS	8.048559 (0.042)**	20.08613 (0.007)*	8.834693 (0.057)**
Tangibility	0.2100236 (0.691)	-0.9748481 (0.389)	-0.1280187 (0.865)
Growth	1.6666667 (0.998)	-0.0003864 (0.442)	-0.0000976 (0.839)
R-squared (R^2)	46.06%	69.68%	29.05%
F-statistic	6.119605 (0.000)*	5.208687 (0.000)*	2.933892 (0.017)*
Durbin-Watsonstat	1.092649	2.056394	1.515751

Source: Authors' own calculation

* Significant at 0.01 or 1% level

** Significant at 0.05 or 5% level

Table IV describes the estimated results of the panel regressions model taking debt to equity as the dependent variable. The value in the parenthesis denotes the level of significance. Below is the chart, test statistics such as R^2, F-statistic, and Durbin-Watson (DW) statistics indicate the overall significance of the regression model. The regression model is a good fit model evident from the value of R^2 and F-statistic. The p-values of all the F-statistic are significant at the 1% level. The DW statistic indicates the independent variables do not have the problem of autocorrelation as the test statistic lies in the range of 1.5 to 2. An acceptable range is 1.5 to 2.5 indicates that there is no first-order autocorrelation. The results of the coefficient in the PRM model reveal the size of the variables and NDTS are positively and significantly

related with the D_E at 1% and 5% levels of significance respectively. The other variables are not significant determinants of leverage however, the PRM explained that 46% of the data fit the regression model. In FEM, only NDTS is positive and significant at a 1% level of significance. The model revealed approximately 70% of the data fit the regression model. Again, in REM only the variable NDTS is positively and significantly correlated with the D_E at a 5% level of significance. However, the model does not well fit as only 30% of the data fit the regression model. Except for the variable NDTS, all the other variables are not significant in the FEM and REM. Hence, only the variable NDTS in PRM, FEM, and REM is a positive and significant determinant of the capital structure of the sample retail firms. Size is the only significant variable in PRM. Although, FEM is the best fit model considering the value of R^2 compared with the PRM and REM. The sample firms are not highly levered and ROA is negatively correlated however, not significant.

Table V: Parameter estimates (Dependent variable: D_TA)

Variables	PRM	FEM	REM
Size	0.0634756 (0.000)*	-0.1172674 (0.021)**	0.018414 (0.479)
Liquidity	-0.0431534 (0.108)	-0.0063152 (0.815)	-0.0470109 (0.051)**
ROA	-0.0042905 (0.041)**	-0.0045932 (0.004)*	-0.0045995 (0.004)*
NDTS	-0.8669361 (0.288)	-0.0962944 (0.932)	-1.658559 (0.060)**
Tangibility	0.1306404 (0.242)	0.374986 (0.045)**	0.2657667 (0.073)
Growth	-0.0000895 (0.437)	-0.0000725 (0.371)	-0.0000354 (0.676)
R-square	51.00%	83.77%	31.76%
F-statistic	7.458171 (0.000)*	11.69880 (0.000)*	3.335758 (0.009)*
Durbin-Watson stat	0.581443	1.695693	1.024894

Source: Authors' own calculation

* Significant at 0.01 or 1% level

** Significant at 0.05 or 5% level

Table V represents the estimated results using debt to total assets as the dependent variable. The value of R-square reveals the regression models are a good fit and all the values of F-statistic in the regression models are significant at a 1% level of significance. The Durbin-Watson stat indicates there is a presence of positive autocorrelation in PRM and REM. However, no such issue was found in FEM as the DW statistic is 1.69 which is within an acceptable range of 1.5 – 2.5. So, FEM does not have an autocorrelation problem. In PRM, the size of the variables and ROA are significant with positive and negative coefficients respectively. The variable size is significant at a 1% level and ROA is significant at a 5% level. The other variables in the PRM are not significant. In FEM, the variable size and ROA are significant with a negative coefficient and tangibility is significant with a positive coefficient. Size and tangibility are significant at a 5% level and ROA is significant at a 1% level. Liquidity, NDTS, and growth are not significant variables in the FEM. In REM, the variables liquidity, ROA and NDTS are significant with negative coefficients. Liquidity and NDTS are significant at a 5% level whereas ROA is significant at a 1% level. The other variables are not significant in the REM. Therefore, ROA is found significant and negatively correlated in all the three-regression models, and size is found significant in PRM and FEM only. FEM reveals approximately 84% of the data fit the regression model. PRM and REM disclose that 51% and 32% of the data fit the regression model. So, taking debt to total assets as the dependent variable, the study found more determinants of capital structure with better data fit in comparison to debt-to-equity ratio as the dependent variable.

Further, for the selection of an appropriate model among FEM and REM, the study conducted the Hausman test. The test was conducted twice taking each dependent variable namely the debt-equity ratio and debt to total assets ratio.

Table VI: Model Selection

Dependent Variable: D_E				
Objective	Test	Null Hypothesis	Test Statistic	Result
REM vs. FEM	Hausman	REM appropriate	6.34 (0.2748)	REM
Dependent Variable: D_TA				

Objective	Test	Null Hypothesis	Test Statistic	Result
REM vs. FEM	Hausman	REM appropriate	15.56 (0.0163) *	FEM

Source: Authors' own calculation

* Significant at 0.05 or 5% level

Table VI describes the results of the Hausman test conducted for finding out the best model among the FEM and REM. The test statistic reveals REM is a suitable regression model when debt to equity is used as the dependent variable. The test statistic of the Hausman test signifies the p-value is greater than the 5% level of significance hence the null hypothesis has been accepted i.e., REM is accepted as an appropriate model. Similarly, FEM is found suitable when debt to total assets is used as a dependent variable. The Hausman test indicates the p-value is less than 5% level of significance and subsequently the null hypothesis has been not accepted. So, FEM is accepted as an appropriate regression model.

VI. Conclusion

The study evaluated the determinants of capital structure of the top ten retail firms based on market capitalization listed in BSE. The study used panel data regression analysis and estimated two regression equations with the help of three-panel models. The study found REM as an appropriate model taking D_E as a dependent variable and FEM as an appropriate model taking D_TA as a dependent variable as per the Hausman test. The independent variables have no autocorrelation issue and the regression model is found well fitted.

The value of R-squared in REM is explaining only thirty percent of the model signifying NDTS as the only independent variable at a 5% level of significance. The coefficient of NDTS signifies a positive relationship with the debt-equity ratio meaning as the NDTS will increase there will be an increase in the debt-equity ratio which is a very unusual estimation found in the study.

The FEM is a good fit model explaining eighty-four percent of the model as can be evident from the value of R-squared. The variables size and ROA have a negative effect on D_TA whereas, tangibility has a positive effect on the debt to total assets ratio.

Therefore, from the study, it can be concluded that the variables NDTS, size of the firm, ROA, and tangibility are the few determinants of the retail firms listed in BSE. However, there might present many more determinants of the retail firms which are not considered for the study.

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Explanatory Power of EVA™ over Traditional Profitability Measures: Evidence from Indian NSE Listed IT Companies

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Abstract

In this paper, the explanatory power of Economic Value Added concerning stock returns has been analysed among the sample companies in the computer industry during the period 2014 to 2020. At first, the relative information content approach is used to justify whether it is preferable to employ EVA over traditional profitability measures to evaluate the corporate financial performance in terms of stock returns. Secondly, the incremental information content approach is employed to answer the question: which performance measure (i.e., EVA or traditional measures) best explains the stock returns of a particular firm? Accordingly, the formal valuation model given by Easton and Harris (1991), has been used for the explanation of stock returns and earnings relationship. Our present study supports the claim of Stern and Stewart that EVA is better correlated with stock market returns over traditional profitability measures in the Computer industry during the period under study.

Keywords: EVA, Traditional profitability measures, relative and incremental approaches

Introduction

Economic Value Added (EVA^{TM}), developed by Stern Stewart & Co, is a value-based measure of performance which has been employed for setting organizational goals, performance measurement, bonus determination, motivating managers, capital budgeting, analysing equity securities, reducing agency conflict, improvements of stock performance etc. As EVA recognises the cost of capital and risk of a farm's operation, it is superior to other accounting-based measures. A number of companies in the USA (*e.g*. Coca Cola, AT & T, Briggs & Stratton, Quaker Oats etc.) who have experienced a significant increase in their shareholders' wealth, adopted EVA as the basis of management performance measurement. The present study examines EVA's power of explanation of stock returns over traditional performance measures in the IT industry in India during the period 2014 to 2020.

Literature Review:

A number of empirical studies (*e.g.* Dodd and Chen, 1996; Biddle, Bowen and Wallace, 1997 etc.) have given conflicting results comparing the better informational content of EVA over the traditional measures of performance. A few empirical investigations in the Indian context discuss the relationship between traditional performance indicators and EVA. Nemivant argued, "Some believe that EVA is applicable everywhere, including India, for the simple reason that there is no other way to run a business". According to him, depending on EVA, could be a deterrent in making a new investment decision, in an inflationary economy like India.

Objectives:

The prime focus of this paper is to investigate the relative and incremental explanatory power of EVA in the context of stock returns over net income (NI), operating income (OI), and residual income(RI) in the IT industry in India during 2014 to 2020.

Hypotheses of the study

The broad hypotheses of the study are as follows:

1. EVA elucidates the stock returns in a better way as compared with different traditional profitability measures.
2. EVA delivers incremental information in the elucidation of the variability of stock returns.

Database

We have considered six years period starting from 2014 to 2020 for detailed analysis in our study. In the final selection of the sample, a total of twenty-seven computer companies have been considered. Zensar Tech., Tata Elxsi., Trigyn Techno., Sonata Software, R S Software (I), Onward Technology, Ramco Systems, Quintegra Soln., Mastek, KLG Systel, KPIT, Infosys., Infotech Enterp., Goldstone Tech., Blue Star Info., Aftek, Wipro, Satyam Computer, MphasiS, HCL Technologies., Polaris Finan., Moser Baer (I), LCC Infotech, HCL Infosystems, Zenith Computers, CMC and MRO-TEK have been included in this study out of fifty-five NSE listed companies during the study period on a random basis. Though a huge number of NSE listed companies (123) have been found in this sector, only fifty-five

companies indicated regular data sets during the study period. The remaining companies have not been considered in the strata, due to the irregularity of the data.

Methodology

The formal valuation model, forwarded by Easton and Harris (1991), has been used in elucidating the relationship between stock returns and earnings. This model correlates stock return to earning levels and earning changes as follows:

The Levels model: $R_{jt}= \alpha_{to}+\alpha_{t1}[A_{jt}/P_{jt-1}] + \varepsilon^{1}_{jt}$ and

The Changes model: $R_{jt}= \varphi_{to}+ \varphi_{t1}[\Delta A_{jt}/P_{jt-1}] + \varepsilon^{2}_{jt}$.

According to them, the model of returns that combines both the earning levels and changes measures is examined by the following cross-sectional regression:

$R_{jt}= \gamma_{to}+\gamma_{t1}[A_{jt}/P_{jt-1}] + \gamma_{2t}[\Delta A_{jt}/P_{jt-1}] + \varepsilon^{3}_{jt}$

where R_{jt}= share return of firm j over the 12 months (extending from 9 months prior to fiscal year-end to 3 months after the fiscal year-end); A_{jt}= accounting earnings per share of firm j for period t; ΔA_{jt} = change in accounting earning per share of firm j; P_{jt-1}= price per share of firm j at time t-1[Easton and Harris (1991), P.25 and P.29]. This model has been widely used by researchers (like Biddl, et.al, 1997; Chen et.al, 1997 and 2001; Worthington et.al, 2001; Moditinons et.al., 2006; Das et.al, 2017, 2018 etc.)

Relative information content relates to which performance measure is superior in terms of association with stock returns [Chen *et. al,* 2001]. In this approach, we have investigated whether the information content of EVA is larger than that of different profitability measures, namely NI, OI and RI. To explore this, based on Easton and Harris (1991) model, we have developed the following equations:

(1) $\text{Return} = a_0 + a_1 \text{NI}/ P_{t-1} + a_2 \Delta\text{NI}/ P_{t-1} + e_1$

(2) $\text{Return} = b_0 + b_1 \text{OI}/ P_{t-1} + b_2 \Delta\text{OI}/ P_{t-1} + e_2$

(3) $\text{Return} = c_0 + c_1 \text{RI}/ P_{t-1} + c_2 \Delta\text{RI}/ P_{t-1} + e_3$

(4) $\text{Return} = d_0 + d_1 \text{EVA}/ P_{t-1} + d_2 \Delta\text{EVA}/ P_{t-1} + e_4$

where NI= Net income of firm at period t; ΔNI= change in NI over period t-1 to t; OI= operating income of firm during the year t; ΔOI= change in OI over period t-1 to t; RI= residual income of firm at time t. ΔRI= change in RI over period t-1 to t; EVA= Economic Value Added of the firm during the year t. ΔEVA= change in EVA over period t-1to t. In this study, residual income has been calculated by using the formula-

RI= NI – EC; where EC = equity share capital × cost of equity capital (K_e). Reported net profit has been considered as a net income, which is a company's total profit before nonrecurring gains or losses, but after all other expenses. For the study, we have computed the ΔEVA by dividing EVA_t of the present year by EVA_{t-1} of the previous year. A similar procedure has been followed for the calculation of ΔNI, ΔOI and ΔRI.

It is to be noted that, earnings and earnings change variables in the original model are substituted with each of the performance measures under investigation, where, returns represent the annual returns. To compute the annual return, we have taken the following steps: (i) by using the logarithmic approximation, daily returns for each stock have been calculated (Benniga 2001):

$R_{jt} = \ln\left(P_{j,t} / P_{j,t-1}\right)$; where R_{jt} = return of j^{th} stock at period t; $P_{j,t}$ = current year price or price of stock jth at time t. $P_{j,t-1}$ = one period lagged price of jth stock or price of the jth stock at time t-1.

(ii) By aggregating the data of daily return, the annual returns of the sample companies under study have been calculated.

All these equations have been estimated cross-sectionally and using annual pooled cross-sectional data. All the explanatory variables are flattened by the stock price (P_{t-1}), to reduce the problem of heteroscedasticity from the data. Besides, to check the presence of heteroscedasticity problems in the said relative information content models, we have used White's test, whereas Glejser test has been used for regression models in the incremental information content approach as the White's test cannot be applied due to the problem of insufficient data. Durbin–Watson statistics (d) and Variance Inflation Factor (VIF) have been used to detect the presence of autocorrelation and multicollinearity problems in all regression models.

The entire hypothesis has been verified by comparing the R^2 of the pooled regression with independent variables for each one measure of the profitability measures under investigation. In the relative information criterion, we examine the F- statistics of each model separately as well as the coefficient of t-statistics of the explanatory variables and then compute R^2. To conduct a formal test on the statistical significance of the differences in the R^2 of the pooled regression, in this study, we have carried out Davidson- MacKinnon J-test for non-nested regression.

The incremental information content examines whether EVA offers more information in illuminating the variability of stock returns, which is not included in other traditional profitability measures, namely NI, OI and RI. The null hypothesis of this study has considered that EVA provides information content and those are useful in elucidating the variability of stock returns, but they are not included in NI, OI and RI.

In order to investigate the incremental information content of EVA, the following models have been used:

$$\text{Return} = n_0 + b_1 \, NI / P_{t-1} + b_2 \, \Delta NI / P_{t-1} + e_1 \, EVA / P_{t-1} + e_2 \, \Delta EVA / P_{t-1} + u_{2t}$$

$$\text{Return} = n_0 + c_1 \, RI / P_{t-1} + c_2 \, \Delta RI / P_{t-1} + e_1 \, EVA / P_{t-1} + e_2 \, \Delta EVA / P_{t-1} + u_{3t}$$

$$\text{Return} = n_0 + d_1 \, OI / P_{t-1} + d_2 \, \Delta OI / P_{t-1} + e_1 \, EVA / P_{t-1} + e_2 \, \Delta EVA / P_{t-1} + e_{4t}$$

The above models have been assessed using both pooled samples and annual cross-sectional samples. The next step is to find out the correlation of each pair-wise regression equation and adjusted R^2 and also to investigate the significance and consistency of the coefficient. The test for the incremental information content of EVA has been accomplished using the Wald test on the coefficients of each variable in the stated pooled regression models.

