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Liquidity and asset pricing: evidence from the Brazilian market

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ABSTRACT

The article examines whether the two-factor model developed by Liu (2006) explains the variations in stock returns in the Brazilian market. We also compare the performance of this model with the CAPM and the three-factor model of Fama & French (1993) and investigate whether the two-factor model is robust to strategies based on size, book-to-market, momentum, earnings/price, cash flow/price, liquidity and leverage, called value anomalies. We used multiple regressions with time series to analyze the performance of the models in explaining the variations in stock returns of various portfolios. The population analyzed consisted of all the firms with shares listed on the BM&FBovespa in the period from 1995 to 2008. The two-factor model performed better than the CAPM and very near the three-factor model in terms of explanatory power. Therefore, the results obtained with the two-factor model are relevant, considering we worked with dynamic portfolios. Finally, even though the two-factor model was not able to explain some of the anomalies commonly documented in the literature, advances were evidenced, which can be considered an important step in the literature, even though much can still be accomplished.

Keywords: Liquidity. Asset pricing models. CAPM. Three-factor model of Fama & French (1993).

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1 INTRODUCTION

The capital asset pricing model (CAPM) assumes that a single risk factor affects stock returns, captured by beta. However, since its formulation, empirical evidence has shown that other risk factors are associated with stock returns as well, altering the predictions of the CAPM.

In recent decades, may researchers have investigated the behavior of systematic anomalies detected in the formation of asset prices not explained by the CAPM, and strategies have been put forward that produce statistically significant positive abnormal returns, independent of the risk level. Fama & French (1996) were the first to call this behavior inconsistent with the CAPM an anomaly.

Banz (1981), Fama & French (1992) and Keim (1983) found that the shares of firms with low market value have higher returns that those with high market value, characterizing the size effect. Stattman (1980), Fama & French (1993), Lakonnishok, Shleifer & Vishny (1994) and De Bondt & Thaler (1985) found evidence that over the long run, value stocks present higher returns than growth stocks, besides having lower risk, characterizing the book-to-market effect, running counter to asset pricing models that predict a positive relation between risk and return. Jegadeesh & Titman (1993, 2001) documented that buying shares that performed better in the previous three to twelve months and selling shares that had worse performance in that time frame provided abnormal returns the following year, characterizing the momentum effect. Bhandari (1988) observed a positive relation between stock returns and indebtedness, characterizing the leverage effect.

In the search for factors that could improve the explanatory power of the CAPM as well as capture asset pricing anomalies, alternative models have been developed. Fama & French (1993) formulated the three-factor model, with the factors being an overall market factor, according to the CAPM, along with size, defined by the market value of equity, and the book-to-market (B/M) index, the ratio between the accounting (book) value and market value of equity.

Carhart (1997) identified the momentum factor and the inability of the three-factor model and the CAPM to explain it (Fama & French, 2004), and suggested adding a fourth factor, reporting empirical evidence of superior performance to the three-factor model.

One of the pillars of traditional asset pricing theory is the assumption that all assets are liquid and easily tradable by economic agents. In reality, however, many important classes of assets are not completely liquid, so that agents often cannot buy and sell them immediately (LONGSTAFF, 2005).

Asset pricing theory suggests that the expected return of an asset should increase with its risk level, because risk-averse investors require additional compensation to accept greater risk. Since investors are also averse to the cost of illiquidity and want to be rewarded for facing it, the expected return of an asset should be a rising function of illiquidity. Therefore, an asset's return depends on two characteristics: risk and liquidity (AMIHUD; MENDELSON, 2006). According to Jacoby, Fowler & Gottesman (2000), risk and liquidity are inseparable variables. Therefore, in valuing assets, financial analysts should consider not only the risk and expected return, they also should consider liquidity.

The literature on the inclusion of liquidity in asset pricing models is relatively recent. Chan & Faff (2003) showed that liquidity was priced in the Australian market, even after controlling for the book-to-market index, size, beta and momentum. Chan & Faff (2005), also in the Australian market, and Pastor & Stambaugh (2003), in the American market, added liquidity to the three-factor model of Fama & French (1993) and found strong evidence supporting the better performance of the model including liquidity. Keene & Peterson (2007) analyzed the importance of liquidity as a risk factor in asset pricing models and added it to the four-factor model of Carhart (1997), concluding that it is priced by the market and explains part of the variations in stock returns, improving the model's explanatory power. Similar results were obtained by Machado & De Medeiros (2011) for the Brazilian market.

Liu (2006) developed a two-factor model, adding liquidity to the single-factor model (CAPM). According to him, the model is more parsimonious and better explains the variation in returns than the CAPM and three-factor model of Fama & French (1993), and is also robust to the various market anomalies that the CAPM and three-factor model fail to capture.

Machado & De Medeiros (2012) observed the existence of a liquidity premium in the Brazilian market, independent of the proxy used. The monthly premium varied from 0.83% to 2.19% without adjustment to risk, and from 1.77% to 2.78% with risk adjustment according to the CAPM, and from 1.24% to 3.04% after risk adjustment according to the three-factor model. They also observed that the liquidity premium was not restricted to the month of January and there were no large changes when using different periods in the analysis. Furthermore, they found that both the CAPM and the three-factor model failed to explain the liquidity effect.

Considering there is a liquidity premium in Brazil (MACHADO; DE MEDEIROS, 2012) and the importance of liquidity as a risk factor in asset pricing models (Machado & De Medeiros, 2011), our main goal here is to analyze whether the more parsimonious model, based on market and liquidity as proposed by Liu (2006), performs better to explain the variation in returns than the CAPM and the three-factor model of Fama & French (1993).

Our secondary objective is to compare the performance of the two-factor model with the CAPM and three-factor model of Fama & French (1993) and to investigate whether the two-factor model is robust to strategies based on the effects of size, book-to-market (B/M), momentum, earnings/price, cash flow/price, liquidity and leverage (as a group called value anomalies).

The article is organized into five sections including this introduction. In the second we present the theoretical framework, summarizing the three asset pricing models studied: CAPM, two- and three-factor models. In the third section we explain the methodology, and in the fourth we present and discuss the results. The fifth section concludes.

