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TESTING CORPORATE LIFE CYCLE THEORY: A MULTINOMIAL LOGISTIC REGRESSION APPROACH

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Abstract *Purpose: This article tests the corporate life cycle theory in the context of an emerging market. Design/Methodology/Approach: We use 3179 non-financial Indian firms' data for the period 2011-2020 to validate the claim. To access the robustness of empirical relationships, we employ multinomial logistic and probit regression models. Findings: The findings indicate that firms' age follow a non-linear pattern over its life cycle. Firms at the birth and decline stages experienced lower profitability, higher investment opportunities and less likelihood for dividends. Growth firms experiences higher investment opportunities, therefore raising more funds from debt along with paying dividends for reputation building. Furthermore, mature firms with larger size and shrinking investment opportunities, generating cash flows due to higher profitability. Thus, they pay dividend and consider being less risky. For 5 years of out-of-sample data (2016-2020), our model predicts with an average accuracy of 65%. From the perspective of inter-stage transition, firms in the birth and decline stages have a tendency to improve their position, whereas firms in the mature stages are relatively stable in future period. Originality: It seems that very few studies have examined the issue of how the firm characteristics varies over its lifecycle in emerging markets and our research bridges this gap in the literature.*

Keywords: *Corporate Life Cycle, Multinomial Logit, Firm Characteristics, Growth and Mature*

INTRODUCTION

Similar to a living organism, a business enterprise follows its own life cycle, beginning with its inception and continuing through its development and growth, maturity and decline. Each stage of development will present its own unique and evolving challenges. Thus, firm's characteristics change throughout its life-cycle (Porter, 2004; Miller & Friesen, 1984). The life cycle has significant economic effects on the operations, investment and financing activities of the business. In the introduction phase of a company's life cycle, innovation is commercialised and business opportunities are exploited. This stage is characterised by low investments in assets, new production processes with high business risk and high borrowing costs. Managerial optimism derives investment at this stage (Jovanovic, 1982). The growth stage is defined as the stage when a firm starts to grow in business, profits start coming and investment increases at and financing happens through reinvestment. Growth firms increase debt (Spence, 1977). The maturity stage is recognised as the optimisation of the production process with earnings expectations at highest. Depreciation finance capital investments at this stage. Also, Myers (1977) and Jensen (1986) found that at this stage the firms focus more on servicing debt and distributing profits. The decline stage is normally characterised by falling sales, declining earnings and increase in unutilised production capacity.

This study extends the existing literature and focuses on two overarching objectives. First, to test the firm's life cycle theory in the context of an emerging market using multinomial logistic approach. The second objective is to examine the transition of a company's life cycle phases. The remainder of the paper is structured as follows: Section 2 discusses existent related literature and hypotheses development. Section 3 explains the research design followed in the study. Section 4 highlights result of the empirical analysis. Section 5 provides a summary of the findings.

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LITERATURE REVIEW

Corporate Life Cycle Theory

Studies in organisation and management sciences have long established that firms follow a consistent pattern of development – life cycle, characterised by distinct developmental stages with distinct firm activities, characteristics and organisational structures. As firms proceed from one stage to another, they undergo a highly multifaceted transition. The conventional corporate life cycle model suggests that firms progress monotonically from the birth stage to the decline stage, and strategies, structures and activities of firms change accordingly (Miller & Friesen, 1980, 1984; Quinn & Cameron, 1983). Penrose (1959) provides a general theory of growth of the firm, arguing that a firm's growth depends on its resources and productive opportunities. The firm life cycle has a valuable impact on management and business strategy and, therefore, the stages in the life cycle are a key determinant of organisational competitiveness. However, most of the studies in the fields are conceptual rather than empirical. Although literature in accounting and finance overcome this limitation by developing accounting-based metrics for categorising life cycle stages. We explore both the antecedents and the implications of firms' transition over the life cycle stages as follows.

Determinants of Corporate Life Cycle

Profitability

Economic theory posits that firm's profit are maximised during increases in investment and efficiency which means that highest profitability is achieve during the growth and maturity stages. The profitability in context to firm life cycle has been studied by Almeida et al., (2004). They posit that the cash holding patterns should vary over the business cycle. In particular, financially constrained firms should increase their propensity to retain cash following negative macroeconomic shocks, while unconstrained firms should not. Warusawitharana (2013) found that growth firms are more profitable in comparison to mature firms. The maturity stage companies were also observed to outperform other life cycle stages (Aldaas, 2021). We use return on assets as the proxy of profitability.

