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The relationship between gross profit, operating profit and net income and future returns in Brazil

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Abstract

Objective: The objective of this study was to verify which of the profit definitions (gross profit, operating profit or net profit) performs better in explaining the future behavior of returns in the Brazilian market, and whether these results are maintained when forming portfolios combining profitability, book-to-market indexes and BrF_Score.
Method: To this end, the Fama and MacBeth two-stage regressions, Hotelling's T2 test and Fama and French's three-factor model are used, in addition to the analysis of the excess returns of the portfolios built. The periodicity of the study is monthly, covering the period from January 2010 to June 2019, totaling 15,577 observations from 200 firms.
Results: The results show that net income and operating income produce the profitability metrics with the greatest explanatory powers for one-month forward returns, and produce the portfolios with the highest excess returns compared to profitability metrics based on gross profit.
Contributions: Therefore, the contribution of the paper was to show that net income explains future returns better in the Brazilian market, while in the American market, there is evidence that gross profit plays this role, and these differences are due to the different macroeconomic influences suffered by such markets.

Keywords: Profitability, book-to-market, stock picking, excess return.

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Introdução

When looking to analyze the performance of a company, one of the performance metrics most used by investors is profitability. Net income, as it represents the result after deducting all expenses for the period, assumes the leading role among the known profitability metrics. However, the study carried out by Novy-Marx (2013) questions the argument that net profit would be the best profitability metric, indicating that gross profit standardized by total assets more reliably represents the company's true profitability.

The results of the work by Novy-Marx (2013) indicate that gross profit standardized by total assets has greater explanatory power than net profit standardized by equity, and the selection of stocks that take this profitability metric into account produces portfolios with greater expected returns. Furthermore, the author argues that income statement expense accounts that reduce gross profit (selling, general and administrative expenses, financial expenses and income tax and social contribution expenses) only add bias to net income and, therefore, the company's true profitability is more reliably measured when done through gross profit.

Ball et al. (2015) question these results arguing that the greater explanatory power attributed to gross profit by Novy-Marx (2013) stems from the different deflators used in the standardization of the two profitability metrics; besides, the author points out that, when standardized by the same deflator, gross, operating income, and net income produce profitability metrics that have similar capabilities in explaining future returns.

Unlike American companies, Brazilian companies are inserted in a macroeconomic scenario of greater uncertainty and volatility that ends up affecting their future results in several ways. Therefore, given the different macroeconomic influences suffered by Brazilian companies in relation to American companies, the following research problem arises: "Do the greater uncertainties related to the Brazilian economy and reflected in the volatility of the financial result influence the choice of accounting indicators used in the evaluation of strategies investment?"

Thus, the objective of this work is to evaluate which of the profit definitions (gross profit, operating profit or net profit) has the best performance in explaining the future behavior of returns in the Brazilian market, and if these results are maintained when analyzing the excess returns of the portfolios created for the different profitability metrics.

Using a monthly database, covering the period from January 2010 to June 2019, totaling 15,577 observations from 200 companies listed on B3, six profitability metrics were constructed. To determine the results, Fama and MacBeth's (1973) two-stage regressions were estimated in order to assess the explanatory power of each profitability metric for the return one month ahead. Fama and French's (1993) three-factor model was also used to assess how excess returns behave as the level of return on the portfolio increases. Therefore, the sample was divided into quintiles based on each profitability metric, and for each quintile, the three-factor model was estimated. And for the construction of the portfolios, the stocks are selected using the profitability metrics, the book-to-market index and the BrF_Score index.

Os resultados indicam que o lucro líquido e o lucro operacional produzem as métricas de rentabilidade com os maiores poderes explicativos para o retorno de um mês à frente, além de produzirem as carteiras com maiores excessos de retorno, se comparadas às métricas de rentabilidade baseadas no lucro bruto.

The results indicate that net income and operating income produce the profitability metrics with the greatest explanatory power for the one-month-ahead return, in addition to producing the portfolios with the greatest excess return, when compared to profitability metrics based on gross profit. Therefore, the contribution of this work is to show that, given the different macroeconomic influences suffered by Brazilian companies in relation to American companies, the profitability metrics that are based on net income and operating income have greater explanatory power for the returns from one-month-ahead, as well as produce portfolios with higher expected returns when combined with the book-to-market index and the BrF_Score index, when compared to profitability metrics based on gross profit.

2. Theoretical Reference

According to the discounted dividend model, the market value of a share is given by the present value of the expected dividends, according to equation (1):

$$P_t = \sum_{t=1}^{\infty} E(D_{t+\tau})/(1+r)^{\tau} \qquad (1)$$

where P_t is the price in period t, $E(Dt+2\tau)$ s) are the expected dividends in period $t+\tau$, and τ is the long-run expected return. Fama and French (2006) are based on

this model to show that the return of a stock is related to three variables: book-to-market ratio, profitability and investment. According to Ohlson (2009), the concept of *clean surplus accounting* says that $Y_{t+1} = Y_t + X_{t+1} - D_{t+1}$, where Y represents the net worth, X earnings per share and D net dividend. Applying this concept and standardized by equity, the discounted dividend model can be rewritten as:

$$Pt/Yt = \frac{\sum_{\tau=1}^{\infty} E(X_{t+\tau} - dY_{t+\tau})/(1+r)^{\tau}}{Y_t} \quad (2)$$

where the dividend of period t, D_t,is equal to earnings per share, X_t, minus the variation in equity, dY_t, from t-1 to t.The authors argue that the equation provides the following relationship: controlled by expected earnings and expected change in equity, a high ratio of book-to-market, Y_t/P_t, implies a high expected rate of return, τ. This relationship can be seen through equation (3):

$$Y_t/P_t = \frac{Y_t}{\sum_{\tau=1}^{\infty} E(X_{t+\tau} - dY_{t+\tau})/(1+r)^{\tau}} \quad (3)$$

where an increase on the left side of the equation must be offset by an increase in the interest rate, τ, which reduces the present value of expected dividends, increasing the ratio on the right side of the equation. Another relationship raised by the authors, through equation (3), shows that, controlled by the book-to-market ratio and by the expected change in equity resulting from reinvestment of profits, companies that are more profitable – specifically, companies that have high expected earnings relative to their net worth – have high expected returns. This relationship can be seen directly in equation (3), where, keeping the other parameters constant, an increase in the expected profit, $E(X_{t+\tau})$, must be offset with an increase in the interest rate, τ, to maintain equality between the two sides of the equation.