2 LITERATURE REVIEW

2.1 THE CAPM

The capital asset pricing model (CAPM) was initially proposed by Treynor (1961) and Sharpe (1964), and was further developed by Mossin (1966), Lintner (1965) and Black (1972). According to the CAPM, the expected return of an asset is a linear function of a risk-free asset, the systematic risk (or market or non-diversifiable risk) of the asset or portfolio of interest, represented by beta, and a risk premium in relation to the risk-free asset, as shown in Equation 1.

$$E(R_i) = R_f + \beta_i \left[E(R_m) - R_f \right] \quad (1)$$

Where:

R_i – real return of asset *i*; R_f – real return of a proxy for the risk-free asset; b_i – beta coefficient of the asset; and R_m – real return of a proxy for the market portfolio.

The CAPM has made important contributions to financial decision making, because it quantifies and prices the risk factor. The development of the model was based on some simplifying hypotheses (Sharpe, 1964; Lintner, 1965; Mossin, 1966; Black, 1972), namely:

- Investors are risk averse and maximize the expected utility of their wealth;

- Investors are price takers and have homogeneous expectations about the return of assets, with a joint normal distribution;
- A risk-free asset exists that investors can borrow or lend without limitation at a risk-free interest rate;
- The quantities of assets are fixed, all assets are negotiable and perfectly divisible;
- Information is free and simultaneously available to all investors;
- There are no market imperfections, such as taxes, regulations or restrictions on small trades.

According to Fama & French (2004), the tests of the CAPM are based on three implications of the relation between expected return and market beta: (i) the expected returns of all assets are linearly related to their betas, and no other variable has marginal explanatory power; (ii) the risk (beta) premium is positive, meaning the expected return on the market portfolio is greater than the expected return on risk-free assets; and (iii) in the CAPM, assets uncorrelated with the market have expected returns equal to the return on a risk-free asset.

According to Equation 1, to calculate the CAPM it is necessary to compute three fundamental variables: the risk-free rate of return, beta and the risk premium. Sharpe (1964) defined the risk-free return as the return on an asset about which investors are certain of the future earnings. Another mathematical property of the risk-free asset is the absence of correlation between its return and the return of a risky asset, i.e., a beta near zero. If a significant beta is found for the risk-free rate of return, this asset will have a systematic risk factor, which is inconsistent with the concept of a riskless asset.

The coefficient beta represents the tendency of a stock to move with the market and measures the stock's volatility in relation to that of the market as a whole, represented by a market-tracking portfolio. The idea behind this coefficient is to measure the degree of volatility of a security to changes in the market's behavior, based on the principle that the prices of all securities tend to change, to a lesser or greater extent, with alterations in the market as a whole (ALCÂNTARA, 1981). According to Fama & French (2004), beta is proportional to the risk that each monetary unit invested in asset *i* contributes to the market portfolio.

Since total risk is equal to the sum of systematic (non-diversifiable) risk and non-systematic (diversifiable) risk, and assuming that market participants efficiently diversify their portfolios, eliminating non-systematic risk, the only remaining component of total risk is systematic risk, represented by beta. Therefore, for a market in equilibrium, the systematic risk of an asset is sufficient to quantify its required return. In this way, the coefficient beta is obtained by regressing the excess returns of the asset of interest on the excess returns of the market portfolio.

The main critique of the CAPM was formulated by Roll (1977), who questioned the testability of the market portfolio. For him, it is not theoretically clear that assets can be legitimately excluded from the market portfolio and the availability of data substantially limits the assets that are included. Thus, the tests of the CAPM are forced to use proxies for the market portfolio, testing them as to minimum variance. Further according to him, the market portfolio is composed of all risky assets of the economy, so it cannot be represented by a stock market index, a claim supported by empirical findings. Therefore, without a genuine market portfolio, the CAPM cannot be tested, and all the methods proposed up to that time were really testing the efficient market hypothesis.

2.2 THE TWO-FACTOR MODEL OF LIU (2006)

The two-factor model developed by Liu (2006) consists of the CAPM plus the liquidity factor, as represented by Equation 2:

$$E(R_i) - R_f = a + \beta_i \left[E(R_m) - R_f \right] + l_i . E(LIQ) \tag{2}$$

Where: R_i is the real return of each asset or portfolio *i*; Rf is the real return of a proxy for the risk-free asset; ($R_m - R_f$) is the market factor premium; LIQ is the liquidity factor premium; and *a, b* and *l* are the coefficients to estimate by the regression.

As a proxy for liquidity, Liu (2006) developed a new measure called the "standardized turnover-adjusted number of zero daily trading volumes over the prior 12 months", according to Equation 3:

$$LIQ = \left[X + \frac{\frac{1}{Z}}{11.000} \right] \times \frac{21 \times 12}{Y} \tag{3}$$

Where: X = the number of days without trading in the past 12 months; Y = the number of days with trading in the market; Z = average turnover in the past 12 months, obtained by the sum of the daily turnovers in the past 12 months, with the daily turnover being the ratio of the number of shares traded on the day and the number of shares outstanding at the end of that day.

According to Liu (2006), this liquidity metric captures multiple dimensions of liquidity, with particular emphasis on the velocity of trading, which previous research had ignored. First, the number of days without trading captures the continuity and the potential delay or difficulty of executing an order. In other words, the absence of trading a security indicates its degree of illiquidity: the greater the frequency of no trading, the less the liquidity. Besides the velocity dimension, the liquidity metric captures the quantity dimension, measured by the turnover. Finally, it reflects the trading cost dimension, because the more liquid a security is, the lower will be the trading costs.

To calculate the liquidity factor, in June each year the stocks are ordered according to their liquidity measure and divided into two portfolios: those with high and low liquidity. The liquidity factor (LIQ) is calculated monthly by the difference between the mean monthly returns of the low portfolios and the mean monthly returns of the high portfolios.

Liu (2006), using data on American companies, analyzed this model's performance in the period from 1960 to 2003. As the main result, he found that the two-factor model performed better in explaining the returns than the CAPM and the three-factor model of Fama & French (1993). Besides this, the two-factor model was robust to the anomalies size, book-to-market, cash flow/price, earnings/price, liquidity and momentum, which both the CAPM and three-factor model failed to capture.

2.3 THE THREE-FACTOR MODEL OF FAMA & FRENCH (1993)

Fama & French (1992), starting from the premise that risk factors other than market risk affect stock returns, evaluated the impact of earnings-to-price, beta, leverage, market value and book-to-market in the cross-sectional variation of stock returns, according to the method of Fama & MacBeth (1973). Their main results were that beta alone or combined with other variables has little explanatory power on average stock returns, a finding contrary to the premises of the CAPM. The variables earnings-to-price, leverage and book-to-market, when used alone, have explanatory power over returns, and the variables market value and book-to-market, when combined, absorb the impact of leverage and earnings-to-price.