Growth Opportunities

In a growth phase, a firm has many positive NPV projects available, it earns large economic profits, has high capital expenditures, low free cash flows and experiences rapid growth in its earnings. As the firm continues to grow, competitors enter the industry, cannibalize the firm's market share and reduce the firm's economic profits. In this transition phase, the firm's investment opportunity set starts shrinking, its growth begins to slow, capital expenditures decline and the firm starts generating larger amounts of free cash flows (Grullon et al., 2002). As firms become more mature, their investment opportunity set becomes smaller. This manifests itself in a declining rate of reinvestment (the amount the firm retains from its earnings to reinvest into the firm), declining return on investment and growth rates, and declining risk. (Levie & Licheenstein, 2008; Loderer & Waelchli, 2010; Vorst & Yohn, 2018). Following Agarwal and Singh (2022), we use annual growth in total assets as the proxy of growth opportunities.

Dividends

Fama and French (2001) posit that dividend paying firms have characteristics such as larger size, higher profitability, and fewer investment opportunities. The ratio of earned to contributed capital positively correlates with the likelihood of a company paying dividends. They suggest that firms with low retained earnings as a proportion of total equity (RE/TE) or total assets (RE/TA) tend to be in the capital infusion stage of their lifecycle and are less likely to pay dividends, whereas firms with high RE/TE (or RE/TA) are more mature and profitable, and thus are more likely to pay dividends (DeAngelo et al., 2006). For Australian firms, dividend payments reflect firm maturity (Coulton & Ruddock, 2011). They posit that those firms paying dividends are larger, more profitable, have fewer growth options and higher retained earnings than non-dividend paying firms. Similar results were found by various studies such as Banyi and Kahle (2014); Bhattacharya (2019); Bhayani and Ajmera (2019), etc.

Leverage

Berger and Udell (1998) posit that the degree of informational opacity is a key feature that drives the financial growth cycle of a firm. In the early stages, firm do not have many business assets that can be easily evaluated or pledged as collateral. Thus, firms at birth and growth stages have higher information asymmetry. The pecking order suggests that informational opacity will favour first using insider funds generated within the firm or from the entrepreneur and other insiders that have superior information about the firm. But equity financing is most likely for closely held firms and in countries in which entrepreneurs face high stigmatisation costs (Hirsch & Walz, 2011). Firms in mature and revival stages have lower debt ratios and firms in birth, growth firms in mature

and revival stages have lower debt ratios and firms in birth, growth (Tian et al., 2015; Faff et al., 2016; Jaisinghani & Kanjilal, 2017). We use ratio of total debt (short term & long term debt) to total assets as proxy of leverage by following Chaudhary (2021).

Systematic Risk

Using maturity hypothesis, Grullon et al. (2002) posit that U.S. firms that increase (decrease) dividends experience a significant decline (increase) in their systematic risk. It indicate that as a firm matures, systematic risk associated with it declines. While Hasan et al. (2015) found that the cost of equity is higher in the introduction and decline stages of the firm, while it is lower in the growth and mature stage. The managerial risk-taking is higher during the introduction and decline stages of the firm life cycle compared to the shake-out stage benchmark. Risk-taking is lower during the growth and maturity phases of the firm life cycle (Habib & Hasan, 2017; Hamers et al., 2016). We use slope coefficient in single index model using BSE sensex as proxy for systematic risk by following Shefali and Kour (2022).

Corporate Life Cycle Measurement

Anthony and Ramesh (1992) is one of the first empirical studies that uses an accounting information-based life cycle model. They use four variables: age, sales growth, dividend yield and capital expenditures, to categorise firms into multiple stages of the life cycle: growth, growth/mature, mature, mature/stagnant and stagnant. Although this measure of the firm life cycle can track the transition of a firm over the life cycle, it suffers from some limitations. The construction of firm life cycle stages using this measure requires a six-year history of the underlying variables, thereby, reducing the probability of observing the true 'introduction stage' firms in the sample. Also, life cycle proxy had to rely on portfolio sorts to draw distinctions between life cycle stages.

DeAngelo et al. (2006) tested the life-cycle theory by assessing whether firms with relatively high retained earnings as RE/TE and (RE/TA are more likely to pay dividends. They argued that retained earnings as a proportion of either RE/TA or RE/TE provide a reasonable indication of the corporate life cycle, in that a firm with higher RE/TA or RE/TE is mature or older, while a firm with lower RE/TA or RE/TE is young and growing. But, it fails to classify firms into multiple stages of life cycle.

