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Strategies for the Creation of Portfolios with Different Degrees of Sophistication: An Analysis of the Brazilian Capital Market

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Abstract: According to Grossman and Stiglitz, the balance of a market in which agents invest more on the acquisition of information have higher performance investment portfolios is possible. This study investigates in line with said theoretic proposal, whether the sophistication in the method for selecting portfolios allows for a better performance. Three portfolio creation methods are evaluated by means of the information on market and accounting prices. The performance evaluation is developed based on three return methods adjusted to risk: the Treynor index, the Sharpe index and the Alfa de Jensen index. The results show that the three portfolio selection methods obtained normal returns. Nonetheless, no evidence was found demonstrating that the most sophisticated strategy obtained higher returns than the others.

Key words: Return adjusted to risk, modern portfolio theory, efficient markets hypothesis, analysis of investments in stock, sophistication

INTRODUCTION

According with the hypothesis of efficient markets, the market prices reflect all the existing information on assets. If so, then why do financial institutions invest in the analysis of the financial assets negotiated in open markets, seeking better investment opportunities? And if no agent were to invest in having access to the information, making transactions based on them, how could the prices reflect said information?

According to Grossman and Stiglitz (1980), it is possible to obtain a higher return on the market without taking greater risk, using the information available. Nonetheless, there is a price for obtaining that information, a fact that limits the number of well-informed agents. According to this theory, the market reflects this information by means of prices, only in a partial manner. The more informed the agents are the more informative the market prices are. Those that incur in the cost obtain a higher return but in balance, said return equals the cost of obtaining the information. This occurs because the greater return will encourage more agents to obtain information, thus increasing the degree of information passed on in the prices and consequently reducing the potential gains with the information.

If cost is what limits the access to the information, it can be inferred that strategies based on more sophisticated information may allow a higher return. In this investigation, we will test three strategies based on market prices and on accounting information publicly available in order to evaluate whether strategies based on theoretically more informative analyses (more complex) allow a higher return.

The methods for the creation of portfolios are commonly used in the market: the Greenblatt (2007) method, known in the literature as "Formula Investing" which uses the EBIT/EV (Earnings Before Interest and Tax/Enterprise Value) and ROIC (Return Over Invested Capital) indexes, the P/E index (share price divided by share dividend) studied by Basu (1977) and the pondered P/E with the ROE (Return on Equity).

For each method the portfolios identified as those that would result in the best returns as well as in the worst were studied with the purpose of evaluating the order of the results. As there were abnormal returns it is necessary to know whether said results can be explained by a higher risk of the chosen portfolio. For this effect, the Treynor, Sharpe and Alfa de Jensen indexes were used as ways to evaluate the performance of the returns adjusted to risk.

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The purpose of this study is to compare the performance (risk-return relation) of portfolios created based on indexes originating in financial statements, seeking to identify whether strategies based on indexes originating from a greater range of information present better performance that the more simple ones. All the strategies analyzed presented positive abnormal returns, nonetheless, the simplest strategy, based on information that was more readily obtainable and interpretable, at price over profit rate, obtained greater performance. This evidence is not consistent with greater returns at higher costs of acquisition of information.

Theoretical backgound

Hypothesis of efficient markets: Studies on the evolution of asset prices were begun by Bachelier who when studying the price of commodities, realized that it was not possible to predict future prices based on price records and proposed the idea of random walk in other words, the behavior of stock could not me forecasted.

In line with the ideas by Fama (1970) argues that all the information available to market agents on a specific asset is reflected in its price and therefore, it is not possible to obtain abnormal profits. That would then be the definition of an efficient market (Fama, 1970).

Historically, the first accounts on efficient markets are found in Gibson who asserted that at the moment in which the dividends were publicly revealed to the market, the value that they acquired from then on could be considered as the best information about them.

Therefore, in a market said to be efficient, new information would immediately have effects on the price of shares. Consequently, the historical series of prices or past information may not be used to estimate towards the future (Fama, 1965).

