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Aims and Scope

IPE Journal of Management is a bi-annual, peer-reviewed journal which publishes empirical, theoretical and review articles dealing with the theory and practice of management. The aim of the journal is to provide a platform for researchers, academicians, practitioners and policy-makers from diverse domains of management to share innovative research achievements and practical experience, to stimulate scholarly debate both in India and abroad on contemporary issues and emerging trends of management science and decision-making.

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Contents

From the Editor's Desk...

The issue for January - June 2023 continues the practice of bringing selected of articles that highlight diverse management issues that would arouse the interest in academicians, researchers and management practitioners. The present issue contains eight articles from researchers exploring assorted themes including. The Hedge Ratio and Hedging Effectiveness in Indian Commodity Markets: Some Empirical Evidence, Impact of Firm Specific Factors on the Indian Stock Returns: A Panel Data Approach, Economic Significance of Priority Sector Lending and Its Impact on Bank Sustainability, Predicting Financial Distress by Using Springate, Grover and Zmijewski Model: A Study of Paint Industry, Inventory Model for Deteriorating Items Involving Fuzzy with Shortages, Employee Satisfaction of Performance Appraisal and Employee Turnover, Qualitative Analysis of WhatsApp Privacy Policy, and An Investigation on the Acceptance of Online Pharmacies among Customers in Punjab.

The first article in this issue of the journal assesses the effectiveness of agricultural commodity futures in India. The study used ADF unit root test, both bivariate and multivariate cointegration tests, VAR and VECM approaches to know the hedge ratio under the study. The second article examines the role of the firm-specific factors in explaining the cross section of returns of the firms listed on the Indian stock market for the period 2000 to 2022. The study used panel unit root, correlation and hausman test to find the optimal model for testing the relationship wherein fixed effect regression model was used that highlighted that profitability factors namely return on capital employed, return on total assets along with size of the firm. The next article aims at identifying the credit disbursement pattern of different commercial banks and its effect on their own sustainability and the economy as a whole. The next article aims to identify bankruptcy predictions and identify most precise ways for evaluating bankruptcy using Springate, Grover, and Zmijewski models for top 5 paint companies. The next article of the series, considers the fluffy inventory model for deteriorating items for power interest under completely multiplied conditions. The next article highlights, direct effect of employee satisfaction of performance appraisal on employee turnover intention and confirms that fairness and transparency have mediating effects on the relationship. The next article uses qualitative data analysis technique to understand the point of view of users of WhatsApp. The data was extracted from twitter with the help of Ncapture utility and was analyzed using word cloud, tree map, sentiment analysis and search map. The last article has explored the role of e-pharmacy in Punjab and examines the factors influencing adoption and non-adoption on online pharmacy among customers in Punjab.

IPE Journal of Management has focused on exploring newer challenges in the domain of management research. The research papers in this issue discuss various aspects related to new education policy, marketing perception, financing of infrastructure and investment in bullion instruments, etc. We trust our readers would appreciate the efforts of the authors and this would contribute to enhancement of management knowledge system.

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Samarendra Kumar Mohanty

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The Hedge Ratio and Hedging Effectiveness in Indian Commodity Markets: Some Empirical Evidence

Thokala Sampath*

Abstract

To assess the effectiveness of agricultural commodity futures in India, secondary data is used in this study and the prices of five commodities such as jeera, wheat, barley, mentha oil, crude palm oil. The data covering the period from 1 December 2010 to 31 May 2019 has been taken to consummate the study. The study used ADF unit root test, both bivariate and multivariate cointegration tests, VAR and VECM approaches to know the hedge ratio under the study. The study confirmed there is a long-run equilibrium relationship among the variables. Finally, the present research also attempts to offer a summary of present competing techniques when determining the optimum hedge ratio. Therefore, the effectiveness of such methods is compared with average returns and average variance decreases in the exposed case.

Keywords: ADF, Cointegration, Commodities, Hedging, VAR, VECM

Introduction

Hedging is the process of lowering risk exposure. As a result, a hedge is any action that decreases the price risk of a certain cash market position. It's worth remembering that futures contracts were created with the sole intention of giving producers and users of various commodities with a mechanism to hedge against price risk. Futures contracts remain a popular way of hedging because they allow market players to mitigate the risks associated with unexpected price changes. When a position in futures is taken that is the inverse of an existing or expected cash position, it acts as a hedge. Hedgers sell futures when they take a long position on a cash asset and purchase futures when they take a small one. A small hedge is when a hedger sells a futures contract with the expectation that prices would

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decline. In the case of a price drop, losses in the spot position would be sustained. When prices fall, a short hedger who is now long on the cash good or has an obligation to sell at an unknown price in the future will lose money in the cash market, but will win money in the futures market due to the short position. Prices may, of course, increase. In that situation, there will be a gain in the spot market, but a loss in the futures position will be sustained. In a long hedge, on the other hand, a hedger purchases futures contracts when he or she is either currently short the cash good or is obligated to buy the good at the current spot price at a later date. The long hedger is exposed to the possibility of price increases. If a price rise occurs, the long hedger will lose money on the cash good but make money on the long futures position (N D Vohra and B R Bagri).

Hedge Ratio

We can now proceed to compute the right amount of futures contracts to buy or sell when hedging by using the relationship among changes in futures prices and prices of cash assets. Normally, one would suppose that the futures contract is of a certain size position should be the same as the amount of the cash asset exposure (i.e., for a Rs. 10 lac cash market position, the size of the futures contract position should also be Rs. 10 lac), and that the hedging ratio should be 1.0. However, as we will show, the ideal hedging ratio is determined by the magnitude and character of relative price changes between futures and cash good prices. The "hedge ratio" refers to the number of futures contracts purchased or selling per unit of a spot good position. The size and character of relative price changes of futures and cash good prices determine the optimal hedge ratio.

Regressing changes in spot prices (ΔS) on changes in futures prices(ΔF) .yields the best hedge ratio, for a risk-minimizing hedger.

For this, we can use the regression model below.

$\Delta S = \alpha + \beta \Delta F$

The slope co-efficient, β, of the regression line so obtained would yield the estimated optimal hedge ratio (N D Vohra and B R Bagri).

Hedging is defined as the acquisition of an asset with the goal of lowering the risk of losses from other assets. "Hedging is a risk management" strategy used in finance to mitigate and reduce the risk of unknowns. It aids in the prevention of financial losses caused by unanticipated market turmoil. "Hedging" acts as a form of protection against any negative market events that might damage your investments. We're not claiming that hedging would keep the bad thing from happening. However, if you're appropriately hedged as it happens, the effect will be lessened. All around us, people are hedging their bets. When you purchase auto insurance, for example, you're protecting yourself against robbery, collateral injury, and other unexpected disasters.

The twin roles of the commodity futures market i.e., price discovery and risk management. Risk control will be carried out by hedging. By establishing a specific position on the futures market, cash market participants can mitigate price risk. As commodities shift together in the futures and financial markets, where gains are primarily attributed to unfavorable price fluctuations on the real market are either completely or slightly compensated by potential stocks. Therefore, hedging is one of the risk control strategies in potential. The effective hedging can be accomplished by requiring significant uncertainty in potential stocks. Hedges may be bought and sold as needed with the use of both brokers and speculators in trades, as well as the purchase of derivatives. The key goal and benefit of potential business shelter is to reduce likely reductions in sales correlated with unfavorable cash price shifts. A hedging strategy can handle the danger of the market fluctuations of the commodity. Hedging helps farm participants to balance the adverse cash market fluctuations with preferred potential price changes in order to minimize overall price risk. Optimal safeguarding methods limit the gap between cash and potential dividends.

Agricultural commodity rates and uncertainty have been significantly modified since the mid-2000s, supply-side factors such as growing and unpredictable extreme weather events are guiding the market. Unanticipated new financial situations, such as droughts, floods, or demand-side developments. Risk management techniques that use monetary tools can mitigate the effects by effective hedging of certain unpredictable price fluctuations. Derivatives are used as useful tools for the battle against business threats such as competitive risk, price risk and counterpart risk. The hedging scheme will handle the product possibility of market volatility. The most cost-effective method of defending against price danger is called commodity derivatives. Traders can use futures and forwards as advanced hedging products to protect themselves from price swings in the spot market. The sustainability in every potential business depends on future deals being successful. The hedge shall be called successful if market fluctuations compensate for price adjustments in the underlying assets in the potential deal. As a result, hedges can avoid prospective transactions that take a long position in the underlying asset or vice versa. The best hedging ratio will vary substantially depending on the methodology used to calculate it. Several researchers predicted this risk to return ratio using the usual model.

The standardized method is defined as such an ordinary least square model whereby the dependent variable is the unhedged value of the place (or the return value of the commodity on the money market), in contrast to the descriptive variable is the value (or return price) of the hedging

instrument. This paradigm is being questioned for three factors. First of all, long-term evidence and short-term trends are disregarded. In other terms, second OLS effects are partial if there is a co-integration of future and spot return. Second, the assumption that spot and future values are spread simultaneously over the years is not regarded as a constant hedge factor. Thirdly, the assumption is based on a continuous and mutual distribute of the position and potential costs. Kroner and Sultan (1993) reported and proposed the appropriate formula for calculating the hedge ratio and cointegration for locations and potential markets to use as a vector error correction. However, for two factors, the VECM model was often attacked. Finally, the VECM hedge ratio obtained by unconditional variance is centred on the conditional variances of the true minimum hedge. As a consequence of underestimating the hedge ratios obtained from these equations, "Ghosh (1993) and Hsiang (1996)" emphasized the constant equations of "hedge-ratio viz., OLS, VECM and VAR". In this sense, most experiments are reported and validated by the Bollerslev (1986) "GARCH" model, to evaluate the optimum hedge ratio. More complex econometric time series strategies including multivariate GARCH models are often used to forecast time-varying hedge relationships that taken into consideration the location's conditions and covariance and potential returns. Several observational studies carried out a contrast with the "time-varying hedge ratio of the constant hedge" relation for the perpetuation of yield as well as the decline in variances. The hedge estimation system consists of two methods the "static hedge ratio and the dynamic hedge ratio". There are two versions. The OLS, VAR, VECM are included in the static strategy and dynamic evaluation of the VECM-MGARCH model.

The prices of commodity depend on the factors like, seasons, consumption levels, government policies, inventory levels and supply and demand balance and these prices cause both manufacturing and market related risks. The revenue of the producers depends on the yield of the crop and their income is affected by the changes in the prices. These carrying costs can be avoided by entering into financial markets. The association among "spot price and the futures price" is reasonable because of holding of commodities in inventories to face the shortage in the future in the commodity economy. The impact of pricing changes on the real economy is significant. Since the variations in the prices of the commodity affect every element in the society, the risk management plays a significant role. The Individuals manage risks to cover their personal incomes, the organisations by protecting their bottom lines and competitive strength, and the economy to protect its macroeconomic stability. Besides price risk management, there are many positives related to hedging. The commodity trading is performed with standardization in sizes and in qualities for

improving efficiency of their extractions, distributions and consumption processes.

Review of Literature

Acharya et al. (2015) in order to approximate the ongoing dynamically hedging ratios in agricultural and non-agricultural commodity contracts, employed a "Standard Least Squares and a Vector Error Correction Model". In the analysis, the growth cycles of the nearby month and next to nearby month were listed. Authors find that the next to near month's maturity contract outcomes are stronger than next month relative to coriander, jeera, pepper, gold and silver. In copper the findings indicate that in both maturities the hedge and hedger ratios are poor. Finally, the report showed that non-agricultural commodity hedges should not hedge potential prices in conjunction with agricultural futures contracts to protect risk on the spot market. Bhaduri and Sethu (2008) during the time span between 4 September 2000 and 4 August 2005, examined the relation between optimized hedge ratio and hedge performance in India. The authors used the ordinary least square, M-GARCH models and vector error corrections. The analytical findings have shown that a hedge utility to test the GARCH model tests stronger output over the long term while OLS tests good performance over the short term.

Choudhry (2009) through using the GARCH family models for the estimation of time-divergent distribution efficiencies in the potential markets of specific agricultural commodities uses the seven commodities, namely soya, coffee, maize, rice, wheat, pork and live animals, for the period from August 1980 to July 2004. Empirical findings from the author reported that the approximate hedge ratio of GARCH-X technique is higher portfolio efficiency. Das and Chakraborty (2015) on the hedging of agricultural commodities (such as turmeric, potatoes, gum, chilly and mentha oil) were analysed in by the implementation of an ordinary least squares system during the time from April 2008 to March 2014. Authors' observations also recorded that hedging results are more acceptable in most agricultural commodities. With the use of econometric models ordinary least square and error correction mechanism and the percent of reduced return variants. Giulio and Paladino (2015) investigated dynamic relations among "spot and futures returns" of commodity markets, use the non-linear means of a Constant Conditional Correlation- Generalized Autoregressive Conditional Heteroscedasticity (CCC-GARCH) model. For the duration from 3 January 1990 to 26 January 2010, the analysis employed many resources, including copper, soybeans, gasoline, cotton and silver. Authors' studies have shown that future prices rely on time interactions between financial traders and hedgers that are risk-averse. Gupta and Poornima

(2016) analysed the relationship between market discovery and uncertainty impact on spot and future markets, utilizing econometric methods such as cointegration, error correction and granger causality tests. In India, for the period from 15 March 2003 to 18 February 2012. The authors find that knowledge flows from potential markets to local markets are higher, but they also claimed that price discovery would take place tomorrow and find two-way causality in the two markets between uncertainty spills.

Gupta et al. (2017) by using econometric techniques including OLS, VAR, VECM and VAR-MGARCH conditions of self-reliance techniques, calculated the constant hedge ratio and time variance hedge ratio efficiencies for Indian commodity futures markets by considering both the agricultural sector and the non-agriculture it has been observed that, relative to industrial commodities and energy commodities, the future demand has greater textile productivity in specific metals. Finally, the findings indicated that hedging was the best in VECM and VAR-MGARCH and hedge was the best in the VECM model.

Haq and Rao (2013) by calculating the error correction mechanism and Ederington model for the optimum hedge ratio and the hedging efficiency of Indian agricultural commodities, have examined 10 commodities namely such as soybeans, pepper, guar gum, barley, chili, soy oil, guar seeds, pepper, turmeric and chana from 2006 January to 2011 December period. The research findings have shown that the optimum hedge ratio has increased dramatically and the model steps by Ederington have demonstrated how the portfolio volatility comprising potential values can be minimized. Finally, the analysis reported in significant measure the decline in variance. Hussain and Kamaiah (2012) by using two econometric models, namely, ordinary less square and error corrector models, analysed hedging efficiency in commodity futures contracts for spices and base metal commodities in the Indian context. They find that in the nearby month deal, the future demand dominates price discovery. Their findings suggested, however, that in the far-month market there are no long-term relationships in turmeric prices with futures prices. The analysis also showed that hedging performance is more efficient across further months and months of expiration contracts. They also indicated, ultimately, that the potential demand belongs to the base metal contract business.

Kumar and Lagesh (2011) used bivariate methods GARCH, DVECH-GARCH, BEKK-GARCH and CCC-GARCH to calculate market uncertainty, hedge ratio and efficiency of the hedge method. Furthermore, the research studied the interpretation of the sample results of the "hedge ratios using the GARCH model for the hedge return and reduction of variances". The success appraisal analytical findings were mixed. In a hedged return study, DVECH-GARCH was used and strong returns

were obtained in all markets. Results of the variance reduction method showed that for both AGRI and COMDX markets full variance reductions are needed. Kumar et al. (2008) the hedging effectiveness and time gap hedge ratios for product markets and bonds in India, by have been studied using different quantitative econometric strategies for the analytical study of VAR, VECM, OLS and VAR-MGARCH. The analysis further measures model and control results and indicates that portfolio exposure is substantially decreased. Owing to the period volatility of the hedge ratio, high variance relative to the constant hedge ratios was greatly decreased. Lee and Yoder (2007) during the duration 2nd January 1991 to 29th December 2004, investigated the time changing hedge ratios of nickel and maize for both spot and future prices by implementing the bivariate Markov regime switching system model (RS-BEKK-GARCH). The results of this study have shown that the optimal hedge ratios for futures contracts for maize and nickel have been marginally improved compared to BEKK or naive approaches. Ming-Yuan Leon (2010) studied the effectiveness of the hedging using the vector threshold correction technique. Empirical findings show that arbitrage activity decreases co-operation among futures and spot markets and improves both futures and spot markets' volatility. Lien Donald et al. (2002) the findings of commodities futures contracts on agricultural products' hedging ratios, including maize, wheat, cotton, soybean and currency futures of Japanese Yen (JY), UK Pound (BP) and German Mark (GM) and the S&P 500 (SP) and NYSE composite (YX) stock index future contracts, spanning the months of January 1988 to June 1998. To their analyses, these authors OLS and VGARCH models. The analysis revealed that the OLS hedging ratio is more efficient than the VGARCH hedging ratio.

Malhotra (2015) estimating the hedging performance of oil and oilseeds futures in the context of India. By using the econometric models of ordinary least square and error correction mechanism for the estimating hedge ratio and hedging effectiveness of particularly oil commodities namely such as "mustard seed, refined soya oil, crude palm oil and mentha oil". The empirical findings showed that the hedging output of the refined soya oil and crude palm oil futures is strong and mustard oil and menthe oil futures rank low in terms of risk reduction. Mandeep and Gupta (2018) analysed in the context of the hedge ratio model for three predictor indexes NIFTYIT, BANKNIFTY and NIFTY traded on the national stock exchange from June 2000 to March 2017. The authors find that BANKNIFTY, NIFTY but NIFTYIT, is the most successful to defend the variation reduction mechanism and the hedge ratio. Once again, the findings of the VECM model indicated that hedge productivity was the best. Lastly, the authors find the lowest hedging efficiency of the Naïve hedge ratios. Nair (2018)

a study using the co-integration model of Engle-Granger on the hedging capacity of prospective rubber markets in India for 2004-2007. Efficient hedging of rubber future has also been shown in the analytical evidence to reduce the danger over the duration before and after the crisis. The hedge effectiveness mechanisms for risk return and variance elimination. Park and Lorne (1995) in order to study time fluctuations in hedge market and spot hedge rates, used the bivariate GARCH model. The data revealed there exists a long-term relationship among the spot and potential stock indices, as well as that the bivariate GARCH hedging technique may be more effective than other standard strategies. Radha and Balakrishnan (2017) investigate the link among "spot and future prices" for agricultural commodities, namely "wheat, castor seed, coriander and soybean". The "Johansen, cointegration test, VECM and Granger causality test" are used to explain the association among spot and future prices. Using "VECM, optimum hedge ratio and hedging efficacy" are measured. The findings show co-integration among spot and future prices for all four items analysed in near-month and next to near-month contracts. For near-month contracts, both markets often respond simultaneously and lead to "price discovery" but the futures market plays a dominant position for near-month contracts. Ripple and Imad (2007) the relationship between future and spots of crude oil prices for the duration of 2 January 1998 to 29 April 2005. Authors find that hedging is more successful in the next month and also reveals that the hedging levels are smaller than hedging for the first month. Srinivasan (2010) in the case of India using econometric models OLS, VECM and for the period from 27 May 2005 to 26 March 2009, it explores hedging utility. In particular, 21 market-traded commodities are used for commercial banking (National Stock Exchange). The author finds that the hedging method is the best way of reducing the conditional volatility of the hedging portfolio. Yang and Awokuse (2003) researched, by the GARCH bivariate model from 1 January 1997 to 31 December 2001, storable, non-storable agricultural futures such as

Maize, wheat, soya, cotton, cattle feed, lean hogs and live cattle. The empirical data showed that the hedging utility of all storable goods is high and that the hedging value of non-storable goods is also poor.

Motivation of the Study

The present research took into account the fact that there had been work on the Indian commodity futures globally in past studies and that various studies centered on agriculture, energy and metals in India, the present study empirically investigated on five most highly liquid agricultural commodities spot and future markets. First, the research used the key commercial commodities in Indian, five faming commodities, such as cumin, mentha oil, barley, crude palm oil and wheat and hence the analysis also limited

it to a few agricultural commodities since there are very large numbers of agricultural commodities. Second, the report revised and protected data sets for review from 1st December 2010 to 31st May 2019. Third, the analyses of market uncertainty, hedging and performance of commodity futures in India have gained substantial attention from researchers and academics. While extensive literature on product stocks is available, furthermost of these studies focus on farming commodity production and the main connection of the Indian spot and future marketplaces, while the cointegration of Johansen, the Ordinary Least Square and Vector Auto Regressive models are used to assess the hedge ratios and hedge performance. In India, however, few studies have centred on assessing the market uncertainty, hedging and efficiency of agricultural commodity futures. Finally, the purpose of the present analysis is to analyse the five potential trade in extremely liquid farm commodities. The present objective therefore used these items to fill the analysis gap. Several researches were conducted to determine the effectiveness of hedging but it is necessary to reexamine the hedging efficiency of the Indian commodity sector in light of recent events such as large and regular swings in uncertainty, further financial downturns in the substantial changes in government policies, as well as the financial market.

Source of Data and Empirical Methodology

Source of Data

The research uses a selection of five most fluid potential goods exchanged on NCDEX and MCX agricultural commodities. In this study the prices of five commodities such as jeera, wheat, barley, mentha oil, and crude palm oil and the correlation among both spot and future markets is investigated. The length of the analysis is from 1 December 2010 to 31 May 2019.

Empirical Methodology

The study employed ADF unit root tests to determine the order of integration of variables in the analysis. To estimate long-term relationship, author applied Johansen cointegration tests. The ordinary least-square (OLS) estimated to know the association between the variable and to examine hedge ratio. Finally, the bivariate autoregressive vector (VAR) approach was used to find the correlations between the variables under study. Using Four distinct hedge ratio calculation approaches are the subject of this study.

ADF Unit Root Model

In order to validate integration and time-series outcomes in order of stationarity, Augmented Dickey-Fuller, Dickey and Fuller, 1981, experiments have been used. The intercept and intercept and trend were

used for these stationary testing, since the data span a long period of time. The ADF research lags have been calculated and the vital values in the Dickey and Fuller studies (1981) have been taken into account, depending on the Akaike information Criterion (AIC). In the use of the time series data, first step significantly needs to verify the stationary properties of the data. In doing this, the study uses the Augmented Dickey Fuller (ADF) test.

The first and only step in every time series approximation. In this study, the Augmented Dickey Fuller (ADF) was used to validate defined properties.

$$\Delta y_t = \mu + \lambda t + \varphi y_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta y_{t-1} + \varepsilon_t$$

Where $y, \mu, \lambda t, p$ and ε Denotes, intercept, linear cycle, statement order and error word are. Denotes, intercept.

Johansen cointegration

The cointegration study is performed using Johansen's (1991) criteria of highest probability.

$$\Delta Y_t = C + \sum_{i-1}^{k} \Gamma_i \Delta Y_{t-1} + \Pi_{t-1} + \eta_t$$

Where Y_t, Γ, Π, k and C are indicates vector of non-stationary variables, the coefficient matrices, the lag length and constant.

The Regression Method

The linear regression model that follows is an example is a common methodology used by plain, ordinary least-square (OLS) estimation to determine an optimum hedge ratio.

$$r_s = \alpha + \beta r_f + \varepsilon_t$$

Where r_s and r_f the spot and the future is the first relation among the logarithmic position and the futures graph for the time t measured. The value of β offers the optimum hedge ratio estimate.

The Bivariate VAR method

The possibility of autocorrelated residuals is a big downside of the above-noted simple regression methodology. This was overcome by a bivariate autoregressive vector (VAR) model. For each lag, n agreed to iterate before the self-relation in the residuals had been fully eliminated from the process. The optimal location and potential lags duration m.

$$r_s = \alpha_s + \sum_{i=1}^{m} \beta_s r_{s-i} + \sum_{j=1}^{n} \gamma_s r_{f-i} + \varepsilon_s$$

$$r_{ft} = \alpha_f + \sum_{i=1}^{m} \beta_f r_{s-i} + \sum_{j=1}^{n} \gamma_f r_{f-i} + \varepsilon_f$$

The remaining series is produced after the estimation of the equation system to calculate the hedge ratio. Let $\mathrm{VAR}(\varepsilon_s) = \sigma_s$, $\mathrm{VAR}(\varepsilon_{ft}) = \sigma_f$ and $\mathrm{COV}(\varepsilon_s, \varepsilon_f) = \sigma_{sf}$, then, the minimum hedge percentage of variance is $h^* = \sigma_{sf} / \sigma_f$.

Results and Discussion

To understand the stationary features of the data series and to meet the study's goal. First, it is significant to avoid the problem of spurious and invalid result because these are mainly depending on non-stationary data series. To estimate the "unit root results" the study adopts "Augmented Dickey Fuller" test to know the order of integration. The "ADF unit root test" required significant lag length, therefore, the study selected based on optimal lags which is determination of the SCI criteria. The results of time series "unit root tests" are displayed in Table-1. The findings of "Augmented Dickey Fuller" demonstration that "crude palm oil future, crude palm oil spot, mentha oil future, mentha oil spot, wheat future, wheat spot, barley future, barley spot, jeera future and jeera spot" commodities are non-stationary at level. Therefore, it converted into first order of integration then all of the variables are stationary at their first order of integration. These results show that "crude palm oil future, crude palm oil spot, mentha oil future, mentha oil spot, wheat future, wheat spot, barley future, barley spot, jeera future and jeera spot" commodities are integrated order of one, i.e. I(1).

Table-1: Unit Root Test Results

Variables	Levels	First Difference
Crude Palm Oil future	0.394 (0.797)	-47.752 (0.000) ***
Crude Palm Oil spot	0.564 (0.838)	-48.145 (0.000) ***
Mentha Oil future	0.0719 (0.705)	-44.422(0.000) ***
Mentha Oil spot	-0.788 (0.374)	-46.412 (0.000) ***
Wheat future	0.599 (0.845)	-51.230 (0.000) ***
Wheat spot	0.432 (0.807)	-14.273 (0.000) ***
Barley future	0.156 (0.731)	-45.669 (0.000) ***
Barley spot	0.254 (0.759)	-10.672 (0.000) ***
Jeera future	-0.136 (0.636)	-19.772 (0.000) ***
Jeera spot	-0.046 (0.667)	-10.934 (0.000) ***

Note: ***, indicates significance at 1% level.

In this section, this study provides empirical results of cointegration, to estimate this the present research apply both bivariate and multivariate cointegration. In order to use lag lengths criteria, the research has adopted automatics lags under study. The estimated results of both bivariate and multivariate long-run cointegration are reported in Table-2 and Table-3. Those bivariate and multivariate cointegration methods have two test statistics to confirm the present of long-term link between factors namely trade and maximum eigen statistics. Existence of a long-term strategy link between the commodities is confirmed by these statistics. In the model, the long-run equilibrium vector association with respect to spot commodities of crude palm oil spot, mentha oil spot, wheat spot, barley spot and jeera spot shows that these are cointegrating coefficients with respect to future prices of crude palm oil future, mentha oil future, wheat future, barley future and jeera future are statistics significant at 1% level.

Table-2: Bivariate Cointegration Results

Hypothesized: No. of CE(s)	Trace Test	Critical Values	λ-Max Test	Critical Values
Crude Palm Oil				
None	138.378	15.494***	138.375	14.264***
At most 1	0.002	3.841	0.002	3.841
Mentha Oil				
None	36.292	15.494***	31.461	14.264***
At most 1	4.8306	3.841**	4.830	3.841**
Jeera				
None	137.085	15.494***	132.750	14.264***
At most 1	4.335	3.841**	4.335	3.841**
Barley				
None	65.769	15.494***	62.369	14.264***
At most 1	3.400	3.841*	3.400	3.841*
Wheat				
None	70.596	15.494***	68.635	14.264***
At most 1	1.961	3.841	1.961	3.841

"Note: ***, **, * indicates significance at 1% 5% and 10% level".

Table-3: Multivariate Cointegration Results

Hypothesized: No. of CE(s)	Trace Test	Critical Values	Prob.	λ-Max Test	Critical Values	Prob.
None	899.862	239.235	0.000***	441.375	64.504	0.000***
At most 1	458.486	197.370	0.000***	164.655	58.433	0.000***
At most 2	293.831	159.529	0.000***	85.740	52.362	0.000***
At most 3	208.091	125.615	0.000***	83.418	46.231	0.000***
At most 4	124.672	95.753	0.000***	62.643	40.077	0.000***
At most 5	62.028	69.818	0.178	26.441	33.876	0.294

Hypothesized: No. of CE(s)	Trace Test	Critical Values	Prob.	λ-Max Test	Critical Values	Prob.
At most 6	35.587	47.856	0.417	19.474	27.584	0.378
At most 7	16.112	29.797	0.704	9.780	21.131	0.764
At most 8	6.331	15.494	0.656	4.157	14.264	0.842
At most 9	2.174	3.841	0.140	2.174	3.841	0.140

Note: ***, indicates significance at 1% level.

Before estimating the optimal hedge ratio, the study needs to estimate the OLS regression. In doing this, the estimated OLS regression (1) with five study commodities such as "barley, crude palm oil, jeera, wheat and mentha oil". The empirical results of ordinary least square regression are reported in Table-4.

Table-4: Least Squares Method Results

Variable	Coefficient	t-Statistic	Prob.
Barley	0.184	14.290	0.000***
Crude Palm Oil	0.993	393.286	0.000***
Jeera	0.217	26.261	0.000***
Wheat	0.058	3.676	0.000***
Mentha Oil	0.014	0.503	0.614

Note: *** donates significance at 1% and 5% levels.

To estimate the hedge ratio, the present study selected using both the VAR and VEC models. The hedge ratio is estimated as $h^* = \alpha_{sf} / \alpha_f$. the results of hedge ratio are reported in Table-5 and 6. The present research were used α_{sf} is variance in the model$(\varepsilon_s \varepsilon_f)$. α_f is variance (ε_f) with ε_s and ε_f.

Table-5: Optimal Hedge Ratio From The Bivariate VAR Model

Variable	*h**
Crude Palm Oil	0.992
Jeera	0.213
Barley	0.179
Wheat	0.070
Mentha Oil	0.010

Table-6: Optimal hedge ratio from the bivariate VEC model.