Data analysis and interpretation

To test the relative and the incremental information content, all the required tests for heteroscedasticity, autocorrelation and multicollinearity have been applied in all the regression models in our study. It has been observed that in most of the cases values of χ^2, observed R^2 and scaled explained Square are insignificant, implying acceptance of null hypothesis *i.e.,* there exists homoscedasticity in the data. Besides this, values of Durbin–Watson statistics (d) approximately tends to 2, which indicates the absence of autocorrelation problem in the regression equations. Similarly, in most of the cases, the reported values of VIF for the regression equation are less than 10, which indicate that multicollinearity does not exist in the regression models in our study.

In the entire result of the relative information, content pooled cross-sectional data, the highest adjusted R^2 has been observed in the regression with EVA as the explanatory variable, where operating income indicates the second-highest explanatory variable in the computer industry during the period under study; which is followed by net income, while RI appears as the smallest explanatory variable concerning stock returns.

The result of the J-test in all the pooled cross-sectional regression in the computer industry suggests that EVA has more value relevance than the other traditional measures (say NI, OI and RI). But based on the annual cross-sectional regressions, it is very difficult to conclude that EVA represents greater information content than NI, OI and RI, because some years represent equal information content with EVA.

The pairwise comparison of RI and EVA reflects the highest adjusted R^2 (0.34) and it is significant at a 1% level among other pooled regression equations in the computer industry. A similar result has also been observed in the case of yearly regressions in which values of adjusted R^2 are statistically significant according to the F statistics. It has also been observed from the table that, in pooled cross-sectional regression, all coefficients of the change explanatory variable (traditional measure) are insignificant *i.e.,* these variables do not contribute any significant information to the information content. The coefficients of the remaining variables in the pooled regression models contain statistically significant information. The annual cross-sectional regressions indicate mixed results so far as their coefficients are concerned as some of them are significant and others are not significant.

It has been observed from Tables 5 to 7 that by using the Wald tests on the coefficients of each variable in the pooled sample, EVA adds some incremental information over the traditional profitability measures. Moreover, for all the yearly cross-sectional regression models, the Wald test supports the hypothesis that EVA adds some incremental information over the other profitability measures according to the significant values of F and χ^2. The results of the Wald test in the computer industry as a whole represent that, EVA adds incremental information over the other traditional profitability measures in explaining the stock returns during the period under study.

Conclusions

It is observed from our study that the relative information content test provides a mixed result during the period. Though the pooled cross-sectional regression suggests that EVA is a more powerful explanatory variable (which supports the claim of Stern and Stewart) than the other traditional measures (say NI, OI and RI), it is very difficult to conclude that EVA represents superior information content than NI, OI and RI based on the annual cross-sectional regressions during the study period. Furthermore, it has also been recognized that EVA adds incremental information over NI, OI and RI in explaining the stock return variability in all the computer industries during the period of our study. Thus, both the financial performance

measurement approaches (*i.e.,* EVA and traditional accounting ratios) give nearly the same result for measuring the financial performance of the companies in our study. However, EVA adds some incremental information over the traditional profitability measures in explaining the variability of stock returns. Thus, it may be concluded that our study supports the claim of Stern and Stewart that EVA is more correlated with stock market returns than traditional profitability measures in the Computer industry during the period under study.

Table 1: Relative Information Content Approach (RICA) Regressions of Annual Stock Returns to EVA Levels and Change in EVA for IT Industry for the Period 2014 to 2020

Model 1: $R_{it} = a_0 + a_1 EVA_{it} + a_2 \Delta EVA_{it} + u_{it}$

Year	a_0	a_1	a_2	Adj R^2	D-W test	White test
Pooled	-1.94 (-1.89)**	1.98 (4.06)* {1.32}	3.37 (1.65) {1.32}	0.39 [6.32]*	1.99	F= 1.48 OR^2= 4.83 SESS=3.22
2014-15	-3.07 (-1.93)**	14.45 (6.84)* {2.07}	13.74 (3.51)* {2.07}	0.65 [25.53]*	1.91	F=1.79 OR^2= 6.73 SESS=4.91
2015-16	2.43 (1.87)*	4.43 (3.39)* {4.96}	20.59 (2.12)* {4.96}	0.83 [67.32]*	1.99	F= 2.48 OR^2= 4.84 SESS=8.07
2016-17	3.15 (2.02)*	7.09 (3.42)* {1.04}	21.87 (5.64)* {1.04}	0.77 [46.09]*	1.98	F=0.79 OR^2= 1.73 SESS=2.94
2017-18	2.43 (1.88)**	4.43 (3.32)* {4.34}	20.59 (2.12)* {4.34}	0.83 [67.32]*	1.98	F=0.52 OR^2=1.43 SESS=2.56
2018-19	-1.51 (-1.86)**	3.63 (11.67)* {1.48}	-2.41 (-1.24) {1.48}	0.15 [3.35]*	2.09	F=1.36 OR^2= 3.64 SESS=5.29
2019-20	-2.63 (-1.99)**	7.55 (3.96)* {1.02}	4.89 (1.97)** {1.02}	0.35 [8.18]*	2.08	F=1.27 OR^2=2.24 SESS=1.87

*Notes: Notes: The first row of the table represents the result of the pooled regressions, whereas the remaining rows indicate the result of annual cross-sectional regressions. The t- statistics are presented in the first bracket. * indicates a 1% level of significance, ** indicates a 5% level of significance, and *** indicates a 10% level of significance. Variance inflation factors are disclosed in the second bracket to find out the degree of multicollinearity. D-W indicates the values of Durbin–Watson test statistics for the autocorrelation test. The White test was used to find out the heteroscedasticity, where F= F- Statistics, OR^2- observed R- squared, SESS = Scaled explained SS*

Table 2: Relative Information Content Approach (RICA) Regressions of Annual Stock Returns to NI Levels and Change in NI for IT Industry for the Period 2014 to 2020

Model 2: $R_{it}= b_0+ b_1 NI_{it}+ b_2 \Delta NI_{it}+ u_{it}$

Year	b_0	b_1	b_2	Adj R^2	D-W test	White test	J -TEST			
							$R_{jt}=\gamma_0+ \gamma_1 NI_{jt}+ \gamma_2 \Delta A_{jt}+ \gamma_3 \widehat{R_{jt}}+\varepsilon_{jt}$		$R_{it}= \delta_0+ \delta_1 EVA_{it}+ \delta_2 \Delta EVA_{it}+ \delta_3 \widehat{R_{it}}+\xi_{it}$	
							Adj R^2	γ_3	Adj R^2	δ_3
Pooled	-1.98 (-1.87)*	1.76 (3.42)* {1.01}	0.06 (0.53) {1.01}	0.36 [5.82]*	1.97	F=1.86 OR²= 3.76 SESS=4.34	0.26 [3.98]**	1.05 (1.93)**	0.068 [0.51]	6.84 (0.95)
2014-15	-3.75 (-1.32)	-0.55 (-0.41) {1.04}	44.35 (4.19)* {1.04}	0.38 [9.16]	2.01	F=1.01 OR²= 2.35 SESS=5.73	0.82 [35.62]*	1.02 (7.14)*	0.86 [22.76]*	0.47 (1.49)
2015-16	3.71 (3.02)*	-0.97 (-1.98)** {1.23}	4.67 (2.87)* {1.23}	0.28 [4.32]*	1.99	F=0.19 OR²=0.78 SESS=.98	0.98 [438.54]*	1.25 [36.01]*	0.99 [999.04]*	-3.83 (-21.6)*
2016-17	2.84 (3.55)*	-1.22 (-1.43) {1.11}	38.54 (3.47)* {1.11}	0.56 [15.43]*	2.12	F=1.73 OR²= 2.65 SESS=4.87	0.88 [45.32]*	1.12 (7.33)*	0.85 [27.66]*	0.34 (1.23)
2017-18	3.71 (2.01)**	1.95 (5.77)* {1.01}	-0.004 (-0.02) {1.01}	0.22 [3.12]**	2.03	F= 2.84 OR²= 4.59 SESS=5.88	0.98 [438.58]*	1.22 (36.09)*	0.99 [987]*	-3.83 (-21.1)*
2018-19	-0.24 (-0.38)	0.14 (0.53) {1.69}	-0.20 (-0.39) {1.69}	0.07 [0.14]	1.93	F=0.65 OR²=1.45 SESS=2.65	0.23 [3.57]*	1.29 (3.17)*	0.21 [2.32]*	3.24 (1.67)
2019-20	-7.55 (-1.83)**	0.68 (0.42) {1.06}	1.61 (0.69) {1.06}	0.05 [0.42]	1.89	F=1.82 OR²= 5.04 SESS=3.44	0.62 [14.83]*	1.83 (6.49)*	0.37 [6.01]*	-1.31 (-1.22)*

Notes: Same as those in Table 1

Table 3: Relative Information Content Approach (RICA) Regressions of Annual Stock Returns to OI levels and change in OI for IT Industry for the Period 2014 to 2020

Model 3: $R_{it}= c_0+ c_1 OI_{it}+ c_2 \Delta OI_{it}+ u_{it}$

Year	c_0	c_1	c_2	Adj R^2	D-W test	White test	J -TEST			
							$R_{jt}=\gamma_0+ \gamma_1 OI_{jt}+ \gamma_2 \Delta A_{jt}+ \gamma_3 \widehat{R_{jt}}+\varepsilon_{jt}$		$R_{it}= \delta_0+ \delta_1 EVA_{it}+ \delta_2 \Delta EVA_{it}+ \delta_3 \widehat{R_{it}}+\xi_{it}$	
							Adj R^2	γ_3	Adj R^2	δ_3

Pooled	-2.13 (-1.98)*	1.51 (4.78)* {1.03}	0.38 (.32) {1.03}	0.37 [5.98]*	1.97	F= 1.09 OR²= 2.65 SESS=1.87	0.21 [3.45]**	1.24 (2.01)**	0.07 [0.56]	2.51 (0.95)
2014-15	-3.10 (-1.11)	-0.23 (-0.23) {2.13}	54.55 (4.81)* {2.13}	0.45 [11.63]*	2.12	F= 1.84 OR²= 3.67 SESS=3.39	0.79 [28.34]*	0.89 (5.56)*	0.71 [22.31]*	0.45 (1.39)
2015-16	2.08 (2.65)*	1.73 (1.78)* {1.04}	-15.21 (-3.36)* {1.04}	0.26 [5.67]*	1.91	F= 1.87 OR²=4.21 SESS=1.09	0.97 [273.58]*	1.07 (23.45)*	0.88 [57.93]*	0.43 (2.61)*
2016-17	-3.10 (-1.11)	-0.56 (-0.78) {1.32}	45.09 (2.88)* {1.32}	0.67 [24.32]*	2.09	F=0.67 OR²= 3.91 SESS=2.62	0.81 [33.46]*	0.98 (6.09)*	0.79 [30.01]*	0.44 (1.36)
2017-18	3.08 (2.11)*	1.73 (1.89)* {1.01}	-15.21 (-3.36)* {1.01}	0.26 [5.67]*	1.92	F= 2.06 OR²= 5.24 SESS=9.43	0.97 [273.59]*	1.07 (23.45)*	0.87 [57.92]*	0.43 (2.61)*
2018-19	-0.13 (-0.18)	0.01 (0.04) {1.01}	-0.16 (-0.49) {1.01}	-0.07 [0.12]	1.91	F= 0.88 OR²= 2.56 SESS=6.71	0.14 [2.46]**	1.05 (2.64)*	0.12 [2.17]	0.54 (0.29)
2019-20	-8.89 (-1.95)**	0.73 (0.49) {1.02}	3.49 (2.11)** {1.02}	-0.03 [0.63]	1.86	F= 1.34 OR²=3.55 SESS=2.83	0.36 [5.84]*	1.05 (3.92)*	0.33 [5.21]*	0.19 (0.23)

Notes: Same as those in Table 1

Table 4: Relative Information Content Approach (RICA) Regressions of Annual Stock Returns to RI levels and change in RI for IT Industry for the Period 2014 to 2020

Model 4: $R_{it}= d_0+ d_1 RI_{it}+ d_2 \Delta RI_{it}+ u_{it}$

Year	d_0	d_1	d_2	Adj R^2	D-W test	White test	J -TEST			
							$R_{jt}=\gamma_0+ \gamma_1 RI_{jt}+ \gamma_2 \Delta A_{jt}+ \gamma_3 \widehat{R_{jt}}+\varepsilon_{jt}$		$R_{it}= \delta_0+ \delta_1 EVA_{it}+ \delta_2 \Delta EVA_{it}+ \delta_3 \widehat{R_{it}}+\xi_{it}$	
							Adj R^2	γ_3	Adj R^2	δ_3
Pooled	1.93 (1.83)**	0.74 (2.19)** {1.06}	18.80 (3.41)* {1.06}	0.34 [5.74]*	1.97	F=0.56 OR²= 1.24 SESS=1.65	0.24 [3.36]**	0.94 (2.45)*	0.06 [0.48]	7.71 (1.09)
2014-15	-1.03 (-0.32)	0.56 (0.34) {1.03}	78.56 (2.73)* {1.03}	0.25 [5.33]*	2.12	F=0.68 OR²= 3.17 SESS=4.25	0.79 [28.23]*	1.12 (7.18)*	0.69 [17.69]*	0.31 (1.14)
2015-16	1.95 (1.78)**	-1.27 (-1.59) {1.16}	-33.27 (-7.18)* {1.16}	0.73 [35.88]*	1.92	F= 2.84 OR²= 5.66 SESS=9.08	0.97 [300.92]*	1.06 (14.46)*	0.87 [50.23]*	0.45 (1.68)

2016-17	-1.03 (-0.32)	1.67 (2.34)*** {1.45}	56.09 (1.98)** {1.45}	0.71 [21.33]*	1.99	F= 1.68 OR^2= 4.57 SESS=4.25	0.78 [29.42]*	1.22 (7.83)*	0.71 [19.34]*	0.39 (1.34)
2017-18	2.59 (1.89)**	-1.27 (-1.59) {1.15}	33.27 (7.18)* {1.15}	0.75 [35.89]*	2.05	F= 1.09 OR^2=2.57 SESS=2.98	0.98 [300.49]*	1.60 (14.47)*	0.85 [50.22]*	0.45 (1.81)**
2018-19	1.06 (2.09)**	-0.75 (-1.95)** {4.41}	-1.18 (-2.03)** {4.41}	0.08 [2.15]	1.97	F=0.75 OR^2= 1.86 SESS=2.99	0.29 [4.92]*	1.08 (2.14)**	0.15 [2.53]**	0.53 (0.98)
2019-20	-4.31 (-1.85)**	-0.72 (-0.38) {1.22}	17.53 (1.77)* {1.22}	0.11 [2.68]**	2.19	F= 1.29 OR^2= 3.04 SESS=2.87	0.62 [15.12]*	1.86 (5.79)*	0.34 [5.46]*	0.38 (0.72)

Notes: Same as those in Table 1

Table 5: Incremental Information Content- Pair-Wise Regression of NI and EVA Component for IT Industry for the Period 2014 to 2020

$$Model\ 1\ R_{j=}\alpha_0 + \alpha_1 EVA + \alpha_2 \Delta EVA + \alpha_3 NI + \alpha_4 \Delta NI$$

