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# ASSET PRICING ANALYSIS OF BOOK-TO-MARKET FACTOR AFTER DEEMED COST

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## ABSTRACT

The determination of the cost of equity is a subject extensively researched and discussed in finance, enabling the development of new related studies. In the Brazilian market, Noda, Martelanc and Kayo (2016) obtained results discordant to those found by Fama and French (1995, 1996), indicating that such divergences can be explained by the high rate of inflation. Thus, the present research seeks to analyze whether after the deemed cost - as a means of resolving the effects of inflation - the returns obtained by the portfolios built on the book-to-market index (PL / VM) are statistically different from those observed by the CAPM by the Profit / Price indicator. By means of the results it was possible to conclude that the L / P index did not present itself as more effective to recognize "cheap" or "value" stocks, compared to the book-to-market index. These results are different from those found by Noda et al. (2016) and coincide with the results found by Fama and French (1995, 1996), showing that the traditional three-factor model explains the returns of the constructed portfolios based on book-to-market. Thus, it can be pointed out that the high historical inflation of the Brazilian market, in particular for firms whose assets are older, makes the accounting information of the entities less significant. However, measurements such as those carried out by deemed cost can soften the impact of inflation, granting greater representativeness to the accounting information, thus

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evidenced that practices such as cost attributed influence the expectations of users, as also verified by Demaria and Dufour (2007) and Cerqueira, Rezende, Dalmácio and Silva (2013).

**Keywords:** CAPM. Multifactor models. Book-to-market. Deemed cost.

## 1 INTRODUCTION

A field of constant research in finance is the pursuit of developing accurate pricing models through the Capital Asset Pricing Model (CAPM) enhancement by adding other factors to the model, such as those performed by Fama and French (1992, 1993, 2012). Among these factors, there is the inclusion of book-to-market (Net Equity on Market Value – NE/MV), whose utilization began in works, such as the one presented by Stattman (1980). In this regard, in a highly developed market such as Japan, research shows results consistent with the literature by showing a high beta and high book-to-market indicator (Chan, Hamao & Lakonishok 1991; Aggarwal, Hiraki & Rao, 1992).

In emerging markets there is divergence in results. Studies such as Claessens, Dasgupta and Glen (1998) found a negative relationship between the book-to-market indicator and returns, describing that such behavior can be explained by the structure of these markets, in which the tax regime and regulations generate distinct environments, which may influence the investor behavior. Studies such as Lyn and Zychomicz (2004) and Girard and Omran (2007) have observed a positive relationship between the book-to-market indicator and the returns.

In the Brazilian market, Noda, Martelanc and Kayo (2016) have applied financial asset pricing models to investment portfolios created in accordance with L/P ratios and the book-to-market of B3's companies. They presented as results that the NE/MV index is less effective to identify “valuable” or “cheap” actions, compared to the L/P index. The portfolios built by book-to-market did not show significant interceptions, while the portfolios based on the L/P indicator presented abnormal returns. These results differ from those presented by Fama and French (1995, 1996). For Noda *et al*. (2016), this could be explained by the high Brazilian inflation, making the accounting information of firms less significant, especially for firms with older assets, since the sample analyzed comprises data from 1995 to 2013.

The historical mismatch in the measurement of immobilized assets can significantly influence the book value of shareholders' equity and, consequently, indicators such as book-to-market. Accordingly, according to ICPC 10 Technical Interpretation, as of 2010, the past values of property, plant and equipment shall be measured in accordance with the deemed cost adjustments, at fair value, dealt with in the CPC 37 Technical Pronouncement and, as a result , in CPC 43 Technical Pronouncement. Thus, when collecting the sample from 2010, part of the mismatched values due to historical inflation in the financial statements should be dissolved, which indicates that for samples from this cut, inflation may not exert significant influence as occurred in Noda *et al* work. (2016).

Thus, due to the lack of a method specifically developed for markets with high inflation rates and the inconsistencies found in the CAPM model in these markets, we seek to evaluate: *What are the returns made by Brazilian portfolios formed on the basis of* book-to-market *and profit/price versus returns predicted by CAPM after the deemed cost?* Thus, the main goal of this paper is – for a sample of Brazilian companies after 2010 (included) - observing whether the realized returns of book-to-market portfolios are significantly different from those forecasted by the L/P indicator and the CAPM.

Given that, while selecting a Brazilian sample and evaluating the explanatory power of book-to-market, two advantages can be highlighted: (i) verify whether measures such as *deemed cost* for measuring fixed assets exert a significant influence on the analysis of asset pricing models, given that Brazil has a higher average inflation rate than countries with more advanced

and free markets; and (ii) overall, whether the Brazilian market, for a number of reasons, may be viewed as less liquid and efficient, with inaccuracies in asset pricing.

## 2 THEORETICAL FRAMEWORK

### 2.1 Deemed cost

As of 2010, the past values of property, plant and equipment shall be measured in accordance with the deemed cost adjustments, at fair value, dealt with in the CPC 37 Technical Pronouncement and, as a result, in CPC 43 Technical Pronouncement. This assignment refers to an option applicable only at the time of initial adoption, and review of the option in subsequent periods is not permitted (ICPC 10, 2009, item 22). The differences determined should be accounted for in the Equity Valuation Adjustments account, under Shareholders' Equity. This accounting entry is similar to revaluation, since the company grabs the opportunity to highlight the value of the asset close to its economic value at the date of attribution. Therefore, as of 2010, the lagged values of fixed assets due to inflation should be dissolved, with a counter party increase in Shareholders' Equity, which impacts book-to-market, indicating that after that date inflation may not exert significant influence, as occurred in the work of Noda *et al*. (2016).

