▪ Advances in Scientific and Applied Accounting, ▪ ISSN 1983-8611 ▪ São Paulo ▪ v.14, n.3 ▪ p. 111-121 ▪ Sep. / Dec. 2021.
▪ DOI: 10.14392/asaa.2021140304

Moderating effect of operational leverage on the relationship between corporate investment and firm profitability

Kelly Cristina Mucio Marques, José Braz Hercos Junior, Helio Masaru Fujihara

Universidade Estadual de Maringá, Maringá-PR, Brazil.

[1]kcmmarques@uem.br
[2]jbhjunior@uem.br
[3]heliofujihara@gmail.com

Edited by:
Orleans Silva Martins
Paulo Roberto da Cunha

Abstract

Objective: the goal was to analyze how the operational leverage moderates the relationship between corporate investment and profitability of companies listed in the Brazilian stock exchange.
Method: The sample consisted of 114 companies active in the stock exchange. Regression with panel data covering the period from 2008 to 2018 was used for data analysis. Static and dynamic models were used.
Findings: The main results showed that operational leverage moderates the relationship between investment and ROA, so that the greater the operational leverage and the greater the investment, the greater the ROA. It was also observed that contemporary explanatory variables were more adequate to explain the model.
Contributions: The findings indicate that greater operational leverage is an advantage for companies that present growth opportunities and have not reached the point of overinvestment, since ROA decreases as less is invested in this scenario. The research implication is that operating leverage is a factor that must be considered both in investment decisions and in profit forecasting models. This study differs from the previous ones, as it deals with the impact of investment and operational leverage on the contemporary results of companies in a joint manner.

Keywords: Corporate investment; Profitability; ROA; Operational Leverage.

Como citar:

Marques, K. C. M. ., Hercos Junior, J. B., & Fujihara, H. M. (2021). MODERATING EFFECT OF OPERATIONAL LEVERAGE ON THE RELATIONSHIP BETWEEN CORPORATE INVESTMENT AND FIRM PROFITABILITY. Advances in Scientific and Applied Accounting, 14(3). Retrieved from https://asaa.anpcont.org.br/index.php/asaa/article/view/834

Received: August 16, 2020
Required revisions: November 5, 2021
Accepted: November 18, 2021

© Copyright 2021

Introduction

Capital expenditures refer to important capital budget decisions, such as factory expansion or equipment replacement, and are generally linked to the strategic decisions of companies (Jiang et al., 2006). When companies invest, their book values increase and so do their fixed production costs (Guthrie, 2011). The increase in fixed costs also increases operational leverage (OL), which in turn is related to risk (Lev, 1974) and market return (Novy-Marx, 2011; Guthrie, 2011).

Managers tend to be risk-takers with the aim of increasing firms' profitability (Lourenço et al., 2020). In this sense, Chen et al. (2019) mention that the OL and the firm's profitability are positively related when sales increase. This behavior is due to the leverage effect promoted by the higher amount of fixed expenses in companies with higher OL.

Kim (2001) argues that despite recent findings that capital investments are important to create value, research has not shown direct evidence that there is a positive linear association between capital expenditures and future earnings. Jiang et al. (2006) found a positive relationship between capital investments and future corporate earnings, but other studies found a negative relationship between these variables (Li, 2004; Dechow et al., 2008).

Chen et al. (2019) analyzed the impact of OL on financial leverage (AF) and profitability, the results showed that OL increases profitability and decreases AF, concluding that OL and AF are substitutes, having a causal effect on operational leverage decisions.

Jiao et al. (2019) analyzed the relationship between investment, OL and PA and concluded that the relationship between investment and PA is negative and moderated by OL in order to weaken its intensity. For Jiao et al. (2019) this behavior of OL in relation to AF can reduce the problem of underinvestment in companies financed by debt. The mechanism used to explain this behavior is that companies with a high level of fixed operating cost (higher OL) have an increase in the post-investment default threshold, amplifying the default probability, which leads to a lower expected debt value (Jiao et al., 2019). Especially in the case of companies that face great fluctuations in the level of operations (Grunewald, 1963). This leads to a replacement of debts owed to third parties by internal debt (fixed expenses, usually contractual).

Kahl et al. (2019), investigated the role of OL in companies' financial policies and concluded that companies with high OL have lower PA and greater cash reserves than companies with low OL. In addition, they argued that this conservative behavior not only serves to avoid default, but also to sustain the investment when sales are low, behavior linked to the search for value maximization through risk management (default risk and reduction in investments when of the drop in profits caused by the high OL).

High OL companies are more likely to have conservative financial policies with higher retained cash flow and lower PA (Kahl et al., 2019), so they would also be more prone to overinvestment, due to excess internal resources, featuring an agency cost (Jensen, 1986). However, empirical results show that the inherent risk of high OL seems to act in the opposite direction to this behavior (Khal et al., 2019; Jiao et al., 2019).

Therefore, empirical results show that corporate investments can affect profitability (Kim, 2001; Li, 2004; Jiang et al., 2006; Dechow et al., 2008) and that OL can affect profitability both (Chen et al., 2008). al., 2019) and corporate investment (Khal et al., 2019; Jiao et al., 2019), raising the hypothesis that OL can moderate the relationship between profitability and corporate investment. The following question then arises: how does OL moderate the relationship between corporate investment and profitability of companies listed on B3?

For data analysis, the regression model with panel data was chosen. The database covers 114 non-financial companies listed on B3, in the period between 2008 and 2018. The dependent variable was ROA (return on assets). As a way to verify the robustness of the results, static and dynamic models were used.

