Firm life cycle persistence, the implied cost of capital and market concentration

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This study examines the relationship between life cycle persistence and the cost of capital moderated by the level of market concentration. Market concentration has an important role in market transactions, especially in the different life cycle stages: in a struggle to survive, external fundraising can be more expensive to new entrants in comparison to stable firms. By looking São Paulo Stock Exchange firms (BOVESPA), we found a negative association between life cycle persistence and implied cost of capital. Further, our findings show that lowering market concentration, a sustainable situation in operating, investing, and financing issues lead to a reduction in the inherent risk and, consequently, reduce the implied cost of capital. The findings highlight important implications. First, in the decision-making process, investors and financial institutions taking into consideration the firm life cycle persistence as a signal of stable firm resource configuration lowering the premium risk. Also, managers can use firm life cycle persistence as signalization tool to fundraise more efficiently. Theoretically, we add to the literature by bringing a novel and complementary proxy to 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[1], we propose the concept of firm life cycle persistence and examine the association between life cycle persistence and implied cost of capital. In addition, 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.

Our primary purpose is to investigate how the environment's perception of risk is associated with life cycle persistence, and then examine how this perception varies across life cycle stages. Considering that the market tends to consistently adopt different discount rates to firms given their fundamentals, industry characteristics and macroeconomic level (Fama &

[1] 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.

French, 1989; Gebhardt et al., 2001; Dittmar & Lundblad, 2017), we argue that using firm life cycle persistence has the potential to improve the analysis of firm valuation and investment decision-making purposes.

The literature suggests that the ability to move and adapt in a chaotic environment must be reflected in the growth of the firm, since growth should be the primary focus of the firm during its first years of existence (Mueller, 1972; Jensen, 1993; Arikan & Stulz, 2016). To grow, firms tend to invest in specific assets to boost its inimitability and develop a sustainable competitive advantage (Porter, 2008). However, the use of these assets as collateral may affect the asset valuation due to informational asymmetry. Thus, from the perspective of a financial institution, it is a tough task to determine which firms will be financed in a given industry considering asset specificity, and consequently firm heterogeneity.

Therefore, due to asymmetric information and from an outsider perspective, it can be a problematic task to identify which resources or combination of resources drive firm performance, considering it is possible to see the effects of performance, but not its causes. The insight here is that independently of the specificity of the resource, its effects will be captured by firm life cycle persistence with the implied cost of capital vary accordingly. Mostly, because the firm life cycle persistence approach is an informational disclosure, which has the primary function of mitigating the information asymmetry problem by providing value-relevant information to investors and capital suppliers.

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 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.

We contribute to prior research on firm life cycle (Dickinson, 2011; Hasan et al., 2015), first by developing and testing a theoretical framework that examines the relationship between firm-level life cycle persistence and implied cost of capital. To the best of our knowledge, researchers have not yet tested this relationship, since the construct is a combination of many overlapping product life cycle stages in different moments (Dickinson, 2011). And the implied cost of capital is commonly calculated in previous studies using only *ex-post* returns, which is

invariably inaccurate (Fama & French, 1997; Hou et al., 2012; Li & Mohanram, 2014; Drobetz et al., 2018). Following Gebhardt et al. (2001), we estimate expected returns by adding a discounted residual income model in the equation, without relying on *ex-post* returns, which consistently improves estimation (Li & Mohanram, 2014; Drobetz et al., 2018).

Another significant contribution is that to our knowledge, near to zero studies have explored the effect of firm life cycle theory on implied cost of capital in emerging markets. Research reports evidence from developed countries, which may not apply to emergent markets. Thus, this research contributes to the literature by focusing on a transitional economy with substantial changes in market structure over the last decades since the start of the economic opening in early 1990: the end of trade barriers increased the access to better quality inputs forcing the national industry to improve its products and methods of production. These factors contributed to increases in productivity and competition (Rossi Jr. & Ferreira, 1999; Reis et al., 2018). Additionally, this study has real implications for emerging markets and transitional economies: our evidence demonstrates that the policies have a economic consequence of lowering the cost of capital through market restructuration. Also, our evidence contributes to financial development with a better mechanism of firm valuation, which facilitates and intensifies investment transactions in the economic system.