In the French market, Demaria and Dufour (2007) investigated the cost attributed to the valuation of assets after the adoption of international accounting standards, finding a moderate impact on stock prices due to the initial adoption at fair value. Still in the French context, Cormier, Demaria, Lapointe-Antunes and Teller (2009) investigated whether managerial incentives influence five accounting choices (including *deemed cost*) when first adopting International Financial Reporting Standards (IFRS), confirming such hypothesis.

As for the Brazilian market, Cerqueira *et al*. (2013) analyzed the relationship between the price and the stock return of Bovespa companies after the adoption of assigned cost, finding as results that the initial adoption of *deemed cost* impacts stock price. Therefore, it is observed that the measurement of assets, by means of practices such as attributed cost, can significantly influence accounting information, as well as market expectations. Costa and Freitas (2014) investigated the characteristics of public companies that determine the *deemed cost* choice for fixed assets, noting that larger and more profitable companies are more likely to use the attributed cost. But, on the other hand, companies that are audited by Big 4 and have differentiated corporate governance practices from BMF & BOVESPA's “New Market” are less likely to opt for the assigned cost.

### 2.2 CAPM, Multi factorial models and the returns

Via the Risk Diversification Theory developed by Markowitz (1952), Sharpe (1964) and Lintner (1965), the CAPM model has been developed, in which the expectations of asset returns above a risk-free rate should be proportional to market risks (systemic risk), measured by β, multiplied by the expected premium for a market portfolio. A market portfolio may consist of all available assets weighted to their value. According to equations 1 and 2, *Rj* is the desired return on the asset *j*; *Rf* is the risk free rate; *β* is the measure of the non-diversifiable risk of the asset *j*; and *Rm* is the expected market return for the portfolio.

$$E[R_j] = Rf_t + \beta(E[RM_t - Rf_t) + e_t \qquad Equation\ (1)$$

$$\beta = \frac{Cov(R_j, RM_t)}{Var(RM_t)} \qquad Equation\ (2)$$

For Levy and Roll (2010), it is not possible to ignore the empirical validity of this model. As for Fama and French (2004), even though it is the most commonly used model for capital

cost calculation, the CAPM has never been an experimental success, and there was no definitive test, since the market portfolio proposed by the model contains assets whose returns may not be observable, such as: human capital, privately held companies, or real estate assets.

As presented by Noda *et al*. (2016), given the advancement of research on the topic and, seeking to complement the CAPM model, Fama and French (1993) analyzed and developed several explanatory models of US asset returns, incorporating stocks and fixed income securities (*bonds*). For the first, the risk factors employed are: (i) Rm-Rf, referring to the market risk factor; (ii) SMB, corresponding to the size risk factor (*small minus big*), that is, the margin of difference between the returns of shares with low market capitalization (*small*) and the returns of shares with high market capitalization (*big*); and (iii) HML, corresponding to a high book-to-market risk factor, or B/M (*high minus low*), which is calculated by subtracting the returns of the high B/M index *(high)* and the returns of the low B/M index *(small).* The dependent variables were composed of 25 portfolios with returns above the risk free rate, Ri, t – Rft, which are composed according to the intersection of size quintiles and book-to-market index. According to equation 3, *a*, *b*, *s*, *h* are the regression coefficients, and *RMt - Rft*, *SMBt* and *HMLt* are the explanatory factors:

$$R_t - Rf_t = a + b\,(RM_t - Rf_t) + s(SMB_t) + h(HML_t) + e_t \qquad Equation\ (3)$$

The Rm-Rf, SMB and HML factors significantly explain the return on portfolios and considerably increase the explanatory power of asset pricing models, as measured by $R^2$ higher than less factor models, exceeding 90% in most portfolios (Fama & French, 1993). In addition, Carhart (1997) proposed a four-factor model, in which the market moment factor *PR1YR* is added, which measures the return difference between the best and the worst return assets in the previous year. Equation 4 formalizes the model:

$$R_t - Rf_t = a + b\,(RM_t - Rf_t) + s(SMB_t) + h(SMB_t) + p(PR1R_t) + e_t \qquad Equation\ (4)$$

For a sample of 1,892 equity mutual funds, between 1962 and 1993, Carhart (1997) demonstrated that the moment factor has additional informational capacity to the three factors proposed by Fama and French (1993) and also that the coefficient *p* is positive, or that is, the return on the assets analyzed is lasting – assets with higher returns in the previous year show a tendency to maintain the higher returns.

In that sense, as for the Brazilian market, Noda *et al*. (2016) applied a four-factor model, attaching the L/P indicator to the three-factor model of Fama and French (1993). The result is that there is a significant premium for returns with a high L/P index, or *value*, of around 1% per month, and also a considerable return discount for stocks with a low L/P index of around 0.5% per month. Thus, the author concluded that for the Brazilian market, the L/P indicator is superior to explain returns, since it does not find a premium or discount related to the book-to-market index. Such a result may be a reflection of the high inflation in Brazil, which makes the book value of companies' net equity lagged and therefore less significant. It was also possible to infer that models that include the L/P indicator, called HEMLE, or *high earnings minus low earnings*, are the most effective in eliminating Jensen alpha-like intercepts.