In order to rectify the above limitations in measurement, Dickinson (2011) develop cash flow-based stages classification method. It argues that cash flows capture differences in a firm's profitability, growth and risk. Thus, classifies firms into one of five lifecycle stages, namely introduction (birth), growth, maturity, shake-out and decline based on the combined signs of net cash flows from operating, financing and investing activities. Net cash flows can be positive or negative, resulting in eight possible cash flow combinations. We use this approach to classify our sample into five stages (see Table 2).

Research Gap

Over the last two and half decades, much has been written about the implications of the organisation's life cycle in accounting and finance, yet there has been comparatively little attention given to the antecedents of corporate life cycle stages. Further, it seems that few studies have examined, comprehensively, the issue of how the firm characteristics varies over its lifecycle in emerging markets and our research bridges this gap in the literature. In light of the preceding discussion, the purpose of this study is to test the firm's life cycle theory in the context of an emerging market using a multinomial logistic approach and to investigate the transition between the phases of a firm's life cycle. Consequently, we developed the following hypotheses for the study:

H1: Profitability vary over corporate life cycle.

H2: Growth opportunities varies over corporate life cycle.

H3: Dividend policy vary over corporate life cycle.

H4: Leverage vary over corporate life cycle.

H5: Systematic risk vary over corporate life cycle.

RESEARCH DESIGN

Sample

Our sample data was extracted from the prowess database maintained by the Centre for Monitoring the Indian Economy (CMIE) Private Limited for the period 2011-2020. We divide this data into two sub-samples viz. estimation and forecasting. In the estimation procedure, the initial five-year data for the period 2011-2015 are considered, whereas in the forecasting procedure, the subsequent five-year data for the period 2016-2020 are considered. Initially, we consider all Indian firms listed on Bombay Stock Exchange (BSE) and exclude financial companies, government-owned companies due to the structure of their financial statements and ownership. For data availability in forecasting, we exclude the companies which are listed after 31st March, 2018. Therefore, our unbalanced panel dataset is narrowed down to 3179 Indian non-financial firms or 12787 firm year observations (See Table 1). Also, to minimise the impact of outliers, we winsorize all the relevant control variables, at 1st and 99th percentiles of their pooled distribution.

Table 1: Sample Description

Initial sample (all public companies listed at BSE)	4801
Less: financial services, banking and insurance companies Less: companies owned by the government (central and state) Less: companies listed after 31st March 2018	(1622)
Number of companies in the final sample	3179
Total firm-year observations (2011-2020)	25714
Firm-year observations for estimation period (2011-2015)	12787
Firm-year observations for forecasting period (2016-2020)	12927

Source: Compiled by authors based on CMIE ProwessIQ data.

Variables

To measure the dependent variable, life cycle, we followed Dickinson's (2011) method to classify a firm's life cycle stage. Consequently, firms were classified into one of five life-cycle stages: introduction (birth), growth, maturity, shakeout and decline based on the combination of signs of net cash flows from operating, financing and investing activities (See Table 2). Net cash flows can be positive or negative, resulting in eight possible cash-flow combinations. Further, Table 2 provides definitions, measurements and abbreviations for all variables used in the model presented above.

Table 2: List of Variables with Their Respective Descriptions and Abbreviations

Variable	Abbreviation	Description
Life Cycle Stages	LC_k	Dickinson (2011) Cash Flows based classification: Stage 1: Birth = CFO<0, CFI<0 and CFF>0 Stage 2: Growth = CFO>0, CFI<0 and CFF>0 Stage 3: Mature = CFO>0, CFI<0 and CFF<0 Stage 4: Shakeout = CFO>0, CFI>0 and CFF>0 OR CFO<0, CFI<0 and CFF<0 OR CFO>0, CFI>0 and CFF<0 Stage 5: Decline = CFO<0, CFI>0 and CFF>0 OR CFO<0, CFI>0 and CFF<0 Where, CFO = Cash Flow from Operating Activities CFI = Cash Flow from Investing Activities CFF= Cash Flow from Financing activities
Age	Age	Current Year- Incorporation Year
Size	Size	Natural logarithm (Total Assets)
Growth Opportunities	GrAssets	$(\text{Total Assets}_t - \text{Total Assets}_{(t-1)})/ \text{Total Assets}_{(t-1)}$
Profitability	ROA	Return on Assets (PBIT/Total Assets)
Dividend Policy	Div	Dummy Variable (1= Paid, 0= Otherwise)
Financial Leverage	Lev	(Short Term Debt + Long Term Debt) / Total Assets
Systematic Risk	Beta	Slope coefficient in Single Index Model (Using BSE Sensex)
Ownership Concentration	Ownership	Promoter's Ownership(%)

Source: Compiled by authors based on CMIE ProwessIQ data.