Therefore, if assets are rationally priced, the authors' results suggest that the risks of equities are multidimensional, with market value and book-to-market serving as risk proxies. If assets are not rationally priced, and the variables market value and book-to-market do not function as proxies for risk, their results can still be used to evaluate the performance of a portfolio and measure the expected return of an alternative investment strategy.

Based on this evidence and the anomalies identified in previous studies, Fama & French (1993) incorporated the size effect, represented by the difference between the return of a portfolio formed by small firms minus the return of a portfolio formed of large firms (small minus big - SMB), and the HML effect (high minus low), represented by the difference between the return of a portfolio formed by firms with high book-to-market ratio minus the return of a portfolio formed by firms with low book-to-market, to the asset pricing model, producing a three-factor model, according to Equation 4:

$$E(R_i) - R_f = a + \beta_i \left[E(R_m) - R_f \right] + S_i.(SMB) + H_i.(HML) \quad (4)$$

Where:

$R_{c_{i,t}}$: real return of portfolio i; $(R_m - R_f)$: market factor premium; SMB : size factor premium; and HML : B/M factor premium.

The works of Fama & French (1992, 1993) together suggest there is an economic fundamental behind the effects of size and book-to-market on stock returns, by capturing the cross-sectional return of shares, consistent with a multifactor asset pricing model.

In applying the three-factor model in the American market, Fama & French (1993) concluded that the model was significantly better than the CAPM to explain stock returns, and that the factors were statistically significant, with the book-to-market ratio having better explanatory power of the returns than size. Besides this, the intercepts of the regressions were near zero.

In Brazil, Matos & Rocha (2009) analyzed the pricing and forecasting capacity of the CAPM, the three-factor model of Fama & French (1993) and the four-factor model of Carhart (1997), applied to 18 investment funds in the period from January 1997 to December 2006. As the main results, they observed a greater incapacity of the CAPM to capture the sources of common risk among the funds with higher net asset value and larger cumulative excess return and better forecasting performance of the four-factor model.

Sylvestre (2009) performed a similar study to that of Matos & Rocha (2009), seeking evidence of a common pattern or characteristics of Brazilian investment funds. For this, he used the canonical version of the CAPM with nonlinear extensions, extending the study period of Matos & Rocha (2009) to include 2007 and 2008, as well as increasing the number of investment funds to 75. The results indicated that the incorporation of non-linearity appeared to be relevant, by better dealing with the drawbacks generated by the alphas of Jensen, but was only able to accurately price a few funds with high net assets and low over-performance, suggesting the need to develop models à la Fama & French (1993) with specific factors for investment funds.

3 METHODOLOGY

3.1 DATA AND METHODOLOGY

The population analyzed consisted of all the companies listed on the São Paulo Stock, Mercantile and Futures Exchange (BM&FBOVESPA[1]) between June 1, 1995 and June 30, 2008. We used this time frame because of it was a period of relative macroeconomic stability. We excluded the following firms from the sample:

(a) financial institutions, because according to Fama & French (1992), their high indebtedness influences the B/M ratio, so it does not have the same meaning as for nonfinancial firms;

(b) firms that did not have consecutive monthly quotations for 24 months (12 before and 12 after forming the portfolios), since the prior period was used to calculate the momentum factor and the subsequent period was used to compute the stock returns, which served as the base for obtaining the portfolios' returns;

(c) firms that did not have any market value on December 31st and June 30th of each year; and

(d) firms that did not have positive stockholders' equity on December 31st of each year.

After these exclusions, we analyzed data on 149 stocks (25.65% of the population), ranging from a minimum of 103 stocks (16.89% of the population) in 2003 to a maximum of 191 (33.81% of the population) in 2006. All the data were obtained from the Economática database.

In the analysis we opted to use portfolios, because this method provides better results than can be obtained from analyzing individual assets, as suggested by Blume & Friend (1973), Fama & French (2004) and Vaihekoski (2004).

We divided the analysis into two steps. The first consisted of analyzing the performance of the two-factor model to explain the returns. For this purpose, referring to June each year we

[1] The São Paulo Stock Exchange (Bovespa) merged with the Mercantile and Futures Exchange (BM&F) in 2006 to form BM&FBovespa.

constructed 24 portfolios resulting from the intersection of the portfolios formed based on market value (Small and Big), three portfolios based on the B/M ratio (Low – 30%; Medium – 40%; and High –30%), two portfolios based on momentum strategy and two based on liquidity, using the trading volume as proxy.

From July of year t to June of year t+1, we calculated the return of each stock in logarithmic form, and of each of the 24 portfolios, by weighting the returns of the stocks composing it by the market value of each stock in relation to the portfolio's total market value. The portfolios were reformulated in June each year. To calculate the excess return, we employed the monthly SELIC rate (the Central Bank's benchmark rate) as the risk-free rate of return, as suggested by Fraletti (2004).

For each month we calculated the size factor by the difference between the average monthly returns of the Small portfolios and the average monthly returns of the Big portfolios; the B/M factor by the difference between the average monthly returns of the High portfolios and the same measure of the Low portfolios; the momentum factor by the difference between the average monthly returns of the Winner portfolios and the same measure of the Loser portfolios; the liquidity factor by the difference between the average monthly returns of the Low portfolios and the same measure of the High portfolios; and the market factor by the difference between the average returns of all the shares, weighted by the value of each stock, and the risk-free rate of return (SELIC rate).

The second step consisted of ascertaining if the two-factor model was robust to strategies based on the effects of, book-to-market (B/M), momentum, earnings/price, cash flow/price, liquidity and leverage, together called value anomalies. For this, we grouped the stocks into portfolios, in June each year, according to the variables of interest, which were: size, measured by the market value of the firms; book-to-market (B/M) ratio, obtained by dividing the book value by the market value of equity; momentum, measured by the cumulative return of the previous 11 months; liquidity, measured by the trading volume; earnings/price ratio, determined by the quotient of earnings per share and the closing price; operating cash flow/price ratio, determined by dividing EBITDA by the market value of each firm; and leverage, calculated by the ratio between financial debt and stockholders' equity.