The use of these three financial anomalies in a combined way is one of the contributions of the work of Fama and French (2006), since previous works analyze the explanatory power of such anomalies in isolation, such as the work of Richardson and Sloan (2003) and Titman, Wei and Xie (2004), who point to the existence of a negative relationship between the company's investment level and the expected return obtained by its share, and Haugen and Baker (1996) and Cohen, Compers and Vuolteenaho (2002) who show that companies with higher levels of profitability have higher returns in the future.

Later works also indicate the relevance of the level of profitability in the stock selection process, such as Novy-Marx (2013), Jiang, Qi and Tang (2018) and Wahal (2019), being the work of Novy-Marx (2013) the most relevant because of its discoveries about a new way of measuring profitability.

Using a sample of American companies during the period from 1963 to 2010, Novy-Marx (2013) shows that profitability, defined as gross profit standardized by total assets, has approximately the same explanatory power of future returns as the book-to-market ratio, and that both parameters have a negative correlation with each other, and combined, produce a hedging strategy that enhances the expected return of a stock portfolio for the same level of risk.

Such findings motivated companies operating in the financial market to include gross profit as a profitability metric for the stock selection process, as reported in Forbes (2013) and CFA Institute Magazine (2014). In addition to the market, the findings of the work by Novy-Marx (2013) caught the attention of researchers in the field of finance, such as Ball et al. (2015), who presented some reservations regarding the results and conclusions presented by the author.

The authors point out that the superiority of gross profit in explanatory power found by Novy-Marx (2013) is exclusively due to the choice of different deflators, as the author compares the performance between gross profit and net profit, standardizing the former by total assets and the latter by net worth. In addition, their results show that expense accounts that reduce gross profit have statistically significant explanatory power for future returns, contradicting the hypothesis that such expense accounts only add bias to the company's profitability, as argued by Novy-Marx (2013). Also according to Ball et al. (2015), when analyzing the performance of operating profit versus gross profit, the results also show that when using the same deflators, both profitability metrics have similar explanatory power.

Unlike American companies, Brazilian companies are inserted in a macroeconomic scenario of greater uncertainty and volatility that ends up affecting their future results in several ways. In addition, in recent years there has been a sharp devaluation of the Brazilian currency against the US dollar. Companies that have operations linked to the dollar, therefore, face the increase in production factors that are imported, as well as see their expenses and costs increase, which ends up reducing the margins of these companies, affecting their profitability.

Therefore, the first hypothesis to be tested is:

H1 – For the Brazilian market, there is no difference in terms of explanatory power between gross profit, operating profit and net profit when using the same deflator.

In addition to the exchange rate, another macroeconomic factor that affects both economies differently are the basic interest rates, and analyzing historical data, it is possible to verify how much higher the Brazilian interest rate is compared to the American one, in addition to having greater volatility, and this indicates how much greater the financial expenses assumed by Brazilian companies can be in the acquisition of loans and financing when they are willing to raise capital to invest in their operations.

Through the discussion of such points, it is evident how the expense accounts used here, which are: general and administrative selling expenses, financial expenses and expenses with income taxes and social contribution, have great relevance in the calculation of the result and can be decisive for the future profitability of Brazilian companies. Therefore, the second hypothesis to be tested is as follows:

H2 - The expense accounts in the income statement, which reduce gross profit, have significant explanatory power for the return one month ahead.

In the same way that Novy-Marx (2013) shows that companies with high book-to-market ratios and high profitability have higher expected returns, Piotroski (2000) for the American market and Galdi and Lopes (2013) for the Brazilian market, point out that companies that have high book-to-market ratios and that are financially strong also have higher expected returns.

Using nine fundamental signs of the financial statements, Piotroski (2000) creates an index (F_Score) for the classification of companies according to their financial situation, and shows that companies that are located at the highest points of the index (financially strong companies) have higher future returns. Galdi (2008) and Galdi and Lopes (2013) present an adapted version of this index for the Brazilian market (BrF_Score), in which the authors replace one of the F_Score signals, the operating cash flow, with the net cash change, due to the non-mandatory disclosure of cash flow statements during the analysis period used in the work.

This work uses the BrF_Score index by Galdi (2008) and Galdi and Lopes (2013), including again the operating cash flow as a fundamental signal due to the availability of data throughout the analysis period.

Noting that the BrF_Score index classifies a company as financially strong considering, in addition to profitability, indicators on its capital structure, liquidity and operational efficiency, a stock selection strategy that takes into account both the book-to-market ratio, profitability, but also the BrF_Score index, can increase the expected return of the portfolio, since a greater number of selection criteria must be met, compared to strategies based on only two parameters. Thus, the next hypothesis to be tested arises:

H3: A portfolio composed of stocks selected using three criteria: BrF_Score index, book-to-market index and profitability, has a higher expected return than a portfolio with stocks selected using only two criteria: book-to-market index and profitability.

3 Methodology

To test hypotheses 1 and 2, the two-stage regressions of Fama and MacBeth (1973), the T^2 test of Hotelling (1931) and the three-factor model by Fama and French (1993) are used, and hypothesis 3 is tested through the analysis of the excess return of the constructed portfolios.

3.1 Regression of Fama-MacBeth (1973)

This regression presents a practical way to test the influence of risk factors on the expected return of an asset. The monthly return is defined as the accumulation of the daily return from the 14th of a month to the 15th of the following month in order to capture any effect on the return on shares arising from the disclosure of the financial statements. As described in Cochrane (2009), for each asset i, with i varying from 1 to n, in factors, in the first stage regressions in time series are estimated, one for each asset i with all factors. Thus, the exposure of each asset to the set of factors is obtained, according to equation (4):

$$R_{n,t} = \beta_n + \beta_{m,n} RENT^m_t + \beta_{s,n} \sum^4_{s=1} CONTROLS^s_t + \varepsilon_{n,t} \quad (4)$$

where $R_{n,t}$ is the return of asset i in month t, being n the maximum. $RENT^m_t$ represents the profitability metric m, with m ranging from 1 to 6, in month t. The profitability metrics are: ROA_{LB} - gross profit standardized by total assets, lagged one month; ROA_{LO} - operating profit standardized by total assets, lagged one month; ROA_{LL} - net income standardized by total assets, lagged one month; ROE_{LB} - gross profit standardized by shareholders' equity, lagged one month; ROE_{LO} - operating profit

standardized by shareholders' equity, lagged one month; ROE_{LL} net income standardized by equity, lagged one month. $CONTROLS^{s}_{t}$ represent the controls used, in month t, which are: the natural logarithm of the book-to-market (BTM), where BTM is defined as equity divided by market value lagged six months - as defined by Novy-Marx (2013) to avoid capturing unwanted momentum effects in this variable - the natural logarithm of market value lagged six months (VM), a momentum variable (MOM), which is defined as the cumulative return from month t-12 until month t-2, and the accumulated return during the previous month (Ret_{t-1}).

