IS THERE REALLY SYNERGY CREATION AFTER M&A? EVIDENCE FROM BRAZIL UNDER THE LIFE CYCLE APPROACH.

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ABSTRACT
We aim to investigate the role of the life cycle stage in the synergy creation after a Merger and Acquisition (M&A) process in the Brazilian market. We use data from non-financial firms listed at the Brazilian capital market in the last decade. Data on M&A negotiations were extracted from the ANBIMA's database, while financial accounting information was collected on the Comdinheiro® database. We firstly used the *Propensity Score Matching* to properly estimate a control group through a Probit model, based on the nearest neighbor procedure. Then, we conducted a linear regression model to capture the *diff-in-diff* effects on synergy creation for mature firms after the M&A activity. After several robustness check, we found no statistical differences, even for other stages. These results give rise to questions about the proper conditions for the bidder before engaging in such a firm reorganization and claims for future researches on synergy creation and motives for M&As.

Keywords: Mergers and acquisitions; Synergy; Life cycle stages; Propensity score matching.

1. INTRODUCTION

The process of merger and acquisition (hereafter, "M&A") is inherently linked with the growth of a firm (Penrose, 1959). A merger and/or an acquisition assemble a choice of growing by recombining the old, or building a new project/firm. Such a position was a breakdown on the analogy of the firm as a biological body, since a corporation might be formed by other firms, changing (or not) the identity, culture and, mainly, achieving economies of scale.

After four periods of reorganizations, between 1887 and 1980, during the so called "M&A waves", scholars struggled to develop theoretical models of takeover bidding process (Fishman, 1988; Grossman & Hart, 1980) and of the choice of exchange medium (cash or stock) under asymmetric information (Hansen, 1987). Although, the theories converge on the assumption that the purchase of the target firm will increase the utility function of the acquirer (Stigler, 1950), through an expected value gain. But the empirical evidence is not so good in favor of these players. Instead, there is a big amount of evidence that the target shareholders have their value increased in the process.

The literature on M&A has been regarded in two different streams: *finance*, which is related to capital market reaction (Elango et al., 2019; Greenwood & Schor, 2009); and *industrial economics*, attempting to discuss fundamentalist performance measures, using accounting numbers (Minadeo & Camargo, 2009; Stiebale, 2016; Wu & Chung, 2019). This paper is placed on the previous stream, because we shed light on the operational gain resulted from the expected synergy to the acquirer, regardless the capital market reaction.

Recently, Fich & Nguyen (2019) show that the knowledge of the acquirer CEO about the target's industry is positively related to the synergy creation, in terms of accounting performance and less goodwill written off. This enlighten that an opportunity of takeover must

be considered under a less uncertain environment, more than a specific manager, otherwise the expectation of the total cost optimization will not appear to be true.

In this regard, the potential acquirer needs to observe the firm potential of acquiring (or merge with) another firm. This might be understood in terms of life cycle stages, that reflect more than a moment, but the operating, investing and financing arrangement of the firm in each moment. According to Black (1997), Cantrell & Dickinson (2018), Dickinson, Kassa, & Schaberl (2018) and Jenkins & Kane (2004), beginning and declining firms, for instance, present differences in structure and strategies compared to growing and mature firms. Further, the mature stage are associated with higher operational returns on assets (Dickinson, 2011a), lower cost of capital (Hasan et al., 2015), higher investment level (Hasan & Habib, 2017b), which can imply better new growth opportunities.

In this regard, considering an opportunity of M&A to emerge from both an uncomfortable situation of the target-firm and from the acquirer optimism, we assume the firm life cycle to play a separating equilibrium role on the pursuing of synergy. Then, *this paper aims to investigate the role of life cycle stage in the synergy creation after a merger and acquisition process at the Brazilian capital market*.

We use the Brazilian scenario because, as an emergent market, member of the BRICs, the country has recently passed through a significant change in economic policies, which has been drawing the attention of both foreign and local investors. Then, the results of this research have the potential to enlighten the conditions where synergy appears to be true (or not) in developing countries.