Therefore, in June of each year t, starting in 1995 and ending in 2008, all the stocks were arranged in decreasing order, according to the variables of interest, and divided into five portfolios, going from highest to lowest value, with the High portfolio being formed of stocks with the highest values and the Low portfolio by stocks with the lowest values of the variables used to construct the portfolios. From July of year t to June of year t+1, we calculated the monthly return of each of the five portfolios, by weighting the returns of the shares composing it by market value of each stock in relation to the market value of the portfolio. The portfolios were rebalanced each year. To calculate the excess return, we used the monthly yield of government bonds paying the SELIC rate as a proxy for the risk-free rate of return.

3.2 THE TWO-FACTOR MODEL

The two-factor model used here is based on the work of Liu (2006). To analyze the model's performance in explaining the variations in stock returns we used multiple regressions of time series, with the dependent variable being the monthly returns of the 24 portfolios minus the risk-free rate, and as independent variables the market (CAPM) and liquidity factors, as in Equation 5:

$$RP_i - Rf_i = a + b\left(R_m - R_f\right)_i + l\left(LIQ\right)_i + \varepsilon_i \qquad (5)$$

Where: RP_i is the weighted average return of each portfolio in month *i*; *Rf* is the SELIC rate for month *i*; ($R_m - R_f$) is the market factor; LIQ is the liquidity factor; *a*, *b* and l are the coefficients estimated by the regression; and ε is the random error (white noise), with normal distribution, mean zero and constant variance σ^2 We estimated this equation for each of the 24 portfolios, using the volume traded as a proxy for liquidity, as suggested by Machado & De Medeiros (2011). The liquidity factor was obtained as described in item 3.1.

The two-factor model implies that the excess return of an asset is explained by the covariance of its return with the market and by the liquidity factor. The constant term in Equation 3 is the risk-adjusted return. If the two-factor model explains the return, the intercept should not be significantly different from zero (Liu, 2006).

4 RESULTS OBTAINED

4.1 PERFORMANCE OF THE TWO-FACTOR MODEL IN EXPLAINING THE RETURNS

We obtained a liquidity premium of 0.77%, significant at 1%, near the figure obtained by Liu (2006) for the American market (0.73%). Additionally, we observed an average premium of 0.6825%, with a standard deviation of 4.2742 and *p*-value of 0.066, when removing the data for January. Therefore, the liquidity premium observed is not limited to January, corroborating the findings of Liu (2006) and Datar, Naik & Radcliffe (1998) but running contrary to the finding of Eleswarapu & Reinganum (1993).

According to Table 1, the regression estimated, considered alone, was statistically significant at 1%, since the *p*-value obtained from the F-test is lower than 0.01 in all the portfolios. Furthermore, the market factor was significant in all the portfolios, positively related with return and near one, as expected.

The liquidity factor was significant in 20 of the 24 portfolios. The four portfolios without significant values were formed by highly liquid stocks. Hence, it appears that the statistical significance is considerably higher for the portfolios formed of stocks with low liquidity. The tendency was also observed by Keene & Peterson (2007) and Machado & De Medeiros (2011).

We obtained an adjusted coefficient of determination ranging from 0.658 to 0.926, with average explanatory power of 0.801. Hence, the explanatory power in many portfolios was lower than 80%. Also, the intercepts for 14 of the portfolios were significantly different from zero, suggesting inadequacy of the model to explain the returns. This indicates that other factors could be influencing the variation of the returns.

Table 1 – Results of the Regressions for the Two-Factor Model

$$RP_i - Rf_i = a + b\left(R_m - R_f\right)_i + l\left(LIQ\right)_i + \varepsilon_i$$

Portfolio	*a*	*B*	*l*	*Adj. R2*	*F-test*
BHLOSHL[1]	-0.0250*	1.0452*	-0.4143**	0.7810	0.0000
BHLOSLL[2]	-0.0285*	1.0429*	0.8038*	0.8136	0.0000
BHWINHL[2]	-0.0047	0.9784*	-0.3112**	0.8590	0.0000
BHWINLL[1]	-0.0028	1.0264*	0.7194*	0.8008	0.0000
BLLOSHL[1]	-0.0063	0.9542*	0.4986*	0.8482	0.0000
BLLOSLL[1]	0.0034	0.9325*	0.8984*	0.8348	0.0000
BLWINHL[2]	0.0121*	1.0026*	-0.2209	0.8909	0.0000
BLWINLL[1]	0.0134**	0.9660*	1.2318*	0.7980	0.0000
BMLOSHL[1]	-0.0137*	1.0318*	-0.1185	0.9100	0.0000
BMLOSLL[1]	-0.0121**	1.0590*	0.8092*	0.7865	0.0000
BMWINHL[1]	0.0075**	1.0037*	-0.2397*	0.9259	0.0000
BMWINLL[1]	-0.0016	1.0311*	0.7140*	0.8727	0.0000
SHLOSHL[2]	-0.0350*	1.0083*	0.3315***	0.7505	0.0000
SHLOSLL[1]	-0.0239*	0.9959*	1.1853*	0.6589	0.0000
SHWINHL[2]	-0.0078	1.0048*	0.2092	0.7852	0.0000
SHWINLL[2]	-0.0263*	0.9256*	1.8080*	0.7232	0.0000
SLLOSHL[1]	-0.0079	0.9379*	0.5200*	0.7984	0.0000
SLLOSLL[1]	0.0002	1.0154*	1.3653*	0.6583	0.0000
SLWINHL[2]	0.0239**	1.0007*	0.1977	0.7222	0.0000
SLWINLL[1]	0.0206**	0.9713*	1.4970*	0.7057	0.0000
SMLOSHL[1]	-0.0191*	1.0022*	0.4517*	0.8108	0.0000
SMLOSLL[2]	-0.0172*	1.0016*	1.0534*	0.8256	0.0000
SMWINHL[1]	-0.0083	1.0269*	0.7524*	0.8467	0.0000
SMWINLL	-0.0097	1.0290*	1.5708*	0.8057	0.0000

* Significant at 1%; ** Significant at 5%; *** Significant at 10%

[1] Standard errors estimated with White correction for heteroscedasticity.
[2] Standard errors adjusted for serial correlation using Newey-West standard error with 4 lags.
To detect the presence of multicollinearity, we used the VIF (variance inflation factor) and tolerance tests, obtaining VIF of 0.9758589 and tolerance of 1.0247383, indicating the absence of multicollinearity.