A body of literature has investigated life cycle theory to explain the relationship between the firms' stages of development and several phenomenon of interest. For instance, there is research on the relationship between life cycle and the cost of capital (Cheynel, 2013; Francis, Nanda, & Olsson, 2008, Erosa, & González, 2019) and life cycle and corporate risk-taking (Habib & Hasan, 2017). However, different from all previous studies, we propose the use of firm life cycle persistence to capture value-relevant information from Dickinson's (2011) life cycle approach and, used it to tackle the phenomenon of interest.

Conceptually, being a persistent firm, is consistently stay at the same life cycle stage for several time-periods signaling to investors the resource allocation uniformity of the strategy of the firm over time. Given that the literature provides evidence of explanatory power in the life cycle related to profitability and earnings persistence (Dickinson, 2011), dividend payout policies (Bulan et al., 2007; DeAngelo et al., 2006; Trihermanto & Nainggolan, 2018) and other performances measures (De Angelo et al., 2010; Habib & Hasan, 2017), it is a reasonable insight that the persistence status can provide information to outsiders about the internal resource configuration of the firm and shifts the cost of capital.

Our findings suggest advances in the approximation between strategic management and accounting literature. Our evidence adds to the broad stream of work that focuses on financial decision under uncertainty and on the financial implications of the firm life cycle. Overall, our research exposes the role that the firm life cycle plays in determining the implied cost of capital and how the firm life cycle persistence approach offers managers an analytic tool to evaluate firm's transitory state and may help optimize the resource configuration to surpass competitors and keep the firm on the desirable firm life cycle stage. Additionally, our persistence life cycle proxy enables a reexamination of the existing body of evidences using life cycle theory in different contexts.

The remainder of the paper is structured as follows. Section I reviews interrelated studies and explains the life cycle theory through Dickinson's (2011) life cycle approach, then we explain the concept of life cycle persistence and how to construct it. Also, this section reveals how we motivate the hypotheses linking life cycle persistence to the implied cost of capital. In addition, this section illustrates the moderating effect of market concentration. Section II describes the data and methods. Section III reports empirical evidence. In Section IV, we discuss the evidences, and on section V, we conclude and proposes future research.

THEORY AND HYPOTHESES

The emerging market context

In the last few decades, emerging economies became major players in the global business environment through market restructuration, improvements in the information flow, and communication technologies. As a result, emerging countries increase the financial and market integration, which induces a structural change in the local capital market.

According to financial development theories, policymakers need to promote the structural change to enforce mechanisms that strengthen economic transactions and help to develop financial markets which provide reductions in transaction costs and information asymmetry such as the cost of capital.

In this context, Brazil is an interesting scenario because it presents some factors that differ from developed countries that could have a significant impact on firms' performance. For instance, Brazil had rapid population growth, low level of corporate governance mechanisms, the high level of social inequalities, and a lack of ethics in management procedures. Also, Brazil presents a complex structure of financial services, and the capital market is small in comparison

with the banking system. For that reason, capital suppliers are still not able to finance long-term investment. In this context, the government becomes the main long-term capital provider.

The consideration of these aspects is crucial as they allow a better understanding of how the context of several financing constraints impacts the implied cost of capital. Accordingly, understanding the Brazilian case may help to shed light for alternatives to overcome these issues and to make external resources less costly for investment decisions.