Fama (1970)'s definition, the Hypothesis of Efficient Markets (HEM) can be divided in three ways in accordance with the information content:

- Weak efficiency: the historical prices and returns do not contain useful information for the creation of strategies that may result in abnormal returns
- Semi-strong efficiency: the information publicly available (price records, financial statements, news) do not contain information that could result in excess profits
- Strong efficiency: information, publicly available or not are unable to generate strategies that may result in abnormal profits

While, the weak form suggests that no technical analysis method can be useful in finding undervalued stock, the semi-strong and strong are against the ideas supported by the fundamentalist analysis.

Michael (1978) enhances the issue of market efficiency with a specific position: it is said that a market is efficient with respect to specific information when no profit can be obtained from negotiating based on that specific information.

Many were the studies that sought to test the HEM: Kendal (1953) assessed whether there were cyclical patterns in the share prices but did not find any and corroborated with Bachelier's random walk test.

Galdao and Fama studied the efficiency of the market by means of the volatility of the price of stock and concluded that for the period studied, the market presented inefficiency given the high level of volatility. The opinions among investigators of the HEM differ: there are endless studies that both confirm and deny it. Table 1 summarizes some studies that will help to emit judgements on HEM.

In light of the aforementioned, the lack of convergence in the results becomes evident: many researchers demonstrated there not being cyclical patterns as well as the impossibility to use the publicly available information in order to obtain abnormal profits. In contrast, several researchers evidenced the possibility of excessive profits using graphical signs or accounting information.

Modern portfolio theory: Based on the supposition that economic agents are rational entities, their decision making for investments is a system of two stages: the observation of the available assets and on the beliefs of their future performances. Following would be the assessment of the relevant beliefs that would result in the selection of the portfolio (Tobin, 1958; Sharpe, 1964).

Markowitz proposes the process described above as portfolio selection where in mathematical terms, besides the return, the risk must be a primary factor to be observed in the analysis of investments. Sometime later, said statement became the conceptual basis of the literature in finances known as the Modern Portfolio Theory (MPT). Furthermore, some premises were proposed concerning agents with respect to investments:

- Investors assess portfolios based on the expected value and on the standard deviation of return rates over a given period

Table 1: Studies on the hypothesis of efficient markets

Researcher/year	Objective	Results
Leite and Sanvicente	To test the HEM in its semi-strong form by means of the "marginal information content" of the equity value during the period of release of accounting information (event study)	The equity Value does not contain significant information content possibly given the anticipated release of financial statements
Fama and French (1992)	To test the efficiency of the market and of the Capital Asset Pricing (CAPM)	Shares with low index values indicate returns consistently higher than shares with high indexes. Therefore, it was not possible to relate return to risk
Perobelli and Ness Jr.	To test the efficiency based on the observation of the price reaction of share prices during the period of release of quarterly results (event study)	The market reacted rapidly to the announcement of the information on positive results coinciding with the hypothesis of efficiency in its semi-strong form
O'Shaughnessy	Assess the return of selected portfolios based on accounting criteria	It was possible to observe abnormal and consistent results in the long term
Sun and Tong (2010)	Assess the risk in different months and the January effect	The results indicated that the "premium risk" is greater in January. Nonetheless, there is no evidence that the volatility (conditional or unconditional) is greater
Olakojo and Ajide (2010)	Examine the Capital Asset Pricing Model (CAPM) for the Nigeria stock market using monthly stock returns from 10 most listed companies on the Nigeria stock exchange for the period 2008-2009	The results demonstrate that residual risk has no effect on the expected returns of stocks. Tests may provide evidence against the CAPM but they do not necessarily constitute evidence in support of any alternative model
Panyagometh (2012)	Assess whether the theory of portfolio management can be applied jointly with the investment of value to produce	The findings agree with previous studies in which share portfolios can produce higher return rates than the market higher returns

