Refining the Firm Life Cycle Classification Method: A Firm Value Perspective

Hartini Jaafar and Hazianti Abdul Halim

***Abstract*—Despite being an important tool in understanding organisations, most of the life cycle literature is conceptually rather than empirically developed. While a comparison among the life cycle models suggests a generally consistent and predictable sequence of firm development, these models suffer from a wide variance in the number of stages and the measures used to delineate the various development stages. A refined model for firm life cycle stages is proposed in this study that should fulfill two important selection criteria. Its ability to: (1) support a large sample size and (2) capture the relative mix between growth opportunities and assets-in-place to reflect firm value. This study is important because the value in understanding the firm life cycle lies in the ability to identify where the firm is in its life cycle and to recognise critical organisational transitions as well as pitfalls the firm should seek to avoid. This, in turn, will enable managers to make strategic and more informed decisions.**

***Index Terms*—Firm life cycle, firm value, methodology.**

I. Introduction

Firm life cycle theory can be viewed as an extension of the product life cycle concept developed in marketing [1]. Similar to an individual product that moves through a sequence of distinct stages in its life cycle, a firm can be described in terms of life cycle stages that depend on the portfolios of strategies, structures, problems and processes that it faces during a particular period in its life. Despite the importance of the firm life cycle concept, two major problems arise in understanding and employing the concept. First, there appears to be no agreement on the operational definition that should be employed to distinguish the life cycle stages. This results in a wide variation in the models of firm life cycle or the number of firm life cycle stages. For example, there are five-stage [2], [3], four-stage [4], and three-stage models [5]. Second, there is also a lack of an established methodology for identifying each life cycle stage. The various methods proposed in existing life cycle studies, therefore, offer inconsistent approaches to the firm life cycle classification procedure.

With no consensus on the definition of the life cycle stages, it is hard to identify directly the dimensions to be utilised in describing and distinguishing between life cycle stages. Consequently, this will affect the number of stages proposed in the life cycle models. The varying number of stages also means studies have to deal with issues such as the model or number of stages that best reflect the evolution or development of a firm and whether all firms evolve through the same series of stages. Finally, most of the life cycle literature is conceptually rather than empirically developed. This suggests that further empirical evidence is needed in this area of research.

This study proposes a refined model for firm life cycle classification method that serves two specific needs; (1) the ability to serve large sample size and (2) to capture firm value perspective.

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II. Firm Life Cycle Theory and Classification Methodology

A. Firm Life Cycle and Firm Value

In their review of the life cycle literature, [6] argue that the lack of an explicit definition of life cycle stages leads to difficulties in applying the concept to specific cases. Based on the descriptions used in each life cycle stage, they make two prominent observations. First, the life cycle stage construct appears to be a multi-dimensional phenomenon and second, while there is considerable variability between life cycle models, all of them include some dimensions relating to organisational context and organisational structure. Examples of organisational context are firm size, growth rate, key strategies and focal tasks and challenges facing the firm, while examples of organisational structure include structural form, formalisation, centralisation and leadership and management style. These dimensions are interrelated and connected to each other and it is the differences in the pattern and magnitude of these dimensions that separates one life cycle stage from another. Reference [3] use the term configuration, which is a representation of common organisational structures, common scenarios of strategy making in context and common developmental or transitional sequences, to describe the association between these dimensions. Building on this characterisation of configuration, [6] define a life cycle stage as “a unique configuration of variables related to organisation context and structure”.

Numerous multi-stage life cycle models have been proposed using a diverse array of measures such as organisational context or situation, strategic orientation, decision-making responsibility, leadership style, critical developmental areas, problems and structural characteristics to describe each stage of development [2], [6]-[11]. Although the number of stages proposed for the life cycle models ranges broadly from three [8] to ten stages[10], all models reveal a fairly consistent pattern of firm development. Models with more stages appear to break down general stages to specific developmental periods, while models with fewer broader stages integrate two or more developmental periods to achieve more parsimonious stages [11].