To compare the performance of the models, we tested the CAPM (Table 2) and three-factor model with the same portfolios (Table 3). In both models, the estimated regression individually was significant at 1%, since the *p*-value obtained for the F-statistic was lower than 0.01 in all the portfolios. Additionally, the market factor was significant in all the portfolios, positively related with return and near one, as expected. The size factor was significant in 20 of the 24 portfolios and the B/M factor in 17 of them.

Table 2 – Results of the Regressions for the CAPM

$$R_i - R_f = a + b\left(R_m - R_f\right)_i + \varepsilon_i$$

Portfolio	*A*	*b*	*Adj. R²*
BHLOSHL[1]	-0.029*	1.063*	0.774
BHLOSLL[2]	-0.013*	1.008*	0.778
BHWINHL[2]	-0.008***	0.992*	0.854
BHWINLL[2]	0.004	0.996*	0.772
BLLOSHL[1]	-0.002	0.933*	0.832
BLLOSLL[1]	0.012***	0.894*	0.777
BLWINHL[2]	0.010**	1.012*	0.889
BLWINLL[1]	0.024*	0.913*	0.703
BMLOSHL	-0.015*	1.037*	0.910
BMLOSLL[1]	-0.005	1.024*	0.753
BMWINHL[1]	0.005	1.014*	0.923
BMWINLL[1]	0.005	1.000*	0.841
SHLOSHL[1]	-0.032*	0.994*	0.746
SHLOSLL[1]	-0.013	0.945*	0.591
SHWINHL[1]	-0.006	0.996*	0.784
SHWINLL[2]	-0.010	0.848*	0.540
SLLOSHL[1]	-0.003	0.781*	0.781
SLLOSLL[1]	0.013	0.957*	0.573
SLWINHL[2]	0.026*	0.992*	0.722
SLWINLL[1]	0.034*	0.907*	0.587
SMLOSHL[1]	-0.015**	0.983*	0.793
SMLOSLL[2]	-0.008	0.956*	0.758
SMWINHL[1]	-0.002	0.995*	0.813
SMWINLL[1]	0.004	0.962*	0.672

* Significant at 1%; ** Significant at 5%; *** Significant at 10%
[1] Standard errors estimated with White correction for heteroscedasticity.
[2] Standard errors adjusted for serial correlation using Newey-West standard error with 4 lags.

Table 3 – Results of the Regressions for the Three-Factor Model

$$R_i - R_f = a + b\left(R_m - R_f\right)_i + s\left(Size\right)_i + h\left(BM\right)_i + \varepsilon_i$$

Portfolio	*A*	*b*	*s*	*h*	*Adj. R²*	*F-test*
BHLOSHL[1]	-0.0005	1.0195*	-0.1201	0.9847*	0.8492	0.000
BHLOSLL[2]	-0.0050	1.0094*	0.6676*	0.5839*	0.8234	0.000
BHWINHL[1]	0.0098***	0.9608*	-0.1931***	0.6037*	0.8932	0.000
BHWINLL[2]	0.0113	1.0065*	0.6055*	0.2778**	0.7950	0.000
BLLOSHL[1]	-0.0155*	0.9638*	0.3363**	-0.4738*	0.8668	0.000
BLLOSLL[1]	0.0026	0.9295*	0.6508*	-0.2983**	0.8230	0.000
BLWINHL[2]	-0.0017	1.0273*	-0.0360	-0.4143*	0.9035	0.000
BLWINLL[2]	0.0066	0.9551*	0.4822**	-0.6148*	0.7587	0.000
BMLOSHL[1]	-0.0079***	1.0270*	-0.0103	0.2392**	0.9140	0.000
BMLOSLL[1]	-0.0014	1.0312*	0.3292**	0.1268	0.7559	0.000
BMWINHL[1]	0.0064	1.0085*	-0.1142	0.0325	0.9226	0.000
BMWINLL[1]	0.0036	1.0234*	0.5961*	-0.0332	0.8643	0.000
SHLOSHL[2]	-0.0196*	1.0205*	1.2318*	0.4605*	0.8421	0.000
SHLOSLL[1]	0.0121	0.9686*	1.6540*	0.9207*	0.7688	0.000
SHWINHL[1]	0.0041	1.0156*	0.9491*	0.3705**	0.8437	0.000
SHWINLL[2]	0.0001	0.8920*	1.6342*	0.3868**	0.6976	0.000
SLLOSHL[1]	-0.0087	0.9543*	0.8769*	-0.1734	0.8440	0.000
SLLOSLL[1]	-0.0022	1.0363*	1.6604*	-0.4818***	0.7403	0.000
SLWINHL[1]	0.0117***	1.0488*	1.0423*	-0.4695*	0.8126	0.000
SLWINLL[1]	0.0194**	0.9778*	1.4162*	-0.4856*	0.7331	0.000
SMLOSHL	-0.0098***	1.0162*	1.1440*	0.2063**	0.8838	0.000
SMLOSLL	-0.0053	0.9947*	1.1735*	0.1088	0.8461	0.000
SMWINHL[1]	0.0006	1.0316*	1.1206*	0.0952	0.8932	0.000
SMWINLL[1]	0.0059	1.0055*	1.2910*	0.0756	0.7655	0.000

* Significant at 1%; ** Significant at 5%; *** Significant at 10%
[1] Standard errors estimated with White correction for heteroscedasticity.
[2] Standard errors adjusted for serial correlation using Newey-West standard error with 4 lags.
To detect the presence of multicollinearity, we used the VIF (variance inflation factor) and tolerance tests, obtaining VIF values of 0.974, 0.961 and 0.963 and tolerances of 1.027, 1.041 and 1.038, for the market, size and B/M variables, respectively, indicating the absence of multicollinearity.

The regression with the CAPM produced an average adjusted coefficient of determination of 0.757 and the intercepts for 10 portfolios were significantly different than zero (Table 2). With the three-factor model, the average adjusted coefficient was 0.827 and the intercepts were significantly different from zero in six portfolios (Table 3). Therefore, both models can be classified as inadequate to explain the returns, indicating that other factors could be influencing the variation of the returns.

Nevertheless, although for the majority of the 24 portfolios the alphas were significantly different from zero, there was in improvement in the explanatory power of the CAPM (4.37%) and performance very near that of the three-factor model. Therefore, the results obtained with the two-factor model are relevant, considering we worked with dynamic portfolios. Finally, the differences in relation to the findings of Liu (2006), mainly regarding the number of significant intercepts, can be due to the proxy used, the number of portfolios, the number of stocks in each portfolio and the method employed.