Year	α_0	α_1	α_2	α_3	α_4	Adj R^2	D-W test	Glejser test	Wald test: $\alpha_1= \alpha_2= 0$
Pooled	-1.56 (-1.92)**	1.65 (2.79)* {3.31}	3.15 (2.01)** {1.21}	1.24 (2.05)** {3.02}	0.01 (0.05) {1.01}	0.23 [3.43]**	1.97	F=1.98 OR^2=3.02 SESS=6.11	F=6.11** χ^2 =12.22*
2014-15	2.49 (2.64)*	17.83 (14.69) * {3.87}	-.76 (-.36) {3.31}	-8.38 (-9.23)* {4.36}	7.12 (1.79)* 1.65	0.93 [100.97]*	1.98	F=1.83 OR^2=6.29 SESS=4.12	F=109.71* χ^2 =219.41*
2015-16	1.24 (3.91)*	7.87 (19.13)* {9.89}	8.01 (2.87)* {8.98}	-3.87 (-22.55)* {1.44}	-0.13 (-1.98)** {1.76}	0.99 [873.04]*	1.97	F=1.53 OR^2=6.98 SESS=10.78	F=325.95* χ^2 =651.9*
2016-17	2.34 (2.78)**	7.65 (10.44)* {8.65}	-3.55 (-1.18)* {7.54}	4.37 (10.58)* {2.61}	-1.56 (-0.33) {1.88}	0.97 [298.75]*	1.98	F=2.83 OR^2=6.47 SESS=3.52	F=34.09* χ^2 =78.53*
2017-18	-1.31 (-1.89)*	10.07 (8.41)* {9.95}	-0.76 (-0.26) {1.27}	5.87 (8.01)* {9.45}	0.03 (0.52) {1.05}	0.78 [22.97]*	1.87	F=.1.97 OR^2=5.83 SESS=7.71	F=45.66* χ^2 =91.32*
2018-19	-1.09 (-2.12)**	1.99 (3.88)* {6.06}	4.09 (2.11)** {2.83}	1.15 (3.57)* {4.62}	-0.01 (-0.33) {1.71}	0.47 [5.85]*	1.91	F=1.45 OR^2=16.97 SESS=17.68	F=11.43* χ^2 =22.86*
2019-20	4.18 (1.97)**	19.67 (10.32)* {3.38}	-6.47 (-2.66)* {1.33}	-9.33 (-7.71)* {3.69}	0.46 (0.46) 1{0.71}	0.81 [28.62]*	1.98	F=2.14 OR^2=6.98 SESS=6.45	F=54.94* χ^2 =109.88*

*Notes: Notes: The first row of the table represents the result of the pooled pairwise (NI and EVA) regressions, whereas the remaining rows indicate the result of annual cross-sectional regressions. The t- statistics are presented in the first bracket. * indicates 1% level of significance, ** indicates 5% level of significance, *** indicates 10% level of significance. Variance inflation factors are disclosed in the second bracket to find out the degree of multicollinearity. D-W indicates the values of Durbin–Watson test statistics for the autocorrelation test. Glejser test was used to find out the heteroscedasticity, where F = F-statistics, OR^2 = observed R^2, SESS - Scaled explained SS. Wald test represents The test for the incremental information content of EVA.*

Table 6: Incremental Information Content- PairWise Regression of OI (traditional measure) and EVA (value-based measure) Components for Computer Industry for the Period 2014 to 2020

$$Model\ 2\ R_{j=}\beta_0 + \beta_1 EVA + \beta_2 \Delta EVA + \beta_3 OI + \beta_4 \Delta OI$$

Year	β_0	β_1	β_2	β_3	β_4	Adj R^2	D-W test	Glejser test	Wald test: $\beta_1 = \beta_2 = 0$
Pooled	-1.89 (-1.96)**	5.89 (9.24)* {1.87}	0.14 (2.07)*** {1.18}	-3.76 (-9.42)* {1.61}	0.29 (0.24) {1.06}	0.27 [3.78]**	1.93	F=1.75 OR^2=3.27 SESS=2.43	F=4.76** χ^2=9.51*
2014-15	2.41 (1.82)**	14.49 (7.41)* {3.78}	29.79 (1.74)* {3.62}	-4.56 (-4.34)* {3.61}	30.18 (2.21)* 1.92	0.84 [34.76]*	1.94	F=.84 OR^2=1.34 SESS=1.36	F=9.31* χ^2=58.61*
2015-16	-1.41 (-2.28)**	6.59 (7.87)* {9.55}	-11.45 (-2.37)* {7.61}	2.37 (10.73)* {1.32}	-0.42 (-0.33) {2.33}	0.97 [242.61]*	1.91	F=0.27 OR^2=1.98 SESS=1.56	F=9.31* χ^2=58.61*
2016-17	2.12 (3.01)	5.36 (18.64)* {7.43}	2.87 (1.84)** {5.47}	-3.62 (-11.03)* {2.26}	8.98 (4.25)* {3.45}	0.97 [312.65]*	2.11	F=1.61 OR^2=5.45 SESS=1.39	F=24.56* χ^2=45.31*
2017-18	-4.19 (-2.17)**	4.76 (3.28)* {6.31}	5.13 (2.18)* {1.21}	2.43 (3.04)* {5.91}	-3.82 (-1.32) {1.07}	0.45 [5.81]*	1.88	F=3.15 OR^2=6.97 SESS=7.17	F=9.03* χ^2=18.06*
2018-19	-1.89 (-1.78)**	1.75 (2.56)* {3.89}	-0.69 (-0.26) {2.58}	1.22 (3.01)* {2.61}	-0.05 (-0.17) 1.04	0.29 [3.76]**	2.13	F=1.04 OR^2=2.43 SESS=3.64	F=3.62** χ^2=7.23**
2019-20	-3.45 (-2.67)**	8.41 (3.73)* {1.36}	0.84 (.188) {1.29}	-2.54 (-1.98)** {1.64}	2.03 (0.68) {1.04}	0.35 [4.26]*	2.14	F=1.22 OR^2=4.95 SESS=2.09	F=7.55* χ^2=15.11*

Notes: Same as those in Table 5

Table 7: Incremental Information Content- PairWise Regression of RI and EVA Components for IT Industry for the Period 2014 to 2020

$$Model\ 3\ R_{j=}\gamma_0 + \gamma_1 EVA + \gamma_2 \Delta EVA + \gamma_3 RI + \gamma_4 \Delta RI$$

Year	γ_0	γ_1	γ_2	γ_3	γ_4	Adj R^2	D-W test	Glejser test	Wald test: $\gamma_1 = \gamma_2 = 0$
Pooled	-1.98 (-1.79)**	1.87 (1.78)** {5.52}	5.11 (2.34)* {1.21}	-1.06 (-1.99)* {5.11}	0.84 (.57) {1.11}	0.34 [5.12]*	1.98	F=1.52 OR^2=2.28 SESS=2.47	F=9.67* χ^2=17.53*
2014-15	2.73 (2.38)**	21.78 (13.83)* {4.74}	18.22 (1.78)** {3.19}	-10.08 (-8.31)* {6.15}	19.61 (1.80)** {1.52}	0.92 [71.91]*	1.95	F=0.23 OR^2=1.91 SESS=0.58	F=96.17* χ^2=192.34*
2015-16	-1.21 (-2.93)*	9.07 (21.83)* {7.56}	8.39 (2.12)* {13.67}	4.43 (15.37)* {3.79}	-3.35 (-1.97)* {7.43}	0.99 [655.62]*	2.05	F=1.07 OR^2=5.05 SESS=7.51	F=320.38* χ^2=640.76*
2016-17	-2.02 (1.96)**	4.55 (7.84)* {8.86}	12.39 (4.51)* {6.47}	1.77 (3.27) {2.48}	-0.16 (-0.25) {1.22}	0.93 [125.35]*	2.03	F=0.93 OR^2=3.75 SESS=2.95	F=27.83* χ^2=49.47*
2017-18	-1.71 (-1.97)*	11.19 (5.81)* {9.18}	19.61 (-3.14)* {1.26}	6.44 (5.38)* {9.21}	-1.91 (-0.43) {1.36}	0.67 [13.76]*	1.78	F=3.87 OR^2=6.69 SESS=3.27	F=19.68* χ^2=39.36*
2018-19	-1.15 (-1.89)*	-2.53 (-3.01)* {11.22}	2.47 (1.98)** {3.36}	1.47 (1.97)* {23.37}	0.24 (0.37) {7.49}	0.35 [4.57]***	1.92	F=1.89 OR^2=18.61 SESS=16.15	F=6.11* χ^2=12.22*
2019-20	5.11 (1.81)**	22.06 (7.47)* {6.22}	-5.72 (-1.8)** {1.71}	-10.91 (-6.34)* {5.94}	15.95 (2.67)* {2.76}	0.76 [20.59]*	2.001	F=1.65 OR^2=6.98 SESS=6.09	F=32.16* χ^2=64.34*

Notes: Same as those in Table 5

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Does Prospect Theory Non-Linearity Explain Mental Accounting? A Study at COVID-19

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Abstract

In examining how investors in the stock markets make many decisions in their minds at once, this study has empirically explored the proposition of possible assimilation of the prospect theory (PT) and the theory of mental accounting (MA) at the use of investors' multiple decisions references. In such pursuit, it has examined the non-linearity property in the PT value function and accordingly it has applied the same at the presence of positive and negative effects for investors' multiple decision references at once. Nonetheless, in the empirical literature of behavioral finance, it has ingeniously used the empirical methodology of the non-linear auto-regressive distributive/ dynamic lag (NARDL) model with the use of three separate data sets covering the pre-COVID-19 period from August 2019 to February 2020, that during COVID-19 period from March 2020 to September 2020 and that covering both altogether, that is, from August 2019 to September 2020. The observed results are all promising to put forth the proposed PT/MA assimilation proposition across the sample stocks over the different sample-data periods as well. The study finally identifies the applicative values of the proposed PT/MA assimilation.

Keywords: *Prospect Theory*, *Non-linear Value Function, Mental Accounting, Assimilation of PT/MA, NARDL Model, Behavioral Finance.*

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Does Prospect Theory Non-Linearity Explain Mental Accounting? A Study at COVID-19

I. Introduction: At investment in stock markets, investors decide on the list of available stocks, their prices, historical return, risk, future growth prospects, etc. They feel love, greed, passion and hatred for them as well. They ponder upon - Will the stock be as loving in the future as it was in the past? They decide on their lucky days or months - When to buy or sell the stocks? Investors take all these decisions instantly. How do they make so many decisions at once?

Essentially, investors take many decisions in their minds – be it a case of buying or holding or selling a common good for day-to-day uses or at long-term financial investments or diversifying a portfolio, holding a losing stock or selling a gaining one, etc. In behavioral finance, these all are covered in Mental Accounting. It describes the policy of keeping accounts in the mind – what they record, classify and evaluate, how to do the same, and when to do as well, etc.? The people record, classify and evaluate available options psychologically. According to Thaler (1985; 1999), by applying mental accounting people psychologically record costs and benefits of different options for decision choices, identify them in separate accounts, categorize their choices from different decision frames, and evaluate them with their perceived gains and losses.

How do human minds operationalize so many decision issues simultaneously? In a simple package on decision guide, Thaler (1985) described this query with the framing effect of Tversky and Kahneman (1981), the theory of self-control of Thaler and Shefrin (1981) and the prospect theory of Kahneman and Tversky (1979). Given the budget constraints, people decide upon their mental accounts at their local situations rather than at global optimization while their perceived value functions define their gains and losses at references. Nonetheless, the value function is non-linear – concave at gains and convex at losses, and losses loom larger than equivalent gains. Thaler (1999) has showed that people decide on their choice brackets, violate the economic principle of fungibility and follow dynamic mental accounting where their mental accounts are evaluated frequently. That is, their mental accounts matter in decision choices like advance purchases, sunk costs, payment depreciation, payment decoupling, self-control and gift-giving, wealth accounting and income accounting and risky choices at given prior outcomes, etc.

In addressing the applicability of mental accounting to solve the equity premium puzzle in the stock markets, Thaler (1999) has argued that "… we need a combination of loss aversion and one-bet-at-a-time mental accounting" and hypothesized that investors show the prospect theory preferences as stipulated in the study of Tversky and Kahneman (1992) and they follow myopic loss aversion (Benartzi & Thaler, 1995). On such myopia, Thaler, Tversky, Kahneman and Schwartz (1997) (read with Thaler, 1999, p.200) have showed that investors are more (less) risk-averse – in the other words, less (more) risk-seeker, at positions in short (long)-horizon periods and prefer the bond (stock) markets for investments. But what role does the parameter "time" play in determining the investors' risk coefficients? Does time itself or its underlying uncertainty contribute "time" to become a risk factor?

The COVID-19 situation across the markets has paved an opportunity to explore the short-horizon impacts of time in aggravating impacts of myopic loss aversion. In examining it, this study seeks to explore the propositions of mental accounting theory with the reference to a few-months short window for COVID-19, the one-bet, and examine if non-linearity property i.e., loss-aversion in the prospect theory value function explains the mental accounting theory.

In organizing the flow, we firstly, review the literature on the exact problem statement briefly, then, we put forth the data and methodology of its empirical explorations, followed by that for the results and findings, and finally, the conclusion and policy implications.

II. Literature Review: At a presence of myopic loss-aversion and assimilation of prospect theory (PT) preferences with those of mental accounting (MA) ones, there are a few experimental studies, empirical studies and microstructure models. These studies put efforts to explain three standard finance puzzles viz., the equity premium puzzle, disposition effects and momentum effect.

On the pursuits of investors' loss-aversion and narrow framing, Barberis and Huang (2001) put forth two alternative MA platforms - individual stock-level accounting and portfolio-level accounting. They showed that at an individual (portfolio)-level, there is a high (moderate) presence of mean returns and volatilities along with a presence of less (high) correlated return series and that of predictable (unpredictable) risk-premiums over a cross-section of stocks. Their first two results are linked to the equity premium puzzle while the rest two have remained unaddressed. Barberis, Huang, and Santos (2001) also found support for the applicability of PT to the stock-level mental accounting. How do stocks' risk-premiums are predictable if their returns series are uncorrelated? What are the factors that contribute to such predictability? Resolving the rest two puzzles appears promising with the assimilation approach at hand.

Langer and Weber (2001) have experimentally showed that investors behave differently at exposure to overall evaluation from that to isolated evaluation. In the first one, they apply mental accounting in processing the non-linear pay-offs with the prospect theory value function and prefer portfolio choice to split it and in the second case, their myopic loss aversion makes individual stock's pay-offs more attractive and so splitting the portfolio into stocks. They have further argued that at exposure to overall (myopic) information, a long-horizon period is viewed at aggregation (isolation) of the series of separate decision frames over time. Investors' decision choices at overall (myopic) information exposure to the items in the income statements have serious implications on the decision choices of the management as well (Bonner, Clor-Proell & Koonce, 2014).

In addressing the puzzle of disposition effects, that is, selling the winner stocks but holding the loser ones, Lim (2006) has documented support for investors' myopic loss aversion effects in their mental accounting efforts and investors aggregate losses from the losing stocks on the same day but segregate gains from the winner stocks on different days. Shapira and Venezia (2001) have found disposition effects for both professional and individual investors in the Israeli stock market. In explaining the same with the PT preferences, Barberis and Xiong (2009) have revealed that an accrual-based accounting of the annual paper gains and losses over holding periods fails to explain the disposition effect while a realization-based accounting explains it.

On the persistency of the momentum effect, Grinblatt and Han (2005) have argued that over a time horizon, investors' price expectations at the forward and backward regions around a reference point – the point of inflection over the non-linear "*S* " shaped PT value function create a momentum of returns – a continued existence of spreads between the perceived fundamental value of a stock and its equilibrium price. They have showed that factors determining PT/MA assimilated lagged demand functions explain the stocks' aggregate returns. The framing of different regions around reference points in the non-linear value function can also be found justified in the "pull-to-center" effect in Gu and Zhang (2020) that refers to overorder (underorder) by the newsvendors at low (high)-profit situations irrespective of their optimal ordering quantities.

That is, at framing the decision issue in the process, PT links MA. Amongst the empirical studies, Barberis, Mukherjee, and Wang (2016) and Wen, Gong, Chao, and Chen (2014) have showed that investors make decision choices on the basis of their observations of the past profit (loss) while at times of their current loss (profit), investors demonstrate risk-seeking (risk-averse) attitudes. On evaluating risk and return, they do not always perceive that their high (low)-risk stocks will ensure the presence of high (low) returns (Mascareñas & Yan, 2017). Investors psychologically entangle (disentangle) loss-making (profit-making) stocks at losses (profits) across different stocks (Shams, Kordlouie, & Dezfuli, 2012). Amongst the recent studies, Tsai and Bui (2021) have explored such a proposition on the consumer's purchase intentions for the cruise travel products with the Word of Mouth (WOM) responses from the social media.

COVID-19 has made itself a reference point in investors' minds (Sinha & Agarwal, 2021). How do investors view gains and losses together in the stock markets and assimilate PT with MA? How do they frame assimilation in the presence of alternative references? The following section explores if PT and MA jointly can explain the stock markets dynamics from the pre-COVID and COVID viewpoints with the sample stocks in the pharmaceuticals industry those are also listed in the National Stock Exchange (NSE) in India.