Prepared by researches

- Between two portfolios with the same risk, the investor will choose the one with the highest return
- Between two portfolios with the same return, the investor will chose the one with lower risk
- The individual assets are infinitely divisible, demonstrating that the investor has the option of simply buying a fraction if he/she so wishes
- Among the possible investments there is a risk free rate which the investor can use as a source of resources or credit
- The operational costs and taxes are irrelevant
- Investors agree with respect to the distribution of probability of the returns of the shares, thus allowing the existence of a sole group of efficient portfolios

Therefore, based on the historical information suppositions, the data that would be relevant for deciding on an investment would be the average (average return) and the standard deviation (average risk: square root of price variation) which may be estimated by means of two equations. Return of the p:

$$r_p = \sum_{i=1}^{n} r_i W_i$$

Where:

r_p = Average return of the asset i

w_i = Proportion invested on the asset i

Portfolio riskp:

$$\sigma_p = \sqrt{\sum_{a=1}^{n}\sum_{b=1}^{n} W_a W_b \, cov_{ab}}$$

Where:

σ_p = Standard deviation of the portfolio p

w_a = Proportion invested in asset a

w_b = Proportion invested in asset b

cov_{ab} = Covariance between assets a and b

Thus, the return of a portfolio is measured by the pondered average of the return of the individual assets. The risk of the portfoliois the assessment of the risk of each asset separately and of the covariances of the assets calculated two by two.

The diverse asset combination possibilities and their corresponding weights demonstrate that there exists an optimal adjustment for the risk x return relation. Being all the compositions possible described by the acircles in a graph (Fig. 1) where the horizontal asis measures the return and the vertical axis the standard deviation, the efficient combinations would be located in the 'AB' arch:

Capital Asset Price Model: Sharpe (1964) developed an Asset Pricing Model (CAPM) in which in market balance each asset is premiered with a price that increases in accordance with the risk. However, Sharpe (1964) broadens the concept of risk by sub-dividing it in diversifiable risk (intrinsic to the asset) and non-diversifiable risk (extrinsic, systemic or market risk).

The diversifiable risk is the risk linked to the business that can be pulverized in a portfolio with other assets. The non-diversifiable risk is interconnected to the macroeconomic asituation and therefore cannot be avoided. This non-diversifiable risk is called beta (β). Sharpe (1964)'s main model can be described by the equation:

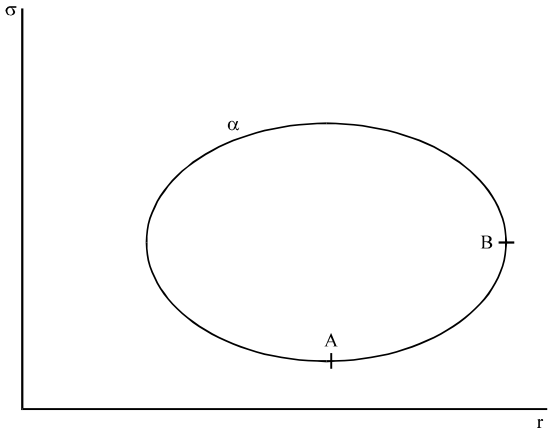

Fig. 1: Risk-return

$$E(R_{it}) = R_{ft} + \beta_{im}(E(R_{mt}) - R_{ft})$$

Where:

$E(R_{it})$ = Expected return of the asset i in period t
R_{ft} = Risk free asset in the period t
$E(R_{mt})$ = Expected market return in period t
β_{im} = Measures the non-diversifiable risk of the asset $I \rightarrow (Cov(R_{it}, R_{mt})/Var(R_{mt}))$

Hence, according to Sharpe (1964)'s proposal, the expected return of a portfolio must be equal to the return of the risk-free rate added to a accrued risk premium which is equal to the difference between the expected market return and the free-risk rate multiplied by the division of the covariance between the returns of the portfolio and of the market over the variance of the market return.