Life Cycle Theory and the formulation of Life Cycle Persistence

Firm life cycle theory provides an explanation of how a firm is born, grows, and declines. Like an organism tends to progress through stages of development from birth to decline. Also, strategies, resource configuration, and actions correspond to their stages of development (Hasan et al., 2015). The life cycle theory primary purpose is to group similar firms in categories (stages) then use these categories to analyze how varying incentives, restrictions, limitations, and strategies over a firm's life cycle are associated to firm performance (Drake, 2013).

Recent studies in accounting and finance present a growing contribution of firm life cycle theory to understand performance issues (Costa, et al., 2014; Dickinson, 2011; Drake, 2013; Jenkins & Kane, 2004; Alhadi et al., 2018) demonstrating that the firm life cycle has significant influence in 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 possible explanations to the growing application of life cycle theory in the literature emerge: first, firms are accumulations of different products, with different life cycle stages competing in many industries (Dickinson, 2011) which makes a firm-level life cycle desirable and easy to comprehend. And second, a firm is influenced by internal factors (strategy choices and financial resources) and the external environment (macroeconomic factors) to reach its goals (Dickinson, 2011) and the result of this interactions can be captured by firm life cycle.

Existing literature proposes different ways to define the stage which the firm is in the life cycle. Anthony & Ramesh (1992) propose a model which demonstrates the utility of firm life cycle theory in the explanation of market performance. To group firms in life cycle stages,

they used monotonic sorts of performance measures such as dividend payout, sales growth, and age. They reported significant differences in accounting performance measures across life stages and the explanatory power of non-earnings data to explain the firm's stock returns.

However, monotonic sorts of performance measures are nonlinearly associated with firm life cycle and its use may result in misclassification. Additionally, this sort of univariate measure makes a distributional assumption of uniformity that is not supported by economic theory (Dickinson, 2011).

Dickinson (2011) develops a proxy for firm life cycle using the three types of cash flow patterns: operating, investing, and financing. She argues that, instead of using a single measure to determine firm life cycle, it is beneficial to use the cash flow pattern because it comprises the complete financial data set contained in operating, investing, and financing cash flows. She reports evidence that her proxy outperforms other life cycle proxies from the literature and has more explanatory power regarding future profitability. Also, she uses earnings persistence to validate the life cycle proxy and documents evidence that the mature stage is associated with earnings persistence.

To calculate it, Dickinson (2011) uses the three cash flow activities (operating, investing, and financing), and each one can take a positive or negative sign, resulting in 8 different combinations. Then, the combinations collapse into five 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 combination represents the firm strategy through resource allocations and operational capabilities. For instance, introductory firms suffer from insufficiency of customers due to lack of market experience about potential revenues and costs, resulting in negative operating cash flows (Dickinson, 2011). As firms get older, profit margins are maximized during increases in efficiency, when they invest less and pay out some of their cash flow in the form of dividends and stock repurchases (Bulan & Subramanian, 2009; Faff et al., 2016), which means that the operating cash flow is positive in growth and maturity stages.

Previous literature documented differences in the firm strategies and characteristics of each life cycle stages. Also, reports evidence of how the cash flow can be an appropriate measure to assess the current stage of the firm in its life cycle. For instance, uncertainty is the most inherent problem of firms in the introductory stage. Then, the entrepreneur needs to develop new products, marketing techniques, or a more efficient organizational structure to quickly move away from this stage and reach the growth stage. It involves "information, intuition, courage or luck to make correct investment decisions in the face of uncertainty" (Mueller, 1972, p. 200).

Therefore, it seems reasonable that the key to expansion (and the uncertainty reduction) relies on the ability to process and disclose useful information. Which is why improvement in the financial accounting system is essential in order to be a reliable indicator of the current life cycle stage of the firm.

The formality of the financial accounting system depends on the stage. However, the growth stage dominates the need for a formal management accounting system when compared to other stages mainly because it is the stage when the firms start dealing with a more diverse and complex environment (Moores & Yuen, 2001; Bedford & Malmi, 2015).