In order to calculate returns, Gebhardt *et al.* (2001) used an abnormal profit model, in which expected returns are estimated based on market value, expected profit and book value of the shareholders' equity. Equation 5 formalizes the calculation, where *r* is the cost of equity, *Vt* is the market value, *Bt* is the book value of equity and *Et* is the net profit:

$$V_t = B_t + \sum_{i=1}^{\infty} \frac{E_{t+i} - rB_{t+i-1}}{(1+r)^i} \qquad Equation\ (5)$$

### 2.3 Empirical work in emerging markets

Barry *et al.* (2002) verified size robustness and book-to-market effects in 35 emerging markets during the 1985 - 2000 period. Average returns from firms with high book-to-market significantly exceeded average returns from entities with low book-to-market. On the other hand, Wang and Xu (2004), while researching the Chinese market between 1990 and 2002, found that *price-to-book* was not representative of explaining stock returns.

In the Brazilian market, Mussa, Rogers and Securato (2009) - testing the predictive power of CAPM models together with the three and four factors - conducted a study based on the method proposed by Fama and MacBeth (1973), based on regressions that employ the risk parameters established in a previous period. As conclusion, the authors presented that the tested models were not effective in anticipating the returns of Brazilian stocks, given the significant presence of Jensen alphas.

Yoshino and Santos (2009) measured the market return factors: size, NE/MV, *dividend yield* and P/L, via panel regressions (*fully modified* OLS), aiming to test this model in Brazil. For the researched sample, they observed these factors were significant to the market.

Takamatsu and Fávero (2013), by analyzing the Brazilian market between 1995 and 2010, observed the relationship between book-to-market and the expected future returns of firms, so that the higher the company's valuation in the market (presenting a smaller book-to-market indicator), the higher the future returns of the company. It was also demonstrated that larger companies would have less chance of insolvency, which would imply lower risk and therefore lower return premium.

Recently, Noda *et al*. (2016) used the L/P index as a proxy for the cost of equity, aiming to explain the stock returns of Brazilian companies, between 1995 and 2013. Initial results showed that stocks with low L/P ratios present lower returns. The portfolios built by book-to-market did not show significant interceptions, while the portfolios based on the L/P indicator presented abnormal returns, in the case of those formed by a single value. These results differ from those presented by Fama and French (1995, 1996). According to the authors, these results may be due to the high historical Brazilian inflation, leading to an informative reduction in the net equity value, which makes the models based on the L/P indicator superior to the book-to-market.

## 3 RESEARCH METHODOLOGY

The goal of this research derives from the results presented by Noda *et al*. (2016). Because these authors inform that their results differ from those of Fama and French (1995, 1996), possibly due to Brazilian historical inflation, it is necessary to observe whether in a period after the deemed cost adjustment for fixed assets - according to the Technique Interpretation ICPC 10 - this behavior shall dissipate and the results will get more similar to those presented by these authors. This is justified because the sample presented by Noda *et al*. (2016) comprises the years 1995 to 2013, mostly non-current fixed assets, which compromises indicators such as the NE/MV, due to the undervaluation of the NE as a result of fixed assets devalued by historical inflation.

Thus, for greater comparability, the methodology utilized was the same as the one presented by Noda *et al*. (2016), except for the sample, as follows.

### 3.1 Sample

The sample utilized consisted of all companies listed on B3 (Bolsa, Brasil, Balcão), which had consecutive data between January 2010 and June 2017, resulting in 90 monthly returns. Shares that do not have at least one of the following information have been excluded:

book value of equity, net income, share price and market value of equity, totaling a final sample of 49 companies.

### 3.2 Variables and portfolio formation

The use of regressions in time series has been employed. The dependent variables are the monthly returns of the equity portfolios of firms listed in B3 minus the risk free rate (Ri, t – Rft). As a risk-free rate, the Interbank Deposit Certificate (CDI) has been utilized. The risk factors are the explanatory variables of the model, as accomplished by Fama and French (1993).

As presented by Noda *et al*. (2016), the dependent variables have been formed by the market value of equity (VM); the Profit/Price (L/P in Portuguese) index; and book-to-market, which is the book value of equity/market value – main variable, whose behavior is analyzed after the deemed cost. As explanatory variables we utilized the risk factors: market (RM-RF), SMB, HML and HEMLE. The variables are defined in Table 1, while the definition of portfolios is shown in Table 2.

Table 1
**Variable calculation methodology**

| Variable | Calculation Method |
|---|---|
| VM | Market value of shareholders' equity at the end of each period, considering the price of each share class multiplied by the respective number of shares. |
| NE/MV (PL/VM) | Book value of shareholders 'equity at the end of each period divided by the market value of shareholders' equity, VM, as defined above. |
| L/P | Earnings per share over the past 12 months divided by the share price. |
| RM – RF | Monthly return on the market portfolio, calculated as the average return on all shares traded on B3, weighted by market value less the CDI rate for the same period. |
| SMB | *Small minus big*: monthly return weighted by portfolio market value S minus monthly return weighted by portfolio market value B. |
| HML | *High minus low*: monthly return weighted by portfolio market value H minus monthly return weighted by portfolio market value L. |
| HEMLE | *High earnings minus low earnings*: Monthly return weighted by the portfolio market value HE minus monthly return weighted by the portfolio market value LE. |

Source: Noda, R. F., Martelanc, R., & Kayo, E. K. (2016). The profit/price risk factor in financial asset pricing models. *Revista Contabilidade & Finanças, 27*(70), 67-79.

