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Validity of Popular Dividend Policy Models and Practice of Dividend Smoothing: An Empirical Study based on BSE SENSEX Companies

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ABSTRACT

In the current era of widespread information asymmetry, the investors perceive that dividend distribution patterns speak more about the financial prospect of the firm than the published financial statements. Managers believe that dividend payment has a strong influence on the stock price of the firm. Smoothing is the strategy used by the managers in setting the dividend level to avoid adverse reaction of the market participants, sometimes even at the cost of profitable investment opportunities, thereby losing out on the intrinsic value of the firm. Therefore, formulating an appropriate dividend policy considering the most important determinants of it is of utmost importance. In this paper four popular dividend policy models proposed by Lintner (1956), Brittain (1966), Darling (1957) and Dobrovolsky (1951) were tested for their validity in the context of BSE SENSEX firms over a study period of 5 years in order to assess whether dividend smoothing practice is prevalent for the sample companies. The study comes up with the conclusion that all the models are good fit to the dataset used and there is clear evidence of practicing dividend smoothing by the managers of the sample companies over the study period.

KEYWORDS: Dividend Smoothing, Models of Lintner, Brittain, Darling and Dobrovolsky, Panel Data Analysis

I. INTRODUCTION

The essence of a dividend policy lies on the typical decision of the management as to how much profits to distribute among the shareholders and how much to plough back. However, in the current era of widespread information asymmetry, the investors perceive that dividend distribution patterns speak more about the financial prospect of the firm, not so truly revealed or possibly concealed in the published financial statements. Dividend smoothing is the strategy used by the managers in setting the dividend level to avoid adverse reaction of the market participants. The innate psychology behind the practice of dividend smoothing stems from the fear of the fact that dividend payment has a strong influence on the stock price of the firm. Under these circumstances, a manager who cares about the market value of the firm may most likely opt for dividend smoothing even at the cost of profitable investment opportunities, thereby losing out on the intrinsic value of the firm. Thus, it is of utmost pertinence of formulating anappropriate dividend policy considering the most important determinants of it. Past studies revealed that important among the determinants of dividend policy are present and past earnings, cash flows, firm's growth, growth in sales etc. that can be broadly traced to the models of Lintner (1956), Brittain (1966), Darling (1957) and Dobrovolsky (1951).

In this backdrop, the present study is a humble attempt to test the validity of the aforesaid models in the context of few selected BSE SENSEX companies over a period of five years ranging from 2015 to 2019 and to evaluate whether dividend smoothing is a practice prevailing amongst the managers of the sample companies.

II. REVIEW OF LITERATURE

Dobrovolsky (1951) had examined the retention policy to capture dividend behaviour and is of the opinion that amount of retained earnings of the firms not only depends on current year's profitability but also on continuity of dividend policy of the previous year as well as on the rate of operating asset expansion to a large extent. He argued that the dividend decision of a firm would also be governed by the same factors that influence retention policy. Since, firms are not willing to change their dividend policy frequently, the last year's dividend payment may be considered as a guiding factor for determining the dividend requirements for the current year. A significant negative association was also found between dividend and growth in operating assets.

Lintner (1956) had conducted an empirical research on dividend pattern of 28

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companies over a period of 7 years from 1947 to 1953. By holding discussions with the CEO and CFO of the companies he was of the opinion that stable dividend policy reduces negative investors' reactions about the company. Past dividend and current earnings were found to be the important determinants of change in dividend pay-out ratio. He was of the opinion that for deciding current year's dividend the dividend paid in the last year (i.e. the existing dividend rate) is considered as the yardstick and based on the current earnings, the management has to decide whether to change the existing dividend rate. Management will change the existing rate of dividend only if it feels that the new level of dividend rate can be maintained. Thus, there is a natural tendency of the companies to move towards a target pay-out ratio. Thus Lintner's model of stability in dividend behaviour is the outcome of various managerial factors and shareholders' preference.

Darling (1957) had used a modified version of Lintner's model. According to him, current dividend is influenced in a better way by lagged profit than by lagged dividend. Thus, he used lagged profit in his model instead of lagged dividend as used in Lintner's model. Darling was of the opinion that the firms would like to follow stable dividend policies rather than adjusting existing dividend rates with change in profit. The firms would tend to move to a new level of dividend only if the management feels that the changed profits will sustain over a reasonably longer period of time.

Brittain (1966) in his study on all major industries over the period from 1919 to 1960 proposed that the dividend paying capacity of a firm can be better explained through cash flow (net profit after tax but before depreciation) than earnings after taxes as used in Lintner's model. He proposed an alternative hypothesis against Lintner. He suggested that method of charging depreciation keeps on changing and, as a result, the earnings net of depreciation fail to reflect the true earnings on which the dividend payment is based. Thus, he pronounced the cash flow version of Lintner's model. Later on, in his second model, Brittain has split cash flows into two components viz. after tax earnings and depreciation. He had used depreciation as a separate explanatory variable along with net current earnings after tax and lagged dividends.

Krishnamurty et. al. (1974) undertook cross sectional analysis on 360 public limited companies spread across different industries. They observed that the dividend behaviour of the sample firms were well explained by Lintner's model. They were also of the opinion that the dividend policy in general would not be significantly influenced by external financing and external expenditure. Retained earnings are residual in nature.