Additionally, reaching the growth stage represents a need for radical changes in terms of policy and operations, such as adopting new production technologies, internationalization process, and seeking investors to finance the expansion plans (Liao, 2008; Wang & Singh, 2014). Hence, the firm financing position is an excellent measure to assess the actual life cycle stage and which firm financial characteristics will provide a possible transitory status.

For instance, Bulan & Subramanian (2009) explain that firms are at a high-growth stage when they adopt a full financing position by accumulating capital and not paying any dividends. At the maturity (low-growth) stage, firms pay dividends, and financing will be restricted to retained earnings. Moreover, at the decline (negative-growth) stage, firms will be liquidate dividends. In sum, prior evidence suggests that the firm life cycle has significant implications as value-relevant information for financing decisions, particularly in the determination of the cost of capital.

In this study, we propose a new form to extract value-relevant information from Dickinson's life cycle approach (2011) which we call 'firm life cycle persistence.' A given firm will be called 'persistent' when consistently stays at the same life cycle stage for several time-periods: our proposition advocates the idea that the persistence status works as a signal about

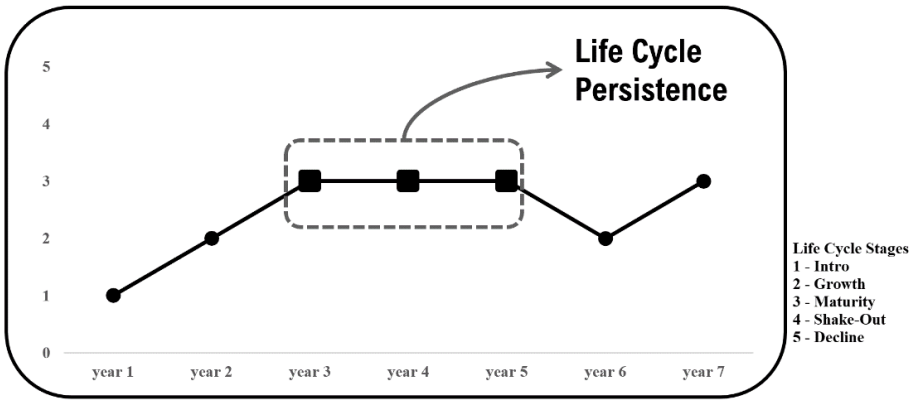
what is going on inside the firm. Moreover, capital suppliers use this signal even when some changes in strategy occurs, but it will not be sufficient to change the firm stage reinforcing the persistence status.

Firms generate cash flows through their actions in product markets and take operating decisions that affect the level of risk of their cash flows. However, sometimes operating decisions change the resource allocation but not the life cycle stage, which reinforces to capital suppliers a signal related to a previous level of risk.

For instance, a young firm that goes from introduction straight to maturity and then goes back to introduction after one year indicates glitches in operating activities. On the other hand, a young firm that goes from the introduction stage straight to maturity and consistently remains in that stage, display performance consistency and stability, which can be captured by the persistence status. Then, in this case, capital suppliers use this information to recalculate the cost of capital.

Once there is quality information in the life cycle related to profitability (Dickinson, 2011) and earnings persistence (Drake, 2013), it is a reasonable insight that capital suppliers will perceive the persistence status and adjust the implied cost of capital. To illustrate, Figure 1 helps to visualize how persistence is achieved:

Figure 1 – Life Cycle Persistence Example



A firm reaches persistence when it remains in the same stage for at least three time-periods for two reasons. First, starting with the idea that persistence means being at the same stage consistently over time, less than three time-periods may be related to temporary issues, coincidences or luck. Additionally, any number greater than three will be a discretionary choice

without a theoretical explanation. Thus, at least three time-periods seem to be accurate to avoid the impact of coincidences and disregard of any discretionary choice.