Variable	*h**
Crude Palm Oil	1.007
Jeera	0.247
Barley	0.246
Wheat	0.154
Mentha Oil	0.159

Conclusion of the Study

The chapter covered the efficiency of hedging for the agricultural commodities studied, which included barley, wheat, cumin, crude palm oil, and mentha oil. To justify the goal of this chapter, the findings were derived from the numerous tests mentioned above. In the international market all transactions are made via both the spot and future market arguments. It is particularly essential for agriculture future markets to minimize the need for an effective hedging approach. The study used ADF unit root test, both bivariate and multivariate cointegration tests, VAR and VECM approaches to know the hedge ratio under the study. The study confirmed that all of the variables are stationary at integrated order of one and also confirms implies there is a long-term link between the commodities. Finally, the present research attempts to offer a summary of present competing techniques when determining the optimum hedge ratio. As a result, the efficacy of such strategies is measured in terms of average returns and average variance reductions in the revealed scenario.

Participants should find it easier to take positions suitable for hedging price risk on commodity derivative markets. To identify the suitable hedge ratio which is the number of futures contracts to sell to hedge per unit of spot asset held, as well as hedging efficiency, which measures how efficiently concurrent gains or losses in physical markets are offset by losses or gains in futures markets. When it comes to derivatives, hedging is an important topic. If the derivative sector is efficient and effective, price risk management is conceivable. Producers that want to resolve price fluctuations in the spot or cash market utilize derivatives as a strategy to protect their in a spot market position. Hedging is the technique of using futures contracts to manage price risk, i.e., critical change in prices in the physical market. Hedging's benefits have also been demonstrated by pragmatic research. Researchers studied the ideal hedge ratio and hedging efficacy in order to better understand the major emphasis of hedging. Price behavior and condition influence both the appropriate hedge ratio and the hedging effectives Garcia et al (2004). The ideal hedge ratio was previously determined to be one, which suggests that one must take the same position in the futures market as in the spot market. However, due to the fact that presence of basis risk (when futures and spot prices are in equilibrium), the best hedge ratio might potentially be less than one Mathew and Holthausen, (1991).

Policy Implications

- Other factors, such as output seasonal variation, rainy season vagaries, storage availability, inventory availability, consumption seasonality, export-import policies, government interventions such as minimum

support prices, and so on, all have an effect on the prices of agricultural commodities.

- The commodity futures contract is a common market-based tool used in India to mitigate price risk by farmers, traders and other users of farming produces. When futures markets are used as a risk reduction tool, spot price risk is replaced by simple risk.
- The future market is considered to be an efficient tool for reducing price risk if the baseline uncertainty is smaller than the spot price variability. If the basis is less volatile than the spot price, by taking the opposite position on the futures market, futures traders can hedge their spot position and reduce the risk associated with their final transaction.

References

Acharya, S., Rath, S. S., & Panchal, B. (2015). Commodity Futures Market in India: Hedging Efficiency.

Bhaduri, S. N., & Sethu Durai, S. R. (2008). Optimal hedge ratio and hedging effectiveness of stock index futures: evidence from India. *Macroeconomics and Finance in Emerging Market Economies*, 1(1), 121-134.

Choudhry, T. (2009). Short-run deviations and time-varying hedge ratios: evidence from agricultural futures markets. *International Review of Financial Analysis*, 18(1-2), 58-65.

Cifarelli, G., & Paladino, G. (2015). A dynamic model of hedging and speculation in the commodity futures markets. *Journal of Financial Markets*, 25, 1-15.

Das, J. K., & Chakraborty, G. (2015). The hedging performance of commodity futures in India: an empirical study on some agricultural commodities. *International Journal of Information, Business and Management*, 7(3), 162.

Easwaran, R. S., & Ramasundaram, P. (2008). Whether commodity futures market in agriculture is efficient in price discovery? - An econometric analysis. *Agricultural Economics Research Review*, 21(347-2016-16671), 337-344.

Gupta, S., Choudhary, H., & Agarwal, D. R. (2017). Hedging efficiency of Indian commodity futures: An empirical analysis. Paradigm, 21(1), 1-20.

Haq, I. U., & Chandrasekhara Rao, K. (2013). Optimal Hedge Ratio and Hedging Effectiveness of Indian Agricultural Commodities. IUP Journal of Financial Risk Management, 10(2).

Hussain Yaganti, C., & Kamaiah, B. (2012). Hedging Efficiency of Commodity Futures Markets in India. IUP Journal of Financial Risk Management, 9(2).

Kaur, G., & Dhiman, B. (2019). Agricultural Commodities and FMCG Stock Prices in India: Evidence from the ARDL Bound Test and the Toda and Yamamoto Causality Analysis. Global Business Review, 0972150919830803.

Kaur, M., & Gupta, K. (2018). Estimation of Hedging Effectiveness Using Variance Reduction and Risk-Return Approaches: Evidence from National Stock Exchange of India. *International Journal of Business Analytics and Intelligence*, 6(1), 35.

Kumar, B., Singh, P., & Pandey, A. (2008). Hedging effectiveness of constant and time varying hedge ratio in Indian stock and commodity futures markets. Available at SSRN 1206555.

Kumar, S., & Lagesh, M. A. (2011) Spot Return Volatility and Hedging with Futures Contract: Empirical Evidence from the Notional Commodity Futures Indices of India. *IUP Journal of Behavioural Finance*, 8(2), 70.

Liu, K., Koike, A., & Mu, Y. (2020). Price Risks and the Lead-Lag Relationship between the Futures and Spot Prices of Soybean, Wheat and Corn. *Asian Journal of Economic Modelling*, 8(1), 76-88.

Malhotra, M. (2015). Evaluating the hedging performance of oil and oilseeds futures in India. Paradigm, 19(2), 184-196.

Nair, S. T. G. (2018) The Effects of Financial Crisis on Hedging Efficiency of Indian Rubber Future Markets. *Financial Statistical Journal*, 1(3).

Naliniprava, T. (2011). Hedge Ratio and Hedging Efficiency: Evidence from Indian Derivative Market. *Journal of Applied Research in Finance (JARF)*, 3(05), 62-75.

Radha, K., & Balakrishnan, S. (2017) The Role of Commodity Futures in Risk Management: A Study of Select Agricultural Commodities. IUP *Journal of Financial Risk Management*, 14(4).

Ranganathan, T., & Ananthakumar, U. (2014). Does hedging in futures market benefit Indian farmers? Studies in Economics and Finance.

Sadefo Kamdem, J., & Moumouni, Z. (2020) Comparison of Some Static Hedging Models of Agricultural Commodities Price Uncertainty. *Journal of Quantitative Economics*, 18, 631-655.

Yang, J., & Awokuse, T. O. (2003) Asset storability and hedging effectiveness in commodity futures markets. *Applied Economics Letters*, 10(8), 487-491.

Zhang, Y., & Choudhry, T. (2015) forecasting the daily dynamic hedge ratios by GARCH models: evidence from the agricultural futures markets. *The European Journal of Finance*, 21(4), 376-399.

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Impact of Firm Specific Factors on the Indian Stock Returns: A Panel Data Approach

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Abstract

The paper examines the role of the firm-specific factors in explaining the cross section of returns of the firms listed on the Indian stock market for the period 2000 to 2022. The study made use of 246 companies listed on BSE 500. A panel data approach was followed to examine the relationship. Eight variables namely current ratio, debt to equity ratio, return on assets, price earning ratio, dividend rate, return on net worth, size, return on capital employed have been used as the explanatory firm specific variables. Panel Unit root, correlation and hausman test were used to find the optimal model for testing the relationship wherein fixed effect regression model was used that highlighted that profitability factors namely return on capital employed, return on total assets along with size of the firm had a significant positive impact on the cross-sectional returns. The study thus provides important insights for the investors, policy makers and academicians to make rational decision.

Keywords: Firm Specific Variables, Fixed Effect, Hausman, Panel Data, Random Effect

Introduction

The development of any economy is concerned not only with the rate of savings and investment but also on how the circular flow of revenue is produced. The assumption that both financial sector expansion and economic development go hand in hand has been supported by numerous

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studies attempting to establish a link between them (Fung, 2009), (Hassan et al., 2011). Residents of a nation seek out different forms of investment as their income rises, and as the capital market expands and becomes more robust, more and more investors are drawn to it. Risk and return are the two important factors that have an impact on the investors' investment decision making process. The investor can predict future asset movements using a variety of methodologies, including the fundamental approach, technical approach, and efficient market hypothesis. Fundamentalists hold that every asset has an inherent value that can differ from the market price and is based on the E-I-C classification of the economic, industry, and company. This is the deciding element that determines whether to buy or sell securities. According to the technical method, share prices exhibit specific patterns that must be recognised by investors before they can decide whether to purchase or sell an asset. The assumption of efficiency among investors and in the purchasing and selling of assets forms the foundation of the terminal theory in this classification. It is believed that there is no consistent pattern in the movement of the stocks, and if the market is efficient, fundamentals and technical analysis are irrelevant because all assets are properly valued. Therefore, a security's high return is only possible due to its higher risk, and vice versa. The idea of diversification introduced by Harry Markowitz (1952) in the Modern Portfolio Theory served as the foundation for the quantitative analysis of the connection between risk and return and it laid the foundation for various theories that tested the relationship between various factors and returns. However, none of the model was able to explain the risk return relationship consistently for all the time periods.

The efficiency of the Indian stock market is investigated in this research by examining the explanatory power of firm specific factors on the future stock returns. If significant risk sources for returns are discovered, a portfolio selection model based on fundamental research may be able to assist in selecting stocks that will provide a significant above-market rate of return, indicating that the Indian stock market is inefficient.

Modern finance gives extreme importance to the asset pricing models specially the SLM capital asset pricing model which provides that the returns across stocks differ only because of the difference in the systematic risk and earning returns more than what is supported by beta is not feasible on a consistent basis. CAPM also provides that unsystematic risk factors that comprises of firm specific factors have no role in the determination of the stock returns. The study is thus an attempt to identify if CAPM is true in its assumptions by identifying the firm factors that explain the cross section of stock returns.

Past studies have shown that stock returns are impacted by various factors like the accounting information, macro-economic factors (Kim &

Wu, 1987), (Amtiran et al., 2017), and other firm-related factors that play an important role in the determination of the stock prices (Kwame Aveh & Awunyo-Vitor, 2017), (Chen et al., 2001), (Sharif et al., 2015) (Pandya & Marvadi, 2016).

In the light of these facts, the present study attempts to investigate the impact of eight firm specific variables on the Indian stock prices. The remaining part of the study is structured as follows: Section 2 provides a brief about the past studies related to the topic. Section 3 provides the data collection and methodology. Section 4 illustrates the results and discussions and the last section 5 provides the conclusions of the study and the suggestions for the future studies.

Review of Literature

Markowitz (1952, 1959) developed the portfolio theory following the earlier base work by Von Neumann and Morgenstern that laid the foundation for future asset pricing theories. Markowitz model was based on the relationship between one factor that is risk which was measured by using standard deviation or variance of the returns and average returns. Sharpe (1964) extended the model further and came up with the concept of systematic risk or beta which has been popularly used by mutual fund managers, portfolio managers, investors and various researchers. It laid down the foundation for one of the widely used model of modern finance that is known as the Capital Asset Pricing Model (CAPM). It was further empirically tested by Lintner (1965), Mossin (1966), Fama (1968), Black, Jensen and Scholes (1972), Sharpe and Cooper (1972), Fama and Macbeth (1973), Blume and Friend (1973), Breen and Korajczyk (1993), Jagannathan and McGrattan (1995), Kothari, Shanken and Sloan (1995) and various other researchers who supported CAPM. However other researchers like Merton (1973), Roll (1977,1981), Dimson (1979), Statman (1980), Banz (1981), Reinganum (1981), Gibbons (1982), Basu (1983), Bhandari (1988), Fama and French (1992, 1996), Davis et al (2000) and others proved empirically that results of CAPM can be further improved by adding additional variables to the one factor CAPM and criticized the model for being too simple and possessing oversimplified assumptions. The insignificance of the simple beta gave rise to studies that factored firm specific factors to explain the cross section of stock returns. The first such study was initiated by Collins, 1957 wherein he identified factors like dividend, net profit, operating earnings and book value as the significant factors that explained the stock returns of the US market. The study laid down the foundation for other studies wherein different factors were used to explain the movement of the stock prices. Das & Pattanayak, 2009 used factor analysis to condense 16 fundamental factors into six common

factors which were then used as the explanatory variables to identify their impact on the stock prices of the 30 scrips that are a part of the Indian broad-based index SENSEX. Results provided that earning power, Returns on Investment, Growth possibility and favourable valuation had a positive impact while high risk and volatility negatively impacted the stock prices thereby highlighting the significance of firm-specific variables on the stock prices. A study by Malhotra & Tandon, 2013 used a sample of 95 companies for the period 2007-12 and using linear regression model found that that firms' book value, earning per share and price-earnings ratio had a significant positive association with firm's stock price while dividend yield provided a significant inverse association with the market price of the firm's stock. Sharif et al., 2015 used panel data regression to identify few firm specific variables like return on equity, book value per share, dividend per share, dividend yield, price earnings, and firm size to be having significant impact on the 41 listed firms of the Bahrain stock exchange during the period 2006-10. Pandya & Marvadi, 2016 used four firm-specific factors – profits, dividend per share, debt to equity ratio and price earning ratio to find its impact on the 30 shares that are part of the BSE SENSEX for the period 2010 to 2014. The results provided a positive and significant relationship between profitability, dividend per share and PE ratio while leverage is found to possess a negative relationship. Aveh & Awunyo-Vitor, 2017 tested the role that accounting information play in the determination of the stock prices in the Ghana stock exchange. The data comprised of all listed firms which were tested using panel regression against the variables Earning per share, dividend per share, dividend yield, book value per share, Return on equity, leverage and market capitalisation. Study found positive and significant relationship between ROE, EPS, book value and market capitalization suggesting that these variables are major determinants of the market price of shares on the Ghana Stock Exchange. Narayan & Reddy, 2018 added an additional modern variable that is Economic value added to the firm-specific traditional factors return on assets, return on equity, return on invested capital to identify the relationship between the variables and stock prices of 408 stocks of the NSE for the period 2002-2017. Results confirmed the positive relationship between return on equity and stock prices. Sukesti et al., 2021 tested the relationship between Leverage, profitability, and Size on the Indonesian stock prices using data of 136 companies for the period 2014-18. Analysis provided that 3 variables that are Debt Equity Ratio, Profit, Return on Assets had a significant positive impact on the stock price thereby justifying the relationship between the fundamental variables and the stock prices.

Table-1: Measurement of Variables

S. No.	Author	Year	Significant Factors	Relation-ship (+ve / -ve)	Country	Technique Used
1	Tudor	2000	PE ratio	+ve	Romania	Regression
			Size	-ve		
2	Das & Pattanayak	2009	Earning power, Returns on Investment, Growth possibility and favourable valuation	+ve	India	Factor Analysis and Regression
			Risk, Volatility	-ve		
3	Malhotra & Tandon	2013	Book value, Earning per share, Price-Earnings ratio	+ve	India	Linear Multiple Regression
			Dividend yield	-ve		
4	Sharif et al.	2015	ROE, BVS, DPS, PE and MCAP	+ve	Bahrain	Pooled OLS and Panel regression
			Dividend Yield	-ve		
5	Pandya & Marvadi	2016	Profitability, PE ratio, dividend per share	+ve	India	Multiple Regression
			Leverage	-ve		
6	Aveh & Awunyo-Vitor	2017	ROE, EPS, book value and market capitalization	+ve	Ghana	Panel Regression
7	Narayan & Reddy	2018	Return on Equity	+ve	India	Panel Data Analysis and Granger Causality Test
8	Ferdaous & Barua	2020	Turnover by value, Volume of Shares	+ve	Bangladesh	Time series, cross-sectional and panel data models
			Firm Beta, Size	-ve		
9	Sukesti et al.	2021	Debt Equity Ratio, Profit, Return on Assets	+ve	Indonesia	Warp PLS statistical test

Source: Author's Compilation

An extensive review of the past studies reveals that the firm specific variables like dividends, price earnings ratio, leverage, earnings per share, return on equity have a significant role in the determination of the share prices. However, the opinions are still mixed and not all studies provide a consensus on the variables that are priced in the stock returns. The paper thus tries to fill the gap by providing a comprehensive study of the 8 firm specific variables on the Indian stock prices.

Data Collection and Methodology

Source: The study collected data from the Centre for Monitoring Indian Economy database PROWESS – The database was used to identify the firms that belonged to BSE 500. The database was also used to extract the financial data of the final eligible companies.

Time Period: The period chosen for the study is 2000 to 2022 for the financial analysis. A sufficiently long time period is able to generate robust and consistent results as it includes all types of phases in the market thereby reducing the impact of any specific trend that is persistent in the short term.

Eligible Companies: Data extraction from PROWESS database provided a total of 246 companies for which the firm specific data was available for all the 23 years. Hence final analysis was done on these 246 companies.

Variables used in the study: Eight variables namely Current ratio, Debt to Equity ratio, return on assets, price earning ratio, dividend Rate, return on net worth, size, return on capital employed have been used as the explanatory firm specific variables to identify its impact on the stock returns of the 246 eligible companies.

Statistical tools used for Analysis: Panel data unit root test, correlation and Panel regression have been used to test the significance of the variables. For this GRETL software and Eviews 9 have been used.

Hypotheses to be tested

H_1: Current ratio has a significant impact on stock returns

H_2: Debt to Equity ratio has a significant impact on stock returns

H_3: Return on Assets (ROA) has a significant impact on stock returns

H_4: Price to Earnings Ratio (PE) has a significant impact on stock returns

H_5: Dividend rate has a significant impact on stock returns

H_6: Return on Net Worth has a significant impact on stock returns

H_7: Market Capitalisation of the firm has a significant impact on stock returns

H_8: Return on Capital employed has a significant impact on stock returns

Results and Discussions

Selection of the Model

According to academics, panel data analysis has two key benefits. The first benefit is that econometric estimations are more accurate than pure cross-sectional or pure time-series data analysis methods (Baltagi, 2005). The second is its capacity to regulate both multicollinearity and individual heterogeneity (Kyereboah and Coleman, 2007). To empirically identify the relationship between the firm specific factors and stock returns, a panel regression procedure has been adopted. Regression using the pooled OLS,

fixed effect and the random effect model have been used for testing the relationship wherein further the Hausman test is utilised to choose between fixed effect estimates and random effect estimates.

Descriptive Statistics

Table-2 below provides the descriptive analysis of the variables – Return on capital employed, return on net worth, return on total assets, market capitalisation, dividend rate, price earning ratio, debt equity ratio, current ratio and stock returns. GRETL has been used to summarise the descriptives of the variables. The summary statistics provides an idea about the variability of the data and hence gives an idea as to in which form the variable has to be used. In the raw/level form or the transformed form. To justify the transformation of the variables, unit root was further conducted. The results are provided in Table-3.

Table-2: Descriptive Statistics

	Mean	Median	Minimum	Maximum	Std. Dev.	C.V.	Skewness	Ex.Kurtosis
ROTA	7.6441	6.8185	-121.07	119.84	9.5885	1.2544	-1.7989	31.210
RONW	15.936	15.813	-2303.8	1250.7	44.640	2.8013	-22.950	1443.9
ROCE	11.597	10.175	1851.8	860.00	36.515	3.1486	-26.000	1355.1
DR	166.77	70.000	0.0000	14500	410.86	2.4635	13.822	347.48
CR	1.8068	1.3122	0.0033360	139.42	3.2047	1.7737	25.721	929.91
DE	1.6708	0.39346	0.0000	4383.0	58.825	35.208	74.387	5537.9
MktCap	1.8658e+005	30601	0.0000	1.7821e+007	6.0062e+005	3.2191	11.138	215.20
PE	135.72	17.999	0.0000	4.7771e+005	6643.6	48.950	71.536	5138.7
BSEReturns	0.70724	0.55245	-23.750	24.299	3.2795	4.6370	0.27409	6.1212

Source: Author's Computation using GRETL

Panel Unit Root Test

The first step in the panel data analysis is to check for the stationarity of the variables as using non stationary variables in the regression produces spurious results. The Levin, Lin, and Chu, Im, Pesaran, and Shin, Augmented Dickey-Fuller, and PP-Fisher tests are used to determine whether the variables are stationary. All of the variables utilised in the models are discovered to be stationary at the level in all of the applied tests. This causes the unit root null hypothesis to be rejected.

Correlation of the Variables

Checking of collinearity amongst the variables is an essential condition to identify the presence of multicollinearity. If explanatory variables have a high degree of correlation amongst them then the chances of a regression providing inefficient results increases as the standard errors inflate leading to difficulty in the interpretation of variables. Table-3 provides the results of the correlation amongst the variables using Eviews 9.

Table-3: Correlation Matrix

	BSE RETURNS	CR	DE	DR	MKTCAP	P/E	ROCE	ROTA	RONW
BSE RETURNS	1.000	-0.019	-0.026	0.0096	-0.026	-0.001	0.003	-0.007	0.004
CR	-0.019	1.000	-0.110	0.0149	-0.005	-0.003	0.020	0.073	-0.027
DE	-0.026	-0.110	1.000	-0.0861	-0.001	-0.007	-0.318	-0.336	0.096
DR	0.009	0.014	-0.086	1.000	0.1674	-0.006	0.294	0.265	0.147
MKTCAP	-0.026	-0.005	-0.001	0.167	1.0000	0.004	0.042	0.026	0.013
P/E	-0.000	-0.003	-0.007	-0.006	0.0041	1.000	-0.018	-0.021	-0.014
ROCE	0.003	0.020	-0.318	0.294	0.0421	-0.018	1.000	0.875	0.558
ROTA	-0.007	0.073	-0.336	0.265	0.0269	-0.021	0.875	1.000	0.492
RONW	0.004	-0.027	0.096	0.147	0.0138	-0.014	0.558	0.492	1.000

Source: Author's Computation

The table provides that there are few variables like ROTA, ROCE and RONW that have some degree of correlation amongst them and that is because they are all the profitability measures. Now the solution to the address multicollinearity lies in wither going for dimension reduction using factor analysis and then using simple multiple regression or to make use of the panel regression that addresses the issue of multicollinearity.

Checking Poolability of data

To ensure that data is suitable for panel regression we have to ensure that the data is not poolable as if the data is poolable, it means that there is neither time effect nor cross sectional effect and hence no heterogeneity and so a simple OLS is sufficient and there is no need of a panel data regression. To check the poolability of the data, GRETL has been used and the results are provided in Table-4.

Table-4: Poolability of Data

Joint Test on Named Regressors		
Test Statistic	**F Value**	**P Value**
	8.22816	0.0000**
Test for Differing Group Intercepts		
Null Hypothesis: The groups have a common Intercept		
Test Statistic	F Value	P Value
	1.38429	0.0001**

**Significant at 1% level of significance

Source: Author's Computation

Checking for Cross Sectional Dependence

As the data is not found to be poolable, so the next step is to check for the presence of cross sectional dependence. This is done using Pesaran CD test and the results are provided in Table-5. The null hypothesis of the test is that there no cross sectional or individual effect.

Table-5: Test for Cross Sectional Dependence

Pesaran CD test for Cross Sectional Dependence		
Test Statistic	**Z Statistic**	**P Value**
	120.060727	0.0000**
Average absolute Correlation		0.292

** significant at 1% level of significance

Source: Author's Computation

Results provide that there is no cross sectional effect proving that there is heterogeneity in the data and the data is suitable for panel regression. Hence the next step is to identify the model for panel regression – Fixed Effect or Random Effect.

Deciding amongst Fixed Effect and Random Effect using Hausman Test

The first step in the panel regression analysis is to identify the suitable model out of the fixed and the random effect. The Hausman fixed random test was conducted to identify the preferred model out of the two models.

The Hausman Specification Test in Table-6 below reveals that the Fixed Effect Model is suitable at the 1% level of significance.

Table-6: Hausman Specification Test

Correlated Random Effects - Hausman Test			
Equation: Untitled			
Test cross-section random effects			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	14.536504	8	0.0068

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
CR	-0.003510	-0.016382	0.000038	0.0356
DE	-0.075442	-0.086026	0.007002	0.8993
DR	0.000164	0.000115	0.000000	0.4685
MKTCAP	-0.000000	-0.000000	0.000000	0.0768
P_E	0.000002	0.000000	0.000000	0.1416
ROCE	0.023350	0.006679	0.000065	0.0384
ROTA	-0.047780	-0.023565	0.000166	0.0603
RONW	0.002310	0.002448	0.000002	0.9213

Source: Author's Computation

Fixed Effect Model

The study made use of the following fixed-effect equation:

$$\text{Stock Returns}_{it} = \beta_1 CR + \beta_1 DE + \beta_1 ROA + \beta_1 PE + \beta_1 DR + \beta_1 RONW + \beta_1 Size + \beta_1 ROC + \alpha_i + \mu_{it}$$

Where α_i represents the unobserved cross-sectional heterogeneity
μ_{it} represents the error term

Results of the fixed effect regression equation are provided in Table-7 below:

Table-7: Fixed Effect Regression Model

Variables	Fixed Effect Panel Regression		
	Coefficient	T Value	P Value
Constant	3.13797	227.6	0.000**
Return on Total Assets	0.002434	3.318	0.0009**
Return on Capital Employed	0.001168	2.618	0.0089**
Return on Net Worth	2.58391e-05	0.2284	0.8193
Debt Equity Ratio	0.002309	0.6114	0.5410
Price Earning Ratio	1.20956e-07	0.4677	0.6400
Market Capitalisation	0.009353	7.3476	2.40e-013**
Current Ratio	-0.00029	-0.5062	0.6128
Dividend Rate	-2.28431e-06	-0.4240	0.6716
Adjusted R^2	0.1384		
F Stat		1.28532	0.0028**

**significant at 1% level of significance

Source: Author's Computation

Results of fixed effect regression provide that three variables namely return on total assets, return on capital employed and market capitalisation have a positive impact on the stock returns for the period under study. The coefficient of determination provides that around 14% of the variation in the stock returns of the selected firms is explained by the firm-specific factors while the remaining 86% is still uncaptured. It can be because of the presence of external factors (macroeconomic factors), and behavioural factors amongst others. Though the F statistic value of 1.28532(0.0028) provides that the model is significantly able to explain the cross-section of returns.

Conclusion and Suggestions for Future Research

The present study was undertaken to identify the impact of firm specific variables namely return on capital employed, return on net worth, return on total assets, market capitalisation, dividend rate, price earning ratio, debt equity ratio and current ratio on the stock returns. The data made use of the 246 companies that were a part of the BSE 500 companies for a continuous period of 23 years from 2000 to 2022. The data was extracted from the CMIE database PROWESS and GRETL and Eviews 9 software was used to do the analysis of the panel data.

The study implemented panel unit root, correlation, panel regression (FEM and REM) to get the results. The results highlighted three important

factors – return on capital employed, return on total assets and size to have a significant and positive impact on the stock returns (Narayan & Reddy, 2018). The explanatory power of the model was identified to be 14% providing that other factors like the macro-economic or behavioural factors too can have an impact on the returns of the stocks other than the intra firm financial variables.

The results thus also provide a key area wherein future research can be carried on to identify an exhaustible model that is able to explain the stock returns. It can make use of the firm specific variables, macro-economic variables, behavioural factors and lags of the dependent as well as independent variables. Dynamic panel regression can thus be used to identify if the inclusion of the lagged variables increases the explanatory power of the model vis-à-vis the firm specific model (Sebnem Er and Bengu Vuran, 2012). Also, a sectoral analysis can be carried out for the firms to identify if there are separate variables that impact a particular sector. The current study on the whole provides a detailed analysis of the variables that can be crucial for investors, policy makers and academicians to understand the movement in the stock prices in the long run.

References

Amtiran, P. Y., Indiastuti, R., Nidar, S. R., & Masyita, D. (2017). Macroeconomic factors and stock returns in APT framework. *International Journal of Economics and Management*, *11*(SpecialIssue1), 197-206.

Aveh, F. K., & Awunyo-Vitor, D. (2017). Firm-specific determinants of stock prices in an emerging capital market: Evidence from Ghana Stock Exchange. *Cogent Economics and Finance*, *5*(1). https://doi.org/10.1080/23322039.2017.1339385

Baltagi, B. H. (2005). Econometric analysis of panel data. New York, NY: Wiley

Chen, C. J. P., Chen, S., & Su, X. (2001). Is accounting information value-relevant in the emerging Chinese stock market? *Journal of International Accounting, Auditing and Taxation*, *10*(1), 1-22. https://doi.org/10.1016/S1061-9518(01)00033-7

Chughtai, A. R., Azeem, A., & Ali, S. (2014). Determining the Impact of Dividends, Earnings, Invested Capital and Retained Earnings on Stock Prices in Pakistan: An Empirical Study. *International Journal of Financial Management*, *4*(1).

Collins, J. (1957). How to Study the Behavior of Bank Stocks. *Financial Analysts Journal*, *13*(2), 109-113. https://doi.org/10.2469/faj.v13.n2.109

Das, N., & Pattanayak, J. K. (2009). Analysis of the fundamental factors affecting the market price of shares constituting the Indian index: a study of SENSEX. *International Journal of Accounting and Finance*, *1*(3), 323. https://doi.org/10.1504/ijaf.2009.026626

Fung, M. K. (2009). Financial development and economic growth: Convergence or divergence? *Journal of International Money and Finance*, *28*(1), 56-67. https://doi.org/10.1016/j.jimonfin.2008.08.001

Hassan, M. K., Sanchez, B., & Yu, J. S. (2011). Financial development and economic growth: New evidence from panel data. *Quarterly Review of Economics and Finance*, *51*(1), 88-104. https://doi.org/10.1016/j.qref.2010.09.001

Kyereboah□Coleman, A. (2007). The impact of capital structure on the performance of microfinance institutions. The Journal of Risk Finance, 8(1), 56–71.

Kim, M. K., & Wu, C. (1987). Macro□Economic Factors and Stock Returns. *Journal of Financial Research*, *10*(2), 87-98. https://doi.org/10.1111/j.1475-6803.1987.tb00481.x

Kwame Aveh, F., & Awunyo-Vitor, D. (2017). *Firm-specific determinants of stock prices in an emerging capital market: Evidence from Ghana Stock Exchange*. https://doi.org/10.1080/23322039.2017.1339385

Malhotra, N., & Tandon, K. (2013). Determinants of Stock Prices: Empirical Evidence from NSE 100 Companies. *IRACST-International Journal of Research in Management & Technology*, *3*(3), 2249-9563.