In the second stage, regressions are generated with cross section data, one for each period, of the returns against the betas estimated in the first stage, because the objective now is to estimate how the exposure of the n assets to the m factors over time will behave. In this way, the average effect of each risk factor on the return of each asset is estimated.

$$R_{i,T}=\gamma_{T,0}+\gamma_{n,m}\,\hat{\beta}^{m}_{n,i}+\gamma_{n,s}\sum^{4}_{s=1}\hat{\beta}^{s}_{n,i}+\vartheta i,T \qquad (5)$$

where $R_{i,T}$ are the same returns as in equation (4), $\gamma_{n,m}$ are the coefficients that measure the average impact of each profitability metric on the return on assets, withm ranging from 1 to 6 for n observations, and the betas of the control variables are identified through the s index. Therefore, the risk premium estimate for each factor, $\hat{\gamma}$, is the average of each γ estimate over the T months.

As an additional test for hypothesis 2, which seeks to test whether the expense accounts that reduce gross profit are able to explain future returns, Hotelling's T^2 test, developed by Harold Hotelling (1931) is used. King and EcKersley (2019) show that the T^2 test is a generalization of Student's t for multivariate data, according to equation (6):

$$t = \frac{\bar{x}-\mu}{s/\sqrt{n}} \qquad (6)$$

where $\underline{x}$ is the sample mean (univariate), μ is the expected value of the mean, n is the sample size and s is the sample standard deviation. By squaring both sides and rearranging, we have:

$$T^2 = n(\underline{x}-\mu)(s^2)^{-1}(\underline{x}-\mu) \qquad (7)$$

where s^2 is the sample variance. The authors show that generalizing the above equation to a multivariate case, the equation in the matrix representation results in:

$$T^2 = n(\underline{x}-\mu)'C^{-1}(\underline{x}-\mu) \qquad (8)$$

where $\underline{X}$ is now the multivariate sample mean, μ is the vector of expected values, and C is the covariance matrix, defined as:

$$C = \frac{1}{n-1}\sum_{i=1}^{n}(X_i-\underline{X})(X_i-\underline{X})' \qquad (9)$$

It is important to note that when squaring a (multivariate) random variable with t distribution with p observations and n-1 degrees of freedom, the result is an F-distributed random variable with p and n-1 degrees of freedom. Harold Hotteling (1937) demonstrates that when the null hypothesis is true, that is, the sample mean is equal to the expected mean, the following approximation occurs:

$$T^2 \approx \frac{p(n-1)}{n-p}F_{p,n-p} \qquad (10)$$

where $F_{p,n-p}$ represents a distribution F with p and n-p freedom degrees. Rearranging the equation, we have:

$$F = \frac{n-p}{p(n-1)}T^2 \qquad (11)$$

Hotelling's T^2 test, according to Ball et al. (2015) is the appropriate test for the context of Fama and MacBeth regressions, as the test is based on collecting each estimated coefficient for each time period of the Fama and MacBeth regression and testing whether this vector is statistically different from a null vector. To complement the test of hypothesis 2, Hotelling's T^2 test was performed using the vector composed of the averages of the coefficients of the three accounts that reduce gross profit, and if the test is rejected, it is concluded that the vector of averages is different from zero and, therefore, the variables have significant explanatory power for future returns.

3.2 Fama and French's Three-Factor Model (1993)

The second regression used was the three-factor model of Fama and French (1993), presented through equation (12):

$$R_{it} - R_{Ft} = a_i + b_i MKT_t + s_i SMB_t + h_i HML_t + e_{it} \qquad (12)$$

where R_{it} is the return of the firm i in month t, R_{Ft} is the risk-free rate, defined as the daily return of the IBrX100 index, accumulated in month t. The three factors were obtained through NEFIN (*Brazilian Center for Research in Financial Economics of the University of São Paulo*) on a daily basis, and subsequently, the accumulation for monthly periodicity. The market factor (MKT_t) is defined as the difference between the return on a market portfolio and the return on the risk-free rate. The SMB_t factor (small

minus big factor) is defined as the return on a portfolio bought in shares of companies with low market value (small) and sold in a portfolio with shares of companies with high market value (big). The HML_t factor (high minus low factor) is defined as the return on a portfolio bought in shares of companies with a high book-to-market ratio and sold in shares of companies with a low book-to-market ratio.

The coefficients b_i, s_i and h_i represent the magnitude with which the factors capture variations in excess return. Therefore, if the coefficients are able to capture all the excess return variation, the intercept α_i is zero for all i (Fama & French, 1993; Fama & French, 2015). The process of estimating the coefficients was through the division of the sample into quintiles, based on the profitability of the companies, in order to verify how the abnormal return (α_i) of portfolios with shares of companies with different levels of profitability behaves, providing an additional way to the Fama and MacBeth regressions to test the first hypothesis of the work.

3.3 BrF_Score Index

According to Galdi and Lopes (2013), the signals that make up the BrF_Score are used to measure profitability, changes in capital and liquidity structure, and operational efficiency in order to identify the actions of companies that are considered financially strong. The BrF_Score index of each company is the sum of all fundamental signals, according to equation (13):

$$BrF\_SCORE = F\_ROA + F\_CE + F\_FCO + F\_\Delta ROA + F\_ACCRUAL + F\_LIQUID + F\_ALAV + F\_(OF\_PUB) + F\_\Delta MARGEM + F\_\Delta GIRO \quad (13)$$

Profitability is measured using the following signals: return on assets (ROA), operating cash flow (FCO), change in return on assets (ΔROA) and accruals (ACC). ROA is defined as net income divided by total assets at the beginning of the period and it is considered a "good" sign when the ROA is positive and a "bad" sign when the ROA is negative. FCO is defined as cash flow generated from operations divided by total assets at the beginning of the period and it is considered a "good" sign when the FCO is positive and a "bad" sign when the FCO is negative. ΔROA is considered a "good" sign when the variation in ROA from one period to the next is positive, and it is considered a "bad" sign when the variation is negative. In the same way that Galdi and Lopes (2013) used Sloan's (1996) balance method to calculate accruals, it is also done in this work. Therefore, the accruals are defined according to equation (14):

$$ACC = (\Delta ASSET\_C - DCE) - (\Delta LIABILITY\_C - \Delta DEBT\_CP) - DEP) / ASSETT_{t-1} \quad (14)$$

where ACC are the total accruals, ΔASSET_C is the change in current assets, DCE the change in cash and cash equivalents, ΔLIABILITY_C the change in current liabilities, ΔDEBT_CP the change in short-term debt, DEP the depreciation and $ASSET\_T_{t-1}$ are total assets lagged one period. Sloan (1996) argues that, given the relationship between profit and operating cash flow, positive accruals (ie, operating cash flow greater than net income) represent a poor indicator of returns and future profitability. Thus, if the accruals are positive, it is considered a "bad" sign, while negative accruals are considered a "good" sign.