The results (static and dynamic models) showed a positive and significant relationship between corporate investment and future ROA, as expected. These results are similar to those found by Jiang et al. (2006). In dynamic models, the lagged ROA was not statistically significant.

The main result of the study showed that the moderation term was statistically significant (levels of 5% and 10%) in all models tested, confirming the hypothesis that OL moderates the relationship between corporate investment and profitability, so that the greater the investment and the greater the OL, the greater the ROA. This result advances by bringing together in its analysis three variables of interest, identifying how OL can influence investment decisions and its impact on profitability, complementing results of previous studies (Jiao et al., 2019; Chen et al., 2019 ; Kahl et al., 2019).

The result found confirms that corporate investment has a positive impact on profitability and adds that OL generally strengthens this relationship, that is, the impact of investment on profitability is greater for companies with higher OL. The contribution of this result is to provide empirical evidence that a higher OL has the potential to increase the firm's profitability not only when sales increase, but also depending on the level of corporate investment in the previous period.

This scenario shows that, although the highest OL has the possibility of increasing the risk of bankruptcy (Chen et al., 2019; Jiao et al., 2019), the results found contradict the negative effect of OL on investment verified by Jiao et al. (2019). The addition of the highest investment level when the OL is greater may signal that instead of inhibiting investments (as found by Jiao et al., 2019), the greater OL may promote investments, leading to the risk of overinvestment.

However, in the analyzed sample, a possible economic explanation for this effect was the negative variation in investment (divestment) in six of the eleven periods analyzed and periods with declines in sales, probably due to the political and economic crises experienced, which may indicate that companies in the sample still had the possibility of growing, especially those with higher OL, because a possible idleness of the installed capacity in times of falling sales would be aggravated if there were more investments, leading to a reduction in profitability instead of an increase. No signs of overinvestment were found in the analyzed sample.

The implication of this result is to show that greater OL is an advantage for companies that have growth opportunities and have not reached the point of overinvestment, since ROA decreases as less investment is made in this scenario. The results found show that OL is a factor to be considered both in investment decisions and in profit forecasting models and are of interest to managers, investors, researchers, analysts and others interested in the dynamics between corporate investments and firm profitability.

In addition to this introductory section, the article presents, in section 2, the theoretical basis and the research hypothesis. In section 3, it presents the methodological procedures used. In section 4, it presents the research results and weaves the analyses. Section 5 presents the conclusions and recommendations for future research

2 Theoretical Foundation

2.1 Investment Decisions and Operational Leverage

The investment decision involves how much and how to invest and, generally, should be based on cost/benefit analysis of the various options available, favoring those that bring positive returns for the company, partners, shareholders and interested parties. When companies invest, their book values increase and so do their fixed production costs (Guthrie, 2011). The proportion of fixed costs in a company generates the OL. Lev (1974) defines OL as the ratio between fixed and variable costs; where the greater the OL, the greater the proportion of fixed costs in the cost structure.

Chen et al. (2019), considered that the OL of a company is determined by the production technology in its industry and, as such, is largely exogenous; managers, then, endogenously choose the AF and the investment, taking into account their OL.

Sarkar (2020) argues that the nexus between OL and AF involves some of the most important managerial decisions in corporate finance, such as investment (which impacts OL), capital structure (which determines AF) and risk management (both systematic risk and default risk are impacted by both types of leverage).

For Chen et al. (2019) the installation of capital (promoted by corporate investments) is analogous to the issuance of internal debt, as once capital is installed, the operating costs are like perpetual fixed payments (which impact the OL) with, therefore, a substitution effect between OL and AF.

Kahl et al. (2019), empirically verified that companies with high OL have conservative financial policies (higher retained cash flow and lower PA) not only to honor debts in periods of low sales, but to sustain investment when sales are low, both that in these periods, such companies cut less investments than companies with lower OL.

Jiao et al. (2019) analyzed the impacts of OL and AF on investment decisions, the results showed that the negative relationship between AF and investment is weakened by OL, which theoretically can reduce the problem of underinvestment for companies financed by debt.

An explanation for these results comes from the cash flow agency theory, in which Jensen (1986) argues that AF is a mechanism that helps to circumvent agency costs related to the conflict between capital holders and managers due to greater monitoring. market, which can reduce undue investments with negative net present value (NPV) when there is high free cash flow (FCL). According to Li (2004), previous studies have shown empirical evidence that FCL can intensify overinvestment or overinvestment, while high PA could reduce this behavior.

However, the results of the study by Jiao et al. (2019) show that both AF and OL impede corporate investment, and also verify that OL had a negative impact on investment, as did AF. Theoretically, companies with higher OL would have less market monitoring by exchanging onerous debt for domestic debt, so they would also have greater potential to invest more, especially with cash leftovers.

Therefore, an additional explanation for this behavior would be the risk factor, which is affected by both PA and OL (Sarkar, 2020). Chen et al. (2019) confirm this when they argue that inflexible operating costs reduce a firm's ability to pay its debt in the event of financial difficulty and that both AF and OL increase the probability of default. The findings by Kahl et al. (2019) also follow this line by showing that high OL companies did not reduce investments in times of falling sales, probably due to risk.

It can be seen from the results of previous studies that investment is impacted by OL, and that the exchange between AF and OL does not seem to change substantially the behavior of investment. Although Jiao et al. (2019) found that switching between AF and OL alleviates underinvestment, the effect found was not strong enough to fully compensate for this problem.