Narayan, P., & Reddy, Y. V. (2018). Impact of financial performance indicators on stock returns: Evidence from India. *International Journal of Business and Society*, *19*(3), 762-780.

Pandya, H. B., & Marvadi, C. R. (2016). Determinants of share prices in India: A study of BSE Sensex. *ZENITH International Journal of Business Economics & Management Research*, *6*(4), 1-7. https://www.indianjournals.com/ijor.aspx?target=ijor:zijbemr&volume=6&issue=4&article=001

Sebnem Er and Bengu Vuran. (2012). Factors Affecting Stock Returns of Firms Quoted in ISE Market: A Dynamic Panel Data Approach. *International Journal of Business and Social Research*, *2*(1), 108-121. https://doi.org/10.18533/ijbsr.v2i1.209

Sharif, T., Purohit, H., & Pillai, R. (2015). Analysis of Factors Affecting Share Prices: The Case of Bahrain Stock Exchange. *International Journal of Economics and Finance*, *7*(3). https://doi.org/10.5539/ijef.v7n3p207

Sukesti, F., Ghozali, I., Fuad, F., Almasyhari, A. K., & Nurcahyono, N. (2021). Factors Affecting the Stock Price: The Role of Firm Performance. *Journal of Asian Finance, Economics and Business*, *8*(2), 165-173. https://doi.org/10.13106/jafeb.2021.vol8.no2.0165

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Economic Significance of Priority Sector Lending and Its Impact on Bank Sustainability

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Abstract

The present study aims at the credit disbursement pattern of different commercial banks and its effect on their own sustainability and the economy as a whole. Regression has been applied on a panel data of 34 commercial banks collected over a period of 11 years from 2010-11 to 2020-21. The results show that advances to priority sectors have a significant effect on the GNPA reported by the commercial banks operating in Odisha and thus, negatively affecting their efficiency and financial sustainability. The further analysis suggested that the priority sectors play a significant role in the economic growth of the state. However, deposits mobilised in the state are diverted less towards the priority sectors than expected. The finding will help bankers in strategy formulation and policy development.

Keywords: Agriculture, Bank Performance, Economic Development, GNPA, MSME, Priority Sector Lending

Introduction

Indian economy has gone through many structural changes since independence and the concept of balanced economic growth has been promoted through many policies. To channelize credit to the sectors prioritized through the Five-Year Plans by the Government, Priority Sector Lending concept was introduced. Finance and credit are directed according to these plans to sectors like agriculture, MSME units, and other weaker sections which would have faced challenges in the absence of such arrangement. The apex bank, from time to time, identifies and defines the

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priority sectors and issues directives to ensure the banks adhere to the objective of the scheme. Presently, the Reserve Bank of India has set a target of 40 per cent of the adjusted net bank credit or credit equivalent amount of off-balance sheet exposure to be channelized to Agriculture, MSME, Export credit, Education, Housing, Social infrastructure, Renewable energy and Others allied industries. In India, a majority of the local economies are sustained by these sectors (Sweetline, 2017) and this arrangement has led to an improvement in their institutional credit access and reduced the credit gap. But it is generally argued that priority sector lending has been a major contributing factor to the rising NPA in the banking industry (Goel, 2018;Gaur et al., 2020; Gaur et al, 2019).

Keeping the context in view, the present study highlights the determinants of bank credit from the viewpoint of the financial intermediaries. Also, the occurrence of non-performing assets in the balance sheet of the banks is highly dependent on the nature of the firms and the economic condition and business environment specific to a region (Narayan and Narayan, 2013). Thus, the contribution of priority and non-priority sector advances to the non-performing assets specific to Odisha has been analysed in the study. It is further investigated to examine the economic relevance of priority sector lending arrangement in the state.

Review of Literature

Bank Credit and Economy

Many theories have established the fact that monetary policies in favour of bank credit helps to boost economic development (Kirikkaleli & Athari, 2020; Levine *et al.,* 2000, Ntarmah, 2020, Krishnankutty, 2011, Thierry *et al.,* 2016). In bank-driven economies like India, the role of banks in the financial intermediation process becomes more essential. In India, there are many sectors which are dependent on bank credit as a major source of finance (Singh *et al.,* 2016). This includes agriculture, medium, small and micro enterprises, and such other sectors which are significant for the economic and occupational sustenance of the local economies (Gaur and Mohapatra, 2020; Bhue *et al*., 2019). The Reserve Bank of India through its Priority Sector Lending programme ensures a steady flow credit to these sectors. This allows a multidimensional effect in terms growth, urbanization, development, empowerment and reduction of inequalities between rural and non-rural areas (Arora, 2009). Credit to priority sectors and economic growth have a bidirectional and positive relationship. It implies that credit to the priority sectors is essential for the balanced economic development (Sharma and Kautish, 2020; Awad and Karaki, 2019). Further, the economic condition and the rate of development in return, direct the demand for and supply of credit in the state (Singh *et al*.,

2016; Vithessonthi, 2016). Krishnankutty (2011) analysed the role of bank credit in the growth of economy in seven North eastern states of India. It was found that credit to agriculture, trade, transportation, artisan and village industries has a significant and positive relationship with the per capita NSDP. In a similar study, Arora (2009) in Uttar Pradesh (UP) was found that though credit has assisted in enhancing the total output in the state, but the credit inequalities has widened between urban and rural, men and women; and small and large borrowers. It is thus, evident that the relationship of bank finance and growth varies across different economies. Economy-specific characteristics along with the interactive development with the financial sector produce the long-run effect on the growth of the states (Owen & Temervary, 2014).

Determinants of Credit

Apart from state-specific factors, the growth in deposits also plays a determinant role in credit expansion of an economy (Levin *et al*., 2000; Guo and Stepanyan, 2011; Singh *et al*., 2016; Owen and Temesvary, 2014). The intermediary role of financial institutions ensures the cyclical conversion of deposits into credit. The deposits of the individuals and firms are however, dependent on the level of economic activity in the particular period (Das and Maiti, 1998). An active economy boosts the earnings of the households and firms, hence leads to increased savings and deposits at their disposal (Imran and Nishat, 2013). It enables the banks to cater to the institutional needs of the business firms, may it be priority or non-priority. Similarly, credit-deposit ratio as a factor of financial health of the banks has a significant influence on their credit risk exposure (Rahman *et al.,* 2017, Jegadeeshwaran and Basuvaraj, 2019) and thus influences the quantum of credit flow in the economy (Sahoo and Goel, 2020).

A number of socio-economic, individual specific and policy factors also influence the availability and access of credit to the rural entities (Awad and Karaki, 2019; Sahu and Rajasekhar, 2005). Kumar (2015) traced the influence of factors from the demand side of credit viz. education, gender, caste affiliation and asset ownership of the individuals in relation to their credit access. Moreover, the study documented a positive association of institutional credit with farm income, which is a major source of livelihood for the rural economy.

Bank Credit and Non-performing Assets

Rising incidence of non-performing assets in the Indian banks is identified as one of the significant reasons of systematic bank failures (Bardhan *et al.,* 2019). Priority sector credit has been associated with the non-performing assets that have been accumulating in Indian banking industry (Goel, 2018; Gaur & Mohapatra, 2019; Rahman *et al.,* 2017). This has dissuaded the purpose behind the arrangement and has demotivated the banks to meet

the priority sector targets. As against this, Kadanda & Raj (2018) found that in 2016 only 25 per cent of total NPAs of scheduled commercial banks could be associated with priority sector credit and opined that large and concentrated credit is the major risk element in the bank portfolio. Further, Goel (2018) found that the incidence of NPA due to priority sector credit is significant in public sector banks. Several other factors such as capital adequacy, operating inefficiency, bank size, economic condition, high inflation significantly impact the health of loan assets and ultimately the profitability of banks (Jegadeeshwaran & Basuvaraj, 2019; Mishra *et al.*, 2019).

Thus, we can say that the issue of non-performing assets is still debatable topic in the context of Indian banking industry. It is also argued that even though preferential lending policy promotes the output of the local economy in the short run (Vittas and Cho, 1996; Ho & Saadaoui, 2020), it results in sacrifice in consumption, decline in skill premium and welfare loss due to investment in inefficient entities in the long run (Bai *et al*., 2020). Further, Bhue *et al*. (2019) have highlighted the need to cover the gap between the interest of the economic groups and the interest of the commercial banks. They believe that the direction of credit to the priority sectors should not be governed by threats of financial penalties, political pressure or negative performance appraisals.

Keeping in view these findings of the reviewed literature, the present study stressed two basic variables i.e., deposits and C-D ratio as the determinant of credit and to identify the major sector accountable for the occurrence of NPA in the context of Odisha using panel regression. This will help to capture the vulnerability of the banks functioning in the state towards the arrangement. The first segment of the study include introduction, review of prior literature and objectives. The second part emphasizes the development of a scientific methodology to achieve the objectives followed by the last section which summarizes the findings and implications.

Objectives

The failure of banks in meeting the prescribed targets for priority sector lending has remained a matter of concern for the economy. The priority sector norms have been set to ensure sufficiency of credit flow into the neglected sectors of the economy. The non-achievement of these targets means a part of the credit remaining unutilized for the desired purpose. Thus, it is imperative to analyse the underlying factors that are resulting in this credit gap. The present research work focuses the following objectives:

- To examine the effect of priority and non-priority sector credit on the gross non-performing assets of the banks
- To investigate the factors determining the credit disbursement to priority and non-priority sectors

- To investigate the economic significance of priority sector credit

Research Methodology

Model and Description

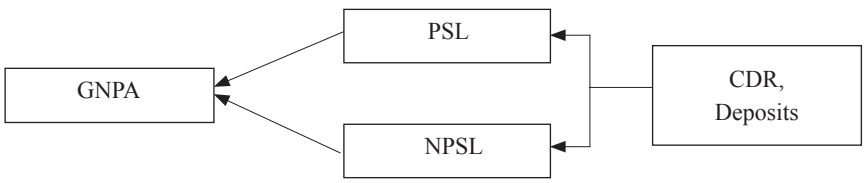
To obtain robust results and to realize the benefit of larger data set, panel data has been employed. Panel models also capture the bank-level heterogeneity present in the data. The hypothesized relationship (Figure-1) among the variables has been examined by employing the following models:

$$GNPA_{it}=\alpha_0+\beta_1 PSL_{it}+\beta_2 NPSL_{it}+\varepsilon_{it} \quad ...(1)$$

$$PSL_{it}=\alpha_0+\beta_1 CDR_{it}+\beta_2 DEP_{it}+\varepsilon_{it} \quad ...(2)$$

$$NPSL_{it}=\alpha_0+\beta_1 CDR_{it}+\beta_2 DEP_{it}+\varepsilon_{it} \quad ...(3)$$

Figure-1: Hypothesized Relationship



Source: Authors' own compilation

Justification of Variables

The growing non-performing assets of the banking sector are the major concern of the Indian banking industry. Following the dilemma in prior literatures where a few research have associated GNPAs with priority sector and another group of researchers are with the argument that non-priority sectors are the major contributors of non-performing assets in the industry, we have designed the model (1) that will analyse the direction and quantum of effect of priority (PSL) and non-priority sector (NPSL) advances on the gross non-performing assets (GNPA) of the commercial banks. The demand for credit can be entertained by the banks with efficient deposit mobilisation (DEP) and liberal credit-deposit ratio (CDR). Thus, the effect of the variables i.e., CD ratio and deposits has been examined in model (2) and (3). The summary of all the variables used in the study has been listed in Table-2.

Data

The data, for the purpose of the study has been extracted from the reports prepared by the Lead Bank of Odisha for State Level Bankers' Committee and Odisha Economic Survey. The time frame for the analysis extends over a period of 11 years from 2010-11 to 2020-21. Out of all the commercial banks that were operative during the period, 34 banks with consistent data availability, were included in the panel.

Table-2: Description of Variables

Variables	Measurement	Description
Gross Non-performing Assets (GNPA)	Absolute value of GNPA	It is used for measuring sustainability of banks.
Priority sector lending (PSL)	Credit to Agriculture and allied activities + MSME advances + advances to Other priority sectors	Concessional credit provided to agriculture, MSME, export, education, housing, social infrastructure, renewable energy, etc.
Non-priority Sector Lending (NPSL)	Advance Utilised in the State-Priority Sector Lending	Credit to sectors other than priority sectors
Credit-Deposit ratio (CDR)	(Advance Utilised in the State/ Deposits) *100	Proportion of deposits going towards credit markets
Deposits (DEP)	Absolute value of total deposits	Total of deposits mobilised in the State
Gross State Domestic Product (GSDP)	GSDP at constant prices	State Domestic Product at constant prices with base 2011-12

Source: Authors' own compilation

Results and Discussion

The results and interpretation of the models have been explained in this section.

Descriptive Summary

Table-3 demonstrates the summary statistics of the variables used in the models. As it can be seen from the table, the sample commercial banks of the state registered a mean GNPA of 198.34 crores in the period under study. The credit to priority sector has averaged to 1390.97 crores which is lesser than credit to non-priority sectors with a mean value of 1909.44 crores. The average credit-deposit ratio of the banks stood at 69.15 which signifies that 69.15 percent of the average deposit mobilised in the state i.e., 6085.52 crores has been channelled back into the economy in the form of credit.

Table-3: Descriptive Summary

Variable	Mean	Standard Deviation	Minimum	Maximum
GNPA	198.3431	471.4498	0	4114.04
PSL	1390.97	2177.048	0	14270.29
NPSL	1909.446	4998.783	0	51920.69
CDR	69.14808	48.50942	0	414.59
DEP	6086.527	14114.39	0	134285.3
GSDP	305481.3	66475.14	197529.9	402383.2

Total observations: 374

Source: Authors' own compilation

Correlation Matrix

The robustness of the predictor variables requires that there should be no high degree of correlation among them. A high degree of correlation can create the problem of multicollinearity between the predictor variables. The pairwise correlation matrix has been presented in Table-4. As it is seen that, most of the variables are not strongly correlated with each other, except for two cases where there exists a strong correlation between PSL with NPSL and DEP and NPSL with DEP. Therefore, the models have also been tested using variation inflation factor to scrutinise any further issue of multicollinearity.

Table-4: Pairwise Correlation Between Independent Variables

	PSL	NPSL	CDR	DEP
PSL	1.0000			
NPSL	0.7155*	1.0000		
CDR	0.0095	0.0210	1.0000	
DEP	0.8702*	0.8718*	-0.0295	1.0000

Source: Authors

*Significance exists at 0.05 level.

Diagnostic Tests

Preliminary diagnostic tests have been performed to examine the appropriateness and robustness of the hypothesised models under study. The initial test to choose between fixed effect and random effect has been performed using Hausman test. The results of Hausman test support for fixed effect in Model (1), (2) and (3). To test the efficiency of the coefficients of these models, it is necessary to check for the presence of heteroskedasticity and the problem of autocorrelation in the sample panel.

Table-5: Diagnostic Tests

	Model 1		Model 2		Model 3	
Hausman Test	$\chi2(2)=128.37$	p=0.00	$\chi2(3)=47.55$	p=0.00	$\chi2(2)=9.52$	p=0.00
Woolridge Test (Autocorrelation)	F(1,33)=18.199	p=0.00	F(1,33)=11.810	p=0.00	F(1,33)=3157.992	p=0.00
Modified Wald Test	$\chi2(34)=2.6e+11$	p=0.00	$\chi2(34)=18161.2$	p=0.00	$\chi2(34)=3.4e+06$	p=0.00
Model Accepted	Prais-Winsten		Prais-Winsten		Prais-Winsten	
VIF (Mean)	2.05		1.00		1.00	

Source: Authors' own findings

Woolridge test for autocorrelation signifies the presence of problem of autocorrelation in the panel. The Modified Wald test was also significant for the presence of panel level heteroskedasticity in the data set. Presence of panel level heteroskedasticity makes the estimates of fixed effect model unreliable (Greene, 2003). Thus, Prais-Winsten regression models have been applied and panel corrected standard errors (PCSE) have been used to report reliable estimates for the regressors. Prais-Winsten regression

takes care of the problem of autocorrelation, heteroskedasticity and panel level heterogeneity and deduces robust estimates of the predictor variables (Greene, 2018). As the correlation matrix reported strong correlation between few explanatory variables, their VIF has been strictly analysed to avoid any problem of multicollinearity in the models. The mean VIF for all the predictor variables is less than 5, which ensures that there is no presence of multicollinearity (Kim, 2019).

Empirical Results

Table-6: Regression Results for Model (1), Dependent Variable: GNPA

Variables	Coefficients	PCSE	z-Value	p-Value	Remarks
PSL	0.1648	0.0395	4.17	0.000	Significant
NPSL	0.0016	0.0166	0.10	0.919	Insignificant
Constant	-17.567	25.231	-0.70	0.486	Insignificant

Note: Number of observations: 374; Number of groups: 34; R-squared= 0.4374; Model fit: Wald $\chi 2(2) = 24.34(0.000)$

Source: Authors' own findings

It is found in the above table the Wald $\chi 2$ is sufficiently high and significant. This testifies that overall fitness of model (1) is fairly good. The R-squared value stood at 0.4374 which means that 43.74 percent of the change in the dependent variable is explained by the explanatory variable. It is clear that priority sector lending has significant and positive impact on gross non-performing asset. With one unit increase in PSL credit, non performing asset is increased by 0.16 units. Non-priority sector advances have no significant impact on NPA.

Table-7: Regression Results for Model (2) and (3)

Variables	Model 2		Model 3	
	PSL		NPSL	
	Coefficients	PCSE	Coefficients	PCSE
CDR	1.8315* (5.56)	0.3295	4.0938* (3.40)	1.2033
DEP	0.1291* (5.96)	0.0217	0.3236* (4.85)	0.0667

Note: Number of observations: 374; R-square for model 1 and model 2 are .38 and .63 respectively. Prob (Wald $\chi 2$) are significant at 0.01 level for both the models.
Source: Authors' own findings
*Significance exists at 0.05 level.
z-value of variables presented in parantheses.

Further analysis in Model (2) and (3) explains the determining variables for mobilisation of credit to priority and non-priority sector. R^2 explain 38 and 62.51 percent of variation in the dependent variables for both the models respectively. The aptness of the model as explained by Wald $\chi 2$ was also found as significant for both the models. Regression results shows that deposits mobilised by the banks and CD ratio have a significant

impact on both priority and non-priority sector advances. With one unit of increase in deposits will lead to 0.12 unit increase in advances to the sector as against 0.32 units increase in credit to non-priority sectors. The CD ratio of the bank is found to have direct influence on the quantity of credit disbursed to both the sectors. However, the non-priority sector has been observed to have relatively more benefit from each unit of increase in CDR as compared to priority sector. The non-priority advances will increase by 4.09 units with one unit increase in CDR. On the other hand, the priority sector will increase by only 1.83 units which are significantly low as compared to the increase in non-priority sector advances. The coefficients of deposits mobilised by the banks are 0.1291 and 0.3237 for PSL and NPSL respectively. This shows that the deposits have a significant influence on the credit mobilisation in the state irrespective of the sector. However, the non-priority sector seems to be more dependent upon the deposits than the priority sector.

Table-9: Relationship of GDP with Credit

Variables	Correlation Statistics
GSDP – PSL	0.963***
GSDP – NPSL	0.892***
GSDP – Agriculture	0.939***
GSDP – MSME	0.965***
GSDP - Other Priority Sectors Lending	0.457

Note: GSDP- Gross state domestic product
Source: Authors' own compilation
***Significance exists at 0.01 level.

A significant correlation is found between GSDP with all credit disbursements at 1 per cent level except other priority sector lending. The correlation between PSL and GSDP is .96 which is highest among all. The correlation between NPSL and GSDP is .89. The correlation of agriculture credit and MSME credit is also more than .9. Other priority sector lending includes credit to education, export, social infrastructure, renewable energy etc. There is no significant correlation of contribution to such sectors with GSDP. Thus, lending to such sectors is pivotal in economic development of the state.

Conclusion and Policy Implications

The rising level of non-performing assets in the portfolio of the banks is a long existent trait that is limiting the efficiency of the financial sector of India. This issue has also engulfed the credit creation capacity of the commercial banks. The priority sector lending arrangement has been set to create synergy along with non-priority sectors that will help to boost the economic growth of the country. However, the accumulating non-

performing loans are acting as a setback that is demotivating the banks to advance credit to non-profitable sectors of the economy (Sathye, 2003).

The present study thus examined the quantum of contribution of priority and non-priority sector advances on the growing GNPA of the commercial banks. The results made it clear that credit disbursed to priority sectors is contributing to the GNPA of the banks as against the results from Gaur and Mohapatra (2020). However, the economic significance of these sectors cannot be ignored (Vittas and Cho, 1996). It is thus important for the banks to balance the quantum of credit disbursed to various sectors, so that the interest of economy and the commercial banks can exist concurrently. Growing economy and healthy balance sheet influences the banks' risk forte (Shijaku and Kalluci, 2013). Their ability to absorb risk is reflected in their credit-deposit ratio. The banks which are willing to take risk liberalize their CD ratio which in return leads to an increase in the credit infusion to the economy which is also supported by Iqbal and Sami (2017). It is thus, an internal policy decision and seems not to affect the quantum of credit to priority sector. This result is in contradiction to the results derived by Sahoo and Goel (2020). This can be justified by the fact that RBI has made it compulsory for the banks to mobilise at least 40 percent of their credit towards PSL. This indirectly gives the banks a freedom to experiment with the remaining 60 percent of its asset portfolio and thus, has been seen to influence the advances to non-priority sector.

Banks are a major player in the financial intermediation process. They have a significant role to mobilise deposits from the households and firms, especially in India. The credit creation mechanism enables the banks to convert these deposits into advances which are channelized back into the economy (Beltratti & Stulz, 2012). As against the argument of Imran and Nishant (2013) the results have reflected in support of our hypothesis. Both the priority and non-priority sector advances are significantly dependent on the efficiency of deposit mobilisation. In addition to the deposits, the government also supports the priority sectors by injecting liquidity through various packages. As evident from the results, priority sector advances are less dependent on the deposits than the non-priority sectors. These results are in conformity with Sulaiman (2016) who studied the impact of sagging CD-ratio in the context of Kerala.

The major justification behind the priority sector credit arrangement is that these sectors are an inherent and significant part of the economy. However, it cannot be ignored that the scale of operations of these units is substantially small as compared to the well-established age-old large-scale industries. And thus, they are highly dependent on the economic condition of their operation (Cowling et al., 2014). Any economic shock leads to high degree of loss to these units (Angadi, 1983). Whereas favourable economic conditions will ensure lower chance of defaults in loans and advances (Ghosh, 2015).

Keeping in view all the elements of the study, capping a part of assets of commercial banks for priority sectors is apt to ensure the continuation of credit flow to this less-profitable part of the economy. The issue of their contribution to GNPAs can be addressed through a stronger customer-relationship management policy of banks. This will help the banks to connect with its customers and counsel for an efficient utilisation of resources. The government should also strengthen the redressal forums (Uppal, 2009) and accelerate the development of financial sector so that the banks can realise their non-performing loans in lesser amount of time and perform efficiently (Herwartz and Walle, 2014). If dragged for longer period, the rising level of bad loans will endanger the survival of the banks and disrupt the balance of credit in the economy.

Limitations and Scope for Further Research

The present study has been presented with view of the economic and financial characteristics of the state of Odisha. The number of states may be increased to further capture the heterogeneity present in different economies and its impact on directed credit programs. The results have been drawn from a panel of data spread over a period of 11 years and only 34 commercial banks out of the total of 42 banks operating in the State. The findings may vary if the window is enhanced by adding more variables and extending the period of study.

References

Angadi, A. V. B. (1983). Banks Advances to Priority Sectors An Enquiry into the Causes of Concentration. *Economic and Political Weekly*, *18*(13), 503-505.

Arora, R. U. (2009). Bank credit and economic development: an empirical analysis of Indian states. *Journal of Asian Public Policy*, *2(1)*(March 2009), 85-104. https://doi.org/10.1080/17516230902734502

Awad, I. M., & Karaki, M. S. Al. (2019). The impact of bank lending on Palestine economic growth : an econometric analysis of time series data. *Financial Innovation*.

Bai, C., Liu, Q., & Yao, W. (2020). Earnings inequality and China ' s preferential lending policy. *Journal of Development Economics*, *145*(April 2019), 102477. https://doi.org/10.1016/j.jdeveco.2020.102477

Bardhan, S., Sharma, R., & Mukherjee, V. (2019). Determinants of Bank-specific Non-performing Assets : An Application in Indian Banking. *Journal of Emerging Market Finance*, *18*(1S), S1-S34. https://doi.org/10.1177/0972652719831546

Beltratti, A., & Stulz, R. M. (2012). The credit crisis around the globe : Why did some banks perform better ? *Journal of Financial Economics*, *105*, 1–17. https://doi.org/10.1016/j.jfineco.2011.12.005

Bhue, G., Prabhala, N., & Tantri, P. (2019). Can Small Business Lending Programs Disincentivize Growth ? Evidence From India's Priority Sector Lending Program. *Indian School of Business*.

Cowling, M., Liu, W., Ledger, A., & Zhang, N. (2015). What really happens to small and medium-sized enterprises in a global economic recession ? UK evidence on sales and job dynamics. *International Small Business Journal*, *33*(5), 488-513. https://doi.org/10.1177/0266242613512513

Das, P. K., & Maiti, P. (1998). Bank Credit , Output and Bank Deposits in West Bengal and Selected States. *Economic and Political Weekly Stable*, *33*(47), 3081-3088. Retrieved from https://www.jstor.org/stable/4407420

Gaur, D., & Mohapatra, D. R. (2019). Non-Performing Assets In India : Priority Vs Non- Priority Sector Lending. *NMIMS Management Review*, *XXXVII*(August), 53-65.

Gaur, D., & Mohapatra, D. R. (2020). The nexus of economic growth , priority sector lending and non-performing assets : case of Indian banking sector. *South Asian Journal of Business Studies*, *10*(1). https://doi.org/10.1108/SAJBS-01-2020-0010

Gaur, D., Mohapatra, D. R., & Jena, P. R. (2020). Asset Quality of Indian Banking Sector and the Role of Government Directed. *Journal of Critical Reviews*, *7*(15). https://doi.org/10.31838/jcr.07.15.299

Ghosh, A. (2015). Banking-industry specific and regional economic determinants of Non-Performing Loans: Evidence from US States. *Journal of Financial Stability*, *20*(October), 93-104. https://doi.org/10.1016/j.jfs.2015.08.004

Goel, P. (2018). Cyclicality of non-performing assets: Evidence from Indian banking industry. *Journal of Commerce & Accounting Research*, *7*(3), 13-19.

Greene, W. H. (2003). Heteroscedasticity. In *Econometric analysis* (5th ed., pp. 215-249). Upper Saddle River, NJ: Prentice Hall.

Greene, W. H. (2018). (8th ed.). Pearson. Retrieved December 13, 2021.

Guo, K., & Stepanyan, V. (2011). *Determinants of Bank Credit in Emerging Market Economies*.

Herwartz, H., & Walle, Y. M. (2014). Determinants of the link between fi nancial and economic development : Evidence from a functional coef fi cient model. *Economic Modelling*, *37*, 417-427. https://doi.org/10.1016/j.econmod.2013.11.029

Ho, S., & Saadaoui, J. (2020). *Bank credit and short-run economic growth: a dynamic threshold panel model for ASEAN countries* (Issue November). https://doi.org/10.13140/RG.2.2.20398.33602

Imran, K., & Nishat, M. (2013). Determinants of bank credit in Pakistan : A supply side approach. *Economic Modelling*, *35*, 384-390. https://doi.org/10.1016/j.econmod.2013.07.022

Iqbal, B. A., & Sami, S. (2017). Role of banks in financial inclusion in India. *Contaduría y Administración*, *62*(2), 644-656. https://doi.org/10.1016/j.cya.2017.01.007

Jegadeeshwaran, M., & Basuvaraj, M. (2019). Impact of economic and banks specific determinants of credit risk of select Indian private sector banks in the post financial crisis period. *International Journal of Scientific & Technology Research*, *8*(09), 1162-1166.

Kadanda, D., & Raj, K. (2018). Non- performing assets (NPAs) and its determinants: a study of Indian public sector banks. *Journal of Social and Economic Development*, *20*, 193-212. https://doi.org/10.1007/s40847-018-0068-0

Kirikkaleli, D., & Athari, S. A. (2020). Time-frequency Co-movements between Bank Credit Supply and Economic Growth in an Emerging Market: Does the Bank Ownership Structure Matter? *North American Journal of Economics and Finance*, *54*(November), 101239. https://doi.org/10.1016/j.najef.2020.101239

Kim, J. H. (2019). Multicollinearity and misleading statistical results. *Korean Journal of Anesthesiology*, *72*(6), 558-569. https://doi.org/10.4097/kja.19087

Krishnankutty, R. (2011). Role of banks credit in economic growth: A study with special reference to North east India. *The Economic Research Guardian*, *1*(2), 60-71.

Kumar, A. (2015). Dynamics of Access to Rural Credit in India: Patterns, Determinants and Implications. *Agricultural Economics Research Review*, *28*, 151–166. https://doi.org/10.1007/978-981-10-6014-4

Levine, R., Loayza, N., & Beck, T. (2000). Financial intermediation and growth: Causality and causes. *Journal of Monetary Economics*, *46*, 31-77.

Mishra, A. K. (2020). Macro-economic determinants of non-performing assets in the Indian banking system: A panel data analysis. *International Journal of Finance & Economics*, *2020*, 1-16. https://doi.org/10.1002/ijfe.1989

Narayan, P. K., & Narayan, S. (2013). The short-run relationship between the financial system and economic growth: New evidence from regional panels. *International Review of Financial Analysis*, *29*(2013), 70-78. https://doi.org/10.1016/j.irfa.2013.03.012

Ntarmah, A. H., Kong, Y., & Manu, E. K. (2020). Investigating the dynamic relationships between credit supply, economic growth, and the environment: empirical evidence of sub-regional economies in Sub-Saharan Africa. *Environmental Science and Pollution Research*, *28*(2021), 5786-5808.