Methods

To examine the relationship between the life cycle stages and firm characteristics, we employ following econometric model for all regressions estimated in this study:

$$LC_{kit} = \alpha_i + \beta_1 Age_{it} + \beta_2 Size_{it} + \beta_3 ROA_{it} + \beta_4 GrAsset_{it} + \beta_5 Div_{it} + \beta_6 Lev_{it} + \beta_7 Beta_{it} + \beta_8 Ownership_{it} + \varepsilon_{it} \quad (1)$$

Where the dependent variable LC_{kit} denotes the kth life cycle stage for firm i in year t. k represents five-life cycle stages coded as 1-Birth, 2-Growth, 3-Mature, 4-Shake-out and 5-Decline using Dickinson (2011) approach. The

explanatory variables include firm's age, size, profitability, growth opportunities, dividend payment, leverage, systematic risk and promoter's ownership (see Table 2 for definition) whereas ε_{it} denote disturbance term.

Since, our dependent variable is categorical with five outcomes and violates the underlying assumptions of ordinary least squares (OLS) regression, the multinomial logit and probit models are appropriate. These regression approaches estimate parameters using the maximum likelihood method (MLM) (Agresti, 2018). Thus, we employ two alternative approaches to analyse regression model: multinomial logit regression and multinomial probit regression.

Logistic Regression

Logistic (or Logit) regression is the natural complement of ordinary linear regression whenever the response is categorical variable. When such discrete variables occur among the explanatory variables, they are dealt with by the introduction of one or several (0, 1) dummy variables, but when the response variable belongs to this type, the regression model breaks down (El-Habil, 2012; Agresti, 2018). For a response variable Y with two measurement levels (dichotomous) and explanatory variable X, let: $\pi(x) = p(Y = 1|X = x) = 1 - p(Y = 0|X = x)$, the logistic regression model has linear form for logit of this probability:

$$logit[\pi(x)] = log\left(\frac{\pi(x)}{1-\pi(x)}\right) = \alpha + \beta x, \text{ where the odds} = \left(\frac{\pi(x)}{1-\pi(x)}\right)$$

The odds = $\exp(\alpha + \beta x)$, and the logarithm of the odds is called logit, thus:

$$logit[\pi(x)] = log\left(\frac{\pi(x)}{1-\pi(x)}\right) = \log\left[\exp\left(\alpha + \beta x\right)\right] = \alpha + \beta x,$$

The logit has linear approximation relationship, and logit = logarithm of the odds. The parameter β is determined by the rate of increase or decrease of the S-shaped curve of π (x). The sign of β indicates whether curve ascends (β > 0) or descends (β < 0), and the rate of change increases as |β| increases.

Multinomial Logistic Regression

The logistic regression can be extending to models with multiple explanatory variables. Let k denotes number of predictors for a binary response Y by $X_1, X_2, \ldots . X_k$, the model for log odds is: $logit[P(Y = 1)] = \alpha + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_k x_k$

Alternatively,

$$\pi(x) = \left(\frac{\exp\left(\alpha + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k\right)}{1 + \exp\left(\alpha + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k\right)}\right)$$

The parameter β_i refers to the effect of x_i on the log odds that Y =1, controlling other x_i. Any category can be taken as the base level, so we will take category k as the base level. Let π_j denote the multinomial probability of an observation falling in the j^{th} category, to find the relationship between this probability and the p explanatory variables, $X_1, X_2, \ldots . X_k$, the multinomial logistic regression model then is:

$$log\left[\frac{\pi_j(x_i)}{\pi_k(x_i)}\right] = \alpha_{0i} + \beta_{1j}x_{1i} + \beta_{2j}x_{2i} + \cdots + \beta_{pj}x_{pi}$$

Where j = 1, 2,……,(k-1) and i = 1, 2,……,n. Since all the π's add to unity, this reduces to

$$log\left(\pi_j(x_i)\right) = \left(\frac{\exp\left(\alpha_{0i} + \beta_{1j}x_{1i} + \beta_{2j}x_{2i} + \cdots + \beta_{pj}x_{pi}\right)}{1 + \sum_{j=1}^{k=1}\exp\left(\alpha_{0i} + \beta_{1j}x_{1i} + \beta_{2j}x_{2i} + \cdots + \beta_{pj}x_{pi}\right)}\right)$$

For j = 1, 2, … , (k-1), the model parameters are estimated by the method of maximum likelihood (MLM).

