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ARTIGO ORIGINAL

PERSISTÊNCIA DO CICLO DE VIDA DA EMPRESA VS. CONCENTRAÇÃO DE MERCADO: UMA NOVA PERSPECTIVA SOBRE DETERMINANTES DO CUSTO DE CAPITAL

ORIGINAL ARTICLE

FIRM LIFE CYCLE PERSISTENCE VS. MARKET CONCENTRATION: A NEW PERSPECTIVE ON CAPITAL COST DETERMINANTS

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RESUMO

Este estudo investiga a interação entre a persistência do ciclo de vida e o custo de capital, moderada pelos níveis de concentração do mercado. A persistência do ciclo de vida de uma empresa desempenha um papel fundamental nas transações de mercado, notadamente nas diferentes fases do ciclo de vida da empresa. Os novos participantes, que lutam pela sobrevivência, muitas vezes enfrentam custos externos de captação de recursos mais elevados em comparação com os seus concorrentes mais estabelecidos. Uma análise das empresas listadas na Bolsa de Valores de São Paulo (B3) revelou uma associação negativa entre a persistência do ciclo de vida e o custo implícito de capital. Além disso, os nossos resultados indicam que a redução da concentração do mercado, aliada a práticas sustentáveis de operação, investimento e financiamento, diminui o risco inerente e, por extensão, reduz o custo implícito de capital. Estas conclusões têm implicações significativas. Em primeiro lugar, sugerem que os investidores e as instituições financeiras considerem a persistência do ciclo de vida como um indicador da configuração estável dos recursos de uma empresa, reduzindo

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assim o prémio de risco. Além disso, os gestores podem aproveitar a persistência do ciclo de vida como uma ferramenta de sinalização estratégica para aumentar a eficiência da captação de recursos. Teoricamente, o nosso estudo contribui para a literatura ao introduzir um novo e complementar indicador para a teoria do ciclo de vida da empresa.

Palavras-chave: Persistência do ciclo de vida; Concentração de mercado; Custo implícito de capital.

ABSTRACT
This study investigates the interplay between life cycle persistence and cost of capital, moderated by market concentration levels. The persistence of a firm's life cycle plays a pivotal role in market transactions, notably across different stages of the firm's life cycle. New entrants, grappling with survival, often face higher external fundraising costs compared to their more established counterparts. An analysis of firms listed on the São Paulo Stock Exchange (B3) revealed a negative association between life cycle persistence and the implied cost of capital. Additionally, our results indicate that reduced market concentration, coupled with sustainable operating, investing, and financing practices, diminishes inherent risk and, by extension, lowers the implied cost of capital. These findings carry significant implications. Firstly, they suggest that investors and financial institutions consider life cycle persistence as an indicator of a firm's stable resource configuration, thereby reducing the risk premium. Moreover, managers might leverage life cycle persistence as a strategic signaling tool to enhance fundraising efficiency. Theoretically, our study contributes to the literature by introducing a novel and complementary proxy to the firm life cycle theory.

Keywords: Life Cycle Persistence; Market concentration; Implied Cost of Capital.

INTRODUCTION

This study contributes to the existing literature on the firm life cycle theory by proposing a complementary approach to the estimation of the firm life cycle. Following Dickinson's (2011) life cycle proxy[6], we introduce the concept of firm life cycle persistence and examine the association between life cycle persistence and implied cost of capital. Also, we investigate the moderating effect of market concentration on this relationship. To better understand the phenomenon, we extend our analysis to examine the systematic relationship between the implied cost of capital and the persistence in specific firm life cycle stages.

The primary objective of this study is to explore the relationship between market perceptions of risk and life cycle persistence, and to further assess how these perceptions shift across different stages of a firm's life cycle. Given the market's propensity to apply varying discount rates to firms based on their accounting fundamentals, industry-specific factors, and the overarching macroeconomic context of their country of operation (Fama & French, 1989; Gebhardt et al., 2001; Dittmar &

[6] Dickinson (2011) created a firm life cycle proxy using the signal combination (positive or negative) of the three cash flow statements (Operating, Investing and Financing) grouping firms in five stages: introduction, growth, maturity, shake-out, decline.

Lundblad, 2017), we propose that incorporating life cycle persistence into the analysis can significantly refine our understanding of firm valuation and inform investment decisions. This approach posits that life cycle persistence serves as a robust indicator for assessing firm valuation, thereby aiding in the strategic decision-making process for investments.

The literature underscores the imperative for firms to exhibit agility and adaptability within volatile environments, particularly emphasizing that growth should be the foremost objective during a firm's nascent stages (Mueller, 1972; Jensen, 1993; Arikan & Stulz, 2016). To achieve growth, firms often invest in unique assets to augment their distinctiveness and cultivate a sustainable competitive edge (Porter, 2008). However, leveraging these assets as collateral can complicate asset valuation due to the prevalence of informational asymmetry. Consequently, for financial institutions, discerning which firms within an industry should receive financing becomes a challenging endeavor, given the intricacies of asset specificity and firm heterogeneity.

The presence of asymmetric information significantly complicates the task for external observers to pinpoint which resources or their combinations underpin firm performance. While the outcomes of performance are observable, the underlying drivers often remain obscured. A critical insight is that, regardless of resource specificity, the determinants of performance can be inferred through the lens of firm life cycle persistence, with the implied cost of capital adjusting in response. This is primarily because firm life cycle persistence serves as a method of informational disclosure, aiming to alleviate the issue of information asymmetry by supplying investors and capital providers with valuable, relevant data.

