The Earnings/ Price Risk Factor In Capital Asset Pricing Models

ABSTRACT

This paper integrates the ideas from two major lines of research on cost of equity: multi-factor models and ex-ante models. We use the E/P ratio, a proxy for the ex-ante cost of equity, to explain realized returns of Brazilian companies, finding that stocks with high (low) E/P ratios have higher (lower) risk-adjusted realized returns. The results show that selecting stocks based on high earnings/price ratios led to significantly higher risk-adjusted returns in the Brazilian market, with average abnormal returns close to 1.3% per month. We develop asset pricing models including an earnings/price risk factor, HEMLE, based on the Fama and French three-factor model. We conclude that such risk factor is significant in explaining returns of the portfolios and that the models including the HEMLE risk factor were superior in explaining the stock returns in Brazil, resulting in a lower number of significant intercepts. This result may be due to the impact of historically high inflation rates that reduce the informative content of book value, thus making the models based on earnings/price ratios superior to the ones based on market/book ratios.

100-WORD BRIEF DESCRIPTION

We use the earnings/price ratio to explain realized returns of Brazilian companies. The results show that stocks with high E/P ratios have higher risk-adjusted realized returns, with average abnormal returns close to 1.3% per month. We also develop asset pricing models including an E/P risk factor, HEMLE. Such risk factor is significant in explaining returns and the models including HEMLE were superior when compared to the F&F 3-factor model. This result may be due to the impact of historically high inflation rates that reduce the informative content of book values, thus making E/P ratios superior to market/book ratios.

Keywords: Cost of equity, asset pricing, multi-factor models, implied cost of equity
JEL codes: G11; G12.

1. INTRODUCTION

Cost of equity estimation is a widely studied topic in finance and, at the same time, offers plenty of room for new developments. In fact, according to Cochrane (2010), theories on the formation of discount rates are controversial and are still in their infancy.

Recent studies seek to develop more accurate asset pricing models by adding risk factors other than CAPM's market risk, such as the ones developed and applied by Fama and French (1992), Fama and French (1993), Carhart (1997) and Fama and French (2012).

Another line of research seeks to estimate the ex-ante or implied cost of equity, based mainly on the relationship between a company's market value of equity and its expected future cash flow, which is measured based on earnings and/or dividends estimates.

Studies that use this type of methodology are Claus and Thomas (2001), Fama and French (2002), Ohlson and Juettner-Nauroth (2005) and Easton (2004). Such models are usually based on current prices and expected earnings. Specifically, in the more advanced models of Ohlson and Juettner-Nauroth (2005) and Easton (2004), the ex-ante cost of equity is equal to the E/P ratio when there are no abnormal earnings. Thus, the earnings/price ratio can be a proxy for the implied cost of equity which, in turn, may be an explanatory factor for realized returns, as identified by Basu (1977).

Using elements of both approaches, the objectives of this study are, based on a Brazilian sample, to (i) verify if the realized returns of portfolios formed based on the stocks' earnings/price ratio are significantly different from the ones predicted by the CAPM, using the Jensen´s Alpha methodology and (ii) test asset pricing models based on the CAPM and on the Fama and French three-factor model with the addition of a risk factor related to the E/P ratio, HEMLE, or high earnings minus low earnings, as an explanatory variable for realized returns.

The selection of a Brazilian sample can have two advantages when analyzing the explanatory power of the earnings/price risk factor. First, Brazil presents a much higher inflation rate when compared more developed markets such as the U.S. The consequence is that the explanatory power of Fama and French's HML risk factor can be inferior, since book values may be severely influenced by the assets' age, making market to book ratios less meaningful. Therefore, the earnings price ratio may be a better, or, at least, complementary,

measure for identifying "cheap" and "expensive" assets. Second, the Brazilian market may be considered less liquid and efficient, with more evident asset pricing imperfections.

The main hypotheses are that (i) the asset portfolios with high (low) E/P ratios tend to have higher (lower) returns than the ones predicted by the CAPM and (ii) the earnings/price risk factor is significant to explain the portfolios' realized returns.

This study extends other studies in the Brazilian market, both by adding the HEMLE risk factor as well as by expanding the sample and the analysis period, as suggested by Costa Jr. and Neves (2000), in addition to testing the Jensen´s Alphas of portfolios formed based on indexes earnings/stock price.

Both hypotheses are confirmed, concluding that stocks with high (low) E/P ratios, i.e., potentially with high (low) implied cost of equity have higher (lower) returns, which are not explained by the CAPM, as well as that the HEMLE risk factor is significant in explaining returns of portfolios of Brazilian stocks, even when controlled by Fama and French's SMB and HML risk factors. The models which include the HEMLE risk factor also presented higher explanatory power and were capable of eliminating most of the intercepts, or unexplained abnormal returns.

Corroborating the idea that M/B ratios are less meaningful in Brazil for identifying "cheap" and "expensive" stocks due to higher inflation, the results also show that portfolios ranked by M/B ratios do not show abnormal returns.

This study is structured as follows: after this brief introduction, we present the theoretical framework in section 2, the methodology and sample description in section 3, the results and their analysis in section 4 and finally the conclusions in section 5.

2. THEORETICAL FRAMEWORK

2.1. CAPM

Inspired by the portfolio theory developed by Markowitz (1952), which is based on optimizing the relationship between risk and return, Sharpe (1964) and Lintner (1965) developed the Capital Asset Pricing Model - CAPM, suggesting that under conditions of market equilibrium, the expected return of a given asset should be proportional to its non-diversifiable risk, or market risk, measured by β, which is the slope of a regression which uses

the asset return as the dependent variable and the market risk premium as the independent variable:

$$R(t) = RF(t) + \beta[RM(t) - RF(t)]$$

Where R(t) is the expected return for a given asset, RF is the risk-free rate or expected return for an asset with β = 0, β is the measure of non-diversifiable risk of certain asset and RM is the return of the market portfolio.

The CAPM predicts that the market portfolio consists of all available assets, each with a weight proportional to its market value, as well as that the market risk factor, RM-RF, is the only factor able to explain asset returns.

