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Long-term PE as investment strategy

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ABSTRACT

This study is a re-examination of the price-to-earnings effect using a variation of the metric. It is analyzed whether the use of long-term or permanent earnings in the estimation of the ratio is able to increase its performance as investment strategy. Diverse variations of the metric are measured in the long and short run and combined with other anomalies in order to increase its performance.

This study focuses on the US market, employing data from 500 firms trading in the S&P500 index during the period 1998-2013. Decile portfolios are formed based on the traditional PE metric and other variations. The results indicate that the addition of remote earnings in the estimation of the multiple do not increase its performance. The evidence obtained shows that only the use of earnings from the previous two years (EP2) outperforms the traditional ratio.

The examination of the PE effect is conducted adopting the 4-factor model approach. Due to the characteristics of the sample, the regression reveals that the effect generated by EP2 is controlled only by value and momentum factors but not by the size one. Moreover, the reward-risk analysis exposes that the regular PE outperform the EP2 in Sharpe ratio basis. Additionally, it is demonstrated that the January effect does not cause the PE effect.

Extensive experiments show that the performance of the multiple can be increased by reducing the holding period, and by combining it with anomalies such as size and momentum. The combination of the size and PE effects provides the best performing ratio in this study and it indicates a clear relation between size anomaly and the PE effect.

KEYWORDS: price-to-earnings ratio, value stock, strategy, anomalies

1. INTRODUCTION

The price-to-earnings ratio (PE) is one of the most used financial measures by market participants because of the several interpretations and applications it has been given. Studies indicate that the ratio has at some point the ability to predict future returns (Nikbakht and Polat, 1998; Campbell and Shiller, 2001; Giannetti, 2007). The ratio is an indicator of the market value of equity given to the firm's earnings and it indicates the possible future performance of a stock (Siegel, 2005:42).

The properties and importance of the metric are derived from the relevance of the elements that compose it. The market estimation of the future performance of a firm is implied on the share price while the earnings component indicates its current operations. In consequence, the metric captures the relation between the current earnings and future earnings. (Barker, 2001:53)

One of the articles that first documented the PE effect was Basu (1977). Using the market model approach, the author found that the stocks with a low PE consistently earned higher returns than the high PE ones. He argued the pattern observed to be a violation of the market efficiency hypothesis because excess returns could be gained systematically by investing in stocks with low ratio. The conduct observed suggested that the ratios contain information about future performance. Employing a different approach, the effect was also confirmed by Jaffe, Keim & Westerfield (1989).

The existing literature has attempted different applications for the metric. For instance, the multiple has demonstrated ability to predict future abnormal returns (Bleiberg, 1989; Chan, Hamao and Lakonishok, 1991; Ball, 1992); changes in future firm profitability (Fairfield, 1994); mispricing stocks due to earnings announcements (Dreman, 1995); as an efficient valuation tool (Alford, 1992), to forecast future changes in share prices (Campbell and Shiller, 1998), and to predict future cash flow (Ang and Bekaert, 2007).

Then, further research extends in the sense to find the determinants that cause the effect. For instance, the following elements has been documented as components of the ratio: future earnings growth and systematic risk, using market betas a proxy (Beaver and Morse, 1978), economic growth (Nikbakht and Polat, 1998; Ramcharran, 2002), expected growth, past long-term growth (Fairfield, 1994), dividend payout, dividend growth and short-term bonds yield, among others, hold explanatory power that explicate the variation of the PE ratio (Dudney, Jirasakuldech & Zorn, 2008). The investigations coincide that the past growth is a basic component that has a large effect on the ratio and therefore it is useful to predict future growth. This explanation is justified since the multiple is derived from the dividend discount model.

The PE effect is also associated with value and growth stock. As documented in Fama and French (1993) and Lakonishok, Shleifer & Vishny (1994) value stock are characterized for having high book-to-market ratio, small market capitalization and low PE. Controversy exists in the sense of whether the abnormal returns obtained by low PE stock are caused by to size effect. Opponents of the PE effect suggest that the PE effect is not an independent effect and this is attributed to the abnormal returns obtained by the size anomaly and January effect (Reinganum, 1981; Bondt and Thaler, 1985; Fama and French, 1996; Chan, et al., 1991).

Variations of the EP ratio using historical long-term information have been considered as well. Anderson and Brooks (2006a) computed the multiple in an innovative way combining the earnings per share of the last period and the figures from the past two to eight years as numerator of the earnings yield or inverse PE. Their results are remarkable as they find that the use of remote data turns the ratio into a better predictor of returns than the regular metric. The combination of earnings from one and eight years in the past for the estimation of the multiple doubled the performance of the metric.

1.1 Purpose of the Study

This paper aims to examine the performance of the modified version of the price-to-earnings ratio, computed based on long-term figures. Several alternatives of the metric are tested in the US stock market in order to prove whether these form produce similar results as those reported in Anderson and Brooks (2006a). The study attempts to give an answer to the hypothesis of the use of long-term information increases the performance of the metric. In addition, it is investigated whether the effect is contained by using the four-factor model approach.