Moreover, firms make operational decisions that ascend from market equilibrium, which is the result of strategic interactions between rivals, which in turn, affect the level of risk and, ultimately, the implied cost of capital. Thus, market competition has a systematic risk that impacts the requirements of capital suppliers (Bustamante & Donangelo, 2017). Therefore, based on the theoretical foundations of industrial organization (Bain, 1954), we explore the moderating effect of market concentration on firm life cycle persistence and the implied cost of capital.

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This research extends the existing body of knowledge on the firm life cycle (Dickinson, 2011; Hasan et al., 2015) by developing and empirically testing a theoretical model that elucidates the correlation between firm-level life cycle persistence and the implied cost of capital. To our knowledge, this relationship remains unexplored, primarily due to the complexity of the life cycle construct, which encompasses overlapping product life cycle stages at various junctures (Dickinson, 2011). Additionally, previous studies predominantly derive the implied cost of capital using ex-post returns, a method often criticized for its lack of accuracy (Fama & French, 1997; Hou et al., 2012; Li & Mohanram, 2014; Drobetz et al., 2018).

Aligned with Gebhardt et al. (2001), our methodological framework introduces a novel approach by employing a discounted residual income model to estimate expected returns. This strategy moves us beyond the traditional reliance on ex-post returns. Such an adjustment significantly improves the accuracy of our cost of capital estimations, as recent research supports (Li & Mohanram, 2014; Drobetz et al., 2018). Moreover, our study stands out because it probes the impact of firm life cycle theory on the implied cost of capital within emerging markets—a domain nearly untouched by existing studies. The prevalent research mainly focuses on developed economies, whose findings might not extend to emerging markets' contexts. Our work addresses this gap, spotlighting an economy that has undergone considerable market structural changes since the early 1990s due to economic liberalization. The elimination of trade barriers and the subsequent introduction of higher-quality inputs forced domestic industries to enhance their products and production methods. These changes have spurred productivity and competition increases, as Rossi Jr. & Ferreira (1999) and Reis et al. (2018) have documented.

Additionally, this study reveals real implications for emerging markets and transitional economies: our evidence shows that policies economically lower the cost of capital through market restructuring. Moreover, our findings enhance financial development by providing a more effective firm valuation mechanism, which streamlines and amplifies investment transactions within the economic system.

A body of literature explores the life cycle theory to elucidate the connection between a firm's developmental stages and various phenomena of interest. For

instance, researchers have examined the link between life cycle and cost of capital (Cheynel, 2013; Francis, Nanda, & Olsson, 2008; Erosa, & González, 2019) and between life cycle and corporate risk-taking (Habib & Hasan, 2017). However, setting our study apart from all previous research, we leverage firm life cycle persistence to capture value-relevant information from Dickinson's (2011) life cycle approach, applying it to address the phenomenon of interest.

Conceptually, a persistent firm maintains its position at the same life cycle stage across multiple time periods, signaling the consistency of its strategic resource allocation to investors. The literature evidences the life cycle's explanatory power regarding profitability and earnings persistence (Dickinson, 2011), dividend payout policies (Bulan et al., 2007; DeAngelo et al., 2006; Trihermanto & Nainggolan, 2018), and other performance measures (DeAngelo et al., 2010; Habib & Hasan, 2017). Given these insights, it's reasonable to infer that a firm's persistence status offers external parties valuable insights into its internal resource configuration and influences the cost of capital.

Our results bridge the gap between strategic management and accounting literature, enriching the extensive body of work on financial decisions amidst uncertainty and the financial ramifications of the firm life cycle. This research unveils the significance of the firm life cycle in shaping the implied cost of capital. It introduces the firm life cycle persistence approach as an analytical tool for managers to assess a firm's transitional phase. This assessment can guide the optimization of resource allocation to outperform rivals and maintain the firm at an advantageous life cycle stage. Furthermore, our life cycle persistence proxy allows for a reevaluation of existing studies employing life cycle theory across diverse contexts.

The rest of the paper is organized as follows. Section I delves into related studies and unpacks the life cycle theory via Dickinson's (2011) framework, followed by a detailed explanation of the life cycle persistence concept and its construction. This section also sets the stage for our hypotheses, connecting life cycle persistence with the implied cost of capital, and discusses market concentration's moderating effects. Section II outlines the data and methodology employed. Section III presents the empirical findings. Section IV interprets the evidence, and Section V wraps up the paper with conclusions and suggestions for future research directions.

THEORY AND HYPOTHESES

THE EMERGING-MARKET CONTEXT

Over the last few decades, emerging economies have taken significant strides in the global business arena, propelled by market restructuring, advancements in information flow, and communication technologies. These developments have facilitated financial and market integration, leading to structural shifts in local capital markets. According to theories of financial development, it falls upon policymakers to champion these structural changes to enhance economic transactions and nurture financial markets. These efforts aim to lower transaction costs and reduce information asymmetry, including the cost of capital.

Brazil stands out in this context due to unique factors that could substantially influence firm performance, distinguishing it from developed nations. These factors include rapid population growth, a rudimentary corporate governance framework, stark social inequalities, and widespread ethical lapses in management practices. Moreover, Brazil exhibits a convoluted financial services landscape with a capital market dwarfed by its banking sector, hindering capital suppliers' ability to back long-term investments. As a result, the government often becomes the main source of long-term capital.

Recognizing these elements is crucial as they provide a deeper understanding of how the context of financing constraints affects the implied cost of capital. Analyzing Brazil's case sheds light on potential solutions to address these challenges, thereby making external resources more accessible and affordable for investment decisions.