Machado & De Medeiros (2011) analyzed the existence of a liquidity premium in the Brazilian market and also investigated whether it is priced and explains part of the variation in asset returns. They constructed a model with five factors, adding the liquidity factor to the four-factor model of Carhart (1997). They found this five-factor model to outperform the CAPM as well as the three- and four-factor models, with mean increases in explanatory power of 10.2%, 3.2% and 1.7%, respectively. Besides this the inclusion of the liquidity factor caused alterations in the coefficients of the other risk factors and reduced the number of intercepts different than zero.

In light of the results obtained by Machado & De Medeiros (2011), we also compared the performance of the two-factor model with that of their five-factor model. As can be seen in Table 4**,** the inclusion of the liquidity factor in the four-factor model of Carhart (1997) improved the explanatory power in comparison to the other models (an increase of 10.2% in relation to the CAPM) and reduced the alphas' significance (according to Machado & De Medeiros (2011), with the five-factor model only three portfolios presented significant alphas), evidencing an important advance in the literature. Therefore, we can conclude that the addition of the liquidity factor to the four-factor model improves the performance even more in relation to the CAPM, indicating the importance of the other factors in explaining the variation of stock returns.

Table 4 – Comparative Analysis of the Explanatory Power of the Models

Portfolio	***CAPM***	**2 Factors**	***3 Factors***	***5 Factors***
BHLOSHL	0.77	0.78	0.85	0.87
BHLOSLL	0.78	0.81	0.82	0.86
BHWINHL	0.85	0.86	0.89	0.90
BHWINLL	0.77	0.80	0.80	0.85
BLLOSHL	0.83	0.85	0.87	0.88
BLLOSLL	0.78	0.83	0.82	0.86
BLWINHL	0.89	0.89	0.90	0.92
BLWINLL	0.70	0.80	0.76	0.84
BMLOSHL	0.91	0.91	0.91	0.92
BMLOSLL	0.75	0.79	0.76	0.83
BMWINHL	0.92	0.93	0.92	0.93
BMWINLL	0.84	0.87	0.86	0.88
SHLOSHL	0.75	0.75	0.84	0.86
SHLOSLL	0.59	0.66	0.77	0.80
SHWINHL	0.78	0.79	0.84	0.86
SHWINLL	0.54	0.72	0.70	0.79
SLLOSHL	0.78	0.80	0.84	0.86
SLLOSLL	0.57	0.66	0.74	0.80

SLWINHL	0.72	0.72	0.81	0.85
SLWINLL	0.59	0.71	0.73	0.78
SMLOSHL	0.79	0.81	0.88	0.90
SMLOSLL	0.76	0.83	0.85	0.86
SMWINHL	0.81	0.85	0.89	0.90
SMWINLL	0.67	0.81	0.77	0.84
Mean	0.76	0.80	0.83	0.86
Minimum	0.54	0.66	0.70	0.78
Maximum	0.92	0.93	0.92	0.93

4.2 PERFORMANCE OF THE TWO-FACTOR MODEL IN EXPLAINING ANOMALIES

In this section we analyze the ability of the two-factor model to explain the anomalies discussed previously. For this purpose we ran time-series regressions for each of the five portfolios. If the intercepts are statistically significant and there is a positive or negative trend in the intercepts over the portfolios and the difference between the intercepts of the portfolios located at the extremes (premium) is significant, the anomaly in question exists and the model fails to explain it. Table 5 shows the results when the portfolios were ordered based on Volume, Momentum, Size and Leverage, and Table 6 when they were ordered based on the B/M, EBITDA/Price and Earnings/Price ratios.

According to Table 5, although the premium was only significantly different from zero when the portfolios were ordered based on Momentum, the two-factor model failed to explain those anomalies, since for all the portfolios the intercepts were significantly different from zero, except when the portfolios were ordered by Size.

Table 5 – Performance of the Two-Factor Model in the Portfolios Constructed Based on Volume, Momentum, Size and Leverage

	1	2	3	4	5	5-1
			Volume			
A	0.054*	0.046*	0.051*	0.048*	0.064*	0.010
B	0.217*	0.221*	0.227*	0.207*	0.124*	-0.092
L	-1.396*	-0.643*	-0.370*	-0.278***	0.299	1.696*
Adj. R^2	0.544	0.378	0.289	0.220	0.005	-
F-test	0.000	0.000	0.000	0.000	0.239	-
DW	2.203	2.035	1.856	1.959	1.926	-
JB	0.000	0.233	0.209	0.439	0.000	-
White	0.000	0.000	0.000	0.038	0.768	-
Schwarz	-2.523	-2.733	-2.628	-2.537	-0.812	-
Obs	2	1	1	1	1	-
			Momentum			
A	0.014*	0.007***	-0.0061***	-0.014*	-0.024*	-0.038*
B	1.004*	1.001*	1.033*	0.972*	1.025*	0.021
L	0.373**	-0.057	0.066	0.094	0.423**	0.051
Adj. R^2	0.877	0.950	0.934	0.899	0.814	-
F-test	0.000	0.000	0.000	0.000	0.000	-

DW	2.134	2.203	2.171	2.215	1.990	-
JB	0.000	0.000	0.246	0.000	0.000	-
White	0.669	0.000	0.016	0.000	0.320	-
Schwarz	-2.814	-3.763	-3.515	-3.083	-2.284	-
Obs	[1]	[2]	[1]	[2]	[1]	-
			Size			
A	0.001	-0.005	-0.007	-0.003	-0.003	-0.004
B	0.999*	1.016*	1.011*	1.012*	0.960*	-0.039
L	-0.144*	0.646*	0.738*	0.830*	0.531	0.675
Adj. R²	0.996	0.940	0.898	0.882	0.802	-
F-test	0.000	0.000	0.000	0.000	0.000	-
DW	2.240	1.926	2.227	2.323	2.249	-
JB	0.000	0.000	0.000	0.000	0.000	-
White	0.000	0.000	0.000	0.000	0.000	-
Schwarz	-6.616	-3.576	-3.018	-2.842	-2.336	-
Obs	[2]	[1]	[2]	[2]	[2]	-
			Leverage			
A	0.048*	0.050*	0.048*	0.055*	0.045*	-0.003
B	0.254*	0.232*	0.256*	0.177*	0.200*	-0.054
L	-0.716*	-1.371*	-0.867*	-1.173*	-0.867*	-0.151
Adj. R²	0.357	0.461	0.427	0.427	0.301	-
F-test	0.000	0.000	0.000	0.000	0.000	-
DW	1.904	1.792	2.323	2.195	2.239	-
JB	0.000	0.000	0.000	0.822	0.000	-
White	0.000	0.000	0.015	0.000	0.000	-
Schwarz	-3.396	-2.185	-2.491	-2.425	-2.201	-
Obs	[1]	[1]	[2]	[1]	[2]	-

* Significant at 1%; ** Significant at 5%; *** Significant at 10%
[1] Standard errors estimated with White correction for heteroscedasticity.
[2] Standard errors adjusted for serial correlation using Newey-West standard error with 4 lags.