Owen, A. L., & Temesvary, J. (2014). Heterogeneity in the growth and finance relationship: How does the impact of bank finance vary by country and type of lending? *International Review of Economics and Finance*, *31*(2014), 275–288. https://doi.org/10.1016/j.iref.2014.02.007

Rahman, M. A., Azaduzzaman, M., & Hossin, M. S. (2017). Impact of Financial Ratios on Non-Performing Loans of Publicly Traded Commercial Banks in Bangladesh. *International Journal of Financial Research*, *8*(1). https://doi.org/10.5430/ijfr.v8n1p181

Sahoo, B. P., & Goel, P. (2020). Impact of Banks' lending pattern on Total priority sector lending (PSL): An empirical approach. *Paideuma Journal*, *XIII*(Vii), 213-218.

Sahu, G. B., & Rajasekhar, D. (2005). Urban Bias In the Flow of Funds and Deposit Mobilisation : Evidence from Karnataka, India. *Savings and Development*, *29*(4), 415-440.

Sathye, M. (2003). Efficiency of banks in a developing economy: The case of India. *European Journal of Operational Research*, *148*, 662-671. https://doi.org/10.1016/S0377-2217(02)00471-X

Sharma, R. (2020). Linkages between Financial Development and Economic Growth in the Middle-Income Countries of South Asia: A Panel Data Investigation. *Vision*, *24*(2). https://doi.org/10.1177/0972262920923908

Shijaku, G., & Kalluci, I. (2017). Determinants of bank credit to the private sector : The case of Albania. *Munich Personal RePEc Archive*. Retrieved from: https://www.researchgate.net/publication/317380525_Determinants_of_bank_credit_to_the_private_sector_The_case_of_Albania

Singh, C. (2016). Economic Growth and Banking Credit in India. *IIM Bangalore Working Paper No. 531*.

Sulaiman, E. (2016). Sagging Credit-Deposit Ratio of Commercial Banks in Kerala. *Consortia*, *3*(1), 5-17.

Sweetline, A. U. (2017). Priority sector lending in India- An analysis. *International Journal of Current Advanced Research*, *6*(11), 7829-7831.

Uppal, R. K. (2009). Priority sector advances: Trends, issues and strategies. *Journal of Accounting and Taxation*, *1*(5), 79-89.

Vithessonthi, C. (2016). Deflation, bank credit growth, and non-performingloans: Evidence from Japan. *International Review of Financial Analysis*, *45*(May), 295-305. https://doi.org/10.1016/j.irfa.2016.04.003

Vittas, D., & Yoon, J. C. (1996). Credit Policies: Lessons from Japan and Korea. *The World Bank Research Observer*, *11*(2), 277-298.

Yang, F. (2018). The Impact of Financial Development on Economic Growth in Middle-income Countries. *Journal of International Financial Markets, Institutions & Money*. https://doi.org/10.1016/j.intfin.2018.11.008

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Predicting Financial Distress by Using Springate, Grover and Zmijewski Model: A Study of Paint Industry

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Abstract

Maximizing profit, return, and wealth is the basic purpose of every commercial enterprise. Profit is crucial for surviving, expanding, and fulfilling the contributor's commitments. It is necessary to create financial distress models as a prototype for an early warning mechanism. Such an effort aims to foresee the circumstances that might result in the company's insolvency. The study's objectives are to identify bankruptcy predictions and identify the Springate, Grover, and Zmijewski models' most precise ways for evaluating bankruptcy. The study looks at the financial standing of the top 5 Paint companies, which are picked on the basis of market capitalization. The study's secondary data, which is gathered from published source that is money control and it is based on the yearly report for the ten-year period (2013 to 2022). The findings of the study shows that Asian Paints Ltd. indicates good financial health under the guidelines of the 3 models used in the study. In addition to it, Grover and Zmijewski model overtook the Springate model to become the most reliable prediction model. The study's findings may be useful to financial managers making financial decisions, investors making investments, and others defending their interests in the biggest paint companies in the country.

Keywords: Bankruptcy, Financial Distress, Grover Model, Springate Model, Zmijewski Model

Introduction

A business's standing will improve in the future if its performance improves. Additionally, the firm needs sound strategy and planning to stay

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viable while operating (Grice & Dugan, 2001). One of the tactics used by the business is to prevent the emergence of a certain amount of financial issues (financial distress) (Maria Sembiring, 2015). Financial distress is an indication of an economic crisis since the company has suffered large losses over the past several years and was not able to fulfil its debt obligations when they came due (Damayanti, 2021). The financial statement will reveal the indication of bankruptcy (Anggraini & Mulya, 2017). For a long time, researchers have been studying how to evaluate financial distress or health. To anticipate business financial difficulties, numerous studies have been conducted since 1940. (Sayari & Mugan, 2013) study found that a company's financial issues were either viewed as the last stage of its collapse or as an early warning sign of financial stability, that might be used to foretell concerns about bankruptcy or liquidation. A lot of academics have made an effort to provide reliable results and have also made an effort to develop a model that would help to predict the financial health or likelihood of business bankruptcy.

The true picture of a company's financial situation can only be obtained by regular review of its financial statements and position (Stefko et al., 2019). By using a model to examine a company's financial situation, management may be able to forecast its future and take preventative measures (Gigova et al., 2019). It might lessen the likelihood of bankruptcy. The financial standing of a corporation will be of interest to shareholders, regulators, and creditors. The Springate, Altman, Grover, and Zmijewski methods are a few strategies or methodologies to quantify the degree of financial suffering that will affect probable bankruptcy (Dolejšová, 2015). (Tyagi, 2014) employed the Altman's Z-score approach to quantify the growth in profitability and productivity of the Indian logistics sector. It illustrates how robust the Indian logistics industry was. It was noticeable that the average Z score rose from 2.54 to 3.01 between 2006 and 2010, while the Indian economy was being impacted by the global recession. This demonstrates the Indian logistics sector's strong overall performance. (Hungan & Sawitri, 2018) has used the Springate and Method of Grover for making distress forecasting for the Coal Industry from 2012 to 2016. (Hertina & Kusmayadi, n.d.) used the four bankruptcy prediction models (Zmijewski, Altman, Grover, and Springate) in the study to determine which mining firms in the coal subsector listed on the Indonesia Stock Exchange between 2014 and 2018 will go bankrupt. In the end, one-way ANOVA revealed a substantial difference across the four models, with accuracy levels of 72.22 percent for Altman Z-Score, 66.67 percent for Springate, and 83.3 percent for Zmijewski and Grover. (Prasetiyani & Sofyan, 2020)decided to study the bankruptcy analysis of Retail Trading Companies listed in Indonesia Stock exchange by using Springate S-score and Altman Z-score

model. (Budiman et al., 2017; Hussain Shar et al., 2010) evaluated the financial distress by using a Bankometer model. (Shalih & Kusumawati, 2019) conducted a comparative analysis of Springate model and Fulmer model for predicting financial distress in manufacturing company from 2014 to 2016 by using One-way Anova. Likewise, (Fachrudin, 2020) carried out research on public manufacturing companies listed in Indonesia Stock Exchange (IDX) to determine the association between financial distress and the model for predicting financial health. (Fakhri Husein & Tri Pambekti, 2014) undertook a study to determine the viability of employing the Zmijewski, Grover, Altman and Springate bankruptcy models as predictors for the firms on the Daftar Efek Syariah list (DES). 132 firms during the years 2009 to 2012 provided the sample. Analysis was performed using a binary logistic regression model, and Zmijewski Model was the most accurate model as a consequence. (Saragih et al., 2020) aimed to identify and study the Grover approach alone in order to predict bankruptcy in telecommunication businesses listed on the Indonesia Stock Exchange. Similary, (Yuna Winaya et al., 2020) predict the bankruptcy in telecommunication sector. (Azwar, n.d.) studied the 28 transport-related firms registered on the Indonesia Stock Exchange (ISE). (Helastica & Paramita, 2020) also did the prediction Retail sector listed on the Indonesia Stock Exchange (Idx). Models including Springate, Altman, Grover, and Zmijewski were used to gauge financial distress.

Objective of the Study

- To measure the financial distress of selected companies by using Springate model, Grover model and Zmijewski model.
- To identifying the model that is best effective in predicting financial distress in the selected companies.

Research Design

The study is concerned with Paint Industry and 5 paint companies ("Asian Paints Ltd., Berger Paints Ltd., Kansai Nerolac Paints Ltd., Akzo Nobel India Ltd., Shalimar Paints Ltd.") which are selected on the basis of market capitalization are analyzed to study the Paint industry's financial soundness. As the study is based on the secondary data, the financial statements of the chosen company are extracted from their annual reports, money control report etc. for a period of 10 years from; 2013 to 2022. The financial health of the company has been assessed using Springate's S-score, Grover's G-score, and Zmijewski's X-score analyses in an effort to forecast and prevent business failure and subsequent bankruptcy. The G-score, S-score, and X-score models developed by Grover, Zmijewski, and Springate are all calculated using Microsoft Excel.

Models Definition and Measurement

Financial ratios are the pillars of 3 financial distress prediction models used in the study. Complete elaboration of the models included in the study is as follows:

Springate's S-score Model

Ratio analysis is widely used to evaluate a company's activity, growth, profitability, and liquidity. A meaningful holistic picture of a company's financial health cannot be obtained from a single ratio calculation. In light of the aforementioned rationale, this study employes the "S-score" model, which anticipates a score that is used to assess a company's financial distress using a variety of financial ratio's. This model represents the predicted viability of a company's financial distress (Yendrawati & Adiwafi, 2020).

Gordon Springate developed the Springate's Bankruptcy Prediction Model in 1978 to predict the likelihood that a company will bankrupt. He used four of the most widely used financial ratios out of nineteen to predict the chance of business failure. Additionally, this model use stepwise discriminant analysis to produce ratings for each individual organization.

S-Score = "1.03 X1 + 3.07 X2 + 0.66 X3 + 0.4 X4"

where:

S = Overall Index

X1 = "Working Capital / Total assets"

X2 = "Earnings Before Interest and Taxes / Total Assets"

X3 = "Earnings Before Interest and Taxes / Current Liabilities"

X4 = "Sales / Total Assets"

Table-1: Springate's Guidelines for Measuring Health Area

Situation	S-score	Health Area	Description
I	Below 0.862	Potentially Bankrupt	The likelihood that the business may experience financial difficulty or possibly bankruptcy in the near future is very high. One may say that the business is in a delicate situation.
II	Above 0.862	Not Potentially Bankrupt	There is little chance that the company will experience financial trouble because it is financially stable. The business financial situation can be described as sound.

Grover's G-score Model

Jeffrey S. Grover created the Grover technique by revising and reassessing the Altman Z-Score methodology. It is applied to bankruptcy forecasting. The Altman Z-Score model and 13 new financial ratios were used to construct samples by Jeffrey S. Grover in 1968. A sample of 70 enterprises, including 35 that filed for bankruptcy and 35 that did not, was examined between 1982 and 1996 (Fredy, n.d.).

G-Score = "1.650X1 + 3.404X2 – 0.016 ROA + 0.057"
where:
X1 = "Working Capital / Total Assets"
X2 = "Earnings Before Interest and Tax / Total Assets"
ROA = "Net Income / Total Assets"

Table-2: Grover's Guidelines for Measuring Health Area

Situation	S-score	Health Area	Description
I	Below or equal to -0.02	Potentially Bankrupt	In the foreseeable future, there is a very strong possibility that the business may have financial difficulties or even go bankrupt.
II	Between -0.02 to 0.01	Grey Area	It is unclear whether the business is in good financial health or not.
III	Above 0.01	Not Potentially Bankrupt	The business is financially secure, thus there is minimal likelihood that it will run into financial difficulties. It is possible to characterise the business financial status as sound.

Zmijewski's X-score Model

Zmijewski makes bankruptcy predictions using ratio analysis, which gauges a company's performance, leverage, and liquidity. The Zmijewski Score is a tool for estimating a company's likelihood of surviving by integrating many general financial ratios with varying weights. According to this model, the biggest factor influencing bankruptcy is the total amount of debt.

X-Score = "- 4.3 - 4.5 X1 + 5.7 X2 + 0.004 X3"
where:
X1 = "Net Income / Total Assets"
X2 = "Total Debt / Total Assets"
ROA = "Current Asset / Current Liabilities"

Table-3: Zmijewski's Guidelines for Measuring Health Area

Situation	X-score	Health Area	Description
I	Equal to or Below 0	Not Potentially Bankrupt	The business is financially sound, therefore there is minimal chance that it will run into problems. It is fair to say that the business financial standing is sound.
II	Above 0	Potentially Bankrupt	There is a very significant possibility that the business will soon face financial difficulties or even bankruptcy.

Analysis and Discussion

This section contains the calculation related to Springate's S-score, Grover's G-score and Zmijewski's X-score.

Table-4: Springate's S-score Analysis

Year	Asian Paints Ltd		Berger Paints India Ltd		Kansai Nerolac Paints Ltd		Akzo Nobel India Ltd.		Shalimar Paints Ltd	
	S-Score	Health Area	S-Score	Health Area	S-Score	Health Area	S-Score	Health Area	S-Score	Health Area
2013	2.03	Healthy	1.66	Healthy	1.84	Healthy	1.11	Healthy	1.07	Healthy
2014	2.01	Healthy	1.55	Healthy	1.52	Healthy	1.03	Healthy	0.81	Distress
2015	2.14	Healthy	1.73	Healthy	1.87	Healthy	1.45	Healthy	0.53	Distress
2016	2.18	Healthy	1.98	Healthy	2.71	Healthy	1.22	Healthy	0.74	Distress
2017	2.15	Healthy	1.87	Healthy	2.28	Healthy	1.59	Healthy	0.32	Distress
2018	2.00	Healthy	1.72	Healthy	2.08	Healthy	1.83	Healthy	-0.30	Distress
2019	1.92	Healthy	1.72	Healthy	1.93	Healthy	1.51	Healthy	-0.41	Distress
2020	2.21	Healthy	1.77	Healthy	1.92	Healthy	1.39	Healthy	-0.13	Distress
2021	2.06	Healthy	1.58	Healthy	1.66	Healthy	1.17	Healthy	0.12	Distress
2022	2.03	Healthy	1.39	Healthy	1.44	Healthy	1.38	Healthy	0.15	Distress

Source: Data is Compiled from Money control report

As per Springate's S-score model (Table-4), the health position of 1 company (Shalimar Paints Ltd.) is classified as financial distressed and 4 companies (Asian Paints Ltd., Berger Paints India Ltd., Kansai Nerolac Paints Ltd. and Akzo Nobel India Ltd.) are classified as healthy.

According to this model, the company's situation is worse when S score value is lower. "Working capital and net profit before tax" both have negative values, which causes Shalimar Paints Ltd. to be in financial trouble. As a result, "Working Capital to Total Assets Ratio, Earnings Before Interest Taxes to Total Assets Ratio, and Net Profit Before Tax to Current Liabilities Ratio" all have negative values as well. This demonstrates how, according to Springate's calculating formula, a company with a modest profit before tax and a lack of working capital would be in financial trouble.

Table-5: Grover's G-score Analysis

Year	Asian Paints Ltd		Berger Paints India Ltd		Kansai Nerolac Paints Ltd		Akzo Nobel India Ltd		Shalimar Paints Ltd	
	G-Score	Health Area	G-Score	Health Area	G-Score	Health Area	G-Score	Health Area	G-Score	Health Area
2013	1.19	Healthy	0.99	Healthy	1.10	Healthy	0.74	Healthy	0.58	Healthy
2014	1.23	Healthy	0.90	Healthy	0.91	Healthy	0.60	Healthy	0.41	Healthy
2015	1.29	Healthy	1.02	Healthy	1.12	Healthy	0.87	Healthy	0.14	Healthy
2016	1.31	Healthy	1.21	Healthy	1.83	Healthy	0.66	Healthy	0.38	Healthy
2017	1.34	Healthy	1.20	Healthy	1.53	Healthy	1.01	Healthy	0.08	Healthy
2018	1.20	Healthy	1.09	Healthy	1.39	Healthy	1.28	Healthy	-0.52	Distress
2019	1.12	Healthy	1.07	Healthy	1.15	Healthy	0.98	Healthy	-0.36	Distress
2020	1.25	Healthy	1.06	Healthy	1.14	Healthy	0.96	Healthy	-0.31	Distress
2021	1.36	Healthy	1.05	Healthy	1.14	Healthy	0.87	Healthy	-0.15	Distress
2022	1.37	Healthy	0.84	Healthy	0.98	Healthy	0.92	Healthy	0.27	Healthy

Source: Data is Compiled from Money control report

Grover technique was able to foresee that all 5 organisations would be categorised as healthy from 2013 to 2017. Shalimar Paints Ltd. is categorised as being in financial hardship from 2018 to 2021, but the other 4 companies are rated as being in good health. All 5 businesses are deemed healthy in 2022. According to this methodology, a company's situation is measured by its G score, and the lower the value, the worse off it is. "Working Capital to Total Assets Ratio, Earnings Before Interest and Tax to Total Assets Ratio, and Return on Assets Ratio" all have negative values for Shalimar Paints Ltd. This demonstrates that, according to the calculation formula used by Grover, a corporation will experience financial trouble if its return on assets is low.

Table-6: Zmijewski's X-score Analysis

Year	Asian Paints Ltd		Berger Paints India Ltd		Kansai Nerolac Paints Ltd		Akzo Nobel India Ltd		Shalimar Paints Ltd	
	X-Score	Health Area	X-Score	Health Area	X-Score	Health Area	X-Score	Health Area	X-Score	Health Area
2013	-8.31	Healthy	-8.29	Healthy	-8.50	Healthy	-8.52	Healthy	-8.67	Healthy
2014	-8.35	Healthy	-8.29	Healthy	-8.61	Healthy	-8.56	Healthy	-8.84	Healthy
2015	-8.37	Healthy	-8.28	Healthy	-8.60	Healthy	-8.52	Healthy	-8.94	Healthy
2016	-8.36	Healthy	-8.20	Healthy	-8.34	Healthy	-8.44	Healthy	-8.74	Healthy
2017	-8.50	Healthy	-8.19	Healthy	-8.64	Healthy	-8.46	Healthy	-8.88	Healthy
2018	-8.50	Healthy	-8.53	Healthy	-8.64	Healthy	-8.38	Healthy	-9.21	Healthy
2019	-8.49	Healthy	-8.56	Healthy	-8.68	Healthy	-8.54	Healthy	-9.21	Healthy
2020	-8.47	Healthy	-8.44	Healthy	-8.70	Healthy	-8.53	Healthy	-9.01	Healthy
2021	-8.50	Healthy	-8.53	Healthy	-8.69	Healthy	-8.58	Healthy	-9.14	Healthy
2022	-8.51	Healthy	-8.53	Healthy	-8.72	Healthy	-8.48	Healthy	-9.06	Healthy

Source: Data is Compiled from Money control report

Due to the five companies' negative X-Score values in the non-distress category, computations using the Zmijewski approach reveal that none of them experienced financial distress. Since the degree of financial issues at "Asian Paints Ltd., Berger Paints India Ltd., Kansai Nerolac Paints Ltd., and Shalimar Paints Ltd". decreased, it may be inferred that these four businesses are now better able to improve their performance by making use of all of the available assets. Asian Paints Ltd. was able to reduce its distress to -8.51 in 2022 from -8.31 in 2013, Berger Paints India Ltd. was able to do the same, going from -8.29 in 2013 to -8.53 in 2022, Kansai Nerolac Ltd. was able to go from -8.50 in 2013 to -8.72 in 2022, and Shalimar Paints Ltd. was able to go from -8.67 in 2013 to -9.06 in 2022. From the aforementioned calculation findings, it can be shown that Akzo Nobel India Ltd. has not been able to manage its assets to their fullest potential and that their level of distress has worsened from -8.52 in 2013 to -8.48 in 2022.

Accuracy Level and Error Level Test

To find out the Level of Accuracy and Level of Error in all three models (Metode Springate et al., n.d.) then use the formula as follows:

Accuracy Level: Total True Prediction / Total Sample * 100

Error Level: Total Error / Total Sample * 100

Table-7: Summary of the Average Results of Financial Health of Paint Companies (2013-2022)

Company Name	Springate Model		Grover Model		Zmijewski Model	
	Average	Health Area	Average	Health Area	Average	Health Area
Asian Paints Ltd	2.07	Healthy	1.27	Healthy	-8.44	Healthy
Berger Paints India Ltd	1.70	Healthy	1.04	Healthy	-8.38	Healthy
Kansai Nerolac Paints Ltd	1.93	Healthy	1.23	Healthy	-8.61	Healthy
Akzo Nobel India Ltd	1.37	Healthy	0.89	Healthy	-8.50	Healthy
Shalimar Paints Ltd	0.29	Distress	0.05	Healthy	-8.97	Healthy

Source: Author

In Table-7 average value of S, G and X score is calculated for determining the health area of 5 Paint companies which in turn helps in determining the accuracy and error level of the models or we can say helps in determining the best prediction model.

Accuracy Level and Error Level Test of Springate Model

The following outcomes are derived from a comparison of the prediction methodologies with the current state of the sample companies using Springate Model:

Table-8: Accuracy Level and Error Level of Springate Model

	Prediction Result of Springate Model		Total
	Non-Distress Area	Distress Area	
Total Companies	4	1	5
Level of Accuracy		80 percent	
Level of Error		20 percent	

Source: Author

The accuracy percentage of the Springate approach, according to an investigation of five companies, is 80 percent. Table-8 shows how well the four companies that provide exact predictions and four companies that predicted healthy are represented by the predictions made using the Springate approach. The results of Level of error shows that the Springate model has a 20 percent error rate; this figure is visible from the one company whose predictions are imprecise. Springate's forecast considers the likelihood of insolvency or financial trouble for one company.

Accuracy Level and Error Level Test of Grover Model

The following outcomes are derived from a comparison of the prediction methodologies with the current state of the sample companies using Grover Model:

Table-9: Accuracy Level and Error Level of Grover Model

	Prediction Result of Grover Model		**Total**
	Non-Distress Area	**Distress Area**	
Total Companies	5	0	5
Level of Accuracy		100 percent	
Level of Error		0 percent	

Source: Author

Grover approach has a 0 percent error rate and a 100 percent accuracy rate, according to analysis performed at five different companies. Table-9 shows the accuracy of Grover's prediction model based on the five firms for which the prognosis is accurate.

Accuracy Level and Error Level Test of Zmijewski Model

The following outcomes are derived from a comparison of the prediction methodologies with the current state of the sample companies using Zmijewski Model:

Table-10: Accuracy Level and Error Level of Zmijewski Model

	Prediction Result of Zmijewski Model		**Total**
	Non-Distress Area	**Distress Area**	
Total Companies	**5**	**0**	**5**
Level of Accuracy		100 percent	
Level of Error		0 percent	

Source: Author

According to studies performed at five different organisations, the Zmijewski approach has a 100 percent accuracy rate and a 0 percent error rate. Zmijewski prediction takes into account the fact that the five companies predicted in Table-10 are healthy and demonstrating the accuracy of Zmijewski's prediction methodology.

Table-11: Comparison of Accuracy and Error of Springate Model, Grover Model and Zmijewski Model Predictions

Models of Prediction	**Accuracy Level**	**Error Level**
Springate	80 percent	20 percent
Grover	100 percent	0 percent
Zmijewski	100 percent	0 percent

Source: Author

The findings of the analysis on the 5 Paint companies utilizing the Springate, Grover, and Zmijewski approach are compared in the Table-11. Grover and Zmijewski's technique, which values accuracy rate at 100 percent with a 0 percent error rate, has the highest accuracy grades, while Springate's model, which values accuracy rate at 80 percent with a 20 percent error rate, comes in second. This demonstrates that for analysing financial health, Grover and Zmijewski's methodology is the most accurate which is in accordance with (Ayu Ditasari & Sasongko, n.d.) titled "Comparison of Altman, Springate, Zmijewski and Grover Models in Predicting Financial Distress on Companies of Jakarta Islamic Index (JII) on 2013-2017," which concludes that there is a significant difference between Springate's model and Grover model and between Springate's model and Zmijewski model in the classification of financial distress. Additionally, there are no significant differences in the characterization of financial distress between the Zmijewski and Grover models.

Limitation of the Study

Regarding the author's limitations, this study still has some flaws and did not utilise the whole bankruptcy model that is now in use. The Fulmar, Ohlson, and Taffler models, as well as additional factors outside the authors' control like inflation and unemployment, are therefore expected to be added to or used in future studies that will predict bankruptcy. Researchers can also add more years or replace variables, therefore it is anticipated that future research will yield the best possible findings.

Conclusion

In terms of predicting bankruptcy (financial distress) in the Paint Industry, the results demonstrate that the Springate, Grover, and Zmijewski models provide different forecasts. As per Springate's and Grover's model, except Shalimar Paints Ltd., the financial stability of the other 4 Paint firms was satisfactory during the research period. Comparing Asian Paints Ltd. to other companies, a study found that it had usually solid financial health. As per Zmijewski's model all 5 companies are in healthy state. With a 100 percent accuracy rate, the Grover and Zmijewski model overtook the Springate model to become the most reliable prediction model. In order to prevent the Paint Industry from truly experiencing bankruptcy, we advise all pertinent and interested parties, including managers and investors, to promptly discover the best option to enhance the company's performance in the future.

References

Anggraini, D., & Mulya, H. (2017). Financial Distress Prediction In Indonesia Companies: Finding An Alternative Model. *Russian Journal of Agricultural and Socio-Economic Sciences*, *61*(1), 29–38. https://doi.org/10.18551/rjoas.2017-01.04

Ayu Ditasari, R., & Sasongko, D. (n.d.). *Comparison of Altman, Springate, Zmijewski and Grover Models in Predicting Financial Distress on Companies of Jakarta Islamic Index (JII) on 2013-2017*. www.NRMnews.com/Eka

Azwar, K. (n.d.). International Journal Of Trends In Accounting Research Implementation of Springate, Altman, Grover and Zmijewski Models in Measuring Financial Distress. */ International Journal of Trends in Accounting Research*, *3*(1), 2022. https://journal.adaindonesia.or.id/index.php/ijtar/index

Budiman, T., Herwany, A., & Kristanti, F. T. (2017). Journal of Finance and Banking Review An Evaluation of Financial Stress for Islamic Banks in Indonesia Using a Bankometer Model. *J. Bank. Fin. Review*, *2*(3), 14–20. www.gatrenterprise.com/GATRJournals/index.html

Damayanti, S. (2021). *Does the Analysis of Altman Z-Score Model, Zmijewski Model, and Springate Model Impact the Financial Distress? Study on Pharmaceutical Companies Listed on the Indonesian Stock Exchange Period 2011-2017*. www.IDX.co.id.

Dolejšová, M. (2015). Is it worth comparing different bankruptcy models? *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, *63*(2), 525–531. https://doi.org/10.11118/actaun201563020525

Fachrudin, K. A. (2020). The Relationship between Financial Distress and Financial Health Prediction Model: A Study in Public Manufacturing Companies Listed on Indonesia Stock Exchange (IDX). *Jurnal Akuntansi Dan Keuangan*, *22*(1), 18–27. https://doi.org/10.9744/jak.22.1.18-27

Fakhri Husein, M., & Tri Pambekti, G. (2014). Precision of the models of Altman, Springate, Zmijewski, and Grover for predicting the financial distress A R T I C L E I N F O. *Journal of Economics*, *17*(3), 405–416. https://doi.org/10.14414/jebav.14.1703010

Fredy, H. (n.d.). The Prediction of Bankruptcy in The Pulp and Paper Industry Company Listed In Indonesia Stock Exchange On 2011-2016 Period Using Z-Score Altman, Springate And Grover Model. *South East Asia Journal of Contemporary Business, Economics and Law*, *15*. www.bps.go.id

Gigova, T., Nikolova-Alexieva, V., & Valeva, K. (2019). Application of Business Crisis Forecasting Models in Bulgaria. *IOP Conference Series:*

Materials Science and Engineering, *618*(1). https://doi.org/10.1088/1757-899X/618/1/012071

Grice, J. S., & Dugan, M. T. (2001). The Limitations of Bankruptcy Prediction Models: Some Cautions for the Researcher Introduction and motivation. In *Review of Quantitative Finance and Accounting* (Vol. 17). Kluwer Academic Publishers.

Helastica, M., & Paramita, S. (2020, December 23). *Analysis Financial Distress Prediction With Model Altman Z-Score, Zmijewski, And Grover In The Sub Sector Retail Listed On The Indonesian Stock Exchange (Idx) 2014-2018 Period*. https://doi.org/10.4108/eai.26-9-2020.2302717

Hertina, D., & Kusmayadi, D. (n.d.). 2020) And Zmijewski Models As Predicting Financial Distress-Palarch's. In *Journal Of Archaeology Of Egypt/Egyptology* (Vol. 17, Issue 5). www.economy.okezone.com

Hungan, A. G. D., & Sawitri, N. N. (2018). Analysis of Financial Distress with Springate and Method of Grover in Coal In BEI 2012 - 2016. *International Business and Accounting Research Journal*, *2*(2), 52. https://doi.org/10.15294/ibarj.v2i2.39

Hussain Shar, A., Professor, A., ali Shah Professor, M., Jamali Professor, H., & University, P. (2010). Performance Evaluation of Banking Sector in Pakistan: An Application of Bankometer. In *International Journal of Business and Management* (Vol. 5, Issue 9). www.ccsenet.org/ijbm

Maria Sembiring, T. (2015). International Journal of Economics and Financial Issues Bankruptcy Prediction Analysis of Manufacturing Companies Listed in Indonesia Stock Exchange. *International Journal of Economics and Financial Issues*, *5*, 10–11. http:www.econjournals.com

Metode Springate, D., GROVER Khoiru Rizkyansyah, D., & Laily, N. (n.d.). *Sekolah Tinggi Ilmu Ekonomi Indonesia (STIESIA) Surabaya*.