Taking into account the existence of "waves of mergers and acquisitions", Napier (1989, p. 272) claims for "more systematic investigations and better understanding of the impact of mergers". Likewise, Ghosh & Ghosh (2014, p. 113) sustain that M&As are the "prime vehicles for business engagement across the countries through the foreign direct investment route". Henceforth, the results of this paper are expected to be useful for financial market analysts and, mainly, managers and investors in order to improve the decision-making process about the moment of rearranging or purchasing a firm.

The remainder of this paper is divided into other 4 parts: *section 2* presents the theoretical and hypothesis development; In *section 3*, we present the operationalization of the sample and variables; *section 4* is dedicated to the results, starting from the descriptive analysis of M&A scenario in Brazil, passing by the propensity score matching procedures, until the estimations results; and finally *sections 5*, with the concluding remarks and suggestions for future researches.

2. THEORETICAL AND HYPOTHESIS DEVELOPMENT
2.1. Mergers and acquisitions – M&A

A Merger process denotes a strategic deal to form a single economic unit, whilst in an Acquisition; there is a purchase of more than the necessary portion of voting shares from the target-firm to control it. This takeover process may be friendly (private offer) or hostile, through a "Tender Offer", which means an offer directly to the voting shareholders, bypassing the board of directors. There is also a situation when the offer is formally declined by the board of directors, but the potential acquirer decides to keep on the offering (Copeland et al., 2012; Matos, 2001).

The incentives towards the decision of merging with, or acquiring, another firm is sometimes based on a horizontal purpose, where the firm seeks for monopoly power and buy their concurrent, or by a vertical one, when two firms operate in the same value chain in an industry. In other situation, big companies diversify risk by forming conglomerates. This economic group diversify its resources and operations in order to add a new product line, to

expand commercial boundaries or due to a pure diversification (Matos, 2001), such as Unilever, DuPont, Mitsubishi, Yamaha among other.

The process of M&A starts when a bidder identifies a target firm and evaluates it, considering potential synergies, including nonpublic information related to growth plans among others. Then, a bid will be offered when the new valuation results in an intrinsic firm value greater than the market current value. Otherwise, a rational bidder abandons the negotiation. However, behind such a comparison of valuation and assumptions for value creation, there are situations concerning the "hubris", when the capital reallocation results in gain only for the target shareholders (Roll, 1986).

Reasonably, when a firm decides to keep the negotiation, facing and beating existing competitors on this process, the most expected result is a gain in efficiency and/or synergy, which might be understood as any gain resulted from the reorganization, related to taxes, cost of debt, production scale or even agency costs. In short, this is expected to minimize the total unit cost of the firm, maximizing the firm value to shareholders, by the classical "one plus one equals three". The Panel 1 shows the hypothesis explored by literature to explain an M&A:

Hypotheses	Theoretical Arguments
Efficiency	An M&A can improve either the performance of a firm or produce a more efficient firm, due to eventual synergies.
Information	Short term effect on stock prices of both acquirer and target firms, attempting to incorporate/anticipate the operation on the price.
Agency	The M&A can be a mechanism to diminish the agency problems and costs.
Market Power	The economies derived from the M&A can be motived by monopoly gains of the resulting firm.
Taxes	The M&A are motivated by taxes gain.

Panel **1. M&A Hypotheses**
Source: Adapted from Camargos & Barbosa (2009).

Bradley & Korn (1984) discuss a methodology to estimate a "true" cost-benefit in an M&A process. The authors point out that sometimes political motive overshadows the traditional "value maximizing approach". Mueller (1972) argues that big corporation intends to maximize the managerial, not stockholder, welfare. Then, the expected gain in an M&A is less related to profitability or pecuniary reward, since the manager utility is associated with the size and the growth in size, but it depends on the position of the top manager distance to the entrepreneurs.

Napier (1989) states an M&A to be incentivized for gains in technical expertise or knowledge in capital allocation, which refers to human capacity. The author points out that culture, employee reaction and structure are relevant factors to be considered before merging or acquiring a firm. Moreover, the reasons why a firm intends to acquire another company may be related to the life cycle stage which both firms are in.