Data and Methodology: At ontological reality, the present authors utilize the non-linear property in the PT value function along with the separate vis-à-vis overall accounting proposal in the MA. The PT value function as offered in Kahneman and Tversky (1979) is that of an *S*-shape, that is, it is concave (i.e., risk-averse) in the domain of gains and convex (i.e., risk-loving) in the domain of losses relative to a reference point. At decision choices, there are three prime effects: a certainty effect inferring investors' inclination to risk-neutral reference, a reflection effect for reflective adjustments as demanded by situations and an isolation effect suggesting some new dimension of decision choice. In certainty effect, nonetheless, investors are used to putting more weights on their sure prospects for the gains than those they weigh for the losses, and at the reflection effect, they tempt to show familiar (inverse) decision choice in similar (opposite) underpinnings of the decision scenarios. The isolation effect, an innovative aspect as offered in Kahneman and Tversky (1979), essentially suggests to proxy for investors' attitude to value that information which is somewhat unique but additive and different in its nature. The cumulative PT of Tversky and Kahneman (1992) specifies a two-part cubic or quadratic cumulative value function with different weighting functions for gains and losses. The weighing function shows the effects of investors' risk-averse (risk-seeking) towards their decision preferences for their feasible gains (losses) at the limits of its moderate or high probability. The MA helps in assimilating the decision issues at reference points.

***Sample and Data Period*:** The study covers a sample stock of 10 scripts those are already listed in the NSE (National Stock Exchange) in the pharmaceutical industry in India. The sample stocks have a track record of listing in the NSE for more than a period of five consecutive years. These stocks are representative to reflect the industry characteristics. These ten stock scripts are popularly known as the ALKE, ARBN, BION, CADI, CIPL, DIVI, LUPN, REDY, SUN and TORP. Their full names are respectively Alkem Laboratories Ltd., Aurobindo Pharma Ltd., Biocon Ltd., Cadila Healthcare Ltd., Cipla Ltd., Divis Laboratories Ltd., Lupin Ltd., Dr.Reddys Laboratories Ltd., Sun Pharmaceuticals Industries Ltd. and Torrent Pharmaceuticals Ltd.

The study covers the relevant full-length data for a period of fourteen months - from August 2019 to September 2020. This full-length data period is sub-divided into three data periods. The first data set covers the pre-COVID-19 period and it consists of seven months' data from August 2019 to February 2020. The second data set covers the COVID-19 data period where we deal with the period from March 2020 to September 2020. The third data set includes the both periods, that is, August 2019 to September 2020.

***Variables*:** On the relationship of stocks' returns with the different reference points, we use proxy measures for various independent variables. The sample stocks' daily return over the said periods is taken as the dependent variable. The ten-years Government bonds' yield data over the said periods is taken as the risk-free rate of return (R_f) and it depicts the PT certainty effect. The other daily time series variables - the gold return (*GR*), the USD-INR exchange rate return (*UI*), EURO-INR exchange rate return (*EI*) and NSE NIFTY index return (*NI*) during the same periods are taken as alternative references for market return variables. We have used www.investing.com to collect these data and each data set consists of 427 observations.

Regression Method: Since the theoretical proposition of the proposed PT/MT assimilation needs both long-run and short-run decision references, the representation of the nonlinear auto-regressive distributed lag (NARDL) model of (Shin, Yu, & Greenwood-Nimmo, 2014) is used to regress the stock's daily returns data with the independent variables. Essentially, before applying the NARDL methodology, the stationarity of each dataset is checked with the Augmented Dickey-Fuller (ADF) unit-root test and all the concerned daily return variables are found to be stationary at *I(0)*. To save space, the ADF unit-root test results are not reported in detail here but could be presented in the appendix on-demand from interested readers. The NARDL approach shows long-run and short-run effects of independent variables. It provides an error correction mechanism to understand the asymmetries in the long run and helps in understanding positive and negative fluctuations. The regression methodology is followed in the next sub-section.

Regression Model: If MA and PT are viewed jointly, the PT can help investors to frame reference points for their mental accounts in determining gains and losses and the MA can help to segregate those gains and losses into separate accounts and apply at decision issues. This study examines if investors in the stock market view the PT/MA perspectives.

Let us consider a long-run decision function R(·) in the equation *Eq-1*such that R_{it} is an *i*-th stock's return at time *t* is a dependent variable defined with the independent variables X_{it} for the

reference points. R_{ft}, the Govt. bond returns proxy for the risk-free return and it represents the certainty effect. EI_t, UI_t, GR_t and NI_t are the other market-returns reference points. The coefficients of these market returns will project their respective systematic risk factor being reflection effects and R_{ft-d}, R_{it-d}, and β_{it-d} being isolation effects respectively for past-memories of R_{it}, R_{ft} and β_{it} at their d time lags viz., r and s, explained latter. At such PT decision frame, it attracts dichotomy of risk averse and risk-seeking attitudes where investors psychologically examine the prospects at positive and negative values for decision inputs $X_{it}(p,n)$ with respect to certainty effect, reflection effects and isolation effects. Since a stock's past return R_{it-d} is already observed by the investors and kept in memory, R_{it-d} has its respective isolation effect at risk-seeking/risk-averse behavior, that is, $X_{it}()$. The proposed assimilation of PT/MA has the following functional form.

$$R_{it} = R\left(X: R_{ft}, \beta_{it}, UI_t, EI_t, GR_t, NI_t, R_{ft-d}, \beta_{it-d}, UI_{t-d}, EL_{t-d}, GR_{t-d}, PI_{t-d}, R_{it-d} \middle| X(n) < 0, X(p) > 0, X() = R_{it-d}\right) \dots (Eq-1)$$

In theorizing the said PT/MA assimilation, investors' decision choice is set forth in a joint function of reference points, reflection effect and isolation effect along with possible dichotomy effects in the unrestricted non-linear autoregressive distributed lag, NARDL model in the equation *Eq-2* where coefficient α_0 is the time invariant effect, and β_{is}-s and β_i-s represent the respective effects at gains and losses. The equation *Eq-4* represents the conditional long-run error correction form (ECF) of the equation *Eq-3* which is the conditional long-run form of the equation *Eq-2*. The coefficient η in *Eq-4* represents the long-run speed of adjustment and the variable Z_{it-1} is the lagged error correction term (ECT). The ECT shows the combine effect of all the long-run variables mentioned in second brackets in *Eq-3*.

$$R_{it} = C_0 + [\sum_{r=1}^{r}\sum_{t=1}^{n} C_{1r}\, R_{it-r} + \sum_{s=1}^{s}\sum_{i=1}^{+P,-P}\sum_{t=1}^{n} \beta_{is} X_{it-s} + \sum_{i=1}^{+P,-P}\sum_{t=1}^{n} \beta_i X_{it}] + \varepsilon_t \dots\dots\dots (Eq-2)$$

$$\Delta R_{it} = C_0 + [\sum_{r=1}^{r}\sum_{t=1}^{n} C_{jr}\, \Delta R_{it-r} + \sum_{s=1}^{s}\sum_{i=1}^{+P,-P}\sum_{t=1}^{n} \beta_{is} \Delta X_{it-s} + \sum_{r=1}^{r}\sum_{t=1}^{n} C_{kr}\, R_{it-r} + \sum_{s=0}^{s}\sum_{i=1}^{+P,-P}\sum_{t=1}^{n} \beta_{iq} X_{it-s}] + \xi_t \dots\dots\dots (Eq-3)$$

$$\Delta R_{it} = C_0 + [\sum_{r=1}^{r}\sum_{t=1}^{n} C_{jr}\, \Delta R_{it-r} + \sum_{s=1}^{s}\sum_{i=1}^{+P,-P}\sum_{t=1}^{n} \beta_{is} \Delta X_{it-s} + \eta Z_{t-1}] + \varphi_t \dots\dots\dots\dots (Eq-4)$$

Lag Selection: In using any auto-regressive model, appropriate lag selection serves a greater role in identifying the influences and their extents in terms of magnitudes of the variable coefficients. We have, therefore, examined the lengths of appropriate lag for the concerned variables in the respective regression models. In doing do, we apply the procedure of Variance Estimation with the relevant dependent variable viz., the stock's return variable and the set of independent variables under the different information criteria viz., AIC, SC, etc. However, we have used the AIC method for determining the optimum lag lengths (r) for its lagged-endogenous terms in the model. We have selected a default length of (s =) 4 lags for the independent variables but opted "automatic selection" in EViews 10 system.

Hypothesis: As mentioned in the proposed assimilation of PT/MA, we formulate the following null H_{01} and alternative H_{11} hypothesis.

H_{01}: The coefficients of positive effect and negative effect of the variables in the NARDL models show presence of the PT/MA effects at the non-linear value function.

H_{11}: The coefficients of positive effect and negative effect of the variables in the NARDL models show absence of the PT/MA effects at the non-linear value function.

Results & Findings: In this section, we report the results and findings in Table 1-3. These tables show coefficients in the Equation *Eq-2*, its regression summery statistics, the results on the BPG heteroskedasticity (HTBPG) tests, the BG serial correlation LM (BGSCLM) tests, the Jarque-Bera Histogram Normality (J-B Norm.) tests along with the F-bound F-test statistics for the conditional NARDL long-run model in *Eq-3*, and the coefficients of the speed of adjustments in the conditional error correction form (*ECF*) of the long-run NARDL model in *Eq-4*. Besides, the results on the persistency of the model specification are reported briefly for the Ramsey RESET Test and the both the CUSUM tests and CUSUM of Squares Test of the recursive residuals.

Pre-COVID-19 Observations: The results in Table 1 depict that coefficients of the independent risk-free rate of return variable at its positive and negative effects $R_{fit,p}$ and $R_{fit,n}$ are different at the current time and at the different time lags as well. Such difference in magnitudes of the coefficients between relevant positive and negative effects over the current time and time-lags can also be observed for coefficients of the variables suggesting for the reference market returns - NSE Nifty (NI_{tp}, NI_{tn}), gold returns ($GR_{t,p}$, $GR_{t,n}$), EURO-INR exchange rate return ($EI_{t,p}$, $EI_{t,n}$), USD-INR exchange rate return ($UI_{t,p}$, $UI_{t,n}$). The magnitudes of all explanatory variables are not reported in details here to save space. In brief, the magnitudes and their directions of effects are different across the sample stocks but these are consistent with the non-linear PT value function of the investors. The results also confirm the presence of stock-specific different weights for gains and losses across the references.

For example, the sample stocks viz., ALKE and BION have significant negative effect for NI_{it} variable while the rest sample stocks have different significant coefficients for their respective positive and negative effects. Besides, the effects of the gold market as a decision reference are observed for the sample stocks viz., ARBN, CADI and REDY only. Investors in the sample stocks viz., LUPN and TROP (CADI, CIPL and REDY) have used EURO-INR (USD-INR) exchange return i.e., *EI* (*UI*) as their decision references. The proportions of these negative and positive effects are not exactly equal to 2. In the other words, the weights for gains in the PT value functions is not strictly twice of that for losses. That is, investors demonstrate dynamic risk-seeking or risk-averseness to an equivalent loss and gain. Similar observations can be found for the positive and negative effects of NI_{it} at its time lags. These results are contrary to a static PT view in Kahneman and Tversky (1979) but consistent with Tversky and Kahneman (1992).

The summery statistics show that the models have explanatory powers ranging 17.13% (12.98%) and 58.75% (57.76%) in terms of R^2 (Adj. R^2). The DW statistics are mostly about 2.00 suggesting absence of residual auto-correlations and the BGSCLM confirms the same. Our HTBPG test finds presence of heteroskedasticity for six stocks except ALKE, ARBN, CIPL and SUN. Therefore, the predictive power of the NARDL models for those six stocks remains under

further cross-checks. The J-B normality test for the regression residuals suggests for presence of non-normal residual distribution as well. This limits real-life applicative value of the unrestricted NARDL model for appraisal of the investment proposals during the pre-COVID-19 periods. The relevant F-value of the F-Bound F-tests suggests that the conditional long-run form of the NARDL models (*Eq-3*) is methodologically stable where there is presence of long-run and short-run effects of the concerned variables across positive and negative regions. Besides the long-run form, the magnitudes of the speed of adjustments (η) in the ECF suggests that investors always seek for adjustments to their perceived long-run equilibrium. Their speeds of adjustments vary across the stocks from -0.72284 (in the case of REDY) to -0.91853 (in the case of SUN).

COVID-19 Observations: Table 2 demonstrates that the coefficients of variable R_{ft} at its positive and negative effects i.e., $R_{fit,p}$ and $R_{fit,n}$ also different at time t and at its time-lags. Such difference in magnitudes is also prevailed for returns of the respective reference market viz., the NSE Nifty return, the gold returns and the two variables proxying for the exchange-rate return.

Table 2 shows that the sample stocks have significant positive and negative effects for the *NI* variable at its current time and at one period time-lag while the coefficient is significant at two periods time-lag for CADI, LUPN and SUN. It also shows effects of the gold market as a decision reference for ALKE, ARBN and CIPL at current time and for ALKE at 1st and 2nd period lag. The investors in the sample stocks - ALKE, ARBN and CADI (ALKE, ARBN, CIPL, REDY and SUN) have used *EI* (*UI*) as their decision references at current time and at time-lags as well. These results suggest that amongst the sample stocks, investors have changed their decision frames and choice references during the COVID-19 periods. But, interestingly, the weights for gains in the stated PT value functions are not approaching to be double at losses than that for gains even at COVID-19 risk-frames. That is, investors' dynamic adjustments sustain at losses and gains.

The explanatory powers range within 41.35% (35.519%) and 79.65% (78.31%) in terms of the magnitudes of R^2 (Adj. R^2). The DW statistics mostly at about 2.00 suggest for absence of residual auto-correlations. The predictability of the model Eq-2 is confirmed by the observations of absence of serial correlation across the stocks except ALKE while the same is restricted with the presence of heteroskedasticity for the stocks except ARBN, BION and DIVI.

However, on applicability and predictive power of the respective NARDL model at *Eq-2* during COVID-19, the results demand further examination since the regression residuals across the stocks confirm non-normality of regression residuals. The statistics of the F-Bound F-tests confirm our handiness with the conditional long-run form of NARDL models in *Eq-3* and the same is methodologically sound at presence of long-run and short-run effects for decision issues. The speed of adjustments (η) in the ECF also confirms adjustments to investors' long-run equilibrium where the speeds of adjustments vary across the stocks from -0.54369 (at the sample stock TROP) to -0.8851 (at stock ARBN).

Pulled Observations: On the pulled data period, Table 3 also depicts that the coefficients of risk-free return R_{ft} at its positive and negative effects ($R_{fit,p}$ and $R_{fit,n}$) are different at time t and lags.

Such difference in magnitudes is also observed for the markets' returns references like the NSE Nifty return, gold return and the two exchange-rates' returns.

The table further shows that the sample stocks have positive and negative effects for the *NI* variable at current *t* time and one period lag as well while coefficients are significant at two periods lag for BION and LUPN. Besides, the effects of the gold market return are present for ARBN and TROP at *t* time and for TROP at 1st time-lag as well. The sample stocks viz., ALKE, ARBN, CADI and TROP have effects of the *EI* as investors' decision reference while the sample stocks of ARBN along with those scripts of BION, CADI, CIPL, REDY, SUN and TROP as well demonstrate effects at *t* time while CADI (ARBN and BION) shows the same at one (two) period lag. That is, investors consider the decision references even at an aggregate time-scale consideration and such framing of decision issue and the choice of market references become different. Therefore, in brief, the PT decision weights for the gains and losses follow a dynamic path of adjustment rather than achieving PT proportions only.

The summery statistics of Eq-2 for R^2 (Adj. R^2) values ranging within 23.01% (21.469%) and 72.52% (71.86%) and DW statistics mostly at 2.00 support for satisfactory observations about the model *Eq-2*. Besides, the presence of residual serial correlation for CADI and CIPL and that of heteroskedasticity for all stocks except BION definitely derogates the predictability of the model *Eq-2*. The respective magnitudes of the F-Bound F-test statistics ventilates the applicative value of the conditional LRF of NARDL models in *Eq-3.* That is, investors decide about a frame for two-front choices - short-run equilibrium and long-run equilibrium where they adjust towards the latter one at an adjustment speed from -0.56403 (at LUPN) to -0.85463 (at BION).