Changes in the capital and liquidity structure are measured using the following signals: net cash change (DCE), liquidity (LIQ), leverage (LEV) and public offering of shares (OF_PUB). The net change in cash is defined as the change in cash and cash equivalents from one period to another, standardized by total assets at the beginning of the period. A positive DCE is a "good" signal, while a negative change is considered a "bad" signal. Liquidity is defined as the ratio between current assets and current liabilities, and it is considered a "good" sign when liquidity is positive, while negative liquidity is considered a "bad" sign. Leverage is defined as the ratio of short-term debt to total assets at the beginning of the period. Leverage represents a "good" signal when it is negative, and a "bad" signal when it is positive. The public offering of shares is defined as the variation in the number of shares outstanding from one period to another, and is a "good" sign when such variation is negative and a "bad" sign when positive.

The signs of operational efficiency are: the variation in gross margin (ΔMARGIN) and the variation in operating turnover (ΔTURN). Gross margin variation is defined as the variation in gross margin from one period to the next, where gross margin is calculated as the ratio of gross profit to net revenue. It is a "good" sign when the change in gross margin is positive, and a "bad" sign when the change is negative. Operating turnover change is defined as the variation in operating turnover from one period to the next, where operating turnover is defined as net income for the period divided by total assets at the beginning of the period, and it is a "good" sign when the variance is positive and a "bad" sign when the variance is negative.

The BrF_Score index can range from zero (when all signals are considered "bad") to ten (when all signals are considered "good"). Galdi (2008) considers companies with a high BrF_Score index to be those that obtained points in the range 7 to 9, while companies with a low BrF_Score index are those with scores less than or equal to 3. As in this work there are 10 fundamental signs, the classification is defined as: companies considered financially strong have scores in the range of 8 to 10, companies considered financially weak have scores in the range of 0 to 2, and companies that have scores in the range of 3 to 7 are considered neutral. In the next section, the analysis of the data and the results found are presented.

4. Data Analysis and Results

4.1 Data Base

The financial statement information was obtained through the Economatica software, the market data through the NEFIN (Brazilian Center for Research in Financial Economics of the University of São Paulo) website and the B3 website, and the results were generated using the Stat software. The periodicity of the study is monthly, covering the period from January 2010 to June 2019. The analysis period is chosen in order to exclude possible effects of the 2007-2008 financial crisis and to cover a period after the adoption of the International Financial Reporting Standards (IFRS). Table 1 below shows the data cleaning process from the initial sample to the final sample.

Table 1. *Data construction*

Total firms in initial sample	**39.917**
Deletion of observations of companies with negative equity	**349**
Exclusion of company observations without information for total assets	(3.796)
Exclusion of observations from companies without information for feedback	(2.938)
Exclusion of company observations without information for book-to-market	(10.047)
Exclusion of observations from companies in the Financial and Others sector	(335)
Deletion of observations of companies without information for momentum	(4.264)
Deletion of observations of companies without information for □ROA□_lb	(2.288)
Deletion of observations of companies without information for financial exp.	(1)
Final sample	(671)
Total firms in initial sample	**15.577**
Quantidade de empresas na Amostra Final	**200**

4.2 Descriptive Statistics

Table 2 below presents the descriptive statistics of the data. All variables were winsorized at the 2.5% level. The reason for using the winsor technique is to minimize the influence of potential data that are outliers. It is a technique that has been commonly used in similar research and its use is important for such research to be comparable.

Table 2. *Descriptives*

	N	Mean	SD	Min	Q1	Med	Q3	Max
RET	15577	0,511	10,35	-21,65	-6,061	0,000	6,540	25,53
IBrX100	15577	0,867	5,522	-9,736	-2,887	0,836	5,218	12,32
EX_RET	15577	-0,004	11,61	-24,49	-7,703	-0,289	7,317	26,87
LIQ	15577	0,314	0,457	0,0001	0,009	0,098	0,462	1,956
ROA_{LB}	15577	11,82	10,88	-0,314	4,118	8,587	15,68	46,74
ROA_{LO}	15577	3,316	5,518	-7,652	0,033	2,384	5,873	19,35
ROA_{LL}	15577	2,115	4,114	-8,175	0,052	1,628	4,191	12,62
ROE_{LB}	15577	37,20	44,75	-1,087	11,03	22,69	44,54	223,2
ROE_{LO}	15577	6,422	18,85	-58,58	0,116	6,002	14,14	56,21
ROE_{LL}	15577	3,157	15,30	-60,81	0,136	4,147	9,730	31,39
BTM	15577	16,13	1,469	12,57	15,22	16,12	17,07	19,39
VM	15577	14,53	1,730	10,89	13,25	14,70	15,75	17,86
RET_{t-1}	15577	0,511	10,41	-21,88	-6,063	0,000	6,514	25,99
MOM	15577	16,64	56,59	-68,03	-21,34	6,764	40,53	198,4
IRCS	15577	0,809	1,227	-1,609	0,071	0,527	1,313	4,503
DVGA	15577	7,212	7,724	0,141	2,113	4,498	9,332	34,27
DF	15577	3,179	2,916	0,036	1,068	2,310	4,310	12,73

Fonte: Elaborado pelos autores.

The results indicate that the average monthly return of the companies in the sample is 0.51% with a standard deviation of 10.35%, indicating the existence of a high heterogeneity of returns, which can also be verified through its amplitude, with a return of -21.65% p.m. for the lowest observed value and 25.53% p.m. to the highest observed value. The liquidity of the Ibovespa and IbrX100 indices, which were 0.80 and 0.62, respectively, indicating that stocks with similar liquidity belong to the last quartile of the sample and that, therefore, more than three quarters of the sample has liquidity lower than the liquidity of such indices. There is greater volatility for profitability metrics based on gross profit, indicating that the deduction of expenses in the income statement ends up reducing the volatility of profits.

Table 3 below presents Pearson's correlations between the variables. Among the profitability metrics, only ROE_{LB} does not have a statistically significant correlation at the 1% level of significance with RET. Analyzing the correlations between the profitability metrics and the book-to-market ratio, it is observed that only the profitability metrics based on gross profit, ROA_{LB} and ROE_{LB}, have a negative correlation with BTM. The justification can be obtained by analyzing the correlations between two of the variables that represent the expense accounts that reduce gross profit (DVGA e DF) and the book-to-market ratio, which are negative and highly significant.