Bhatia et. al. (1978) studied the dividend policy of 50 Indian companies during the period 1966-68. They suggested that the companies should pay regular dividends by maintaining a stable dividend rate over the years. No relationship was found between factors like dividends, profit and market price of shares.

Jaidev (1992) examined the appropriateness of some well-known dividend payment behaviour models based on 18 companies from man-made fibre industries over the period 1978-79 to 1987-88. Lintner's model was found to be a good fit to the dataset with significant impact of current earnings and insignificant impact of lagged dividends on current dividend payment. However, the application of Brittain's model revealed that cash flow has more significant explanatory power than earnings to describe dividend payment.

Garg et. al. (1996) conducted a study on 44 companies from textile industry during a 10 year period from 1980-81 to 1989-90 to find out the factors affecting the dividend payment. It was observed that liquidity, profitability and capital structure are the key determinants of dividend payment. These factors continue to improve with the increase in size of the companies causing increase in dividend payment.

Barker et. al. (2001) surveyed management of both financial and non-financial NASDAQ listed companies in 1999. From the information provided by the respondents, 22 different factors were found that influence dividend policy. The relevant factors which were common to both financial and non-financial companies include pattern of past dividends, stability of earnings, current and expected earnings level. Significant differences between response of financial and non-financial firms were obtained in 9 out of 22 factors. This result established the relevance of industry effect on dividend decision. Consistency with Lintner's empirical model was also found.

Sarma et. al. (2004) conducted a study based on 96 trading and service companies listed in Kuala Lumpur stock exchange over a period of 3 years from 1998 to 2001. Lintner's model was found to be a good fit to the dataset with significant impact of current earnings and lagged dividends on current dividend payment. It was also observed that

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Malaysian corporate sector preferred stable dividend policy.

Amidu et. al. (2006) had studied the determinants of dividend pay-out ratios for listed firms on Ghana stock Exchange over a period of six years by using OLS regression equation model. They had used institutional holding as a proxy for agency cost and growth in sales and market to book value as proxies for investment opportunities. They found positive relationship between dividend pay-out ratios and profitability and cash flow and negative association between dividend pay-out and risk, institutional holding, growth in sales and market to book value with profitability, cash flow, sales growth and market to book value as significant explanatory variables.

Koerniadi et. al. (2008) had investigated whether stock dividends provide management with an incentive for manipulating earnings. Refined accrual model was used in their study for controlling the performance effects in estimating the part of accrual subject to management discretion. It was found that discretionary accruals of stock dividend issuing firms are negatively correlated with both future earnings and abnormal stock returns.

Al-Najjar (2009) had investigated the dividend policy and dividend payment behaviour of Jordanian non-financial firms operating in emerging markets. It was observed that the dividend policy in Jordan, as a developing country, is influenced by factors like leverage ratio, institutional ownership, profitability, business risk, asset structure, growth rate and firm size. The study also revealed that Lintner model is valid for the dataset of Jordanian non-financial firms and they adjust to their target pay-out ratios relatively faster than firms in more developed countries.

Fairchild (2010) had focussed on the relationship between dividend policy, managerial incentives and firm value. A theoretical model had been developed on dividend policy combining managerial communication and reputation effects with signalling and free cash flow motives. He argued that for investment in value creating projects, firms may go for dividend cuts which leaves a negative impact on investors and adversely effects the market value of the firms. He was also of the opinion that, to overcome such a problem managers must communicate the reasons for dividend cut to the investors for improving managerial reputation which ultimately effects the market value of the firms favourably.

Consler et.al. (2011) had compared relative power of operating cash flow and earnings in prediction of dividends. Quarterly data for 1,902 dividend paying firms were studied over a period of 5 years from 2002 to 2006. It was observed that cash flow per share produced a better fit than earnings per share. They were also of the opinion that investors and analysts predict dividends as a part of their stock valuation work.

Parasuraman et. al. (2012) had tested the applicability of Lintner's model for dividend pay-out on BSE Sensex firms during the period 2002 to 2011 by using multiple regression analysis. Along with Lintner's model, Britain's cash flow model and explicit depreciation model were also used in their study. It was found that the pay-out decision of the selected firms depends on earnings after tax, cash earnings, lagged dividends and capital expenditure. Lintner's model was also found to be a good fit. They had concluded that managers should not ignore current year's after tax earnings and lagged dividends while formulating a dividend policy.

Sobha Rani et. al. (2013) had evaluated the profitability and its growth rate in selected pharmaceuticals companies in India for the period 2002 to 2011. CAGR was calculated for profit before interest and tax, profit after tax, earnings per share and dividend per share. They found that the profitability of pharmaceutical companies are affected by determinants of dividend. They had also argued that higher DPS does not necessarily mean the all-round performance of a company, rather it depends on board decision, dividend pay-out ratio and several other factors.

Kaur et. al. (2014) had studied the concept and scope of dividend policy and examined the applicability of Modigliani-Miller dividend irrelevance hypothesis to know the relationship between dividend policy and share prices based on 5% of the companies listed in CNX Dividend Opportunities Index during the year 2013-14. It was found that there is no relationship between dividend pay-out and the market price of shares, the latter is affected due to other factors. They came up with the conclusion that although relevance theory holds good in short run, irrelevance theory shows the true picture in the long run.