The dearth of empirical studies in this area is mostly attributable to the difficulties in operationalising the life cycle concept, which is closely related to the lack of specificity in measures used to classify firms into life cycle stages [6], [12], [13]. In addition, other dimensions, for example, those concerning organisational structure are addressed only in general categorical terms [6]. Consequently, life cycle stage descriptions remain vague, resulting in the need for a certain degree of discretion to determine into which particular stage a firm currently falls. Hence, there are suggestions to move from the broad categorical measures of firm life cycle dimensions to higher level measures that are more amenable to empirical analysis and provide greater specificity for classification purposes [6], [12]. Several financial accounting studies that apply the life cycle concept [4], [5], [14] appear to have a strong foundation in developing these measures to distinguish firm life cycle stages. Nonetheless, similar to other methods, the methodology is subject to criticism. For example, because these studies have defined life cycle stages a priori using existing conceptualisations, it is argued that this could lead to potential over-simplification in classifying firms into a predetermined number of life cycle stages [13].

Further, while the conceptual literature generally postulates a fairly consistent, structured and not easily reversed sequence of stages, progressing from start-up to growth to maturity and finally to revival or decline [7], [10], [15], subsequent longitudinal empirical studies provide some evidence of a non-deterministic sequence of life cycle stages [3], [16]. Specifically, it is found that although a majority of the firms tend to demonstrate long-term evolutionary patterns similar to those proposed by the life cycle literature, there are still some firms that fail to exhibit the common life cycle progression. This suggests a large number of transitional paths available to organisations and that firm development does not necessarily conform to the predictable paths proposed in the life cycle theory. Overall, it is important to recognise that there are inherent limitations in the development and application of the life cycle concept before proposing the most suitable model to capture firm value.

Underpinning the concept of firm value are assets-in-place and growth opportunities and the proportion of these two components changes as a firm moves through its life cycle. For example, when a firm is first set up, its value consists almost exclusively of ideas the founders or owners have for profitable future investments, which are in the form of growth opportunities, rather than its assets-in-place [17]. However, as the firm matures, its growth opportunities are financed and converted into assets (and liabilities) and the fraction of value attributable to its assets-in-place increases relative to that of its growth opportunities. This suggests that a firm, at different stages of its life cycle, can be valued differently depending on the relative proportion of its assets-in-place and growth opportunities.

B. Extant Firm Life Cycle Classification Methods

In one of the earliest empirical studies, [2] classify firms into five different life cycle stages which are birth, growth, maturity, revival and decline, based on a series of histories for 36 firms that had been in existence for at least 20 years. This series of histories is developed based on information gathered from books, annual reports, a series of *Fortune* articles and various magazine articles written about the firms concerning their environment, organisational structures, decision-making styles and strategies. This information is later verified by top executives or former top executives of the firms via questionnaires sent to them.

The main advantage of this method is that the development of the series of histories for each firm provides in-depth insights into its evolution over the life cycle stages, and hence, more accurate classification. Nonetheless, this also creates a major concern in that it requires a tremendous amount of information about the firms before they can be assigned to different periods. This rigorous classification method consequently leads to a relatively small sample size. Moreover, [3]'s classification criteria in which identified periods are assigned into five life cycle phases are conducted on the basis of their own expert knowledge, which suggests that the results are hard to replicate.

Reference [4] utilise a multivariate cluster analysis to partition voluntarily divesting firms into four stages of firm life cycle: late expansion/early maturity, late maturity/early decline, regenerating maturity and decline. This classification procedure uses measures of firm financial characteristics which are liquidity, financial leverage, operating profitability, dividend payment policy, sales generating ability and market power. A multivariate cluster analysis is performed using 18 variables, which results in four main clusters. Therefore, the divesting firms in these four clusters are classified into four life cycle stages. Reference [14] argues that this is not a satisfactory procedure because after performing a cluster analysis, the life cycle stage must still be determined using univariate measures, which is done in the multivariate classification. Further, and probably one of the biggest concerns of this particular method, is that the number of firm life cycle stages will vary depending on the type of cluster analysis used as well as the resulting clusters. For example, while seven clusters were initially chosen based on initial analysis, only four clusters were used in the final analysis. The remaining three clusters had to be discarded because each contained two outlier cases [4]. However, should there be no extreme values or outliers in these three clusters, then, the use of this procedure will produce seven main clusters from which to classify the sample firms into life cycle stages. Moreover, the numbers of clusters vary depending on the type of cluster analysis used. For example, in the complete linkage and average linkage methods, the number of clusters is reduced from eight to seven, while the single and centroid hierarchical methods show a decrease from seven to six clusters.