Tabela 3. *Correlação de Pearson*

	RET	IBrX100	EX_RET	LIQ	ROA_{LB}	ROA_{LO}	ROA_{LL}	ROELB	
RET	1,0000								
IBrX100	0,0249*	1,0000							
EX_RET	0,8733*	-0,4468*	1,0000						
LIQ	0,0238*	0,0084	0,0174	1,0000					
ROA_{LB}	0,0440*	-0,0020	0,0388*	-0,0261*	1,0000				
ROA_{LO}	0,0912*	-0,0080	0,0842*	0,1164*	0,6325*	1,0000			
ROA_{LL}	0,1125*	-0,0028	0,1009*	0,1057*	0,5595*	0,8550*	1,0000		
ROE_{LB}	0,0114	0,0002	0,0078	-0,0019	0,6345*	0,2022*	0,1350*	1,0000	
ROE_{LO}	0,0933*	-0,0021	0,0834*	0,1707*	0,4767*	0,8246*	0,6959*	0,2076*	
ROE_{LL}	0,1087*	-0,0037	0,0978*	0,1562*	0,3867*	0,6597*	0,8081*	0,0722*	
BTM	0,0479*	0,0178	0,0367*	0,6378*	-0,1212*	0,1751*	0,1844*	-0,2686*	
VM	0,0375*	0,0057	0,0318*	0,6823*	0,1032*	0,3536*	0,3288*	-0,0138	
RET_{t-1}	0,0649*	-0,0746*	0,0922*	0,0249*	0,0404*	0,0978*	0,1184*	0,0055	
MOM	0,0612*	-0,0333*	0,0703*	0,0342*	0,1380*	0,2252*	0,2667*	0,0443*	
IRCS	0,0654*	-0,0083	0,0609*	0,0356*	0,4977*	0,7163*	0,6409*	0,1969*	
DVGA	0,0100	0,0003	0,0076	-0,1226*	0,8708*	0,2582*	0,2527*	0,5901*	
DF	-0,0409*	0,0143	-0,0430*	-0,0949*	0,2205*	-0,1602*	-0,1682*	0,4756*	

	ROE_{LO}	ROE_{LL}	BTM	VM	RET_{t-1}	MOM	IRCS	DVGA	DF
ROE_{LL}	1,0000								
BTM	0,7963*	1,0000							
VM	0,2514*	0,2674*	1,0000						
RET_{t-1}	0,3951*	0,3535*	0,8470*	1,0000					
MOM	0,0994*	0,1169*	0,0475*	0,0348*	1,0000				
IRCS	0,2069*	0,2427*	0,0295*	0,0818*	0,2549*	1,0000			
DVGA	0,5876*	0,4730*	0,0443*	0,2134*	0,0673*	0,1685*	1,0000		
DF	0,1438*	0,1364*	-0,2726*	-0,1050*	0,0033	0,0523*	0,2330*	1,0000	
	-0,1810*	-0,2117*	-0,2119*	-0,1413*	-0,0621*	-0,1029*	-0,0897*	0,2488*	1,0000

Nota 1: Os asteriscos, *, representam correlações estatisticamente significantes ao nível de 1% de significância.
Fonte: Elaborado pelos autores.

4.3 Regressions of Fama-MacBeth

Table 4 below presents the results of the Fama and MacBeth's regressions (1973). The regression (1) is estimated without profitability metrics so that the incremental explanatory power of each metric can be compared when added, one by one, to regressions (2) through (7). In regressions (8) and (9) profitability metrics based on gross profit are used and expense accounts that reduce gross profit are included, in order to verify whether these expense accounts also help to explain future return.

Table 4. *Fama and Macbeth regressions (1973)*

ROA_{LB}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ROA_{LO}		0.119***						0.199***	
		[0.017]						[0.034]	
ROA_{LL}			0.263***						
			[0.029]						
ROE_{LB}				0.389***					
				[0.040]					
ROE_{LO}					0.011***				0.032***
					[0.003]				[0.007]
ROE_{LL}						0.057***			
						[0.007]			
DF							0.080***		
							[0.009]		
IRCS								-0.057	-0.024***
								[0.048]	[0.007]
DVGA								0.367***	0.065**
								[0.122]	[0.028]
BTM								-0.147***	-0.020***
								[0.035]	[0.007]
VM	0.020	-0.379***	-0.440***	-0.410***	-0.156	-0.341***	-0.254**	-0.521***	-0.273*
	[0.122]	[0.133]	[0.124]	[0.120]	[0.143]	[0.126]	[0.121]	[0.144]	[0.147]
RET_{t-1}	-0.005	-0.011	-0.012	-0.013	-0.07	-0.009	-0.011	-0.017	-0.014
	[0.013]	[0.012]	[0.012]	[0.012]	[0.013]	[0.013]	[0.012]	[0.013]	[0.013]
MOM	0.014***	0.012***	0.009***	0.007**	0.014***	0.011***	0.009***	0.010***	0.012***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
CON	-4.011***	-6.753***	-3.125**	-2.599	-5.658***	-2.305*	-1.646	-4.543***	-3.362**
	[1.374]	[1.380]	[1.361]	[1.361]	[1.537]	[1.371]	[1.367]	[1.402]	[1.696]
Pr.>F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
$R^2_{Aj.}$	6,15%	7,00%	7,87%	8,12%	6,57%	7,63%	7,60%	7.75%	8.12%
$\Delta R^2_{Aj.}$	-	0,85%	1,72%	1,97%	0,42%	1,48%	1,45%	1,60%	1,97%
T test for the variation of the Adjusted R2 in relation to the model (1)									
Est. T		4.08	5.90	6.59	3.09	5.60	5.91	4.56	6.81
p-Value		0.0001	0.0000	0.0000	0.0032	0.0000	0.0000	0.0000	0.0000
T test between the Adjusted R2 between models									
Test Order		(4) – (2)	(3) – (2)	(4) – (3)	(5) – (7)	(6) – (5)	(7) – (6)	(4) – (7)	(9) – (8)
Est. T	-	3.79	3.46	1.45	3.96	3.80	0.77	2.37	1.31
p-Value	-	0.0001	0.0004	0.1503	0.0001	0.0002	0.4404	0.0193	0.1919
Obs.	15577	15577	15577	15577	15577	15577	15577	15577	15577
T^2								7,08	13,52
Pr.> T^2								0.0002	0.0000

Note 1: The asterisks, ***, **, * represent statistically significant coefficients at the 1%, 5% and 10% levels, respectively.

The results show that all increases in explanatory power are statistically significant, indicating that all profitability metrics add explanatory power to the model, confirming the usefulness of taking into account the profitability levels of companies when designing an investment strategy.