III. OBJECTIVE OF THE STUDY

The objective of the study is to test the validity of four popular dividend policy models viz. Lintner's model, Brittain's cash flow and explicit depreciation model, Darling's model and Dobrovolsky's model in the context of few selected BSE SENSEX companies over a period of five years from 2015 to 2019 and to examine whether

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dividend smoothing is a practice prevailing amongst the managers of the sample companies.

IV. RESEARCH METHODOLOGY

Sample Selection: First, thirty companies are taken from the list of BSE SENSEX companies as it stands on January, 2020. From this list, finally seventeen companies have been selected on the basis of regular dividend payment record over the study period of 2015 to 2019. The list of selected companies are given in Table: 1.

Table: 1 List of Selected Companies

1. Asian Paints Ltd.	2. Bajaj Auto Ltd.	3. HCL Technologies Ltd.
4. Hero Moto Corps Ltd.	5. Hindustan Unilever Ltd.	6. Housing Development Finance Corporation Ltd.
7. Infosys Ltd.	8. ITC Ltd.	9. Mahindra and Mahindra Ltd.
10. Maruti Suzuki Ltd.	11. National Thermal Power Corporation Ltd.	12. Oil and Natural Gas Corporation Ltd.
13. Power Grid Corporation Ltd.	14. Tata Consultancy Services Ltd.	15. Tata Steel Ltd.
16. Tech Mahindra Ltd.	17. Ultra Tech Cements Ltd.	

Data Collection: The relevant data for the sample companies were collected from their financial statements available in money control database www.moneycontrol.com.

Data Analysis: The collected data were analysed using the framework of four popular dividend policy models viz. Lintner's model, Brittain's cash flow and explicit depreciation model, Darling's model and Dobrovolsky's model. Appropriate panel data regression analysis have been carried out to assess whether these models are good fit to the collected dataset over the study period and to examine whether dividend smoothing is a practice prevailing among the sample companies as per these models.

V. DATA ANALYSIS AND INTERPRETATION

A. Lintner's (1956) Dividend Smoothing Model

This model specifies about two main factors / components for deciding the firm's dividend payment behaviour viz. (i) the target pay-out ratio and (ii) the speed of adjustment of the current dividend to the target dividend. His basic model is as follows:

$$D_t - D_{t-1} = \alpha + SOA * [D_t^* - D_{t-1}] + \mu_t$$

$$or, \quad D_t - D_{t-1} = \alpha + SOA * [TDP * E_t - D_{t-1}] + \mu_t$$

$$or, \quad D_t - D_{t-1} = \alpha + SOA * TDP * E_t - SOA * D_{t-1} + \mu_t$$

$$or, \quad D_t = \alpha + SOA * TDP * E_t + D_{t-1} - SOA * D_{t-1} + \mu_t$$

$$or, \quad D_t = \alpha + SOA * TDP * E_t + [1 - SOA] * D_{t-1} + \mu_t$$

Where,

$D_t^*$is the desired dividend in the current year,

$D_t$is the actual dividend paid in the current year,

$TDP$is the target dividend pay-out ratio,

$E_t$is the after tax earnings of the current year,

$D_{t-1}$is the lagged dividend i.e. dividend paid in the previous year,

$SOA$is the speed of adjustment or partial adjustment factor,

$\alpha$is the intercept component and

$\mu_t$is the error component

Now, if two embedded regression coefficients viz. $[SOA * TDP]$ and $[1 - SOA]$ are expressed as β_1 and β_2 respectively, the Lintner's model in its simplest form can be re-written as follows:

$$\boldsymbol{D_t = \alpha + \beta_1 * E_t + \beta_2 * D_{t-1} + \mu_t}$$

Therefore, $[1 - SOA] = \beta_2 \Rightarrow \boldsymbol{SOA} = [\boldsymbol{1 - \beta_2}]$ and

$$[SOA * TDP] = \beta_1 \Rightarrow [1 - \beta_2] * TDP = \beta_1 \Rightarrow \boldsymbol{TDP} = \left[\frac{\boldsymbol{\beta_1}}{\boldsymbol{1 - \beta_2}}\right]$$

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Table: 2 Lintner's Model – Choosing the Appropriate Regression Equation

	Pooled OLS	Fixed Effect Model	Random Effect Model	Panel Tests
	Estimate (p-value)	Estimate (p-value)	Estimate (p-value)	1. Wald F Test F = 3.277 (p-value 0.000) Fixed Effect model is preferred to Pooled OLS 2. Breusch Pagan LM Test LM = 8.519, $\chi^2_{(0.05,2)}$ = 5.991 Random Effect model is preferred to Pooled OLS 3. Hausman Test χ^2 = 44.800 (p-value 0.000) Fixed Effect model is preferred to Random Effect model Therefore, the most appropriate model is the **Fixed Effect model.**
$Intercept$	-142.430 (0.630)	3114.388* (0.000)	-142.430 (0.563)	
E_t	0.299* (0.000)	0.136 (0.136)	0.299* (0.000)	
D_{t-1}	0.326* (0.011)	-0.352* (0.018)	0.326* (0.002)	
R^2	0.736	0.853	0.736	
$ANOVA-F$	114.225* (0.000)	21.245* (0.000)	114.225* (0.000)	
DW	1.909	1.581	1.909	
SOA	0.674	1.352	0.674	
TDP	0.444	0.101	0.444	