Such inconsistencies will consequently affect both the number of life cycle stages as well as the number of observations included in each life cycle stage. For example, using seven variables, [13] utilise a relatively similar method of factor analysis followed by the hierarchical cluster analysis and end up with four clusters. These are labelled as cluster 1 (initial growth), cluster 2 (rapid growth), cluster 3 (maturity) and cluster 4 (revival). This suggests that this method does not allow for any presumption as to how many life cycle stages should be distinguished before the analysis begins. Finally, since the focus of [4] was on voluntary divestiture phenomenon, firms can only be classified in the later stages of their life cycles. As a result, there is no group which could unequivocally be viewed as consisting of pioneering or early expansion stage firms [4]. In addition, the life cycle classification method used results in relatively small samples, ranging from 31 to 38 observations in each life cycle stage.

Most subsequent accounting studies (for example, [14], [18]-[20]) that examine firm life cycle rely on the basic classification method introduced by [5]. Four classification variables are utilised in [5], which are; annual dividend as a percentage of income (DP), percentage of sales growth (SG), capital expenditure as a percentage of total value of the firm (CEV), and age of the firm (AGE). These variables are chosen for their frequency of reference in the economics, management and management accounting literature. Further, [5] argue that because the financial classification variables used are also directly related to firm risk, firms sorted on these variables could have a differential response to performance measures, even without life cycle considerations. Thus, a non-financial variable (AGE) is chosen to minimise the effect of possible correlation of risk with life cycle stages. The argument is that firms in early life cycle stages, on average, exhibit higher sales growth, have higher investment in plant and equipment and have lower dividend payout ratios given their opportunity set of positive net present value projects. Moreover, younger firms are more likely to have new products. Firms are classified into their respective life cycle stages using both univariate and multivariate ranking procedures. In the univariate procedure, firms are ranked on each of the four life cycle descriptors and grouped into various life cycle stages in each year. Then, each firm is given a score: growth=1, mature=2 and stagnant=3. In the multivariate ranking procedure, a composite score is computed by summing the individual variable scores. Based on this composite score, each firm-year observation is assigned to five life cycle groups: growth, growth/mature, mature, mature/stagnant and stagnant.

Similar to other previous methods, there are also several issues about this life cycle classification procedure. The first issue concerns the inclusion of age of the firm as one of the life cycle descriptors. Studies such as [3], [11] reveal non-deterministic life cycles of firms and argue that most firms do not pass inexorably from one stage of development to another in the traditional biological sense. For example, [3] highlight that firms that simply get older, but do not grow and diversify, are unlikely to move between stages. Although older firms tend to be more complex, elaborate and bureaucratic than their younger counterparts, they state that this is attributable largely to growth and strategy than maturity. Second, classifying firms into life cycle stages by ranking them among all the firms in each year can result in misclassification and compromise the power of the tests. This is because every firm is different and has a unique path of development [21]. For example, while a 10 percent sales growth may be fairly high for a firm in a stable industry, such as food and beverage, it may be considered low for a firm in the pharmaceuticals and biotechnology industry.

Nonetheless, the main advantage of this method is that it incorporates some interactions among different variables in determining life cycle stages. While a univariate classification that uses only one proxy has the potential to result in a misclassification [14], [22], a multivariate classification can provide more accurate results. This is because the joint presence of, for example, high sales growth and high capital expenditure, is likely to preclude misclassification of firms with cash flow problems that are not growth firms. Other studies that applied the method introduced by [5] did so with some modifications. For example, sample firms in [14] are also assigned into growth, mature and decline stages. However, the method of classification into three life cycle stages depends on the quintile of combined scores. More recently, [23], [24] consider the potential effect of industry by ranking firms relative to other firms in their industry and using only industry-adjusted sales growth rate, respectively.