Performance assessment models: In an investment analysis, rational agents must incorporate a risk metric in their analyses being the simplest measurement that of the standard deviation of the return rate. We will now present the different ways to measure the risk-return relation. The models here described are used both by the academic literature and by the market being this the reason why they were selected.

Sharpe index: After Markowitz seminal work on the selection of portfolios in conjunction with risk, several other models were developed as a way to measure risk. Sharpe (1966), one of Markowitz's students developed a metric commonly known as Sharpe Index (SI) which is the result of dividing the exceeding return (return of the portfolio minus the risk-free return)of the portfolio by the standard deviation of the return of the portfolio:

$$IS_{pt} = \frac{(R_{pt} - R_{ft})}{\sigma_{pt}}$$

Where:

SI_p = Sharpe index of the portfolio p
R_{pt} = Return of portfoliopin the period t
R_f = Risk-free return in the period t
σ_{pt} = Standard deviation of the portfolio pin the period t

Looking at the IS equation it is possible to see that when the risk-free return is higher than the return of the portfolio, the final result is negative, making the investment meaningless while the agent could have a better result without in theory, taking any risk. In practical terms, the result of the equation demonstrates the compensation for every unit point of variability accrued: the higher, the better the performance. However, for it to be considered a good performance, the SI of the portfolio must be higher than the SI of the market portfolio.

It is understood that the intention is to obtain ex-ante value but for the purposes of the estimating of values ex-post they can be used even if it is far from the ideal. Another detail to be observed for the calculation of the ex-post SI is the determining of the size of the historical series since, very old data may not provide useful content for the developing of obtained information (based on the supposition of the weak form of the HEM by means of the concept approached by Michael (1978).

Treynor index: Another way of assessing the return is by means by Treynor (1965) metric, called the Treynor Index (TI). Through, it it is possible to measure the risk premium obtained by assumed risk unit. We see:

$$IT_{pt} = \frac{(R_{pt} - R_{ft})}{\beta_{pt}}$$

Where:

TI_{pt} = Treynor index of the portfolio p in the period t
R_{pt} = Return of the portfolio pin the period t
R_{ft} = Risk free return in the period t
β_{pt} = Beta of the portfolio in the period t
R_m = Market return in the period t

In the TI, the focus is on the exposure to systematic risk in other words, the part of the risk that is not prone to diversification. In this case, the assessment through Treynor's metric occurs comparing the TI of the portfolio with the TI of the market that has the beta = 1. Therefore, we have:

$$TI_m = \frac{(R_{mt} - R_{ft})}{\beta_m} = \frac{(R_{mt} - R_{ft})}{1} \therefore IT_m = R_{mt} - R_{ft}$$

A higher performance in the Treynor metric occurs when the index generated by the market portfolio is

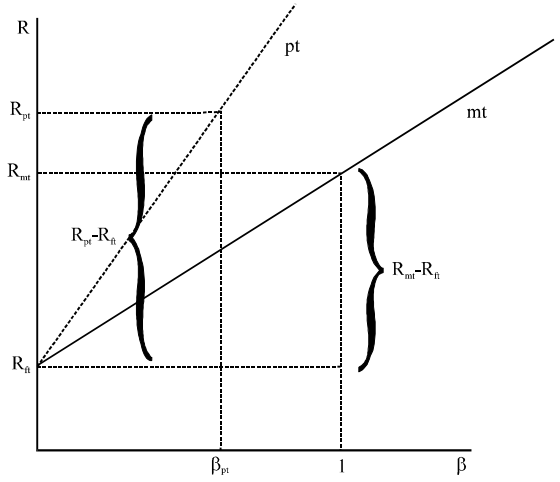

Fig. 2: Portfolio Treynor index

>0 and then the market IT. To illustrate below is a demonstration of a portfolio with a IT >0. An illustrative way, the demonstration of a portfolio with IT >0 is shown in Fig. 2.