After the classification according to Table 1, each share belongs to three distinct portfolios, divided by size, PL/VM (NE/MV) and L/P, as shown in Table 2.

Table 2
**Share classification**

| Criteria | Portfolio | Actions |
|---|---|---|
| Size | S | 50% of shares with lower VM, ie *Small* company shares |
| | B | 50% of shares with higher VM, ie *Big* company shares |
| NE/MV (PL/VM) | H | 30% of stocks with higher PL/VM (*High*) |
| | F | 40% of stocks with mean PL/VM (*Medium*) |
| | LE | 30% of stocks with lower PL/VM (*Low*) |
| L/P | HE | 30% of stocks with higher L/P (*High Earnings*) |
| | ME | 40% of stocks with average L/P (*Medium Earnings*) |
| | LE | 30% of stocks with lower L/P (*Low Earnings*) |

Source: Noda, R. F., Martelanc, R., & Kayo, E. K. (2016). The profit/price risk factor in financial asset pricing models. *Revista Contabilidade & Finanças, 27*(70), 67-79.

After this process, the 18 final portfolios employed as dependent variables are based on the three criteria at the same time, maintaining a constant composition over the subsequent months. Table 3 shows each of the 18, in which each share will refer to a single portfolio.

Table 3
**Formed portfolios**

| Portfolio | Criteria |
|---|---|
| S-L-LE | Shares belonging to groups S, L and LE |
| S-L-ME | Shares belonging to groups S, L and ME |
| S-L-HE | Shares belonging to groups S, L and HE |
| S-M-LE | Shares belonging to groups S, M and LE |
| S-M-ME | Shares belonging to groups S, M and ME |
| S-M-HE | Shares belonging to groups S, M and HE |
| S-H-LE | Shares belonging to groups S, H and LE |
| S-H-ME | Shares belonging to groups S, H and ME |
| S-H-HE | Shares belonging to groups S, H and HE |
| B-L-LE | Shares belonging to groups B, L and LE |
| B-L-ME | Shares belonging to groups B, L and ME |
| B-L-HE | Shares belonging to groups B, L and HE |
| B-M-LE | Shares belonging to groups B, M and LE |
| B-M-ME | Shares belonging to groups B, M and ME |
| B-M-HE | Shares belonging to groups B, M and HE |
| B-H-LE | Shares belonging to groups B, H and LE |
| B-H-ME | Shares belonging to groups B, H and ME |
| B-H-HE | Shares belonging to groups B, H and HE |

Source: Noda, R. F., Martelanc, R., & Kayo, E. K. (2016). The profit/price risk factor in financial asset pricing models. *Revista Contabilidade & Finanças, 27*(70), 67-79.

### 3.3 Returns calculation and specification of models

As calculated by Noda *et al*. (2016), for each portfolio i, returns are calculated for each month t, Ri, t, based on the weighted average stock returns. Equation 7 formalizes the calculation, in which: *VMa,t* is the market value of the company's *PL*, "*a*" in *t* period; *Ra,t* is the return on "*a*" share over the period *t*; *n* is the amount of assets that belong to the portfolio *i*; and *VMi,t* is the market value of portfolio *i*, resulting from the sum of the market value of all shares in portfolio *i*.

$$R_{i,t} = \sum_{a=1}^{n} \frac{VM_{a,t}\ x\ R_{a,t}}{VM_{i,t}} \qquad Equation\ (7)$$

In order to determine if the portfolios constituted by the PL/VM indexes present returns significantly different from those predicted by the CAPM, the method developed by Jensen (1968) – Jensen's alpha – given as abnormal behavior of the asset *i*, will be utilized. According to equation 8, *Rit* is the return on the portfolio *i* in month *t*; α is Jensen's alpha; and *RMt - RFt* is the market return that exceeds the risk free rate at the month *t*. And, as dependent variables, the monthly returns on the edge portfolios formed by a single criterion (H and L) will be utilized, as performed by Noda *et al*. (2016).

$$R_{i,t} - Rf_t = \alpha_i + \beta_i(RM_t - Rf_t) + e_t \qquad Equation\ (8)$$

The hypothesis related to Equation 8 is that portfolios based on PL/VM ratios should have significant intercepts – positive for the low PL/VM portfolio and negative for the high PL/VM portfolio. Demonstrating, we have:

$H1_0$: $\alpha_i = 0$

$H1_{a1}$: $\alpha_i > 0$, when $i = H$
$H1_{a2}$: $\alpha_i < 0$, when $i = L$

Regressions similar to those developed by Fama and French (1993) will be used to evaluate asset pricing models that contain the *HML* risk factor as an explanatory variable of returns. The following models will be estimated:

Model 1: $R_{i,t} - RF_t = \alpha_i + b_i(RM_t - RF_t) + e_{i,t}$ *Equation* (9)
Model 3: $R_{i,t} - RF_t = \alpha_i + b_i(RM_t - RF_t) + s_i(SMB_t) + h_i(HML_t) + e_{i,t}$ *Equation* (10)
Model 4: $R_{i,t} - RF_t = \alpha_i + b_i(RM_t - RF_t) + s_i(SMB_t) + k_i(HEMLE_t) + e_{i,t}$ *Equation* (11)
Model 5: $R_{i,t} - RF_t = \alpha_i + b_i(RM_t - RF_t) + s_i(SMB_t) + h_i(HML_t) + k_i(HEMLE_t) + e_{i,t}$
Equation (12)

Seeking greater comparison with the work of Noda *et al*. (2016), there is also due attention to the L/P factor for the sample in consideration.