III. Refining Firm Life Cycle Classification Method

A refined model for firm life cycle classification is proposed in this study that should fulfill two important selection criteria. Its ability to: (1) support a large sample size and (2) capture the relative mix between growth opportunities and assets-in-place to reflect firm value. These two criteria are needed to broaden the use of the model in analysis of financial reporting practices of firms. The large sample size requirement suggests that the use of the methodology offered either by [2] or [4] may not be a satisfactory choice. Hence, multiple financial-based life cycle proxies are utilised in the life cycle classification procedure which is based on [5]. Some modifications involving the selection of financial proxies and the use of industry quintiles to control for industry effect are introduced in the procedure to take into account the requirements and scope of this study.

Several proxies have been used in the accounting and finance literature to capture [17]'s characterisation of growth opportunities or investment opportunity set. The main reason is that empirical specification of these growth opportunities is problematic because they are largely unobservable and hence, no consensus has emerged concerning an appropriate proxy variable [22], [25]. Nonetheless, a review of previous literature suggests that they can be classified into three categories which are price-based proxies, investment-based proxies and variance measures [25]. Therefore, using multiple life cycle proxies, the classification procedure is as follows.

Step 1: Select the Proxy Variables for Firm Life Cycle Classification

Based on previous studies (for example, [25]-[26]), three proxy variables are selected to be used for the firm life cycle stage classification: market-to-book value of assets (MBA) ratio, capital expenditures to property, plant and equipment (CE) ratio and percentage of sales growth (SG). Besides being the most commonly used proxies for firm life cycle, two of the variables also represent one of the economic characteristics of firms important to this study, which is the proportion of assets-in-place relative to growth opportunities in representing firm value. The chosen proxy variables also reflect organisational change and sales generating ability and, therefore, are expected to signal differences in firms' strategic emphases. Overall, these life cycle classification proxies conform to [6]'s observations of a firm life cycle stage construct being a multi-dimensional phenomenon.

The MBA ratio, which is a price-based proxy, represents the mix between a firm's assets-in-place and its growth opportunities and is perhaps the most commonly used proxy. The book value of assets represents assets-in-place, while the market value of assets represents the economic value of assets-in-place and present value of future growth opportunities [26], [27]. Therefore, a high MBA ratio indicates that a firm has more investment opportunities relative to its assets-in-place. However, one limitation in the use of the MBA ratio to proxy for growth opportunities is that the market value of assets requires an estimation of the market value of debt, which information is often not publicly available. Extant studies, therefore, rely on book value of debt as a proxy for market value of debt [25], [26], [28]. Despite this particular limitation, the validity of the MBA ratio as a proxy for growth opportunities is supported empirically [25], [26]. These studies examine the performance of several commonly used proxy variables for a firm's investment opportunity set on the basis of their associations with realised growth and real option measures (value of reserves and resources), respectively.

Two main reasons can be put forward for the selection of another proxy variable for life cycle classification. First, the inclusion of another variable can potentially reduce or minimise potential misclassification of firms into their respective growth opportunities characteristics compared to if only one measure for growth opportunities is used. For example, while most studies use the proxies individually and evaluate the sensitivity of the results to the choice of a particular proxy variable, [22], [29] use a composite measure of growth opportunities. The underlying argument is that since the investment opportunity set is inherently unobservable it is likely to be imperfectly measured by any single empirical proxy. Therefore, this approach is intended to reduce the measurement and classification error inherent in selecting a single variable to proxy for investment opportunities. Second, the use of a market measure as the primary proxy for firms' growth opportunities can potentially result in spurious correlations with other variables in the value relevance tests, Third, [22] argue that while market-to-book ratios capture in spirit the [17] characterisation of growth opportunities, a disadvantage of these measures is that they rely on stock price and the inverse relation between financial leverage and stock price makes them sensitive to the capital structure of the firm. As a result, an alternative measure of firms' growth opportunities that utilises pure accounting numbers can be used.