When analyzing the t tests, which assess whether the increase in explanatory power differs between the profitability metrics, the following conclusions are obtained: the explanatory power generated by ROA_{LO} is statistically significant greater than the explanatory power generated by ROA_{LB}, with a p-value of 0.0004; the explanatory power generated by ROA_{LL} is not statistically significantly greater than the explanatory power generated by ROA_{LO}, with a p-value of 0.1503. Likewise, when analyzing the results for the profitability metrics that are standardized by equity, the explanatory power generated by ROE_{LO} is statistically significantly greater than the explanatory power generated by ROE_{LB}, with a p-value of 0.0002 ;the explanatory power generated by ROE_{LL} is not statistically significantly greater than the explanatory power generated by ROE_{LO}, with a p-value of 0.4404, but the explanatory power of ROE_{LL} is statistically significantly greater than the explanatory power of ROE_{LB}, with a p-value of 0.0001.

These results do not confirm the first hypothesis of the work that when using the same deflator, both gross profit and operating profit and net profit must present the same explanatory power. The results of regressions (8) and (9) show that the expense accounts are statistically significant and, therefore, have significant explanatory power for the return one month ahead. Furthermore, since Hotelling's T^2 statistic is proportional to an F distribution (3, 111), which yields a test statistic of 7.08 for regression (8) and 13.52 for regression (9), the test reject the null hypothesis that the vector of averages of the coefficients of the variables DVGA, DF and IFRS is equal to a null vector.

4.4 Fama and French's Three-Factor Model

Table 5 below presents the results for the regressions of Fama and French's (1993) three-factor model, where each panel presents the results for a given profitability metric.

Table 5. *Three factors model: Fama e French (1993)*

Panel A			**Gross Profit / Total Assets - ROA_{LB}**					
	α	**MKT**	**SMB**	**HML**	**EX_RET**	**Liquidez**	**ROA_{LB}**	**Obs**
Low	-1.229*** [0.249]	-0.919*** [0.056]	0.491*** [0.076]	-0.078 [0.082]	-1,508	0,236	1,631	2377
2	-0.218 [0.189]	-0.878*** [0.042]	0.454*** [0.058]	-0.167*** [0.062]	-0,463	0,408	5,906	3107
3	0.509*** [0.175]	-0.935*** [0.038]	0.478*** [0.053]	-0.228*** [0.057]	0,193	0,325	8,792	3400
4	0.900*** [0.175]	-0.947*** [0.038]	0.454*** [0.052]	-0.296*** [0.056]	0,532	0,315	13,17	3237
High	1.016*** [0.164]	-0.888*** [0.036]	0.569*** [0.049]	-0.374*** [0.054]	0,749	0,272	26,34	3456
A – B **(chi2)** **p-Value**	**2.245***** 56.00 0.0000	0.031 0.22 0.6382	0.078 0.75 0.3876	**-0.296**** 9.01 0.0027				
Panel B			**Operating Income / Total Assets - ROA_{LO}**					
	α	**MKT**	**SMB**	**HML**	**EX_RET**	**Liquidez**	**ROA_{LO}**	**Obs**
Low	-1.712*** [0.233]	-0.884*** [0.053]	0.544*** [0.072]	-0.226*** [0.077]	-2,006	0,122	-3,947	2819
2	-0.256 [0.211]	-0.911*** [0.046]	0.475*** [0.064]	-0.157** [0.068]	-0,591	0,334	0,419	2943
3	0.590*** [0.184]	-0.957*** [0.041]	0.433*** [0.055]	-0.138** [0.061]	0,343	0,396	2,696	2986
4	1.106*** [0.159]	-0.874*** [0.035]	0.475*** [0.047]	-0.284*** [0.051]	0,789	0,352	5,025	3384
High	1.362*** [0.153]	-0.928*** [0.033]	0.525*** [0.046]	-0.375*** [0.050]	1,093	0,343	10,62	3380
A – B **(chi2)** **p-Value**	**3.074** 119.03 0.0000	**-0.044** 0.48 0.4906	**0.019** 0.05 0.8232	**-0.149** 2.45 0.1175				

Panel C					Net Income / Total Assets - ROA_{LL}			
	α	MKT	SMB	HML	EX_RET	Liquidez	ROE_{LL}	Obs
Low	-1.714*** [0.226]	-0.919*** [0.051]	0.547*** [0.070]	-0.122 [0.074]	-2,006	0,160	-3,649	2978
2	-0.271 [0.199]	-0.902*** [0.045]	0.483*** [0.059]	-0.243*** [0.066]	-0,569	0,326	0,424	3091
3	0.625*** [0.180]	-0.942*** [0.039]	0.425*** [0.054]	-0.148*** [0.058]	0,385	0,385	1,948	3087
4	1.220*** [0.164]	-0.935*** [0.036]	0.494*** [0.049]	-0.298*** [0.054]	0,844	0,349	3,634	3175
High	1.458*** [0.159]	-0.866*** [0.035]	0.512*** [0.048]	-0.380*** [0.051]	1,174	0,343	7,107	3246
A – B	**3.172*** **	**0.053**	**-0.035**	**-0.258*** **				
(chi2)	126.19	0.02	0.07	7.95				
p-Value	0.0000	0.8851	0.7909	0.0048				
Panel D					**Gross Profit / Equity Book Value - ROE_{LB}**			
	α	MKT	SMB	HML	EX_RET	Liquidez	ROE_{LB}	Obs
Low	-0.959*** [0.251]	-0.897*** [0.056]	0.441*** [0.077]	-0.077 [0.082]	-1,357	0,141	-1,826	2197
2	0.189 [0.181]	-0.860*** [0.040]	0.529*** [0.055]	-0.325*** [0.059]	-0,058	0,397	15,36	3242
3	0.372** [0.171]	-0.914*** [0.038]	0.385*** [0.052]	-0.164*** [0.056]	0,128	0,347	23,95	3312
4	0.710*** [0.169]	-0.988*** [0.037]	0.532*** [0.050]	-0.271*** [0.054]	0,432	0,324	36,93	3514
High	0.698*** [0.185]	-0.890*** [0.041]	0.536*** [0.056]	-0.310*** [0.061]	0,354	0,305	161,2	3312
A – B	**1.657*** **	**0.007**	**0.095**	**-0.233** **				
(chi2)	28.08	0.01	1.03	5.05				
p-Value	0.0000	0.9199	0.3100	0.0246				
Panel E					**Operating Income / Equity Book Value - ROE_{LO}**			
	α	MKT	SMB	HML	EX_RET	Liquidez	ROE_{LO}	Obs
Low	-1.665*** [0.232]	-0.891*** [0.052]	0.548*** [0.076]	-0.194** [0.076]	-1,980	0,133	-62,23	2903
2	-0.187 [0.210]	-0.905*** [0.047]	0.489*** [0.064]	-0.236*** [0.069]	-0,516	0,310	1,308	2756
3	0.662*** [0.187]	-0.870*** [0.041]	0.429*** [0.056]	-0.209*** [0.060]	0,342	0,319	7,729	3004
4	0.873*** [0.154]	-0.928*** [0.034]	0.492*** [0.046]	-0.264*** [0.050]	0,524	0,358	9,531	3512
High	1.446*** [0.159]	-0.949*** [0.035]	0.493*** [0.048]	-0.293*** [0.052]	1,288	0,422	29,74	3337
A – B	**3.111*** **	**-0.058**	**-0.055**	**-0.099**				
(chi2)	120.49	0.85	0.40	1.11				
p-Value	0.0000	0.3566	0.5279	0.2920				
Panel F					**Net Income / Equity Book Value - ROE_{LL}**			
	α	MKT	SMB	HML	EX_RET	Liquidez	ROE_{LL}	Obs
Low	-1.758*** [0.224]	-0.899*** [0.050]	0.518*** [0.069]	-0.132* [0.073]	-2,081	0,175	-48,29	3077
2	-0.229 [0.204]	-0.905*** [0.046]	0.501*** [0.062]	-0.243*** [0.068]	-0,516	0,282	0,671	2859
3	0.607*** [0.179]	-1.006*** [0.039]	0.478*** [0.054]	-0.100* [0.058]	0,326	0,355	4,454	3003
4	1.046*** [0.156]	-0.854*** [0.034]	0.435*** [0.047]	-0.336*** [0.051]	0,727	0,330	9,013	3462
High	1.653*** [0.167]	-0.902*** [0.037]	0.537*** [0.050]	-0.375*** [0.054]	1,361	0,422	16,94	3176
A – B	**3.411*** **	**-0.003**	**0.019**	**-0.243*** **				
(chi2)	147.88	0.00	0.05	6.87				
p-Value	0.0000	0.9531	0.8291	0.0088				