According to the 1985 edition of the Business Week, 30% of the M&A resulted in "divestiture", and more than 50% are "generally unsuccessful" (Napier 1989, p. 271). Recently, Fich & Nguyen (2019) show that the knowledge of the acquirer CEO about the target's industry is positively related to the synergy creation in US. This enlightens that an opportunity of takeover must be considered under a less uncertain environment, otherwise the expectation of the total cost optimization will not appear to be true.

However, emergent capital markets like the ones from the BRICs are characterized by intensive concentration, which modifies the traditional theory of the firm and this may lead to

different results compared to developed countries. For example, Camargos & Barbosa (2009) showed the existence of operational synergy after merger and acquisitions in Brazil, analyzing 74 operations between 1996 and 2004. Recently, Silva, Kayo, & Nardi (2016) evidenced abnormal stock returns for the acquirer listed at the top tier of corporate governance practices, the "Novo Mercado", where 100% of voting share are floating.

Nonetheless, the Brazilian capital market has evidenced significant opportunities of negotiations. In an 11 years window, while the developed economies were in crisis during 2007 and 2009, the Brazilian market faced intensive years of economic distress, at least on the short windows between 2008-09 and 2015-16, also concerning political changes. In 2019, the Brazilian stock exchange registered a record in number of new investors and in negotiation volume, responding to an expectation of credit recovery by the local and foreign investors, after significant economic changes (Lourenço, 2019). This uncertainty reduction is also understood as an opportunity for foreign companies to enter the Brazilian market through M&A process.

Then, the decision of reorganize the firm must be crafted properly. If the assumptions used on the valuation are not based upon a managerial, operational and financial structure, the attempting to reorganize may fall flat, causing more distress to the acquirer than the status quo situation.

2.2.   Firm life cycle stages and capital market

Recent studies in financial and accounting literature present a growing contribution of the firm life cycle to understand capital market issues (Al-Hadi, Hasan, & Habib, 2015; Dickinson, 2011; Hasan et al., 2015; Jenkins & Kane, 2004). Hasan et al. (2015, p. 48) state that "the firm life cycle has important implications in management and business strategy".

The firm theory assumes that, during its life, a company interacts with many others interested agents to reach its goals (Miller & Friesen, 1980). In this sense, Dickinson (2011) concludes that the life of a firm is influenced by internal (strategy choices and financial resources) and external environments (sectorial and macroeconomic factors) and the life cycle of a firm can be segregated into *introduction*, *growth*, *maturity*, *shake-out* and *decline* stages.

Mueller (1972) reports the uncertainty to be the most inherent problem of an introducing firm. Then, it is the responsibility of the entrepreneur to make decisions to rapidly move away from this stage. He argues that reaching the growth stage is more important than profitability for a while. It involves "information, intuition, courage or luck to make correct investment decisions in the face of uncertainty" (Mueller, 1972, p. 200).

Bender (2013, p. 126) complements that there is a compounded "business risk" associated to introducing firms based on "whether the company will gain an adequate market share to justify its involvement in the industry". Then, despite the expected potential to growth, resource funding tends to be expensive, due to attracting only investors prepared to accept such risk, which may be worthy of closer investigation, requiring higher return instead.

2.3.   Firm life cycle and M&A

Penrose (1959) posits that the M&A is associated with the growth of a firm because it assembles a choice of growing by recombining the old or building a new project/firm. This negotiation involves at least two parts: the *acquirer* (bidder), who is usually optimist and self-motivated to merge with another firm interested in a potential synergy creation; and the *target*, who will make the deal if the present value of the expected future benefits (not only financial) are considered to be lower than the negotiation value (and consequent benefits) offered by the bidder.

Damodaran (2005) regards that in emergent markets, there are relatively greater opportunities to acquiring potential growing firms; however this negotiation is sensible to cash slack, because the inexistence of cash by the optimist acquirer would lead to more risk- taking

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(financial) in addition to the inherent operating risk. Then, mature firms are expected to make better negotiations than firms in other stages, resulting in more share of synergy derived from the stable situation.