Moreover, the period of the study comprises two relevant events in the US market such as the high-tech bubble in 2000 and the financial crisis of 2008. Then, it is analyzed the performance of the strategy throughout these years whether by following merely the variation of the PE as investing strategy is a worthy tactic during both expansion and recession phases of the economy. Also, a different treatment is given to data to control for these events by using an adjusted version of the multiple which aims to nullify the cyclical effects on the earnings.

1.2 Research Problem and Hypothesis Development

The random walk theory claims that stock prices changes are not predictable so financial ratios or fundamental analysis done about stocks should not have predictability power to anticipate the drives in the market (Campbell and Cochrane, 1999). However, the literature shows that the PE multiple is useful to forecast changes in future stock price moves and suggests that stocks with low PE ratio outperform both the market and high PE (Campbell and Shiller, 1988, 2001). Therefore, the first and basic hypothesis is investigated regarding that portfolios created with low PE stocks will have a greater mean return than high PE portfolios.

Previous studies have associated the PE effect with the size anomaly. Reinganum (1981), Bondt and Thaler (1985) and Fama and French (1996) found evidence that the pattern is caused by the abnormal returns generated by small firms. In this paper, it is analyzed whether the returns from the best performing variation of the ratio are originated by the market, size, value and winner-loser premiums employing the four-factor approach.

Furthermore, this study examines whether the combination of recent and remote financial information improves the returns of the metric. Earnings from the previous periods are used to compute the PE ratio and tested whether the mean return of the low PE portfolio significantly increases as observed in Anderson and Brooks (2006a). In addition, the variations of the ratio are also examined in a variety of scenarios. It is investigated if the performance of the strategies is affected in the short and long run.

The reward-risk ratio of the strategies is estimated to compare the expected returns to the level of risk exposed. Ball (1992) and Anderson and Brooks (2006a) assess the risk-adjusted performance of the portfolios utilizing the Jensen measure and concluded that the low PE stocks outperform the high PE. Then, following the literature, I hypothesize that the adjusted returns of the long-term based PE portfolios are superior to the regular PE portfolios.

Finally, the performance of the PE ratio strategy is attempted to improve by combine it with other anomalies. For instance, it is seek whether the returns of the low PE portfolio are incremented by mixing it with the size effect initially reported in Banz (1981). The paper contributes to the literature with the examination of momentum effect, incorporated into the PE strategy. It is proposed that the combination will be able to surpass the returns obtained from the regular form of the ratio.

1.3 Structure of the Study

The remainder of this work contains the sections following described. Section 2 exhibits the fundamentals of two essential theories: markets efficiency and portfolio theory. Section 3 includes a revision of the publications related with the PE effect, for future returns prediction, as well as its determinants and explanations for the anomaly. In the fourth section, it is described the data and its characteristics, the method adopted in the study in conjunction with the empirical findings derived from the examination along with the respective discussion. Finally, Section 5 presents a brief summary of the main points treated in the study, conclusions and suggestions for further research.

2. THEORETICAL FRAMEWORK

This section introduces the elemental background related to the underlying theories of the investigation, such as the efficient markets and portfolio theory. Additionally, it describes valuation and predicting returns models like the CAPM, dividend discount model and the Fama and French (2003) three-factor model as well as its components, assumptions and the origin of these.

2.1 Efficient Markets

Kendall and Hill (1953) after examining the behavior of stock and commodities prices failed to find a regular pattern in the price cycle. He concluded that changes in securities prices were random, implying that the market moved in an erratic and illogical way. This provided the beginning of the so called Random walk theory. This says that stocks follow a random walk for instance the price of a security last week is not useful to predict the current price of the same asset due to an independency between consecutive price changes.

Further investigation interpreted Kendall's results as a form of efficiency of the markets. Then, statisticians and economists observed certain trends to forecast future prices placed on valuation measures which conducted to new beliefs (Malkiel, 2003). According to the efficient markets hypothesis in the ideal market, the assets prices are unbiased and these fully incorporate all the new information released at any time. Then, this leads to measure firms at their fair valuation level. Considering this, the reveal of new information should be the only cause of variations in stock prices, if the prices are determined rationally as stated by Bodie, Kane & Marcus (2005:341).

The existence of some type of predictability of security returns would be interpreted as evidence of inefficiency of the market. That is, profits can be captured by the use of adequate market predictions from analysts and privileged material that the market in general ignores. Since the information is not well known by all the participants, in consequence, this is not integrated in the current price and the securities are not assessed at the correct value. (Malkiel, 1989)

The efficient markets hypothesis is constructed under several assumptions that create the perfect market. These assumptions are explained by Copeland, Weston & Shastri (2014: 351–352) as following: a rational behavior by the participants at valuating correctly the assets, factors such as transaction costs, taxes and regulations are omitted; the prices cannot be driven by individual investors because there is a perfect competition.

The hypothesis is classified into three categories: weak, semi-strong and strong form of efficiency (Malkiel and Fama, 1970). The criteria standing for this classification is the accessibility to all the market information to the participants. This information is the relevant data utilized for valuating securities. The speed at which prices are adjusted is another factor in the market efficiency classification (Copeland, et al. (2014: 358).