Note 1: The asterisks, ***, **, * represent statistically significant coefficients at the 1%, 5% and 10% levels, respectively.

Note 2: Portfolios are constructed by separating the sample into quintiles, based on profitability metrics, where Low represents the portfolio composed of shares of companies with the lowest level of profitability and the High portfolio represents the portfolio composed of shares of companies with the highest level of profitability. of profitability.

The results obtained in long-short strategies (when trading short in portfolios composed of shares of companies with a low level of profitability and long in portfolios composed of shares of companies with a high level of profitability) were 2.24% p.m., 3, 07% p.m. and 3.17% p.m. for ROA_{LB}, ROA_{LO} and ROA_{LL}, respectively, and 1.65% p.m., 3.11% p.m. and 3.41% a.m. for ROA_{LB}, ROE_{LO} and ROE_{LL}, respectively. Thus, it is observed that regardless of the deflator used, gross profit has the worst performance in generating excess returns, followed by operating income and net income, which have not very different excess returns, which indicates that profitability is capable of to capture part of the expected return that Fama and French's (1993) three-factor model does not capture.

4.5 Formation of Portfolios

In this section, the portfolios constructed taking into account the level of profitability, the book-to-market index and the punctuation in the BrF_Score index of the companies are presented, in order to analyze the average performance in terms of excess return of the different strategies.

Table 6. *Portfolio excesso return*

Portfolio	EX_RET	DP	MED	LIQ	N
ROA_{LB} x BTM (1x1)	-2,201	12,87	-2,633	0,015	1152
ROA_{LB} x BTM (3x3)	0,958	9,796	0,342	0,624	1343
Long – Short	**3,159**				
ROA_{LO} x BTM (1x1)	-1,999	12,85	-2,609	0,023	1978
ROA_{LO} x BTM (3x3)	0,828	9,590	0,536	0,604	2098
Long – Short	**2,827**				
ROA_{LL} x BTM (1x1)	-2,168	12,62	-2,671	0,030	2002
ROA_{LL} x BTM (3x3)	0,779	9,870	0,449	0,615	1937
Long – Short	**2,947**				
ROE_{LB} x BTM (1x1)	-1,405	12,77	-1,852	0,018	1048
ROE_{LB} x BTM (3x3)	0,626	10,85	0,274	0,701	1530
Long – Short	**2,031**				
ROE_{LO} x BTM (1x1)	-2,024	12,90	-2,616	0,021	1957
ROE_{LO} x BTM (3x3)	0,716	9,837	0,342	0,698	2161
Long – Short	**2,740**				
ROE_{LL} x BTM (1x1)	-2,138	12,64	-2,609	0,027	1936
ROE_{LL} x BTM (3x3)	0,851	9,863	0,510	0,698	2015
Long – Short	**2,989**				

Note 1: The average liquidity for the IBrX100 and Ibovespa shares is 0.62 and 0.80, respectively.

The results show that operating long in portfolios composed of shares of companies with high profitability and with a high book-to-market ratio present excess positive returns that vary between 0.62% p.m. and 0.96% p.m., on average. It is also observed that the strategy of operating short in portfolios composed of shares of companies with low profitability and low book-to-market ratio can present high excess returns, given the poor performance of these portfolios.

In this way, the implementation of long-short strategies enhances the expected return of the portfolios, which can vary between 2.03% p.m. and 3.16% p.m., for the worst and best scenario, respectively. It is observed that the portfolios composed of stocks of companies with high profitability and high book-to-market ratio present greater liquidity than the portfolios formed by stocks with low profitability and low book-to-market ratio, requiring greater attention to liquidity for the implementation of strategies.

Table 7 below shows the performance of the portfolios built through the interaction between strategies based on profitability, book-to-market index and BrF_Score.

Table 7. *Portfolio Excess Return*

Portfolio	EX_RET	DP	MED	LIQ	OBS
ROA_{LB} x BTM x BrF (1x1x1)	-5,219	13,32	-6,133	0,014	234
ROA_{LB} x BTM x BrF (3x3x3)	1,708	9,090	0,862	0,559	166
Long – Short	**6,927**				
ROA_{LO} x BTM x BrF (1x1x1)	-5,521	12,95	-6,495	0,014	326
ROA_{LO} x BTM x BrF (3x3x3)	2,350	8,444	2,123	0,540	250
Long – Short	**7,871**				
ROA_{LL} x BTM x BrF (1x1x1)	-5,514	12,86	-6,415	0,016	333
ROA_{LL} x BTM x BrF (3x3x3)	2,522	8,463	2,185	0,532	219
Long – Short	**8,036**				
ROE_{LB} x BTM x BrF (1x1x1)	-5,326	13,20	-7,210	0,022	195
ROE_{LB} x BTM x BrF (3x3x3)	1,145	9,664	0,931	0,576	155
Long – Short	**6,471**				
ROE_{LO} x BTM x BrF (1x1x1)	-5,563	12,89	-6,574	0,014	327
ROE_{LO} x BTM x BrF (3x3x3)	1,970	8,308	1,406	0,574	248
Long – Short	**7,533**				
ROE_{LL} x BTM x BrF (1x1x1)	-5,497	12,90	-6,399	0,016	330
ROE_{LL} x BTM x BrF (3x3x3)	2,347	8,440	2,163	0,558	218
Long – Short	**7,844**				

Note 1. The average liquidity for the IBrX100 and Ibovespa shares is 0.62 and 0.80, respectively.