Regarding return, Morgado and Pindado (2003) argue that whenever a process of underinvestment or overinvestment arises, the company's value will be affected in such a way that companies undertake investment projects with a positive NPV first, and the company's value will increase until that these valuable projects run out; companies that continue to invest take on negative NPV projects and therefore their market value will decline.

Morgado and Pindado (2003) empirically verified that the relationship between company value and investment is quadratic; this implies the existence of an optimal investment point, in which companies that invest below this point have problems of underinvestment (and positive performance), while those that invest above show overinvestment (and negative performance). Depending on the quality of each company's investment opportunities, this optimal point can be higher or lower (Morgado & Pindado, 2003). This finding can help to understand negative returns when evaluating equity investments.

Although Morgado and Pindado (2003) analyzed the impact of investment on market value, it is possible to expect something similar in relation to the firm's profitability, since investments above the optimal point or with a negative NPV can reduce profitability.

The investment discussions punctuated here will be used to build the research hypothesis of this study, which advances by testing evidence of OL moderation in the relationship between corporate investment and profitability. Next, the results of research that included profitability in the analysis of corporate and OL investments and the development of the research hypothesis were analyzed.

2.2 Profitability in the Context of Corporate Investment and Operating Leverage

The concern with the profitability and sustainability of companies are important factors for management. Measuring the performance of companies is essential not only for good management practice, but it is a necessary action to monitor the fulfillment of objectives and planning previously defined by managers. Performance or profitability can be assessed using metrics known as indicators, such as: ROA, operating margin, asset turnover and return on equity (Navarro et al., 2013).

Li (2004) found a negative relationship between future ROA and investment, and this association was stronger in the sample of companies with greater discretionary power over investment decisions, that is, they had higher FCL and lower PA, being more likely to have overinvestments.

Jiang et al. (2006) identified a positive association between capital expenditures and future corporate profits. Fortunato et al. (2012) did not find a statistically significant relationship between operating profit and capital investment.

Navarro et al. (2013) found that, from a long-term perspective, ROA reflects the results of investment decisions in the company, with a positive relationship of future profitability with future investment and past profitability being observed, indicating that to maintain its profitability, new investments are needed.

Dechow et al. (2008) found that retained cash flows simultaneously lead to the following future relationships: higher investment, lower earnings and lower stock returns. Chen et al. (2019) found that OL increases profitability and reduces AF, generating a negative relationship between profitability and financial leverage.

It is noticed that the findings involving profitability are conflicting, especially when involving the issues of overinvestment, discussed by Jensen (1986), as is the case of Li (2004) and Dechow et al. (2008). As the inclusion of the OL variable in the present study can affect profitability, we start from the idea of a positive relationship between profitability and investment in the construction of the hypothesis, similar to the findings of Jiang et al. (2006), Navarro et al. (2013) and Chen et al. (2019).

Based on the discussions of the results of the studies mentioned in items 2.1 and 2.2, it is possible to argue that: a positive relationship between corporate investment and future profitability is expected, as found by Jiang et al. (2006). Companies with higher OL did not invest less than companies with lower OL, even in periods of falling sales (Khal et al., 2019), and higher OL can be positively related to profitability when sales increase (Chen et al., 2019). Therefore, a higher OL may have the potential to positively affect investment and profitability, so that the expected positive relationship between investment and profitability is strengthened by the OL. This possible combination between the variables generated the following research hypothesis:

Hypothesis: The joint effect of OL and corporate investment has a positive impact on profitability

3 Methodological Procedures

3.1 Survey Population and Sample

The research population consists of active publicly traded companies listed on the B3 Stock Exchange (Brazil, Bolsa, Balcão) in São Paulo, except companies in the financial industry due to their specific characteristics and differentiated legislation.

The data used to test the hypothesis were collected from the Economática® platform and cover the range from 2008 to 2018. The initial base consisted of 271 companies, 157 companies were excluded due to lack of data in some period, making it impossible to calculate the EC variable for the same. The final sample resulted in 114 companies.

3.2. Operational Definition of Research Variables

As some variables were used for their absolute value, such as sales (to measure size and as a basis for calculating the cost structure), it was necessary to use an index to adjust inflation for the period, in this case the IPCA. This is because the intention was to capture the real evolution of these variables and not the nominal evolution. In order not to use this feature for just a few variables, it was decided to use values adjusted by the IPCA in all currency-related data.

The main measure of profitability was the ROA financial indicator, being the dependent variable. ROA was measured by dividing the operating result and total assets at the end of the period. The main explanatory variables of the model, as discussed in section 2, are OL and corporate investment (INV). As for investment, the value of invested capital was first collected, as follows: Invested capital = total assets - current liabilities + total short-term loans and financing - financial investments - cash and cash equivalents (Economática, 2019). This value was chosen because it represents the operational and long-term investment. Subsequently, the percentage variation of invested capital in relation to its value in the previous year was calculated, in order to capture the period's investment (INV) relatively.