EMPIRICAL FINDINGS

Frequency Distribution

Mature firms are characterised by stability, while the decline stage is transitory. Given these characteristics, we expect the highest (lowest) frequency of observations in the mature (decline) stage. Table 3 confirms this prediction with 40 (11)% of firm-observations classified as mature (decline) stages.

Table 3: Frequency Distribution 2011-15 (by Life Cycle)

Stage	Firm-Year Obs.	Percent	Cumulative
Birth	2031	15.88	15.88
Growth	2683	20.98	36.87
Mature	5120	40.04	76.91
Shakeout	1525	11.93	88.83
Decline	1428	11.17	100.00
Total	12787	100.00	

Source: Computed by authors based on CMIE ProwessIQ data.

Descriptive Analysis

Table 4 shows the descriptive statistics for various variables used in the study. In accordance with economic theory, a company's profitability reaches its zenith in the maturity stage and then declines into the negative zone in the later stages. Table 4 demonstrates the same pattern, where return on asset (ROA) is 4.40% at maturity and declines in later stages (0.58% for shakeout and -2.71% for decline). In the

birth and growth phases, firms are anticipated to use more leverage (Myers, 1984). The leverage ratio is 28% and 23% in birth and growth stages respectively. While dividends are more likely to be paid by mature firms due to decreased investment opportunities (DeAngelo et al., 2006). More than 55% of mature firms are paying dividends in the sample. Asset beta is lowest for mature firms (0.9). Size and age follow a non-linear pattern consistent with the existing literature on the life cycle (Dickinson, 2011; Anthony & Ramesh, 1992).

Table 4: Descriptive Statistics of Variables

Variable	Total	Birth	Growth	Mature	Shakeout	Decline
Age	29.72	25.81	28.25	31.56	31.98	29.02
	(100)	(16)	(21)	(40)	(12)	(11)
Size	7.36	7.12	7.78	7.59	7.14	6.35
	(100)	(16)	(21)	(40)	(12)	(11)
Growth in Assets(%)	14	31	25	8	3	8
	(100)	(15)	(21)	(42)	(12)	(10)
ROA(%)	2.42	0.25	4.02	4.40	0.58	-2.71
	(100)	(16)	(21)	(40)	(12)	(11)
Dividend Payment	(46.1)	(32.7)	(54.0)	(55.3)	(38.9)	(24.9)
Leverage(%)	23	28	23	20	23	23
	(100)	(16)	(21)	(40)	(12)	(11)
Beta[#]	0.92	0.94	0.96	0.9	0.92	0.89
	(100)	(14)	(21)	(43)	(12)	(10)
Ownership(%)	48.23	43.91	48.07	51.00	48.85	44.08
	(100)	(16)	(21)	(40)	(12)	(11)

#All values are mean (*except median for Beta*) Frequencies are given in parentheses (percentage).

Source: Compiled by authors based on CMIE ProwessIQ data.

Regression Results

Table 5 demonstrates the regression results for Equation 1. Given the categorical nature of the dependent variable, LCk, we employ multinomial logistic and probit models. The first four columns of the table display the results of multinomial logistic regression and columns (5) through (8) display the results of multinomial probit regression. The multinomial logit model and multinomial probit model yield comparable regression results for the majority of stages. However, we choose akaike information criterion (AIC) as goodness-of-fit measure because AIC penalises a model for having many parameters more, therefore smaller AIC is better (Agresti, 2018). Moreover, we are selecting the results of the multinomial logit model, that is, columns (1) through (4), for testing hypotheses due to the model's superior statistical properties indicated by lower AIC and BIC values. This model exhibit pseudo R-squared value of 9.21% and a likelihood ratio (chi-squared) statistic of 2490.7 with p-value of 0.01.