Prasetiyani, E., & Sofyan, M. (2020). Bankruptcy Analysis Using Altman Z-Score Model and Springate Model In Retail Trading Company Listed In Indonesia Stock Exchange. *Ilomata International Journal of Tax & Accounting*, *1*(3), 139–144. https://www.ilomata.org/index.php/

Saragih, F., Sinambela, E., & Sari, E. (2020, February 18). *Bankruptcy Prediction By Using The Grover Method*. https://doi.org/10.4108/eai.8-10-2018.2288689

Sayari, N., & Mugan, F. N. C. S. (2013). Cash Flow Statement as an Evidence for Financial Distress. *Universal Journal of Accounting and Finance*, *1*(3), 95–102. https://doi.org/10.13189/ujaf.2013.010302

Shalih, R. A., & Kusumawati, F. (2019). *Journal of Auditing, Finance, And Forensic Accounting (Jaffa) Prediction of Financial Distress In Manufacturing Company: A Comparative Analysis Of Springate Model And Fulmer Model*. *7*(2). https://doi.org/10.21107/jaffa.v7i2.6423

Stefko, R., Jencova, S., Vasanicova, P., & Litavcova, E. (2019). An evaluation of financial health in the electrical engineering industry. *Journal of Competitiveness*, *11*(4), 144–160. https://doi.org/10.7441/joc.2019.04.10

Tyagi, V. (2014). *A Study To Measures The Financial Health Of Selected Firms With Special Reference To Indian Logistic Industry: An Application Of Altman's Z Score*. *4*(4). www.iiste.org

Yendrawati, R., & Adiwafi, N. (2020). Comparative analysis of Z-score, Springate, and Zmijewski models in predicting financial distress conditions. *Journal of Contemporary Accounting*, *2*(2), 72–80. https://doi.org/10.20885/jca.vol2.iss2.art2

Yuna Winaya, G., Rm, K. M., Ayu, G., Budiasih, N., Dewa, I., & Wiratmaja, N. (2020). Analysis of Altman Z-Score and Zmijewski Bankruptcy Prediction in Telecommunication Sub-Sectors Registered in Indonesia Stock Exchange in 2016-2018. In *American Journal of Humanities and Social Sciences Research* (Issue 1). www.ajhssr.com

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Inventory Model for Deteriorating Items Involving Fuzzy with Shortages

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Abstract

This paper considers the fluffy inventory model for deteriorating items for power interest under completely multiplied conditions. We characterize different components which are influencing the inventory cost by utilizing the lack costs. An expectation of this paper is to concentrate on the inventory displaying through fluffy climate. Inventory boundaries, like holding cost, lack cost, buying cost and disintegration cost are thought to be the trapezoidal fluffy numbers. What's more, a productive calculation is created to decide the ideal strategy, and the computational exertion and time are little for the proposed calculation. It is easy to carry out, and our methodology is delineated through some mathematical guides to exhibit the application and the presentation of the proposed philosophy.

Keywords: Deteriorating, Inventory

Introduction

Presented "Fluffy Sets". They foster fluffy rationale around then. The possibility of fluffy sets and fluffy rationale were not acknowledged well inside scholastic circles, since a portion of the basic math had not yet been investigated. So that, the utilizations of fluffy rationale were delayed to create, besides in the east. In Japan explicitly fluffy rationale was completely acknowledged and executed in items just on the grounds that fluffy rationale worked. The achievement of numerous fluffy rationale items in Japan in prompted a recovery in fluffy rationale in the US in the last part of the 80s. Since that time America has been playing find the east in the space of fluffy rationale. The impacts of deteriorating are significant in many inventory frameworks. Disintegration implies the tumbling from a higher to a lower

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level in quality, character, or essentialness. Disintegration stresses physical, scholarly, or particularly upright retrogression. Wantonness surmises a coming to and passing the pinnacle of improvement and infers a rotate toward the ground with misfortune in essentialness or energy. Outstanding interest is a normal strategy. This is valuable if the new changes in the information result from a change, for example, an occasional example rather than simply arbitrary vacillations This paper comprises of lack cost. Normally, an estimated figure is shown up at after our suspicion of the few qualities like lost of client, lost deal, stock-out punishments and debates in agreement. In that manner the inventory deficiency doesn't cost a prompt misfortune in deals or benefit. The seller might resolve to convey the item inside a specific lead time. The expense brought about all things considered is the 'raincheck cost'. We convert the inventory model into fluffy inventory model. The holding costs, deficiency cost, buying cost are thought to be the trapezoidal fluffy numbers. Trapezoidal fluffy number is the fluffy number addressed with three points as follows (a_1, a_2, a_3). This paper has fostered a successful methodology for deciding the ideal arrangements of inventory request amount, time, and absolute expense. Additionally, a proficient calculation is created to decide the ideal arrangement, and our methodology is delineated through a mathematical model. Affectability examination has been done to delineate the practices of the proposed model and some administrative ramifications are additionally included.

Literature Review

Inventory frameworks with deteriorating items have gotten impressive consideration as of late. These frameworks are held in stock experience persistent crumbling over the long haul. Instances of items that experience weakening while in stock incorporate food stuff, medications, unpredictable fluids, blood donation centers, and so forth Insights about inventory models with deteriorating items were found in the new audit by (Raafat, F. 2013).

Aggarwal, and Jaggi, C. K. (2012) stretched out Goyal's model to think about the deteriorating items. Chandrasekhara Reddy and Ranganatham (2012) examined about the interest changes every once in a while, the inventory issue becomes dynamic. Chang and Dye (2001) fostered an incomplete multiplying inventory model for deteriorating items with Weibull dissemination and admissible postponement in installments. Simultaneously, Chang et al. (2011) introduced an inventory model for deteriorating items with direct pattern under the state of reasonable deferral in installments. Chang et al. (2008) made a survey on past related written works under exchange credit.

Chang et al. (2009) proposed an ideal installment time for deteriorating items under swelling and allowable postponement in installments during a

limited arranging skyline. Dutta and Pavan Kumar (2013) were portrayed the trapezoidal fluffy number in ordinary inventory models deliberately of diminishing the complete expenses. Goyal (2015) was quick to build up a monetary request amount model with a consistent interest rate under the state of a passable postponement in installments.

Halkos et al. (2012) portrayed the assessor of the second assessment strategy to guarantee that the mentioned basic elements are accomplished. And furthermore they told that the third assessment strategy, the relating assessor is acquired augmenting benefit concerning a consistent which incorporated the type of the assessor. Halkos et al. (2013) set up the qualities for the two measures. What's more, the relative-anticipated half-length, values are figured additionally logically.

Horng-Jinh Chang and Chung-Yuan Dye (2014) fostered the multiplying rate. The multiplying rate work is viewed as a dramatic diminishing capacity of the sitting tight an ideal opportunity for the following recharging. Hwang and Shinn (2015) added the valuing system to the model, and fostered the ideal cost and part size for a retailer under the state of an allowable postponement in installments. Jaggi et al. (2012) introduced a fluffy inventory model for deteriorating items with time-fluctuating interest and deficiencies.

Jamal et al. (2013) proposed an inventory model with deteriorating items under swelling when a deferral in installment is allowable. Kapil Kumar Bansal and Navin (2012) depicted dramatically expanding request has been considered instead of steady interest. Since the dramatically expanding request, whose request changes consistently alongside a consistent expansion in populace thickness? Liang and Zhou (2011) gave a two-distribution center inventory model for deteriorating items under restrictively admissible postponement in installment.

Maragatham and Lakshmidevi (2014) fostered a legitimate EOQ crumbling inventory model, there exists the exceptional ideal answer for limit absolute expense and the scientific arrangement of the ideal request cycle was inferred. Rather than having close by inventory, permitting deficiencies was the best strategy to limit the absolute expense. Mary Latha and Uthayakumar (2014) depicted the disintegration was probabilistic to track down the partner absolute expense. Nithya and Ritha [17] inventory models examined with fluffy boundaries for fresh request amount, or for fluffy request amount. Furthermore, work rule was proposed as a number-crunching activity of fluffy trapezoidal number to get fluffy financial request amount and fluffy yearly benefit.

Nirmal Kumar Duari and Tripti Chakraborty (2012) accepted that the interest is as remarkable appropriation, they expected to actuate expansions popular and deals in promoting. Ritha and Rexlin Jeyakumari

(2013) portrayed the ideal request amount is in fluffy sense with the assistance of marked distance strategy. Sarah Ryan (2003) contended the limit when huge abundance limit remains, or to introduce enormous limit increases. And furthermore examined about the lead times, the still up in the air development size, request attributes are influencing both strategy measurements however in various ways.

An elevated standard of interest development spurs enormous extensions that happen to some degree prior. Sanhita Banerjee and Tapan Kumar Roy (2012) were counseled about on expansion guideline, span strategy and vertex technique and look at three strategies. And furthermore tackled some mathematical issues with different qualities. Savitha Pathak and Seema Sarkar (Mondal) (2012) thought about that the destinations were boosted and furthermore the expenses were accepted in fluffy climate as three-sided fluffy and trapezoidal fluffy. Shah (2014) considered a stochastic inventory model when delays in installments are allowable. Shah (2006) considered an inventory model for deteriorating items and time worth of cash under passable postponement in installments during a limited arranging skyline.

Soni et al. (2006) examined an EOQ model for moderate installment plot under limited income (DCF) approach. Sushil Kumar and Rajput (2015) examined about a fluffy inventory model for deteriorating items with time subordinate interest and furthermore deficiencies were allowed. In this conversation they considered the interest rate, disintegration rate and accumulating rate were accepted as a three-sided fluffy numbers. Syed and Aziz [28] were determined the ideal request amount by utilizing marked distance technique for defuzzification.

In this paper, we consider a fluffy inventory model for deteriorating items with deficiencies under completely accumulated condition and outstanding interest. The inventory costs are thought to be the trapezoidal fluffy numbers. Mathematical models and affectability are investigated and determined. We can likewise bear the cost of the documentations and suppositions for the accepted model in area 3. A Mathematical model is perceived in segment 4. In segment 4.1 contains fluffy model and arrangement method. In segment 5 a proficient calculation is created to get the ideal arrangement. Mathematical investigation for inventory control and fluffy model are introduced in area 6. In segment 6.3 the affectability examination of the ideal arrangement with deference upsides of the framework is acquired in a similar area. In segment 6.4 there were the administrative ramifications of the inventory control and the fluffy model. At last, we give the ends and future exploration in segment 7.

Notations and Assumptions

For developing the proposed models, the following assumptions and notations are used throughout this chapter.

Notations

The following notations and assumptions are used here:

C_0 Ordering cost per order

C_h Holding cost per unit per unit time

C_s Shortage cost per unit time

$C_{p\ Purchasing}$ cost per unit per unit time

D Demand rate at any time t per unit time $(D(t)=ae^{bt}\ a>0;b>0)$

A Deterioration function $(0<a_1<1)$

T Length of ordering cycle

Q Order quantity per unit

C_{Ts} Total shortage cost per unit time

ςs Fuzzy total shortage cost per unit time

$(C_{Ts})ds$ Defuzzified value of fuzzy number ς_{Ts} by using signed distance method

$Tc(t_1,T)$ Total inventory cost per unit time

$T\varsigma(t_1,T)$ Fuzzy total cost per unit time

$(C_{Ts})ds\ (t_1,T)$ Defuzzified value of fuzzy number $T\varsigma(t_1,T)$ by using signed distance method

Assumptions

To develop the proposed model, we adopt the following assumptions

- Demand rate is exponential function of time t $(D(t)=ae^{bt}\ a>0;b>0)$
- Lead time is zero.
- Shortages are allowed and fully backlogged.
- During the cycle deterioration is not repaired or replaced.
- Replenishment rate is infinite.
- Holding cost is as time dependent.

Mathematical Modeling

The start of the item or bought the item dependent on Q and subsequent to satisfying delay purchases. During the period [0, 1 t] the inventory level steadily lessens and at last tumbles to nothing. From this time stretch deficiencies might happen and completely multiplied. Let ( ) 1 I t be the on – hand inventory level at time t, which is created from the accompanying conditions:

$$\frac{dI_1(t)}{dt}+a_1I_1(t)=-ae^{bt}\quad \text{For}\quad 0\le t\le t_1 \qquad ...(1)$$

$$\text{and}\quad \frac{dI_2(t)}{dt}=-ae^{bt}\quad \text{for}\quad t_1\le t\le T \qquad ...(2)$$

$$\text{with}\quad I_1(0)\ =\ Q\ \text{ and }\ I_1(t_1)=0 \qquad ...(3)$$

Now solve in (1) and (2) using (3) we get the final solutions, which is given by

$$I_1(t) = -\left[\frac{ae^{bt}}{(b+a_1)}\right]+\left[\frac{ae^{bt_1}}{(b+a_1)}\right] \quad \text{for} \quad 0 \le t \le t_1$$

And

$$I_2(t) = \left[\frac{ae^{bt}}{b}\right] \quad \text{for} \quad t_1 \le t \le T$$

Using the condition (0) 1 I = Q we get the value of

$$Q = -\left[\frac{a}{(b+a_1)}\right]+\left[\frac{ae^{bt_1}}{(b+a_1)}\right]$$

(6) Total average number of holding costs is I_h, during the period [0, T] is given by

$$I_h = \int_0^{t_1} I_1(t)dt = \left[\frac{t_1 ae^{bt_1}}{(b+a_1)}\right]-\left[\frac{ae^{bt_1}}{b(b+a_1)}\right]$$

Total number of deteriorated units I_d during the period [0, T] is given by

$$I_D = \frac{C_0}{T}\int_0^T ae^{bt} I_1(t)dt = \frac{C_0}{T}\left[\frac{a^2 e^{b(t_1+T)}}{b(b+a_1)}\right]-\left[\frac{a^2 e^{2bT}}{2b(b+a_1)}\right]$$

Total number of shortage units I during the period [0, T] is given by,

$$I_s = \int_{t_1}^{T} I_2(t)dt = \left[\frac{ae^{b(T-t_1)}}{b^2}\right]$$

Total costs per unit time

$$C_{Ts} = \frac{1}{T}[C_s I_s]$$

Total cost of the system per unit time

$$Tc(t_1,T) = \frac{1}{T}[C_0 + C_h I_h + C_p I_D + C_s I_s],$$

$$Tc(t_1,T) =$$

$$\frac{1}{T}\left[C_0 + C_h\left[\frac{t_1 ae^{bt_1}}{(b+a_1)}-\frac{ae^{bt_1}}{b(b+a_1)}\right]+C_p\left(C_0\left[\frac{a^2 e^{b(t_1+T)}}{b(b+a_1)}-\frac{a^2 e^{2bT}}{2b(b+a_1)}\right]\right)+C_s\left[\frac{ae^{b(T-t_1)}}{b^2}\right]\right]$$

To minimize the total cost per unit time 1)t ,T(Tc , the optimal value of T and 1 t can be obtained by solving the following equations:

$$\frac{\partial Tc(t_1,T)}{\partial t_1}=0 \quad \text{and} \quad \frac{\partial Tc(t_1,T)}{\partial T}=0$$

$$\text{Now, } \frac{\partial Tc(t_1,T)}{\partial t_1}$$

$$=\frac{1}{T}\left[C_h\left(\frac{t_1 a e^{bt_1}}{b(b+a_1)}+\frac{ae^{bt_1}}{(b+a_1)}-\frac{ae^{bt_1}}{b(b+a_1)}\right)+C_pC_0\left(\frac{a^2e^{b(t_1+T)}}{b^2(b+a_1)}\right)-C_s\left(\frac{ae^{b(T-t_1)}}{b^3}\right)\right]=0$$

And

$$\frac{\partial Tc(t_1,T)}{\partial T}=-\frac{1}{T^2}\left[C_0+C_h\left(\frac{t_1 a e^{bt_1}}{(b+a_1)}-\frac{ae^{bt_1}}{b(b+a_1)}\right)+C_pC_0\left(\frac{a^2e^{b(t_1+T)}}{b(b+a_1)}-\frac{a^2e^{2bT}}{2b(b+a_1)}\right)+C_s\frac{ae^{b(T-t_1)}}{b^2}\right]$$

$$+\frac{1}{T}\left[C_pC_0\left(\frac{a^2e^{b(t_1+T)}}{b(b+a_1)}-\frac{a^2e^{2bT}}{4b^2(b+a_1)}\right)+C_s\left(\frac{ae^{b(T-t_1)}}{b^3}\right)\right]$$

We solve the non-linear equations (14) and (15) by using the computer software Matlab, We can easily prove the total cost $Tc(t_1,T)$.

Fuzzy Model and Solution Procedure

We think about the model in fluffy climate. Because of vulnerability, it isn't not difficult to characterize all boundaries precisely.

Let $C_h=(\varsigma_{h1},\varsigma_{h2},\varsigma_{h3},\varsigma_{h4})$, $C_p=(\varsigma_{p1},\varsigma_{p2},\varsigma_{p3},\varsigma_{p4})$, $C_s=(\varsigma_{s1},\varsigma_{s2},\varsigma_{s3},\varsigma_{s4})$, $a_1=(a_{11},a_{12},a_{13},a_{14})$ be trapezoidal fuzzy numbers. Then the total cost of the system per unit time in fuzzy sense is given by

$$T\varsigma(t_1,T)=\left[\frac{1}{T}\left(C_0+\varsigma_{h1}\left(\frac{-ae^{bt_1}}{b(b+a_{11})}\right)+\varsigma_{p1}\left(\frac{-a}{(b+a_{11})}-\frac{ae^{bt_1}}{b}\right)+\varsigma_{s1}\left(\frac{ae^{b(T-t_1)}}{b^2}\right)\right)\right],$$

$$\left[\frac{1}{T}\left(C_0+\varsigma_{h2}\left(\frac{-ae^{bt_1}}{b(b+a_{12})}\right)+\varsigma_{p2}\left(\frac{-a}{(b+a_{12})}-\frac{ae^{bt_1}}{b}\right)+\varsigma_{s2}\left(\frac{ae^{b(T-t_1)}}{b^2}\right)\right)\right],$$

$$\left[\frac{1}{T}\left(C_0+\varsigma_{h3}\left(\frac{-ae^{bt_1}}{b(b+a_{13})}\right)+\varsigma_{p3}\left(\frac{-a}{(b+a_{13})}-\frac{ae^{bt_1}}{b}\right)+\varsigma_{s3}\left(\frac{ae^{b(T-t_1)}}{b^2}\right)\right)\right],$$

$$\left[\frac{1}{T}\left(C_0+\varsigma_{h4}\left(\frac{-ae^{bt_1}}{b(b+a_{14})}\right)+\varsigma_{p1}\left(\frac{-a}{(b+a_{14})}-\frac{ae^{bt_1}}{b}\right)+\varsigma_{s4}\left(\frac{ae^{b(T-t_1)}}{b^2}\right)\right)\right]. \quad (16)$$

$$T\varsigma(t_1,T)=\left[\frac{1}{T}\left(C_0+(\varsigma_{h1},\varsigma_{h2},\varsigma_{h3},\varsigma_{h4})+(\varsigma_{p1},\varsigma_{p2},\varsigma_{p3},\varsigma_{p4})+(\varsigma_{s1},\varsigma_{s2},\varsigma_{s3},\varsigma_{s4})\right)\right] \quad (17)$$

$$T\varsigma(t_1,T)=W,X,Y,Z \quad (18)$$

$$\text{Where W}=\left[\frac{1}{T}\left(C_0+\varsigma_{h1}\left(\frac{-ae^{bt_1}}{b(b+a_{11})}\right)+\varsigma_{p1}\left(\frac{-a}{(b+a_{11})}-\frac{ae^{bt_1}}{b}\right)+\varsigma_{s1}\left(\frac{ae^{b(T-t_1)}}{b^2}\right)\right)\right];$$

$$X=\left[\frac{1}{T}\left(C_0+\varsigma_{h2}\left(\frac{-ae^{bt_1}}{b(b+a_{12})}\right)+\varsigma_{p2}\left(\frac{-a}{(b+a_{12})}-\frac{ae^{bt_1}}{b}\right)+\varsigma_{s2}\left(\frac{ae^{b(T-t_1)}}{b^2}\right)\right)\right];$$

$$Y=\left[\frac{1}{T}\left(C_0+\varsigma_{h3}\left(\frac{-ae^{bt_1}}{b(b+a_{13})}\right)+\varsigma_{p3}\left(\frac{-a}{(b+a_{13})}-\frac{ae^{bt_1}}{b}\right)+\varsigma_{s3}\left(\frac{ae^{b(T-t_1)}}{b^2}\right)\right)\right]$$

And

$$Z=\left[\frac{1}{T}\left(C_0+\varsigma_{h4}\left(\frac{-ae^{bt_1}}{b(b+a_{14})}\right)+\varsigma_{p1}\left(\frac{-a}{(b+a_{14})}-\frac{ae^{bt_1}}{b}\right)+\varsigma_{s4}\left(\frac{ae^{b(T-t_1)}}{b^2}\right)\right)\right].$$

The cuts,– α C (u) L and C (u) R of trapezoidal fuzzy number tς(,) T 1 T all given,

$$C_L(\alpha)=W+(X-W)\alpha$$

$$=\left[\frac{1}{T}\left(C_0+\varsigma_{h1}\left(\frac{-ae^{bt_1}}{b(b+a_{11})}\right)+\varsigma_{p1}\left(\frac{-a}{(b+a_{11})}-\frac{ae^{bt_1}}{b}\right)+\varsigma_{s1}\left(\frac{ae^{b(T-t_1)}}{b^2}\right)\right)\right]+$$

$$\left(\alpha\left\{\left[\frac{1}{T}\left(C_0+\varsigma_{h2}\left(\frac{-ae^{bt_1}}{b(b+a_{12})}\right)+\varsigma_{p2}\left(\frac{-a}{(b+a_{12})}-\frac{ae^{bt_1}}{b}\right)+\varsigma_{s2}\left(\frac{ae^{b(T-t_1)}}{b^2}\right)\right)\right]\right.\right.$$

$$\left.\left.-\left[\frac{1}{T}\left(C_0+\varsigma_{h1}\left(\frac{-ae^{bt_1}}{b(b+a_{11})}\right)+\varsigma_{p1}\left(\frac{-a}{(b+a_{11})}-\frac{ae^{bt_1}}{b}\right)+\varsigma_{s1}\left(\frac{ae^{b(T-t_1)}}{b^2}\right)\right)\right]\right\}\right) \quad (19)$$

And $C_R(\alpha)=Z+(Z-Y)\alpha$

$$=\left[\frac{1}{T}\left(C_0+\varsigma_{h4}\left(\frac{-ae^{bt_1}}{b(b+a_{14})}\right)+\varsigma_{p1}\left(\frac{-a}{(b+a_{14})}-\frac{ae^{bt_1}}{b}\right)+\varsigma_{s4}\left(\frac{ae^{b(T-t_1)}}{b^2}\right)\right)\right]-$$

$$\left(\alpha\left\{\left[\frac{1}{T}\left(C_0+\varsigma_{h4}\left(\frac{-ae^{bt_1}}{b(b+a_{14})}\right)+\varsigma_{p1}\left(\frac{-a}{(b+a_{14})}-\frac{ae^{bt_1}}{b}\right)+\varsigma_{s4}\left(\frac{ae^{b(T-t_1)}}{b^2}\right)\right)\right]\right.\right.$$

$$\left.\left.-\left[\frac{1}{T}\left(C_0+\varsigma_{h3}\left(\frac{-ae^{bt_1}}{b(b+a_{13})}\right)+\varsigma_{p3}\left(\frac{-a}{(b+a_{13})}-\frac{ae^{bt_1}}{b}\right)+\varsigma_{s3}\left(\frac{ae^{b(T-t_1)}}{b^2}\right)\right)\right]\right\}\right) \quad (20)$$

By using signed distance method, the defuzzified value of fuzzy number $\varsigma(t_1,T)$ is given by

$$T\varsigma_{ds}(t_1,T)=\frac{1}{2}\int_0^1[C_L(\alpha)+C_R(\alpha)]d\alpha$$

$$T\varsigma_{ds}(t_1,T)=\frac{1}{2T}\left[C_0T-C_{h1}T\left(\frac{ae^{bt_1}}{b(b+a_{11}}\right)-C_{p1}T\left(\frac{a}{b+a_{11}}+\frac{ae^{bt_1}}{b}\right)+C_{s1}T\left(\frac{ae^{b(T-t_1)}}{b^2}\right)\right.$$

$$-C_{h2}\left(\frac{ae^{bt_1}}{b(b+a_{12})}\right)\frac{T^2}{2}-C_{p2}\left(\frac{a}{b+a_{12}}+\frac{ae^{bt_1}}{b}\right)\frac{T^2}{2}+C_{s2}\frac{T^2}{2}\left(\frac{ae^{b(T-t_1)}}{b^2}\right)$$

$$+C_{h1}\left(\frac{ae^{bt_1}}{b(b+a_{11})}\right)\frac{T^2}{2}+C_{p1}\left(\frac{a}{b+a_{11}}+\frac{ae^{bt_1}}{b}\right)\frac{T^2}{2}-C_{s1}\frac{T^2}{2}\left(\frac{ae^{b(T-t_1)}}{b^2}\right)$$

$$C_0T-C_{h4}\left(\frac{ae^{bt_1}}{b(b+a_{14})}\right)T-C_{p4}T\left(\frac{a}{b+a_{14}}+\frac{ae^{bt_1}}{b}\right)+C_{s2}T\left(\frac{ae^{b(T-t_1)}}{b^2}\right)$$

$$+C_{h4}\left(\frac{ae^{bt_1}}{b(b+a_{14})}\right)\frac{T^2}{2}+C_{p4}\frac{T^2}{2}\left(\frac{a}{b+a_{14}}+\frac{ae^{bt_1}}{b}\right)-C_{s2}\frac{T^2}{2}\left(\frac{ae^{b(T-t_1)}}{b^2}\right)$$

$$-C_{h3}\left(\frac{ae^{bt_1}}{b(b+a_{13})}\right)\frac{T^2}{2}-C_{p4}\frac{T^2}{2}\left(\frac{a}{b+a_{13}}+\frac{ae^{bt_1}}{b}\right)+C_{s3}\frac{T^2}{2}\left(\frac{ae^{b(T-t_1)}}{b^2}\right)$$

To minimize the total costs function per time $T\varsigma_{ds}(t_1,T)$ T the optimal value of 1 t and T can be obtained by solving the following equations

$$\frac{\partial T\varsigma_{ds}}{\partial t_1}=0 \quad \text{and} \quad \frac{\partial T\varsigma_{ds}}{\partial T}=0$$

Algorithm

Stage 1: Enter the interest (here request is power interest), buying costs, holding expenses and crumbling costs for all items.

Stage 2: Define fluffy trapezoidal number for the interest (here request is power interest), buying costs, holding expenses and crumbling costs for all items.

Stage 3: We decide the complete expense for fresh model,

$= Tc(t_1,T)$

$$Tc(t_1,T)=\frac{1}{T}\left[C_0+C_h\left[\frac{t_1ae^{bt_1}}{(b+a_1)}-\frac{ae^{bt_1}}{b(b+a_1)}\right]+C_p\left(C_0\left[\frac{a^2e^{b(t_1+T)}}{b(b+a_1)}-\frac{a^2e^{2bT}}{2b(b+a_1)}\right]\right)+C_s\left[\frac{ae^{b(T-t_1)}}{b^2}\right]\right].$$

Step 4: From equation (22), we determine the total cost for fuzzy model.

Step 5: Defuzzified value of fuzzy number ς_{Ts} by using signed distance method.

Step 6: Compared the total inventory cost for crisp model and fuzzy model.

Step 7: Print the comparison between the crisp model and the fuzzy model.

Numerical Analysis

To find the planned method, let us consider the following given data:

Crisp Model

a=110 per year, b=0.522 per unit, C0 =Rs. 200 per order,

Table-1: Illustration of the solution procedure for the Numerical Model

Changing Parameters	Values of the Parameters (Per Year)	T (Year)	t_1 (Year)	TC (Rs.)	C_{TS}
Ch	5	0.8215	0.6792	390.642	50.765
C_s	15				
C_p	20				
a_1	0.012				

Numerical Analysis for Fuzzy Model

Input Data

Let a = (80, 100, 120, 140), b = (0.452, 0.55, 0.623, 0.685),

$\varsigma h = (\varsigma h_1, \varsigma h_2, \varsigma h_3, \varsigma h_4) = (2, 4, 6, 8)$

$\varsigma s = (\varsigma s_1, \varsigma s_2, \varsigma s_3, \varsigma s_4) = (12, 14, 16, 18)$

$\varsigma p = (\varsigma p_1, \varsigma p_2, \varsigma p_3, \varsigma p_4) = (14, 18, 22, 26)$

And $a_1 = (a_{11}, a_{12}, a_{13}, a_{14}) = (0.004, 0.008, 0.012, 0.016)$. Then by using signed distance method, we obtain:

Case 1

When ςh, ςs, ςp and 1 a_1 are fuzzy trapezoidal numbers. The solution of fuzzy model is:

Case 2

When ςs, ςp and a are fuzzy trapezoidal numbers. The solution of fuzzy model is:

t_1 = 0.6313 year, $T\varsigma_{ds}(t_1, T)$ = Rs. 405.012, T = 0.8246 year, ς_{Ts}= 53.175

Case 3

When pς and 1 a are fuzzy trapezoidal numbers. The solution of fuzzy model is: 1 t = 0.6589 year, 6 =Rs. 406.182, T= 0.8279 year, ςTs = 51.635.

$T\varsigma_{ds}(t_1, T)$ = Rs. 406.182

Case 4

When 1 a is fuzzy trapezoidal number. The solution of fuzzy model is: 1 t = 0.6614 year,

Case 5

When none of ςh, ςs, ςp and a_1 is fuzzy trapezoidal numbers. The solution of fuzzy model is:

t_1 = 0.6792 year, $T\varsigma_{ds}(t_1, T)$ = Rs. 390.642 T = 0.8215 year, ς_{Ts}= 50.765

Comparison Table for Optimal Results'

Table-2: Comparison between Crisp and Fuzzy

Model	Optimal Value of t_1 (Years)	Optimal Value T (Years)	Optimal Value of TC (Rs.)	Optimal Value of $T\varsigma(t_1, T)$ (Rs.)	Optimal Value of C_{TS}	Optimal Value of ς_{Ts}
Crisp	0.6792	0.8215	390.642		50.765	
Fuzzy	0.6203	0.8021		415.532		55.445

Conclusion

We introduced fluffy inventory model for deteriorating items with deficiencies under completely multiplied condition. Normally the inventory model comprises of the deficiency cost and crumbling cost. Here we utilized the force interest and the decay rate was consistent. In fluffy climate, all connected inventory boundaries were thought to be trapezoidal fluffy numbers. The ideal aftereffects of fluffy model were defuzzified into marked distance technique. This will build the complete benefit. A mathematical investigation was outlining the complete expense. Affectability investigation demonstrates the complete expense work was more delicate to change the benefit of holding cost. For other related boundaries we can choose the ideal worth of all out cost. For additional examinations we are wanting to degree the numerical models to consider more factors identified with store network execution.