Our proposition is based on the theoretical foundation of signaling theory (Spence, 1973; Ross, 1973; Connelly et al., 2010). Signaling theory is necessarily concerned with reducing information asymmetry between two agents. In our case, firms try to communicate positive information in an effort to transmit unobservable positive organizational qualities (Spence, 2002). Once capital suppliers make investment decisions with incomplete information, firms tend to disclose more (quantity) and better (quality) information to increase fundraising or decrease the cost of capital.

In this theoretical perspective, firm life cycle persistence has significant characteristics of effective signal because the source of this approach is the Cash Flow Statements. First, the signal cost is very low because the disclosure of the Cash Flow Statement is mandatory to public firms. Another important characteristic is the high signal observability, which refers to the extent to which outsiders are able to notice the signal (Connelly et al., 2010).

However, since the cash flow is divided into three components (Operating, Financing, and Investing), the choice of which of the three cash flows is the most important to any investment decision becomes subjective. Therefore, the life cycle approach compresses the cash flows sign patterns in an intuitive and highly observable approach. What we propose and test with the firm life cycle persistence is whether there is a high signal fit between our approach and the implied cost of capital.

The literature documents variation in the cost of equity across different stages of life cycle stages (Hasan et al., 2015), and this evidence impacts their capacity to raise capital from the market. In comparison with other stages, mature firms are better known by capital suppliers, which improves information precision, lowering the level of uncertainty and consequently the cost of capital.

Also, mature firms are bigger and have more market experience and constant operational cash flows. So, analysts strongly scrutinize mature firms to deliver detailed forecasting reports to capital suppliers. Hence, these firms are less risky once they have lower levels of informational asymmetry. In contrast, firms on the earlier stages are unknown and not evaluated by analysts, which increases the information asymmetry substantially and consequently, the cost of capital.

Given that capital suppliers buy financial assets with the expectation of future cash flows, it is plausible that the current financial asset price represents the expectation of this future cash generation, discounted at its cost of capital. Therefore, managers attempt to create sustainable financial performance identifying efficient components to play with pricing strategies, signaling, and the control of information.

Thus, firms attempt to create an optimal capital structure at different environments resulting in a persistent status, which reduces the inherent uncertainty, since capital suppliers assess firms considering resources allocation that creates future profits expectations.

Assuming that the required return from capital suppliers (we consider the implied cost of capital - ICC) is related to the level of firm uncertainty and also that firms play a game of structure adaptation to achieve persistence. We therefore, hypothesize:

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

The moderating effect of market concentration

Firms make revenues through their actions in the product market. They risk their cash flows in operational decisions that ascend from interactions with rivals, which determines the market structure. For instance, firms in competitive markets which adopt risk-taking and innovative strategies perform better. In contrast, more conservative strategies are positively related to firm performance in concentrated markets.

Also, the current stage of the industry life cycle conditions firm performance. For instance, proactive firms (i.e., firms which act in anticipation of a future demand) perform better in markets which are at introduction or growth stages, while firms with aggressiveness orientation (i.e., firms which act in response to a competitor's movement in the market) perform better in mature industries, where there are fewer opportunities, and the market concentration is higher.

These ideas are also related to the Structure/Conduct/Performance (S/C/P) paradigm (Bain, 1954) which connects industry production characteristics with pricing behavior of the firm, which determines firm performance. S/C/P paradigm suggests delimitations in the market structure that can determine the conduct of the firm and consequently, its performance.

For instance, the pharmaceutical industry demands a high level of investments in Research and Development, which drastically limits competition. So, these high investments needs are the entry barrier that delimits the number of competitors (structure). Thus, if the number of participants is low and the entry barrier is high, pharmaceutical firms would be able to keep the prices high (conduct) without worrying about new competitors which results in abnormal positive cash flows (performance). Therefore, this analysis suggests that entry barriers affect the number of possible competitors altering the pricing practices and consequently changing the risk characteristics. Therefore, we propose a 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 economic and financial data of Brazilian public firms. The sample is drawn from the population of firms listed on the São Paulo Stock Exchange (BOVESPA), 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[2].