First, the weak form of efficiency implies that currently assets prices contain all the historical rates of returns and trading volume data of the stocks. This form of efficiency implies a lack of relationship between previous data of trade volume and rates with future rates. Then, the past rates and future rates are independent of each other, and there is no impact from past rates on futures. Therefore, the analysis of historical data does not provide a prediction for the future. Given these conditions investments strategies of buying and selling securities based on technical analysis of historical information should not be profitable. It can be interpreted that prices do not represent their fair value. (Malkiel and Fama, 1970; Bodie, et al., 2005:342)

The semi strong form suggests that the markets are efficient with certain constrains. In addition to the historical prices, returns and volume data, other information such as macroeconomic news and firm-specific factors, are all the publicly available. For instance, fundamental data, dividends payments, valuation ratios, stock splits, repurchases, analysis previsions, as well as management and accounting aspects are absorbed by the market and adjusted quickly the security prices. The speed at which the market incorporates the disclosure of new information into the prices restricts the possibility of investors to profit by trading on new information, making the investment strategies built to profit new information releases, should profit only a risk free rate. (Malkiel and Fama, 1970; Bodie, et al., 2005:343)

The strong form of efficiency represents the integration of the two previous versions plus an additional private information component. It states the existence of inside information, which refers to relevant information non-publicly available and known only by specific group of investors. Then, both public and private knowledge are fully incorporated into the current security price; a circumstance that leaves no chance for investors to consistently obtain returns above the average investor, taking in consideration the efficient market assumptions. (Malkiel and Fama, 1970)

In the real markets, the strong form is a complicated issue. Bodie, et al., (2005:343) argue that regulations have been applied in order to restrict insiders to profit by having access to confidential statements before the rest of the participants. If markets were strongly efficient, then the exclusive possession of relevant information would not be enough to profit since the market adjustments make it unable.

The efficient market hypothesis implies due to the condition that all the information is reflected in the assets price at any time, it makes profits unreachable. Securities priced beyond their fair value should not be found under the prior assumptions. Then, to obtain superior returns in this market is necessary to invest in more risky securities and manage with economic news through the asset allocation. However the literature lists a considerable number of cases in which the real market in fact does not adjust swiftly to public information (Reilly & Brown, 1997).

The exhaustive research of investment strategies and the deep analysis of historical series and financial information should not provide returns under this hypothesis. As Malkiel (2003) states, the technical or fundamental analysis would not improve the ability of portfolio managers to reach higher returns than an average investor.

The variation of stock returns is related to an undefined number of variables. The beta of the CAPM model is not the only determinant of the variability as it was demonstrated in Fama and French (1992). In this context, Fama and French (1996) developed a new model to explain stock returns considering two additional factors that were omitted in the CAPM. The size of the firm and the ratio of its book valuation to market capitalization were shown to have explanatory power since stocks with high book value and small size present higher than average returns.

2.2 Asset Valuation

The price of an asset is determined on basis of its expected return and risk. At the same time, Barker (2001:14) abounds on this point, explaining that the expected return is conditional on the amount of money returned for the investment, the duration and external factors that depreciate the value of the capital such as the inflation. While the second factor, not less important, risk, represents the possibility of the future cash flows to not be delivered.

The literature indicates that the price today of an asset is equivalent to the future cash flows discounted by (one plus) the corresponding discounting rate for at each point of time. Then, in the case of a stock valuation, the future price plus the dividends represent the cash flows while the discount rate of rate of return in the denominator remains. The discount or required rate is conditional on the risk the security is exposed, therefore as Brealey, Myers & Allen (2006:62) states all the securities with a similar risk level should be priced at the same expected return rate.

From the prior calculation is derived the dividend discount model (DDM), a generally accepted approximation of the theoretical value of a share. The model formulates that the current price (P_0) of a stock represents the sum of its future dividends (D) divided by (one plus) the expected rate of return (k) on the equity invested.

(1) $$P_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+k)^t}$$

Barker (2001:21) clears the interpretation of the DDM in regard of revealed economic news. On one hand, the excess earnings have a positive effect on the share price as it raises the expectations about future dividends; on the other hand, a negative change in dividend policy certainly decreases future cash flows as well as the price and inversely impacts the perception of the risk. A contraction in interest rates raises the present value of future payments while the increase in inflation, consequently increment the rate and negatively impacts the price.

Since in the reality there is uncertainty about future dividends, a further model is derived.

(2) $$P_0 = \frac{D_1}{k-g}$$

The dividend growth model (DGM) assumes that the subsequent dividends will growth at a constant rate (g). Then, the price is determined by the dividend paid (D_1) discounted at the rate of return (k) minus the constant growth rate assumed. This is also known as the Gordon (1962) growth model.

Assuming that the future dividends represent the expected earnings, then taking the dividend yield formula $E(r) = Div_1/P_0$ is obtained the price-to-earnings ratio $E(r) = EPS/P_0$. Brealey, et al., (2006:72) explains that the expected return of an asset is determined the ratio of the future earnings per share divided by the latest price of the security.