The main motivation for the use of the CE ratio is that capital expenditures are largely discretionary and lead to the acquisition of new investment opportunities. Firms that invest more acquire more investment opportunities relative to their existing assets-in-place than do firms that invest less. However, one disadvantage of this measure is that, similar to R&D costs or other discretionary expenditures as a matter of fact, capital expenditures may or may not lead to the acquisition of investment opportunities. Thus, it is not clear whether the relationship between expenditures and the value of the acquired investment options is linear [26]. Nonetheless, [26] find this purely accounting-based proxy to be positively related to the value of investment opportunities although it appears to be performing less well than other price-based proxies such as the MBA, the MBE and the EP ratios. Additional analysis using a broader sample size, however, does not suggest lesser performance of the CE ratio compares to other proxies. Meanwhile, [25] find capital investment activity as measured by capital expenditures to assets to be positively correlated with realised growth, implying the validity of this particular variable as a proxy for growth opportunities. In addition, the CE ratio is also one of the most commonly used life cycle proxies for life cycle stages classification. This proxy has been used mainly by [5] and subsequent life cycle studies such as [14] to proxy for the relative value of assets-in-place compared to growth opportunities.

The justification for the inclusion of SG as one of the life cycle proxies is fairly straightforward. That is, firms in the early stage of their life cycle, namely growth firms, usually have higher sales growth than firms that are in the later part of their life cycle stages. Mature firms, on the other hand, are characterised by mature product markets and considerable competition [4], [5] and, as a consequence, sales growth stagnates while market share remains unchanged or declines. Meanwhile, a firm's product dies away in the decline stage, causing sales to drop off significantly and losses to occur. However, most importantly, this particular proxy variable has been used in all prior life cycle studies (for example, [2], [4], [5]) despite the differences in the method used for life cycle classification.

Two main variables, which are Firm age (AGE) and Dividend payout ratio (DP) have been used in most prior studies in life cycle stage classification [5], [13]-[14], [19]. These variables, however, are not utilised in this study for several reasons. The argument against the use of AGE as a proxy variable for life cycle classification has been presented earlier. It highlights the non-sequential nature of the firm life cycle and the poor correlation between AGE and stage of firm development. Reference [30] maintains that if AGE is used as a life cycle proxy, an implicit and likely flawed assumption is that a firm moves sequentially through its life cycle. Firm life cycle, however, is cyclical and non-sequential in nature because a firm's performance is a portfolio of many products, each with a distinct product life cycle stage.

Based on their review of the characteristics of life cycle stages, [6] are able to synthesise that as firms evolve through various life cycle stages, they are theorised to increase in age and size. Nonetheless, while the parallel movement between firm age and life cycle stages can be observed from the start-up stage until maturity stage, the association no longer holds in the decline stage. In other words, firms can enter the decline stage at any age. Moreover, a firm's primary objective of profit maximisation, which is achieved through continual product and market innovation and expansion, as well as organisational structural changes, implies that firm age is non-linearly related to its life cycle stage [30]. This illustrates that there is an obvious disconnect between firm age and firm life cycle stages.

Similar to AGE, DP is also among the most commonly used life cycle proxy variables in prior life cycle studies, in which the argument for the use of this variable centres upon firms' levels of liquidity. Specifically, low dividend payout ratios are usually associated with firms in the early life cycle stages mainly because they require cash to meet their operating needs and fund huge capital expenditures. Mature firms are less likely to incur large amounts of capital expenditure since these firms typically have excess capacity, thus, any further investment in capacity is likely to result in reduced profitability [23]. Thus, they are more likely to have higher dividend payout ratios. The relationship between dividend payout ratios and decline firms, on the other hand, is relatively ambiguous. This is because while some may pursue divestiture to improve liquidity and maintain dividend payments, some may choose to stop paying dividends in favour of other operating activities.

A multivariate analysis in [25] suggests that dividend payment policy may reveal some incremental information about the firm's growth prospects relative to book-to-market measures alone. In their examination of several other corporate policy variables, which are financing, dividend and compensation policies that may affect firms' realised growth in addition to growth opportunities, the dividend policy variables are found to be negatively correlated with realised growth as expected. The findings also indicate that other corporate policy variables examined seem to show little promise for constructing a multivariate growth proxy. This leads them to suggest that a classification model which includes both market-to-book ratios and dividend policy ratios may provide a better growth proxy than market-to-book ratios alone.