In multinomial logit regression, the slope coefficients are relative to the base category. A coefficient can be interpreted as the effect of a unit of change in the x variable on the logit of category k, relative to the base category, is expected to change by its respective coefficient estimate given the other variables in the model are held constant. In Table 5, mature stage is used as a base category for estimating various coefficients.

Table 5: Regression Results **(Reference : Mature stage)**

$$LC_{kit} = \alpha_i + \beta_1 Age_{it} + \beta_2 Size_{it} + \beta_3 ROA_{it} + \beta_4 GrAssets_{it} + \beta_5 Div_{it} + \beta_6 Lev_{it} + \beta_7 Beta_{it} + \beta_8 Ownership_{it} + \varepsilon_{it}$$

Dep Var: LC_k	Pooled Multinomial Logit				Pooled Multinomial Probit			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Birth	Growth	Shakeout	Decline	Birth	Growth	Shakeout	Decline
Intercept	-0.742***	-1.270***	-0.664***	0.716***	-0.539***	-0.853***	-0.447***	0.338*
	(0.194)	(0.169)	(0.188)	(0.207)	(0.132)	(0.122)	(0.129)	(0.137)
Age	-0.010***	-0.008***	0.005**	0.004	-0.006***	-0.006***	0.003*	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)

Dep Var: LC_k	Pooled Multinomial Logit				Pooled Multinomial Probit			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Birth	Growth	Shakeout	Decline	Birth	Growth	Shakeout	Decline
Size	-0.065**	0.047*	-0.037	-0.255***	-0.042*	0.031*	-0.030	-0.156***
	(0.025)	(0.020)	(0.024)	(0.030)	(0.017)	(0.015)	(0.017)	(0.019)
GrAsset	4.367***	3.750***	-0.928***	2.062***	2.612***	2.246***	-0.089	1.181***
	(0.174)	(0.164)	(0.242)	(0.228)	(0.103)	(0.100)	(0.133)	(0.124)
ROA	-0.090***	-0.033***	-0.052***	-0.107***	-0.059***	-0.020***	-0.038***	-0.071***
	(0.006)	(0.005)	(0.006)	(0.006)	(0.004)	(0.004)	(0.004)	(0.004)
Dividend	-0.187*	0.125	-0.222**	-0.241*	-0.132*	0.074	-0.174**	-0.159*
(1 = Paid)	(0.086)	(0.073)	(0.085)	(0.099)	(0.059)	(0.054)	(0.059)	(0.064)
Leverage	0.917***	0.877***	-0.120	-0.535**	0.650***	0.611***	-0.054	-0.276*
	(0.166)	(0.155)	(0.170)	(0.191)	(0.113)	(0.111)	(0.115)	(0.123)
Beta	0.215*	0.106	0.040	0.310**	0.147*	0.088	0.048	0.204**
	(0.101)	(0.085)	(0.098)	(0.113)	(0.069)	(0.063)	(0.067)	(0.073)
Ownership	-0.008***	-0.007***	-0.004	-0.010***	-0.006***	-0.006***	-0.003*	-0.006***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)
No. of obs	9439				9439			
log likelihood	-12279.6				-12338.7			
Pseudo R2	9.21%							
Chi2	2490.7				2003.8			
AIC	24655.1				24773.5			
BIC	24998.5				25116.8			
p-value	0.0000				0.0000			

Std errors in parentheses and two-tailed tests: *** p<0.01, ** p<0.05, * p<0.1

Source: Computed by authors based on CMIE ProwessIQ data.

Accordingly, all coefficients for profitability ROA are significant and negative (-0.090, -0.033, -0.052 and -0.107) in all stages, hence show proofs for hypothesis 1. It indicates that decrease in the profitability results in higher likelihood of movement from mature to other stages. In other words, comparatively mature firms enjoy higher profitability than other firms.

For hypothesis 2, significant coefficients of growth opportunities are positive (4.367 and 3.750) and negative (-0.928) in early stages (birth and growth) and later stage (shakeout) respectively. The positive coefficients indicates that increase in the growth opportunities results in higher likelihood of movement from mature to early stages. In other words, birth and growth firms has more investment opportunities as compared to mature firms. While, the negative coefficients indicate that decrease in the growth opportunities results in higher likelihood of movement from mature to later stages. The coefficients of dividend payment (hypothesis 3) are significant and have negative values of -0.187, -0.222 and -0.241 for birth, shakeout and decline stages respectively. We can infer that reduction in dividend payment enhance the likelihood of movement from mature to other stages. In other words, comparatively mature firms pays higher dividends than other firms.