## 4 RESULTS ANALYSIS

Table 4 shows Jensen's alpha for portfolios based on a single risk factor, in which the coefficient was positive with p-value <1% for the HE portfolio, showing that firms with higher L/P index showed returns significantly higher than those predicted by the CAPM. These results are similar to those obtained by Costa Jr. & Neves (2000) and Noda *et al*. (2016), demonstrating a continuity of this indicator.

The market risk factor coefficient, β, was significantly different from zero and positive for the single criterion portfolios, in line with the results obtained by Fama and French (1993) and Noda *et al*. (2016).

Table 4
**Estimated Jensen's alphas**

| Portfolios | a | | β | $R^2$ | No. of notes |
|---|---|---|---|---|---|
| | Coeff. | p | Coeff. | | |
| S | -0.013 | 0.002 | 0.655* | 0.503 | 90 |
| B | 0.003 | 0.018 | 0.837* | 0.940 | 90 |
| H | -0.004 | 0.416 | 1.277* | 0.756 | 90 |
| LE | 0.007 | 0.034 | 0.916* | 0.313 | 90 |
| HE | 0.006 | 0.006 | 0.369* | 0.880 | 90 |
| LE | -0.001 | 0.849 | 1.633* | 0.720 | 90 |

* p-value < 0.01
Source: Research results (2018).

Portfolio (B) - large companies - had a coefficient β (CAPM beta) close to 1 and a high $R^2$. As portfolio B is weighted by the market value of listed assets, representing 98% of all equity in the Brazilian market, such results were expected. As for portfolios (S) – small businesses – present a negative Jensen alpha and a smaller beta. Moreover, considering a statistical significance of 5%, Jensen's alpha is positive for portfolio L, and this same parameter is insignificant for portfolio H. These results differ from the results of Noda *et al*. (2016) and are similar to those obtained by Fama and French (1995, 1996), indicating that stocks of entities with lower PL/VM present higher returns compared to the values of high PL/VM. Thus, it can be attributed that the *deemed cost* that occurred after 2010 had a significant impact on the PL/VM indicator for portfolios built by a single risk factor.

Ratifying this result, it is also observed that the portfolio with high Profit/Price was above the market by 0.6% per month, while the portfolio with low book-to-market hit the market by 0.7% per month, indicating that for portfolios built by a single risk factor, the book-to-market generates higher yields than the P/P indicator, which is a result contrary to the one presented by Noda *et al*. (2016).

Table 5 presents the one-factor model, considering only the market, according to equation 9. The coefficient β was positive and significant, as expected, and corresponding to the results of other Brazilian studies, as shown in Mussa, Trovao, Santos and Famá (2007) and Noda *et al*. (2016). Among the 18 intercepts (Jensen's alpha – "a") of portfolios analyzed, seven were significant, indicating that the market risk factor, although relevant, was not satisfactory in explaining the returns made by the portfolios, contrary to the forecasts of the CAPM. Due to the differences within the sample, a significant increase in Jensen alphas is observed compared to the work by Noda *et al.* (2016), in which five significant coefficients were present.

Table 5
**Estimated parameters for the one-factor model**

| Portfolios | A | | b | | $R^2$ | No. of notes |
|---|---|---|---|---|---|---|
| | Coeff. | p | Coeff. | p | | |
| S-L-LE | -0.022 | 0.002 | 1.070 | 0.000 | 0.486 | 90 |
| S-L-ME | 0.010 | 0.206 | 0.332 | 0.012 | 0.069 | 90 |
| S-L-HE | -0.016 | 0.182 | 0.625 | 0.004 | 0.092 | 90 |
| S-M-LE | -0.009 | 0.237 | 0.329 | 0.014 | 0.067 | 90 |
| S-M-ME | 0.001 | 0.854 | 0.654 | 0.000 | 0.385 | 90 |
| S-M-HE | -0.010 | 0.046 | 0.391 | 0.000 | 0.192 | 90 |
| S-H-LE | -0.019 | 0.027 | 0.859 | 0.000 | 0.294 | 90 |
| S-H-ME | -0.015 | 0.056 | 0.729 | 0.000 | 0.250 | 90 |
| S-H-HE | -0.003 | 0.381 | 0.425 | 0.000 | 0.347 | 90 |
| B-L-LE | 0.011 | 0.482 | 1.965 | 0.000 | 0.377 | 90 |
| B-L-ME | 0.008 | 0.045 | 0.316 | 0.000 | 0.201 | 90 |
| B-L-HE | 0.012 | 0.013 | 0.490 | 0.000 | 0.309 | 90 |
| B-M-LE | -0.001 | 0.915 | 1.536 | 0.000 | 0.576 | 90 |
| B-M-ME | 0.003 | 0.291 | 0.562 | 0.000 | 0.607 | 90 |
| B-M-HE | 0.007 | 0.005 | 1.012 | 0.000 | 0.866 | 90 |
| B-H-LE | 1.725 | 0.839 | 0.002 | 0.000 | 0.666 | 90 |
| B-H-ME | 0.006 | 0.481 | 0.756 | 0.000 | 0.255 | 90 |
| B-H-HE | 0.001 | 0.927 | 0.501 | 0.000 | 0.206 | 90 |

Source: Research results (2018).