2.2. The Fama and French three-factor model

Fama and French (1993) test several explanatory models for realized returns in the U.S., including equities *(stocks)* and fixed income *(bonds)*. For stocks, they use the following risk factors: (i) RM-RF, representing the market risk factor, (ii) SMB, or small minus big, representing the size risk factor and (iii) HML, or high minus low, representing a risk factor for related to the Book-to-Market ratio, or B/M.

The authors use the returns of 25 portfolios in excess of the risk free rate, R (t) - RF (t), as dependent variables. Such portfolios are formed based on quintiles of size, measured by market capitalization, and *book-to-market ratios*. Formally, the time-series regressions used by the authors are:

$$R(t) - RF(t) = a + b[RM(t) - RF(t)] + sSMB(t) + hHML(t) + e(t)$$

Where a, b, s, h are the regression coefficients and RM-RF, SMB, and HML are explanatory risk factors as described above.

Fama and French (1993) conclude that the factors RM-RF, SMB and HML are significant in explaining portfolio returns and also add explanatory power to the asset pricing models, measured by significantly higher R^2 when compared to models with fewer factors. The models' R^2 exceed 90% for most portfolios.

2.3. The relevance of the E/P risk factor in explaining returns and ex-ante models

Basu (1977) developed a seminal work relating *price/earnings* ratios to realized stock returns. The author used a sample of 500 companies traded on the New York Stock Exchange (NYSE) in the period between 1956 and 1969, grouping them into five portfolios according to their E/P ratios. He conducted a regression whose dependent variable was the return of a given portfolio and the independent variable was the market risk factor:

$$R(t) - RF(t) = \alpha + \beta[RM(t) - RF(t)]$$

Where the intercept, α, is the Jensen's Alpha (Jensen, 1968).

Basu found positive and significant alphas for the two portfolios consisting of stocks with low E/P ratios and negative alphas for the two portfolios consisting of stocks with high E/P ratios, concluding that the E/P ratio may have been a relevant factor in explaining returns and that this fact may be an indication of market inefficiencies.

The main models for calculating the ex-ante cost of equity also use the stocks' price and earnings to estimate expected returns. Gebhardt, Lee, and Swaminathan (2001), for example, use a model of discounted abnormal earnings, in which the cost of equity is a function of the stock price, the expected earnings and book value of equity:

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

Where B_t is the book value of equity at time t, E_t is the net income in the period **t** and **r** is the cost of equity.

Claus and Thomas (2001), with the objective of estimating the ex-ante market risk premium, use a model similar to the one developed by Gebhardt et al. (2001), adopting the concept of abnormal earnings as those that exceed the book value of equity multiplied by the cost of equity. Both models are based assume the clean surplus accounting methodology (Feltham & Ohlson, 1995).

Ohlson and Juettner-Nauroth (2005) develop a model relating price, earnings, abnormal earnings and cost of equity:

$$P_0 = \frac{eps_1}{r} + \sum_{i=1}^{\infty} R^{-t} r^{-1} (eps_{t+1} + rdps_t - Reps_t)$$

Where P_t is the stock price in period t, r is the cost of equity, R = 1+r, eps_t is the earnings per share in period t, and dps_t is the dividend per share in period t.

Easton (2004) developed a model based on Ohlson & Juettner-Nauroth (2000), which is the precursor of their 2005 work (Ohlson & Juettner-Nauroth, 2005):

$$P_0 = \frac{eps_1}{k} + k^{-1} \sum_{i=1}^{\infty} (1+k)^{-1} agr_t$$

Where P_t is the price per share in period t, eps_t is the earnings per share in period t, k is the cost of equity and agr is the abnormal growth in account earnings, defined as follows:

$$eps_{t+1} + kdps_t - (1+k)eps_t$$

Where dps_t is the dividend per share in period t.

When the companies do not have abnormal earnings, or agr = 0, Easton's model is reduced to:

$$P_0 = \frac{eps_1}{k}$$

In this scenario, the implied cost of equity is equivalent to the earnings yield, or E/P.

The ex-ante models are used as the basis for many subsequent studies, such as Attig, Guedhami, and Mishra (2008) and Hail and Leuz (2009).

2.4. The relation between earnings yields and B/M ratios

Some studies test the relation between earnings and other asset pricing risk factors. Fama and French (1995), based on the Fama and French Three-Factor Model, argue that (i) two variables, market equity and B/M ratios, capture much of the cross-section of average stock returns and (ii) such variables are able to predict the evolution of the profitability of listed companies. The authors conclude that companies with high B/M ratios tend to be distressed and have low future profitability. Fama & French (1996), in a related study, apply the Fama and French Three-Factor Model to portfolios sorted separately by deciles of B/M, E/P, Cashflow/Price (C/P) and 5-year sales growth (SG). They show that, while there is strong positive relation between average return and B/M, E/P, C/P and SG, the Three-Factor

model is capable of explaining such "anomalies", with regression intercepts that are consistently small.

2.5. Brazilian Studies

Costa Jr. and Neves (2000) tested the influence of fundamentalist variables in the returns of portfolios consisting of stocks traded in the Brazilian market from March 1987 to February 1996, using the SUR *(seemingly unrelated regression)* estimator. The authors found significant and negative coefficients for the variables P/E (price/earnings) and ln(MV), the natural logarithm of the market value of firms and positive and significant coefficients for the variable VPA/P (book value per share/price per share). They also conclude that the beta estimated using the Bovespa Index is the most relevant variable for explaining returns. The authors also suggest conducting similar studies in periods of greater economic stability and low inflation.

Málaga and Securato (2004) confirm that the three-factor model is superior to the CAPM in explaining Brazilian stock returns.

Mussa, Santos, and Famá (2007) use a similar methodology, also for a sample of stocks listed on Bovespa, in the period between 1995 and 2003. They test it by adding the market moment risk factor, proposed by Carhart (1997), to the three-factor model, concluding the superiority of the proposed model of four factors in the Brazilian market, both regarding the three-factor model and also the CAPM.

Mussa, Rogers, and Securato (2009) go a step further, with the aim of testing the predictive ability of the models. To that end, they carry out a study in two stages, the first being similar to work done by Mussa et al. (2007) and the second, based on the methodology proposed by Fama and MacBeth (1973), which consists of *cross-section* regressions using risk parameters estimated in the previous period. They conclude that none of the tested models (CAPM, three-factor and four factors) were efficient in predicting the Brazilian stock returns, since they found significant intercepts.