The proxy used to measure the OL was the cost structure (EC), measured following the procedures of Khal et al. (2019). This measure directly reflects the importance of operating costs in the cost structure, making it possible to infer on the results both in terms of cost structure and OL. The construction of the measure takes place in several stages, as described below, based on Kahl et al. (2019). It is noteworthy that due to the lags used in the CE formulas, the data for its calculation cover the period between 2001 and 2018. First, based on the geometric growth rate in the two previous years, ex ante sales expectations were estimated (Equation 1) and operating costs (Equation 2) of each company.

$$E[V_{it}] = V_{i,t-1} \times (\text{Square root } (V_{i,t-1}/V_{i,t-3})) \qquad \text{Equation 1}$$
$$E[Cit] = C_{i,t-1} \times (\text{Square root } (C_{i,t-1}/C_{i,t-3})) \qquad \text{Equation 2}$$

Where E are expectations, V are sales adjusted for inflation and C are operating costs of firm i in year t, adjusted for inflation. For operating costs, Kahl et al. (2019) used values represented by the XOPR variable in the Compustat database. To arrive at a similar amount, the "operating costs" were calculated following the XOPR components, as follows: cost of product sold + selling expenses + administrative expenses + losses due to non-recoverability of the asset + other operating income + other operating expenses + equity income result. All values have been adjusted for inflation. Subsequently, its difference with the expected values was calculated, generating innovations in growth rates, according to Equations 3 (sales) and 4 (costs).

$$UV_{it} = (V_{i,t} - E[V_{it}]) / V_{i,t-1} \qquad \text{Equation 3}$$
$$UC_{it} = (C_{i,t} - E[C_{it}]) / C_{i,t-1} \qquad \text{Equation 4}$$

Where U represents the innovations in growth rates, V are the sales adjusted for inflation and C are the operating costs of firm i in year t, adjusted for inflation. Finally, an equation that uses covariance and variance per firm and considers five years of innovation to obtain the measure was created (Equation 5). Kahl et al. (2019) used seven years of innovations, but this period would further reduce the number of observations from the sample to the final model.

$$EC = covariance\ (UC_{it}:UC_{it+5};\ UV_{it}:UV_{it+5}) / variance\ (UV_{it}:UV_{it+5}) \qquad \text{Equation 5}$$

Where EC is the cost structure. For Equation 5, the calculations started in the base year of 2004, due to the delay in the calculation of expected values, generating available values for the variable EC from 2008 onwards. period is from 2008 to 2018.

The EC values, calculated in Equation 5, correspond to the coefficient that captures the sensitivity of operating cost growth in relation to sales growth, after computing growth trends (Kahl et al., 2019). Companies with higher ratios of fixed costs to total operating costs have lower sensitivities (EC) and vice versa. That is, the sign of the variable EC is contrary to the definition of OL. For the EC to be used as a proxy for the OL, it was necessary to reverse the reasoning found in the models during the analyses. The rationale was as follows: higher EC means more variable costs and expenses, so lower OL and vice versa.

Control variables were also used, based on the works of the theoretical review, especially Jiao et al. (2019), Khal et al. (2019) and Chen et al. (2019). AF, FCL, sales, industry and year were used. AF was collected from Economática with the following formula: liabilities/total assets at the end of the period. FCL was collected from Economática: cash generated by operations - Capex. Capex is: -1 x net purchase of permanent assets. If the purchase is null, then the formula will be: investment in permanent assets – sale of fixed assets, also with values corrected for inflation.

The industry of activity influences the amount of OL and other variables, therefore, dummies for indrustries were created according to the classification of B3. To measure the size of the company (logvendas), the logarithm of sales was used. The year was included as a dummy to control periods of economic and political uncertainty constant in the time interval, as well as the periods marked by the introduction of international accounting standards in Brazil (2008 and 2009) when full compliance was not yet mandatory.

3.3. Models Used in Data Analysis

Due to its characteristics and based on the works mentioned above, the regression model with panel data was chosen. The base equation for testing the hypothesis was as follows:

$$ROA_{i,t} = a + \beta 1INV_{i,t-1} + \beta 2EC_{i,t-1} + \beta 3AF_{i,t-1} + \beta 4logvendas_{i,t-1} + \beta 5FCL_{i,t-1} + industry + year \qquad \text{Equation 6}$$

The subscript i represents the company and the t represents the year. For all explanatory and quantitative control variables, a one-period lag was used, as corporate investment decisions generally impact future profitability (Li, 2004; Jiang et al., 2006). Subsequently, to test the research hypothesis, the model of Equation 6 was compared with another model including the moderation term INVxEC (investment x cost structure) also lagged. For Hair et al. (2009), this term represents the moderating effect, in which a third independent variable (the moderating variable) changes the relationship between a pair of dependent/independent variables.

To verify the multicollinearity of the models, a correlation matrix was created (available upon request), according to Gujarati and Porter (2011). The results showed correlations below 32.83% (thirty-two point eighty-three percent) between each pair of explanatory variables, including the control variables. Another way to assess multicollinearity is when the model has a high R2, but few regressors are significant (Gujarati & Porter, 2011), which was not the case for the models analyzed here.

The statistical tests of the models and the analysis of the results were presented in the next section.

4 Presentation and Analysis of Results

4.1 Descriptive Analysis

Table 1 presents the results of the descriptive statistics of the variables of interest. It is noteworthy that, in order to choose the models for testing the research hypothesis, the outliers of severe severity were removed from each individual variable, using the IQR (interquartile range) method in Stata. Descriptive statistics values were calculated before this procedure, so the analysis was performed in relation to the median. ROA had a median of 6.8% in the ten years analyzed (2008 to 2018). The median of investment changed positively by 1.91%. The EC, a proxy for the OL, had a median of 0.676, bearing in mind that the lower the EC, the higher the OL. AF and INV showed greater variability.