2.3 The Portfolio Theory

Markowitz (1952) brought a big contribution when he presented a form to diversify the risk in an investing portfolio. By combining the variables of risk and expected return to create efficient portfolios, he introduced the modern portfolio theory. The integration of a portfolio implies a covariance between the stock returns joined and the utility can be optimized in basis of the portfolio mean-variance.

In this context, Sharpie, Lintner and Treynor a decade later, proposed the capital asset price model. The model implies that the risk premium of an asset is proportional to its beta, which as in Markowitz (1952) approach, it represents the risk. Beta indicates the sensitivity of a stock to the variations of value of the market portfolio and it is formulated by Copeland, et al. (2014: 150) as:

(3) $$\beta_j = \frac{Cov\,(r_j, r_m)}{\sigma_m}$$

where $Cov(r_j\,,\ r_m)$ denotes the covariance between the returns of a stock j and the market portfolio m; and σ represents the variance of the market.

The expected rate of return for an investor to compensate the risk assumed by investing in the market, under the assumptions of an efficient market, is determined by the CAPM. The return suggested by the CAPM is represented in the following equation:

(4) $$r = r_f + \beta(r_m - r_f)$$

where the $r_f$stands for the risk free rate, represented by the short-term treasury bills, plus a an additional benefit, in contrast with the market r_m, for the implied risk taken expressed by the coefficient beta β. (Brealey, et al., 2006:189)

In the model, the capital market line (CML) is the trade–off line, as seen in Figure 1. This exposes the best combination of the return and risk variables. By definition the CML represents a better choice to the efficient frontier since it considers the risk free rate. It is expressed as:

(5) $$E(r) = r_f + \frac{E(r_m - r_f)}{\sigma_m} * \sigma_m$$

where σ_m denotes the standard deviation of the market portfolio, r_m and r_f are the return of the market and risk free rate respectively. (Bodie, et al., 2009:361)

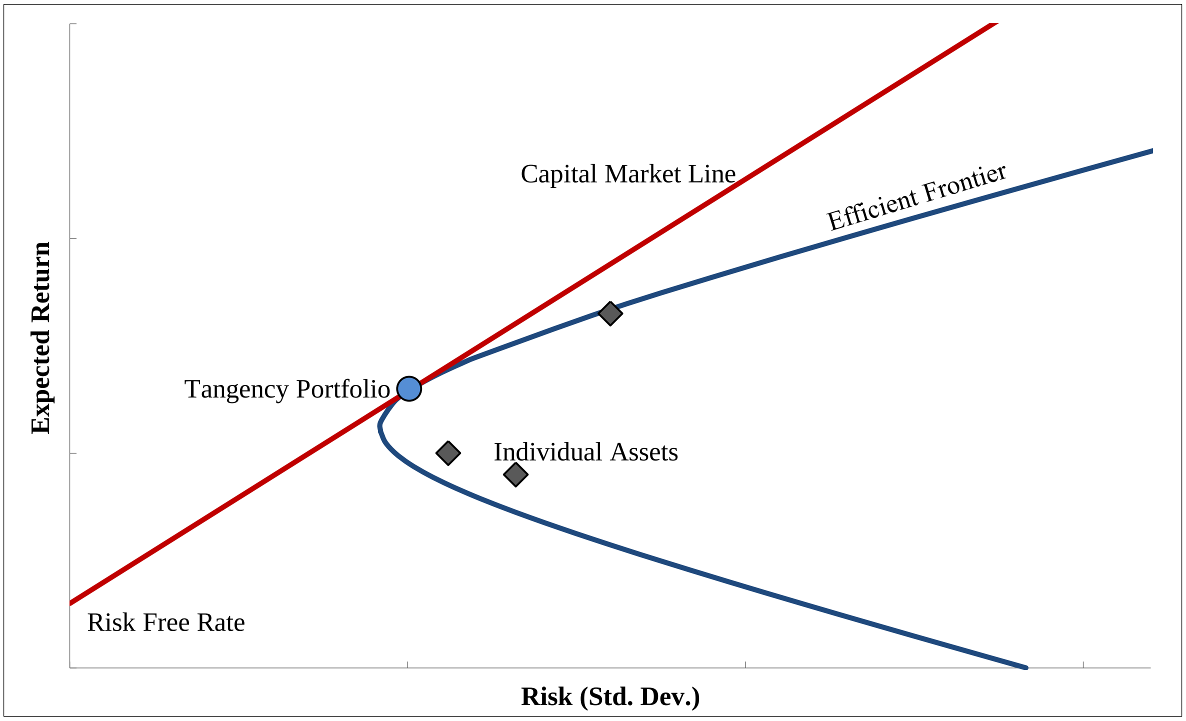

Figure 1. Capital Market Line

The model presents certain assumptions that create equilibrium in the market. For instance, it assumes the unimaginable case of default of the US treasury bills which represent the risk free rate. The investors are risk-averse and aim to maximize the wealth, the assets quantities are fixed, marketable and perfectly divisible. Also, the model infers that borrowing and lending rates are equivalent, it removes the existence of information costs, implying that all the information is available at the same time for the investors. (Mitchell and Pulvino, 2001; Copeland, et al., (2014:147-148); Brealey, et al., (2006:197)

Another key assumption of the model regarding the demand and supply of the securities is explained by Bodie, et al., (2009:360). The market runs in an optimal way all the time as when there is always a buyer and supplier available. Thus, the supply equals the demand at any moment eliminating inefficiencies. It states as well that all the participants coincide in the expected return for a specific asset and market imperfections such as taxes, regulations or short position restrictions, do not exist.