Stability Analysis: We perform the Ramsey RESET test for persistency of the unrestricted version of the NARDL model *Eq-2*. Here, we find that the magnitudes of the relevant t-test statistics and F-test statistics are insignificant at four instances out of ten sample stocks under considerations, and this suggests for a good model specification during the pre-COVID-19 data period. With the rest six cases, the Ramsey RESET test suggests for the use of an advance GARCH set-up with the data. The both CUSUM test of residuals and that of squared residuals mostly suggest for model stability with the data sets during the pre-COVID-19 time periods (please see Table 1). During the COVID-19 periods, in Table 2, the earlier status of stability with the sample stocks shows updates in terms of their magnitudes and level of significance as well. The CUSUM test of residuals shows coefficient stability for all sample stocks while the CUSUM test statistics of the squared residuals show stability for four cases. Besides, with the pull data set, in Table 3, the said update in terms of the Ramsey RESET test statics are further observed showing a presence of five stocks those are sufficiently specified in the NARDL models. The models are mostly stable at presence of positive and negative effects where investors track these effects at their market references.

Conclusion: Investors consider many decision references simultaneously. At decision making, they consider positive and negative effects of the decision issues for all available references. In determining the decision values, such assimilation of the PT aspects along with the MA aptitudes is not a rare phenomenon rather investors are well adapted in doing so. Perhaps, the upgradation of the human intellect over its long evolution across the time has contributed an enumerable mental capacity to process such complex and non-linear accounting in their minds. The present study has

originally contributed to the literature in this direction. It confirms feasibility of assimilation of the PT/MA empirically with a small sample of NSE listed stocks out of the Indian stock market at the references of COVID-19 phenomena – during the pre-COVID periods, the COVID periods and including the both. We substantiate the presence of the proposed assimilation in all the cases.

Essentially, the human adaptation comes across new information vis-à-vis noises at mental accounting and their evolutions carry the traces of such noises in the process. That is why, we find the mixed evidences for the models' persistency and stability along with their odds. Nonetheless, the presence of significant coefficients in the Ramsey RESET test suggests us to consider volatility clustering in the future studies and this could be explained by the momentum effects as mentioned in the theoretical development. The present study has remained its scope limited in explaining the aspects of PT/MA assimilations and avoided bringing in the momentum effects in explaining the observations here. Since the present study is limited within the NARDL model, it has avoided the said route theoretical argument. The future researchers can advance the same by augmenting the NARDL model within the GARCH framework.

This research has many applicative values to the investors, market practitioners, academics, researchers, and the government as well. For example, the investors may be got accustomed about their own PT/MA aspects and take decisions accordingly. Essentially, investors who have attention exposure to the exchange-rate fluctuations should have different portfolios from others who have attention exposure to the gold rate in the bullion market. At times of launching new or innovative products like E-Bikes, Solar-electricity panel, etc., the market practitioners can apply mixed tools for their product promotions, and thereby, can penetrate both on-sought and un-sought customers. The researchers and academics with the economics background are exposed differently from those with commerce backgrounds and persons in these camps have different underpinnings of viewing the ontology of the economic reality around us and collaborative researches can explore the reality at much more logically than that at separate exploration. Finally, the government agencies like the Reserve Bank of India (RBI) or the management of the nationals banks or insurances agencies can use the PT/MA tools for trapping the long-term and short-term investors in the primary as well as secondary capital markets, and thereby, maintaining a dynamic equilibrium in the markets.

Table 1: Results on the NARDL Model during the sample's data period of Pre-COVID-19

Regression Model	$R_{it} = C_0 + [\sum_{r=1}^{r}\sum_{t=1}^{n} C_{1r}\, R_{it-r} + \sum_{s=1}^{s}\sum_{i=1}^{P}\sum_{t=1}^{n} \beta_{is} X_{it-s} + \sum_{i=1}^{P}\sum_{t=1}^{n} \beta_i X_{it}] + \varepsilon_t$									
t	**ALKE**	**ARBN**	**BION**	**CADI**	**CIPL**	**DIVI**	**LUPN**	**REDY**	**SUN**	**TORP**
R_{it} (-1)	**0.126967**^^ (0.068985)	**0.193034*** (0.061235)	**0.153971**^^ (0.06841)	**0.141078**^^ (0.059709)	**0.253014**** (0.067984)	**0.112353**^^ (0.065294)	**0.170289**^ (0.06775)	**0.277156**** (0.062597)	**0.081469**^^ (0.047095)	**0.145208**^ (0.064916)
R_{it} (-2)	0.107073 (0.067759)									
R_{fit} p	**0.525535**** (0.154482)	-0.31701 (0.24629)	0.10307 (0.157765)	**-0.80342**** (0.183674)	-0.1114 (0.129145)	0.124715 (0.17186)	**-0.4066**** (0.100295)	**0.24625**^ (0.106859)	**-0.19999**^ (0.100839)	-0.06766 (0.142826)
R_{fit} n	**0.40962*** (0.140528)	0.186671 (0.227188)	0.18329 (0.155522)	**0.381184**^ (0.174921)	**0.33867*** (0.170984)	**0.30346**^ (0.121798)	**-0.3213**** (0.098463)	0.119215 (0.101689)	**-0.1766**^^ (0.100037)	-0.09437 (0.141015)
R_{fit} p (-1)				**0.966279**** (0.227181)		**0.303171**^^ (0.178393)				
R_{fit} n (-1)				**-0.75232**** (0.221059)	**-0.41264**^ (0.190159)					

R_{fit} p (-2)				**-0.35218^** (0.17082)						
R_{fit} n (-2)				**0.44715*** (0.173875)						
EI_t p							-0.11447 (0.255078)	0.284238 (0.360581)		**-1.20147*** (0.382433)
EI_t n							**0.638792^** (0.269724)	-0.20249 (0.319071)		-0.40263 (0.482817)
EI_t p (-1)							0.381541 (0.25203)	**-0.77852^** (0.3709)		
EI_t n (-1)							**-0.4559^^** (0.258662)			**-0.92511*** (0.359184)
GR_t p	0.16773 (0.110778)	**0.520949^^** (0.282212)		**0.248771*** (0.092534)		0.06174 (0.091196)		**-0.26447^** (0.105571)		
GR_t n	0.145938 (0.109746)	**-0.89344**** (0.269931)		0.127854 (0.090508)		0.111069 (0.093261)		-0.14337 (0.090728)		
GR_t p (-1)		**-0.46229^^** (0.276659)						0.171097 (0.116465)		
GR_t n (-1)		**0.668632^** (0.294379)								
NI_t p	0.091662 (0.098851)	**1.624749**** (0.204614)	0.282632 (0.181098)	**0.637168**** (0.084187)	**0.867343**** (0.134737)	**0.743018**** (0.123502)	**0.918566**** (0.111316)	**0.917764**** (0.102477)	**1.094026**** (0.075233)	**0.374707**** (0.099506)
NI_t n	**0.169977^^** (0.093323)	**2.123628**** (0.235649)	**0.825718**** (0.161569)	**0.645068**** (0.079585)	**0.665618**** (0.126395)	**0.498608**** (0.089199)	**0.821905**** (0.100328)	**0.574121**** (0.077388)	**1.079639**** (0.069031)	**0.380286**** (0.092526)
NI_t p (-1)			**0.330327^^** (0.182197)		**-0.42659*** (0.144516)	**-0.27806^** (0.133566)	**-0.31204^** (0.125386)	**-0.58756**** (0.144844)		
NI_t n (-1)		**-0.5868^** (0.285014)	-0.26706 (0.169752)		-0.21167 (0.133545)		**-0.23575^** (0.110806)			
NI_t p (-2)								0.152226 (0.105361)		
UI_t p	-0.30634 (0.299741)			**0.768601^** (0.35235)	-0.45151 (0.288463)			-0.43359 (0.425451)		**1.211479*** (0.453463)
UI_t n	-0.2567 (0.280828)			**-1.76231**** (0.411913)	0.11635 (0.371819)			0.405003 (0.382371)		**1.3785*** (0.484487)
UI_t p (-1)				**-0.96274*** (0.376511)				**1.038963^** (0.44988)		
UI_t n (-1)				**1.314235*** (0.385332)	**-0.68017^^** (0.394699)					
C	0.000435 (0.004897)	**-0.01328^^** (0.006835)	0.001401 (0.004393)	**-0.01983**** (0.004539)	**-0.01104^** (0.004578)	**-0.00785^** (0.003238)	**-0.00867^** (0.004202)	-0.00436 (0.004413)	**-0.01564**** (0.002701)	-0.00493 (0.006027)
R^2 (Aj. R^2)	0.171321 (0.129887)	0.459058 (0.432011)	0.192022 (0.164161)	0.448131 (0.405461)	0.432807 (0.401455)	0.30052 (0.2692)	0.532266 (0.506411)	0.534629 (0.496049)	0.587571 (0.57756)	0.208576 (0.169005)
Reg. F-stat	**4.1348****	**16.97252****	**6.892069****	**10.50219****	**13.80462****	**9.595161****	**20.58686****	**13.85769****	**58.69589****	**5.270919****
DW Statistics	1.99827	1.944132	2.017242	2.009558	2.048446	1.961212	2.062071	1.97702	1.842227	1.955076
HTBPG F-stat	**1.774514^^**	**2.241752^**	1.598425	1.44385	**2.796182***	1.312168	1.135675	0.892443	**1.969164^^**	1.336408
BGSCLM F-stat	0.003886	0.571977	0.724399	0.177658	1.337295	0.423068	1.49589	0.039993	2.413486	0.630021
JB Norm (Prob.)	**8.58^**	**577.18****	**17.92****	**5.38^^**	**10.85****	**582.50****	**84.23****	**17.55****	**76.99****	**12.30***
F-value of F-Bound Test	8.303783 (2.62)	22.86427 (3.17)	25.84635 (3.60)	23.05367 (2.62)	15.57854 (3.17)	24.98563 (3.17)	19.67993 (3.17)	12.37576 (2.41)	85.21276 (3.60)	18.56299 (2.62)
η	**-0.76596**** (0.08223)	**-0.806966**** (0.05865)	**-0.846029**** (0.067116)	**-0.85892**** (0.055301)	**-0.74698**** (0.065765)	**-0.88765**** (0.061719)	**-0.82971**** (0.064992)	**-0.72284**** (0.057694)	**-0.91853**** (0.040138)	**-0.85479**** (0.061373)
Ramsey RESET: t-stat (F-Stat)	**3.909**** **(15.285)****	**2.908 *** **(8.4601)***	1.1188 (1.25187)	**2.061 ^** **(4.2459) ^**	0.0261 (0.00068)	**1.69123*** **(2.8604) ***	0.445578 (0.20773)	**1.7399^^** **(3.02759)^^**	1.05013 (1.102768)	**1.7637 ^^** **(3.111) ^^**
CUSUM Test of Residual Stability	**Stability ^**	**Stability ^**	**Stability ^**	**Stability ^**	**Stability ^**	**Stability ^**	**Stability ^**	**Stability ^**	**Stability ^**	**Stability ^**
CUSUM Test for Squared Residual	**Marginally Stable ^**	**Unstable ^**	**Marginally Stable ^**	**Stable ^**	**Marginally Stable ^**	**Marginally Stable ^**	**Stable ^**	**Stable ^**	**Marginally Stable ^**	**Stable ^**
** 0.1 % significance level; * 1% significance level; ^ 5% significance level; ^^ 10% significance level.										

Table 2: Results on the NARDL Model during the sample's data period of COVID-19

T	ALKE	ARBN	BION	CADI	CIPL	DIVI	LUPN	REDY	SUN	TORP

R_{it} (-1)	**0.286618**** (0.065551)	**0.292444**** (0.071529)	**0.19545*** (0.069288)	**0.480202**** (0.065595)	**0.356021**** (0.067873)	**0.340712**** (0.066615)	**0.527803**** (0.066439)	**0.410964**** (0.065418)	**0.231021**** (0.067945)	**0.456301**** (0.062905)
R_{it} (-2)	**-0.09891^^** (0.06072)	**0.141568*** (0.046915)	**0.155526*** (0.05899)	-0.01019 (0.05881)		**0.075877^^** (0.041045)	-0.03246 (0.063317)	**-0.07989^^** (0.046968)		
R_{it} (-3)		-0.02259 (0.048648)	**-0.09987^** (0.047882)	-0.01566 (0.049095)			-0.06736 (0.052447)	**-0.08957^** (0.04395)		
R_{it} (-4)		**-0.08889^^** (0.048152)	**-0.10031^** (0.04742)	**-0.12561*** (0.045923)			0.01431 (0.052675)			
R_{it} (-5)		**-0.09531^** (0.046415)					0.067845 (0.052132)			
R_{it} (-6)		-0.01225 (0.046971)					0.069144 (0.0518)			
R_{it} (-7)		0.044704 (0.046037)					**-0.19926**** (0.047296)			
R_{it} (-8)		**-0.14476*** (0.047705)								
R_{fit} p	-0.1363 (0.172703)	0.035578 (0.217484)	**-0.2058^^** (0.125647)	**-0.22707^^** (0.137892)	0.063553 (0.147239)	-0.00984 (0.108426)	**0.633313*** (0.199436)	**-0.42281**** (0.121348)	0.010032 (0.131253)	0.239757 (0.192167)
R_{fit} n	**-0.27795^^** (0.17161)	0.09761 (0.200766)	-0.13356 (0.124577)	**-0.40358*** (0.13648)	**0.455353^** (0.184085)	-0.06965 (0.107673)	**0.384391^** (0.169585)	**-0.50355**** (0.120778)	**0.323953*** (0.114069)	-0.24025 (0.155934)
R_{fit} p (-1)							**-0.37495^^** (0.207888)		**0.420494*** (0.160568)	**-0.43867^** (0.19912)
R_{fit} n (-1)					**-0.39035^** (0.198936)					
R_{fit} p (-2)									-0.19717 (0.126296)	
EI_t p	**2.013899**** (0.540448)	-0.09008 (0.623469)		0.501929 (0.332563)	-0.3661 (0.274914)					
EI_t n	-0.42336 (0.399339)	**1.468299**** (0.43994)		**-0.41868^^** (0.250263)	-0.19307 (0.258318)					
EI_t p (-1)	**-1.34028*** (0.506233)	**1.746639*** (0.6337)		-0.17595 (0.40901)						
EI_t n (-1)	**0.735426^^** (0.38013)									
EI_t p (-2)				**-0.9224*** (0.315591)						
GR_t p	**-0.63797**** (0.175479)	**-0.55964**** (0.153816)			0.120345 (0.093292)					
GR_t n	**0.345353^^** (0.188279)	**-0.39265*** (0.140335)			**0.156826^^** (0.092809)					
GR_t p (-1)	**0.648959*** (0.2042)									
GR_t n (-1)	**-0.98388**** (0.206106)									
GR_t n (-2)	**0.619571**** (0.16315)									
NR_t p	**0.500728**** (0.091051)	**1.42456**** (0.133086)	**0.918854**** (0.086773)	**1.136596**** (0.096321)	**1.116332**** (0.087399)	**1.014092**** (0.071907)	**0.948132**** (0.099756)	**1.011473**** (0.078853)	**1.02203**** (0.066593)	**0.742792**** (0.094066)
NR_t n	**0.361447**** (0.113545)	**1.336629**** (0.131309)	**0.809477**** (0.079171)	**1.070872**** (0.091521)	**1.217656**** (0.08722)	**0.966035**** (0.068276)	**1.017411**** (0.094991)	**0.899877**** (0.078239)	**0.999972**** (0.064823)	**0.825741**** (0.091391)
NR_t p (-1)		**-0.6596**** (0.172015)	-0.11293 (0.128429)	**-0.41278**** (0.118936)	**-0.24993^** (0.116167)	**-0.37869**** (0.090395)	**-0.57347**** (0.135918)	**-0.40235**** (0.083729)	**-0.23565^** (0.102623)	**-0.24702^** (0.097563)
NR_t n (-1)	**0.221078^^** (0.127669)	**-0.67669**** (0.157059)	**-0.26173^** (0.110405)	-0.13695 (0.152329)	**-0.42991**** (0.118761)	**-0.30532*** (0.100766)	**-0.46588**** (0.123919)	**-0.30035*** (0.111082)	**-0.31643*** (0.100625)	**-0.31493*** (0.114865)
NR_t p (-2)			**-0.22619^** (0.094865)				**0.250039^** (0.107598)		**-0.1209^** (0.058489)	
NR_t n (-2)				-0.18354 (0.126567)						
UI_t p	-0.75193 (0.637922)	0.725982 (0.815908)			**1.443309*** (0.52126)		-0.38331 (0.354395)	**1.011292*** (0.353155)	**-1.1665**** (0.310913)	
UI_t n	**0.895874^^** (0.485208)	**-2.26777**** (0.690405)			**-0.20579^^** (0.460424)		-0.30487 (0.343287)	**1.17428**** (0.296508)	-0.39458 (0.306001)	