Table 1: Descriptive statistics of variables

Variables	Average	P10	P90	Median	Standard deviation	N
ROA (return on assets)	0,061	-0,031	0,167	0,068	0,160	1254
INV (investment)	-0,025	-18,398	26,980	0,191	75,918	1253
EC (cost structure)	0,576	0,172	1,061	0,676	1,148	1254
AF (financial leverage)	110,357	35,849	117,574	62,173	402,950	1254
Logvendas (company size)	14,346	11,811	16,971	14,420	2,110	1254
FCL (free cash flow)	0,028	-0,076	0,116	0,016	0,374	1182

Source: Research data

Table 2 shows the median of the variables distributed in the lower and upper tertiles to facilitate understanding of the behavior of the two explanatory variables (OL and INV). Regarding EC (first and second columns), it is observed that the median ROA is smaller for the larger OL. The median of AF and logvendas was also lower for companies with higher OL. FCL and INV were higher in the first tertile, where OL is higher. The results of ROA, AF, logvendas are similar to those found by Khal et al. (2019). The EC median is lower in the first tertile, indicating a greater amount of fixed costs in the cost structure, that is, higher OL.

Table 2: Median of variables in relation to investment level and cost structure level

	EC (cost structure)		INV (investment)	
Median	First tertile	Third tertile	First tertile	Third tertile
	Greater OL	Smaller OL	Smaller NV	Greater INV
ROA (return on assets)	0,672	0,787	0,047	0,081
INV (investment)	0,197	-1,142	-12,074	15,674
EC (cost structure)	0,324	0,928	0,665	0,669
AF (financial leverage)	61,491	64,536	67,657	61,869
Logvendas (company size)	13,905	14,808	13,704	14,895
FCL (free cash flow)	0,016	0,014	0,040	-0,008

Caption: OL = operational leverage

Source: Research data

As for the INV, in the third tertile are the largest average changes in investment and also the largest values of ROA, EC (the higher the EC, the lower OL) and logvendas. In the first tertile of the INV are the highest averages of AF and FCL.

4.2 Regression Models

Two different models of unbalanced panels were developed: 1) by the static model according to Equation 6 with and without moderation; 2) by the dynamic model, in which the dependent variable (ROA) was added as an explanatory variable with a one-year lag, representing the average rate of persistence of past ROA in the companies' future ROA. In model 2, only the results were presented with moderation due to the volume of data.

The tests of the regressions of the static model, with the moderation term, were estimated by ordinary least squares. For this model, Chow's F test was first applied, to choose between pooling or panel models. The probability F of 0.2301 indicates that the best model is the panel. Afterwards, the fixed effects model was run to verify heteroscedasticity problems (Wald test, with probability of 0.0017), confirming this problem; and autocorrelation test (Woldridge test, with F 0.8273), therefore, without autocorrelation problem. Subsequently, the random effects equation was run and the Hausman test was used to verify the best model. A probability of 0.0004 indicates that the best is fixed effects.

As only the heteroscedasticity problem was detected, the FGLS (feasible generalized least squares) estimation was chosen, which allows for the correction of heteroscedasticity and the inclusion of categorical variables, according to Baltagi (2005). To test the robustness of the results, the PCSE (panels corrected standard errors) estimation was also used, which also corrects for heteroscedasticity and allows the inclusion of categorical variables. Thus, the complete model was run according to the tests, including the dummies for the industries and years (according to Equation 6). The results of the models are shown in Table 3.

In the dynamic model, to enable comparison, it was also run with an FGLS and PCSE estimator.

Table 3: Regression results

Model	static	static	dynamic	static	static	dynamic
Dependent variable	ROA	ROA	ROA	ROA	ROA	ROA
Moderation	without	with	with	without	with	with
ROA outdated[1]			0,046			0,053
INV(investimento)	0,000	0,001**	0,001***	0,000	0,001***	0,001
EC x INV(moderation termo)		-0,001**	-0,001**		-0,001***	-0,001***
EC(cost structure)[2]	0,011	0,012	0,012	0,012	0,013	0,013
AF(financial leverage)	0,000	0.000	0.000	0,000	0,000	0,000
log vendas	0,001	0.001	0,001	0,001	0,001	0,001
FCL(free cash flow)	0,054	0.053	0,031	0,046	0,046	0,021
Industrial goods	-0,036*	-0,037*	-0,035*	-0,035*	-0,036*	-0,034*
Communications	-0,025	-0,024	-0,022	-0,024	-0,024	-0,022
Cyclical consumption	-0,035*	-0,035*	-0,034*	-0,034*	-0,035*	-*0,034*
Non-cyclical consumption	0,019***	0,019***	0,021***	0,021***	0,021***	0,023***
Basic materials	-0,047*	-0,046*	-0,045*	-0,043*	-0,042*	-0,041*
Oil/gas/biofuel	-0,006	-0,007	-0,004	-0,004	-0,004	-0,001
Health	0,007	0,007	0,009	0,005	0,005	0,008
year2009	-0,025**	-0,025**	-0,024**	-0,025**	-0,025**	-0,023**
year2010	-0,005	-0,004	-0,003	-0,005	-0,004	-0,003
year2011	-0,032*	-0,032*	-0,031*	-0,032*	-0,032*	-0,031*
year2012	-0,033*	-0,033*	-0,032*	-0,033*	-0,033*	-0,031*

year2013	-0,035*	-0,036*	-0,035*	-0,034*	-0,035*	-0,034*
year2014	-0,045*	-0,043*	-0,042*	-0,044*	-0,043*	-0,042*
year2015	-0,066*	-0,065*	-0,063*	-0,065*	-0,065*	-0,062*
year2016	-0,069*	-0,069*	-0,067*	-0,069*	-0,069*	-0,066*
year2017	-0,047*	-0,047*	-0,044*	-0,047*	-0,046*	-0,044*
year2018	-0,050*	-0,049*	-0,047*	-0,050*	-0,049*	-0,047*
_cons	0,104*	0,106*	0,103*	0,104*	0,106*	0,102*
R2				14.28%	14,58%	14.75%
Notes	822	822	822	822	822	822
Estimation	FGLS	FGLS	FGLS	PCSE	PCSE	PCSE