However, one major problem associated with the use of DP is that its scoring procedure depends on other life cycle variables. For example, a low DP could indicate either high growth opportunities (thus be given a score of 1 or 2) or cash flow problems (thus be given a score of 4 or 5). Due to the inconsistency and ambiguity on what score is to be assigned, the final decision depends on the composite score of other life cycle variables. This complicates the scoring process because the composite score has to be determined twice; first, to assign a score for DP and, second, to classify firms into their respective life cycle stages. Furthermore, studies such as [20], [31] find a high concentration of zero values for DP throughout their study period. While DP is not employed in [20] for this reason, it is still used in [31] causing an uneven distribution of observations across life cycle stages. Similarly, a high concentration of zero values for DP in its quintiles is found in this study during the data collection process. Recognising these limitations, DP is therefore, not considered as one of the life cycle proxies in the firm life classification procedure in this study.

Step 2: Calculate the Life Cycle Proxies for Each Sample Firm in Each Year

Based on prior studies and the information obtained from Aspect Huntley FinAnalysis, the following life cycle proxies are computed for each firm in each year between 2002 and 2009.

1) MBA = [(Number of ordinary shares outstanding) × (Closing share price) + Total debt – Cash] ÷ Book value of net assets
2) CE = Capital expenditures ÷ Book value of net property, plant and equipment
3) SG = (Current year net sales – Previous year net sales) ÷ Previous year net sales

Depending on the availability of the data, these proxies are calculated yearly at the end of the financial year of the firm. The computation for life cycle proxies and firm life cycle classification starts from 2002 and ends in 2009 in order to allow for additional tests to be performed in relation to the stability and consistency of the classification.

Step 3: Calculate the Industry Quintiles for the Life Cycle Proxies for Each Year Using All ASX Listed Firms with the Same Two-Digit Global Industry Classification Standard (GICS) as Target Firms

This particular step takes into account the limitation in [5] with regards to the life cycle variables scoring process. Reference [5] classify sample firms into life cycle stages by ranking them on each of the life cycle variables among all firms in the year irrespective of industry. By pooling over the entire cross-section of firms, the study implicitly assumes a homogeneous, economy-wide benchmark. However, it is known that industries, like individual firms, have unique operating structures that cause financial ratios to cluster by industry groupings. This indicates that ranking firms using this approach can potentially result in misclassification. For example, as mentioned before, a comparison of the percentage of sales growth between a firm operating in the consumer services industry and a firm in the information technology industry would be a pointless and perhaps misleading exercise due to the differences in the way these two industries generate sales. Additional analysis in [14] reveals some clustering of industries in their life cycle stage portfolios. He states that clustering by industry is likely because industries also have life cycles that affect the firm life cycle and failure to control for industry factors can lead to the power of the tests being compromised.

As a result, the use of industry quintiles in assigning the scores for each firm on individual life cycle proxies will better capture firms' economic characteristics and strategic emphases within the industry and, consequently, improve the life cycle classification procedure. The industry sectors according to the two-digit GICS code are; Energy, Materials, Industrials, Consumer Discretionary, Consumer Staples, Health Care, Information Technology, Telecommunication Services and Utilities.

Step 4: Assign Scores to the Life Cycle Proxies for Each Year According to the Industry Quintile Classification

Scores are assigned for individual life cycle proxies in each year to allow for temporal shifts in the life cycle stage of sample firms. The life cycle proxies are given a score as in Table I.

TABLE I: SCORES ASSIGNED TO FIRM LIFE CYCLE PROXIES

Industry Quintiles	MBA	CE	SG
0%-20%	5	5	5
21%-40%	4	4	4
41%-60%	3	3	3
61%-80%	2	2	2
81%-100%	1	1	1

where: 1 = Growth; 2 = Growth/Mature; 3 = Mature; 4 = Mature/Decline; 5 = Decline

Step 5: Calculate the Composite Scores for Each Firm in Each Firm Year and Assign Into Firm Life Cycle Stages

The composite scores for each firm are obtained by summing the individual scores of life cycle proxy variables in each year. Previous studies such as [20], [23] divide their sample firms into three life cycle groups; growth, mature and decline, by sorting the composite range into three approximately equal parts. The range of the composite score depends on the number of variables used for life cycle classification. For example, since four life cycle variables are used in [23], the range of the composite scores is between four and twenty. A firm-year is classified in the (1) growth stage if its composite score is between 16 and 20, (2) mature stage if its composite score is between nine and fifteen and (3) decline stage is its composite score is between four and eight. Therefore, with three variables, the composite score in this study ranges from three to fifteen.