Jensen index: The Jensen or Alfa de Jensen index also takes the performance or non diversifiable risk measured by the beta in its measurement. Varga states that such na indicator:

> ...disqualifies managers that have success in the high (low) of the market only for having a beta greater (smaller) than 1. A successful asset must demonstrate a positive alfa but in order to achieve surpassing the market, he must also acquire a portfolio different from the market portfolio (or of the index that represents the market), this is why the price is a lesser diversification

Following is the equation to calculate the Alfa de Jensen:

$$\alpha_{pt} = R_{pt}-\left(R_{ft} + (R_{mt}-R_{ft})\beta_{pt}\right)$$

Where:

α_{pt} = Alfa de Jensen of the portfolio pin the period t
R_{pt} = Return of the portfoliopin the period t
R_{ft} = Return of the risk free asset in the period t
R_{mt} = Market return in the period t
β_{pt} = Beta of the portfolio in the period t→(Cov(R_{pt}, R_{mt})/ Var(R_{mt}))

By the above equation, it is possible to define another equation that enables calculating the Alfa de Jensen by means of the estimation of a simple linear regression model:

$$R_{pt}-R_{ft} = \alpha_{pt} + \beta_{pt}(R_{mt}-R_{ft}) + \varepsilon_{pt}$$

where, the variables are equivalent to the Alfa Jensen equation increased in the random error of portfolio ain period t and based on the estimation of the previous model, na abnormal return is represented by a positive and statistically significant alfa value.

MATERIALS AND METHODS

The methodology used to answer the investigation question can be basically divided in three stages: the selection of the assets that were candidates for inclusion in a portfolio, the strategies adopted for the formation of the portfolios and the tests carried out for the assessment of their performance, thus testing the hypothesis of efficient market in the semi-strong form.

On the selection of the assets candidate to the creation of portfolios: The first step of the work was the definition of the assets that would be candidates for inclusion in any of the observed portfolios.

The universe of the stock negotiated in the Sao Paulo Stock Exchange (BOVESPA) in the period between 2001 and 2012. All the data for this study was gathered by means of the Economatica Software.

The portfolios were initiated on April 5, 2002 and kept for a period of 1 year. Said initial data was chosen after the observation of the holiday calendar of the previous years and after ensuring the inexistence of a holiday on that day, thus avoiding gaps in the temporal series.

The data for the creation of the portfolios for each year were obtained through the evaluation of the year before. Thus, the portfolios of 2002 were generated through, the results of the financial statements of 2001 and so on.

At the end of every 12 month cycle a reassessment of the market is made with the purpose of repeating all the process and beginning new portfolios until 2013. The difference is only evident in the last portfolio which is finalized with a lower temporal space: on the 13th of March, 2013, date in which the data was gathered.

Cut-off procedures were necessary in the sample as a whole in the creation of two portfolios. In general, all the shares that obtained liquid profit and liquid equity above zero in the financial statements of each year were accepted as part of the samples. The reason for the use of said specimens was to avoid distortions in the selection of assets of the portfolio given that some strategies tested depend on these indicators as will be explained later.

The variables "presence in Stock Exchange" greater than zero and "liquidity" >0.01 in the year prior of the

investment were also used as criteria in the selection of assets; this in order to guarantee the negotiability and liquidity of the portfolio. If one same company presented more than one negotiated asset, only the most "liquid" would be assessed as part of the sample. Companies of the financial sector were also eliminated from the sample.

On the selection of the portfolios and the description of the variables: The procedure for the selection of the shares and formation of the portfolios of this study considers three methods: the Greenblatt method also known as "Formula Investing" and the method that consists in forming portfolios using the EBIT/EV' and 'ROIC' indexes.

The second method (marked as "method 2") created the portfolios through the P/E variable. Basu (1977) carried out a study in which he analyzed the market history of shares for 14 years and concluded that the portfolios that had shares with low P/E were more profitable than portfolios that included shares with high P/E. Moreover, he complemented stating that there is a discrepancy between the information publicly available and its adhesion to price as stated by the hypothesis of efficient markets, thus indicating inefficiencies of the market in its semi-strong form.