Moreover, Napier (1989, p. 273) called attention to the "lack of research linking motives to what happens after the merger, resulting in little information or knowledge about how mergers may, for different reasons, affect the subsequent structure or characteristics of the merged firms in the implementation stage". Owen & Yawson (2010) find that mature firms are more propensity to engage in a M&A activity as acquirer and less propensity to a tender offer. However, the authors discuss the relation of M&A and firm life cycle under the market reaction approach and then subject remains under debate. Then, under the arguments presented, we test the hypothesis that:

H1: As acquirer, mature firms realize greater synergy than firms in other stages after a Merger & Acquisition activity.

This is also aligned with the deterministic theory of Structure-Conduct-Performance (Bain, 1959), but the life cycle approach reassemble the reversal arguments of Porter (1980) that the current situation of the firm, including the performance, may conduct to a dynamic reorganization of the firm into the industry. Then, we expect that the mature firms have the internal structure to restore the industry and create synergy.

3. METHODS AND ECONOMETRIC ISSUES
3.1. Sample selection

We use data from firms listed at the Brazilian capital market in the last decade according to the following procedures:

Table **1**
Sample Selection

Steps	Num. Obs
All firms available on Comdinheiro® database between 2010 and 2017.	2,692
Excluded:	
Firms without information of Cash Flow Statement	-567
Firms without information of Assets	-127
Firms from Financial Industry	-340
Sample	**1,658**

M&A negotiations data are extracted from the ANBIMA (Brazilian Association of Finance and Capital Market Entities)'s database. This entity regulates, informs and educates the capital market, among other things. It is the entity responsible by certifying Qualified Investor Consultants (CPA 20), Hedge Funds and M&A processes with negotiation value up to 20 million BRL. Consolidated Financial accounting data are collected on *Comdinheiro®* database.

3.2. Firm Life Cycle Stages

We use the Dickinson (2011)'s model to classify the firm into 5 life cycle stages (*introduction*, *growth*, *mature*, *shake-out* and *decline*), using a combination of the Cash Flow Statements signals, as presented by the Panel 2:

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

| From *Financing* Activities | + | + | - | - | + | - | + | - |

Panel **2. Combination of cash flow signals**
Source**:** Dickinson (2010, p. 9)

Dickinson (2011) highlights that a benefit of this proxy "is that it uses the entire financial information set contained in operating, investing, and financing cash flows statement rather than a single metric to determine firm life cycle". The growing use of the metric is observed in international (Drake, 2013; Hasan et al., 2015; Hasan & Habib, 2017a) and in national (Brazilian) studies (Costa et al., 2014; Novaes, 2015; A. S. de Oliveira & Girão, 2018).

3.3. Synergy

The literature is inconsistent about the best proxy for "synergy" or "value creation" after the M&A. Following Damodaran (1995), we assume the synergy to increase the value to shareholder via both *operating issues*, increasing the expected future cash flow and, *financial issues*, reducing the rate of expected return. Then, we use the Return on Invested (ROI), traditionally used for both practitioners and academics:

$$ROI_{it} = \frac{Net\ Income}{Total\ Assets} \tag{1}$$

We use the total asset in end of the fiscal year, to absorb any change on the size during the year. Additionally, we argue the net income to ensure the effect of operating results added to results in subsidiaries and financial decision (cost of debt) on the index. Moreover, we use consolidated information, prepared under the International Financial Standards (IFRS).

Then, to test the hypothesis of comparatively greater synergy of acquirer in mature stage, we *firstly* run a *Propensity Score Matching* procedure to identify a control group comprising firms that has not passed through an M&A process, but with other same characteristics (year, size, and industry concentration level), to be compared with those which has engaged in such a reorganization.

Secondly, we run the following regression model:

$$Syn_{it} = \beta_0 + \beta_1 PostM\&A_{it} + \beta_2 Mat_{it} + \beta_3(PostM\&A * Mat) + \beta_4 Size_{it} + \varepsilon_{it} \tag{2}$$

Where Syn_{it} means the synergy creation, measured by the ROIC of firm i in year t; $PostM\&A_{it}$ is a dummy variable with value 1, if the year is greater than the M&A, and 0, otherwise. $Size_{it}$ is the natural logarithm of total assets in the end of the fiscal year. This control variable is expected to isolate the effect of the main variables. Mat_{it} is a dummy for firms classified as Mature companies. The coefficient $\beta_3(PostM\&A * Mat)$ captures a diff-in-diff effect to enable the comparison of a mature stage firm before and after the M&A process on the synergy creation, which is expected to be significantly positive. Hence, mature acquirers that engage in M&A process are expected to significantly create synergy, by increasing the operational return of the firm.