2.4 Three Factor Model

The CAPM showed not to be sufficient to determine the expected returns since the beta factor did not manage to explain all the variations of the returns. Therefore in further investigation, Fama and French (1996), added additional components to the model creating in that way the three-factor model. Since it was noticed that small-firm stocks consistently outperformed those of large firms, a size element was included in the model. A similar pattern was observed for the securities with high market capitalization in relation to the value presented in its balance (B/M).

It is been demonstrated that the market capitalization of the stocks plays an important role in the portfolio selection. Early papers like Banz (1980) and Keim (1983) show that small-firm stocks, in terms of market value, trend to persistently obtain superior returns than the large-firms. Based on the literature, there is evidence that the tendency have been present in the market since at least the 20’s (Malkiel, 2003). These studies were the origin of the research concentrated in the small-firms anomaly and consequently for the canalization of this pattern into the three-factor model.

Moreover, a similar trend that contemplated that used of the book value to the market price of a share as an investment strategy, introduced the value anomaly. A study conducted by Rosenberg, Reid, and Lanstein (1985) demonstrate an existing significant difference between portfolios formed in basis of the highest and lowest book-to-market ratio. As the persistent effect cannot be explained by the CAPM, it was considered a violation of the efficient markets hypothesis and therefore called an anomaly.

Fama and French (1993) claim that the book to market equity, leverage, size and earnings yield have an explanatory power when these are used integrated in a model separately. Additionally, they suggest that elements like book-to-market and size, measured by the market equity, incorporate the ability of the rest of the other two variables stated a priori.

Regardless, the small-minus-big size factor and high-minus-low factors by themself cannot explain the innovations of the returns in a time series experiment (Fama and French, 1992). In an extension of their previous work, Fama and French (1993) applied these factors in a different sample and concluded that an improved model containing the three factors was able to capture the variation of the cross-section mean return.

3. PRICE-TO-EARNINGS MULTIPLE

The price-to-earnings (PE) multiple is generally defined in the existing literature as the value of the earnings per share given by investors. It is also described as a measure of the price paid for a share of the net income earned by a firm. For Barker (2001:53), it represents a direct relationship between highly relevant figures of a firm, such as the performance measure by the earnings and the market estimation of its future results. However, the ratio implies a linear relation between earnings and price and the assumption that the constant term is zero; therefore Booth, et al. (1994) claim that the ratio cannot be taken as a rule to fairly valuate an asset.

Commonly calculated as the latest stock price to the earnings per share reported, the multiple can be a simple but useful measure to compare stocks among industries and to the benchmark as well as an indicator of overpriced assets. The dividend discount model by Gordon (1962), described in section 2, is viewed as the starting point of the metric. The model relates asset prices as a function of dividend payout ratio, the growth rate of dividends and the required rate of return. It also assumes that the investor pays for a dividend expectation and that the rate of return required is in function to the rate of growth.

The multiple, together with the forecasted earnings growth in the long term are used for analysts to set target prices and provide stock recommendations (Bradshaw, 2002). From these elements, the forward PE can be obtained. This is calculated based on the latest market price and substituting the realized earnings with future earnings per share. The forward PE provides a forward-looking perspective when comparing the metric among companies located in the same industry.

An example of the use of the metric as an indicator of the fair valuation is explained by White (2000). He analyzes the pattern of the market ratio using S&P500 as benchmark over time. It is observed that the historical levels of the PE in the US market had fluctuated from

5.9 to 35 in the period 1949-1999. The author states that viewed in a different perspective, it has increased as much as five times since the lowest point till the high-tech bubble in 1999.

As it can be seen on Figure 2, the historical market PE presents a mean-reverting process. When the ratio is above (below) the mean, it is interpreted as overvaluation (undervaluation) of the assets. The mean-reverting process indicates that at some point the market will correct the valuation given to stocks, driving the ratio below the historical average. However, the firms' earnings, component of the metric, are affected by economic cycles; therefore recession periods with depressed profits are represented by unusual peaks which does not necessarily represent the market valuation level (Campbell and Thompson, 2008).