According to Porta *et al.* (1995), the market overvalues "glamour" type shares which in general present a high price over profit ratio. We tested whether associating the price over profit ratio to other information could indicate if the potential of profitability of the share makes a greater return to the investor possible.

The third method (from here on called "method 3) uses the P/E and the ROE indexes for the creation of the portfolios. Penman assessed the role of the ROE in the transversal evaluation of the differences in prices and variations on returns. The empirical results demonstrate that the ROE per se is not enough to point at future profitability and therefore is not a satisfactory measure for the evaluation of the demonstrations of the results. Table 2 shows the variables of each model and their form of measurement.

The portfolios were set up in all methods in accordance with the orientations by Greenblatt which consist of three stages:

Table 2: Strategies tested

Method	Index	Definition
Greenblatt	EBIT/EV	Liquid operational profit/(No. of shares×Price of the share) + Total liquid debt + Participation of minority interests
	ROIC	Liquid profit/invested capital
Method 2	P/E	Market value per share/earnings per share
Method 3	ROE	Liquid profit/liquid equity
	P/E	Market value per share/earnings per share

Prepared by researches

- Ordering the samples in descending order to the EBIT/EV from 1 to n (where "n" is the total number of companies for a given year), giving the "1" value to the asset of higher EBIT/EV and the value of 'n' to that of lower EBIT/EV
- Ordering the sample in descending order to the ROIC from 1 to n (where "n" is the total number of companies for a given year), giving the "1" value to the asset of higher ROIC and the value of 'n' to that of lower ROIC
- Adding the results of the order of each index for each share and make a final ascending order

The portfolios were finally created based on this last order. The procedure is repeated for method three with only one difference: the P/E variable is ordered in an ascending order, thus remaining the share with the lowest value of the P/E in first place, the second to lowest value of the P/E in the second position and so on. This procedure also applied to method 2. It is worth noting that the price of the share which makes up the P/E variable has the date April 1 and if that day was a holiday, a Saturday or Sunday, then the following business day was used.

Each portfolio is made up of 12 assets. The reason for this number of assets per portfolio was determined based on the results found in studies on degree of optimal diversification. Evans and Archer (1968) identified that the diversifiable risk has an inversely proportional relation with the number of shares that make up a portfolio up to the tenth share. And that from then on that benefit is almost null.

Klemkosky and Martin (1975) evaluated the beta in terms of measurement of risk in portfolios containing from 2-25 assets for a period of 10 years. The results demonstrated that portfolios having between 10 and 14 assets hindered the optimal level of diversification.

In Brazil, states that the best strategy for individual investors would be to form portfolios with eight shares and that diversification gains in portfolios with >15 shares is infamous.

De Paula determined that the optimal level of diversification in operations via a home brokert aking into consideration the transactional costs is 12 shares. Taking into account the currentness of this result and its similarity with the behavior of the individual investor is that it was determined as a pattern for the size of the portfolios.

The 4 portfolios were observed in each method. Two portfolios formed with the 24 best positioned assets in the raking of each method and two others with the 24 assets holding the last positions.

On the returns and risks of the portfolios and other parameters: The performance of the portfolios formed were analyzed according to the three metrics described in study: Sharpe index, Treynor index and Alfa de Jensen index. For the calculation of the metrics of the risks, the following indicators will be used:

- Market return = Ibovespa
- Risk-free return = Interbank Deposit Certificates (IDC)

The calculation of the return of the assets was carried out by the following equation:

$$r_i = l_n\left(\frac{p_{i_t}}{p_{i_{t-1}}}\right)$$

Where:

r_i = Return of the asset i
p_{i_t} = Price of the asset i in period t
$p_{i_{t-1}}$ = Price of the asset i in the period t-1

For calculating the standard deviation and the beta (β), the monthly returns were used, totaling 132 observations in each estimate. The portfolios of each method will be compared among them in order to observe if there is ordering of the returns in each period: given that the Greenblatt Model proposes a ranking of assets from "best" to "worst", the expectation is the portfolios formed by the last 24 shares never obtain a higher result than the 24 best ranked.