Finally, Yoshino and Santos (2009) tested the market, size, B/M, P/E and *dividend yield* risk factors, using regressions based on the panel FMOLS *(fully modified* OLS) estimator, with the objective of testing the validity of CAPM in Brazil. They concluded that

these factors were able to explain stock returns in Brazil, in conjunction with the market factor.

3. METHODOLOGY

3.1. Sample

The sample consists of all listed companies of the São Paulo Stock Exchange (Bovespa), in the period between January 1995 and March 2013. We use monthly returns, resulting in a total of 219 periods. In each period, we exclude the stocks which do not have at least one of the following data: stock price, book value of equity, net income and market value of equity. The average number of stocks used for the period was 187.

3.2. Variables

Similarly to Fama and French (1993), we use time series regressions in which the dependent variables are the excess monthly return of the stock portfolios in relation to the risk-free rate, i.e., $R_{i,t} - RF_{t,}$ as described in section 3.2.1, and the independent variables are a vector of risk factors, as described in section 3.2.2. The specification of the models used is detailed Section 3.2.3.

3.2.1. Formation of Portfolios

We used as dependent variables the returns of portfolios formed based on the following: (I) the market value of equity, or MV, as a measure of firm size, (ii) the book value of equity / market value of equity ratio, or B/M, and (iii) earnings/price ratio, or E/P. The variables are calculated as shown in Table 1.

Table 1: Methodology for the calculation of the variables used to form the portfolios

Variable	Method of Calculation
MV	Market value of equity at the end of each period, considering the price of each class of stocks multiplied by the respective number of stocks, as provided by the Economática database.
B/M	Book value of equity at the end of each period, divided by the market value of equity, MV, as defined above.

E/P	Earnings per share in the last twelve months divided by the stock price, as provided by the Economática database.

The stocks are then sorted according to the variables MV, B/M and E/P and grouped into portfolios. Each stock belongs to three portfolios created by a: one by size, by B/M and another for E/P, as shown in Table 2.

Table 2: Classification of stocks

Criteria	**Portfolio**	**Stocks**
Size	S	50% stocks with lower MV, i.e., small company stocks *(Small)*
	B	50% stocks with higher MV, i.e., large company stocks *(Big)*
B/M	H	30% stocks with higher B/M *(High)*
	M	40% stocks with average B/M *(Medium)*
	L	30% stocks with lower B/M *(Low)*
E/P	HE	30% stocks with higher E/P *(High Earnings)*
	ME	40% stocks with average E/P *(Medium Earnings)*
	LE	30% stocks with lower E/P *(Low Earnings)*

The final portfolios are formed based on three criteria simultaneously, in June of each year, remaining with constant composition for the next 12 months. As a result, the following 18 (2 x 3 x 3) portfolios are created, as shown in Table 3. In this case, each stock will belong to only one portfolio.

Table 3: Portfolios formed

Portfolio	**Criteria**
S_L_LE	Stocks belonging to the S, L and LE groups
S_L_ME	Stocks belonging to the S, L and ME groups
S_L_HE	Stocks belonging to the S, L and HE groups
S_M_LE	Stocks belonging to the S, M and LE groups
S_M_ME	Stocks belonging to the S, M and ME groups
S_M_HE	Stocks belonging to the S, M and HE groups
S_H_LE	Stocks belonging to the S, H and LE groups
S_H_ME	Stocks belonging to the S, H and ME groups

Table 3: Portfolios formed

Portfolio	Criteria
S_H_HE	Stocks belonging to the S, H and HE groups
B_L_LE	Stocks belonging to the B, L and LE groups
B_L_ME	Stocks belonging to the B, L and ME groups
B_L_HE	Stocks belonging to the B, L and HE groups
B_M_LE	Stocks belonging to the B, M and LE groups
B_M_ME	Stocks belonging to the B, M and ME groups
B_M_HE	Stocks belonging to the B, M and HE groups
B_H_LE	Stocks belonging to the B, H and LE groups
B_H_ME	Stocks belonging to the B, H and ME groups
B_H_HE	Stocks belonging to the B, H and HE groups

3.2.2. The explanatory variables

We use the risk factors market (RM - RF), SMB, HML and HEMLE as independent variables, as defined in Table 4.

Table 4: Explanatory variables

Variable	Description
RM - RF	Monthly return of the market portfolio, calculated as the average return of all stocks traded on the São Paulo, weighted by their market value, minus the Selic rate in the same period
SMB	*Small minus big:* Monthly return weighted by market value of the portfolio S, minus monthly return weighted by the market value of portfolio B
HML	*High minus low*: Monthly return weighted by market value of the portfolio H, minus monthly return weighted by the market value of the portfolio L
HEMLE	*High earnings minus low earnings*: Monthly return weighted by market value of the portfolio HE, minus monthly return weighted by the market value of the portfolio LE

3.2.3. Returns to be explained

The returns on each portfolio i are calculated in each month t, $R_{i,t,}$ based on the weighted average stock returns:

$$R_{i,t} = \sum_{a=1}^{n} \frac{MV_{a,t} \times R_{a,t}}{VM_{i,t}}$$

Where $MV_{a,t}$ is the market value of equity of company a in period t, $R_{a,t}$ is the return of the stock a in period t, n is the number of assets belonging to portfolio ***i***, and $MV_{i,t}$ is the market value of the portfolio i, equal to the sum of the market capitalization of all stocks comprising the i.

3.3. Specification of models

To achieve the first objective, i.e., to verify weather portfolios formed by earnings/price ratios have returns significantly different from those provided by the CAPM, we use the methodology developed by Jensen (1968), in which the intercept of the regression, the Jensen's Alpha, is considered to be the abnormal performance of asset i.

$$R_{i,t} - RF_t = a_i + b_i(RM_t - RF_t)\, e_{i,t} \quad (1).$$

Where $R_{i,t}$ is the return on portfolio i in month t, a is the Jensen's Alpha and $RM_t - RF_t$ is the return of the market portfolio in excess to the risk free rate in month t, as defined in Table 4 .