Nevertheless, the approach should enable a homogeneous group for each life cycle stage to be obtained. This is important to ensure the predictive ability of the life cycle variable and not to compromise the power of subsequent tests. Taking these into consideration, this study will initially follow the method applied in [5], [19] in which sample firms are ranked on their composite scores and divided into five life cycle groups; growth, growth/mature, mature, mature/decline and decline. Table II illustrates life cycle classification based on composite scores:

TABLE II: FIRM LIFE CYCLE CLASSIFICATION BASED ON THE COMPOSITE SCORE

Firm Life Cycle Stage	Composite Score
Growth	3 – 6
Growth/Mature	7
Mature	8 – 11
Mature/Decline	12
Decline	13 – 15

Next, firms classified in the intermediate categories; growth/mature and mature/decline are deleted in order to increase the homogeneity among life cycle categories. Consequently, only three main life cycle groups will be retained for any further tests.

Step 6: Perform Additional Test for Life Cycle Classification Stability

An additional test is performed to examine the life cycle classification methodology used in this study. Existing theoretical and empirical studies have shown that life cycle stages are not necessarily connected to each other in a deterministic sequence and can move back and forth between stages [2], [16], [32]. Nonetheless, it is an accepted consensus that the development of a firm as an evolving entity is affected by the interactions of multiple external and internal forces [6], [30]. Therefore, while it is possible for these forces to have shocks such as mergers and acquisitions which consequently affect the life cycle stages of a firm, they should remain relatively stable and continuous at macro-, industry- or firm-level during most of the time [14], [24]. Further, it has been demonstrated that there is a common but by no means universal tendency for firms to move through the phases of the firm life cycle in a particular sequence [3]. That is, for example, the start-up stage will be followed by a growth phase which, in turn, will result in a period of maturity.

This suggests that, if the firm life cycle has any economic meaning, each life cycle should remain relatively stable for a certain period of time and exhibit a regular pattern rather than a random walk. Further, it has been found that each stage lasts for six years on average, with the shortest interval being 18 months and the longest 20 years [3]. Additionally, [3] observe that aside from the tendency to remain within the same stage, there is also a tendency to follow the life cycle stages.

Based on these arguments, a check is made on the stability of the firm-year life cycle classification to substantiate further the classification methodology. This method is also employed by [5], [14]. If a firm-year is classified in a particular life cycle stage, an examination is made in a year before and after the year of classification to determine in which life cycle stage the firm is classified in those years. Two assumptions are made in this test. First, the life cycle classification will be sticky. That is, most firms will remain in the same life cycle stage from one year (t) to the next (from t-1 to t and t to t+1). The second assumption concerns the progressive nature of the life cycle in which the classification will exhibit a forward rather than a backward movement in life cycle stages.

IV. ILLUSTRATION OF FIRM LIFE CYCLE CLASSIFICATION METHOD

A. Applying the Classification Method

The sample used in this study includes all ASX listed firms in the years 2002 to 2009. Firms in the Financials industry are excluded from the sample due to significant differences in the structure of financial statements of firms in this industry, which is also in keeping with previous studies [33]-[35]. Using this initial sample, the firm life cycle classification procedure is conducted to classify sample firms into the three stages of Growth, Mature and Decline. Data needed to conduct the analyses in this study are obtained from FinAnalysis Aspect Huntley and DatAnalysis Aspect Huntley databases maintained by the University of Tasmania Library.

The sample selection process is shown in Table III and can be described as follows; first, an initial sample of all firms listed on the ASX excluding firms in the Financials industry for the years 2002 to 2009 is selected. This initial sample, composed of a total of 8,880 firm-years, is used to perform the firm life cycle stages classification. Next, firms with missing data that are needed to perform the firm life cycle stages classification are dropped from the sample, leaving 7,998 firm-year observations. Finally, after the life cycle classification are performed, 1,284 firm-years are found to be in the intermediate categories of Growth/Mature and Mature/Decline. This leaves a total of 6,714 firm-year observations with useful firm life cycle stages.