For hypothesis 4, significant coefficients of leverage are positive (0.917 and 0.877) and negative (-0.535) in early stages (birth and growth) and later stage (decline) respectively. The positive coefficients indicates that increase in the financial leverage results in higher likelihood of movement from mature to early stages. While, the negative coefficients indicate that decrease in the financial leverage results in higher likelihood of movement from mature to later stages. The coefficients for beta (hypothesis 5) found to be significant and positive for firms in birth stage and decline stage. It indicates that increase in the systematic risk results in higher likelihood of movement from mature to birth and decline stages. In addition, the coefficients of age reveal non-linear pattern as indicated by positive and negative values for early and later stages respectively.

Marginal Effects of Regressors

Table 6 shows the average marginal effects of explanatory variables in terms of probabilities. We can interpret a positive value of a coefficient in table as change in probability of moving to respective stage. These results provide additional proofs to support hypothesis mentioned in previous section. For hypothesis 1, the positive and significant value of ROA

coefficient for mature infer that an increase in profitability enhance likelihood to become a mature firm. Similarly, to confirm hypothesis 2, increase in asset growth is associated with likelihood to be a birth and/or growth firm, while the decrease is associated with higher likelihood to be a mature, shakeout or declining firm.

Table 6: Average Marginal Effects (Using Multinomial Logit Regression)

Variable	Birth	Growth	Mature	Shakeout	Decline
Age	-0.001***	-0.001***	0.001***	0.001***	0.000***
Size	-0.004*	0.014***	0.010***	-0.001	-0.019***
ROA	-0.006***	0.001	0.014***	-0.002***	-0.006***
Dividend (Paid=1)	-0.018**	0.034***	0.019	-0.020**	-0.015**
Assets Growth	0.318***	0.425***	-0.541***	-0.259***	0.057***
Leverage	0.076***	0.116***	-0.092***	-0.035**	-0.065***
Beta	0.014	0.004	-0.032**	-0.005	0.019***
Ownership	0.000	-0.001**	0.002***	0.000	0.000***
Pr(Y | Base)	**0.132**	**0.211**	**0.443**	**0.123**	**0.091**

*** p<0.01, ** p<0.05, * p<0.1
Source: Computed by authors based on CMIE ProwessIQ data.

Furthermore, dividend payment phenomenon is associated with higher likelihood for a mature firm defend hypothesis 3. An increment in firm's leverage is associated with likelihood to be an early stages firm. Whereas decline in leverage is associated with likelihood to be a mature and later stage firm support hypothesis 4. Since, mature firms are characterised by lower systematic risk. The marginal coefficients for beta are negative and positive for mature and decline stages. This confirms hypothesis 5 and infer that mature firms are considered to less risky while declining firms are perceive to be highly risky by the financial markets.

Forecasting of Life Cycle Stages

In order to check robustness of multinomial logit regression estimates, we conduct out-of-sample forecasting for the period 2016-20. Firstly, we calculate probabilities (predicted) by using following formulae:

For Stages other than Mature (m = 1, 2, 4, 5):

$$P(Y_i = m) = \frac{\exp(Z_{mi})}{1+\sum_{h=1}^{M}\exp(Z_{hi})}$$

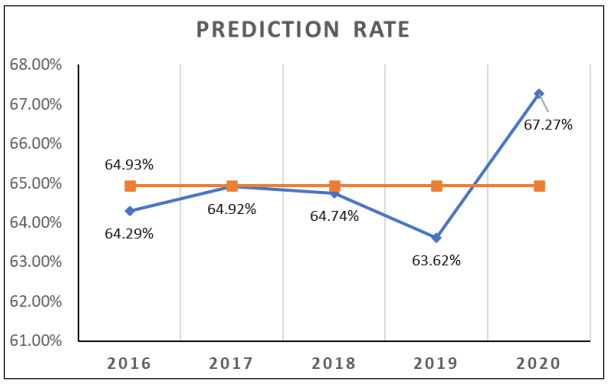
For Mature (Reference) Stage:

$$P(Y_i = 3) = \frac{1}{1+\sum_{h=1}^{M}\exp(Z_{hi})}$$

Secondly, we calculate the actual stage for this out-of-sample data using Dickinson (2011) classification. Third, we select the stage predicted by highest probability value calculated in step 1 above. Four, we assign "true" for correct prediction in case of stages are same in step 2 and step 3, otherwise "false". Lastly, we calculate the prediction rate (yearly) by using following formula:

$$Prediction\ Rate = \frac{No.of\ "True"\ values}{No.of\ "True"\ values + No.of\ "False"\ values}$$

Fig. 1 show the prediction rate vary from 64 to 67% over the period of 2016-2020. However, the average prediction rate turns out to be around 65%.