4. RESULTS
4.1. Descriptive Results

The figure 1 shows the number of negotiations in which Brazilian listed firms were the acquirer. Despite the evidence, the ANBIMA registered a mean of 150 negotiations per year, totaling 1.197 M&As between 2010 and 2017, but a relevant portion of those information is not published by both parts. Moreover, only 10% of the negotiations are headed by a listed public firm, which limits our analysis.
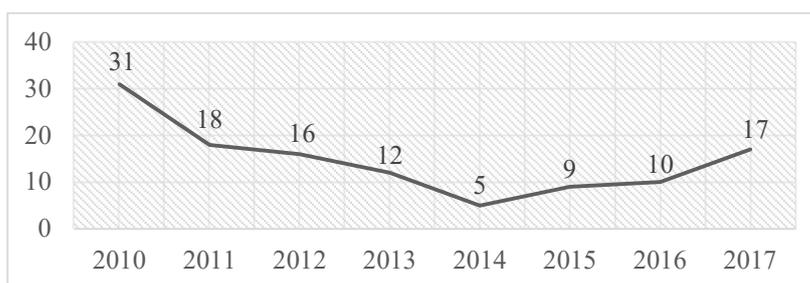
Figure **1. Number of M&A across the sample period**

The conglomerate Hypermarcas (HYPE3) is the firm with the greater number of acquisitions, being 6 in 2010, 3 in 2011 and 2 in 2016. VALE3 follows with 5 acquisitions in 2011, 1 in 2014 and 2 in 2017. Moreover, BrMalls (BRML3) calls the attention due to the frequency of M&A on the period: the firm has acquired 8 firms, but the acquisitions are distributed on the period of analysis. These scenarios enable a separate analysis, but difficult the main objective of this paper, since there is a short period to considered as "post-M&A".

Table 2 shows the distribution of M&A across the life cycle stages:

Table **2**
Frequency of M&A across life cycle stages

M&A	Life Cycle Stages					Total
	Introduction	*Growth*	*Mature*	*Shake-Out*	*Decline*	
0	152	376	617	160	87	1,392
1	8	23	24	5	3	63
Total	160	399	641	165	90	1,455

Consistent with the literature, there's a greater number of firms in growth and mature stages, with relative superior incidence of M&A in these stages compared to the others. Figure 2 shows the frequency of M&A across the Brazilian industries in the time:
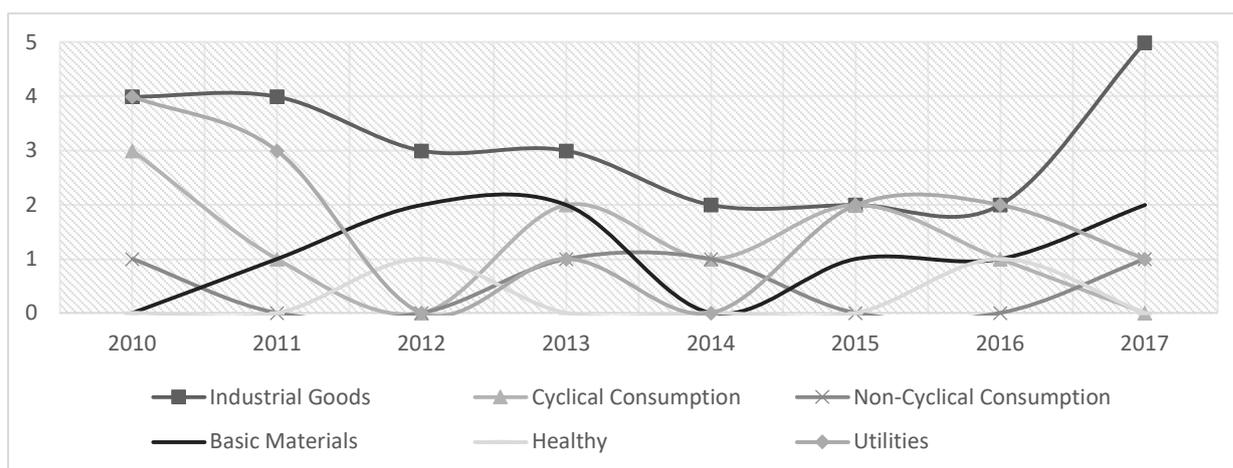