TABLE III: SAMPLE SELECTION PROCESS

Description	Firm-Years
Initial number of firm-years	8,880
Less: Firm-years with missing data for firm life cycle classification	(882)
Less: Firm-years not meeting the Growth, Mature and Decline classification	(1,284)
Number of firm years with firm life cycle stages	6,714

Table IV details the distribution of this selected sample firm-years according in their respective life cycle and industry.

From the table, it can be seen that Mature firms constitute the largest portion of the life cycle with approximately 67%, while Decline firms are the lowest with only 14% from the total sample. Further analysis by industry reveals that Materials and Utilities have the highest and lowest amount of firms that can be categorised into any three life cycle stages with 36.1% and 1.7% respectively.

B. Life Cycle Stability Test

An additional test is conducted to examine the stability of the firm life cycle classification methodology employed in this study. There are two assumptions in this test. First, the life cycle classification is sticky, which means most firms will remain in the same life cycle stage from one year to the next (*t*-1 to *t* and *t* to *t*+1). Second, the life cycle classification exhibits a forward rather than a backward movement. The results of the test are presented in Tables V and VI show that a majority of the firms remain in the same life cycle stage in the year before and after the classification, providing evidence for stability in classification.

TABLE IV: DISTRIBUTION OF FIRM-YEAR OBSERVATIONS ACCORDING TO LIFE CYCLE AND INDUSTRY

Industry	Growth	Mature	Decline	Total
Materials	307	1806	313	2,426
Consumer Discretionary	200	488	133	821
Consumer Staples	161	100	24	285
Energy	130	516	123	769
Health Care	136	466	97	699
Industrial	210	507	140	857
Information Technology	128	390	81	599
Telecommunication Services	28	106	9	143
Utilities	18	84	13	115
Total	1318	4463	933	6,714

TABLE V: FIRM LIFE CYCLE TRANSITION MATRICES (*T* TO *T*+1)

	Firm Life Cycle (Year *t*+1)			
Firm Life Cycle (Year *t*)	Growth/ Growth to Mature	Mature	Mature to Decline/ Decline	NA
Growth/ Growth to Mature	**754 (50.2%)**	620 (41.3%)	60 (4.0%)	68 (4.5%)
Mature	562 (18.7%)	**1816 (60.4%)**	458 (15.2%)	170 (5.7%)
Mature to Decline/ Decline	93 (9.2%)	**440 (43.6%)**	403 (39.9%)	74 (7.3%)

TABLE VI: FIRM LIFE CYCLE TRANSITION MATRICES *T*-1 TO *T*

	Firm Life Cycle (Year *t*-1)			
Firm Life Cycle (Year *t*)	Growth/ Growth to Mature	Mature	Mature to Decline/ Decline	NA
Growth/ Growth to Mature	**760 (50.6%)**	561 (37.4%)	86 (5.7%)	95 (6.3%)
Mature	585 (19.5%)	**1650 (54.9%)**	437 (14.5%)	334 (11.1%)
Mature to Decline/ Decline	48 (4.8%)	**433 (42.9%)**	400 (39.6%)	129 (12.8%)

Further, the results indicate that except for Mature to Decline/Decline stage, the classification provides evidence of forward, rather than backward movement, in life cycle stages. Specifically, it is found that while firms in Growth/Growth to Mature stage have a greater tendency to move to Mature stage, firms in the Mature stage are likely to remain in the same stage rather than to progress to the next stage of Mature/Mature to Decline. Nonetheless, the difference between Mature and Mature/Mature to Decline stage is not substantial. Overall, this suggests the stability and consistency of the life cycle classification method used in this study.

V. CONCLUSIONS

This study introduces a refined method for firm life cycle classification that captures two important attributes; sample size adequacy and firm value dimension, to broaden the use of firm life cycle concept in academic literature. Due to some major limitations in the operationalisation of firm life cycle concept, studies in this area have been fairly limited. In this proposed method, emphasis is given to multiple financial proxies and the elimination of several problematic proxies (AGE and DP). Additionally, the life cycle stability test performed in this study provides evidence that the method proposed can be utilised. A major contribution of this paper is to suggest alternative direction in firm life cycle classification on the basis of firm value. However, further research that extends the methodology proposed in this study is essential.

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