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. In order to investigate the hypotheses 1 and 2, we test the following regression model:

[2] Appendix B presents the sample distribution by persistence status

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

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 β_1 to be negative for hypothesis 1 and, β_2 and β_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 to assess the robustness of the results. The results of 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 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 decision, 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:

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

Where P_t is the median of stock price of the firm at data *t;* $\grave{x}_{t+\tau}$ is the expected future accounting earnings for 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 $bv_{t+\tau} = bv_{t+\tau+1} + \grave{x}_{t+\tau} - \grave{d}_{t+\tau}$ and $\grave{d}_{t+\tau}$ corresponds

to the expected future net dividends for period (t+τ-1, t+τ), derived from the dividend payout ratio k times the earnings forecast $\grave{x}_{t+\tau}$.

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 3 periods, otherwise 0.

Market Concentration

We use 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.

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 (1992) 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	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 in page 4	Dickinson (2011)
	LCP	Life Cycle Persistence	Dummy equal to 1, if a stage persists 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 in each year and K means the total of items comprised on the check-list.	Almeida and Rodrigues (2017)
	SIZE	Total Asset	*Ln*(Total Assets)	Fama and French (1992); 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 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, higher MTB ratio is positively associated with higher level of voluntary disclosure.

- **Voluntary Disclosure**: we control for voluntary disclosure in order isolate the effect of high/low analyst's 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 measure 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, presenting 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 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
	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

Table 4 presents Pearson correlations using the implied cost of capital, life cycle persistence, market concentration and control variables. Then, lower values of HHI reflects 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 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 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 disclosure 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.

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 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 a presence of a concentration environment, a firm with sustainable operating, investing, and financing issues (reflected on the firm life cycle persistence) tend 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 is defined as a permanence of any firm life cycle stage at least 3 periods; 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

In Panels 6, we stress the analysis and tested each life cycle stage separately (only reported maturity and growth; fixed effects estimation). Looking to 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

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 develop a proxy of life cycle persistence using Dickinson's (2011) life cycle approach as reference. Also, by looking a sample of Brazilian firms, we test the association of our persistence proxy with implied cost of capital to measure the signal fit between them. Our preliminary findings reveal a negative association highlighting a recognition of the life cycle persistence by the investors and capital suppliers. However, analyzing each stage separately reveals that mature firms in persistence status have a stronger signal fit in comparison with other stages. Investors and capital suppliers strongly recognize mature firms with persistence status and diminish the risk premium. One interpretation is the level of

transience between stages: introduction, growth, shake-out, and decline has more transitory characteristics if compared with the mature stage, which make the persistent status of mature firms more trustable.

Additionally, market concentration enhances the impact of firm life cycle persistence on the implied cost of capital. One possible is explanation is that the capital suppliers perceive the concentration as an advantage in a chaotic context with low investment opportunities.

This study contributes to the literature in several ways: we offer to the growing body of literature that focuses on the financial issues of the firm life cycle theory with an analysis of firm life cycle persistence showing a strong signal fit between persistence status and firm outcomes, in our case, the implied cost of capital.

In contrast with Hasan et al. (2015), our proxy revealed a strong negative association between mature firms with persistence status and implied cost of capital, but not for other stages. Possibly, the persistence status can be more relevant to mature firms because it is the desirable stage to be and providing to outsiders a signal of unobservable positive firm characteristics. In comparison with matures firms in persistence status, other stages may not give relevant signals because the transitory characteristics of the stage.

These results suggest a number of possible areas for future research. Our empirical evidence suggests the need to incorporate firm life cycle persistence in the body of literature through a reexamination of the outcomes used in life cycle theory. Also, provide evidences using a sample of Brazilian firms. The Brazilian market starts its financial integration in the last three decades, so we believe that the evidence of signalization through the persistence status can be stronger in developed/industrialized markets and contributes to the literature.

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