UI_t p (-1)	**1.198614^** (0.610048)	**-1.92539*** (0.713092)			**-0.72148^^** (0.38942)			**-0.85002^** (0.426695)		
UI_t n (-1)		1.041872 (0.711443)			**0.915871** (0.478378)				**-0.97437** (0.392112)	
UI_t p (-2)								**0.845861*** (0.324392)		
C	-0.01647 (0.01182)	-0.015 (0.014911)	**-0.02416**** (0.005365)	**-0.03237**** (0.007189)	**-0.03125**** (0.008369)	**-0.02719**** (0.004927)	**-0.02516**** (0.007256)	**-0.01182^** (0.006016)	**-0.03346**** (0.005501)	**-0.02369**** (0.006262)
R^2 (Aj. R^2)	0.413532 (0.355192)	0.686928 (0.647364)	0.607918 (0.586136)	0.697843 (0.674481)	0.764177 (0.744827)	0.687383 (0.675063)	0.721802 (0.696779)	0.689205 (0.668696)	0.796538 (0.783112)	0.535674 (0.517376)
Reg. F-stat (Prob.)	**7.088328****	**17.36243****	**27.90879****	**29.87009****	**39.49315****	**55.79449****	**28.84544****	**33.60448****	**59.32628****	**29.27412****
D.W. Statistics	2.102031	2.012967	2.020335	1.967641	2.044952	2.029483	2.068006	2.055491	1.986054	2.041241
HTBPG F-stat	**3.624936****	1.065606	1.478768	**4.757244****	**5.512248****	1.233973	**5.474794**	**6.969406****	**2.7257****	**4.043288****
BGSCLM F-stat	**3.383202^^**	0.079207	0.818646	0.00027	0.648444	0.585407	1.007062	0.753256	0.016555	0.661815
JB Norm (Prob.)	**73.14266****	**1321.714****	**124.0567****	**307.6893****	**90.30246****	**19.40260****	**44.55451****	**14.56127****	**16.0224****	**21.03362****
F-value of F-Bound Test (sign.)	10.34985 (2.41)	7.34356 (2.41)	14.99924 (3.60)	11.45586 (3.17)	8.88376 (2.41)	13.16218 (3.60)	7.6026 (3.17)	13.82075 (3.17)	16.66669 (3.17)	13.31173 (3.60)
η	**-0.8123**** (0.070876)	**-0.8851**** (0.091558)	**-0.8492**** (0.088407)	**-0.67125**** (0.068886)	**-0.64398**** (0.06068)	**-0.58341**** (0.064856)	**-0.61998**** (0.078065)	**-0.75849**** (0.070886)	**-0.76898**** (0.065443)	**-0.54369**** (0.060101)
Ramsey RESET Test	**2.05747 ^ (4.23319)^**	0.930214 (0.86299)	0.027252 (0.000743)	**4.41328 ** (19.477) ****	**3.6589** (13.388)****	0.16199 (0.26241)	**2.05054^ (4.2047)^**	**6.8804 ** (47.3345)****	0.21461 (0.046057)	**2.8618 * (8.18985)***
CUSUM Test of Residual **Stability**	**Stability ^**	**Stability ^**	**Stability ^**	**Stability ^**	**Stability ^**	**Stability ^**	**Stability ^**	**Stability ^**	**Stability ^**	**Stability ^**
CUSUM Test for Squared Residual	**Marginal Stability ^**	**Unstable ^**	**Marginal Stability ^**	**Marginal Stability ^**	**Unstable ^**	**Stability ^**	**Marginal Stability ^**	**Marginal Stability ^**	**Stability ^**	**Unstable ^**

** 0.1 % significance level; * 1% significance level; ^ 5% significance level; ^^ 10% significance level.

Table 3: Results on the NARDL Model with the full-length sample data period

Variables / Parameters	ALKE	ARBN	BION	CADI	CIPL	DIVI	LUPN	REDY	SUN	TORP
R_{it} (-1)	**0.235959**** (0.045995)	**0.269672**** (0.047558)	**0.18236**** (0.048872)	**0.368514**** (0.047982)	**0.378617**** (0.046134)	**0.291426**** (0.04683)	**0.514183**** (0.048391)	**0.434593**** (0.046452)	**0.282307**** (0.046937).	**0.358901**** (0.046125)
R_{it} (-2)		**0.0771^** (0.035693)	**0.136924*** (0.045151)	-0.0278 (0.03822)			-0.00065 (0.051311)	-0.04179 (0.036114)		
R_{it} (-3)			**-0.0744^^** (0.038969)	-0.02779 (0.03921)			-0.04832 (0.038166)	**-0.07434^** (0.033781)		
R_{it} (-4)			**-0.09944*** (0.038434)	**-0.12064**** (0.036263)			-0.01315 (0.038337)			
R_{it} (-5)							**0.064084^^** (0.03815)			
R_{it} (-6)							**0.068271^^** (0.037947)			
R_{it} (-7)							**-0.14844**** (0.03461)			
R_{fit} p	0.118538 (0.108684)	-0.00332 (0.147838)	-0.01547 (0.098554)	**-0.15937*** (0.093831)	0.016971 (0.097116)	0.102336 (0.078225)	**0.33192*** (0.12902)	**-0.20511** (0.076638)	-0.08142 (0.099985)	0.158272 (0.142267)
R_{fit} n	0.095618 (0.106895)	-0.12947 (0.143158)	-0.02399 (0.095718)	**-0.14924^^** (0.091908)	**0.384512*** (0.125442)	0.077228 (0.076555)	0.13537 (0.096875)	**-0.18974^** (0.075012)	0.102105 (0.076019)	-0.1478 (0.107851)
R_{fit} p (-1)							**-0.22136^^** (0.132355)		**0.19057^^** (0.102656)	**-0.27291^^** (0.145646)
R_{fit} n (-1)					**-0.34742^** (0.139668)					
EI_t p	**0.707127*** (0.261147)	-0.53798 (0.490455)		**0.62517^** (0.316147)						**-0.40038^^** (0.232393)
EI_t n	0.218116 (0.192833)	**0.974457*** (0.341409)		**-0.53682^** (0.21603)						**-0.48167^** (0.223155)
EI_t p (-1)	0.158571 (0.328983)	0.157056 (0.601502)		-0.47778 (0.352229)						
EI_t p (-2)	**-0.60416^** (0.249139)	**1.051933^** (0.461554)		**-0.69546*** (0.223267)						

GR_t p		**-0.25732**^ (0.107022)	0.082298 (0.072908)							0.083938 (0.084414)
GR_t n		**-0.24963**^ (0.108463)	0.090114 (0.073877)							**0.245002**^ (0.102114)
GR_t n (-1)										**-0.15952**^ (0.113261)
NR_t p	**0.31938**** (0.077017)	**1.52359**** (0.114091)	**0.804482**** (0.076123)	**0.97499**** (0.073617)	**1.102319**** (0.067399)	**0.911891**** (0.058457)	**0.918403**** (0.071135)	**0.915575**** (0.057581)	**1.082861**** (0.053041)	**0.637924**** (0.077848)
NR_t n	**0.480281**** (0.061128)	**1.492466**** (0.109377)	**0.801402**** (0.074458)	**0.899033**** (0.074268)	**1.065019**** (0.065467)	**0.883077**** (0.057118)	**0.973052**** (0.067959)	**0.835744**** (0.057216)	**1.052258**** (0.053323)	**0.720956**** (0.077126)
NR_t p (-1)	**0.133298**^^ (0.081922)	**-0.53003**** (0.133285)	0.017883 (0.106938)	**-0.23966*** (0.077981)	**-0.37826**** (0.082659)	**-0.31726**** (0.069618)	**-0.46831**** (0.102872)	**-0.3752**** (0.061591)	**-0.33786**** (0.072027)	**-0.16421**^ (0.078536)
NR_t n (-1)		**-0.55816**** (0.129667)	**-0.28774*** (0.090738)	-0.14613 (0.093713)	**-0.34188**** (0.084135)	**-0.27539**** (0.07279)	**-0.51859**** (0.103744)	**-0.29883**** (0.074759)	**-0.30134**** (0.074919)	-0.22343 (0.087113)
NR_t p (-2)			**-0.29153**** (0.083478)				**0.142469**^^ (0.080319)			
NR_t n (-2)							0.125556 (0.08497)			
UI_t p		0.595939 (0.615384)	-0.32762 (0.281457)	-0.26342 (0.393385)	**0.420699**^^ (0.246275)			**0.573602**** (0.178446)	**-0.44104*** (0.166308)	**0.580019**^^ (0.313674)
UI_t n		**-1.44584*** (0.468879)	-0.21747 (0.314361)	**0.570435**^^ (0.307299)	-0.17185 (0.275766)			**0.556267**** (0.165245)	**-0.44939*** (0.153494)	**0.647705**^ (0.297881)
UI_t p (-1)		-0.4362 (0.7357)		**0.932956**^ (0.392295)						
UI_t n (-1)			**0.699288**^^ (0.403572)		-0.01609 (0.344563)					
UI_t p (-2)		**-1.67447*** (0.565823)								
UI_t n (-2)			**-0.74368**^ (0.311348)		0.568919 (0.25724)					
C	-0.00797 (0.005663)	-0.00128 (0.007806)	-0.00012 (0.00537)	**-0.01792**** (0.005311)	**-0.0114**^ (0.004552)	**-0.00875**** (0.002699)	-0.00479 (0.003305)	**-0.00795**^ (0.003746)	**-0.01104*** (0.003489)	**-0.01152**^ (0.005294)
R^2 (Aj. R^2)	0.230111 (0.211469)	0.546551 (0.526397)	0.474068 (0.451992)	0.585893 (0.568511)	0.685449 (0.676265)	0.567294 (0.56003)	0.663585 (0.650228)	0.616781 (0.60655)	0.725223 (0.718586)	0.425295 (0.404218)
Reg. F-stat (Prob.)	**12.34407****	**27.11965****	**21.47418****	**33.70638****	**74.63545****	**78.1004****	**49.68271****	**60.28223****	**109.2678****	**20.17795****
DW Statistics	2.021	2.009	2.013	2.05581	2.074223	2.022879	1.953503	2.015862	2.031004	2.012514
HTBPG F-stat	**3.434603****	**1.764482**^	1.25714	**8.419635****	**9.578595****	**3.07254***	**8.258328****	**14.31842****	**5.856832****	**3.325582****
BGSCLM F-stat	0.305574	0.07662	0.795008	**3.618635**^^	**3.679067**^^	0.631979	0.221208	0.312804	1.167386	0.245472
JB Norm (Prob.)	**371.0537****	**1544.076****	**116.3390****	**720.1504****	**209.7161****	**175.9312****	**428.2380****	**101.6336****	**86.69870****	**82.80607****
F-value of F-Bound Test (sign.)	38.02392 (3.17)	14.66499 (2.41)	15.63758 (2.62)	21.24846 (2.62)	24.28638 (3.17)	38.40325 (3.60)	15.02925 (3.60)	22.20015 (3.17)	29.55806 (3.17)	16.82458 (2.41)
η	**-0.7641**** (0.043440)	**-0.6532**** (0.048586)	**-0.85463**** (0.067596)	**-0.80772**** (0.054805)	**-0.62138**** (0.044204)	**-0.70857**** (0.046402)	**-0.56403**** (0.05903)	**-0.68153**** (0.050712)	**-0.71769**** (0.046282)	**-0.6411**** (0.044525)
Ramsey RESET Test	0.8244 (0.67964)	0.819028 (0.670807)	0.636904 (0.405647)	**6.2609 ** (39.199) ****	**4.88173 ** (23.8313)****	0.58129 (0.33790)	**3.9940 ** (15.9521)****	**7.05124 ** (49.7199)****	0.698817 (0.488345)	**4.03649 ** (16.2932)****
CUSUM Test of Residual **Stability**	**Stability** ^	**Stability** ^	**Stability** ^	**Stability** ^	**Stability** ^	**Stability** ^	**Stability** ^	**Stability** ^	**Stability** ^	**Stability** ^
CUSUM Test for Squared Residual	**Unstable** ^	**Marginal Stability** ^	**Stability** ^	**Unstable** ^	**Marginal Stability** ^	**Stability** ^	**Unstable** ^	**Unstable** ^	**Marginal Stability** ^	**Marginally Unstable** ^
** 0.1 % significance level; * 1% significance level; ^ 5% significance level; ^^ 10% significance level.										

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Comparison between Virtual and Traditional Modes of Teaching: A Case Study on Students of Higher Education during the Pandemic Period

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Most of us must have read the story of Aruni. There we have seen the traditional methods of teaching that were famous in ancient India. India has the tradition of the Gurukul system of education in which the sishya or the students resided with the Guru or Guru's clan and the central emphasis was on communicating knowledge to the students in usual surroundings. It was more predominant in the Vedic period where pupils were trained on several subjects and were also taught how to live a cultured and self-controlled life. Transforming the Vedic period's Gurukul system of learning into the brick and mortar classrooms led to the chalk and talk method of teaching. The classroom teaching method inculcated among the pupils conflict resolving skills, communication and listening power, and team spirit development along with the peers. Thus, the classroom method of teaching prospered for decades and helped mankind in their personality development, career building, developed social skills, and promoted shared wisdom.
The contagion effect of COVID 19 has locked down the classrooms and has popularized a new technique of learning i.e., the virtual or online education system. But the question is that can the brick and mortar classrooms be replaced with the virtual classroom in which the teacher remains behind the computer screen and can it be better than the traditional teaching system?
For this, we have conducted a study selecting a sample of students from both PG and UG levels of the University of Burdwan. In surveying them through the questionnaire method, we have categorized their responses on an ordinal scale and to find the variation between virtual and traditional modes of teaching, Kruskal Wallis Test has been applied in the present study to draw the conclusion of the study.

Introduction

Most of us must have read the story of Aruni. There we have seen the traditional methods of teaching that were famous in ancient India. India has the tradition of the Gurukul system of education in which the sishya of the students resided with the Guru or Guru's clan and the central emphasis was on communicating knowledge to the students in usual surroundings. It was more predominant in the Vedic period where pupils were trained on several subjects and were also taught how to live a cultured and self-controlled life. Transforming the Vedic period's Gurukul system of learning into the brick and mortar classrooms led to the chalk and talk method of teaching. The

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The contagion effect of COVID 19 has locked down the classrooms and has popularized a new technique of learning i.e., the virtual or online education system. But the question is that can the brick and mortar classrooms be replaced with the virtual classroom in which the teacher remains behind the computer screen and can it be better than the traditional teaching system? For this, we have conducted a comparative study on virtual and traditional modes of teaching by selecting a sample of students from both PG and UG levels of the University of Burdwan.

Literature Review

Black(2002)has studied the course design and delivery factors that affect students' learning in the traditional classroom courses as well as online classes or in the blended mode of learning. The author concludes that the use of blended mode may deliver an ideal "mix" for students' education.

Suanpang*et. al.*(2004) have compared traditional classroom teaching as well as online teaching for two groups of students. The results of the study show that there are significant differences in attitudes towards traditional classroom teaching and online teaching.

Hameed*et.al.* (2008) have highlighted the blended learning environment which can be used effectively by the teachers, students, and alike. According to the authors, a blended learning environment provides an effective E-Learning approach to the students.

Emerson*et.al.*(2011) have compared traditional classroom-based learning and online learning in relation to students. The results of the study show that pupils who sat for the examination in off-line mode performed better than those who sat for the examination in online mode. However, the authors do not provide any explanation for their results.

Golchai*et.al.*(2012) have undertaken a study with the help of a clinical trial method among the pupils studying at Guilan Medical Sciences University. The authors have divided the students into intervention group and control group. The traditional lecture-based education system in histology course is being followed by the control group intervention group follows the e-learning lecturing method. The authors conclude that the marks of histology of pupils using the learning lecturing method are significantly more than pupils using the traditional learning method.

Mosalanejad*et.al.* (2012) have tried to find the efficiency of online systems for the first-year nursing pupils. The theory and practical contents are trained in one group by traditional method and in another by interactive online mode. Paired t-test and independent sample t-test are applied by the authors. The study shows that the average score in the online teaching group is more than traditional teaching group; however, the authors did not find any significant results in the objective structured clinical examination.