References

Aggarwal, S. P. and Jaggi, C. K. (1995) Ordering policies of deteriorating items under permissible delay in payments, *Journal of the Operational Research Society*, Vol.46, 658-662.

Chandrasekhara Reddy, B. and Ranganatham, G. (2012).An EOQ Model with Exponentially Increasing Demand fewer than Two Levels of Storage, Journal of perspective - Gurgaon, Vol.16, 121-127.

Chang, H. J. and Dye, C. Y. (2001). An inventory model for deteriorating items with partial backlogging and permissible delay in payments, *International Journal of Systems Science*, Vol. 32, 345-352.

Chang, H. J., Hung, C. H. and Dye, C. Y. (2001). An inventory model for deteriorating items with linear trend demand under the condition of permissible delay in payments, Production Planning & Control, Vol. 12, 274-282.

Chang, C. T., Teng, J. T. and Goyal, S.K. (2008). Inventory lot-size models under trade credits: a review, *Asia-Pacific Journal of Operational Research*, Vol. 25, 89-112.

Chang, C. T., Wu, S. J. and. Chen, L. C. (2009). Optimal payment time with deteriorating items under inflation and permissible delay in payments, *International Journal of Systems Science*, Vol. 40. 985-993.

Dutta, D. and Pavan Kumar. (2013). Fuzzy Inventory Model for Deteriorating Items with Shortages under Fully Backlogged Condition, *International Journal of Soft Computing and Engineering (IJSCE)*, Vol.3, 393-398.

Goyal, S. K. (1985). Economic order quantity under conditions of permissible delay in payments, *Journal of the Operational Research Society*, Vol. 36, 335-338.

Halkos, G. and Kevork, I. (2012). Validity and precision of estimates in the classical newsvendor model with exponential and Rayleigh demand, MPRA Paper No. 36460, posted 6. 12:22 UTC.

Halkos, G. and Kevork, I. (2013). Evaluating alternative frequentist inferential approaches for optimal order quantities in the news vendor model under exponential demand, International transactions in Operational research Vol. 20, 837-857.

Horng-Jinh Chang and Chung-Yuan Dye. (1999). An EOQ Model for Deteriorating Items with Exponential Time-Varying Demand and Partial Backlogging, Information and Management Sciences, Vol. 10, 1-11.

Hwang, H. and Shinn, S. W. (1997). Retailer's pricing and lot sizing policy for exponentially deteriorating products under the conditions of permissible delay in payments, Computers & Operations Research, Vol. 24, 539-547.

Jaggi, C. K., Pareek, S., Sharma, A. and Nidhi, A. (2012). Fuzzy inventory model for deteriorating items with time varying demand and shortages, *American Journal of Operational Research*, Vol. 2, 81-92.

Jamal, A. M. M., Sarker, B. R. and Wang, S. (1997). An ordering policy for deteriorating items with allowable shortages and permissible delay in payments, *Journal of the Operational Research Society*, Vol. 48, 826-833.'

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Employee Satisfaction of Performance Appraisal and Employee Turnover

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Abstract

The study aims to examine the effect of the Employee Satisfaction of Appraisal process on Employee turnover intention. It also investigate the effect of the mediating role played by Fairness and Transparency on the relationship of primary variables. The sample size for the study consisted of 430 employed individuals from different firms. SPSS and AMOS are used to develop a measurement and structural model for confirming validity and reliability. Using Process Macro model 6 (serial sequential mediation model) tested hypothesis. The study results confirms the direct effect of employee satisfaction of performance appraisal on employee turnover intention and confirm that fairness and Transparency have mediating effects on the relationship. Given that information was only acquired from people who are now employed in India, there is a chance that there may be general biases. Also, the current study does not compare or incorporate performance management approaches from other Asian nations. Asian nations are likely to have diverse organisational practises and cultures. The study expands the knowledge by using sequential model method for examining Employee Satisfaction of Performance appraisal, Employee Turnover Intention, Fairness and Transparency. The study is one of the few to study a sequential model using variables under study. The study encourages the development of organizational practices to improve the employee performance management process. It gives insight for the organization in developing employee satisfaction of organizational processes. The study will help frame policies and practices for employee retention and performance.

Keywords: Employee Satisfaction of Performance Appraisal, Employee Turnover Intention, Fairness, Transparency

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Introduction

Performance appraisal plays a significant role in developing employee contributions for organizational goals and objectives. It helps shape employee performance and enhance their potential for future roles in an organization. Armstrong (2003) suggested that performance appraisal systems are the outcome of initial people management practices and lately are seen as a part of organizational performance management. Performance appraisal helps the organization in assessing and evaluating employee performance. The experience of performance appraisal significantly contributes towards developing an understanding of organizational capability. Performance appraisal evaluates employee performance to identify gaps and promotes improvement amongst employees (Hee & Jing, 2018).

Every employee in the organization expects just and fair treatment. Organizations should ensure that all the employees have a positive attitude toward the accuracy of the performance appraisal process. The decisions made in due course of performance appraisal shape the employee perception of fair treatment. The performance appraisal process implemented transparently, ethically, and with values positively affects employee morale. It helps employees become responsible and accountable for their performance. In case employees develop the feeling of unjust treatment harms their performance. Hence, Employees' sense of fairness and Transparency in the system depends upon how the organization implements the appraisal process. The performance appraisal outcome may be in terms of pay, promotion, and career advancement opportunities (Girma, Lodesso, & Sorsa, 2016). The aspect of fairness relates to organizational justice delivered by employing performance appraisal. The fairly treated employees will have a positive perception compared to unfairly treated employees who develop low feelings towards the organization (Chang et al., 2020; Van Dijke et al., 2019)

Performance appraisal is a significant contributor to employee performance and organizational outcome. Given the process and the result of Performance appraisal, it is interesting still the desired results are scarcely achieved (Grubb, 2007). Most of the studies focus on the characteristics of the employee and job. They overlook the necessary concern and effect of fairness and Transparency. Practitioners and scholars agree on the need for effective performance appraisal implementation and the outcome in terms of employee performance, but they debate the quality of the process. (Heathfield, 2007). There is a need to study employee perceptions of fairness and employee satisfaction of the performance appraisal process (Pichler, 2012). Also, there is a lack of studies on Transparency in performance appraisal (Van, 2014). In a study, Palaiologos et al. (2011) argued lack of employee satisfaction from the performance appraisal process. In the same

study author further stated that unfairness in the appraisal will develop negative employee perception and increase dissatisfaction. By analyzing the mediating influence and examining alternative HRM approaches, Otoo (2020) pushes research on improving employee engagement and organizational effectiveness (Varma and Chavan, 2019). As a result, the current research focuses on the relationship between employee appraisal process satisfaction and the likelihood of turnover. It looks at the role of Fairness and Transparency in mediating the link between the significant variables. Furthermore, organizations that facilitate information exchange among various functions contribute to developing an innovative culture and improving organizational performance (Arsawan et al. 2022; Migdadi, 2020; Varma and Chavan, 2020).

Research Questions

The study proposes to explore the following research questions:

RQ1. How does the Employee Satisfaction of Performance appraisal process affect Employee Turnover Intention?

RQ2. What is the effect of Fairness and Transparency on the relationship of Employee Satisfaction with the performance appraisal process that affects Employee Turnover Intention?

Literature Review and Hypothesis Development

The Relationship between Employee Satisfaction of Performance Appraisal and Employee Turnover Intention

Performance appraisal as an HRM function integrated into organization strategies delivers sustained competitive advantage. It plays a vital role in enhancing employee performance (Armstrong & Baron, 2005; Garengo and Sardi, 2021). The performance appraisal process keeps track of current output and compares it to previous to improve future performance (Bersin, 2008). Performance appraisal significantly contributes to building employee perception towards the organization. If the employee perceives that the process followed and the outcome of the performance appraisal is fair will have a positive effect and vice versa (Mullins, 2007, p. 43). Performance appraisals play a significant role in assessing employee performance. The performance appraisal process helps the organization make employee management decisions based on the outcome achieved by individuals contributing to organizational goals. The performance appraisal process helps decisions on training and development, compensation, and succession planning (Torrington et al., 2020). It helps both the company and the employees. When it comes to generating clarity and offering feedback, organizations must exercise extreme prudence. It can potentially encourage or demotivate people and play a crucial part in developing

employer-employee relationships (Rana and Singh, 2022). The backing of organizational leadership is crucial in encouraging employees to behave in an inclusive manner (Ramalu and Janadari, 2022). High-performing HR management techniques boost employee morale (Goyal and Patwardhan, 2021)

Employee involvement is critical for organizational productivity and efficiency, according to Khan et al. (2018). It suggested a correlation between employee satisfaction and employee performance; Also stated that dissatisfaction among employees may lead to low individual performances and affect organizational outcome overall. It encourages companies to build effective assessment methods for continual employee performance monitoring and review. Organizations also appreciate employee participation in the assessment process (Denisi & Pritchard, 2006). Employees that are happy with the performance assessment process create overall work satisfaction and are devoted to corporate goals, according to Jawahar (2007). It helps to retain personnel and keep them interested in the organization. Pre-defined standards and Transparency are significant predictors of employee engagement (Lindholm, 1999).

Jawahar & Carr (2007) suggested that employee perception of Performance appraisal fairness and Transparency leads to employee satisfaction. Organizations have been facing the challenge of developing clarity on the expected performance resulting ineffective evaluation process. There is a lack of objectivity and biases resulting lack of Transparency in the process. With a lack of clarity, uncertain evaluation criteria develop dissatisfaction among employees. As a result of the uncertainty, employees' capabilities are underutilized. It results in low growth and employee resistance to the performance appraisal process resulting in employee turnover. The employee resistance is to secure the job would resist the performance appraisal process (Saffie-Robertson & Brutus, 2014)

H1. There is a significant relationship between Employee Satisfaction of Performance Appraisal (ESPA) and Employee Turnover Intention (ETI)

Fairness

Armstrong (2006) supports the view of setting standards and taking a step ahead by involving employees in the goal-setting process. It will enhance fairness and Transparency in setting performance targets. Allowing employees to participate in goal setting has a significant effect on employee efficiency and performance (Pettijohn et al., 2001; Knight et al., 2001; Ryu & Hong, 2020). Also, Encouraging employee participation in organizational processes enhances the level of trust between managers and employees (Tzafrir et al., 2004). Denisi & Pritchard (2006) suggested that employee participation enhances the feeling of fairness among employees and motivates them. It also helps in developing an effective appraisal

process. Therefore, an ineffective system will lead to dissatisfied employees affecting their performance. It significantly affects the performance appraisal system (Shewit, 2016). Sharma et al. (2016) advised that the accuracy and fairness of the method and practice determine the efficacy of the performance rating system. Employees respond favourably to a fair and open performance review system (Brown and Benson, 2003). Researchers have constantly spoken about fairness being a significant element of performance appraisal (Denisi & Sonesh, 2011; Sardi et al., 2021)

H2. Fairness mediates the Relationship between Employee Satisfaction of Performance Appraisal and Employee Turnover Intention (ETI).

Transparency

Organization hiring and employee expects them to help achieve organizational objectives. Similarly, employees join an organization with the expectation of growth and development. The employee appraisal process helps determine the gaps which have not allowed to achieve the desired performance. Organizations involve supervisors and managers in the performance evaluation process (Kuvaas, 2006). Hence, it is the responsibility of managers to develop clarity on the appraisal process (Cheng, 2014). Organizations can enhance overall performance by simple explanation and developing clear roles and criteria of assessment (Kelly et al., 2008; Chakrabarty, 2014). Also, rewarding potential in the organization is the foremost aim of performance appraisal processes. Transparency increases the feeling of trust among employees towards the organization. Performance assessment has been scrutinized for ethical difficulties and questioned for fairness in execution, which is critical to establishing trust (Lau, Wong & Eggleton, 2008). There is a lack of fairness and Transparency in administering compensation and benefits to the employees after performance appraisal (Cardona, 2007). There is noticeable discontent related to Transparency in the performance appraisal process.

H3. Transparency mediates the Relationship between Employee Satisfaction of Performance Appraisal and Employee Turnover Intention (ETI).

Performance Appraisal and Employee Turnover Intention – Effect of Fairness and Transparency

Employee willingness to perform and turnover intention are directly or indirectly affected by HRM practices (Zimmerman and Darnold, 2009). Performance appraisal is often responsible for employee perception of justice in organizational practice (William, 1992). Organizations developing and designing appraisal processes stress improving trust in the evaluation process. It supports the development of a favourable attitude regarding the accuracy of data and decisions made for employees (Guest,

2004). Employee perceptions of work roles and HRM procedures are significant predictors of the desire to leave (Edgar and Geare, 2005). There is a clear link between fairness and transparency and employee perceptions of the performance assessment process being excellent or negative (Maley, 2009). The company must realize that developing or designing a fair and transparent assessment procedure is insufficient. Employee satisfaction is equally critical for the successful execution of appraisal and desired outcome (Keeping & Levy, 2000; Murphy & Cleveland, 1995). Employee perception of organizational justice is instrumental in explaining employee reactions to the performance appraisal process (Erdogan, 2002). Previous studies have observed a positive and significant relationship between how employees perceive organizational justice and successful implementation and outcome of the performance appraisal process (Rumold, 2010). The view directs towards employee satisfaction of appraisal process and its positive and significant relationship with organizational justice in terms of fairness and Transparency. Fairly and transparently implemented processes and decisions made are well accepted by the employees (Labuschagne, Brent, Van, 2005).

H4. The Relationship between Employee Satisfaction of Performance Appraisal and Employee Turnover Intention sequentially mediated by Fairness and Transparency maintained in the performance appraisal process.

Research Methodology

The study hypothesizes that the Employee Satisfaction of Performance appraisal process directly affects Employee Turnover intention. Also, the study investigates the relationship in the presence of mediating variables fairness and Transparency. Using Hayes' Model 6, Process macro, the study investigates the importance of serial sequential mediation (Hayes, 2013). Baron and Kenny, (1986) suggested a strategy based on regression and bootstrapping approaches. A 5000 bootstrap with 95% confidence intervals was utilized (Hayes, 2013).

Confirmatory Factor Analysis ascertain the goodness of fit. SPSS and AMOS were used to assess validity and reliability. The current study performs Process macro with one Predictor variable (ESPA), one Outcome variable (ETI), and two mediating variables. Firstly, the study analyzes the direct effect of ESPA on ETI. Then fairness is introduced as the first mediator, and its effect on the relationship are analyzed. Thirdly, the second mediator, Transparency, is introduced, and its effect is analyzed. Later the three path model with two primary variables and two mediators is analyzed for serial mediation effect (Hayes, 2009). The Complete serial sequential model is analyzed using Process Macro (Hayes, 2013).

Hypothesized model

Figure-I: Direct Effect

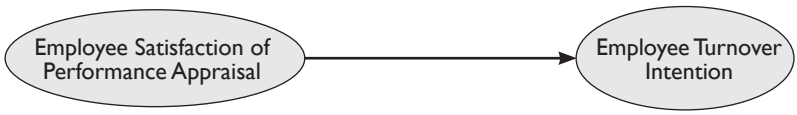
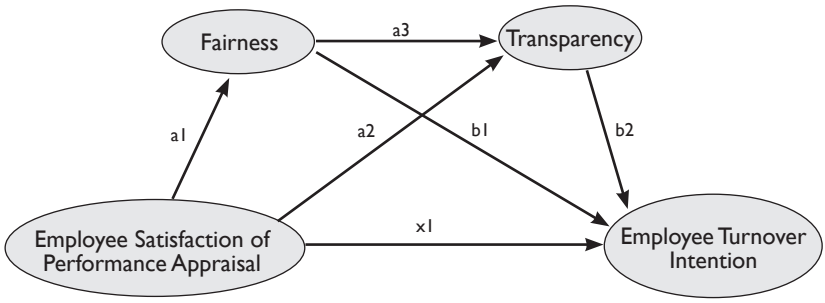


Figure-II: Indirect Effect



Sampling and Data Collection

The study conducted a questionnaire survey to investigate the interest variables. The target population is employees of the IT and ITES industry. The data were collected from employed professionals using the Snowball Sampling method. For the study, 430 questionnaires were found suitable. The survey instrument had two sections: the first section collects demographic information, while the second section gathers data on the interest factors. The data included 42% male and 58% female responders from various organizations. Around 67% of the responders are between the age group of 26 and 35. Employees who had been with their company for five years or more made up around 75% of the total.

Measures

The study uses established multi-item scales from earlier research. The interest variables measured are Employee Satisfaction of Performance Appraisal Process, Employee Turnover Intentions, Fairness and Transparency. The interest variables are measured 5-point scale (1 = Strongly disagree, 5 = Strongly agree).

Employee Satisfaction of Performance Appraisal Process: A subscale developed by Cook and Crossman (2004) measures ESPA. The scale measures employee satisfaction in the performance appraisal process (pay, promotion, and growth opportunities). It is a 7 item scale used to measure ESPA.

Employee Turnover Intentions: 3 item scale is adopted to measure Employee turnover intention originally developed by Kuvaas (2006)

Fairness: 5 item scale comprises two subscales developed by Prather, T. M. (2010) Cook, and Crossman (2004).

Transparency: 6 item scale developed by Cook and Crossman (2004) measures Transparency in the performance appraisal process.

The validity and reliability of the scales is measured

Data Analysis and Findings

Table-I presents the descriptive statistics derived after analyzing the interest variables. The table also shows the correlation between the variables studied. The study observes a positive and significant relationship between the Independent and dependent variables. Preliminary results provide support for further study. Cronbach's Alpha is estimated to examine the reliability. The values obtained for interest variables are above 0.7 (see Table-II).

Table-I: Descriptive Statistics

	Mean	Std. Deviation	ESPA	FA	TA	ETI
ESPA	4.2479	.69543	1			
FA	3.9557	.79451	.688**	1		
TA	3.2098	.63920	.574**	.728**	1	
ETI	3.9607	.87470	.527**	.624**	.962**	1

**Correlation is significant at the 0.01 level (2-tailed).

Source (s): Own Study

Table-II: Cronbach's Alpha

Variables	Cronbach's Alpha	N of Items
ESPA	0.925	6
FA	0.874	4
TR	0.853	4
ETI	0.845	3

Source (s): Own Study

Multi-collinearity

The study examined multi-collinearity to check tolerance and VIF (Variance inflation factor) within the interest variables. Table-III presents multi-collinearity values of the predictor variables. It indicates achievement of the multi-collinearity assumption as the value for tolerance is below 1.0 and the value for predictor variables VIF is less than 5. There is no violation of multi-collinearity (Yu, Jiang, & Land, 2015). The tolerance value for ESPA (0.392), FA (0.557) and TR (0.368). The VIF value obtained is ESPA (2.548), FA (1.795), and TR (2.715). The statistics for lower tolerance value is o.20 and VIF thresh-hold value five or around 2.5.

Table-III: Multi-Collinearity

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	-.051	.019		-2.672	.008		
	ESPA	1.403	.007	1.175	210.948	.000	.392	2.548
	FA	-.122	.007	-.084	-18.022	.000	.557	1.795
	TR	-.212	.007	-.181	-31.523	.000	.368	2.715

a. Dependent Variable: ETI

Source (s): Own Study

Confirmatory Factor Analysis

A measurement model explores the four-factor model (Employee Satisfaction of Performance Appraisal, Employee Turnover Intention, Fairness, and Transparency). CFA observes excellent model fit measures (Table-III). The observed values are excellent and acceptable against the standard recommendation. (X2 /df = 1.991, GFI = 0.952, NFI = 0.959, CFI = 0.979, TLI = 0.974, RMSEA = 0.048). RMSEA value observed is (0.44) is below the recommended value of 0.05 (Hu and Bentler, 1999). The findings of Confirmatory Factor Analysis establish empirical support for further study.

Table-IV: Model Fit Measures

Measure	Estimate	Threshold	Interpretation
CMIN	167.227	--	--
DF	84	--	--
CMIN/DF	1.991	Between 1 and 3	Excellent
CFI	0.979	>0.95	Excellent
SRMR	0.035	<0.08	Excellent
RMSEA	0.048	<0.06	Excellent
PClose	0.604	>0.05	Excellent

The study tested in all 21 items Employee Satisfaction of Performance Appraisal 7 items, Employee Turnover Intention 3 items, Fairness 5 items, and Transparency 6 items. Four variables had low loadings and cross-loadings. The study continued further analysis with 17 items and removed four items.

The measurement model assessed the Discriminant & Convergent Validity (DV, CV) along with the Composite Reliability (CR). It measures the internal consistency of the items measuring the construct (Hair et al., 2014; 2017). Table-V & VI presents the values obtained for testing CR, AVE, MSV. Composite reliability for ESPA (0.949), TR (0.864), FA (0.883) and ETI (0.834). All the values obtained for CR are above the threshold of (0.7). Anderson and Gerbing (1988) suggested the threshold value be

greater than 0.7 (CR > 0.7), therefore indicating good internal consistency. The items in the same constructs positively correlated, indicating a good CV. The values obtained are (CV > 0.7, AVE > 0.5), supporting the validity of the items and constructs studied (Fornell and Larcker, 1981; Hair et al., 2006; 2010). Discriminant validity (DV) is the square root of AVE is greater than the inter construct correlation value (Table-VI) (Malhotra and Dash, 2011, p.702; Hu and Bentler, 1999). An initial analysis had no reliability and validity concerns.

Table-V: Reliability and Validity

Constructs	Measured Items	Factor Loading	CR	AVE	MSV
Employee Satisfaction of Performance Appraisal (ESPA)	ESPA1	0.89	0.949	0.755	0.564
	ESPA2	0.889			
	ESPA3	0.862			
	ESPA4	0.885			
	ESPA5	0.827			
	ESPA7	0.86			
Fairness (FA)	FA1	0.804	0.883	0.653	0.47
	FA3	0.819			
	FA4	0.793			
	FA5	0.815			
Transparency (TR)	TR1	0.742	0.864	0.614	0.564
	TR2	0.863			
	TR5	0.796			
	TR6	0.726			
Employee Turnover Intention (ETI)	ETI2	0.799	0.834	0.626	0.47
	ETI1	0.764			
	ETI3	0.809			

Source (s): Own Study

Table-VI: Discriminant Validity

	ESPA	TR	FA	ETI
ESPA	0.869			
TR	0.751***	0.784		
FA	0.555***	0.577***	0.808	
ETI	0.575***	0.535***	0.685***	0.791

Source (s): Own Study

Hypothesis and Model Testing

The study tested Serial Mediation Model using Model number 6 and SPSS Process Macro recommended by Hayes (2013). The direct and indirect effect is studied by bootstrapping up to 5000 samples and a 95% Confidence Interval (CI) to estimate the direct and indirect effect. The CI determines the significance of the study. If the lower level of confidence

interval (LLCI) & upper level of confidence interval (ULCI) value does not include zero, the results are significant. Figure III presents the serial mediation model path coefficients. Tables-VII & VIII present total, direct, and indirect effects.

The results show that ESPA has a direct and negative effect on ETI, i.e. when Employee satisfaction rises, the Employee intention to leave decreases. The study observes the effect of mediating variables Fairness and Transparency. ESPA has a direct and indirect effect through the mediating variables. The result confirms a direct relationship between ESPA and ETI and the two other variables mediating the relationship. Table-VI presents the direct effect of ESPA on ETI. The results show the direct effect of ESPA on ETI in the presence of mediating variables FA and TR. Table-VII present the direct effect. It is negative and significant (Direct Effect = (-.3913), SE = ((.0637), 95% CI, LLCI = (-.5164) – ULCI = (-.2662)). The value observed LLCI-ULCI does not include zero. It supports H1 that ESPA significantly affects ETI.

Figure-III: Direct effects Direct Effect ESPA on ETI

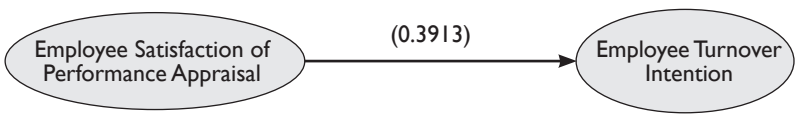


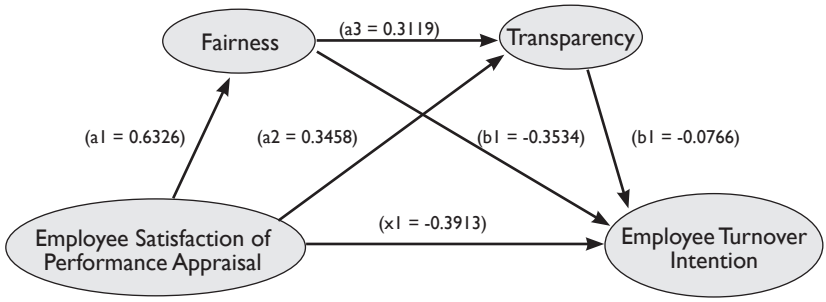
Table-VII: Direct Effect ESPA on ETI

Effect	se	t	p	LLCI	ULCI
-0.391	0.064	-6.147	0.000	-0.516	-0.266

Source (s): Own Study

Table-VIII presents total and indirect effect obtained during the analysis of the interest variables. The results confirm total effect to be negative and significant (Total Effect = (-.2360), SE = (.468), 95% CI, LLCI = (-.3303) – ULCI = (-.1462)). After introduction of the mediating variables FA & TR the results obtained are M1- (Indirect Effect = (-.0485), SE = (.430), 95% CI, LLCI = (-.1350) – ULCI = (-.335)). M2 – (Indirect Effect = (-.1102), SE = (.290), 95% CI, LLCI = (-.1727) – ULCI = (-.0584)). The results support H2 and H3. Fairness and Transparency mediate individually between ESPA and ETI. Lastly, the results obtained confirm that ESPA has significant indirect effect on ETI through FA and TR (Indirect Effect = (-.0773), SE = (.190), 95% CI, LLCI = (-.1165) – ULCI = (-.429)) supporting H4.

Figure-IV: Indirect Effect



Source (s): Own Study

Table-VIII: Indirect effect ESPA – ETI via Fairness and Transparency

	Effect	BootSE	BootLLCI	BootULCI
TOTAL	-0.2360	-0.0469	0.3304	-0.1439
Ind1	-0.0485	0.0424	-0.1317	-0.0350
Ind2	-0.1102	0.0292	-0.1745	-0.0578
Ind3	-0.0773	0.0197	-0.1195	-0.0422

Indirect effect key:

Ind1	ESPA	->	FA	->	ETI	
Ind2	ESPA	->	TR	->	ETI	
Ind3	ESPA	->	FA	->	TR	-> ETI

Discussion

The study tries to understand the relationship and effect of employee satisfaction of performance appraisal on employee turnover intention. In addition, it also analyses the effect of mediating variables fairness and Transparency on the relationship. The results of the study rationally provide support to the proposed hypothesis. The results obtained have confirmed the hypothesis decided for the study. Employee satisfaction of performance appraisal has a direct effect on employee turnover intention. The effect of ESPA on ETI is negative and significant. Therefore, with employee satisfaction increasing, the employee turnover intention decreases. Further, fairness and Transparency mediate the relationship of primary variables. Table-VIII presents the results of the hypothesis tested.

Table-IX: Hypothesis Testing

	Hypothesis	Result
H1	There is a significant relationship between Employee Satisfaction of Performance Appraisal (ESPA) and Employee Turnover Intention (ETI)	Supported

	Hypothesis	Result
H2	Fairness mediates the Relationship between Employee Satisfaction of Performance Appraisal and Employee Turnover Intention (ETI).	Supported
H3	Transparency mediates the Relationship between Employee Satisfaction of Performance Appraisal and Employee Turnover Intention (ETI).	Supported
H4	The Relationship between Employee Satisfaction of Performance Appraisal and Employee Turnover Intention sequentially mediated by Fairness and Transparency maintained in the performance appraisal process.	Supported

The study's findings align with significant studies presenting significant effects of employee perception on employee satisfaction and turnover intentions (Kinnie et al., 2005; Palaiologos et al., 2011). Gupta and Kumar (2013) advocate procedural justice. The view is supported by Van & Lind (2002) as they recommend developing clarity and eliminating uncertainties to make the process as fair and transparent as possible. A study confirmed the significant role of High-performance HRM practices in developing a climate for innovation and employee competencies (Noopur and Dhar, 2021). Lassi et al. (2020) & Chen et al. (2021) support the view that HRM practices impact employee satisfaction and workplace behaviour. The findings emphasize the need to design an assessment process with fairness and implement it transparently. Organizations must devote substantial resources to designing procedures that include variables that contribute to favourable employee impressions. A sense of fairness and openness influences employee happiness. HRM strategies centred on resource identification enhance employee and employer success (Mohanty and Arunprasad, 2021; Varma and Chavan, 2021).

Thus, employee satisfaction with performance appraisal and its components is practical in increasing the effectiveness of these appraisals (Toppo and Prusty, 2012). Kuvaas (2006) points out that organizations can utilize performance appraisal activities to convey an organization's strategies, goals, and attitudes. In addition, the affective and emotional impacts of these superordinate goals can capture the heart of employees and give them a reason to continue their activities.

Findings extend the existing knowledge in performance appraisal, employee satisfaction, and employee turnover intention. The study simplifies, and better understands the interest variables, which offer a dynamic and complex relationship. Performance appraisal effective and efficient implementation has constantly been a challenge for organizations (Brown et al., 2010). Most of the researchers in performance appraisal claim the importance of fairness and Transparency but agree to not being there in practice. The current study presents the importance of the interest

variables and empirically tests and establishes a relationship. Few studies have tested the serial mediation model considering ESPA, ETI, Fairness, and Transparency. The study's findings significantly contribute to further enhancing and validating the knowledge.