For these regressions, we use as dependent variables the monthly returns of extreme portfolios formed by a single criterion (HE and LE). For illustrative purposes, in addition to the returns of portfolios formed based on E/P ratios, we also test returns of extreme portfolios formed based on size and M/B criteria.

To test asset pricing models that include the HEMLE risk factor as an explanatory variable for returns, we use regressions similar to the ones developed by Fama and French (1993). The models used are as follows:

Model 1: $R_{i,t} - RF_t = a_i + b_i(RM_t - RF_t) + e_{i,t}$ (1)

Model 2: $R_{i,t} - RF_t = a_i + b_i(RM_t - RF_t) + k_i(HEMLE_t) + e_{i,t}$ (2)

Model 3: $R_{i,t} - RF_t = a_i + b_i(RM_t - RF_t) + s_i(SMB_t) + h_i(HML_t) + e_{i,t}$ (3)

Model 4: $R_{i,t} - RF_t = a_i + b_i(RM_t - RF_t) + s_i(SMB_t) + k_i(HEMLE_t) + e_{i,t}$ (4)

Model 5: $R_{i,t} - RF_t = a_i + b_i(RM_t - RF_t) + s_i(SMB_t) + h_i(HML_t) + k_i(HEMLE_t) + e_{i,t}$ (5)

For these regressions we use monthly returns from 18 portfolios formed by the criteria size, M/B and E/P as dependent variables ($R_{i,t}$), as described in Table 3.

4. RESULTS

4.1. Jensen's alphas of portfolios formed based on a single risk factor

As expected, the market risk factor coefficient, b, was positive and significantly different from zero for all single-criterion extreme portfolios (S, B, H, L, HE, ME), in line with the results obtained by Fama and French (1993).

The coefficient a (Jensen's Alpha) was positive and significant at 1% for the HE portfolio, i.e., it is clear that companies with high E/P showed consistently higher realized returns than the ones predicted by the CAPM in Brazil. Such results are qualitatively similar to the findings by Basu (1977) and Costa Jr. and Neves (2000). Accordingly, the LE portfolio presented a negative alpha. These results confirm the first hypothesis.

This is also consistent with the idea that the earnings price ratio can be a reasonable proxy for the implied or ex-ante cost of equity – portfolios with higher implied cost of equity presented higher realized returns.

Similar analyses were repeated for portfolios not weighted by the market value of the stocks, i.e. equally weighed. The Alpha of portfolio HE remains positive and significant and the portfolio LE remains negative and significant, reinforcing the robustness of the results.

Table 5: Estimated Jensen´s Alphas

$R_{i,t} - RF_t = a_i + b_i(RM_t - RF_t) + e_{i,t}$

Portfolio	a		b			R^2	No. of obs.
	Coef.	t	Coef.	t against 0	t against 1		
S (*small*)	0.010	(3.027)***	0.573	(12.60)***	(-9.39)***	0.422	219
B *(big)*	-0.001	(-0.946)	1.000	(135.60)***	(0.00)	0.988	219
H (high B/M)	-0.002	(-0.357)	1.058	(16.26)***	(0.89)	0.549	219

Table 5: Estimated Jensen´s Alphas

$R_{i,t} - RF_t = a_i + b_i(RM_t - RF_t) + e_{i,t}$

Portfolio	a		b			R^2	No. of
L (low B/M)	-0.001	(-0.826)	0.915	(43.61)***	(-4.05)***	0.898	219
HE (high E/P)	0.013	(3.259)***	0.859	(16.44)***	(-2.70)***	0.555	219
LE (low E/P)	-0.004	(-1.976)***	0.963	(35.53)***	(-1.37)	0.853	219

*** p<0,01, ** p<0,05, * p<0,10

The coefficient b (CAPM's Beta) for the portfolio of large companies (B) is close to 1 and the regressions' R^2 is close to 100%. This fact is expected, given that the market portfolio is weighted by the market value of companies, with 96% of all market capitalization in Brazil deriving from companies in portfolio B.

In contrast, the portfolio comprised of small companies (S) has a low beta and high Jensen's alpha. The low beta stems from two facts. First, from the low correlation with the portfolio of large companies (B), whose returns are similar to those of the market portfolio, being necessarily less than 1. Second, the standard deviation of portfolio S is also lower than that of B, due to the low liquidity of the stocks of small companies, whose prices tends to remain unchanged for a relatively large number of trading days. The alpha of portfolio S is positive and significant, offsetting the effect of the portfolio's low beta.

As a robustness check, the analysis was repeated with the market portfolio returns calculated without weighting by market value, i.e. equally weighed market returns. In this case, the betas of portfolios S and B are closer to 1 and the alphas are closer to zero.

Additionally, portfolio L showed a beta significantly less than 1, which is consistent with most of the literature, which finds that the stocks of companies with lower B/M *(growth)* have consistently lower returns to high B/M *(value*) (Fama & French, 1996, 1998; Yoshino & Santos, 2009).

4.2. Models with one factor: market

Similarly to other Brazilian studies, such as Málaga and Securato (2004) and Mussa et al. (2007), and, as expected, we identify that the market risk factor was relevant to explain the return of all portfolios, with the coefficient b being positive and highly significant. The coefficients a (Jensen's Alpha) were significant in 5 of the 18 portfolios, suggesting that the

market risk factor, albeit relevant, was not sufficient to explain the portfolios' realized returns, contradicting the CAPM's predictions.

Table 6: Estimated parameters for the one-factor model (CAPM)
$R_{i,t} - RF_t = a_i + b_i(RM_t - RF_t) + e_{i,t}$
$R_{i,t}$ are monthly returns of portfolios formed based on the stocks market capitalization, E/P and B/M ratios, for a sample of Brazilian stocks in the January 1995 – March 2013 period. $RM_t$is the value-weighted market portfolio return. $RF_t$is the monthly Selic rate.