LIFE CYCLE THEORY AND THE FORMULATION OF LIFE CYCLE PERSISTENCE

Firm life cycle theory outlines the phases a firm undergoes from inception, through growth, to decline, mirroring the developmental stages of an organism from birth to decline. Strategies, resource configurations, and actions align with these developmental stages (Hasan et al., 2015). The core aim of life cycle theory is to categorize similar firms into stages, using these classifications to explore how

different incentives, restrictions, limitations, and strategies throughout a firm's life cycle correlate with its performance (Drake, 2013).

Recent research in accounting and finance highlights the increasing importance of firm life cycle theory in deciphering performance issues (Costa et al., 2014; Dickinson, 2011; Drake, 2013; Jenkins & Kane, 2004; Alhadi et al., 2018), showing that the firm life cycle significantly impacts management and business strategy (Hasan et al., 2015).Using life cycle theory, there is research related to governance (Chiang et al., 2011), incentives and competitive advantage (Liao, 2008), research and development and capital expenditures (Ahmed and Jinan, 2011), and firm payout policy (Bulan & Subramanian, 2009; Huang & Chiu, 2018).

Two reasons underpin the expanding use of life cycle theory in scholarly work. Firstly, firms encompass diverse products at various life cycle stages, competing across multiple industries (Dickinson, 2011), making a firm-level life cycle analysis both desirable and straightforward. Secondly, a firm's trajectory is shaped by internal factors, such as strategic choices and financial resources, as well as external influences like macroeconomic conditions (Dickinson, 2011). The firm life cycle effectively captures the outcomes of these interactions.

The literature offers various methods for identifying a firm's current life cycle stage. Anthony & Ramesh (1992) developed a model showcasing the applicability of firm life cycle theory in explaining market performance. To classify firms into life cycle stages, they utilized performance measures including dividend payout, sales growth, and company age, noting marked differences in accounting performance across life stages and the significant role of non-earnings data in elucidating a firm's stock returns.

However, using monotonic sorts of performance measures to classify firms along their life cycle stages can lead to misclassification due to their nonlinear association with the firm life cycle. Additionally, such univariate measures assume a uniform distribution that economic theory does not support (Dickinson, 2011).

Dickinson (2011) proposes a more nuanced proxy for the firm life cycle, focusing on patterns in three types of cash flows: operating, investing, and financing. She posits that utilizing the comprehensive financial data set embodied by these

cash flow patterns is more advantageous than relying on a singular measure to ascertain a firm's life cycle stage. Dickinson's approach not only offers a broader view of a firm's financial health but also demonstrates superior performance over other life cycle proxies in literature, especially in terms of predicting future profitability. Furthermore, she validates her life cycle proxy using earnings persistence and finds that earnings persistence is notably associated with the mature stage of a firm's life cycle.

To construct her proxy, Dickinson (2011) examines the three cash flow activities (operating, investing, and financing), each of which can be either positive or negative, yielding eight possible combinations. She then categorizes these combinations into five distinct stages, as follows::

Table 1 - Combination of Cash Flows Signals

Cash Flow	Intro	Growth	Mature	Shake-out			Decline	
From ***Operating*** Activities	-	+	+	-	+	+	-	-
From **Investing** Activities	-	-	-	-	+	+	+	+
From **Financing** Activities	+	+	-	-	+	-	+	-

Source: Dickinson (2011)

Each cash flow combination reflects a firm's strategic direction through resource allocation and operational capabilities. For example, firms in the introductory stage often face customer scarcity due to unfamiliarity in the market with potential revenues and costs, leading to negative operating cash flows (Dickinson, 2011). As firms mature, they achieve higher profit margins through increased efficiency, characterized by reduced investments and the distribution of cash flows via dividends and stock repurchases (Bulan & Subramanian, 2009; Faff et al., 2016). This shift results in positive operating cash flows during the growth and maturity stages.

Previous studies have identified distinct strategies and characteristics across different life cycle stages and highlighted cash flow as a suitable measure for determining a firm's current life cycle stage. The introductory stage presents the highest level of uncertainty for firms. Entrepreneurs must innovate in product development, marketing strategies, or organizational efficiency to advance rapidly to

the growth stage. This advancement requires "information, intuition, courage or luck to make correct investment decisions in the face of uncertainty" (Mueller, 1972, p. 200).

Consequently, the essence of expansion—and the reduction of uncertainty—hinges on the ability to process and communicate useful information. Hence, enhancing the financial accounting system is critical for accurately indicating a firm's life cycle stage.

The sophistication of the financial accounting system varies by life cycle stage. However, the need for a formal management accounting system becomes paramount during the growth stage, as firms begin to navigate a more diverse and complex environment (Moores & Yuen, 2001; Bedford & Malmi, 2015). This stage demands a structured approach to financial management to support strategic decision-making and facilitate further growth.

Additionally, advancing to the growth stage necessitates substantial changes in policy and operations, including adopting new production technologies, embarking on internationalization, and attracting investors for expansion financing (Liao, 2008; Wang & Singh, 2014). Therefore, a firm's financing position serves as a robust indicator of its current life cycle stage and identifies financial characteristics indicative of a possible transitional status.