Table: 3 Summary Results of Lintner's Model under Fixed Effect (LSDV) Regression Equation Approach

	Fixed Effect Firm Specific Model		Fixed Effect Time Specific Model	
	Estimate	p-Value	Estimate	p-Value
$Intercept$	1567.870*	0.034	209.625	0.646
E_t	0.136	0.136	0.292*	0.000
D_{t-1}	-0.352*	0.018	0.345*	0.009
ASIAN	-772.984	0.391		
HCL	724.398	0.429		
HDFCL	593.638	0.536		
HERO	110.797	0.899		
HUL	2685.328*	0.005		
INFOSYS	5848.671*	0.000		
ITC	5190.874*	0.000		
MARUTI	-611.311	0.501		
MM	-937.141	0.289		
NTPC	1692.921	0.117		
ONGC	6451.952*	0.001		
POWERGRID	-468.579	0.616		
TATASTEEL	-1034.045	0.253		
TCS	8930.595*	0.000		
TECHM	-594.723	0.499		
ULTRATECH	-1519.585	0.094		
2016			-585.724	0.314
2017			-343.132	0.553
2018			-683.308	0.240
2019			-122.537	0.835
R^2	0.853		0.743	
$ANOVA-F$	21.245*(0.000)		37.506*(0.000)	
DW	1.581		1.922	
SOA	1.352		0.655	
TDP	0.101		0.446	

First we have checked that amongst pooled OLS model, fixed effect model and random effect model, which one is most appropriate to test the validity of the Lintner's model. For that purpose, we have carried out Wald F-test, Breusch Pagan Lagrangian Multiplier test and Hausman test. The test results give an indication that fixed effect model is most appropriate amongst all.

Next we have set the fixed effect firm specific and fixed effect time specific regression equations with least square dummy variables. While setting the fixed effect firm specific regression equation, Bajaj Auto Ltd. is considered as the base category, other firms are used as dummy variables. Similarly, while setting the fixed effect time specific regression equation, 2015 is considered as the base year, other years are used as dummy variables.

From the results of both firm-specific and time-specific fixed effect models, it is clearly revealed that the Lintner's model is a good fit to the dataset considered for the purpose of our analysis as F-values are statistically significant at 5% level. R^2-values are also high (0.853 in firm-specific model and 0.743 in time-specific model) indicating that quite a significant portion of change in dividend is explained by changes in after tax current year's earnings and lagged dividend payment jointly. Durbin-Watson test statistic values suggest that there is no instance of serial auto correlation in the dataset.

Hindustan Unilever Ltd., Infosys Ltd., ITC Ltd., Oil and Natural Gas Corporation Ltd. and Tata Consultancy Services Ltd. were found to have firm effects (i.e. significantly differing from the other members of the sample). However, no time effect has been found for the years under study.

Thus, we may conclude that there is a clear evidence of practicing dividend smoothing by the managers over the study period as far as Lintner's dividend payment model is concerned.

B. Brittain's (1966) Dividend Smoothing Model

Considering Lintner's model as the basis, an alternate hypothesis by John Brittain (1966) suggests that cash flow (net current earnings after tax plus depreciation) is a better measure of company's capacity to pay dividends and accordingly substituted the after tax current year's earnings, as used in Lintner's model, by cash flow for the current year. Thus, the model, referred to as **"Brittain's cash flow model"**, is expressed as follows:

$$\boldsymbol{D_t = \alpha + \beta_1 * CF_t + \beta_2 * D_{t-1} + \mu_t}$$

Where,
D_t is the actual dividend paid in the current year,
CF_t is the cash flow after tax (i.e. after tax earnings plus amortization and depreciation charges) of the current year,
D_{t-1} is the lagged dividend i.e. dividend paid in the previous year,
α is the intercept component and
μ_t is the error component

Later on, in his second model, Brittain has split cash flows into two components viz. after tax earnings and depreciation.He has used depreciation as a separate explanatory variable along with net current earnings after tax and lagged dividends. Thus, the model, referred to as **"Brittain's explicit depreciation model"**, is expressed as follows:

$$\boldsymbol{D_t = \alpha + \beta_1 * E_t + \beta_2 * D_{t-1} + \beta_3 * A_t + \mu_t}$$

Where,
D_t is the actual dividend paid in the current year,
E_t is the after tax earnings of the current year,
D_{t-1} is the lagged dividend i.e. dividend paid in the previous year,
A_t is the amortization and depreciation charges for the current year,
α is the intercept component and
μ_t is the error component

Table: 4 Brittain's Cash Flow Model – Choosing the Appropriate Regression Equation

	Pooled OLS	Fixed Effect Model	Random Effect Model	Panel Tests
	Estimate (p-value)	Estimate (p-value)	Estimate (p-value)	**1. Wald F Test** F = 4.905 (p-value 0.000) Fixed Effect model is preferred to Pooled OLS
$\boldsymbol{Intercept}$	149.104 (0.634)	2679.999* (0.001)	149.104 (0.528)	**2. Breusch Pagan LM Test** LM = 4.473, $\chi^2_{(0.05,2)}$ = 5.991 Pooled OLS is preferred to Random Effect model
$\boldsymbol{CF_t}$	0.121* (0.001)	0.149* (0.033)	0.121* (0.000)	
$\boldsymbol{D_{t-1}}$	0.619* (0.000)	-0.366* (0.013)	0.619* (0.000)	
$\boldsymbol{R^2}$	0.689	0.858	0.689	**3. Hausman Test**