Table 6 presents the results of the traditional three-factor model of Fama and French (1993), according to equation 10. Although statistically insignificant in some portfolios, the three presented explanatory power for returns. A single portfolio had significant alpha with p-value < 5%, and 3 portfolios had significant alpha with p-value < 10%. Brazilian studies have found analogous results, such as Mussa *et al.* (2007) and Noda *et al*. (2016).

Table 6
**Estimated parameters for the three-factor model of Fama and French**

| Portfolios | Coefficients and p-value in parentheses | | | | $R^2$ | No. of notes |
|---|---|---|---|---|---|---|
| | a | b | s | h | | |
| S-L-LE | -0.006 | 1.234 | 1.015 | 0.022 | 0.690 | 90 |
| | (0.355) | (0) | (0) | (0.808) | | |
| S-L-ME | 0.016 | 0.347 | 0.366 | 0.057 | 0.107 | 90 |
| | (0.057) | 0.046 | (0.06) | (0.658) | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| S-L-HE | -0.003 | 0.895 | 0.940 | -0.110 | 0.202 | 90 |
| | (0.828) | (0.001) | (0.002) | (0.58) | | |
| S-M-LE | 0.002 | 0.401 | 0.661 | 0.053 | 0.190 | 90 |
| | (0.81) | (0.017) | (0.001) | (0.668) | | |
| S-M-ME | 0.009 | 0.896 | 0.633 | -0.140 | 0.602 | 90 |
| | (0.046) | (0) | (0) | (0.052) | | |
| S-M-HE | -0.004 | 0.501 | 0.388 | -0.043 | 0.290 | 90 |
| | (0.402) | (0) | (0.002) | (0.598) | | |
| S-H-LE | 0.006 | 1.117 | 1.530 | 0.021 | 0.734 | 90 |
| | (0.316) | (0) | (0) | (0.81) | | |
| S-H-ME | -0.005 | 0.781 | 0.621 | 0.066 | 0.333 | 90 |
| | (0.575) | (0) | (0.002) | (0.605) | | |
| S-H-HE | 0.002 | 0.478 | 0.351 | 0.011 | 0.457 | 90 |
| | (0.508) | (0) | (0) | (0.851) | | |
| B-L-LE | 0.026 | 2.279 | 1.019 | -0.143 | 0.432 | 90 |
| | (0.132) | (0) | (0.01) | (0.583) | | |
| B-L-ME | 0.002 | 0.711 | -0.057 | -0.447 | 0.615 | 90 |
| | (0.486) | (0) | (0.417) | (0.000) | | |
| B-L-HE | 0.009 | 0.639 | -0.068 | -0.178 | 0.350 | 90 |
| | (0.087) | (0) | (0.554) | (0.022) | | |
| B-M-LE | 0.006 | 1.263 | 0.207 | 0.341 | 0.606 | 90 |
| | (0.49) | (0) | (0.313) | (0.014) | | |
| B-M-ME | 0.002 | 0.676 | 0.050 | -0.116 | 0.641 | 90 |
| | (0.411) | (0) | (0.478) | (0.014) | | |
| B-M-HE | 0.004 | 1.040 | -0.149 | -0.061 | 0.876 | 90 |
| | (0.133) | (0) | (0.018) | (0.14) | | |
| B-H-LE | 0.009 | 0.846 | -0.201 | 0.927 | 0.889 | 90 |
| | (0.085) | (0.000) | (0.079) | (0.000) | | |
| B-H-ME | -0.008 | 0.815 | -0.062 | -0.077 | 0.258 | 90 |
| | (0.406) | (0) | (0.766) | (0.579) | | |
| B-H-HE | 0.003 | 0.570 | 0.170 | -0.042 | 0.220 | 90 |
| | (0.683) | (0) | (0.282) | (0.693) | | |

Source: Research results (2018).

Table 7 contains the results of the three factor model in which HML is replaced by the HEMLE factor, according to equation 11. In this case applied to the Brazilian market, similar behavior has been observed to the traditional Fama and French model, in which two intercepts with p-value < 5% and two with p-value < 10% have been presented. In the traditional Fama and French model, presented in Table 8, the h coefficient was significant with p-value < 10% in six of 18 regressions, compared to 7 of 18 k coefficients. Thus, it is observed that for a sample after the *deemed cost*, the difference between both models is given by a significant parameter, as opposed to the significant difference pointed out by Noda *et al*. (2016).