For example, Bulan & Subramanian (2009) note that firms are in a high-growth phase when they assume a comprehensive financing position, accumulating capital without distributing dividends. During the maturity (low-growth) phase, firms begin paying dividends, with financing primarily through retained earnings. In the decline (negative-growth) phase, firms move towards liquidating dividends. This prior evidence underscores the firm life cycle's critical role as value-relevant information for financing decisions, especially in calculating the cost of capital (Armstrong et al., 2011).

In this study, we introduce a novel method to derive value-relevant information from Dickinson's life cycle approach (2011), termed 'firm life cycle persistence.' We classify a firm as 'persistent' if it remains within the same life cycle stage across multiple time periods. Our theory posits that this persistence serves as an internal

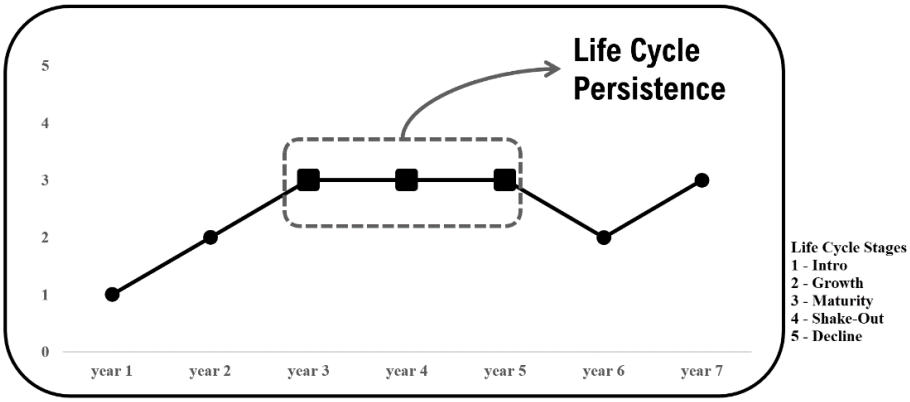
signal of the firm's operational and strategic consistency. Capital suppliers rely on this signal, even amidst strategic changes that do not alter the firm's fundamental stage, thereby reinforcing the notion of persistence.

Firms generate cash flows from product market activities and operational decisions that influence their cash flow risk level. Occasionally, these operational decisions may alter resource allocation without shifting the life cycle stage, sending a consistent risk level signal to capital suppliers.

For example, a young firm transitioning directly from the introduction to maturity stage, only to regress to introduction within a year, signifies operational inconsistencies. Conversely, a firm that progresses from introduction to maturity and maintains that stage demonstrates performance consistency and stability, a trait capital suppliers can identify through the persistence status. Consequently, capital suppliers may adjust the cost of capital based on this information.

Given the established correlation between life cycle stages and profitability (Dickinson, 2011) and earnings persistence (Drake, 2013), it stands to reason that capital suppliers will recognize a firm's persistence status and modify the implied cost of capital accordingly. Figure 1 provides a visual representation of how firms achieve persistence status:

Figure 1 – Life Cycle Persistence Example



A firm achieves persistence by staying within the same life cycle stage for at least three periods, based on two considerations. Firstly, the concept of persistence implies consistent stage alignment over time; spans shorter than three periods might

merely reflect transient challenges, coincidences, or even luck. Moreover, extending beyond three periods lacks a theoretical basis, making a minimum of three periods a logical threshold to negate the influence of chance and arbitrary decisions.

This approach draws on the foundational principles of signaling theory (Spence, 1973; Ross, 1973; Connelly et al., 2010), which focuses on mitigating information asymmetry between parties. Here, firms aim to broadcast positive internal qualities that are not directly observable (Spence, 2002). Given that capital suppliers make investment decisions under conditions of incomplete information, firms are motivated to provide more (in quantity) and better (in quality) information to either boost fundraising efforts or reduce capital costs (Hail, 2002).

Firm life cycle persistence emerges as a potent signal under this theoretical lens, primarily because it originates from Cash Flow Statements. The signal's cost is notably low, given the mandatory disclosure of Cash Flow Statements by public companies. Another vital feature is the signal's high visibility, enabling external parties to easily recognize it (Connelly et al., 2010).

However, with cash flow divided into operating, financing, and investing activities, selecting the most critical component for investment decisions remains subjective. Thus, the life cycle approach offers a streamlined and easily observable method to interpret cash flow indications. Our research explores whether firm life cycle persistence aligns closely with changes in the implied cost of capital.

Evidence indicates that the cost of equity varies across life cycle stages (Hasan et al., 2015), influencing a firm’s ability to secure market-based financing. Compared to firms in other stages, mature firms are more familiar to capital suppliers, enhancing the accuracy of information, reducing uncertainty, and, by extension, the cost of capital.

Furthermore, mature firms, with their size, market experience, and stable operational cash flows, attract detailed analysis and forecasts from analysts, reducing informational asymmetry and perceived risk. In contrast, firms in earlier stages lack visibility and analyst coverage, increasing information asymmetry and, subsequently, their cost of capital.

Given capital suppliers' investment in financial assets based on expected future cash flows, the prevailing financial asset price likely mirrors these anticipated cash flows, discounted by the cost of capital. Consequently, managers strive to foster sustainable financial performance, focusing on optimizing pricing strategies, signaling effectiveness, and information control to influence asset pricing positively.

In this context, firms endeavor to devise an optimal capital structure tailored to various environments, aiming for a state of persistence that mitigates inherent uncertainty. Capital suppliers then evaluate firms based on resource allocation strategies that engender expectations of future profitability.