$ANOVA - F$	90.857* (0.000)	22.146* (0.000)	90.857* (0.000)	χ^2 = 70.235 (p-value 0.000) Fixed Effect model is preferred to Random Effect model Therefore, the most appropriate model is the **Fixed Effect model.**
DW	2.205	1.604	2.205	

Table: 5 Summary Results of Brittain's Cash Flow Model under Fixed Effect (LSDV) Regression Equation Approach

	Fixed Effect Firm Specific Model		Fixed Effect Time Specific Model	
	Estimate	**p-Value**	**Estimate**	**p-Value**
$Intercept$	1494.318*	0.033	481.632	0.324
CF_t	0.149*	0.033	0.114*	0.003
D_{t-1}	-0.366*	0.013	0.640*	0.000
ASIAN	-755.794	0.389		
HCL	645.833	0.468		
HDFCL	582.110	0.521		
HERO	84.310	0.922		
HUL	2681.915*	0.004		
INFOSYS	5624.142*	0.000		
ITC	5041.190*	0.000		
MARUTI	-1013.392	0.277		
MM	-1108.345	0.205		
NTPC	772.156	0.524		
ONGC	4437.960*	0.045		
POWERGRID	-1614.248	0.161		
TATASTEEL	-1471.222	0.116		
TCS	8586.260*	0.000		
TECHM	-640.806	0.459		
ULTRATECH	-1695.500	0.056		
2016			-703.252	0.262
2017			-341.510	0.584
2018			-641.137	0.307
2019			111.732	0.860
R^2	0.858		0.700	
$ANOVA - F$	22.146* (0.000)		30.285* (0.000)	
DW	1.604		2.231	

First we have checked that amongst pooled OLS model, fixed effect model and random effect model, which one is most appropriate to test the validity of the Brittain's Cash Flow model. For that purpose, we have carried out Wald F-test, Breusch Pagan Lagrangian Multiplier test and Hausman test. The test results give an indication that fixed effect model is most appropriate amongst all.

Next we have set the fixed effect firm specific and fixed effect time specific regression equations with least square dummy variables. While setting the fixed effect firm specific regression equation, Bajaj Auto Ltd. is considered as the base category, other firms are used as dummy variables. Similarly, while setting the fixed effect time specific regression equation, 2015 is considered as the base year, other years are used as dummy variables.

From the results of both firm-specific and time-specific fixed effect models, it is clearly revealed that the Brittain's Cash Flow model is a good fit to the dataset considered for the purpose of our analysis as F-values are statistically significant at 5% level. R^2-values are also high (0.858 in firm-specific model and 0.700 in time-specific model) indicating that quite a significant portion of change in dividend is explained by changes in current year's cash flow and lagged dividend payment jointly. Durbin-Watson test statistic values suggest that there is no instance of serial auto correlation in the dataset.

Hindustan Unilever Ltd., Infosys Ltd., ITC Ltd., Oil and Natural Gas Corporation Ltd. and Tata Consultancy Services Ltd. were found to have firm effects (i.e. significantly differing from the other members of the sample). However, no time effect has been found for the years under study.

Thus, we may conclude that there is a clear evidence of practicing dividend smoothing by the managers over the study period as far as Brittain's Cash Flow Model of dividend payment is concerned.

Table: 6 Brittain's Explicit Depreciation Model – Choosing the Appropriate Regression Equation

	Pooled OLS	Fixed Effect Model	Random Effect Model
	Estimate (p-value)	**Estimate (p-value)**	**Estimate (p-value)**
Intercept	-118.642 (0.686)	2789.448* (0.001)	-118.642 (0.616)
E_t	0.341* (0.000)	-0.014 (0.892)	0.341* (0.000)
D_{t-1}	0.281* (0.030)	-0.352* (0.014)	0.281* (0.007)
A_t	-0.092 (0.136)	0.619* (0.012)	-0.092 (0.065)
R^2	0.743	0.867	0.743
ANOVA – F	78.089* (0.000)	22.212* (0.000)	78.089* (0.000)
DW	1.893	1.645	1.893

Panel Tests

1. Wald F Test
F = 3.758 (p-value 0.000)
Fixed Effect model is preferred to Pooled OLS

2. Breusch Pagan LM Test
LM = 7.719, $\chi^2_{(0.05,3)}$ = 7.815
Pooled OLS is preferred to Random Effect model

3. Hausman Test
χ^2 = 52.595 (p-value 0.000)
Fixed Effect model is preferred to Random Effect model

Therefore, the most appropriate model is the **Fixed Effect model.**

Table: 7 Summary Results of Brittain's Explicit Depreciation Model under Fixed Effect (LSDV) Regression Equation Approach