Table 6 – Performance of the Two-Factor Model in the Portfolios Constructed Based on B/M, EBITDA/Price and Earnings/Price

	1	2	3	4	5	5-1
			B/M			
A	-0.018**	-0.013**	-0.011**	-0.001	0.006	0.024**
B	1.019*	1.064*	1.006*	1.022*	0.972*	-0.047
L	-0.280	0.348*	0.279**	-0.042	0.216	0.496
Adj. R²	0.767	0.889	0.892	0.945	0.284	-
F-test	0.000	0.000	0.000	0.000	0.000	-
DW	2.144	2.280	2.287	1.996	2.009	-
JB	0.013	0.000	0.000	0.012	0.000	-
White	0.000	0.000	0.029	0.000	0.000	-
Schwarz	-2.037	-2.807	-2.951	-3.639	-3.311	-
Obs	[1]	[2]	[2]	[1]	[1]	-
			EBITDA/P			
A	0.029*	0.051*	0.058*	0.055*	0.041*	0.011**
B	0.299*	0.244*	0.203*	0.203*	0.214*	-0.085**
L	-0.680*	-0.995*	-1.386*	-0.947*	-0.580*	0.100
Adj. R²	0.338	0.398	0.475	0.375	0.307	-
F-test	0.000	0.000	0.000	0.000	0.000	-
DW	2.050	2.220	2.174	2.141	1.992	-

JB	0.015	0.615	0.000	0.000	0.062	-
White	0.446	0.000	0.000	0.000	0.505	-
Schwarz	-2.138	-2.297	-2.297	-2.413	-2.550	-
Obs	1	2	1	1	1	-
			E/P			
A	0.051*	0.054*	0.054*	0.041*	0.035*	-0.016*
B	0.207*	0.245*	0.262*	0.218*	0.288*	0.081**
L	-1.275*	-1.108*	-0.715*	-0.718*	-0.550*	0.725*
Adj. R^2	0.494	0.423	0.396	0.315	0.347	-
F-test	0.000	0.000	0.000	0.000	0.000	-
DW	2.024	2.293	2.164	1.933	1.858	-
JB	0.000	0.000	0.719	0.011	0.936	-
White	0.000	0.000	0.056	0.123	0.031	-
Schwarz	-2.484	-2.297	-2.520	2.381	-2.347	-
Obs	1	2	1	1	1	-

* Significant at 1%; ** Significant at 5%; *** Significant at 10%
[1] Standard errors estimated with White correction for heteroscedasticity.
[2] Standard errors adjusted for serial correlation using Newey-West standard error with 4 lags.

According to Table 6, when the portfolios were ordered based on B/M and EBTIDA/Price, there was tendency in the intercepts over the portfolios, but contrary to the expectation, showing monthly premiums of 2.4% and 1.1%, respectively, at 5% significance. Furthermore, the intercepts were significantly different from zero in all the portfolios when ranked by EBITDA/Price, and in portfolios 1, 2 and 3 when ordered by B/M. Finally, when the portfolios were ordered based on the Earnings/Price ratio, there also was a tendency in the intercepts, indicating a 1.6% premium per month, at 1% significance. From this evidence, it can be concluded that the two-factor model does not capture the effects of B/M, EBITDA/Price and Earnings/Price.

5 CONCLUSION

Our main objective was to analyze whether the two-factor model developed by Liu (2006) can explain the stock returns in the Brazilian market. Our secondary goals were to compare the performance of the two-factor model with the CAPM and the three-factor model of Fama & French (1993), as well as to investigate if the model is robust to strategies based on size, book-to-market (B/M), momentum, earnings/price, cash flow/price, liquidity and leverage, called value anomalies.

We obtained a liquidity premium of 0.77%, significant at 1%, and not limited to January. Although the alphas of the majority of the portfolios were significantly different from zero, the two-factor model generally outperformed the CAPM in terms of explanatory power, and was very near the three-factor model. Therefore, the results obtained with the two-factor model are relevant, considering that we worked with dynamic portfolios. Finally, even though the two-factor model did not explain the anomalies commonly documented in the literature, the results make an important contribution to research on the theme.

Future studies could further investigate the performance of the two-factor model proposed by Liu (2006) in explaining the variation of returns. In particular, we used monthly return data, but different results might have been obtained if we had employed daily data. Other time periods, alternative liquidity proxies and different samples also can be studied, as well as different methods of constructing the portfolios, such as using multivariate cluster analysis. This would enable verifying the stability of the results obtained here.

REFERENCES

ALCANTARA, J. C. G. O modelo de avaliação de ativos (capital asset pricing model): aplicações. **Revista de Administração de Empresa**, v. 21, n. 1, p. 55-65, 1981.

AMIHUD, Y. Iliquidity and stock returns: cross-section ant time series effects. **Journal of Financial Markets**, v. 5, n. 1, p. 31-56, 2002.

AMIHUD, Y.; MENDELSON, H. Asset pricing and the bid-ask spread. **Journal of Financial Economics**, v. 17, n. 2, p. 223-249, 1986.

AMIHUD, Y.; MENDELSON, H. Liquidity and asset price: financial management implications. **Financial Management**, v. 17, n. 1, p. 5-15, 1988.

AMIHUD, Y.; MENDELSON, H. Stock and bond liquidity and its effect on prices and financial policies. **Financial Market Portfolio Management**, v. 20, n. 1, p. 19-32, 2006.

AMIHUD, Y.; MENDELSON, H. Liquidity, assets prices and financial policy. **Financial Analysts Journal**, v. 47, n. 6, p. 56-66, 1991.

BANZ, R. W. The relationship between return and market value of common stocks. **Journal of Financial Economics**, v. 9, n. 1, p. 3-18, 1981.