Table 7
**Estimated parameters for the three-factor L/P model**

| **Portfolios** | Coefficients and p value in parentheses | | | | **$R^2$** | **No. of notes** |
|---|---|---|---|---|---|---|
| | **a** | **b** | **s** | **k** | | |
| S-L-LE | -0.007 | 1.297 | 0.994 | 0.065 | 0.692 | 90 |
| | (0,261) | (0,000) | 0.000 | (0,436) | | |
| S-L-ME | 0.016 | 0.345 | 0.361 | -0.073 | 0.109 | 90 |
| | (0,055) | (0,028) | (0,058) | (0,536) | | |
| S-L-HE | -0.002 | 0.847 | 0.965 | 0.066 | 0.200 | 90 |
| | (0,894) | (0,001) | (0,001) | (0,716) | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| S-M-LE | 0.002 | 0.359 | 0.669 | -0.128 | 0.201 | 90 |
| | (0,760) | (0,017) | (0,000) | (0,253) | | |
| S-M-ME | 0.012 | 0.786 | 0.679 | 0.013 | 0.584 | 90 |
| | (0,014) | (0,000) | (0,000) | (0,848) | | |
| S-M-HE | -0.004 | 0.461 | 0.404 | -0.004 | 0.288 | 90 |
| | (0,477) | (0,000) | (0,001) | (0,952) | | |
| S-H-LE | 0.005 | 1.136 | 1.523 | 0.001 | 0.734 | 90 |
| | (0,337) | (0,000) | (0,000) | (0,987) | | |
| S-H-ME | -0.007 | 0.898 | 0.580 | 0.089 | 0.335 | 90 |
| | (0,412) | (0,000) | (0,003) | (0,445) | | |
| S-H-HE | 0.002 | 0.498 | 0.344 | 0.015 | 0.457 | 90 |
| | (0,557) | (0,000) | (0,000) | (0,774) | | |
| B-L-LE | 0.024 | 2.438 | 0.986 | 0.411 | 0.449 | 90 |
| | (0,147) | (0,000) | (0,010) | (0,081) | | |
| B-L-ME | 0.008 | 0.452 | 0.062 | 0.174 | 0.283 | 90 |
| | (0,062) | (0,000) | (0,513) | (0,004) | | |
| B-L-HE | 0.011 | 0.516 | -0.014 | 0.039 | 0.312 | 90 |
| | (0,029) | (0,000) | (0,901) | (0,586) | | |
| B-M-LE | 0.005 | 1.243 | 0.181 | -0.454 | 0.638 | 90 |
| | (0,534) | (0,000) | (0,350) | (0,000) | | |
| B-M-ME | 0.003 | 0.648 | 0.069 | 0.102 | 0.639 | 90 |
| | (0,261) | (0,000) | (0,315) | (0,018) | | |
| B-M-HE | 0.004 | 1.076 | -0.153 | 0.128 | 0.889 | 90 |
| | (0,132) | (0,000) | (0,009) | (0,001) | | |
| B-H-LE | 0.004 | 0.941 | -0.318 | -1.012 | 0.972 | 90 |
| | (0,130) | (0,000) | (0,000) | (0,000) | | |
| B-H-ME | -0.008 | 0.858 | -0.067 | 0.159 | 0.269 | 90 |
| | (0,370) | (0,000) | (0,740) | (0,209) | | |
| B-H-HE | 0.001 | 0.712 | 0.132 | 0.260 | 0.286 | 90 |
| | (0,900) | (0,000) | (0,372) | (0,006) | | |

Source: Research results (2018)

And, in Table 8, we present the results of the model with the four factors, according to equation 12. The addition of the HEMLE risk factor showed results similar to those proposed by the traditional Fama and French model. Only one of the 18 portfolios had significant intercepts with p-value < 0.05. It is observed that, for data collected after 2010, there is a lower presence of significant Jensen alphas compared to the results presented by Noda *et al.* (2016) – two significant intercepts. On the other hand, the work of these authors presented higher presence of significant coefficients within HML and HEMLE factors.