	Fixed Effect Firm Specific Model		Fixed Effect Time Specific Model	
	Estimate	**p-Value**	**Estimate**	**p-Value**
Intercept	1966.322*	0.007	217.908	0.631
E_t	-0.014	0.892	0.332*	0.000
D_{t-1}	-0.352*	0.014	0.302*	0.025
A_t	0.619*	0.012	-0.089	0.157
ASIAN	-1088.291	0.213		
HCL	931.411	0.292		
HDFCL	1397.146	0.153		
HERO	-134.117	0.874		
HUL	2765.360*	0.002		
INFOSYS	6748.232*	0.000		
ITC	5713.225*	0.000		
MARUTI	-1753.283	0.076		
MM	-1611.635	0.072		
NTPC	-888.909	0.536		
ONGC	957.490	0.726		
POWERGRID	-4499.821*	0.015		
TATASTEEL	-2405.962*	0.020		
TCS	11206.860*	0.000		
TECHM	-852.115	0.317		
ULTRATECH	-2492.457*	0.010		
2016			-565.942	0.327
2017			-322.496	0.574
2018			-654.265	0.258

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2019		-121.167	0.836
R^2	0.867	0.749	
$ANOVA-F$	22.212* (0.000)	32.870* (0.000)	
DW	1.645	1.905	

First we have checked that amongst pooled OLS model, fixed effect model and random effect model, which one is most appropriate to test the validity of the Brittain's Explicit Depreciation model. For that purpose, we have carried out Wald F-test, Breusch Pagan Lagrangian Multiplier test and Hausman test. The test results give an indication that fixed effect model is most appropriate amongst all.

Next we have set the fixed effect firm specific and fixed effect time specific regression equations with least square dummy variables. While setting the fixed effect firm specific regression equation, Bajaj Auto Ltd. is considered as the base category, other firms are used as dummy variables. Similarly, while setting the fixed effect time specific regression equation, 2015 is considered as the base year, other years are used as dummy variables.

From the results of both firm-specific and time-specific fixed effect models, it is clearly revealed that the Brittain's Explicit Depreciation model is a good fit to the dataset considered for the purpose of our analysis as F-values are statistically significant at 5% level. R^2-values are also high (0.867 in firm-specific model and 0.749 in time-specific model) indicating that quite a significant portion of change in dividend is explained by changes in current year's after tax earnings, lagged dividend payment and amortization and depreciation charges jointly. Durbin-Watson test statistic values suggest that there is no instance of serial auto correlation in the dataset.

Hindustan Unilever Ltd., Infosys Ltd., ITC Ltd., Power Grid Corporation Ltd., Tata Steel Ltd., Tata Consultancy Services Ltd. and Ultra Tech Cements Ltd. were found to have firm effects (i.e. significantly differing from the other members of the sample). However, no time effect has been found for the years under study.

Thus, we may conclude that there is a clear evidence of practicing dividend smoothing by the managers over the study period as far as Brittain's Explicit Depreciation Model of dividend payment is concerned.

C. Darling's (1957) Dividend Smoothing Model

Darling (1957) is of the opinion that after tax earnings of the previous year better explains the current year's dividend than the previous year's dividend and thus replacedprevious year's dividend payment, as used in Lintner's model,by after tax earnings of the previous year. He has further stated that firms remainreluctant to give immediate and full effect of rising or falling current year's after tax earnings on dividends which can be viewed as a tendency of referring to the after tax earnings of the previous year while formulating the current year's dividend policy. He has hypothesized that current year's dividend payment tends to vary directly with current year's after tax earnings, last year's after tax earnings and amortization and depreciation charges and inversely with persistent changes in the level of sales. His dividend smoothing model can be expressed as follows:

$$\boldsymbol{D_t = \alpha + \beta_1 * E_t + \beta_2 * E_{t-1} + \beta_3 * A_t + \beta_4 * \Delta S_{t-2} + \mu_t}$$

Where,
D_t is the actual dividend paid in the current year,
E_t is the after tax earnings of the current year,
E_{t-1} is the after tax earnings of the previous year,
A_t is the amortization and depreciation charges for the current year,
ΔS_{t-2} is the change in sales in current year w.r.t. sales two years before
α is the intercept component and
μ_t is the error component

Table: 8 Darling's Dividend Smoothing Model – Choosing the Appropriate Regression Equation

	Pooled OLS	Fixed Effect Model	Random Effect Model	<u>**Panel Tests**</u>
	Estimate (p-value)	**Estimate (p-value)**	**Estimate (p-value)**	**1. <u>Wald F Test</u>** F = 3.222 (p-value 0.000) Fixed Effect model is preferred to Pooled OLS
$Intercept$	-263.508 (0.382)	1456.941 (0.124)	-265.073 (0.405)	**2. <u>Breusch Pagan LM Test</u>** LM = 15.047, $\chi^2_{(0.05,4)}$ = 9.488
E_t	0.109 (0.453)	-0.272 (0.057)	0.056 (0.648)	

<table>
<tr><td>E_{t-1}</td><td>0.393*
(0.008)</td><td>0.297*
(0.041)</td><td>0.418*
(0.001)</td><td rowspan="6">Random Effect model is preferred to Pooled OLS

3. <u>Hausman Test</u>
χ^2 = 25.652 (p-value 0.000)
Fixed Effect model is preferred to Random Effect model