Portfolio	Coefficients and t-statistics in parentheses		Obs.	R^2
	a	b		
S_L_LE	-0.00425	0.561***	202	0.081
	(-0.428)	(4.188)		
S_L_ME	-6.13e-05	0.542***	219	0.118
	(-0.00805)	(5.394)		
S_L_HE	0.0115	0.768***	183	0.157
	(1.179)	(5.813)		
S_M_LE	-0.00493	0.606***	214	0.133
	(-0.610)	(5.701)		
S_M_ME	0.0106**	0.620***	219	0.340
	(2.389)	(10.57)		
S_M_HE	0.0104**	0.551***	219	0.325
	(2.554)	(10.22)		
S_H_LE	0.00973	0.591***	219	0.154
	(1.364)	(6.273)		
S_H_ME	0.00941	0.624***	217	0.224
	(1.565)	(7.869)		
S_H_HE	0.0138**	0.578***	219	0.215
	(2.439)	(7.716)		
B_L_LE	-0.00495**	0.870***	219	0.784
	(-2.107)	(28.06)		
B_L_ME	0.00345	0.942***	219	0.782
	(1.346)	(27.86)		
B_L_HE	0.00654	0.723***	166	0.310
	(1.002)	(8.581)		
B_M_LE	2.23e-05	0.916***	219	0.527
	(0.00499)	(15.56)		
B_M_ME	-0.000416	1.017***	219	0.739
	(-0.134)	(24.77)		
B_M_HE	0.00751*	0.796***	219	0.471
	(1.730)	(13.89)		
B_H_LE	-0.00412	1.030***	219	0.354
	(-0.576)	(10.90)		
B_H_ME	-0.00280	0.879***	195	0.398
	(-0.465)	(11.29)		
B_H_HE	0.00809	0.920***	205	0.243
	(0.923)	(8.075)		

*** p<0.01, ** p<0.05, * p<0.10

In order to make the interpretation of Table 6 easier, Figure 1 presents a summary containing only the signs and significance levels of the intercepts of the 18 regressions.

Figure 1: Significance of the intercepts of portfolios

Criteria	LE	ME	HE
H	no significative alpha	no significative alpha	S_H_HE: positive, p <0.05
M	no significative alpha	S_M_ME: positive, p <0.05	S_M_HE: positive, p <0.05 B_M_HE: positive, p <0.10
L	B_L_LE: negative, p <0.05	no significative alpha	no significative alpha

Not surprisingly, the portfolios of stocks which are "cheap" by the two criteria (H by B/M and HE by E/P), which can be classified as value stocks, showed superior returns and the "expensive" portfolios presented lower returns. This effect is made stronger by the size of the companies, which tends to generate positive intercepts for portfolios of smaller companies and negative intercepts for large companies. Specifically, the "cheap stocks" portfolios S_H_HE, S_M_HE, B_M_HE and S_M_ME showed positive and significant intercepts, with a predominance of portfolios comprised of small companies (S); whereas the "expensive stocks" portfolio B_L_LE showed negative and significant intercept.

4.3. Models with two factors: market and E/P

The HEMLE risk factor was significant for explaining returns in most the portfolios, adding explanatory power to the one-factor model. Adding the HEMLE risk factor also reduced the number of portfolios in which the intercept (a) was significant: only 2 of the 18 portfolios, compared with 5 in the one-factor model. Again, the market factor was highly significant for all portfolios.

Table 7: Estimated parameters for the two-factor model
$R_{i,t} - RF_t = a_i + b_i(RM_t - RF_t) + k_i(HEMLE_t) + e_{i,t}$
$R_{i,t}$ are monthly returns of portfolios formed based on the stocks market capitalization, E/P and B/M ratios, for a sample of Brazilian stocks in the January 1995 – March 2013 period. $RM_t$is the value-weighted market portfolio return. RF_t is the monthly Selic rate. $HEMLE_t$ is the monthly return of the high E/P portfolio minus the monthly return of the low E/P portfolio.

Portfolio	Coefficients and t-statistics in parentheses			Obs.	R^2
	a	b	k		
S_L_LE	-0.0127	0.579***	0.492***	202	0.131
	(-1.269)	(4.432)	(3.381)		
S_L_ME	-0.00181	0.553***	0.103	219	0.122
	(-0.230)	(5.464)	(0.933)		
S_L_HE	0.00755	0.801***	0.298**	183	0.177
	(0.768)	(6.071)	(2.083)		
S_M_LE	-0.00613	0.612***	0.0684	214	0.134
	(-0.734)	(5.722)	(0.585)		
S_M_ME	0.0103**	0.622***	0.0163	219	0.340
	(2.254)	(10.51)	(0.253)		
S_M_HE	0.00746*	0.570***	0.176***	219	0.353
	(1.804)	(10.69)	(3.026)		
S_H_LE	0.00783	0.602***	0.112	219	0.158
	(1.066)	(6.358)	(1.085)		
S_H_ME	0.00713	0.637***	0.134	217	0.232
	(1.155)	(8.015)	(1.542)		
S_H_HE	0.00621	0.624***	0.449***	219	0.323
	(1.143)	(8.905)	(5.877)		
B_L_LE	-0.00237	0.855***	-0.152***	219	0.804
	(-1.024)	(28.66)	(-4.686)		
B_L_ME	0.00230	0.949***	0.0676*	219	0.785
	(0.877)	(28.04)	(1.832)		
B_L_HE	-0.00182	0.734***	0.478***	166	0.411
	(-0.290)	(9.401)	(5.278)		
B_M_LE	0.00448	0.889***	-0.263***	219	0.563
	(1.014)	(15.57)	(-4.226)		
B_M_ME	-0.00247	1.030***	0.121***	219	0.747
	(-0.781)	(25.28)	(2.722)		
B_M_HE	-0.00158	0.851***	0.536***	219	0.648
	(-0.432)	(18.06)	(10.42)		
B_H_LE	-0.00133	1.013***	-0.165	219	0.362
	(-0.181)	(10.69)	(-1.594)		
B_H_ME	-0.00103	0.872***	-0.0888	195	0.401
	(-0.164)	(11.17)	(-1.034)		
B_H_HE	-0.00487	1.002***	0.737***	205	0.374
	(-0.591)	(9.578)	(6.507)		

*** p<0.01, ** p<0.05, * p<0.10

4.4. The Fama and French three-factor model

The three factors proposed by Fama and French (1993) were relevant in explaining the portfolios' returns, although not statistically significant in some of them. Three portfolios

presented significant Jensen's alphas with p<0.05, suggesting that the three-factor model still lacks explanatory power. These results are similar to those found in other Brazilian studies, including Málaga and Securato(2004), Mussa et al. (2007) and Mussa et al. (2009).