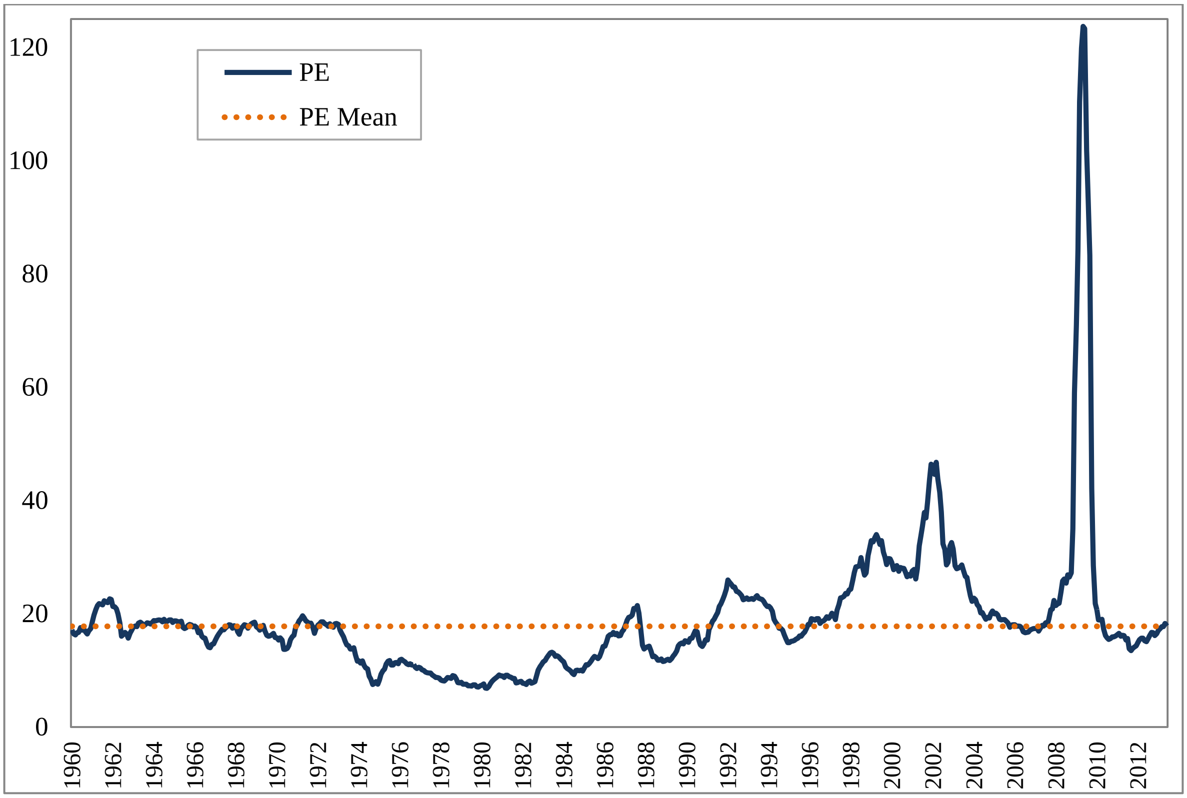

Figure 2. Historical price-to-earnings ratio of the S&P 500 1960-2013. Source: Schiller data.

The early literature brought evidence about the presence of the low PE effect. This influence is described as the consistent outperforming of low PE stocks against the market and the high PE ones. Basu (1977) in his approach used annual data of industrial firms in the NYSE from 1956 to 1971 and formed quartile portfolios classified by low to high PE stocks. The outcome showed a significant difference in mean return of about 7% between the lowest and highest PE portfolios. Therefore, he concluded that the assets with low PE tend to outperform high PE, although adjustments for risk free are done.

A subsequent paper by Basu (1983) investigates the issue previously noticed. He finds that stocks with high earnings yield, equivalent to low PE, outperform high PE stocks on average. However, he expresses that the pattern is not totally an independent effect since it is related to the firm size documented by Banz (1981). The significance of the low PE effect diminishes when it is examined jointly with the small size effect. A considerable portion of the returns gained by low PE stocks is explained by the returns obtained by small size stocks. Additionally, he found that the effect was not connected with the release of financial data or information effects.

Opponents of the PE effect believe that this impact comes as a result of the firm's size. Reinganum (1981) argues that PE power can be contained by controlling for small firm effect. Also, Bondt and Thaler (1985) research about momentum effect, the PE effect was partially examined as well. They concluded that the firm size effect and January effect are the causes of the large earnings obtained by the low PE stocks. However, the results reported in Jacobs and Levy (1988) indicate that both anomalies, the small firms and PE effect, are independent of each other and have a significant impact on predicting excess return.

Cook & Rozeff (1984) re-examined the contradictory findings from Basu (1983) and Reinganum (1981) to find whether the PE effect was caused by size effect. In the study, the authors use different approaches to calculate abnormal returns, portfolio formation rules and a larger data sample. The findings suggested that the January, value and PE effects are independent and they generate abnormal returns. No evidence was found that size effect neutralizes the PE or conversely.

The PE effect was examined together with other anomalies such as: firm size, PE, neglect, January, day of the week, residual risk, earnings surprise, residual risk, yield, skewness, return reversal and low price by Jacobs and Levy (1988). The study was done using US data from 1978 to 1986. They ran univariate and multivariate cross-sectional regressions with variables for all the anomalies and controlling for industry. The results evidenced economic and strong statistically significance in returns for the presence of low PE effect, small size, neglect, sales price, trend in analysts' estimates, earn surprise, relative strength and residual reversal variables.