Therefore, the most appropriate model is the Fixed Effect model.</td></tr>
<tr><td>A_t</td><td>-0.132*
(0.028)</td><td>0.527
(0.058)</td><td>-0.103
(0.104)</td></tr>
<tr><td>ΔS_{t-2}</td><td>0.000
(0.993)</td><td>0.060
(0.127)</td><td>0.024
(0.415)</td></tr>
<tr><td>R^2</td><td>0.756</td><td>0.865</td><td>0.672</td></tr>
<tr><td>$ANOVA - F$</td><td>62.028*
(0.000)</td><td>20.497*
(0.000)</td><td>40.963*
(0.000)</td></tr>
<tr><td>DW</td><td>1.346</td><td>2.215</td><td>1.489</td></tr>
</table>

Table: 9 Summary Results of Darling's Dividend Smoothing Model under Fixed Effect (LSDV) Regression Equation Approach

	Fixed Effect Firm Specific Model		Fixed Effect Time Specific Model	
	Estimate	**p-Value**	**Estimate**	**p-Value**
$Intercept$	1214.068	0.105	-78.353	0.868
E_t	-0.272	0.057	0.128	0.399
E_{t-1}	0.297*	0.041	0.377*	0.015
A_t	0.527	0.058	-0.135*	0.029
ΔS_{t-2}	0.060	0.127	-0.009	0.801
ASIAN	-705.160	0.428		
HCL	569.326	0.533		
HDFCL	837.091	0.406		
HERO	-103.405	0.904		
HUL	2078.129*	0.018		
INFOSYS	4799.352*	0.001		
ITC	4037.863*	0.001		
MARUTI	-2020.465*	0.049		
MM	-1374.543	0.129		
NTPC	-1586.244	0.366		
ONGC	-630.416	0.860		
POWERGRID	-3817.275	0.066		
TATASTEEL	-2303.241*	0.031		
TCS	7160.264*	0.004		
TECHM	-744.528	0.389		
ULTRATECH	-2067.894*	0.031		
2016			-315.324	0.585
2017			-182.205	0.750
2018			-362.599	0.530
2019			136.460	0.819
R^2	0.865		0.759	
$ANOVA - F$	20.497* (0.000)		29.997* (0.000)	
DW	2.215		1.339	

First we have checked that amongst pooled OLS model, fixed effect model and random effect model, which one is most appropriate to test the validity of the Darling's dividend smoothing model. For that purpose, we have carried out Wald F-test, Breusch Pagan Lagrangian Multiplier test and Hausman test. The test results give an indication that fixed effect model is most appropriate amongst all.

Next we have set the fixed effect firm specific and fixed effect time specific regression equations with least square dummy variables. While setting the fixed effect firm specific regression equation, Bajaj Auto Ltd. is considered as the base category, other firms are used as dummy variables. Similarly, while setting the fixed effect time specific regression equation, 2015 is considered as the base year, other years are used as dummy variables.

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From the results of both firm-specific and time-specific fixed effect models, it is clearly revealed that the Darling's dividend smoothing model is a good fit to the dataset considered for the purpose of our analysis as F-values are statistically significant at 5% level. R^2-values are also high (0.865 in firm-specific model and 0.759 in time-specific model) indicating that quite a significant portion of change in dividend is explained by changes in current year's after tax earnings, last year's after tax earnings, amortization and depreciation charges and persistent growth in sales jointly. Durbin-Watson test statistic values suggest that there is no instance of serial auto correlation in the dataset.

Hindustan Unilever Ltd., Infosys Ltd., ITC Ltd., Maruti Suzuki Ltd., Tata Steel Ltd., Tata Consultancy Services Ltd. and Ultra Tech Cements Ltd. were found to have firm effects (i.e. significantly differing from the other members of the sample). However, no time effect has been found for the years under study.

Thus, we may conclude that there is a clear evidence of practicing dividend smoothing by the managers over the study period as far as Darling'smodel of dividend payment is concerned.

D. Dobrovolsky's (1951) Dividend Smoothing Model

Dobrovolsky (1951) has examined the retention policy to capture dividend behaviour and is of the opinion that amount of retained earnings of the firms not only depends on current year's profitability but also on continuity of dividend policy of the previous year as well as on the rate of operating asset expansion to a large extent. In fact, a firm's dividend and retention policies are the opposite faces of the same coin. Hence, the dividend decision of a firm would also be governed by the same factorsthat influence retention policy. Since, firms are not willing to change their dividend policy frequently, the last year's dividend payment may be considered as a guiding factor for determining the dividend requirements for the current year. Moreover, dividend is negatively and significantly associated with the growth in operating assets. Thus, Dobrovolsky's dividend smoothing model can be expressed as follows:

$$\boldsymbol{DY_t = \alpha + \beta_1 * EY_t + \beta_2 * DY_{t-1} + \beta_3 * OAG_t + \mu_t}$$

Where,

DY_t is the dividend yield of the current year (measured by amount of dividend paid in the current year as a percentage of the average net worth of the year)

EY_t is the earnings yield of the current year (measured by after tax earnings of the current year as a percentage of the average net worth of the year)

DY_{t-1} is dividend yield of the last year (measured by amount of dividend paid in the last year as a percentage of the average net worth of the current year)

OAG_t is the growth in operating assets of the firm in the current year w.r.t. the last year.

α is the intercept component and

μ_t is the error component

It is to be noted that Dobrovolsky's model is different from the other models used in this analysis, as all the variables, both dependent and explanatory, are expressed as ratios rather than absolute amounts. Thus the issue of the size difference of various firms is very well taken care of in this model.