Source: Compiled by authors based on CMIE ProwessIQ data.

Fig. 1: Prediction Rate of Multinomial Logistic Model (out-of-sample)

Life Cycle Stages' Transition Analysis

Table 7 examines the transition of firm-observations from one life cycle stage to another in subsequent periods. Bold data represent the proportion of firms that remain in their initial stage beyond the initial portfolio formation year. For

instance, 29.38% of birth firms remain in birth stage one year after initial classification and this proportion monotonically decreases to 14.41% by year t+5.

Table 7: Life Cycle Stages' Transition Over 5 Years

Stage (t=0)	Stage in Future	t+1	t+2	t+3	t+4	t+5
Birth	Birth	29.38	20.52	19.22	16.86	14.41
	Growth	19.69	19.05	15.18	13.07	12.46
	Mature	29.43	34.55	35.73	36.65	39.40
	Shakeout	9.95	12.39	14.25	16.52	18.07
	Decline	11.55	13.48	15.63	16.91	15.65
Growth	Birth	14.94	11.93	10.93	9.06	8.42
	Growth	34.66	26.79	21.67	19.97	18.78
	Mature	36.95	44.79	47.79	47.63	48.69
	Shakeout	7.08	10.07	11.89	14.31	15.28
	Decline	6.38	6.42	7.71	9.02	8.83
Mature	Birth	9.52	8.82	7.49	7.83	7.99
	Growth	16.91	16.21	15.74	15.63	14.85
	Mature	56.30	54.93	55.63	54.82	53.33
	Shakeout	11.12	12.77	13.64	13.99	14.98
	Decline	6.15	7.27	7.49	7.73	8.85
Shakeout	Birth	9.39	9.24	8.50	9.27	8.96
	Growth	8.68	8.80	10.20	9.95	9.20
	Mature	35.71	38.25	37.99	39.56	40.76
	Shakeout	28.65	26.18	25.87	23.74	22.99
	Decline	17.57	17.53	17.44	17.48	18.08
Decline	Birth	12.90	13.88	13.92	13.04	14.79
	Growth	9.23	10.03	11.33	10.89	10.70
	Mature	22.46	24.08	23.64	26.63	27.63
	Shakeout	21.46	22.71	23.28	22.44	21.50
	Decline	33.94	29.31	27.83	27.00	25.39

(All figures are in percentage).

Source: Computed by authors based on CMIE ProwessIQ data.

Some insights relating to transition over life cycle worth looking for are as follows:

- Only 14.41% of birth firms are likely to stay in same stage after 5 years. A substantial proportion of them move to mature stage.
- A large proportion of growth firms (48.69%) will move to mature stage after 5 years.
- Growth and mature firms are less likely to move to decline stage after 5 years (8.83% and 8.85%, respectively)
- About one fourth of decline firms remain in decline after 5 years, but movement to mature (27.63%) or shakeout (21.50%) is also fairly common.
- Hence, we may infer that birth and decline firms tend to improve their position, while the growth and mature firms are relatively stable in subsequent periods.

SUMMARY

Corporate life cycle theory postulates that firms' development progression is characterised by distinct developmental stages, that is, birth, growth, mature, shakeout and decline. In this study, we discuss how the firm-level factors vary over various life cycle stages. Findings suggest that age follow a non-linear pattern over life cycle. Firms at the birth and decline stages experienced lower profitability, higher investment opportunities and less likelihood for dividends. The investor perceives them as riskier. Growth firms having higher investment opportunities, therefore raising more funds from debt along with paying dividends for reputation building. Furthermore, mature firms with larger size and shrinking investment opportunities, generating cash flows due to higher profitability. Thus, they pay dividend and consider being less risky. In addition, we analyse firms' transition over its life cycle stages. The firms'

transition behaviour shows that a large proportion of growth firms will move to mature stage after 5 years. In nutshell, birth and decline firms tend to improve their position, while the mature firms are stagnant in movement.

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