It is observed that an investor who wants to operate only long, obeying the three stock selection criteria, obtain excess returns of 1.71% p.m., 2.35% p.m. and 2.52% p.m. when profitability metrics are ROA_{LB}, ROA_{LO} e ROA_{LL}, respectively, and excess returns of 1.14% p.m., 1.97% p.m. and 2.35% p.m. when profitability metrics are ROE_{LB}, ROE_{LO} e ROE_{LL}, respectively. These results indicate that, whether standardized by total assets or equity, in short strategies, net income has the best performance in generating portfolios with higher expected returns, while gross profit has the worst performance.

For long-short operations, excess returns of 6.93% p.m., 7.87% p.m. are obtained. and 8.04% p.m. when the profitability metrics are ROA_{LB}, ROA_{LO} e ROA_{LL}, respectively, and excess returns of 6.47% p.m., 7.53% p.m. and 8.84% a.m. when the profitability metrics are ROE_{LB}, ROE_{LO} e ROE_{LL}, respectively, indicating that for this strategy, operating profit assumes a prominent position next to net profit in terms of better performance, while

gross profit continues to be the profitability metric that presents the worst relative performance. Although such a strategy demonstrates high attractiveness due to the high excess average return generated, it is observed again that the implementation of the short operation can be compromised due to the low liquidity of these shares. Therefore, operating long may be a more viable strategy, even if it presents a lower excess of expected return.

Table 8. *Portfolio Excess Return*

PORTFOLIO	EX_RET	DP	MED	LIQ	OBS
ROA_{LB} x BTM (3x3)	0,958	9,796	0,342	0,624	1343
ROA_{LB} x BTM x BrF (3x3x3)	1,708	9,090	0,862	0,559	166
Δ Excesso de Retorno	**0,750**				
ROA_{LO} x BTM (3x3)	0,828	9,590	0,536	0,604	2098
ROA_{LO} x BTM x BrF (3x3x3)	2,350	8,444	2,123	0,540	250
Δ Excesso de Retorno	**1,522**				
ROA_{LL} x BTM (3x3)	0,779	9,870	0,449	0,615	1937
ROA_{L}L x BTM x BrF (3x3x3)	2,522	8,463	2,185	0,532	219
Δ Excesso de Retorno	**1,743**				
ROE_{LB} x BTM (3x3)	0,626	10,85	0,274	0,701	1530
ROE_{LB} x BTM x BrF (3x3x3)	1,145	9,664	0,931	0,576	155
Δ Excesso de Retorno	**0,519**				
ROE_{LO} x BTM (3x3)	0,716	9,837	0,342	0,698	2161
ROE_{LO} x BTM x BrF (3x3x3)	1,970	8,308	1,406	0,574	248
Δ Excesso de Retorno	**1,254**				
ROE_{LL} x BTM (3x3)	0,851	9,863	0,510	0,698	2015
ROE_{LL} x BTM x BrF (3x3x3)	2,347	8,440	2,163	0,558	218
Δ Excesso de Retorno	**1,496**				

Note 1: The average liquidity for the IBrX100 and Ibovespa shares is 0.62 and 0.80, respectively.

The results in Table 8 above present a summary of how the excess return varies as a result of the inclusion of the BrF_Score index as a third criterion for selecting stocks when the investor trades long. It is observed that the variation of excess return is 0.75% p.m., 1.52% p.m. and 1.74% a.m. when the profitability metrics are ROA_{LB}, ROA_{LO} e ROA_{LL}, respectively, and the excess return variation is 0.52% p.m., 1.25% p.m. and 1.49% p.m. when profitability metrics areo ROE_{LB}, ROE_{LO} e ROE_{LL}, respectively. Such results indicate that, when combined with the book-to-market index and the BrF_Score index, net income produces a profitability metric capable of generating greater excess returns than gross profit and operating profit. Furthermore, it is observed that the inclusion of the BrF_Score index as a criterion for stock selection increases the expected return of the portfolio, which confirms the third hypothesis of this work.

5 Conclusion

The objective of this work was to evaluate which of the profit definitions (gross profit, operating profit or net profit) has the best performance in explaining the future behavior of returns in the Brazilian market, and if these results are maintained when forming portfolios combining profitability, index book-to-market and BrF_Score index.

The results obtained show that net income and operating income produce the profitability metrics with the greatest explanatory power for the one-month-ahead return, in addition to being statistically similar, while gross profit has significantly less explanatory power. One of the points that may explain this result is the relevance of the financial result for Brazilian companies, especially those that have currency exposure (such as exporters, importers and indebted companies).

It is also observed that the expenses variables that reduce profits have a statistically significant explanatory power for the returns from one month ahead. Such results may occur due to the macroeconomic scenario of greater uncertainty and volatility in which Brazilian companies are inserted, compared to American companies. This reality ends up affecting, in a more expressive way, the levels of costs and expenses of these companies and, consequently, their results in terms of gross, operating and net profit.

For the construction of the portfolios, it is observed that the profitability metrics that are based on net income and operating income have the highest excess returns, which is in agreement with the results obtained through regression analysis. In addition, it can be seen that the construction of these portfolios, when carried out through the combination of the BrF_Score index, the book-to-market index and the profitability metrics provide a significant increase in the excess return of the portfolios, since the BrF_Score index increases the rigor in relation to the company's fundamentals so that its share will become part of the portfolio.

Therefore, the contribution of this work was to show that, given the different macroeconomic influences suffered by Brazilian companies in relation to American companies, the profitability metrics that are based on net income and operating income have greater explanatory power for the returns from one month ahead, as well as producing portfolios with higher expected returns when combined with the BrF_Score index, and the book-to-market index, when compared to profitability metrics based on gross profit. Thus, for the Brazilian reality, net income and operating income more reliably represent the true profitability of companies. This analysis increases the understanding of the financial anomalies in question and contributes to the literature on the subject. In addition, the definition of which profitability metric is most suitable to determine how profitable a company is can help investors in an allocation of resources with a higher expected return.

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