Given the correlation between capital suppliers' required returns (considered here as the implied cost of capital - ICC) and the level of uncertainty surrounding a firm, as well as firms' strategic adjustments to secure a persistent status, we propose the following hypothesis:

Hypothesis 1. The life cycle persistence is negatively associated with the Implied Cost of Capital, *ceteris paribus*.

THE MODERATING EFFECT OF MARKET CONCENTRATION

Firms generate revenue through their engagements in the product market, taking risks with their cash flows based on operational decisions influenced by competitive interactions, which shape the market structure. For example, in competitive markets, firms adopting risk-taking and innovative strategies tend to outperform, whereas in concentrated markets, a conservative strategy correlates with better firm performance.

Additionally, a firm's performance is influenced by the current industry life cycle stage (Black, 1998). Proactive firms, or those anticipating future demand, excel in markets at the introduction or growth stages. In contrast, firms with aggressive orientations, responding to competitors' moves, fare better in mature industries characterized by limited opportunities and higher market concentration.

These observations align with the Structure/Conduct/Performance (S/C/P) paradigm (Bain, 1954), which links industry characteristics to firms' pricing behaviors

and performance. The S/C/P paradigm identifies market structure constraints that influence firm behavior and, subsequently, performance.

Consider the pharmaceutical industry, which requires substantial investments in Research and Development, significantly limiting competition. These investment demands create an entry barrier, defining the competitive landscape (structure). With few competitors and high entry barriers, pharmaceutical firms can maintain elevated prices (conduct), leading to exceptionally positive cash flows (performance). This analysis suggests that entry barriers, by affecting competitor numbers, alter pricing strategies and, thus, risk characteristics. Based on this understanding, we propose our second hypothesis:

Hypothesis 2. The reduction in market concentration reinforces the negative relation between life cycle persistence and the implied cost of capital.

RESEARCH DESIGN

SAMPLE SELECTION

We use the Comdinheiro® database for the economic and financial data of Brazilian public firms. The sample is drawn from the population of firms listed on the São Paulo Stock Exchange (B3), covered by analysts between 2008 and 2014. Also, we take data from I/B/E/S database from Thomson Reuters® for analysts' information to calculate the dependent variable implied cost of capital.

We dropped firms classified as "banks and financial services" and "holdings" due to differences in accounting standards. We also dropped firms from the industries "agricultural and fishing," "electronics," and "software and data" because they exhibit only one firm each. Then, we select an unbalanced panel data with an amount of 576 firm-years observation, from 15 industries.

ANALYTICAL STRATEGY AND VARIABLE DESCRIPTION

Using regression models (OLS and fixed effects), we first investigate the relationship between life cycle persistence and the implied cost of capital, and then the moderating effect of market concentration, considering that more competitive industries require faster decisions and considering that investors assess the firm by

means of future profit expectations. To investigate the hypotheses 1 and 2, we test the following regression model:

$$ICC_{it+1} = \beta_0 + \beta_1 LCP_{it} + \beta_2 HHI_{it} + \beta_3 (HHI_{it} * LCP_{it}) + \sum_i^j \beta_j CV_j + \alpha_i + u_{it} \quad (1)$$

Where ICC_{it+1} represents the Implied Cost of Capital level; LCP_{it} is the Life Cycle Persistence, measured by a dummy variable that assumes 1 if a firm life cycle stage persists for more than 2 periods, otherwise 0; HHI_{it} is the Herfindahl-Hirschman Index of the firm *I*; and $HHI_{it} * LCP_{it}$ captures the interaction of industry market concentration level of the firm *i* and the life cycle persistence; $\sum_i^j CV_j$ means the control variables Voluntary Disclosure, Size, Liquidity, and Market-to-Book ratio.

Our main variable of interest is LCP_{it}. Based on what was discussed in the previous section, we expect $\beta_1$to be negative for hypothesis 1 and, β_2 and $\beta_3$to be negative for hypothesis 2.

We reported fixed effects and pooled OLS models. The former is robust to control for time-invariant heterogeneity omitted variable bias (Chamberlain, 1978; Hausman and Taylor, 1981). The latter is effective in assessing the robustness of the results. The results of the Hausman tests indicate that the random effect model may be inconsistent. Additionally, the hypothesis of fixed effects was rejected, providing additional validation for the modeling approach employed.

VARIABLES MEASUREMENTS

DEPENDENT VARIABLE

Implied Cost of Capital

We follow Gebhardt et al. (2001) and Hail & Leuz (2006) to calculate the implied cost of capital - ICC, based on the Residual Income Model (Ohlson, 1995). The ICC is understood as the required rate of return to maintain a firm's optimal capital structure. In investment decisions, it is also the hurdle rate to screen the project. Then, it calculates the rate the market uses to reach the current stock price by solving the following equation:

$$P_t = bv_t + \sum_{\tau=1}^{n}\left[\frac{\dot{x}_{t+\tau} - r_e.bv_{t+\tau-1}}{(1+r)^{\tau}}\right] + \sum_{t=n+1}^{\tau}\left[\frac{\dot{x}_{t+\tau} - r_e.bv_{t+\tau-1}}{(1+r)^{\tau}}\right] + \left[\frac{\dot{x}_{t+\tau+1} - r_e.bv_{t+\tau}}{r_e(1+r)^{\tau}}\right] \quad (2)$$

Where P_t is the median of the stock price of the firm at data *t;* $\dot{x}_{t+\tau}$ is the expected future accounting earnings for the period (t+τ-1, t+τ), either explicitly forecasted, generated by a linear fading rate, or assumed to be constant; r_e represents the estimate of the ex-ante cost of capital calculated as the internal rate of return to solve the equation; and expected future accounting book value of equity at date t+τ, where $bv_{t+\tau} = bv_{t+\tau+1} + \dot{x}_{t+\tau} - \dot{d}_{t+\tau}$ and $\dot{d}_{t+\tau}$ correspond to the expected future net dividends for the period (t+τ-1, t+τ), derived from the dividend payout ratio k times the earnings forecast $\dot{x}_{t+\tau}$.