Interestingly, the intercepts were negative and statistically significant for portfolios with low earnings-price ratios.

Table 8: Estimated parameters for the F&F three-factor model
$R_{i,t} - RF_t = a_i + b_i(RM_t - RF_t) + s_i(SMB_t) + h_i(HML_t) + e_{i,t}$
$R_{i,t}$ are monthly returns of portfolios formed based on the stocks market capitalization, E/P and B/M ratios, for a sample of Brazilian stocks in the January 1995 – March 2013 period. $RM_t$is the value-weighted market portfolio return. RF_t is the monthly Selic rate. SMB_t is the monthly return of the small stocks portfolio minus the monthly return of the large stocks portfolio. HML_t is the monthly return of the high B/M portfolio minus the monthly return of the low B/M portfolio.

Portfolio	Coefficients and t-statistics in parentheses				Obs.	R^2
	a	m	s	h		
S_L_LE	-0.0183**	1.014***	1.140***	0.114	202	0.260
	(-1.987)	(7.290)	(6.835)	(0.992)		
S_L_ME	-0.00782	0.868***	0.700***	-0.190**	219	0.240
	(-1.079)	(7.909)	(5.309)	(-2.270)		
S_L_HE	0.00103	1.225***	0.998***	-0.00429	183	0.280
	(0.111)	(8.265)	(5.532)	(-0.0410)		
S_M_LE	-0.0159**	1.005***	0.961***	0.0421	214	0.303
	(-2.140)	(9.001)	(7.146)	(0.492)		
S_M_ME	0.00321	0.918***	0.673***	-0.0732*	219	0.551
	(0.853)	(16.13)	(9.843)	(-1.684)		
S_M_HE	0.00399	0.805***	0.587***	-0.0168	219	0.513
	(1.121)	(14.93)	(9.073)	(-0.408)		
S_H_LE	0.00377	0.835***	0.539***	-0.0986	219	0.225
	(0.539)	(7.880)	(4.237)	(-1.219)		
S_H_ME	0.000878	0.953***	0.793***	0.0391	217	0.407
	(0.163)	(11.73)	(8.104)	(0.629)		
S_H_HE	0.00158	1.043***	1.121***	0.0939**	219	0.629
	(0.395)	(17.23)	(15.43)	(2.032)		
B_L_LE	-0.00528**	0.901***	0.0238	-0.142***	219	0.811
	(-2.339)	(26.38)	(0.580)	(-5.452)		
B_L_ME	0.00301	0.979***	0.0339	-0.160***	219	0.810
	(1.229)	(26.44)	(0.763)	(-5.644)		
B_L_HE	0.00120	0.872***	0.341***	-0.0563	166	0.346
	(0.181)	(9.053)	(2.940)	(-0.713)		
B_M_LE	-0.000804	0.935***	0.0798	0.107**	219	0.538
	(-0.178)	(13.65)	(0.970)	(2.055)		
B_M_ME	-8.58e-05	1.006***	-0.0307	-0.0132	219	0.739
	(-0.0269)	(20.84)	(-0.529)	(-0.358)		
B_M_HE	0.00514	0.879***	0.219***	0.0686	219	0.492
	(1.180)	(13.32)	(2.757)	(1.361)		
B_H_LE	-0.00635	1.049***	0.225*	0.536***	219	0.480
	(-0.965)	(10.53)	(1.879)	(7.044)		
B_H_ME	-0.00242	0.855***	0.0576	0.436***	195	0.511

Table 8: Estimated parameters for the F&F three-factor model
$R_{i,t} - RF_t = a_i + b_i(RM_t - RF_t) + s_i(SMB_t) + h_i(HML_t) + e_{i,t}$
$R_{i,t}$ are monthly returns of portfolios formed based on the stocks market capitalization, E/P and B/M ratios, for a sample of Brazilian stocks in the January 1995 – March 2013 period. $RM_t$is the value-weighted market portfolio return. RF_t is the monthly Selic rate. SMB_t is the monthly return of the small stocks portfolio minus the monthly return of the large stocks portfolio. HML_t is the monthly return of the high B/M portfolio minus the monthly return of the low B/M portfolio.

Portfolio	Coefficients and t-statistics in parentheses				Obs.	R^2
	(-0.434)	(10.46)	(0.581)	(6.629)		
B_H_HE	0.00320	1.021***	0.383**	0.441***	205	0.332
	(0.378)	(8.044)	(2.519)	(4.624)		

*** p<0.01, ** p<0.05, * p<0.10

4.5. Three-factor model with Market, Size and E/P

The proposed three-factor model, which substitutes HML for HEMLE, proved superior to the traditional Fama and French three-factor model in the Brazilian market, resulting in only one intercept with p < 0.05. The k coefficient was significant with p < 0.05 in 10 of the 18 regressions compared to 8 regressions for the ha coefficient in the Fama and French Three-Factor model.

Table 9: Estimated parameters for the E/P three-factor model
$R_{i,t} - RF_t = a_i + b_i(RM_t - RF_t) + s_i(SMB_t) + k_i(HEMLE_t) + e_{i,t}$
$R_{i,t}$ are monthly returns of portfolios formed based on the stocks market capitalization, E/P and B/M ratios, for a sample of Brazilian stocks in the January 1995 – March 2013 period. $RM_t$is the value-weighted market portfolio return. RF_t is the monthly Selic rate. SMB_t is the monthly return of the small stocks portfolio minus the monthly return of the large stocks portfolio.$HEMLE_t$ is the monthly return of the high E/P portfolio minus the monthly return of the low E/P portfolio.