Practical Implication

Organizations continuously measure employee satisfaction in the performance appraisal process (Keeping and Levy, 2000; Varma and Chavan, 2019). It is an investment to harness employees' long-term commitment (Gardner, Pierce, & Peng, 2021). Continuous performance evaluation has a significant effect on organizational performance. The performance is positive or negative depending upon how employees perceive it as fair or unfair practice (Kim & Holzer, 2016). The perception developed by employees influences employee behaviour and participation in the appraisal process, ultimately affecting appraisal outcomes (Kim & Rubianty, 2011). Employees equate performance evaluation outcome with organizational justice, i.e., how an organization behaves with the employee justly and fairly. It helps develop employee perceptions and behaviour of accepting or rejecting organizational practices (Greenberg, 1986); Cawley, Keeping, and Levy, 1998). It affects the employees' opinions and degree of participation in the process.

The positive perception of employees significantly affects the way employees accept feedback on areas of improvement (Cawley, Keeping, and Levy, 1998). Singer (2000) suggested that the employee performance evaluation relates to justice and ethical practices. Farndale et al., (2011) supported the view and explained the importance of organizational justice. Petrick & Quinn (1997) also explained the benefits of organizational practices established with good intentions resulting in enhanced integrity from employees in return. The study's findings have a significant suggestion for the practitioners and endeavouring to develop an effective and efficient performance appraisal process. According to the study's findings, implementing a fair and transparent performance assessment system can boost employee satisfaction and minimize turnover. Rikhardsson, Wendt, Arnardóttir, and Sigurjónsson (2021) advocated that the performance review process can have the unpredictability of the environment in mind.

Limitation and Direction of future research

The study faces certain limitations. The first limitation faced is that details collected from currently employed individuals and possibilities of common biases are there. The second limitation is that the study was not longitudinal and not being done at different points of time, due to which there is no effect of changing environment analyzed. The third limitation

is that the study is limited to collecting data, analyzing, and interpreting results about the two primary and two mediating variables. The findings of the current study provide directions for future studies. Future studies can help overcome the limitations by focus groups and a longitudinal study to obtain results for different times. Also, future studies can include more variables that can mediate the interest variables.

Conclusion

Organizations develop compliance models for their functions and processes based on these four principles of ethical corporate governance are fair, accountable, responsible, and transparent (Rezaee, 2009). As an organization sets out to achieve its goals and objective by employing human resources, it needs to develop ethical standards in managing employee performance and expectations (Greenwood, 2002). Also, a study by Marescaux et al. (2013) reported autonomy and relatedness' employee satisfaction mediates between the HRM practices and HRM Outcome. Employee performance management has always been an important area of study. Similarly, it has always faced the challenge of ethics and justice observed in implementation (Jamaiudin, 2021).

However, the challenge of fairness and Transparency in the performance appraisal process or any organizational process related to employee management exists in the organization. If it exists, it presents a stronger and more ethical organizational character. Organizations to develop a transparent and fair performance appraisal system to eliminate employee dissatisfaction with the appraisal process (Lu, Zhao, & Liu, 2021). The study results present empirical evidence to prove the relationship between Employee satisfaction of Performance appraisal and employee turnover intention. Fairness and Transparency confirm the effectiveness of the performance appraisal system.

References

Anderson, J. C., & Gerbing, D. W. (1988), "Structural equation modeling in practice: a review and recommended two-step approach". Psychological Bulletin, Vol. 103 No. 3, pp. 411-423.

Armstrong, M. (2006). A handbook of human resource management practice. Kogan Page Publishers.

Armstrong, M., & Baron, A. (2005). Managing performance: performance management in action. CIPD Publishing.

Arsawan, I.W.E., Koval, V., Rajiani, I., Rustiarini, N.W., Supartha, W.G. and Suryantini, N.P.S. (2022), "Leveraging knowledge sharing and innovation culture into SMEs sustainable competitive advantage",

International Journal of Productivity and Performance Management, Vol. 71 No. 2, pp. 405-428. https://doi.org/10.1108/IJPPM-04-2020-0192

Baron, R. M., & Kenny, D. A. (1986), "The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations". Journal of personality and social psychology, Vol. 51 No. 6, pp. 1173-1182.

Bersin, J. (2008). The training measurement book: Best practices, proven methodologies, and practical approaches. John Wiley & Sons.

Brown, M., & Benson, J. (2003), "Rated to exhaustion? reactions to performance appraisal processes", Industrial Relations Journal, Vol. 34 No. 1, pp. 67-81.

Brown, M., Hyatt, D. and Benson, J. (2010), "Consequences of the performance appraisal experience", Personnel Review, Vol. 39 No. 3, pp. 375-396.

Cardona, F. (2007). Performance Related Pay in Public Service in OECD and EU Member States. Sigma.

Cawley, B. D., Keeping, L. M., & Levy, P. E. (1998), "Participation in performance appraisal process and employee reactions: a meta-analytic review of fields investigations", Journal of Applied Psychology, Vol. 83 No. 4, pp. 615–633. doi:10.1037/0021-9010.83.4.615

Chakrabarty, K. (2014), Human resource challenges in Indian banks—'foolproofing' the employees [Paper presentation]. HR Heads of Banks and Financial Institutions. https://www.bis. org/review/r140211c.htm

Chang, H., Son, S. Y., & Pak, J. (2020), "How do leader-member interactions influence the HRM–performance relationship? A multiple exchange perspective", Human Performance, Vol. 33 No. 4, pp. 282-301.

Cheng, S. Y. (2014), "The mediating role of organizational justice on the relationship between administrative performance appraisal practices and organizational commitment", The International Journal of Human Resource Management, Vol. 25 No. 8, pp. 1131-1148.

Chen, J., Kang, H., Wang, Y. and Zhou, M. (2021), "Thwarted psychological needs: the negative impact of customer mistreatment on service employees and the moderating role of empowerment HRM practices", Personnel Review, Vol. 50 No. 7, pp. 1566-1581.

Cook, J., & Crossman, A. (2004), "Satisfaction with performance appraisal systems: a study of role perceptions", Journal of Managerial Psychology, Vol. 19 No. 5, 526-541.

DeNisi, A. S. & Sonesh, S. (2011), "The Appraisal and Management of Performance at Work," S. Zedeck, (ed), APA Handbook of Industrial and Organizational Psychology, Vol 2, Washington, DC, US: American Psychological Association, pp. 255-279.

DeNisi, A.S. and Pritchard, R.D. (2006), "Performance appraisal, performance management and improving individual performance: a motivational framework", Management and Organization Review, Vol. 2 No. 2, pp. 253-279.

Edgar, F. and Geare, A. (2005), "HRM practice and employee attitudes: different measures – different results", Personnel Review, Vol. 34 No. 5, pp. 534-549.

Erdogan, B. (2002), "Antecedents and consequences of justice perceptions in performance appraisals", Human Resource Management Review, Vol. 12 No. 4, pp. 555-578.

Farndale, E., Hope□Hailey, V. and Kelliher, C. (2011), "High commitment performance management: the roles of justice and trust", Personnel Review, Vol. 40 No. 1, pp. 5-23.

Fornell, C., & Larcker, D. F. (1981), "Structural equation models with unobservable variables and measurement error: algebra and statistics". Journal of Marketing Research, Vol. 18 No. 3, pp. 328–388.

Gardner, D.G., Pierce, J.L. and Peng, H. (2021), "Social exchange and psychological ownership as complementary pathways from psychological contract fulfillment to organizational citizenship behaviors", Personnel Review, Vol. 50 No. 6, pp. 1479-1494.

Garengo, P. and Sardi, A. (2021), "Performance measurement and management in the public sector: state of the art and research opportunities", International Journal of Productivity and Performance Management, Vol. 70 No. 7, pp. 1629-1654. https://doi.org/10.1108/IJPPM-03-2020-0102

Girma, T., Lodesso, S. L., & Sorsa, G. (2016), "The Effect of Performance Appraisal on Employee Performance: a Survey on Administrative Staff of Hawassa Univesity", IOSR Journal of Business and Management, Vol. 18 No. 3, pp. 36–44.

Goyal, C. and Patwardhan, M. (2021), "Strengthening work engagement through high-performance human resource practices", International Journal of Productivity and Performance Management, Vol. 70 No. 8, pp. 2052-2069. https://doi.org/10.1108/IJPPM-03-2020-0098

Greenberg, J. (1986), "Determinants of perceived fairness in performance evaluation", Journal of Applied Psychology, Vol. 71 No. 2, pp. 340–342. doi:10.1037/0021-9010.71.2.340

Greenwood, M. R. (2002), "Ethics and HRM: a review and conceptual analysis" Journal of Business Ethics, Vol. 36 No. 3, pp. 261-278.

Grubb, T. (2007), "Performance appraisal reappraised: it's not all positive", Journal of Human Resources Education, Vol. 1 No. 1, pp. 1-22.

Guest, D. E. (2004). "The psychological of the employment relationship: an analysis based on the psychological contract", Applied Psychology, Vol. 53 No. 4, pp. 541–555. doi:10.1111/ j.1464-0597.2004.00187.x

Gupta, V. and Kumar, S. (2013), "Impact of performance appraisal justice on employee engagement: a study of Indian professionals", Employee Relations, Vol. 35 No. 1, pp. 61-78.

Hair Jr, J. F., Matthews, L. M., Matthews, R. L., and Sarstedt, M. (2017), "PLS-SEM or CB-SEM: updated guidelines on which method to use", International Journal of Multivariate Data Analysis, Vol 1 No. 2, pp.107-123.

Hair, J. F., Gabriel, M., & Patel, V. (2014), "AMOS covariance-based structural equation modeling (CB-SEM): guidelines on its application as a marketing research tool", Brazilian Journal of Marketing, Vol. 13 No. 2, pp. 44-55.

Hair, J. F., Jr., Black, W. C., Babin, B. J., Anderson, R. E., and Tatham, R. L. (2006), Multivariate data analysis (6th ed.). New Jersey: Pearson Prentice Hall.

Hair, J., Black, W., Babin, B., and Anderson, R. (2010). Multivariate data analysis (7th ed.): Prentice-Hall, Inc. Upper Saddle River, NJ, USA

Hayes, A. F. (2009), "Beyond Baron and Kenny: statistical mediation analysis in the new millennium", Communication Monographs, Vol. 76 No. 4, 408-420.

Hayes, A. F. (2013), Introduction to Mediation, Moderation, and Conditional Process Analysis: a regression-based approach, New York, The Guilford Press

Heathfield, S. (2007), "Performance appraisals don't work-what does?". The journal for Quality and Participation, Vol. 30 No. 1, pp. 6-9.

Hee, O.C. and Jing, K.R. (2018), "The Influence of human resource management practices on employee performance in the manufacturing sector in Malaysia", International Journal of Human Resource Studies, Vol. 8 No. 2, pp. 129-147.

Hu, L., Bentler, P.M. (1999), "Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives" SEM Vol. 6 No. 1, pp. 1-55.

Jamaiudin, N. (2021), "Determinants of integrity in the implementation of performance appraisal system (PAS): the case of Malaysia enforcement agency", Management Research Journal, Vol. 10 No. 1, pp. 24-41.

Jawahar, I. M., & Carr, D. (2007), "Conscientiousness and contextual performance: the compensatory effects of perceived organizational support and leader-member exchange", Journal of Managerial Psychology, Vol. 22 No. 4, pp. 330–349.

Jawahar, I.M. (2007), "The influence of perceptions of fairness on performance appraisal reactions", Journal of Labor Research, Vol. 28 No. 4, pp. 735-754.

Keeping, L.M. and Levy, P. E. (2000), "Performance appraisal reactions: measurement, modelling and method bias". Journal of Applied Psychology, Vol. 85 No. 5, pp. 708-723.

Kelly, K. O., Ang, S. Y. A., Chong, W. L., & Hu, W. S. (2008), "Teacher appraisal and its outcomes in Singapore primary schools", Journal of Educational Administration, Vo. 46 No. 1, pp. 39–54. https://doi.org/10.1108/MBE-09-2016-0047

Khan, M. A., Mdyusoff, R., Ismail, F., Hussain, A., & Yunus, F. B. M. (2018), "The impact of performance appraisal on employee job performance in public sector Universities of Khyber". International Journal of Engineering & Technology, Vol. 7 No. 3.25, pp. 544–548.

Kim, S. E., & Rubianty, D. (2011), "Perceived fairness of performance appraisals in the federal government: does it matter?", Review of Public Personnel Administration, Vol. 31 No. 4, pp. 329-348.

Kim, T., & Holzer, M. (2016), "Public employees and performance appraisal: A study of antecedents to employees' perception of the process", Review of Public Personnel Administration, Vol. 36 No. 1, pp. 31-56.

Kinnie, N., Hutchinson, S., Purcell, J., Rayton, B., & Swart, J. (2005), "Satisfaction with HR practices and commitment to the organization: why one size does not fit all", Human Resource Management Journal, Vol. 15 No. 4, pp. 9-29.

Knight, D., Durham, C. C., & Locke, E. A. (2001), "The relationship of team goals, incentives, and efficacy to strategic risk, tactical implementation, and performance", Academy of Management Journal, Vol. 44 No. 2, pp. 326-338.

Kuvaas, B. (2006), "Performance appraisal satisfaction and employee outcomes: mediating and moderating roles of work motivation", The International Journal of Human Resource Management, Vol. 17 No. 3, pp. 504-522.

Labuschagne, C., Brent, A. C., & Van Erck, R. P. (2005), "Assessing the sustainability performances of industries", Journal of cleaner production, Vol. 13 No. 4, pp. 373-385.

Lasisi, T.T., Ozturen, A., Eluwole, K.K. and Avci, T. (2020), "Explicating innovation-based human resource management's influence on employee satisfaction and performance", Employee Relations, Vol. 42 No. 6, pp. 1181-1203.

Lau, C. M., Wong, K. M., & Eggleton, I. R. (2008), "Fairness of performance evaluation procedures and job satisfaction: the role of outcome□based and non□outcome□based effects", Accounting and business research, Vol. 38 No. 2, pp. 121-135.

Lindholm, N. (1999), "Performance management in MNC subsidiaries in China: a study of host-country managers and professionals", Asia Pacific Journal of Human Resources, Vol. 37 No. 3, pp. 18-35.

Lu, H., Zhao, P., & Liu, S. (2021, February), "Research on performance appraisal method in internet-based working", In Journal of Physics: Conference Series, IOP Publishing, Vol. 1815 No. 1, p. 012003, pp. 1-5.

Maley, J. F. (2009), "The influence of performance appraisal on the psychological contract of the inpatriate manager", South African Journal of Human Resource Management, Vol. 7 No. 1, pp. 100–109

Malhotra, N. K., & Dash, S. (2011). Marketing research an applied orientation (paperback). Pearson Publishing, London.

Marescaux, E., De Winne, S. and Sels, L. (2013), "HR practices and HRM outcomes: the role of basic need satisfaction", Personnel Review, Vol. 42 No. 1, pp. 4-27.

Migdadi, M.M. (2022), "Knowledge management processes, innovation capability and organizational performance", International Journal of Productivity and Performance Management, Vol. 71 No. 1, pp. 182-210. https://doi.org/10.1108/IJPPM-04-2020-0154

Mohanty, S.K. and P, A. (2021), "Identification of drivers of employee engagement in Indian power companies", International Journal of Productivity and Performance Management, Vol. 70 No. 6, pp. 1263-1290. https://doi.org/10.1108/IJPPM-08-2019-0414

Mullins, L. J. (2007). Management and Organizational Behavior. 8th ed. London: Prentice Hall.

Murphy, K. R., & Cleveland, J. N. (1995). Understanding performance appraisal: Social, organizational, and goal-based perspectives. Sage.

Noopur and Dhar, R.L. (2021), "The role of high performance human resource practices as an antecedent to organizational innovation: an empirical investigation", Employee Relations, Vol. 43 No. 1, pp. 279-295.

Otoo, F.N.K. (2020), "Measuring the impact of human resource management (HRM) practices on pharmaceutical industry's effectiveness: the mediating role of employee competencies", Employee Relations, Vol. 42 No. 6, pp. 1353-1380.

Palaiologos, A., Papazekos, P. and Panayotopoulou, L. (2011), "Organizational justice and employee satisfaction in performance appraisal", Journal of European Industrial Training, Vol. 35 No. 8, pp. 826-840. https://doi.org/10.1108/03090591111168348

Petrick, J. A., & Quinn, J. F. (1997). Management ethics: Integrity at work (Vol. 6). Sage.

Pettijohn, C., Pettijohn, L. S., Taylor, A. J., & Keillor, B. D. (2001), "Are performance appraisals a bureaucratic exercise or can they be used to enhance sales□force satisfaction and commitment?", Psychology & Marketing, Vol. 18 No. 4, pp. 337-364.

Pichler, S. (2012), "The social context of performance appraisal and appraisal reactions: a meta□analysis", Human Resource Management, Vol. 51 No. 5, pp. 709-732.

Rana, S. and Singh, S. (2022), "Performance appraisal justice and affective commitment: examining the moderating role of age and gender", International Journal of Organizational Analysis, Vol. 30 No. 1, pp. 24-46. https://doi.org/10.1108/IJOA-04-2020-2124

Rezaee, Z. (2009). Corporate governance and ethics. John Wiley & Sons. Danvers. MA.

Rikhardsson, P., Wendt, S., Arnardóttir, A.A. and Sigurjónsson, T.O. (2021), "Is more really better? Performance measure variety and environmental uncertainty", International Journal of Productivity and Performance Management, Vol. 70 No. 6, pp. 1446-1469. https://doi.org/10.1108/IJPPM-11-2019-0539

Rumold, A. K. (2010). An examination of the relationship between a climate for justice and organizational outcomes. Emporia State University.

Ryu, G., & Hong, S. W. (2020), "The mediating effect of trust in supervisors in the relationship between constructive performance feedback and perceived fairness of performance appraisal", Public Performance & Management Review, Vol. 43 No. 4, pp. 871-888.

Saffie-Robertson, M. C., & Brutus, S. (2014), "The impact of interdependence on performance evaluations: the mediating role of discomfort with performance appraisal", The International Journal of Human Resource Management, Vol. 25 No. 3, pp. 459-473.

Sardi, A., Sorano, E., Garengo, P. and Ferraris, A. (2021), "The role of HRM in the innovation of performance measurement and management systems: a multiple case study in SMEs", Employee Relations, Vol. 43 No. 2, pp. 589-606.

Sharma, N.P., Sharma, T. and Agarwal, M.N. (2016), "Measuring employee perception of performance management system effectiveness: Conceptualization and scale development", Employee Relations, Vol. 38 No. 2, pp. 224-247

Shewit, T. (2016). The effect of performance appraisal on job satisfaction. CIPD - Center for Evidence-Based Management (CEBMa), (December).

Singer, M.S. (2000), "Ethical and fair work behavior: a normative-empirical dialogue concerning ethics and justice", Journal of Business Ethics, Vol. 28 No. 3, pp. 187-209.

Sri Ramalu, S. and Janadari, N. (2022), "Authentic leadership and organizational citizenship behaviour: the role of psychological capital", International Journal of Productivity and Performance Management, Vol. 71 No. 2, pp. 365-385. https://doi.org/10.1108/IJPPM-03-2020-0110

Toppo, L., & Prusty, T. (2012), "From performance appraisal to performance management", Journal of Business and Management, Vol. 3 No. 5, pp. 1-6.

Torrington, D., Hall, L., Atkinson, C., & Taylor, S. (2020), Human Resource Management. Pearson UK.

Tzafrir, S.S., Baruch, Y. and Dolan, S.L. (2004), "The consequences of emerging HRM practices for employees' trust in their managers", Personnel Review, Vol. 33 No. 6, pp. 628-647.

Van den Bos, K., & Lind, E. A. (2002), "Uncertainty management by means of fairness judgments", Academic Press, In Advances in experimental social psychology, Vol. 34, pp. 1-60.

Van Der Wal, C. (2014). Transparency as a dimension of ethics in performance appraisal. University of Johannesburg (South Africa).

Van Dijke, M., Leunissen, J. M., Wildschut, T., & Sedikides, C. (2019), "Nostalgia promotes intrinsic motivation and effort in the presence of low interactional justice", Organizational Behavior and Human Decision Processes, Vol. 150, pp. 46-61.

Varma, C., & Chavan, C. (2020). The effect of perceived organizational support and psychological contract on employee job satisfaction & turnover intention. Journal of the Social Science P-ISSN, 0253-1097.

Varma, C., & Chavan, C. (2019). A Case of HR Analytics–to Understand Effect on Employee Turnover. Journal of Emerging Technologies and Innovative Research, 6(6).

Varma, C. (2021). Perceived Organizational Support and Employee Engagement: Mediator Role of Extrinsic Factors of Job Satisfaction. Innovations, (67).

Varma, C., & Chavan, C. (2019). Role of HR in Talent Management for Building Future Organizational Competence. International Journal of Advance and Innovative Research, 6(2).

Williams, G. J. (1992). Ethics in modern management.

Yu, H., Jiang, S., & Land, K. C. (2015), "Multicollinearity in hierarchical linear models", Social science research, Vol. 53, pp. 118-136.

Zimmerman, R.D. and Darnold, T.C. (2009), "The impact of job performance on employee turnover intentions and the voluntary turnover process: A meta-analysis and path model", Personnel Review, Vol. 38 No. 2, pp. 142-158. https://doi.org/10.1108/00483480910931316

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Qualitative Analysis of WhatsApp Privacy Policy

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Abstract

WhatsApp is the most popular app and used by billions of people for day to day as well as for business conversation. The purpose of present study is to shed some light on the opinion, sentiment and concerns of people towards the new privacy policy which was announced by WhatsApp.

The paper used qualitative data analysis technique to understand the point of view of users of WhatsApp. The research used the data extracted from twitter with the help of Ncapture utility. The analyses included word cloud, tree map, sentiment analysis and search map to analyse the tweets.

The paper identified that concern for privacy was more for the users, evident from word cloud and tree map, whereas sentiment analysis brought forward the negative sentiments of users about the new policy.

Keyword: WhatsApp, New Privacy Policy, Privacy Policy, Thematic analysis, Sentiment Analysis, Nvivo

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In the end of the year 2020 and beginning of 2021 the newspaper, social media and news channels were talking about the new privacy policy of WhatsApp. The so called news or say rumour created a lot of confusion, misinformation and a lot of misinterpretation of the news. The news started when WhatsApp asked WhatsApp users to accept the updated privacy policy.

The WhatsApp privacy has nothing to do with personal chats but, it did not change anything for personal chat but many people got alarmed by the thought of losing their privacy. WhatsApp also provided option of

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either "accept the policy or leave the group" conditions which WhatsApp added in the term and conditions that made many people unhappy. The information that has been shared on different social media platforms changed the perception and raised a lot of misinformation

WhatsApp is an instant messaging service launched in year 2009 and since then there is no looking back by Brian Acton and Jan Koum. Only after two years of its launch in 2011, WhatsApp got the place in top 20 mobile phone applications. The basic purpose of Whatapp then was to share short messages with some additional features like read receipt what apps got more popularity when it added wide varity of emojis, support for different regional languages, GIFs etc. the reduction in mobile internet charges, WhatsApp got more popularity. WhatsApp is a popular mobile messaging app that allows users to share photos, text, video, and voice messages, as well as conduct individual or group conversations. (2017, Kumar & Sharma)

WhatsApp has revised its privacy policy in month of December 2020 and since then it was talk of the town, According to Rosenfield it is one of the most popular medium for interpersonal communication (Rosenfeld *et al.*, 2018). The information which WhatsApp collects from its user include phone number, the name associated with the account, the profile picture of the user actually have for WhatsApp, the smartphone that a person is using, online activity time , all of the groups of which user is a member, the device model, the IP address, device build number, device maker, specifics about the web/desktop edition, and the site on which a person is using WhatsApp. It also shows the precise moment at which user changed profile picture and status post. Just the cell phone numbers are listed in the list, which contains all friends with whom the user may have chatted on WhatsApp. It also includes the app's features, such as Last Viewed, Profile Photo, About Anonymity, and Status Privacy privacy settings.

Though Facebook-owned WhatsApp's revised privacy policy has stoked questions about privacy and data sharing with other users, what has been lost in the clamour is that WhatsApp may not have been able to continue with this reform in the first place. The WhatsApp policy was declared in such era when people are in general concerned about privacy issues all over the world. The world is working upon one or the other data protection and privacy related Laws and issues.

The news had an impact on people and Due to privacy issues, many users switched to Signal, telegram or other similar communication apps, which is a more privacy focused messaging app. As a result, Signal app got 1st position in India on App Store in India and Third position on Google Play. It also led to downloading of other private messaging app.

In reaction to this WhatsApp tried to clarify its part by differentiating between messages in close family and friends and business messages and it clarified that the policy will affect only the"messages with a business" and not "messages with friends or family". It clarified that private or personal messages will be protected as it was by end-to-end encryption and neither accessed nor heard by WhatsApp or Facebook. They also claimed that privacy and security risk are most important so they do not maintain any No log of personal messages or calls Location shared by users are also protected by end-to-end encryption and cannot be seen by WhatsApp or Facebook. They also claimed that they do not share any contact with any app. Businesses on Facebook will be able to create Facebook shops to create an online store and interact with the users through WhatsApp.

The above information leads to one direction that misinformation has created some fear in minds of people and the present study tries to identify the sentiments of people towards the new privacy policy that has been communicated by media. The users may have developed different types of emotions and sentiments among them.

The literature has shows evidence that people are willing to use such apps and social networking sites but still privacy is a concern. SNSs have grown in popularity in recent years because they encourage users to express their creativity while still connecting with others who share common interests. However, there are a number of possible privacy risks involved with these SNS, including data fraud and the leakage of personal details (Ho, Maiga and Aimeur 2009) hence Consumers are looking for chat applications with improved privacy capabilities such as end-to-end encryption and texts that vanish.

Research Methodology

The qualitative reserch methods were used to complete the research. The goal of qualitative research is to understand and identify trends within words in order to come up with new ideas. construct a meaningful image without sacrificing its depth and dimensionality (leung, 2015). The data was collected from the comments and statements made on twitter handle. Ncapture, a utility provided by Nvivo was used to capture data from the twitter. The data string used for search was "WhatsApp privacy policy". In total about 5710 tweets were captured and downloaded. The tweets that were in english language mainly were used and abusive or absurd tweets were not used, were textually analysed with the help of qualitative analysis software NVivo 12 (Godau, 2004). The input data was the tweets from twitter about WhatsApp privacy policy. This study textually analysed the tweets. These tweets were analysed to form word Cloud, Tree Map, identify common themes and search Map.

Figure-1: Exhibits the frequently used words in the tweets by Word Cloud

Figure-2. Presents the tree Map of the concern related to using other Apps.

Figure-3: Presents the tree Map of the concern for privacy.

Figure-4: presents the word tree for concern for privacy policy

Figure-5: Twitter search map

Table-1 shows the word frequency table of 20 most frequently repeated words in the tweets.

Table-2: Thematic Analysis

Table-3: Sentiment Analysis

The data was analyzed through thematic analysis. Thematic analysis is a methodology for defining, interpreting, and documenting trends (Alhojailan, 2012). The data when analysed using tool of thematic analysis, it allows for changes as per the study, resulting in detailed, reliable data (Nowell, et al., 2017); Braun & Clarke, 2006.

The word cloud for the data is also generated as word cloud and tree map helps in better visulisation of the data collected (kaurav et.al., 2021)

Wordcloud and Treemap

For better visualization of the results, Word Cloud and TreeMap were prepared the word cloud shows the most used word in the tweets, lager the size of the word more number of times the word has been used in the tweets that were captured in the center of the word cloud the word "WhatsApp privacy policy" is there which is obvious, but the other words like that surrounds this word is telegram, facebook, signa app, policy update, data l etc.

Figure-1: Word Cloud of Frequently Used Word in the Tweets

A treemap diagram shows the captured data in a hierarchy. it is set of nested blocks. the size and the shapes of the blocks shows the frequency and the percentage of the use of the word and figure 2, 3 and 4 shows the frequency of word like signal app, Indian messenger app, deleting WhatsApp, concern for privacy, seeing data etc. are the most used words.