The firm value is equal to the accounting book value plus an infinite sum of residual incomes discounted to present value at a discount rate ***r*** (Hail & Leuz, 2006). This metric is based on some assumptions, including the Clean Surplus Relation (CSR) and, consequently, that no reference to the dividend is required.

INDEPENDENT VARIABLES

Firm Life Cycle Persistence

We assume that life cycle persistence is captured if a firm life cycle stage persists for more than three time-periods - such as seen for sustained superior performance in Vasconcelos & Brito (2004). So, the life cycle persistence will be measured by a dummy variable that assumes 1 if a firm life cycle stage persists for at least three periods, otherwise 0.

Market Concentration

We use the Herfindahl-Hirschman Index (HHI) as a measure of the intensity of market concentration through the degree of concentration across units. Following Besanko et al. (2004) we separate all into market concentration levels defined as ($x \leq 0.4$) for low concentration; ($0.4 < x < 0.8$) for the interquartile area, and ($x \geq 0.8$) for monopoly.

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Control Variables

We included some control variables to reduce omitted variable bias. According to the literature, we use the following variables:

- *SIZE*: measured by the natural logarithm of total assets. Firm size is a common control variable due to its association with firm performance. According to Agarwal and O'Hara (2007), bigger firms tend to appreciate less information asymmetry. Due to more reporting of voluntary information, considering the complexity of contracts and the requirement for greater transparency with investors, and also more analysts' coverage. Yet, Fama and French (1993) find that expected returns are negatively associated with size, which is also found in Botosan (1997).

Table 2 – Variables measures and sources

	Cod.	Variable	Measure	Source
Interest	ICC	Implied Cost of Capital	As described on page 8	Gebhardt et al. (2001); Verdi (2005); Hail and Leuz (2002, 2006)
	LC	Firm Life Cycle	Cash flow statement patterns combination described on page 4	Dickinson (2011)
	LCP	Life Cycle Persistence	Dummy equal to 1, if a stage persists for at least 3 periods.	
	HHI	Herfindahl-Hirschman Index	$HHI_j = \sum_{i=1}^{I} S_{ij}^2$	Besanko et al. (2006)
Control	VD	Voluntary Disclosure	$VD_i = \sum_j^k \frac{Discl_i}{k}$, where *Discl*$_i$ means the number of items reported by the firm each year, and K means the total of items comprised on the checklist.	Almeida and Rodrigues (2017)
	SIZE	Total Asset	*Ln*(Total Assets)	Fama and French (1993); Botosan (1997); Al-Hadi, Taylor and Hossain (2015)
	LIQ	Liquidity	Stock liquidity	Balakrishnan, Billings, Kelly, & Ljungqvist, 2014
	MTB	Market-to-Book	Market Value/Book Value	Martins, Paulo, and Albuquerque (2013)

- *MTB*: which means the Market-to-Book ratio, indicating the growth opportunity measured by the market. Firms with a lower MTB ratio are expected to

present more information asymmetry (Martins, Paulo, and Albuquerque, 2013). Then, it is plausible to expect the opposite; that is, a higher MTB ratio is positively associated with a higher level of voluntary disclosure.

- *Voluntary Disclosure*: we control for voluntary disclosure to isolate the effect of high/low analyst coverage: analysts are information intermediaries, and it is a proxy for quality informativeness because it is associated with higher firm valuation (Shi et al., 2014). We follow the voluntary disclosure index developed by Almeida and Rodrigues (2014). The index was created through 38 attributes collected from the accounting statements (annual reports, footnotes, and management reports). The calculation is based on the frequency scaled by the total of the attributes. Table 2 summarizes all the measures and variable sources.

RESULTS

Table 3 reports the descriptive statistics for the key variables included in the regression models segregated by life cycle stage. We observe that the ICC means are higher in initiating and declining firms, compared to others, but introduction presents the highest deviation coefficient (111%) due to the firm Vanguarda Agro (VAGR) in 2008, showing an implied cost of capital of 1.0792%. The management report of Vanguarda Agro revealed that this firm went public in 2006, after diversifying its object and activities, which may explain an uncertainty measured in that year.

Table 4 presents Pearson correlations using the implied cost of capital, life cycle persistence, market concentration, and control variables. Then, lower values of HHI reflect more intense market competition, with each firm having a small market share in its industry. As expected, the correlation between life cycle persistence and implied cost of capital is negative ($r = - 0.12$; $p<0.01$).