	Coefficients and t-statistics in parentheses					
Portfolio	a	b	s	k	Obs.	R^2
S_L_LE	-0.0209**	0.999***	1.056***	0.218	202	0.265
	(-2.241)	(7.178)	(6.020)	(1.541)		
S_L_ME	-0.00652	0.856***	0.764***	-0.113	219	0.225
	(-0.877)	(7.726)	(5.355)	(-1.015)		
S_L_HE	9.85e-05	1.219***	0.960***	0.1000	183	0.282
	(0.0106)	(8.234)	(5.126)	(0.716)		
S_M_LE	-0.0131*	1.031***	1.062***	-0.229**	214	0.316
	(-1.741)	(9.313)	(7.456)	(-2.050)		
S_M_ME	0.00559	0.928***	0.771***	-0.202***	219	0.571
	(1.496)	(16.68)	(10.76)	(-3.604)		
S_M_HE	0.00386	0.802***	0.583***	0.0109	219	0.513
	(1.065)	(14.86)	(8.403)	(0.202)		
S_H_LE	0.00433	0.828***	0.568***	-0.0484	219	0.221
	(0.606)	(7.788)	(4.150)	(-0.453)		
S_H_ME	0.00208	0.967***	0.837***	-0.0997	217	0.410
	(0.380)	(11.93)	(8.010)	(-1.220)		
S_H_HE	-0.000232	1.039***	1.044***	0.154**	219	0.633

Table 9: Estimated parameters for the E/P three-factor model
$R_{i,t} - RF_t = a_i + b_i(RM_t - RF_t) + s_i(SMB_t) + k_i(HEMLE_t) + e_{i,t}$
$R_{i,t}$ are monthly returns of portfolios formed based on the stocks market capitalization, E/P and B/M ratios, for a sample of Brazilian stocks in the January 1995 – March 2013 period. $RM_t$is the value-weighted market portfolio return. RF_t is the monthly Selic rate. SMB_t is the monthly return of the small stocks portfolio minus the monthly return of the large stocks portfolio.$HEMLE_t$ is the monthly return of the high E/P portfolio minus the monthly return of the low E/P portfolio.

Portfolio	Coefficients and t-statistics in parentheses				Obs.	R^2
	(-0.0575)	(17.26)	(13.47)	(2.546)		
B_L_LE	-0.00310	0.902***	0.119***	-0.186***	219	0.810
	(-1.351)	(26.36)	(2.697)	(-5.408)		
B_L_ME	0.00221	0.955***	0.0143	0.0636	219	0.785
	(0.836)	(24.19)	(0.281)	(1.603)		
B_L_HE	-0.00365	0.806***	0.172	0.433***	166	0.419
	(-0.575)	(8.822)	(1.493)	(4.553)		
B_M_LE	0.00310	0.978***	0.225***	-0.326***	219	0.577
	(0.705)	(14.93)	(2.663)	(-4.959)		
B_M_ME	-0.00186	0.990***	-0.0989	0.149***	219	0.750
	(-0.586)	(20.97)	(-1.627)	(3.136)		
B_M_HE	-0.00134	0.836***	-0.0391	0.547***	219	0.648
	(-0.363)	(15.21)	(-0.553)	(9.900)		
B_H_LE	-0.00324	1.136***	0.309**	-0.252**	219	0.376
	(-0.442)	(10.39)	(2.196)	(-2.294)		
B_H_ME	-0.00150	0.905***	0.0848	-0.112	195	0.403
	(-0.237)	(9.985)	(0.723)	(-1.223)		
B_H_HE	-0.00496	1.007***	0.0135	0.733***	205	0.374
	(-0.596)	(8.196)	(0.0855)	(6.029)		

*** p<0.01, ** p<0.05, * p<0.1

4.6. Four-factor models

The HEMLE risk factor proved significant in explaining the portfolios' returns even when used jointly with the three other risk factors - RM-RF, SMB and HML. Two of the eighteen portfolios, however, still showed significant intercepts with p <0.10, which may be an indication that there are other factors that explain the returns, which are not included in the model.

Nevertheless, the four-factor model has been the most efficient in removing intercepts: only one portfolio had a significant Jensen's alpha with p<0.05, when compared to three significant intercepts in the three-factor model.

Table 10: Estimated parameters for the four-factor model
$R_{i,t} - RF_t = a_i + b_i(RM_t - RF_t) + s_i(SMB_t) + h_i(HML_t) + k_i(HEMLE_t) + e_{i,t}$
$R_{i,t}$ are monthly returns of portfolios formed based on the stocks market capitalization, E/P and B/M ratios, for a

sample of Brazilian stocks in the January 1995 – March 2013 period. $RM_t$is the value-weighted market portfolio return. RF_t is the monthly Selic rate. SMB_t is the monthly return of the small stocks portfolio minus the monthly return of the large stocks portfolio. HML_t is the monthly return of the high B/M portfolio minus the monthly return of the low B/M portfolio. $HEMLE_t$ is the monthly return of the high E/P portfolio minus the monthly return of the low E/P portfolio.