Table-1: Most Frequently Repeated 20 Words in the Tweets

Word	Count	Weighted Percentage (%)	Similar Words
#whatsappprivacy	3259	5.11	#whatsappprivacy
https	2825	4.43	@https, https
whatsapp	2398	3.76	#whatsapp, #whatsapps, @whatsapp, whatsapp, whatsapp, whatsapp'ını, whatsapp'tan, whatsapps, whatsapps'
telegram	704	1.10	#telegram, @telegram, telegram
#whatsappnewpolicy	681	1.07	#whatsappnewpolicy
signal	629	0.99	#signal, #signals, signal
privacy	627	0.98	#privacy, privacy, "privacy
#whatsappnewprivacypolicy	536	0.84	#whatsappnewprivacypolicy
facebook	523	0.82	#facebook, @facebook, facebook
#whatsappprivacypolicy	438	0.69	#whatsappprivacypolicy
policy	422	0.66	#policy, policies, policy
@signalapp	362	0.57	#signalapp, @signalapp
updates	216	0.34	#update, update, updated, updates, updating
users	171	0.27	#users, users
#whatsappheadquarters	162	0.25	#whatsappheadquarter, #whatsappheadquarters, whatsappheadquarters
switching	132	0.21	#switch, switch, switched, switches, switching
sharing	105	0.16	#share, share, shared, shares, sharing
democracy	93	0.15	#democracy, democracy
messaging	93	0.15	#message, #messaging, message, messaged, messages, messaging

Figure-2: Using Other apps

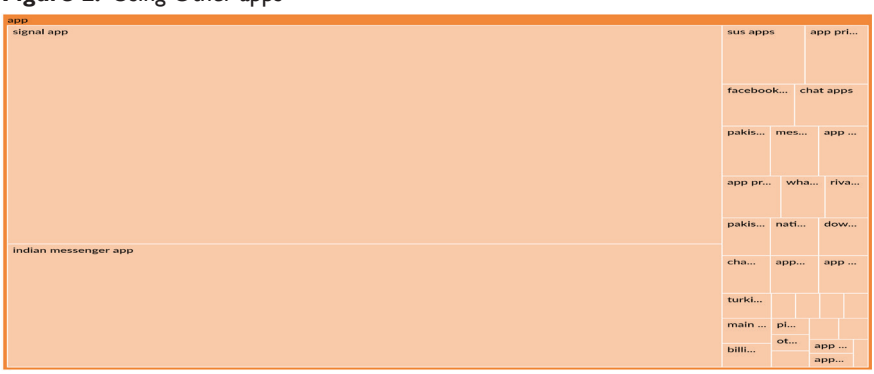


Figure-3: Tree Map Concern for Privacy

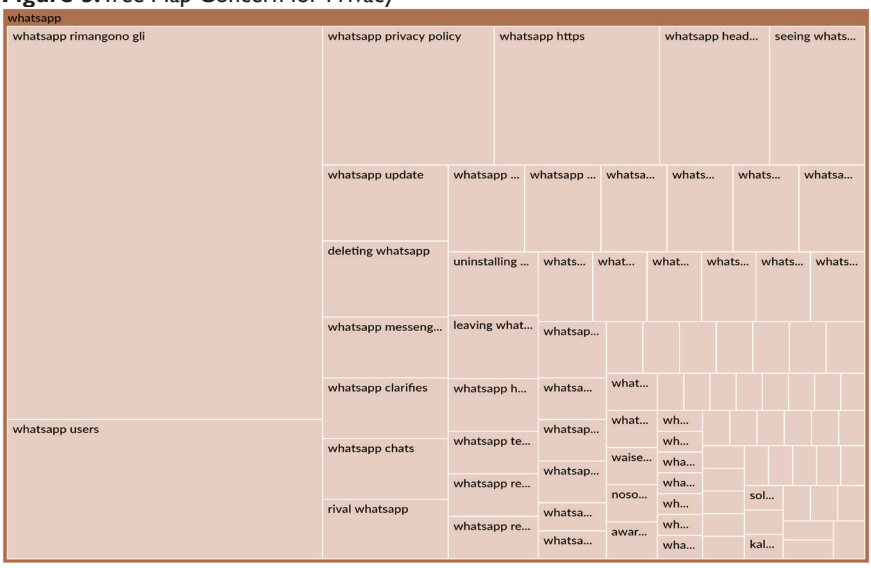
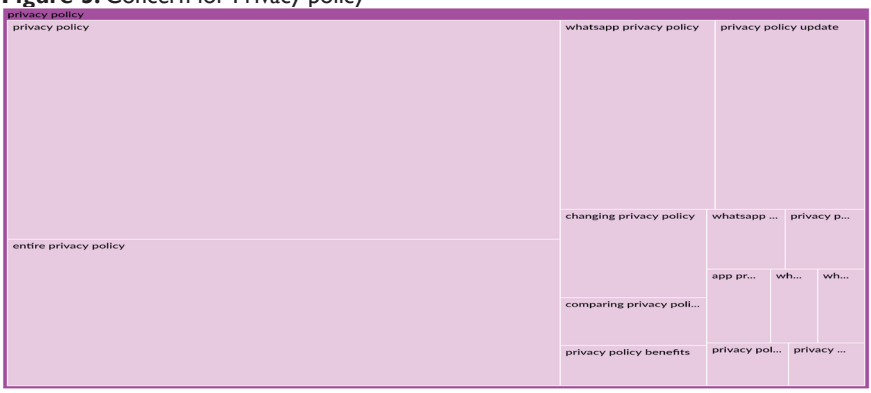


Figure-3: Concern for Privacy policy



Thematic Analysis

The Table-3 shows the result of thematic analysis the themes that has been identified consists of the themes like WhatsApp, app, http, privacy, users, policy, signal, updates and the table shows the no of times such words are used resulting into development of a theme.

Table-2: Thematic Analysis

Themes	A : Files\\#WhatsappPrivacy - Twitter Search ~ Twitter
Whatsapp	2280
App	1870
https	1840

Themes	A : Files\\#WhatsappPrivacy - Twitter Search ~ Twitter
Privacy	1440
Users	1200
Policy	1070
Signal	1020
Update	1020
signal app	850
privacy policy	780

Sentiment Analysis

The table shows the sentiment analysis done with the help of N vivo software. The table clearly shows that most of the tweets done were either highly negative or moderately negative. The number of very positive tweets is very small in comparison so it is very clear from the table that very positive impact is very less as majority of the tweets are negative, so we can say that WhatsApp new privacy policy is viewed in a very negative manner by the users and may be this is the reason they are either talking about switching to other secured app or deleting WhatsApp.

Table-3: Sentiment Analysis

Sentiments	
1 : Very negative	980
2 : Moderately negative	2220
3 : Moderately positive	1810
4 : Very positive	700

Search Map

The figure below shows the twitter search map which helps in visualizing the place from where the tweets were done and in the figure it can be seen that most of the tweets were done from Asia, Europe and north America whereas very little tweets or retweets were done from south Africa, south America and other parts of world.

Figure-5: Twitter Search Map

Discussion

WhatApp updated its privacy policy and the results were evident that it was the greatest controversy about the App. The y had planned the update for February 8, but the time they announce the changed the various social networking sites, news papers, and the app itself was loaded with the conversation about the policy. The tweets that were made from the different handles were under major themes which shows the concern of user about the privacy of the messages, data , picture and other content that they were sharing on the app. The announcement itself has brought so much of criticism for the app. Though the company has tried its best to describe that the new policy has no effect on the privacy of individual chats, people talked about deleting WhatsApp and installing the other apps like signal, Line, telegram.

By sentiment analysis it was reveled that The people were also having strong intuitions that the WhatsApp is sharing data with its parent Company Facebook and other subsidiaries. However after clarification by WhatsApp that it does not share any data with Facebook a little positive sentiment were seen. The impact of such tweets was that the company had to come forward and The instant messaging service said that it needed to "counter rumours" and that WhatsApp would "continue to secure the private messages with end-to-end encryption." The company had to clarify that it couldn't see or hear the private messages or phone calls. It also claimed that its parent company, Facebook, could not read its users' messages or calls. The new development comes in the wake of widespread public condemnation of the policy as well as increasing shift of people to alternative messengers WhatsApp had to postpone the applicability of the policy to 15th of may 2021, which was intended to be applied from February.

The analysis also reveled that Inadvertently, changes to the privacy policies have aided competitors such as Telegram and Signal in gaining traction. WhatsApp, on the other hand, had already stated that the updates are aimed at company accounts but it did not help too much for the company.

Conclusion

Till announcement of new privacy policy WhatsApp was the most popular app, the big upside down in its usability, popularity, trust and downloading took place after September 2020. The causes was the change in policy, it is owned by Facebook and the concern for privacy. The analysis of the threads on tweeter made few things clear that announcement of privacy policy resulted in uproar by the people against it and people started switching to the other Apps which they considered safe.

Reference

Alhojailan, M. I. (2012). Thematic analysis : a critical review of its process and evaluation. *West East Journal of Social Sciences*, *1*(1), 8-21.

Leung L. Validity, reliability, and generalizability in qualitative research. J Family Med Prim Care 2015;4:324-7

Singer B, Walsh CM, Gondwe L *et al.* WhatsApp as a medium to collect qualitative data among adolescents: lessons learned and considerations for future use [version 1; peer review: 1 approved with reservations, 1 not approved]. *Gates Open Res* 2020, **4**:130 (https://doi.org/10.12688/gatesopenres.13169.1)

A. Ho, A. Maiga and E. Aimeur,(2009), "Privacy protection issues in social networking sites," 2009 IEEE/ACS International Conference on Computer Systems and Applications, Rabat, Morocco, 2009, pp. 271-278, doi: 10.1109/AICCSA.2009.5069336.

Kaurav, R. P. S., Suresh, K. G., Narula, S., & Baber, R. New Education Policy: Qualitative (Contents) Analysis And Twitter Mining (Sentiment Analysis).

NVivo Help (2020). About hierarchy charts. http://help-nv11.qsrinternational.com/ desktop/concepts/about_hierarchy_charts.htm

NVivo Help (2020). About project maps. http://help-nv11.qsrinternational.com/ desktop/concepts/About_project_maps.htm

Indianexpress.com/article/technology/social/whatsapp-privacy-policy-update-delayed-your-account-wont-be-deleted-7148553/

Economictimes.Indiatimes.com/tech/technology/after-facing-backlash-whatsapp-clarifies-its-new-privacy-policy/articleshow/80226028.cms?from=mdr

Smartinvestor.business-standard.com/pf/story-671270-storydet-WhatsApp_says_latest_policy_update_doesnt_affect_privacy_of_messages.htm

https://www.thehindu.com/sci-tech/technology/messaging-apps-with-privacy- features/article33384305.ece

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An Investigation on the Acceptance of Online Pharmacies among Customers in Punjab

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Abstract

The present study aims to explore the role of e-pharmacy in Punjab and examine the factors influencing adoption and non-adoption on online pharmacy among customers in Punjab. Based on constructs formed from the well-established theoretical models, a model was proposed for the study Descriptive research has been used to study the adoption and non-adoption of technology. Furthermore, Structural equation model is used to analyse the structured relationship between the preference of online pharmacies and independent variables. The findings of the study revealed that a sizable proportion of Punjab customers are aware of the practise of buying medicines and pharmaceutical products online. This would facilitate the expansion of pharmacy industry to adopt better strategy in future. This study provides a theoretical contribution and presents practical implications relevant to academics and practitioners working in areas of online pharmacies.

Keywords: E-Pharmacy, Punjab, Structural Relationship

Introduction

Information and communication Technology has revolutionised the world and the world has become digital, thus shrinking in a very small place. Data can be processed digitally and new technology forces the usage of social media. Advancement in ICT affected the use of traditional medium of information sharing and delivery. The term Information and Communication Technology (ICT) has been serving as a reagent for universal integration by making efficient and effective channels for the exchange of information. In 2022, it is projected that the Indian e-commerce market will expand by 21.5% and reach $74.8 billion. In India, e-commerce has completely transformed how businesses run. The Indian e-commerce

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market is anticipated to grow from US$ 46.2 billion in 2020 to US$ 188 billion by 2025. By 2030, it is projected to reach US$ 350 billion. By 2024 and 2026, respectively, it is projected that India's e-commerce market will reach 111 billion and 200 billion US dollars[2].

The industry's growth is mostly attributable to a rise in internet and smartphone usage. Very recently, e-pharmacy or online pharmacy, that is, trading of medications via a website and distributing them directly to the consumers, is also gaining ground. The effortless access to internet, awareness toward digital literacy, the shift from the physical doctor-patient interaction to self-diagnosing and an integrated e-commerce supply chain has fueled the growth of e-pharmacies in the recent years (Srivastava and Raina, 2020). Globally, online pharmacies are continuously replacing traditional offline pharmacies at an accelerating rate (Sabbir et al., 2021) In the state of Punjab, there is currently an unheard-of rising demand for online purchasing services, However, there aren't many studies on the use of internet pharmacies in Punjab. Thus, the present study attempts to investigate the acceptance of online pharmacies amongst users in Punjab. The rest of the paper is organized as follows.

Section 2 presents the review of literature. Section 3 details the research methodology. Thereafter, section 4 presents the data analysis and findings and finally section 5 concludes the paper.

Review of Literature

Most of the research conducted conducted in the field of online pharmacies have been of recent origin. For example, Batenburg and Van den Broek (2008) focussed on the consumer satisfaction level within a chain of Dutch pharmacies. They found that information and communication technology was the most crucial drivers for the satisfaction of consumers. Thereafter, Wiedmann et al. (2010) investigated the perception of people towards e-pharmacy and they found that presence of risk factor in online payment was inhibiting people from purchasing online.

Furthermore, Thalkari et al. (2018) studied the perception of people towards e-pharmacy sector in India. Also, Srivastava and Raina (2020) examined the various factors involved in adoption of e-pharmacy in India. They found that social influence, hedonic motivation, performance expectancy and effort expectancy had positive impact on adoption of e-pharmacy in India. In addition, Agarwal and Bhardwaj (2020) also studied the consumer buying behaviour towards E-pharmacies in Delhi and Singh et al. (2020) investigated the need and importance of e-pharmacy in pandemic era. Furthermore, Gupta (2020) analysed the consumer

2 https://www.ibef.org/industry/ecommerce

buying behaviour towards online pharmacy and investigated the factors influencing them to purchase online medicines. He found that the majority of the people used e-pharmacy for discount and convenience.

Fabius et al. (2020) investigated the impact of COVID-19 on usage of online pharmacy and found that the usage of online pharmacies increased significantly during COVID-19. Also, Arekar et al. (2021) conducted a cross country research for predicting the consumer buying behaviour towards online pharmacy. The result shows that trust is considered as an important variable in the UK context, but it is not a significant factor in context of USA and India. They further found that perceived usefulness is the major factor influencing the buying behaviour of people. In addition, Baid and Ghosh (2021) had explored the various factors affecting the consumers' decision while procuring medical items via online mode. Relationship between the various factors and purchase decision was analysed. They applied the reliability test and Factor analysis to predict the factors affecting shift of customers toward e-pharmacy.

The above literature makes it evident that not even a single study has been conducted so far investigating the acceptance of online pharmacies amongst customers in Punjab. Thus, in particular the key objectives of the study are:

- To study the growth of E-Pharmacy sector in India.
- To examine the demographic factors of consumers and the awareness level of E-Pharmacy with reference to Punjab.
- To determine the structural relationship among the preference of online pharmacy and independent variables (Range of choices, convenient, cost effective, Ease of use, Time saving etc.)

Research Methodology

The consumer's perception of using internet pharmacies is investigated through an online poll. Questionnaire is constructed using Google Forms. The survey link was sent at random via email and social media platforms like Facebook, Instagram, and WhatsApp. Both primary and secondary data collection method are used to collect data regarding the consumers' perception of e-pharmacy. Period of study covered from January 2022 to September 2022. Sample size is 400. Purposive sampling is adopted for this research as the study area restricted to Punjab. The data has been analysed using descriptive statistics and structured equation model.

Data Analysis and Findings

E-Pharmacy Sector in India

The e-pharmacy industry is anticipated to reduce the market share of competitors with physical storefronts. Due to its potential and growth

opportunities, the sector will continue to attract investments from both new and established businesses. Since legislation controlling the e-pharmacy sector is already being drafted with the Union Health Ministry, it is predicted that the industry will have the essential legal protection it needs to exist and prosper in the country. E-pharmacies across the country will need to go a long way to draw in clients. Solutions that are specifically tailored to each customer's needs, such as one-time orders with repeat deliveries at regular intervals for patients with chronic illnesses, expanding the reach of e-pharmacies to include more regional languages, and tighter time-bound delivery infrastructure to ensure that customers receive their prescription drugs.

Major Players in Indian Electronic Pharmacy Market are:

- Apollo Pharmacy Pvt. Ltd.
- Practo Technologies Private Limited
- Tata Digital Limited (1mg Technologies Pvt. Ltd)
- Docprime Technologies Private Limited
- API Holdings Private Limited (PharmEasy)
- Lybrate, Inc.
- Netmeds Marketplace Ltd (Reliance Retail)
- mChemist Global Pvt. Ltd
- Care On Go

As COVID-19 expanded over the world, the need for medical services and drugs underwent a significant adjustment. While there was a drop in the need for services and treatments for common illnesses, there was an urgent need for healthcare infrastructure related to COVID-19. As lockdowns and the potential for COVID-19 infection kept the majority of people at home, consumers and people throughout India began to rely on internet deliveries for nearly all of their needs, from food and electronics to pharmaceuticals. While the epidemic has suddenly boosted the Indian e-pharmacies market, a number of other factors have been laying the groundwork for industry growth for some time.

Demographics of the Sample Respondents

Table-1: Demographic Factors

Demographic Factor	Group	Number of Respondents	Percent
Age (in years)	Less than 20	120	30
	20 to 40	210	52.5
	41 to 60	50	12.5
	Above 60	20	5

Demographic Factor	Group	Number of Respondents	Percent
Gender	Male	282	70.5
	Female	118	29.5
	Trans Gender	-	-
Nature of family	Nuclear	165	41.25
	Joint	235	58.75
Family Income of respondent (monthly income in rupees)	Below 10000	20	5
	10,001 to Rs.30,000	200	50
	30,001 to 50,000	60	15
	Above 50,000	120	30
Number of family members	Less than 3 members	22	5.5
	3 to 5 members	260	65
	6 to 8 members	98	24.5
	More than 8 members	20	5
Educational qualification	Degree/Diploma holder	12	3
	Professional degree	260	65
	Post graduate and higher	98	24.5
	Below degree level	30	7.5
Total		400	100

It is evidenced from the above Table-1, maximum of 52.5% of the respondents were belong to the age group of 20-40 years. Only 5% of the respondents fall under the category of above 60 years. 70.5% of the respondents were male and 29.5% of the respondents were female. Maximum of the respondents (58.75%) stated as they are living in joint family and 41.25% of the respondents are living in nuclear family. Maximum of 50 percent of the respondents' family monthly income fall between Rs.10,001 to Rs. 30,000. Only 5% of the respondents have the annual income of below Rs.10,000. Majority of the respondents (65%) have 3-5 members in their family. Majority of the respondents (65%) completed their professional degree, 24.5% of the respondents completed post graduate and higher, 7.5% of the respondents completed below the degree level and only 3% of the respondents were degree/diploma holder.

Descriptive Analysis

Table-2: Descriptive Statistics

Variables	Mean	Std. Deviation	N
Convenient	4.65	.830	400
Timesaving	3.87	.548	400
Cost Efficient	2.89	.865	400
Information is private and confidential	3.02	1.947	400
Easy secured payment	2.45	.833	400
Range of choices	2.38	1.088	400

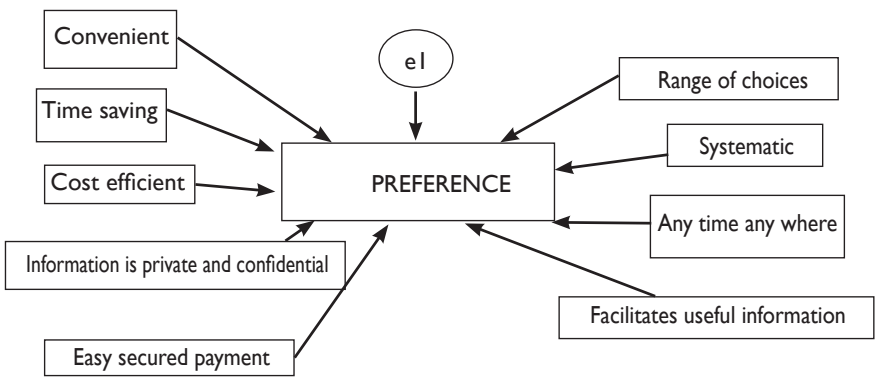
Variables	Mean	Std. Deviation	N
Systematic	2.28	1.198	400
Anytime anywhere	1.73	.447	400
Facilitate useful information	2.40	.858	400

Table-2 shows the descriptive statistics for the variables. Convenient has the highest mean score of 4.65, followed by Time saving with the mean score of 1.73 and least mean score is 1.73 for anytime and anywhere. It implies that lesser effort involved in purchasing medicines online and saying of time is the major factor liked by customers in Punjab while purchasing medicines from e-pharmacy.

Structured Equation Model

Structural equation modelling (SEM) is a tool for marketing researchers to estimate a network of causal relationships linking two or more complex concepts.

Figure-2: SEM (Path diagram)



In the present study, preference of online pharmacy is a dependent variable which is hypothesized to be related with the following nine independent variables:

- Convenient
- Time saving
- Cost efficient
- Information is private and confidential
- Easy secured payment
- Range of choices
- Systematic
- Anytime anywhere
- Facilitate useful information

Table-3: Correlation

Correlations

		Pre-ference	Con-venient	Time Sav-ing	Cost Effi-cient	Informa-tion is Private and Con-fidential	Easy Se-cured Pay-ment	Range of choic-es	Sys-tematic	Any time any where	Facilitate Useful Infor-mation
Pearson Correlation	Preference	1	0.577	0.253	-0.303	0.086	-0.105	0.002	-0.532	-0.378	-0.166
	Convenient	0.577	1	0.305	-0.485	0.179	-0.157	-0.103	-0.565	-0.26	-0.177
	Timesaving	0.253	0.305	1	-0.173	0.054	-0.364	-0.122	-0.248	-0.149	-0.367
	Cost efficient	-0.303	-0.485	-0.173	1	0.219	-0.671	-0.194	0.702	-0.077	-0.591
	Information is private and confidential	0.086	0.179	0.054	0.219	1	-0.481	-0.776	-0.283	-0.626	-0.406
	Easy secured payment	-0.105	-0.157	-0.364	-0.671	-0.481	1	0.361	-0.255	0.331	0.732
	Range of choices	0.002	-0.103	-0.122	-0.194	-0.776	0.361	1	0.272	0.766	0.263
	Systematic	-0.532	-0.565	-0.248	0.702	-0.283	-0.255	0.272	1	0.51	-0.19
	Any time any where	-0.378	-0.26	-0.149	-0.077	-0.626	0.331	0.766	0.51	1	0.286
	Facilitate useful information	-0.166	-0.177	-0.367	-0.591	-0.406	0.732	0.263	-0.19	0.286	1

Table-3 shows the correlations between the dependent variable and the independent variables as well as between different independent variables. In the most of the cases, the inter correlation elements are well below the threshold value of 0.85, indicating that the analysis is avoiding multicollinearity (Kline, 2015). Therefore, study proceeds to apply structured equation model.

Table-4: Baseline Comparisons

Model	RMR	GFI	AGFI	PGFI
Default model	.387	.441	.146	.288
Saturated model	.000	1.000		
Independence model	.384	.406	.274	.332

The following variable show the goodness of the fit model. The model is said to be a perfect fit if it meets the conditions of the said indices.

RMR = Root Mean Square Residual. The smaller the RMR value the better. An RMR of 0 represents a perfect fit.

GFI = Goodness of Fit Index and takes values of ≤ **1** where 1 represents a perfect fit.

AGFI = Adjusted Goodness of Fit Index and indicates the degree of freedom (df) for testing the model. A value of **1** indicates a perfect fit. Unlike GFI, AGFI values do not stop at 0.

PGFI = Parsimony Goodness of Fit Index is a modification of GFI (Mulaik et al.,1989) and calculates the degree of freedom for the model.

The value of interest here is the **GFI** for the default model and interpreted as follows:

- A value of 1 represents a perfect fit.
- A value ≥ **0.9** indicates a reasonable fit (Hu & Bentler, 1998).
- A value of ≥ **0.95** is considered an excellent fit (Kline, 2005).

The indices listed above, namely, RMR, GFI, AGFI, PGFI show that the structured equation model has been a perfect fit. So, the results given by the model can be considered conclusive and generalized to the population at large. The table 4 reports the results of the model.

Table-5: Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P
PREFERENCE	<---	Convenient	.468	.038	12.205	***
PREFERENCE	<---	Timesaving	.162	.058	2.797	.005
PREFERENCE	<---	Cost efficient	.218	.037	5.912	***
PREFERENCE	<---	Information is private and confidential	.008	.016	.464	.643
PREFERENCE	<---	Easy secured payment	.187	.038	4.886	***
PREFERENCE	<---	Range of choices	.514	.029	17.553	***
PREFERENCE	<---	Systematic	-.217	.027	-8.177	***
PREFERENCE	<---	Anytime anywhere	-1.196	.071	-16.785	***
PREFERENCE	<---	Facilitate useful information	-.151	.037	-4.071	***

Table-5 shows the regression weight through the Critical Ratio (CR), which is used to indicate that the variables that can represent a significant indicator and predictor for latent variables. Significance effect is reflected by p value in the above regression estimation. When the critical ratio (CR) is > 1.96 for a regression weight, that path is significant at the .05 level or better (that is, its estimated path parameter is significant). In the p-value column, three asterisks (***) indicate significance smaller than .001.

Table-5 makes it evident that convenience is the significant variable affecting the preference of people towards online pharmacies. It is very easy to order prescription drugs through E-Pharmacy. Particularly for people who live far away from a traditional pharmacy, the elderly, disabled people, and those who work very intensively, this system is both a very easy and a very fast method of obtaining medicine. In addition, the variable; time saving is also a significant variable affecting the preference of people towards adoption of online pharmacy. The advantage of placing an order by entering the prescription through mobile application and getting the order within minutes, always pleases the user.

In addition, the another variable; easy secured payment is also a significant variable affecting the preference of people towards adoption of online pharmacy. It is due to the reason that online payments are protected by SSL certificates, firewalls and regular system scans and people in Punjab feel safe and secured while making online payments. Furthermore, the variable; range of choices is also significantly impacting the preference of customers towards this system. It is due to the reason that e-pharmacy, which offers a much wider range of options than a traditional pharmacy, provides a great advantage to patients. It is not possible to find every drug in a physical pharmacy in a particular area, but there are many more drug options available in general drug stores. Thereafter, the variable; systematic also affects the preference of people to switch to e-pharmacies significantly. It is due to the reason the most of the legal stores that work with E-Pharmacy have a drug verification process. These stores request a prescription from a personal doctor or drug delivery is applied after completing a questionnaire about the patient's health status. These questionnaires are approved by a doctor before being distributed.

Furthermore, the variable; anytime anywhere also entails the convenience of the customers to buy medicines online and hence it has also been found to be the significant variable in the study. Thereafter, the variable; facilitate useful information has also found to be the significant variable affecting the preference of the people of Punjab towards online pharmacies. It is due to the reason that some online pharmacies share useful information about medicines and illnesses. It provides links to useful information, as well as important medical resources, universities, and government agencies. Lastly, the variable, the information is private and confidential has found to be insignificant in affecting the preference of people towards using online pharmacies.

Conclusion and Implications

The present study has been conducted to explore the role of e-pharmacy in Punjab and examine the factors influencing adoption and non-adoption on online pharmacy among customers in Punjab. A sample of 400 users of online pharmacies has been taken from the state of Punjab. Descriptive research has shown that the majority of users of online pharmacies are males, holding professional degrees and they fall in age group of 20-40 years. Furthermore, Structural equation model is used to analyse the structured relationship between the preference of online pharmacies and independent variables. The results of the model show that the variables, namely, convenience, time saving, cost efficient, easy secured payment, range of choices, systematic, anytime anywhere and facilitate useful information are found to be significant variables affecting the preference

of people towards online pharmacies. However, the variable, information is private and confidential has been found out to be insignificant variable in impacting the preference of users towards online pharmacies.

Several important implications can be drawn from the findings of the above study.

The study shows that home delivery, convenience, and reasonable prices are the primary motivators for opting to buy drugs online. In order to increase the market share and keep customers interested, stakeholders must take advantage of these factors. This can be made more feasible by investing in well-planned logistical systems, encouraging quick and safe delivery methods, and conducting periodic market assessments that allow for the maintenance of competitive prices. The study also shows that the Punjabi consumers are very likely to utilise an online pharmacy, and their frequency of purchases has grown during the epidemic. Thus, in order to achieve healthy earnings and organisational development, the marketeers must focus on increasing and maintain long term relationships with its customers. Moreover, there is a need to enhance the literacy among the customers to counteract the elements that lead the majority of customers to reject this approach. Marketers also need to adopt a holistic approach to educate the advantages of buying medicines online to females and other age groups, preferable greater than 40 years, to widen the base of their customers.

However, the proposed research study acknowledges a few limitations which might confine the implications of the current findings. In this study, Data were collected through social media like Facebook, WhatsApp and Instagram which could be further enhanced by incorporating all users in various fields. Moreover, it would be interesting to examine whether consumers' adoption intention varies based on their demographics (e.g. gender, internet usage experience), which might be included as moderating variables in future studies.

In a nutshell, the findings of the study reveal that a sizable proportion of Punjab customers are aware of the practise of buying medicines and pharmaceutical products online. This would facilitate the expansion of pharmacy industry to adopt better strategy in future. This study provides a theoretical contribution and presents practical implications relevant to academics and practitioners working in areas of online pharmacies.

References

Agarwal, S., & Bhardwaj, G. (2020). A study of consumer buying behaviour towards E-pharmacies in Delhi NCR. *International Journal of Forensic Engineering*, *4*(4), 255-260.

Arekar, K., Jain, R., & Kumar, S. (2021). Predictive Model to Study the Consumer Buying Behaviour towards E-Pharmacy through Social

Media Influence: A Cross Country Study. *Academy of Marketing Studies Journal*, *25*(2), 1-21.

Batenburg, R., & Van den Broek, E. (2008). Pharmacy information systems: the experience and user satisfaction within a chain of Dutch pharmacies. *International journal of electronic healthcare*, *4*(2), 119-131.

Baid, A. N., & Ghosh, A. (2021). Factors Affecting the Shift of Consumers Towards E-Pharmacies. *Sambodhi*, 44 (1), 39-45.

Fabius, V., Kohli, S., Timelin, B., & Moulvad Veranen, S. (2020). Meet the next-normal consumer. *McKinsey & Co*.

Gupta, M. S. (2020). Consumer Buying Behavior towards E-Pharmacy. *Dogo Rangsang Research Journal*, *10*(03), 183-190.

Hu, L. T., & Bentler, P. M. (1998). Fit indices in covariance structure modeling: Sensitivity to under parameterized model misspecification. *Psychological methods*, *3*(4), 424.

Kline, R.B. (2015), Principles and Practice of Structural Equation Modeling, 4th edn. New York, NY, USA, Guilford publications.

Mulaik, S. A., James, L. R., Van Alstine, J., Bennett, N., Lind, S., & Stilwell, C. D. (1989). Evaluation of goodness-of-fit indices for structural equation models. *Psychological bulletin*, *105*(3), 430.

Sabbir, M. M., Islam, M., & Das, S. (2021). Understanding the determinants of online pharmacy adoption: a two-staged SEM-neural network analysis approach. *Journal of Science and Technology Policy Management*, *12*(4), 666-687.

Singh, H., Majumdar, A., & Malviya, N. (2020). E-Pharmacy impacts on society and pharma sector in economical pandemic situation: a review. *Journal of Drug Delivery and Therapeutics*, *10*(3-s), 335-340.

Srivastava, M., & Raina, M. (2020). Consumers' usage and adoption of e-pharmacy in India. *International Journal of Pharmaceutical and Healthcare Marketing*, 15 (2), 235-250.

Thalkari, A. B., Karwa, P. N., & Gawli, C. S. (2018). A review on online pharmacy: Views and counterviews. *AJPT*, *8*(2), 108-111.

Wiedmann, K. P., Hennigs, N., Pankalla, L., Kassubek, M., Seegebarth, B., & Reeh, M. O. (2010). Online distribution of pharmaceuticals: investigating relations of consumers' value perception, online shopping attitudes and behaviour in an e-pharmacy context. *Journal of Customer Behaviour*, *9*(2), 175-199.

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