Table 3 – Descriptive statistics by life cycle stage

Stage	Statistic	ICC	HHI	Discl	Size	MTB	Liquid
Introduction	Num. Obs.	80	80	80	80	76	80
	Mean	0.127	0.027	0.202	15.098	1.607	0.413
	Std Dev	0.142	0.097	0.099	1.223	1.167	0.564
	Minimum	0.000	0.004	0.041	11.555	0.000	0.000
	Maximum	1.079	0.750	0.431	19.434	7.233	2.995
Growth	Num. Obs.	193	193	193	193	180	193
	Mean	0.094	0.128	0.291	15.772	2.711	0.770

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	Std Dev	0.065	0.252	0.122	1.557	3.141	1.702
	Minimum	0.000	0.000	0.102	12.264	0.000	0.000
	Maximum	0.580	0.967	0.616	20.439	21.179	15.173
Maturity	Num. Obs.	254	254	254	254	220	254
	Mean	0.101	0.071	0.302	15.384	3.864	0.565
	Std Dev	0.079	0.173	0.117	1.557	6.932	0.912
	Minimum	0.000	0.000	0.082	7.171	0.393	0.001
	Maximum	0.647	0.963	0.616	19.491	85.339	7.586
Shake-Out	Num. Obs.	31	31	31	31	31	31
	Mean	0.074	0.079	0.228	15.346	11.408	0.561
	Std Dev	0.067	0.176	0.097	2.088	48.808	0.702
	Minimum	0.000	0.000	0.061	12.376	0.428	0.003
	Maximum	0.223	0.829	0.452	20.275	250.658	2.380
Decline	Num. Obs.	16	16	16	16	16	16
	Mean	0.122	0.011	0.204	15.550	1.446	0.851
	Std Dev	0.123	0.012	0.085	0.908	0.904	0.673
	Minimum	0.000	0.000	0.102	12.687	0.302	0.065
	Maximum	0.375	0.048	0.349	16.549	3.527	2.456

Note: icc is the implied cost of capital; hhi is the Herfindahl-Hirshman index; size is the logarithm of assets; mtb represents the market-to-book; discl is the voluntary disclosure and liquid is the stock liquidity

The results suggest a significant positive association between SIZE and ICC (r = 0.10; *p*<0.05), proposing that, on average, bigger firms tend to appreciate higher levels of implied cost of capital. We also observe a significant negative association between market concentration level and size (r = -0.51; *p*<0.01). Consistent with Liao (2008), size is positively correlated with the level of voluntary disclosure (r = 0.58; *p*<0.01), showing that bigger firms tend to disclose more.

Table 5 reports the outcomes regressions to test testing both hypotheses 1 and 2. Panels A and B represent OLS and Fixed Effects, respectively. In panel B (fixed effects regression), we specify year and industry dummies.

Table 4 - Correlation Matrix

Variables	ICC	Lcpersist	HHI	DISCL	SIZE	MTB	LIQUI
ICC	1						
Lcpersist	-0.123**	1					
HHI	-0.0495	0.0645	1				
DISCL	0.0144	0.135**	-0.239***	1			
SIZE	0.0995*	-0.0391	-0.517***	0.585***	1		
MTB	-0.0682	0.0546	0.0479	-0.0335	-0.154***	1	
LIQUI	0.0757	-0.0993*	-0.623***	0.375***	0.598***	-0.0328	1

Source: Author

Note: The values in the matrix are Pearson correlation coefficients and ***, **, and * denote significance at 1%, 5% and 10% levels, respectively (two-tailed test).

The regression results show a negative relationship between life cycle persistence and implied cost of capital, confirming hypothesis 1. This evidence is strong across models, even controlling size, market-to-book, voluntary disclosure, and liquidity. On average, a persistence status diminishes the implied cost of capital (β_1 = -0.026; p<0.01) when controlling for size, market-to-book, voluntary disclosure, and liquidity. The results also reveal that capital supplies request less risk premium when firms disclosure more voluntarily (β_5 = -0.0155; p<0.01).

Also, hypothesis 2 is confirmed once there is a significant moderating effect of market concentration on the effect of firm life cycle persistence on the implied cost of capital. We observe a significant negative β_3 (lcpersist x hhi) indicates that *ceteris paribus*, in the presence of a concentration environment, a firm with sustainable operating, investing, and financing issues (reflected on the firm life cycle persistence), tends to convey reliance to the market, which responds by reducing the cost of capital.

Table 5 – Estimated coefficients with OLS (Panel A) and Fixed Effects (Panel B)

	Panel A				Panel B			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
lcpersist	-0.020**	-0.019**	-0.021**	-0.025**	-0.016**	-0.017**	-0.018**	-0.026***
	(-2.380)	(-2.338)	(-2.404)	(-2.572)	(-1.910)	(-1.969)	(-1.988)	(-2.626)
hhi		-0.017	-0.004	0.027		0.077**	0.085**	0.107**
		(-0.926)	(-0.128)	(0.816)		(2.448)	(2.385)	(2.525)
lcpersist x hhi			-0.024	-0.033			-0.113**	-0.169***
			(-0.637)	(-0.824)			(-2.399)	(-3.380)
size				0.006				-0.010*
				(1.504)				(-1.887)
mtb				-0.000				-0.000
				(-1.049)				(-0.779)
discl				-0.030				-0.155***
				(-0.731)				(-3.117)
liqui				0.002				0.011**
				(0.479)				(2.086)
Constant	0.116***	0.115***	0.116***	0.037	0.101***	0.120***	0.114***	0.353***
	(16.657)	(15.890)	(15.438)	(0.641)	(3.956)	(4.620)	(4.387)	(4.498)
Observations	574	574	574	518	574	574	574	518
R-squared	0.010	0.011	0.012	0.029	0.149	0.150	0.159	0.206
Industry FE	No	No	No	No	Yes	Yes	Yes	Yes
Year FE	No	No	No	No	Yes	Yes	Yes	Yes
Adj. R^2	0.81%	0.78%	0.68%	1.57%	11.70%	11.60%	12.40%	16.20%
F-Stat	5.665	3.261	2.307	2.175	4.604	4.425	4.520	4.699