Notes: [1]ROA lagged one year in relation to the other quantitative variables in the dynamic model. All explanatory and quantitative control variables were lagged by one year in relation to the dependent variable. 2The values found by the EC variable were used, with inverted signs, as a proxy for the OL in the analyses. Therefore, greater sensitivity of total costs in relation to sales (EC) implies lower OL; and smaller EC implies greater OL. ROA is the return on assets.
, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.*
Source: Survey data

The results of the models were similar in relation to the sign of the variables and their significance. Models without moderation show a non-significant relationship between INV and ROA. However, the models with moderation (static and dynamic by FGLS and static by PCSE) showed a positive and significant relationship, as expected. EC did not show statistical significance in any model. As for the control variables, none showed statistical significance.

The communications, oil, gas and biofuels and healthcare industry did not fit any model. The year dummies showed a negative sign and were statistically significant in all models, with the exception of 2010, indicating that in all years there was an average reduction in ROA compared to the base year (2008), showing that the context influenced the results of the model.

To test the research hypothesis, the moderation term between the INV and EC variables was included in the models. It is observed in Table 3 that the explanatory and control variables showed no change in the sign of the relationship compared to the models without moderation and, with the exception of the INV, none showed statistical significance.

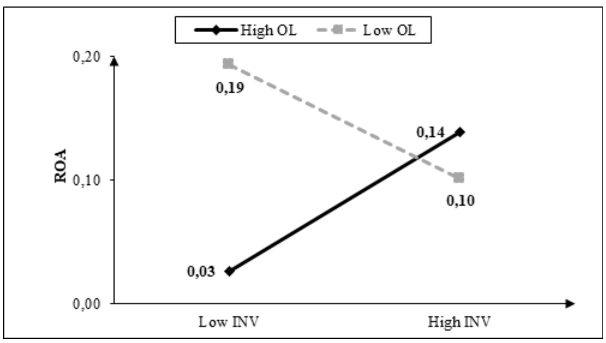
To determine whether the moderating effect is significant, Hair et al. (2009) suggest three steps: I. estimate the original (unmoderated) equation; II. estimate the moderate relationship (original equation plus the moderating variable) and III. evaluate the change in R2: if it is statistically significant, then the moderating effect is present; in this case, only the incremental effect is evaluated, not the significance of the individual variables. But, for Dawson (2014), if (and only if) the moderation term is statistically significant, it can be said that the OL is a moderator of the linear relationship between ROA and investment.

The results in Table 3 show that the moderation term was statistically significant (at the 5 and 10% level) in all models and the R2 of the PCSE model increased in the models with moderation. Therefore, this result shows that OL moderates the relationship between INV and ROA.

In the models with moderation, the INV was statistically significant and positive in the static models (FGLS and PCSE) and in the dynamic model with FGLS estimation, while the EC remained without showing statistical significance in both. Baron and Kenny (1986) mention that there may also be significant main effects for the two variables of moderation, but they are not directly relevant conceptually for testing the moderation hypothesis.

The moderation term had a negative sign, indicating that the higher the INV and the lower the EC, that is, the higher the OL, the higher the ROA and vice versa. Thus, although the term has a negative sign in the equation, when the analysis considers the OL, the sign becomes positive, as higher EC indicates lower OL. To properly visualize the effect of the two variables on the ROA, a graph of the moderation effect was drawn up, as shown in Figure 1, based on the model by West et al. (1996).

The graph was constructed using the betas of the static regression equation with the FGLS estimation and moderation term (Table 3), including the intercept coefficient, considering the mean and one standard deviation above (labeled as greater OL and greater INV) and one below average (labeled as lowest OL and lowest INV) for the moderation term variables. It was decided to present only the graph referring to the calculations with the static model, since for the other models with moderation there was no change in the form of the relationship. In Graph 1, the variable EC was replaced by OL, following the logic of its interpretation to facilitate the analysis.



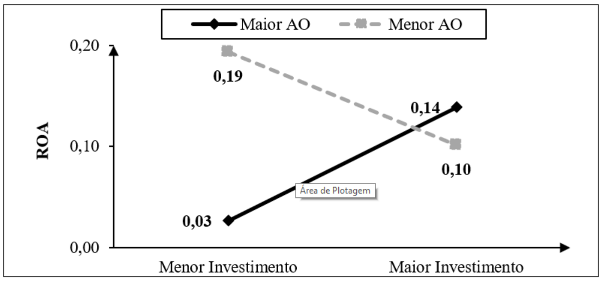


Figure 1: Effect of OL (operational leverage) and investment moderation on ROA (return on assets)
Source: Survey data

It is possible to verify that the moderation of the OL over the ROA, in situations where the INV is higher, changes the ROA levels from 0.14 for companies with higher OL, to 0.10 for companies with lower OL. In turn, in situations where the INV has lower levels, the smallest OL has a higher ROA (0.19), revealing that in this situation (smaller INV and lower OL) the ROA has a better result and, for a higher OL, the ROA decreases to 0.03.

It is also observed that only the line with the highest OL has an increasing behavior in relation to the ROA, the line with the lowest OL has a decreasing behavior. From the above, it is possible to confirm the hypothesis that OL moderates the relationship between INV and ROA, so that the greater the INV and the greater the OL, the greater the ROA.