In the same line, further investigations supply more evidence that supports the phenomena in different period samples. Bleiberg (1989) examines the period 1938 -1988 in the US market and brings more evidence that support the hypothesis of the use of the ratio as a predictor of returns. He reveals that periods with relative high (low) PE lead to low (high) returns in the future. Despite the multiple can be a useful indicator of under or overvaluation of a security, he advises that the ratio should not be used as an accurate investment strategy. The reason is that it is not possible to define when the market will adjust the valuation of the stock to its fair value. Therefore, its use as a trustable strategy is debatable.

Jaffe, Keim & Westerfield (1989) reviews the PE anomaly a sample period with different features, changing the approach method and including the seasonal examination. They find that the effect remains after controlling for the January effect. Also, it was found that the EP effect was independent of the size effect when the market model is used. An interesting finding reported is the existence of abnormal positive returns for stocks with negative earnings which was not related with the size effect.

Contradictory evidence about the low PE strategy is presented in Chan, et al., (1991). The study was centered in the Japanese market in the time period 1971 to 1988 and using monthly data. It was observed that the low PE decile outperformed the high PE one in the Asian market as well. Yet, the regression analysis showed the absence of significance of the earnings yield as explanatory component of the return variations. The authors suggest that the returns achieved with the EP variable are attributed to the January effect. Among the findings of the research, it was noticed that fundamental variables such as book value and cash flow yield are highly associated with expected returns.

Conversely, the cash-to-price ratio (C/P) happened to have a higher ability to predict returns and presents a particular high correlation with the PE multiple. It was documented a stronger predictability of the stock returns by the C/P ratio, compared with a weak ability of observed in the PE. Chan, et al., (1991) suggested that the possibility of biased earnings in the Japanese firms due to discrepancy in the reported depreciation is what causes the behavior.

Ball (1992) reviews the anomaly and suggests the existence of market inefficiency is caused by the real ability of current earnings to predict future returns. The author also leaves the possibility that the effect could not be an anomaly whether alternate methods to estimate expected returns are employed. He claimed that the effect is associated with the stocks' risk. Assuming that current earnings are positively related with expected earnings, stocks with expected high returns have a higher level of risk and are valuated at low prices in relation to the earnings.

Fama and French (1992) argue that PE effect and other anomalies are diminished when it is controlled for size and value. Using a large sample of US data from 1963 to 1990 they find that explanatory power of the ratio disappears when the size variable is included in the model. An interesting finding is observed when the effect is analyzed when negative ratios are included in the sample. The portfolio formed with stocks that reported negative earnings gain higher than average returns.

Booth, Martikainen, Perttunen & Yli-Olli (1994) studied the EP anomaly in Finnish and US markets. They analyzed the existence of a reciprocal association between earnings and share prices and found evidence that rejected the hypothesis. The study concluded that the PE effect is attributed to the size and the share price anomalies. The latter refers to the inverse association between stock prices and expected returns.

Fairfield (1994) documents a positive association between the PE multiple and the expected changes in future profitability. The author reveals that that the PE ratio represents a linear function of the present value of the estimated earnings growth. For instance, when the PE is placed away from its average level, it indicates future changes in abnormal earnings in the same proportion as it is deviated from its mean. Therefore, she infers that firms are likely to exhibit high PE during bear markets since temporal low or negative earnings are informed, which are anticipated to increase in the subsequent periods. Additionally, when the PE and the B/M ratios are combined, it can predict at some point the future profitability, measured as the return of equity.

It is been also documented that portfolios formed with extremely high PE and extremely low-PE stocks show a type of stability that tend then to remain into the initial category, high or low, in the long term (Fairfield (1994). Similarly, an identical form of persistence was noticed in Beaver and Morse's work (1978) where low PE portfolios tend to remain with a low ratio and the high group presented a similar behavior. However, the multiples of the portfolios in the long-term were not as high or low as originally.

The effect generated by the introduction of new information in the market, regarding stocks with high and low PE, has been examined by Dreman (1995). An asymmetric reaction about earnings surprises for low and high PE stocks as he finds that analysts' forecasts errors have a direct inverse impact on stocks. In the case of firms which have relative low PE stocks, the positive earnings surprises derive in a return higher than the market. Otherwise, this effect is more conservative with the high PE stocks. A similar effect takes place when it is a negative surprise after an earnings announcement.

Moreover, Dreman (1995) further examined noticed that when the earning surprise was positive the lowest PE quintile displayed an economically and statistically significant result that outperformed the market in contrast with the high PE quintile that considerably underperformed it. Conversely, the high PE quintile presented a more negative influence than the low PE group when the surprise was negative. The economic and statistical significant difference between these categories is described as a result of the overreaction and mispricing of the market. It is also observed that positive earnings surprises have a more positive impact on the best performing stocks by PE. Likewise, negative earnings surprises have a greater impact on the low PE stocks while the magnitude of this effect is more moderate in the high or worst performing PE stocks.