Dimitrios*et.al.* (2013) have tried to find the different views and research findings on the important issue of education in accounting internationally. According to the authors, students mainly desire personalized teacher-centered methods along with the contemporary teaching approaches which integrate ICT on the idea that the latter would be much more effective for the students.

Belias*et. al*(2013) have proposed an alternative web-based method for the coaching of accounting in place of traditional teaching. According to the authors, the online teaching method along with the traditional method of teaching in accounting will help pupils.

Ni (2013) has provided the proof that student performance as measured by grade is not dependent on the method of teaching namely online or offline. The author opines that the online education system is much more challenging in practical classes than that in other theoretical classes.

Moro *et.al.* (2017) have compared the performance of examination between two virtual reality headsets and also examined perceptions of pupils in this respect. The study concludes that the mobile-based VR is more appropriate for education than the desktop-based VR. According to the authors. the use of mobile-based virtual reality devices is very effective in medical education.

Habibzadeh*et.al.* (2019) have compared offline and online instruction methods for nursing students. The findings of this quasi-experimental study indicate that both offline and online instruction methods have augmented students' knowledge but the offline education method had a larger influence on them. However, according to the authors, the study shows that both groups have no significant difference in the level of knowledge in the pre-intervention stage.

Spencer *et.al.*(2019) have conducted a study comparing role-play with mixed-reality simulation in preservice courses. The findings of the study show that respondents find mixed-reality sessions significantly more realistic when it is compared with role-play participants. The study also indicates that respondents realize the better value of coteaching associates in the simulated atmosphere.

Soltanimehr*et. al.* (2019) have compared the effect of online and offline modes of education for dental students. The study concludes that the online mode of teaching is superior to an offline lecture-based method for the improvement of their knowledge in the radiographic interpretation of bony lesions of the jaw.

Banafshi*et.al.* (2020) have examined the two different styles of education namely, offline and online. The authors have used the Shapiro-Wilk test, Q-Q plot, Wilcoxon test, and Mann-Whitney U test in order to examine the research problem. The study demonstrates that the participants' interaction during the offline teaching-learning method is more than in the online mode. Demitriadou *et. al.* (2020) have investigated the impact of online teaching on primary school children. The authors divide the school students into one control group and two experimental groups. The first and second experimental groups use the online mode while students from the control group use the traditional offline mode as part of the learning process. The results indicate that the implementation of a new online mode of teaching increases interest in mathematics education as compared to traditional teaching methods.

Morice*et. al.*(2020) have compared online and offline modes of teaching with respect to students' knowledge and satisfaction. According to the authors, there is no difference between the online and offline modes of teaching, and online teaching may be applied along with offline teaching.

Boscolo-Berto*et. al.* (2021) have examined whether the online mode of dissection can add value to the offline teaching method. According to the CONSORT guidelines, second-year medical students are chosen randomly by the authors to study anatomical structures with the help of online dissection (intervention) or textbooks (controls). The study concludes that the combination of the online and offline modes of teaching results in a significant enhancement of second-year medical pupils' learning results.

Lynch*et. al.*. (2021) have examined the perceptions of the usefulness of online and offline observation in physical education for teachers. The study concludes that offline comments are favored over online and online opinion is a feasible alternative when technological challenges are properly considered .

Bączek*et. al.* (2021) have undertaken a study to examine the perception of offline learning and online learning among medical scholars. The study shows that there is no statistical difference between offline and online learning and the authors opine that online teaching method is considered less effective than offline learning.

Usman *et. al.* (2021) have reviewed the effectiveness between online lab and offline lab as a medium of distance learning. The findings of the study show that the use of online lab media has the same or even better effectiveness than traditional offline labs.

Objective

The objective of the present study is to identify whether the variation in the perception level of virtual and traditional modes of teaching exists among students of urban and rural areas during the pandemic period.

Database and Methodology

Data have been collected by circulating questionnaires in Google form among 200students from both PG and UG levels of the University of Burdwan. Keeping in view the problem of the study, the convenience sampling method of choosing students has been adopted to select respondents during the pandemic period. However, we have considered only those students in our sample who have either desktop or laptop or smart phone and used to attend their classes physically regularly. To examine whether the variation in the perception level of virtual and traditional modes of teaching exists among students of urban and rural areas during the post-covid period, Kruskal Wallis Test has been applied in the present study.

Hypotheses

1. Ho: There exists no significant variation between urban and rural pupils with regard to the effectiveness of the traditional mode of teaching
2. Ho: There exists no significant variation between urban and rural pupils with regard to the effectiveness of the virtual mode of teaching
3. Ho: There exists no significant variation between urban and rural pupils with regard to internet connectivity while learning through virtual mode.
4. Ho: There exists no significant variation between urban and rural pupils with regard to the infrastructure of gadgets while learning through virtual mode.

Analysis and Interpretation

From Table 1, it is observed that there exists no significant variation between urban and rural pupils with regard to the effectiveness of the traditional mode of teaching as the chi-square is insignificant. It implies that both groups of students opine about the effectiveness of the traditional mode of teaching in their teaching-learning process. The null hypothesis that there exists no significant variation between urban and rural pupils with regard to the effectiveness of the virtual mode of teaching is rejected as the value of the Kruskal Wallis Test is significant at 1% level (Chi-square = 13.654). There is significant variation between urban students and rural students in respect of internet connectivity while learning through virtual models the value of chi-square is 8.976 which is significant at a 5% level. There is also significant variation between urban students and rural students in respect of infrastructure of gadgets while learning through virtual mode as the value of chi-square is significant at 1% level.

Table 1: Results of Kruskal Wallis Test

	Type	Mean Score	Kruskal Wallis Test
Traditional mode of teaching	Urban students(90)	119.21	Chi-square = 1.765
	Rural students (110)	118.74	
Virtual mode of teaching	Urban students (90)	117.45	Chi-square = 13.654***
	Rural students (110)	83.67	
Internet connectivity	Urban students (90)	90.34	Chi-square = 8.976**
	Rural students (110)	115.54	
Infrastructure of gadgets	Urban students (90)	89.67	Chi-square = 26.403***
	Rural students (110)	125.12	

*Notes: *** implies significant at 1% level, ** implies significant at 5% level.*

Table 2 shows that there exists no significant difference among the urban PG students, rural PG students, urban UG students, and rural UG students so far as the effectiveness of the traditional mode of teaching is concerned as the estimated value of the Kruskal Wallis Test is insignificant. However, there is a significant difference among the urban PG students, rural PG students, urban UG students; rural UG students so far as the effectiveness of virtual mode of teaching, internet connectivity, and infrastructure of gadgets are concerned as the estimated values of the Kruskal-Wallis Test are significant either at 5% level or 10% level. From the mean scores of Table 2, it is evident that urban PG students and urban UG students are more aware of the virtual mode of teaching than the rural students but the rural PG and UG students face more problems with the access to internet connectivity and infrastructure of gadgets while learning through virtual mode than the urban counterparts.

Table 2: Results of the Kruskal Wallis Test

	Type	Mean Score	Kruskal Wallis Test
Traditional mode of teaching	Urban PG students	111.09	Chi-square = 1.432
	Rural PG students	110.08	
	Urban UG students	100.22	
	Rural UG students	99.98	
Virtual mode of teaching	Urban PG students	116.57	Chi-square = 6.841*
	Rural PG students	92.76	
	Urban UG students	93.36	
	Rural UG students	82.67	
Internet connectivity	Urban PG students	90.43	Chi-square = 6.414**
	Rural PG students	115.70	
	Urban UG students	92.10	
	Rural UG students	119.21	
Infrastructure of gadgets	Urban PG students	98.65	Chi-square = 5.851*
	Rural PG students	123.90	
	Urban UG students	92.74	
	Rural UG students	118.88	

*Notes: ** implies significant at 5% level, * implies significant at 10% level.*

Conclusion

It may be concluded from the findings of the study that the students prefer the traditional mode of teaching as compared to the virtual mode of teaching at least for our sample. It is also observed that urban students have a higher awareness of the virtual mode of teaching than rural students and students of the rural area come across more problems with the access to internet connectivity and infrastructure of gadgets while learning through virtual mode than their urban counterparts. However, we are aware of the limitations of our study. This study is limited to a very small group of pupils from Burdwan University and Rampurhat College, particularly from the department of commerce. For inferring a general conclusion in this regard, one should take a large sample size from the students of other universities as well.

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Entrepreneurial Challenges in the Small Dairy Farming Business in India- A Study on the Farmers of the Raina-II Block of Purba-Bardhaman District, West Bengal

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Abstract

Dairy farming can be considered as a direct source of income that plays a vital role in poverty alleviation through employment generation, Dairy farmers may face different constraints to run their farming activities. The study has been conducted to find the major problems and level of the challenges confronted by the dairy farmers, to measure the variations in the level of challenges confronted by the farmers belonging to different socioeconomic characteristics, and to show the associations between such levels of challenges and the demographic characteristics of farmers. An empirical assessment was made in the study where the Raina II block of Purba-Bardhaman district of West Bengal was taken as the study area. To collect the primary data a field survey was undertaken through a structured questionnaire. The objectives of the study were fulfilled by computation of Problem Relevancy Score (PRS), Problem Facing Score (PFS), and by application of binary logistic regression model and non-parametric test statistics like Kruskal-Wallis H test, Mann-Whitney Utest, and Pearson's Chi-square test. The findings of the study confirmed the significant impacts of the size of the farm, social participation, and nature of the occupation of the farmers on PFS as well as on variations in their level of the problem facing. 79 percent of farmers were scored as they faced a high level of problems. The major challenges confronted by farmers in the study area can be reduced by making special attention to controlling the high cost of feeds and medicine and by properly activating some supportive facilities like veterinary, training facilities, etc.

Keywords: Constraints, Dairy farmers, Raina II

1. Introduction

Agricultural progress plays a vital role in the Indian economy (Arjun, 2013). Dairy farming has been considered an important aspect of agricultural activities for thousands of years to alleviate poverty, reduce unemployment, accelerate economic growth, develop socio-economic growth, promote income-generating activities, etc. It has an important role to generate daily income, self-dependency, and food security for the farmers in rural areas (Jaklic et al., 2014). An interaction between livestock farming and crop cultivation has been found (Singh & Kishore, 2004; Kumar & van Dam, 2013). The by-products from various grains produced through agriculture are used as input in dairy farming. In the same tune, animal feces and urines are used as inputs in crop cultivation by farmers in order to improve soil fecundity of agricultural land (Singh & Kishore, 2004; Kumar and van Dam, 2013). In this context, India has ranked the 1st position in milk production as well as consumption with a remarkable contribution (23 percent) to global production (Hegde, 2006). The top milk-producing states of India are Uttar Pradesh (14.9%), Rajasthan (14.6%), Gujarat (7.6%), and Andra Pradesh (7%) (www.investindia.gov.in). Dairy farming has restored its progress because it provides essential nutrients to meet the regular increasing demand for milk more efficiently than other agricultural sectors.

But ,the dairy farming system has confronted some major constraints that interrupt the inclusive growth and progress of dairy farming in India. Constraints are some causes that prohibit a particular course of action. Dairy farming has faced many problems like low productivity of the animals, large population of livestock and it creates a problem with land allocation, high cost, and scarcity of food and fodder, mediocre quality in cow's milk, the difficulty in discarding aged cows, etc (Samal&Pattanaik, 2014; Dhindsa et al., 2014). The level of challenges confronted by dairy farmers can be affected by their demographic and socio-economic statuses like age, gender, marital status, educational qualification, experience, size of the farm, nature of the occupation, type of finance, etc. (Bickerstaff, 2004; Paul & Chandel, 2010; Singh et al., 2012).

Considering these facts, the study was made to address the level and variations in constraints confronted by the dairy farmers. The remainder of the study is divided into another seven sections. The section 2 is devoted to a survey of relevant literature, section 3 is focused on the objectives of the study, the data sources and methodology are explained in section 4, section 5 highlighted the conceptual framework, section 6 exhibited the result and discussion, section 7 presented the conclusion and recommendation and section 8 expressed the limitations of the study.

2. Review of Relevant Literature

The importance of dairy farming in Indian economy may consider as an interesting issue in research fields. Besides, the level of constraints faced by the dairy farmers may create special attention in this context. Some of the related literature can be enumerated below.

The rising demand of milk was cited as a major motivator for dairy farming(Nicholson et al., 1999). Dairy farming has a significant role in women's empowerment (Shefner-Rogers et al., 1998). But, the dairy farmers have faced several constraints which create barriers to their development (Mohapatra et al., 2012). If the constraints are clearly identified, the dairy farmers become very helpful to overcome the constraints by adopting different technologies on their farms (Rathod et al., 2014). The poor knowledge about milk production, poor cattle sheds, and lack of information about animal nutrition was detected as the major challenges of dairy farming (Thorat& Kulkarni, 1994; Mustafa et al., 2004; Kumar et al., 2011). The study by Radder & Bhanj (2011) mentioned that most farmers were not getting a fair price for milk production. The input cost of feed had a significant influence on increasing the total production cost of milk (Saravanakumara & Jain, 2009). Buffalo milk was always more pricey than cow milk. But owning a buffalo resulted in a negative return due to having more maintenance costs for buffalo like fodder, shed, feed, and labor costs (Shah, 2012; Meena & Jain, 20012).

In the southern region, Karnataka Dairy Development Project resulted in an increase in milk output. Farmers were able to raise the size of their livestock and their investment in cattle as a result of the project. The farmers replaced the indigenous milch animal with the crossbred animals under this project (Alderman, 1987). Another study in the southern region was conducted to measure the profitability of the dairy industry using Z score analysis in Andhra Pradesh. According to the findings of the study, four dairy units were financially sound out of five (HimaBindu & Subrahmanyam, 2012). A study in Maharashtra of the western region was carried out to show the strength of cooperative unions. The study showed a successful performance of the union in dairy production and marketing services (Rathod et al., 2011). Another study expressed that the shortage of veterans, medical services and high amount of feed cost were considered as the major challenges confronted by the farmers in Maharashtra (Rathod et al., 2012). Besides, deficiency of green feed and insufficient technical services were the important challenges confronted by dairy farmers at Nagpur of Maharashtra (Patil et al., 2009). The study made by Patel, 2005 in Gujarat revealed that the procurement costs made up the majority of the total cost of milk production in the dairy business as the result of increasing transportation costs year by year, and processing costs were considered the second largest cost. The farmers of Haryana of the north region also suffered from the high cost of feeds and the most lucrative sector was shown to be ice cream production compared to the other milk-based products in that state (Chauhan et al., 2006). A study in Bihar of the north-central region showed that large farmers preferred crossbred cows rather than local cows and buffalos, whereas the small farmers preferred the local cows and buffalos over crossbred cows. The low productivity of milks was caused by the rise in farm size. The farm size, the experience of farmers, and the season had a significant impact on milk manufacture. Moreover,

the study also expressed that the milk manufacturing capability in urban regions was more than that of the rustic regions due to the high cost of feeds and fixed costs (Singh et al., 2012). The poor performance of Assam in the northeast east region was found due to lack of demand for milk and the difficulty in obtaining it, absence of a proper collection center of incentives other than price, etc. (Sirohi et al., 2009). Khoveio (2012) performed a study in Nagaland that revealed the major constraints of farmers were costly feeds, lack of green ensilage, cheap price of milk, delay in payments, etc. A study on selected three states (Assam, Tripura, and Manipur) of the northeast-east region revealed that the major affecting factors of milk production were technological and socio-economic status, feeding practices, and medical treatment facilities for diseases. Improvement in these factors would invite good performance of dairy farming in that region (Paul & Chandel, 2010). The major challenges confronted by the dairy farmers of West Bengal of the eastern region were found as infrastructural problems, lack of veterinary practitioners, lack of finance to invest, marketing problems and socio-psychological problems like busy in other agricultural works, lack of awareness, fear to lose social recognition, etc. In this context, the non-cooperative farmers faced more constraints as compared to the corporative farmers (Sarker& Ghosh, 2010). The key components of the total cost were variable costs such as feed and labour. The financial performances (NPV, IRR, and Profitability Index) of cooperative farms were better than non-cooperative dairy farms (Sarker& Ghosh, 2008).

Based on an examination of literature, it may be considered that a good number of studies were carried out on dairy farming. A Little number of studies were found to focus on constraints faced by dairy farmers in West Bengal especially. Therefore, the study was taken in an attempt to address the challenges faced by dairy farmers through a practical appraisal in the Raina II block the of Purba-Bardhaman district of West Bengal.