Note: hhi is the Herfindahl-Hirshman index; lcpersist represents a persistent life cycle and is defined as the permanence of any firm life cycle stage at least three periods; size is the logarithm of assets; mtb describes the market-to-book; discl is the voluntary disclosure and liquid is the stock liquidity; t-statistic in parentheses; *** p<0.01, ** p<0.05, * p<0.1

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In Panel 6, we stressed the analysis and tested each life cycle stage separately (only reported maturity and growth; fixed effects estimation). Looking at the mature stage, we reported a significant negative main effect of life cycle persistence on the implied cost of capital. In panel A, the control variables increase the Adjusted R^2 from 11.9% to 14.7%, and all the 2, 3, and 4 estimators confirm the moderating effect of market concentration on the relationship between firm life cycle persistence and the implied cost of capital.

Additionally, in Panel B of Table 6, analyzing persistence status in growth firms, we observe a significant moderation effect on implied cost capital. The direct effect of persistence in growth firms is not significant, but moderation suggests that persistence_grow becomes positively associated with the implied cost of capital as the concentration increases.

Table 6 – Regression coefficients with persistence in maturity and growth stages only (Fixed Effects)

Variables	Persist_Maturity				Persist_Growth			
	1	2	3	4	1	2	3	4
persist_mat	-0.015*	-0.018**	-0.016**	-0.018*				
	(-1.716)	(-2.035)	(-2.236)	(-1.755)				
persist_growth					0.003	0.005	-0.004	-0.006
					(0.344)	(0.594)	(-0.386)	(-0.582)
hhi		-0.068**	-0.071**	-0.083**		-0.063**	-0.078**	-0.101**
		(-2.175)	(-2.268)	(-2.358)		(-2.251)	(-2.315)	(-2.448)
persist_mat x hhi			-0.103**	-0.123**				
			(-2.211)	(-2.444)				
persist_grow x hhi							0.109**	0.152***
							(2.301)	(3.058)
size				-0.008				-0.007
				(-1.626)				(-1.418)
mtb				-0.000				-0.000
				(-0.849)				(-0.990)
discl				-0.134***				-0.157***
				(-2.676)				(-3.157)
liquidity				0.011**				0.011**
				(2.096)				(2.093)
Constant	0.096***	0.121***	0.135***	0.348***	0.110***	0.199***	0.225***	0.308***
	(3.972)	(4.799)	(4.675)	(4.368)	(4.640)	(7.553)	(7.873)	(3.955)
Observations	574	574	574	518	574	574	574	518
R-squared	15.10%	15.40%	15.50%	19.10%	14.60%	14.80%	15.60%	19.90%
Adj. R^2	11.90%	12.00%	12.00%	14.70%	11.40%	11.40%	12.10%	15.40%
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F	4.668	4.549	4.396	4.293	4.510	4.347	4.421	4.496

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Note: hhi is the Herfindahl-Hirshman index; persist_mat represents the persistence in the mature stage; persist_growth represents the persistence in the growth stage; size is the logarithm of assets; mtb represents the market-to-book; discl is the voluntary disclosure and liquid is the stock liquidity; t-statistic in parentheses; *** p<0.01, ** p<0.05, * p<0.1

As expected, a greater voluntary disclosure may incentive an implied cost of capital reduction. In contrast, liquidity presents a significant positive relation with the cost of capital, denoting that greater liquidity conveys an idea of risk, which increases the return required to the investors.

DISCUSSION AND CONCEPTUAL CONTRIBUTION

In this study, we introduce a novel metric, termed "life cycle persistence," grounded in Dickinson's (2011) conceptualization of the firm life cycle. Our empirical analysis, focused on a cohort of Brazilian firms, investigates the relationship between this persistence metric and the implied cost of capital. Initial findings demonstrate a negative correlation, suggesting that investors and capital providers recognize and respond to indicators of life cycle persistence.

A detailed examination across different life cycle stages reveals that mature firms, identified by their persistence status, exhibit a notably stronger correlation with the implied cost of capital compared to firms in other stages. This indicates a higher level of recognition from investors and capital providers, who adjust the risk premium downwards for mature firms. This adjustment likely stems from the greater stability and reliability associated with firms that consistently maintain their life cycle stage, particularly the mature stage, compared to the more transitional nature of earlier stages.

Moreover, the study finds that market concentration amplifies the influence of firm life cycle persistence on the implied cost of capital. This suggests that in markets with fewer investment opportunities and higher concentration, capital providers might view persistence as a competitive advantage, enhancing their perception of firm stability and reducing the perceived risk.

This research contributes to the academic literature by providing a new lens through which to examine the financial implications of firm life cycle theory, particularly through the construct of life cycle persistence. Unlike Hasan et al. (2015), our findings reveal a significant negative association between life cycle persistence in

mature firms and the implied cost of capital, a relationship not observed in other life cycle stages. This underscores the potential importance of persistence status for mature firms, signaling stable and positive firm attributes to external stakeholders. In contrast, the transient characteristics of other life cycle stages may not offer similarly impactful signals.

These results open several avenues for future research. They underscore the need to further integrate the concept of firm life cycle persistence into the existing body of literature, encouraging a reevaluation of outcomes associated with life cycle theory. Additionally, by utilizing a Brazilian firm sample, this study contributes insights into the financial market's evolution in Brazil over the past three decades. It suggests that the effectiveness of signaling through persistence status may vary by market maturity, offering a valuable perspective for future investigations into firm life cycle theory.

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