Figure **2. Frequency of M&A across Industries**

We observe that industrial goods concentrate the most incidence of M&As, followed by Utilities and Cyclical Consumption. It is also possible to observe that while there is an increase in Industrial Goods from 2010 to 2014, the negotiations in Basic Materials increased until 2013. In the Cyclical Consumption industry, the opportunities are more pronounced between the 2013-2015.

4.2. Propensity Score Matching

The PSM is a technic that enables a fair comparison between groups, once this seeks for a matched group. By year, we control for size and the level of concentration of the industry to estimate the probability of a firm engages in a M&A operation, through a Probit model. Firstly, Table 3 shows the distribution information for the metric variables to be used in this procedure, segregated into treatment group (dummy of M&A: "d_ma=1") and the "overall control group" (d_ma=0):

Table **3**
Descriptive Analysis of metric variables of treatment and control group

Variable	Obs	Mean	Std. Dev.	Min	Max
Panel A: d_ma = 0					
roi	1,389	-0.0029273	0.3	-8.257	4.07308
size	1389	21.56187	1.8	11.81	27.44652
hhi_rl	1,389	0.2875629	0.2	0.094	1
Panel B: d_ma = 1					
roi	63	0.02208	0.1	-0.343	0.1455791
size	63	23.76403	1.7	19.81	27.52581
hhi_rl	63	0.3146116	0.1	0.1	0.5803794

Notes: *roi* is the total return on investments; *size* is the natural logarithm of total asset in end of the fiscal year; year is a dummy variable; and *hhi_rl* is the Hirfindhal-Hirshman Index of concentration, using the Net Revenue.

Caution is need here once the segregation enables a firm to appear in both groups in different years. Additionally, we observe negative ROI values for both groups (minimum values). We decided not to drop at this step, to further investigate in robustness check. The number of M&A on the sample represents about 4% of the total, and the control group was extracted from these 1,389 observations.

There are different options of extraction and we used the type "Nearest Neighborhood", which calculates the probability in blocks. After that, an algorithm finds the same propensity on the control group. Table 4 shows the estimated propensity for the treatment group:

Table **4**
Estimated propensity for the treatment group

Estimated propensity			score	
	Percentiles	Smallest		
1%	0.004277	0.0040711		
0.05	0.0052987	0.0040799		
10%	0.0066788	0.0040816	Obs	1205
0.25	0.0121376	0.0040914	Sum of Wgt.	1,20
50%	0.029427	Largest	Mean	0.0519045
0.75	0.0668132	0.5202192		
90%	0.1130422	0.5292591	Variance	0.0045838
0.95	0.1574435	0.5342072	Skewness	3.589664
99%	0.4002167	0.5367422	Kurtosis	20.40035

The procedure creates a new variable (pscore) with a distinct distribution. We observe this to be asymmetric and with heavy tails. However, this procedure is needed only to find the control group. Table 5 show the propensity estimation according the variable mentioned before:

Table **5**
Probit model estimations

d_ma	Coef.	Std. Err.	z	P>z
size	0.3431315	0.0407243	8.43	0.000
year	-0.0593529	0.0287006	-2.07	0.039
hhi_rl	0.8061405	0.4261924	1.89	0.059
cons	109.8079	57.67016	1.9	0.057

According to the p-value of the Z-distribution, it is possible to ensure that the probability of a firm engage in a M&A operation have decreased along the period of analysis and a bit higher the higher is the concentration level of the industry and the higher is the firm size. Additionally, the algorithm found the final number of blocks is 6, which is the number of blocks who ensures that the mean propensity score is not different for treated and controls in each block. Table 6 shows the inferior bound, the number of treated and the number of controls for each block:

Table **6**
Inferior of block of pscore

| Inf. of block of pscore | d_ma | | Total |
	0	1	
0.0040711	527	7	534
0.025	255	9	264
0.05	232	17	249
0.1	100	18	118
0.2	21	6	27
0.4	7	6	13
Total	1,142	63	1,205

Despite the difference in number of observations, the procedure finds a proper control for each block without losing a significant number of observations. It is also observed that the highest probability found for the treatment group is comparable by only 7 firms on the control groups. Therefore, another variable is created (comsup), which means a common support. This dummy variable receives zero if the firm is not comparable. Then, the following procedures include the condition of "*comsup*" equals to 1, and then the number of observations decreases to 1,205 (control plus treatment group).

4.3. Linear Regression Estimations Results

To estimate the differences-in-differences model, we test the possible approaches for panel data. The results are presented in Table 7:

Table **7**
Tests for Panel Data

| | Tests | | |
	Chow	**Breusch-Pagan**	**Hausman**
H_0:	Pooled	Pooled	RE
Ha:	FE	RE	FE
Stat	$F_{(183, 1017)} = 1.24$	chibar2 (01) = 3.50	chi2(4) = 1.52
p-value	0.0262	0.0307	0.8226

In short, assuming an alfa of 1% we did not reject the null hypothesis of insignificant specific error term (c_i) in Chow test. In turn, Breusch-Pagan test shows a p-value lower than

the alfa, which signalize a constant variance of these specific residuals. Presumably, the Hausman test did not reject the null, indicating the Random effects are superior, compared to the Fixed Effects. However, we use the traditional OLS model concerning the Chow test, and the results are shown in Table 8:

Table **8**
Regression Results

$$Syn_{it} = \beta_0 + \beta_1 PostM\&A_{it} + \beta_2 Mat_{it} + \beta_3 (PostM\&A * Mat) + \beta_4 Size_{it} + \varepsilon_{it}$$

Variables	(1) OLS	(2) White	(3) Ctrl 1	(4) Ctrl 2
Post_M&A	**-0.0429***	**-0.0429****	**-0.0451****	**-0.0422****
	(-1.650)	(-2.367)	(-2.417)	(-2.139)
Mature	-0.000409	-0.000409	-0.000746	-0.0146
	(-0.00592)	(-0.0233)	(-0.0332)	(-0.771)
Post_M&A*Mature	0.0300	0.0300	0.0323	0.0462
	(0.343)	(1.068)	(1.019)	(1.533)
Size	**0.00716***	**0.00716*****	**0.00693*****	**0.00873*****
	(1.903)	(2.981)	(2.670)	(3.143)
Constant	-0.136	**-0.136****	**-0.124****	**-0.132****
	(-1.636)	(-2.455)	(-2.093)	(-2.172)
Num of Obs	1,205	1,205	1,205	1,205
R²	0.40%	0.40%	1.40%	2.30%
Adjusted R²	0.11%	0.11%	0.34%	0.65%
F-test	1.335	**2.999****	**2.763*****	**3.733*****
Industry Control	No	No	Yes	Yes
Year Control	No	No	No	Yes

Notes: t-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1;

After estimation of the OLS model, we *i)* observed a VIF mean of 2.15, that indicates low level of multicollinearity; *ii)* tested (and did not rejected) the null hypothesis of correct model specification (Ramsey test: 0.3044); *iii)* though, we rejected the null hypothesis of constant variance of errors (prob>chi2: 0.0003). Then, we estimate the model with White's estimator of robust standard-errors to treatment of heteroscedasticity (column 2), also controlling for industry (column 3) and both industry and year (column 4). In short, the results are qualitatively the same among the estimators 2, 3 and 4.

Post_M&A is a time dummy variable the captures the years after the M&A operation. The coefficient is negatively significant at 5%, which means that, on average, the total Return on Investment decreases after the M&A. Additionally, ***Mature*** is the dummy variable that receives one if the firm (the object) is classified at mature stage in each year. Such coefficient is not significant, indicating that, *ceteris paribus,* on average, there are no differences in terms of total return on investments between mature firms and firms in other life cycle stages.