4.3 Results Analysis

The relationship between INV and ROA was positive and significant in some models with moderation similar to the findings of Jiang et al. (2006). This result indicates that the investment made in the past period influences the future return, here considering one year ahead.

The inclusion of lagged ROA as an explanatory variable (dynamic models) was not statistically significant, and it is not possible to identify the persistence of past ROA in future profitability in this sample.

As for moderation, the results showed that the variable OL moderates the relationship between INV and ROA, so that the higher the INV and the higher OL, the greater the ROA, as expected. This result suggests that part of the relationship between INV and ROA can be explained by OL, with moderation being its marginal effect, indicating that the positive effect of INV on ROA depends on the level of OL. In other words, corporate investment had a positive impact on profitability and OL generally strengthens this relationship, that is, the impact of investment on profitability is greater for companies with higher OL.

This scenario shows that, although the highest OL has the possibility of increasing the risk of bankruptcy (Chen et al., 2019; Jiao et al., 2019), the results found do not indicate a negative effect of OL on investment, according to findings by Jiao et al. (2019). On the other hand, the non-significance of the control variables does not allow inferences about the association of FCL and PA in profitability or whether the possible replacement of part of PA by OL changes the type of relationship with investment or not (Chen et al., 2019; Jiao et al., 2019).

According to the results, the addition of the highest level of investment when the OL is greater may lead to the reasoning that instead of inhibiting investments (as found by Jiao et al., 2019), the greater OL promotes investments, which can be reached to the point of overinvestment. In relation to this possible behavior, some analysis is in order.

The period analyzed in the study, with the presence of political and economic crises, showed an average reduction in sales in five of the periods analyzed and the INV showed a negative average variation (ie, divestment) in six periods. This panorama may indicate that the companies in the sample still need investments to make up for the divestments in these periods of crisis.

An economic implication of this is the issue of idleness linked to OL. In the case of high OL, a greater impact of idle capacity is to be expected in times of reduced revenues, and more investments in this scenario can lead to more idleness and, consequently, lower profitability. But, that's not what the results showed. So, the adjustment of installed capacity, in times of falling sales, which may have occurred due to divestments, may have provided the need for more investments in times of sales growth, especially for companies with higher OL, as they have greater participation of fixed costs in the cost structure. Companies with lower OL tend to adjust more, simply because they have more variable costs, which generally follow the behavior of sales.

Although the investment measure used in this work takes into account not only expenses with fixed assets, which have a closer relationship with idle capacity, it is possible that companies in the sample with higher OL are affected by this problem in times of crisis.

Another point that reinforces this explanation is that the discussions and findings of Morgado and Pindado (2003) lead to the reasoning that, if the profitability found was higher for companies that invested more, it is possible that the optimal investment point was not reached by sample companies.

Therefore, tests were carried out to analyze the issue of overinvestment. Following the logic of the findings of Morgado and Pindado (2003), in the case of the presence of overinvestment, the expected performance would be negative. First, companies were classified by tertiles in relation to INV values, those belonging to the third tertile (highest values) were analyzed as having super investments. In this group, different results were not found in relation to the total sample and most of the coefficients proved to be non-significant.

Subsequently, Tobin's Q measure was used to classify companies in terms of growth opportunity, as used by Morgado and Pindado (2003). The results generated by the sample of companies with growth opportunity (Tobin's Q greater than 1) also did not show different results than those of the total sample.

The conclusion is that in the analyzed sample there is not a sufficient number of companies or periods with overinvestment capable of presenting a significant difference for this group. Which may be an indication that political and economic crises may have biased the calculation to capture overinvestment in the sample. Thus, the positive result between INV and ROA poto indicate that, on average, the companies in the sample did not exceed the optimal investment point, that is, they do not present super investments.

This result indicates that greater OL is an advantage for companies that have growth opportunities and have not reached the point of super investment. On the other hand, companies that face a lot of instability in relation to revenues or that have little opportunity for growth, would have more advantage in terms of ROA if they present a lower OL. The implication of this finding is that in investment decisions, the amount of OL and the investment opportunity are important factors.

5 Conclusions and Recommendations

Faced with the interaction of factors under which investment decisions are taken, which should aim at positive performance, this research sought to contribute by investigating the impact of OL on the relationship between corporate investment and profitability of companies listed on B3.

Based on the results, it was possible to verify that the OL moderates the relationship between investment and profitability, so that the higher the OL and the greater the investment, the greater the ROA. The contribution of this finding is to provide empirical evidence that a higher OL has the potential to increase the firm's profitability not only when sales increase, but also depending on the level of corporate investment in the previous period.

An economic explanation for this result is the possibility that companies in the sample with higher OL, in general, may have adjusted the idle capacity of installed capacity in periods of falling sales, probably due to divestments present in six of the eleven periods analyzed, the that would allow greater investments in times of increased sales. The implication of this result is that greater OL is an advantage for companies that have growth opportunities and have not reached the point of overinvestment in the companies in the sample.

By showing empirically that the investment is positively related to the company's profitability and that OL has an impact on this relationship, the study also contributes in several aspects. First, in relation to managers, by showing the behavior of factors that can affect investment decisions and profitability, which can provide subsidies to analyze the quality of investment decisions. This is important when bringing to management accounting discussions about aspects that affect the investment decision, cost structure and profitability.