Table: 10 Dobrovolsky's Dividend Smoothing Model – Choosing the Appropriate Regression Equation

	Pooled OLS	Fixed Effect Model	Random Effect Model	**Panel Tests**
	Estimate (p-value)	**Estimate (p-value)**	**Estimate (p-value)**	**1. Wald F Test** F = 1.845 (p-value 0.044) Fixed Effect model is preferred to Pooled OLS
Intercept	-5.231* (0.000)	-5.005* (0.011)	-5.231* (0.000)	**2. Breusch Pagan LM Test** LM = 4.984, $\chi^2_{(0.05,3)}$ = 7.815 Pooled OLS is preferred to Random Effect model
$\boldsymbol{EY_t}$	0.488* (0.000)	0.687* (0.000)	0.488* (0.000)	
$\boldsymbol{DY_{t-1}}$	0.428* (0.000)	-0.076 (0.598)	0.428* (0.000)	
$\boldsymbol{OAG_t}$	0.008 (0.245)	0.010 (0.103)	0.008 (0.209)	**3. Hausman Test** χ^2 = 26.586 (p-value 0.000) Fixed Effect model is preferred to Random
$\boldsymbol{R^2}$	0.939	0.958	0.939	

$ANOVA - F$	412.333* (0.000)	77.531* (0.000)	412.333* (0.000)	Effect model
DW	2.294	2.149	2.294	Therefore, the most appropriate model is the **Fixed Effect model.**

Table: 11 Summary Results of Dobrovolsky's Dividend Smoothing Model under Fixed Effect (LSDV) Regression Equation Approach

	Fixed Effect Firm Specific Model		**Fixed Effect Time Specific Model**	
	Estimate	**p-Value**	**Estimate**	**p-Value**
$Intercept$	-6.158*	0.018	-4.703*	0.003
EY_t	0.687*	0.000	0.474*	0.000
DY_{t-1}	-0.076	0.598	0.446*	0.000
OAG_t	0.010	0.103	0.007	0.289
ASIAN	-0.357	0.879		
HCL	-2.251	0.341		
HDFCL	-1.186	0.622		
HERO	0.027	0.991		
HUL	16.100*	0.008		
INFOSYS	2.912	0.215		
ITC	4.341	0.073		
MARUTI	-2.604	0.294		
MM	-0.953	0.701		
NTPC	2.228	0.388		
ONGC	3.270	0.206		
POWERGRID	-1.034	0.680		
TATASTEEL	1.357	0.609		
TCS	-1.386	0.578		
TECHM	-0.914	0.703		
ULTRATECH	0.046	0.986		
2016			-0.464	0.742
2017			-0.916	0.521
2018			-0.670	0.634
2019			0.208	0.882
R^2	0.958		0.939	
$ANOVA - F$	77.531* (0.000)		170.025* (0.000)	
DW	2.149		2.340	

First we have checked that amongst pooled OLS model, fixed effect model and random effectmodel, which one is most appropriate to test the validity of the Dobrovolsky's dividend smoothing model. For that purpose, we have carried out Wald F-test, Breusch Pagan Lagrangian Multiplier test and Hausman test. The test results give an indication that fixed effect model is most appropriate amongst all.

Next we have set the fixed effect firm specific and fixed effect time specific regression equations with least square dummy variables. While setting the fixed effect firm specific regression equation, Bajaj Auto Ltd. is considered as the base category, other firms are used as dummy variables. Similarly, while setting the fixed effect time specific regression equation, 2015 is considered as the base year, other years are used as dummy variables.

From the results of both firm-specific and time-specific fixed effect models, it is clearly revealed that the Dobrovolsky's dividend smoothing model is a good fit to the dataset considered for the purpose of our analysis as F-values are statistically significant at 5% level. R^2-values are also high (0.958 in firm-specific model and 0.939 in time-specific model) indicating that quite a significant portion of change in dividend yield is explained by changes in current year's after tax earnings yield, last year's dividend yield and growth in operating assets of the firm during the current year jointly. Durbin-Watson test statistic values suggest that there is no instance of serial auto correlation in the dataset.

Only Hindustan Unilever Ltd., was found to have firm effects (i.e. significantly differing from the other members of the sample). However, no time effect has been found for the years under study.

Thus, we may conclude that there is a clear evidence of practicing dividend smoothing by the managers over the study period as far as Dobrovolsky's model of dividend payment is concerned.

VI. CONCLUSION

All the models were found to be good fit to the dataset used in the study. Amongst the explanatory variables that are used in these four models, current year's earnings after tax (both in absolute term and in terms of percentage of average net worth), last year's earnings after tax, current year's cash flow, lagged dividend i.e. dividend paid for the last year (both in absolute term and in terms of percentage of average net worth) and amortization and depreciation charges were found to be statistically significant at 5% level in explaining the smoothing effect in dividend payment for the current year. Explanatory variables viz. persistent sales growth (as used in Darling's model) and growth in operating assets during the current year (as used in Dobrovolsky's model) were found to have insignificant impact on formulation of current year's dividend policy. Thus, to conclude, it may be argued that there is clear evidence of practicing dividend smoothing by the sample firms over the study period according to the above mentioned factors.

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