Besides the analysis of the performance indexes and the comparison of the portfolios within each method, the returns among the three models were compared. The averages of the monthly returns were compared by means of t tests in order to verify the existence of statistically significant differences: the intention was to at the end to reveal within the period studied which was the best strategy.

RESULTS AND DISCUSSION

First, it is necessary to describe the nomenclatures used here for the portfolios: each of the methods has four portfolios being these made up by the shares ranked according to their specific method. So, in the Greenblatt Method for example, there are the G1, G2, G3 and G4 portfolios being G1 the best portfolio of the model, G2 the second, G3 the third and G4 the last and therefore, the worst portfolio of the model.

Jensen index: The Jensen index evidences the performance by means of the interceptions of the regression which quantifies the profitability above what is expected for a determined risk level, suggested by the CAPM (Table 3).

The higher portfolios (G1, G2, PL1, PL2, ROEPL1 and ROEPL2) obtained a positive Jensen index which means that they presented abnormal returns significantly above the expected by the CAPM Model. The better performance only occurs in portfolios formed with the best positioned assets in each selection model.

As was expected, the methods obtained decreasing results which evidences the capacity of the methods to identify the assets with better returns by means of the ranking. The exception occurred in portfolios G1 and G2.

Treynor and sharpe indexes: Simply said, the equation of the Treynor index is the return of the portfolio minus the risk free asset, pondered by the non-diversifiable risk. Then its result is the premium due to the incurred risk by unit of assumed risk. In this case, the abnormal performance occurs when the index of the portfolio is higher than the market index since, it demonstrates that despite the higher return, its incurred risk was lower than that of the market. The results are shown in Table 4.

Table 3: Jensen index

Indexes	Coefficient	SD	p-value
Greenblatt			
G1	0.0069	0.0034	**
G2	0.0095	0.0035	***
G3	-0.0040	0.0036	
G4	-0.0099	0.0042	**
Method 2			
PL1	0.0090	0.0047	*
PL2	0.0073	0.0032	**
PL3	0.0029	0.0037	
PL4	-0.0088	0.0039	**
Method 3			
ROEPL1	0.0120	0.0035	***
ROEPL2	0.0055	0.0031	*
ROEPL3	-0.0003	0.0038	
ROEPL4	-0.0055	0.0038	

Statistically significantat: ***1, **5 and *10%

Table 4: Treynor and sharpe indexes

Indexes	Treynor	Sharpe	Beta (β)	Average R.	Cumulative R.
Greenblatt					
G1	0.0114	0.1110	0.6218	0.0178	2.3602
G2	0.0167	0.1557	0.5795	0.0204	2.7004
G3	-0.0045	-0.0479	0.8541	0.0069	0.9119
G4	-0.0105	-0.1091	0.9231	0.0010	0.1379
Method 2					
PL1	0.0137	0.1209	0.6673	0.0199	2.6377
PL2	0.0101	0.1068	0.7469	0.0183	2.4217
PL3	0.0038	0.0403	0.8081	0.0139	1.8383
PL4	-0.0117	-0.1164	0.7324	0.0021	0.2832
Method 3					
ROEPL1	0.0188	0.1850	0.6497	0.0230	3.0380
ROEPL2	0.0087	0.0898	0.6532	0.0164	2.1768
ROEPL3	-0.0002	-0.0023	0.8279	0.0105	1.3981
ROEPL4	-0.0070	-0.0712	0.7601	0.0053	0.7125
IBOV	0.0002	-	1.0000	0.0110	1.4547
CDI	-	-	0.0000	0.0107	1.4227