Table 8

**Estimated parameters for the four-factor model**

| **Portfolios** | Coefficients and p value in parentheses | | | | | **$R^2$** | **No. of notes** |
|---|---|---|---|---|---|---|---|
| | **a** | **b** | **s** | **h** | **k** | | |
| S-L-LE | -0.005 | 1.224 | 1.035 | 0.205 | 0.213 | 0.699 | 90 |
| | (0.429) | (0) | (0) | (0.166) | (0.117) | | |
| S-L-ME | 0.016 | 0.351 | 0.358 | -0.015 | -0.083 | 0.109 | 90 |
| | (0.065) | (0.045) | (0.068) | (0.944) | (0.663) | | |
| S-L-HE | -0.003 | 0.897 | 0.937 | -0.139 | -0.034 | 0.202 | 90 |
| | (0.821) | (0.001) | (0.002) | (0.667) | (0.909) | | |
| S-M-LE | 0.001 | 0.412 | 0.639 | -0.150 | -0.236 | 0.206 | 90 |
| | (0.899) | (0.014) | (0.001) | (0.449) | (0.194) | | |
| S-M-ME | 0.009 | 0.907 | 0.611 | -0.337 | -0.230 | 0.624 | 90 |
| | (0.065) | (0) | (0) | (0.004) | (0.028) | | |
| S-M-HE | -0.005 | 0.505 | 0.379 | -0.121 | -0.092 | 0.295 | 90 |
| | (0.369) | (0) | (0.003) | (0.356) | (0.446) | | |
| S-H-LE | 0.006 | 1.115 | 1.534 | 0.058 | 0.043 | 0.734 | 90 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | (0.307) | (0) | (0) | (0.684) | (0.741) | | |
| S-H-ME | -0.003 | 0.765 | 0.655 | 0.374 | 0.358 | 0.360 | 90 |
| | (0.689) | (0) | (0.001) | (0.069) | (0.057) | | |
| S-H-HE | 0.003 | 0.476 | 0.356 | 0.062 | 0.060 | 0.460 | 90 |
| | (0.472) | (0) | (0) | (0.505) | (0.483) | | |
| B-L-LE | 0.029 | 2.243 | 1.096 | 0.549 | 0.805 | 0.461 | 90 |
| | (0.087) | (0) | (0.005) | (0.184) | (0.035) | | |
| B-L-ME | 0.001 | 0.729 | -0.094 | -0.776 | -0.383 | 0.752 | 90 |
| | (0.792) | (0) | (0.103) | (0) | (0) | | |
| B-L-HE | 0.008 | 0.650 | -0.090 | -0.376 | -0.231 | 0.382 | 90 |
| | (0.12) | (0) | (0.426) | (0.003) | (0.04) | | |
| B-M-LE | 0.004 | 1.288 | 0.155 | -0.127 | -0.545 | 0.639 | 90 |
| | (0.638) | (0) | (0.434) | (0.551) | (0.006) | | |
| B-M-ME | 0.003 | 0.674 | 0.054 | -0.072 | 0.050 | 0.643 | 90 |
| | (0.379) | (0) | (0.439) | (0.337) | (0.465) | | |
| B-M-HE | 0.005 | 1.031 | -0.128 | 0.126 | 0.218 | 0.895 | 90 |
| | (0.052) | (0) | (0.028) | (0.043) | (0) | | |
| B-H-LE | 0.005 | 0.887 | -0.288 | 0.151 | -0.904 | 0.974 | 90 |
| | (0.038) | (0) | (0) | (0.013) | (0) | | |
| B-H-ME | -0.006 | 0.803 | -0.036 | 0.155 | 0.270 | 0.273 | 90 |
| | (0.474) | (0) | (0.863) | (0.487) | (0.187) | | |
| B-H-HE | 0.005 | 0.543 | 0.228 | 0.475 | 0.601 | 0.357 | 90 |
| | (0.415) | (0) | (0.118) | (0.003) | (0) | | |

Source: Research results (2018)

In a different way than presented by Noda *et al.* (2016), the three and four-factor models using the HEMLE risk factor made no difference in the elimination of intercepts, compared to the traditional Fama and French model. This model resulted in a significant intercept with p-value < 5%, as well as the four-factor model. As for the three-factor model with the presence of the risk factor, HEMLE presented two significant intercepts with p-value < 5%. Such results demonstrate that, for a sample collected after the *deemed cost* effects, the three and four-factor models using the HEMLE risk factor were no more efficient in explaining returns in the Brazilian market compared to the classic three-factor model.

## 5 CONCLUSION

For the Brazilian market, the work of Noda *et al*. (2016) indicated that the PL/VM index has low efficacy to identify "valuable" or "cheap" stock. These results differ from those presented by Fama and French (1995, 1996), so that those authors pointed out that this difference could be explained due to the high Brazilian inflation. On the other hand, as from 2010, the past values of fixed assets have been measured according to the deemed cost adjustments at fair value, indicating that, for samples after this date, the historical inflation of the financial statements may be attenuated. Therefore, the goal of this paper was – after the *deemed cost* – to observe if the returns obtained by the book-to-market-built portfolios differ significantly from the returns forecasted by the CAPM and the L/P indicator.

For the studied sample, we can conclude that the L/P index was not more effective to recognize "valuable" stock, than compared to the book-to-market index. These results differ from those found by Noda *et al.* (2016) and coincide with the results found by Fama and French (1995, 1996), showing that the three-factor model, based on book-to-market, has explanatory power over stock portfolio returns.

Thus, it can be indicated that the high historical inflation of the Brazilian market, specifically for firms with older assets, turns the entities' accounting information less significant. However, measurements such as those considered by *deemed cost* may soften the impact of inflation, giving greater representativeness to the accounting information. This result is in line

with the one presented by Demaria and Dufour (2007) and Cerqueira *et al*. (2013), showing that practices such as the attributed cost influence the expectations of market users, as well as accounting information.

The HML risk factor was significant in explaining stock returns in the proposed models. Thus, we can also conclude that, after the deemed cost, models using the HEMLE risk factor do not have superior capacity to eliminate Jensen alphas compared to models using the HML factor, such as the traditional Fama and French model. From the results obtained in this study, it is also confirmed the hypothesis that book-to-market-based portfolios have representative intercepts – positive and significant for the low book-to-market portfolio and negative, albeit without significance, for portfolios with high value.

This research may encourage other works that assess the explanatory power of the HML risk factor in various types of markets, especially those with less controlled inflation or less developed economies, especially in emerging countries that have gone through accounting procedures such as *deemed cost.* Another possible option is testing, on a larger scale, whether book-to-market is more appropriate for countries with controlled inflation and whether the L/P ratio is a more explanatory factor for countries with high inflation.

The Brazilian market generates limitations to this work because it is an emerging country, where there is high economic instability and high interest rates, which results in a scenario in which the market return is lower than the risk free rate for long periods of time, directly influencing the market risk factor and the explanatory power of the models.

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