3. Objectives of the Study

The study was carried out to achieve the following objectives:

i) To find out the major problems faced by the dairy farmers,

ii) To observe the influence of farmers' socio-economic statuses on the level of the problem faced by farmers,

iii) To find out the variations in the level of the problem facing among different categories under socio-economic characteristics of farmers and

iv) To assess the association between the level of the problem facing and different demographic characteristics of farmers.

4. Data sources and Methodology

4.1Collection of Data

The required data for the study was collected through both primary sources and secondary sources. Different articles, dissertations, reports, etc. were used as secondary sources of data. The primary data were captured from responses provided by 100 dairy farmers of Raina II Block[1] of Purba-Bardhaman district. The responses to the challenges confronted by the surveyed farmers were recorded using an ordinal scale where '0' has been used for 'Not at all, '1' used for 'Little', '2' used for 'Moderate', and '3' used for 'Extreme'.

4.2 Tools of Data Analysis

I) Problem Relevancy Score (PRS) was calculated to identify the major challenges confronted by farmers. Hence, to get the PRS of each constraint/challenge, values could be assigned with the degree of responses i.e. 3 with 'Extreme', 2 with 'Moderate', 1 with 'Little' and 0 with 'Not at all'. PRS of a constraint was calculated through the total value of real responses at various scale points divided by the maximum possible score. Here, the maximum possible score was the value if all the respondents responded in 'Extreme-scale' (i.e. 300). Therefore, the formula of PRS was as follows:

$$\text{PRS} = \frac{[\text{Extreme X 3 + Moderate X 2+ Little X 1+Not at all X 0}]}{\text{Maximum Possible Score}}$$

In this context, the constraints/challenges of having the highest PRS get ranked first and so on. Moreover, the constraints/challenges having PRS>0.500 were treated as major problems faced by farmers and vice versa.

II) A Problem Facing Score (PFS) was computed for each surveyed farmer by taking the ratio between summed captured responses against all 12 constraints and the maximum possible responses. In this regard, the following formula was used to compute the individual PFS:

$$PFS = \sum_{i=1}^{12}(x_i)/\text{n}$$

Where x_i was used for the response on i^{th} constraint and n was used for maximum possible responses on all constraints faced (i.e. 36). In this case, the PFS was situated between 0 and 1. The

[1] Raina II Block is a community development block in Purba-Bardhaman district with total population 1,93,793 (male-female ratio 51:49). The overall literacy rate is 81.48% (male and female literacy rates are 87.69% and 74.96% respectively). Most of the population is engaged in agricultural activities.

respondents having scored more than 0.50 were considered to be faced a high level of problems and scored ≤0.50 were treated as facing a low level of problems.

III) The impact of respondents' socio-economic statuses on the level of PFS was measured using a binary logistic regression model considering the codes as '0' for 'Low Level of Problem' and '1' for 'High Level of Problem'. The binary logistic regression model was as under:

Level of PFS = $\alpha + \sum_{i=1}^{7}.\beta_i X_i + \varepsilon$

Here, X_i represents i^{th} socio-economic characteristics of farmers. β denotes the respective coefficients of regressors and ε uses for random error.

IV) The variations in the level of PFS among the different categories under socio-economic characteristics of the farmers were detected by applying the Kruskal-Wallis test statistic (for more than two groups) and Mann-Whitney test statistic (for two groups).

V) Moreover, the associations between the level of PFS and demographic characteristics of farmers were measured by using the Pearson's Chi-square test statistic through SPSS.

4.3 Hypotheses of the Study

The designed hypotheses of the study were as follows:

H_{01}: No significant impact was found of the farmers' socio-economic statuses on the level of PFS.

H_{02}: No significant variance was found in the level of PFS among the different categories under socio-economic characteristics of farmers.

H_{03}: No significant association was found between the level of PFS and the different demographic statuses of the farmers.

5. Conceptual Framework

Based on the literature, the study was constructed 12constraints/challenges confronted by the dairy farmers at the time of designing the questionnaire and the responses of the farmers on these 12 constraints were captured in order to compute the Problem Relevancy Score (PRS), Problem Facing Score (PFS) and to continue the statistical analysis to fulfill the study's objectives. In this context, the challenges/constraints confronted by dairy farmers are presented in Figure 1.

Challenges/Constraints confronted by dairy farmers

i) High purchasing cost of milch animal (cow and buffalo)

ii) High cost of construction of cattle shed

iii) High cost of feed and medicine

iv) Unavailability of nutritious and hygiene feed for quality milk production

v) Lack of finance to invest

vi) Lack of supportive services (veterinary, training facilities, etc.)

vii) Susceptibility of vital diseases

viii) Unexpected result of quality assessment of milk at local milk collection centre

ix) Not getting fair price for selling of milk

x) Difficulty in replacement of the milch animal due low resells value

xi) Low productivity

xii) Lack of proper knowledge and technical skills

Figure 1: Challenges/Constraints confronted by dairy farmers

Source: Authors' own compilation based on literature

Different studies were revealed that the level of challenges faced by dairy farmers was affected by their demographic and socio-economic statuses like age, gender, marital status, education, experience, size of the farm, nature of the occupation, social participation, etc. (Bickerstaff, 2004; Paul & Chandel, 2010; Singh et al., 2012).

6. Result and Discussion

6.1 Profile of the sample respondent

The classifications of different categories under the demographic/socio-economic characteristics of respondents were made based on the availability of data. The maximum number of respondents (49%) was found in the '25 to 40 years aged group. The male and female ratio of respondents was found as 66:34. The majority of respondents were from reserved caste (52%). The majority of respondents were not passed the secondary education level (43%). In respect of marital status, the married group contained a maximum number of respondents (64%). 57% of respondents had

adequate working experience of about '5 to 10 years'. Maximum farmers operated their activities with medium-size farms[2] (39%). 62% of the farmers considered maintaining dairy farms as their primary occupation. Most of the cattle sheds of farmers were paved (62%). 77% of the farmers engaged themselves as a worker on their farms without employing any hired workers. 53% of farmers were involved in a high level of active social participation through sharing their activity-related problems with others. Maximum farmers used their pure own funds as a capital of the dairy farm (53%). Table 1 reflects the surveyed respondents' profiles.

Table 1: Surveyed Respondents' Profile

Demographic/Socioeconomic Characteristics	Categories	Number of respondents
Demographic Characteristics		
Age of farmers	Below 25 years (Young-aged)	22
	25 to 40 years (Middle-aged)	49
	More than 40 years (Old-aged)	29
Gender	Male	66
	Female	34
Caste	Unreserved	48
	Reserved	52
Education	Secondary not passed (Less-educated)	43
	Secondary passed (Moderately-educated)	30
	Higher secondary and above (More-educated)	27
Marital status	Married	64
	Unmarried	36
Socio-economic Characteristics		
Experience of farmers	Below 5 years	26
	5 to 10 years	57
	Above 10 years	17
Size of the farm	Small	32
	Medium	39
	Large	29
Nature of occupation	Primary	62
	Secondary	38
Condition of cattle shed	Unpaved	38
	Paved	62
Types of labour	Owned only	77
	Hired only	16
	Both owned and hired	7

[2]Based on the number of milch animals maintained by farmers, the size of the farm was divided into three categories: small, medium, and large.

Social participation	Low	8
	Moderate	39
	High	53
Types of finance	Own only	53
	Debt only	16
	Both own and debt	31

Source: Primary Survey (March 2022)

6.2 Problem Relevancy Score

Problem Relevancy Score (PRS)was determined for each constraint faced by the farmers. PRS was helped to identify the difficulty level of a constraint faced by farmers. In order to identify the difficulty level, the 12 constraints were divided into two categories like major problems and minor problems based on PRS in this context. Among all the constraints, 10 constraints were found under major problem as having their PRS> 0.500, and the rest 2 constraints were under minor problem as their PRS≤0.500. The major challenges confronted by the farmers were detected as high cost of feed and medicine (0.797), lack of finance to invest (0.723), high cost of construction of cattle shed (0.700), difficulty in replacement of the milch animal due to low resell value (0.607), lack of supportive services like veterinary, training facilities, etc. (0.603), the high purchasing cost of milch animal (0.603), unexpected result of quality assessment of milk at a local milk collection center (0.597), low productivity (0.570), lack of proper knowledge and technical skills (0.553), and not getting a fair price for selling of milk (0.520). Table 2 represents the responses of sample respondents and respective problem relevancy score.

Table 2: Responses on Constraints and Problem Relevancy Score (PRS)

Constraints/Challenges faced by dairy farmers	**Degree of constraints faced (number of respondents)**				**Problem Relevancy Score (PRS)**	**Rank**
	Extreme	**Moderate**	**Little**	**Not at all**		
i) High purchasing cost of milch animals (cow and buffalo)	29	32	30	9	0.603	5.5
ii) High cost of construction of cattle shed	39	37	19	5	0.700	3
iii) High cost of feed and medicine	49	41	10	0	0.797	1
iv) Unavailability of nutritious and hygiene feed for quality milk production	22	26	19	33	0.457	11
v) Lack of finance to invest	39	41	18	2	0.723	2
vi) Lack of supportive services (veterinary, training facilities, etc.)	23	42	28	7	0.603	5.5

vii) Susceptibility of vital diseases	5	29	43	23	0.387	12
viii) Unexpected result of quality assessment of milk at the local milk collection center	21	50	16	13	0.597	7
ix) Not getting a fair price for selling of milk	21	35	23	21	0.520	10
x) Difficulty in replacement of the milch animal due to low resell value	26	43	18	13	0.607	4
xi) Low productivity	22	41	23	14	0.570	8
xii) Lack of proper knowledge and technical skills	19	41	27	13	0.553	9

Source: Primary Survey (March 2022)

6.3Level of Problem Facing

The result of the Problem Facing Score (PFS) of each respondent was helped to determine the level of the problem faced by the respective respondent. The high and low levels of problems faced by farmers were 79% and the rest 21% respectively based on PFS computed from responses made by the respective respondents. Table 3 shows the summary results of the level of problem facing.

Table 3: Level of Problem Facing

Levels	**Number of Respondents**
High Level of Problem Facing (PFS > 0.50)	79
Low Level of Problem Facing (PFS ≤ 0.50)	21

Source: Primary Survey (March 2022)

6.4 Result of Hypothesis Testing

6.4.1 Impact of socio-economic statuses on the level of problem facing (H_{01} testing)

While measuring the impact of respondents' socio-economic statuses on the level of the problem faced, the coefficients of logistic regression and its significance level were taken into consideration.

The significant negative impacts were found on the level of PFS for the factors like size of the farm, nature of the occupation, and social participation at 10%, 10%, and 1% levels of significance respectively. Whereas, the significant positive impacts were found for the factors like the condition of cattle sheds and types of labour at 5% and 10% significance levels respectively. Table 4 exhibits the coefficients of logistic regression on the level of the problem faced by farmers.

Table 4: Coefficients of logistic regression on level of the problem facing

Socio-economic Characteristics	Coefficient	Standard Error	df	P-value
Experience of farmers	-0.317	0.415	1	0.445
Size of the farm	-0.605	0.662	1	**0.094**
Nature of occupation	-0.946	0.551	1	**0.086**
Condition of cattle shed	2.256	0.577	1	**0.049**
Types of labour	1.844	0.635	1	**0.084**
Social participation	-3.174	0.443	1	**0.009**
Types of finance	0.196	0.309	1	0.657
Constant	-0.497	1.943	1	0.798
Nagelkerke's $R^2 = 0.536$				

Source: Primary Survey (March 2022)

6.4.2 Variation of responses on the level of PFS (H_{02} testing)

The variations of PFS among different categories under socio-economic characteristics were found based on responses made by the respondents.

The significant variations of PFS were detected among different categories of experience of farmers(K. W. H = 4.345, df = 2, P = 0.040), size of farm (K. W. H = 3.833, df = 2, P = 0.047), social participation(K. W. H = 7.108, df = 2, P = 0.029), and nature of occupation(M. W. U = 1027.000, df = 1, P = 0.019) of the respondents.

The less experienced farmers (having experience below 5 years) contained more PFS due to having their inadequate problem handling capability as compared to other categories of farmers' experience (Mean Rank 55.38). As per the size of the farm, the small farmers were given maximum responses on PFS because of facing the high cost of required feeds and medicine, lack of proper knowledge and skills, etc. as compared to other groups of farmers (Mean Rank 56.31). The moderately social participative farmers were detected as having more PFS as compared to their counterparts (Mean Rank 57.15). In respect of the nature of the occupation, the farmers who considered the dairy farm as their main occupation responded maximum in favor of the PFS due to having their active involvement in all activities relating to dairy farms as their main source of income (Mean Rank 52.94). Table 5 reveals the variations in the level of PFS among different socio-economic categories of farmers.

Table 5: Variations in the level of PFS among the different socio-economic statuses of farmers

Kruskal-Wallis H Test Result					
Socio-economic Characteristics	**Categories**	**Mean Rank**	**Kruskal-Wallis H**	**d.f.**	**P-value**
	Below 5 years	55.38	4.345	2	**0.040**

Experience of farmers	5 to 10 years	48.72			
	Above 10 years	51.12			
Size of farm	Small	56.31	3.833	2	**0.047**
	Medium	48.18			
	Large	47.21			
Types of labour	Owned only	48.66	2.186	2	0.236
	Hired only	57.88			
	Both owned and hired	53.86			
Social participation	Low	42.25	7.108	2	**0.029**
	Moderate	57.15			
	High	46.85			
Types of finance	Own only	48.74	1.134	2	0.567
	Debt only	54.75			
	Both own and debt	51.32			
Mann-Whitney U Test Result					
Socio-economic Characteristics	**Categories**	**Mean Rank**	**Mann-Whitney U**	**df**	**P Value**
Nature of occupation	Primary	52.94	1027.000	1	**0.019**
	Secondary	46.53			
Condition of cattle shed	Unpaved	50.47	634.000	1	0.792
	Paved	50.52			

Source: Primary Survey (March 2022)

6.4.3 Association between the level of PFS and the demographic characteristics of respondents(H_{03}testing)

The association between the level of PFS and the demographic characteristics of respondents was measured by the Chi-square test as highlighted in Table 6.

The PFS was significantly associated with age ($\chi 2 = 5.953$, df = 2, P=0.021) and caste ($\chi 2 = 4.232$, df = 1, P= 0.069) of the farmers at 5% and 10% level of significant respectively. The study confirms that the PFS is influenced by the age and caste of farmers. On the contrary, the study also finds the insignificant role of gender, education, and marital status of farmers on PFS in the study area.

Table 6: Association between Level of PFS and Demographic Characteristics

Demographic Characteristics	**Chi-square**	**d.f.**	**P-value**
Age of farmers	5.953	2	**0.021**
Gender	1.199	1	0.656
Caste	4.232	1	**0.069**
Education	1.263	2	0.423

Marital status	0.542	1	0.861

Source: Primary Survey (March 2022)

7. Conclusion and Recommendation

The study revealed the major problems and the level of problems faced by dairy farmers which was determined absolutely based on the responses on different constraints of farmers. Moreover, such responses on constraints were affected by the demographic and socio-economic characteristics of respective farmers. In this context, the variations of responses on the level of the problem faced by the farmers belonging to different socio-economic features were found in the study.

The majority of the farmers in the study region were dealing with serious challenges like high amount of feed and medicine cost, scarcity of funds to invest, high cost of construction of cattle shed, difficulty in replacement of the milch animal due to low resell value, lack of supportive services like veterinary, training facilities, etc. 79% farmers have faced a high level of problems. The farmers from less experienced, small size farms, moderately social participative and primary occupation groups faced a high degree of problems based on their mean rank. In this connection, significant negative impacts were found of the size of the farm, nature of the occupation, and social participation on the level of challenges confronted by the farmers. The findings of the work also highlighted the existence of a significant role of age and caste of farmers on the level of problems faced.

Some recommendations could be offered based on the study's findings to clobber the challenges confronted by the dairy farmers.

i) Some attention should be taken to clobber the major challenges confronted by farmers. In this context, special attention should pay to reducing the cost of feeds and medicine, making the availability of supportive services like veterinary, help centre etc., establishing reliability on quality assessment of milk by local collection centers, and making payment with a fair price of milk to the farmers timely.

ii) In order to the improvement of the performance of farmers, proper training to improve their knowledge and technical skills relating to their activities should be required.

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