BHANDARI, C. L. Debt/equity ratio and expected common stock returns: empirical evidence. **Journal of Finance**, v. 43, n. 2, p. 507-528, 1988.

BLACK, F. Capital market equilibrium with restricted borrowing. **Journal of Business**, v. 45, n. 3, p. 444-455, 1972.

BLUME, M. E.; FRIEND, I. A new look at the capital asset pricing model. **Journal of Finance,** v. 28, n. 1, p. 19-33, 1973.

BROOKS, C. **Introductory econometrics for finance**. Cambridge: Cambridge University Press, 2002.

CARHART, M. M. On persistence in mutual fund performance. **Journal of Finance**, v. 52, n. 1, p. 57-82, 1997.

CHAN, H. W.; FAFF, R. W. An investigation into the role of liquidity in asset pricing: Australian evidence. **Pacific-Basin Finance Journal**, v. 11, n. 5, p. 555-572, 2003.

CHAN, H. W.; FAFF, R. W. Asset pricing and the illiquidity premium. **The Financial Review**, v. 40, n. 4, p. 429-458, 2005.

DATAR, V. T.; NAIK, N. Y.; RADCLIFFE, R. Liquidity and stock returns: an alternative test. **Journal of Finacial Markets**, v. 1, n. 2, p. 203-219, 1998.

DeBONDT, W. F.; THALER, R. Does the stock market overreact? **Journal of Finance**, v. 40, n. 3, p. 793-805, 1985.

ELESWARAPU; V, R.; REINGANUM, M. R. The seasonal behavior of the liquidity risk premium in asset pricing. **Journal of Financial Economics**, v. 34, n. 3, p. 373-386, 1993.

ELTON, E. J.; GRUBER, M. J. **Modern portfolio theory and investment analysis**. 5. ed. New York: John Willey, 1995.

FAMA, E. F.; FRENCH, K. R. Common risk factors in the returns on stocks and bonds. **Journal of Financial Economics**, v. 33, n. 1, p. 3-56, 1993.

FAMA, E. F.; FRENCH, K. R. Multifactor explanations of asset pricing anomalies. **Journal of Finance**, v. 51, n. 1, p. 55-84, 1996.

FAMA, E. F.; FRENCH, K. R. The capital asset pricing model: theory and evidence. **Journal of Economic Perspectives**, v. 18, n. 3, p. 25-46, 2004.

FAMA, E. F.; FRENCH, K. R. The cross-section of expected stock returns. **Journal of Finance**, v. 47, n. 2, p. 427-465, 1992.

FRALETTI, P. B. **Ensaio sobre taxa de juros em reais e sua aplicação na análise financeira**. 2004. 160 f. Tese (Doutorado em Administração) – Faculdade de Economia, Administração e Contabilidade, Universidade de São Paulo, 2004.

JACOBY, G.; FOWLER, D. J.; GOTTESMAN, A. A. The capital asset pricing model and the liquidity effect: a theoretical approach. **Journal of Financial Markets**, v. 3, n. 1, p. 69-81, 2000.

JEGADEESH, N.; TITMAN, S. Profitability of momentum strategies: an evaluation of alternative explanations. **Journal of Finance**, v. 56, n. 2, p. 699-720, 2001.

JEGADEESH, N.; TITMAN, S. Returns to buying winners and selling losers: implications for stock market efficiency. **Journal of Finance**, v. 48, n. 1, p. 65-91, 1993.

KEENE, M. A.; PETERSON, D. R. The importance of liquidity as a factor in asset pricing. **The Journal of Financial Research**, v. 30, n. 1, p. 91-109, 2007.

KEIM, D. B. Size related anomalies and stock returns seasonality. **Journal of Financial Economics**, v. 12, n. 1, p. 13-32, 1983.

LAKONISHOK, J.; SHLEIFER, A.; VISHNY, R. W. Contrarian investment, extrapolation, and risk. **Journal of Finance**, v. 49, n. 5, p. 1541-1578, 1994.

LINTNER, J. The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. **Review of Economics and Statistics**, v. 47, n. 1, p. 13-37, 1965.

LIU, W. A liquidity-augmented capital asset pricing model. **Journal of Financial Economics**, v. 82, n. 3, p. 631-671, 2006.

LONGSTAFF, F. A. Asset pricing in markets with illiquid assets. **University of California, Los Angeles** (UCLA), working paper, 2005. Disponível em: <http://ssrn.com/abstract=687298>.

MACHADO, M. A. V.; MEDEIROS, O. R. Modelos de precificação de ativos e o efeito liquidez: evidências empíricas no mercado acionário brasileiro. **Revista Brasileira de Finanças**, v. 9, n. 3, p. 383-412, 2011.

MACHADO, M. A. V.; MEDEIROS, O. R. Existe o efeito liquidez no mercado acionário brasileiro? **Brazilian Business Review**, v. 9, n. 4, p. 28-51, 2012.

MARKOWITZ, H. Portfolio selection. **Journal of Finance**, v. 7, n. 1, p. 77-91, 1952.

MATOS, P. R. F.; ROCHA, J. A. T. Ações e fundos de investimentos em ações: fatores de risco comum? **Brazilian Business Review**, v. 6, n. 1, p. 22-43, 2009.

MOSSIN, J. Equilibrium in a capital asset market. **Econometrica**, v. 34, n. 4, p.768-783, 1966.

PASTOR, L.; STAMBAUGH, R. F. Liquidity risk and expected returns. **The Journal of Political Economy**, v. 111, n. 3, p. 642-685, 2003.

SHARPE, W. F. Capital asset prices: a theory of market equilibrium under conditions of risk. **Journal of Financial**, v. 19, n. 3, p. 425-442, 1964.

STATTMAN, D. Book values and stock returns. The Chicago MBA: **Journal of Selected Papers**, v. 4, p. 25-45, 1980.

SYLVESTRE, G. Z. **Análise do efeito do patrimônio líquido no apreçamento de fundos de investimento em ações**. 2009. 42 f. Dissertação (Mestrado em Economia) – Universidade Federal do Ceará, Fortaleza, 2009.

TREYNOR, J. **Toward a theory of the market value of risky assets**. Artigo não publicado, 1961.

VAIHEKOSKI, M. Portfolio construction for tests of asset pricing models. **Financial Markets, Institutions & Instruments**, v. 13, n. 1, p. 1-39, 2004.