Table 5: Differences in average among the returns of the portfolios

Indexes	r	G1 (0.0178)	G2 (0.0204)	PL1 (0.0199)	PL2 (0.0183)	ROEPL1 (0.0230)	ROEPL2 (0.0164)
G1	0.0178	X					
G2	0.0204	0.7194	X				
PL1	0.0199	0.5529	-0.1437	X			
PL2	0.0183	0.1423	-0.6440	-0.4183	X		
ROEPL1	0.0230	1.8028**	0.8563	1.0851	1.5140***	X	
ROEPL2	0.0164	-0.4497	-1.3071*	-0.8858	-0.7041	-2.0784**	X

Statistically significantat: ***1, **5 and *10%

Again the higher portfolios obtained elevated Treynor indexes, abnormal returns (G1, G2, PL1, PL2, ROEPL1 and ROEPL2), incurring in risks lower than those of the market thus concluding an abnormal higher performance.

The is not much difference in the analysis of the results of the Sharpe and Treynor indexes what is to be observed is the way in which the risk is measured: whereas in Treynor the beta (β, non-diversifiable risk) is used in shape the standard deviation is the one used.

The results found in the Sharpe index again demonstrate a higher result to that of the market of the higher portfolios (G1, G2, PL1, PL2, ROEPL1 and ROEPL2). Abnormal returns with risk always lower than the market were observed in the three risk models.

An avergage difference test (t-test) was carried out with the purpose of analyzing significant differences among the average returns of the portfolios. The test was conducted verifying whether the difference among the returns of the portfolios listed in the lines and listed in the columns was greater or smaller than zero according to the resulting indicator of the t-test. For example: the result of the test for portfolio ROEPL1 (line) against portfolio G1 (column) resulted in a test statistic of 1,8028 and which was statistically significant at 5%. The indicator shows which of the portfolios obtained the highest average return. Due to line X being column, the ROEPL1 portfolio had a higher result (positive indicator) that that of portfolio G1 being statistically significant at 5%.

In evaluating the test statistics, what is observed is a higher performance of ROEPL1 over G1, even so with a significant difference at only 5%.

Hence, the evidence indicates that it is possible to use publicly available information to obtain an abnormal profit. This logically means a rebuttal of the hypothesis of efficient markets in its semi-strong form at least for the period being studied (Table 5).

Therefore, the problem of the investigation was resolved in the following manner: during the period analyzed, it was possible to obtain abnormal returns using financial statement information which indicated inefficiency in the market. Among the methods for the creating of portfolios, method 3 stood out, even though said result may be different in different temporal series and/or different markets.

CONCLUSION

The purpose of this study was to evaluate whether more elaborate techniques for the selection of assets and creation of portfolios have a better performance than techniques based on more simple information in terms of interpretation and cost. Subjacent to this question is the testing of the hypothesis of efficient markets given that under it, the expectation of abnormal performances is impossible. Even according to the theoretical analysis by Grossman and Stiglitz (1980), the cost for the acquisition of the information would allow a higher profit, enough to cover it. Therefore, strategies based on more sophisticated information should have a better performance.

The portfolios were formed based on indexes originating from financial statements. The P/E index, maybe the most widely used by the market underlies one of the strategies for selection of assets. The other two are based on EBIT/EV jointly with ROIC, proposed by Greenblatt and ROE jointly with P/E. The risk of the portfolios created is evaluated in two ways: total risk, proposed by Markowitz and non-diversifiable risk proposed by Sharpe.

The performance of the portfolios, evaluated by the return indexes adjusted by the risk, demonstrates that during the 2003-2013 period it was possible to observe abnormal returns and that the most complex information, in this case, those associated with the strategy proposed by Greenblatt did not result in better results nor in higher values in indicators that relate risk and return. This evidence does not support the idea that the cost inherent to the acquisition of information can result in better performance. It was even possible to observe the occurrence of fewer risks in portfolios with higher returns, in direct contrast with the hypothesis of efficient markets.

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