Portfolio	Coefficients and t-statistics in parentheses					Obs.	R^2
	a	m	s	h	k		
S_L_LE	-0.0207**	0.992***	1.060***	0.0902	0.202	202	0.267
	(-2.222)	(7.097)	(6.034)	(0.780)	(1.411)		
S_L_ME	-0.00683	0.875***	0.739***	-0.183**	-0.0840	219	0.242
	(-0.926)	(7.937)	(5.209)	(-2.160)	(-0.755)		
S_L_HE	8.56e-05	1.220***	0.960***	-0.0144	0.103	183	0.283
	(0.00916)	(8.207)	(5.111)	(-0.136)	(0.726)		
S_M_LE	-0.0130*	1.024***	1.071***	0.0648	-0.239**	214	0.317
	(-1.731)	(9.223)	(7.486)	(0.758)	(-2.127)		
S_M_ME	0.00549	0.934***	0.763***	-0.0555	-0.193***	219	0.574
	(1.473)	(16.75)	(10.64)	(-1.298)	(-3.426)		
S_M_HE	0.00383	0.804***	0.581***	-0.0181	0.0138	219	0.513
	(1.055)	(14.82)	(8.325)	(-0.435)	(0.252)		
S_H_LE	0.00417	0.838***	0.555***	-0.0956	-0.0332	219	0.225
	(0.584)	(7.862)	(4.046)	(-1.170)	(-0.309)		
S_H_ME	0.00219	0.962***	0.843***	0.0498	-0.108	217	0.412
	(0.401)	(11.81)	(8.041)	(0.794)	(-1.312)		
S_H_HE	-9.73e-05	1.031***	1.055***	0.0810*	0.141**	219	0.638
	(-0.0242)	(17.15)	(13.63)	(1.756)	(2.327)		
B_L_LE	-0.00331	0.915***	0.102**	-0.127***	-0.166***	219	0.831
	(-1.525)	(28.17)	(2.429)	(-5.102)	(-5.055)		
B_L_ME	0.00193	0.972***	-0.00844	-0.168***	0.0903**	219	0.816
	(0.787)	(26.44)	(-0.178)	(-5.961)	(2.435)		
B_L_HE	-0.00457	0.817***	0.164	-0.139*	0.473***	166	0.430
	(-0.722)	(8.988)	(1.431)	(-1.829)	(4.878)		
B_M_LE	0.00333	0.964***	0.243***	0.139***	-0.349***	219	0.592
	(0.770)	(14.90)	(2.923)	(2.813)	(-5.341)		
B_M_ME	-0.00190	0.993***	-0.103*	-0.0273	0.153***	219	0.751
	(-0.600)	(20.94)	(-1.680)	(-0.750)	(3.201)		
B_M_HE	-0.00131	0.834***	-0.0366	0.0186	0.544***	219	0.649
	(-0.354)	(15.10)	(-0.515)	(0.440)	(9.756)		
B_H_LE	-0.00229	1.078***	0.386***	0.567***	-0.342***	219	0.508
	(-0.351)	(11.05)	(3.072)	(7.591)	(-3.478)		
B_H_ME	0.00104	0.877***	0.163	0.471***	-0.228***	195	0.529
	(0.184)	(10.85)	(1.552)	(7.139)	(-2.726)		
B_H_HE	-0.00481	0.967***	0.0668	0.378***	0.672***	205	0.426
	(-0.601)	(8.167)	(0.440)	(4.240)	(5.714)		

*** p<0.01. ** p<0.05. * p<0.10

4.7. Analysis of significance of the intercepts

In their seminal 1993 paper, Fama and French show that their three-factor model does a good job explaining the cross-section of average stock returns because it generates intercepts not significantly different from zero.

In our Brazilian sample, the models that use the risk factor HEMLE were the most efficient in eliminating intercepts. All three models including such risk factor resulted in only one significant intercept with p < 5% each, compared to 3 in the Fama and French three-factor model and 4 in the one factor model (CAPM).

The results indicate that any of the models including the HEMLE risk factor, including the 2-factor model, are more efficient than the Fama and French three-factor model for explaining returns in the Brazilian market, as shown in Table 11.

Table 11: Analysis of significance of the intercepts. Number of significant intercepts. Each model was applied to the 18 portfolios.

Intercepts significance	CAPM (RM-RF)	Fama & French three-factor model (RM-RF, SMB, HML)	Models with HEMLE		
			2 factors (RM-RF, HEMLE)	3 factors (RM-RF, SMB, HEMLE)	4 factors (RM-RF, SMB, HML, HEMLE)
p <1%	0	0	0	0	0
1%≤ p <5%	4	3	1	1	1
p≥ 5%	14	15	17	17	17

5. CONCLUSION

This study tested the realized returns of portfolios formed based on the E/P ratio of stocks traded in Brazil, as well as the addition of the HEMLE risk factor to asset pricing models. The HEMLE risk factor can be understood as an expected risk/return premium for stocks with high earnings/price ratio, or earnings yield, which can be a good approximation the company's ex-ante or implied cost of capital, in line with the models of Gebhardt et al. (2001), Claus and Thomas (2001), Easton (2004) and Ohlson and Juettner-Nauroth (2005).

Therefore, the results of this study can be understood as a convergence of two major lines of research on cost of equity and asset pricing: the development ex-post multi-factor models with a greater number of risk factors and the adoption of ex-ante models. The results show that assets with high implied cost of equity, measured by high E/P ratios, also posted superior realized returns, as well as that the risk factor related to the high implied cost of equity, HEMLE, is significant in explaining stock returns in Brazil.

We also conclude that, in Brazil, the E/P ratio can be more effective in identifying "cheap" or "value" stocks when compared to B/M ratios. While portfolios formed based on E/P ratios presented abnormal risk-adjusted returns, the portfolios formed by M/B ratios did

not have significant intercepts. Such results are different from the ones obtained by Fama and French (1995) and Fama & French (1996), who show that the three-factor model can explain the returns of portfolios formed based on E/P ratios. This may be due to the high inflation rate in Brazil, which makes the book values of companies less meaningful, especially for firms with older assets.

More generally, the results also show that using E/P ratios in Brazil for selecting value stocks resulted in significantly superior risk-adjusted performance for investors, even when controlled by other risk factors. While the market portfolio generated an average monthly excess return over the risk-free rate of 0.6%, the portfolio comprised of high earnings/price stocks presented a monthly excess return of 1.8%, while having a slightly lower beta, resulting in an excess risk-adjusted monthly return close to 1.3%.

More formally, the study confirms the hypotheses that (i) the stocks with high (low) E/P ratios, i.e., potentially high (low) implied cost of equity exhibit abnormally high (low) realized returns not captured by the CAPM, and (ii) the HEMLE risk factor was significant in explaining stock returns, both in models controlled by the market risk factor and in models jointly controlled by the factors market risk, size risk premium (SMB) and the risk premium related to the B/M ratio (HML).

We also conclude that the models using the HEMLE risk factor resulted in greater ability to eliminate the intercepts of the regressions. The two-factor model (market and HEMLE), the three-factor model (market, SMB and HEMLE) and the four-factor model (market, SMB, HML and HEMLE) showed less significant intercepts when compared to the Fama and French three-factor model.

A limitation of this study is that the sample, despite being the largest in number of assets and in period of time used in Brazil to the authors' knowledge, is still rather limited when compared to those used in international studies.

These results may encourage future studies that test the explanatory power of the HEMLE risk factor in other markets, especially those with higher inflation or lower development when compared to the U.S. market, where the most relevant models have been developed.

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