Finally, the variable ***Post_M&A*Mature*** (the *diff-in-diff* coefficient) captures the effect of both variations (object and time), but the coefficient is not statistically significant for none of the 4 estimators. The only significant variable is ***Size***, signaling that the greater the firm, the greater the total return, regardless the merger and acquisition. This is consistent with the economy of scale (Silberston, 1972), once the greater structure might represent higher fixed cost, which comparatively reduces the total unit cost, by means of the operating leverage (França & Lustosa, 2011; Mandelker & Rhee, 1984).

We have first considered M&A operation in any year, then the periods after received value 1. Afterwards, we controlled for windows of short (1 year), medium (3 years) and long terms (5 years) after the M&A, but the results are qualitatively the same. We tested alternative

proxies for synergy, dropping negative values of ROI, winsorizing it at 2.5% in each tail, but the results did not change. Alternatively, we switched the Net Income for EBIT (Earnings Before Interest and Taxes), but nothing was found to be significant. In addition, we used the first and second lagged return on investment as independent variable, but the result for the diff-in-diff coefficient is qualitatively the same.

We also included a dummy variable to capture periods of financial distress on the economy, proxied by the negative variation on the GDP (Opler & Titman, 1993). Then, a dummy received the value 1 if year equals 2015 or 2016 for economic crisis in Brazil. This variable was tested alternatively on the Probit model and the regression model, but the results remain identical. In further investigations, we considered the possibility of life cycle stage transition after the M&A and then we tested the effect only for those firms, and not for the stage. However, the decrease of observations restricts the analysis. We also investigated it by each life cycle stages and nothing different was found.

5. CONCLUDING REMARKS

We investigated the role of life cycle stage in the synergy creation after a merger and acquisitions in the Brazilian setting in the last decade. Literature advocates that an opportunity of M&A emerges from an optimistic view from the bidder in purchasing firms to create value to investors, among other motives, by reducing the total unit cost, which enhances the total return. We argue that mature firms are more prepared in terms of cash slack and are expected to present a stable structure and business model (Damodaran, 2005; Mueller, 1972).

We then assume the firm life cycle to play a separating equilibrium role on the pursuing of synergy and hypothesized that after the M&A, mature firms would increase the total return on investment. Nevertheless, using the PSM to estimate a control group by year, size and the industry concentration level, we found no significant result for the comparison between mature firms and firms from other stages. Therefore, we refute the research hypothesis that as acquirer, mature firms realize greater synergy than firms in other stages after a Merger & Acquisition activity. At least in Brazil in the last decade it was not confirmed by the results in this research.

The national literature is weak in presenting results derived from M&As. Studies such as Camargos & Barbosa (2009) and Oliveira (2016) find significant operating synergy. However, we understand that the synergy of a group concerns the operational income plus the results in subsidiaries. Neither of them has isolated potential effects of other phenomena by creating a matched group, which can disturb the analysis. Then, this research innovates in presenting evidences about this global return, through a comparative instrument of analysis.

Taking into account the several robustness check, the insignificant effect of our interesting variable might be explained by the arguments of Bradley & Korn (1984), Napier (1989) and Roll (1986), that non-financial factors can negatively influence the realization of the synergy (i.e. hubris, employee's motivation, management turnover and other agency conflicts). Teece & Pisano (1994) advocates that "the properties of internal organization cannot be replicated by a portfolio of business units amalgamated through formal contracts as the distinctive elements of internal organization simply cannot be replicated in the market". Additionally, they agree on the role of the organizational structure and managerial process, which refers to items eventually out of the balance sheet, in order to generate productivity and efficiency.

Hence, this paper shed light on this stream of work, incentivizing more instrumentalized studies to both enhance the quality of the literature and to provide relevant micro and macro factors to be studied by potential investors and other stakeholders, such as financial market analysts and underwriters, before embarking on a M&A activity. Subsequent studies can further investigate such situation by controlling for cross-border acquisition (Vennet, 1996) or even by the composition of institutional investors (Faelten et al., 2015).

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