Second, it contributes to the financial market (investors and analysts), by showing that OL is a factor to be considered in profit forecasting and that it can influence risk/return not only in relation to the market (Lev, 1974; Guthrie, 2011), but as for the company's profitability as well.

Third, it also contributes to academia, confirming that theoretical assumptions related to OL have been empirically confirmed. More specifically, it complements the study by Jiao et al. (2019), by including the company's profitability, showing how investment and OL decisions can affect it.

A limitation of the study is that the results are limited to companies in the observed sample. Another point that deserves to be highlighted is the period of time used, which resulted in only ten years of data for the analysis of the hypothesis.

A recommendation for future work is to expand the data/ observations and also carry out the analysis with other control or even explanatory variables that inhibit or promote investment, such as managers' remuneration, corporate governance and earnings management, to complement the results found in this study.

References

Baltagi, B. (2005). Econometric analysis of panel data (3rd ed.). New Jersey: John Wiley & Sons.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51(6), 1173-1182. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.917.2326&rep=rep1&type=pdf

Chen, Z., Harford, J., & Kamara, A. (2019). Operating Leverage, Profitability, and Capital Structure. *Journal of Financial and Quantitative Analysis*, 54(1), 369-392. DOI: https://doi.org/10.1017/S0022109018000595

Dawson, J. F. (2014). Moderation in management research: What, why, when and how. *Journal of Business and Psychology*, 29, 1-19. https://doi.org/10.1007/s10869-013-9308-7

Dechow, P. M., Richardson, S. A., & Sloan, R. G. (2008). The Persistence and Pricing of the Cash Component of Earnings. *Journal of Accounting Research*, 46 (3), 537-566. https://doi.org/10.1111/j.1475-679X.2008.00283.x

Fortunato, G., Funchal, B., & Motta, A. P. (2012). Impacto dos Investimentos no Desempenho das Empresas Brasileiras. *Revista de Administração Mackenzie*, 13(4), 75-98. https://doi.org/10.1590/S1678-69712012000400004

Grunewald, A. E. (1963). Planejamento financeiro e determinação do lucro. *Revista de Administração de Empresas*, 3(9), 69-89. https://www.scielo.br/j/rae/a/jqh4zgBT44SXNjm5sdzmrPb/?lang=pt

Gujarati, D. N., & Porter, D. C. (2011). *Econometria Básica*. 5a ed. Mc Graw Hill, Porto Alegre, RS.

Guthrie, G. (2011). A note on operating leverage and expected rates of return. *Finance Research Letters*, 8, 88-100. https://doi.org/10.1016/j.frl.2010.10.004

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2009) Análise multivariada de dados. 6a ed. Porto Alegre: Bookman.

Jensen, M. (1986). Agency Costs of Free Cash Flow, Corporate Finance and Takeovers. *American Economic Review*, 76(2), 323-329. https://www.jstor.org/stable/1818789

Jiang, C., Chen, H., & Huang, Y. (2006). Capital expenditures and corporate earnings evidence from the Taiwan Stock Exchange. *Managerial Finance*, 32(11), 853-861. https://doi.org/10.1108/03074350610703812

Jiao, F., Nishihara, M., & Zhang, C. (2019). Operating leverage and underinvestment. *The Journal of Financial Research*, XLII, 3, 553–587. https://doi.org/10.1111/jfir.12188

Kahl, M., Lunn, J., & Nilsson, M. (2019). Operating leverage and corporate financial policies. AFA. *Chicago Meetings Paper.* Retrieved from SSRN: http://dx.doi.org/10.2139/ssrn.1787184.

Kim, S. (2001). The near-term financial performance of capital expenditures: a managerial perspective. *Managerial Finance*, 27(8), 48-62. https://doi.org/10.1108/03074350110767330

Lev, B. (1974). On the association between operating leverage and risk. *The Journal of Financial and Quantitative Analysis*, 9(4), 627-641. https://doi.org/10.2307/2329764

Li, D. (2004). The Implications of Capital Investments for Future Profitability and Stock Returns in Overinvestment Perspective. Hass School of Business. University of California, Berkeley. Retrieved from: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.616.87&rep=rep1&type=pdf.

Lourenço, W. S., Louzada, L. C., & Novaes, P. V. G. (2020). Como a concentração do mercado influencia o desempenho operacional das empresas brasileiras? Uma análise do efeito moderador da concentração. *Revista de Gestão dos Países de Língua Portuguesa*, 19(1), 14-38. DOI: 10.12660/rgplp.v1n1.2020.78460

Morgado, A., & Pindado, J. (2003). The underinvestment and overinvestment hypotheses: an analysis using panel data. *European Financial Management*, 9(2), 163–177. https://doi.org/10.1111/1468-036X.00214

Navarro, A. C., Silva, A. F., Parisi, C., & Robles Jr, A. (2013). Decisões de Investimento e rentabilidade futura: estudo empírico com companhias abertas não financeiras. *Contabilidade, Gestão e Governança,* 16(1), 19-34. https://www.revistacgg.org/contabil/article/view/490

Novy-Marx, R. (2011). Operating Leverage. *Review of Finance*, 15, 103-134. https://doi.org/10.1093/rof/rfq019

Sarkar, S. (2020). The relationship between operating leverage and financial leverage. *Accounting & Finance*, 60, 805–826. https://doi.org/10.1111/acfi.12374

West, S. G., Aiken, L. S., & Krull, J. L. (1996). Experimental personality designs: analyzing categorical by continuous variable interactions. *Journal of Personality*, 64(1), 1-48. https://doi.org/10.1111/j.1467-6494.1996.tb00813.x