The low PE effect was examined again in Fama and French (1996) by utilizing a different approach. They criticize that the initial papers about the PE anomaly employed the capital asset pricing model and found that the returns of these portfolios were not explained by the CAPM. Nevertheless, when the three-factor model is utilized, controlling for additional components like market capitalization and book-to-market valuation, the effect of the PE was diminished.

Due to the variation of the PE ratio throughout time, White (2000) explores whether the variation observed over time is justified by the market conditions. He finds that an average level in the range of 18 to 23 units is justified by the conditions of the economy and market in that specific year when the ratio is estimated. However, the metric at that point of time reached over 30 which took him to anticipate a crash in the market in the following years.

The PE and dividend-price metric has been utilized to predict financial data. Campbell and Shiller (2001) by obtaining fitted values of the multiples, they stated that the ratios are inadequate indicators to predict future dividend growth or productivity growth since the ratios are able to explain a small portion of these variables. However, they remark the main ability of the PE multiple to predict future changes in stock prices.

Additionally, the examination of the PE effect was extended to the international context by Campbell and Shiller (2001). With samples of developed countries as Canada, Australia and UK, they found significant differences between the highest and lowest PE portfolios. Another developed market like Hong Kong, was analyzed by Lam (2002) who notices similar results.

The literature about the predictability of stock returns employing financial ratios is expanded by Lewellen (2004). Financial multiples like dividend yield, book-to-market and earnings-to-price ratios are used in the study as well as NYSE monthly data for a large period 1946-2000. He computes the EP ratio with operating earnings before depreciation in the previous year divided by market equity in the previous month and using vector autoregressive model finds that the ratio is able to predict returns in the subsample 1963-2000. The dividend yield proved to be a more efficient forecaster of returns for the whole sample examined.

A modified version of the discount cash-flow model, documented in Bagella, Becchetti and Adriani (2005), is able to explain large portion of the variability of the EP ratio. The model implemented uses cash flow, expected growth rate of earnings, risk-free rate, market capitalization, dividend yield, sales per share ratio and the variation of past analyst forecasts to estimate the fundamental EP ratio in high-tech firms. The coefficient of the model approaches to almost one and it is highly significant, indicating that the components used in the estimation nearly explain the total variation of the realized ratio.

Similarly, Ang and Bekaert (2007) conduct a research about predictability of the EP and dividend yield and find the second one to be more at forecasting returns. An initial weak association is detected between stock returns and earnings yield or dividend yield in a univariate regression. This low relation is caused due to both metrics are formed with the element price in the denominator. In their attempt to predict returns using financial yields, they find just little evidence that the earnings and dividend yield predict abnormal returns.

On the other hand, the earnings yield (EP) is revealed as a predictor of cash-flow only in the short term.

In recent studies, Giannetti (2007) exposes the predictability in the short term of the earnings price ratio for the returns of the S&P 500 using quarterly data in the period 1994 to 2003. The study reveals the effectiveness of a timing strategy for an investor to take advantage of the finding as well. However, it is also exposed that the ability to predict falls before and during the high-tech bubble in the period from 1997 to 2002. The author suggests direct link between the investors' sentiment and the risk premium which is not contemplated in the model.

In Campbell and Thompson (2008) build a restricted model that helps to predict stock returns over a high volatile period such as 1980 to 2005. The model includes valuation ratios, profitability and consumption indicators, interest rate variables, inflation, term and default spreads. The results show the EP ratio (earnings yield) to be a highly significant variable in the model to predict monthly and annual returns. Meanwhile, 10-years earnings smoothed EP is employed, it is found to be better estimator for annual returns only, yet having a high explanatory power measured by R-squared (13.6%).

Lettau and Van Nieuwerburgh (2008) express certain inconsistency and poor ability of financial ratios to predict of returns in the long run. The paper discusses the instability of the EP ratio using unadjusted prices. They observed that the short-term returns present non-stationary properties which made them inconsistent over time. Therefore, in the long-run the mean of the prices has to be adjusted to present more favorable properties and make it able to forecast returns. For instance, when using adjusted EP ratios the regression coefficients are more stable over time and it is obtained stronger significance. The same pattern is found in the study of other financial ratios such as dividend-to-price and book-to-market.

Huang and Wirjanto (2012) analyze the positive association of growth rates and stock performance in the framework of emerging markets where generally companies exhibit higher growing rates that in those developed. The high growth rates affects the interpretation of the ratios since these high multiples does not necessarily mean over valuated stocks. A similar patter happens in the context of developed markets where low growth rates are common and alters the perception of a low PE ratio.

3.1 Long-term based PE ratio

Alternative estimations of the multiple have been tested as well. Usually, the investigations centered on the low PE effect are largely done by employing the regular ratio computed with current earnings and latest price as elements of the multiple. An isolated work by Graham, Dodd and Cottle (1934) is one of the earliest literatures that suggest the use of historical earnings to compute the meter. They insinuate that the use of average earnings of the past five to ten years might increase the ability of the multiple to predict returns.

A procedure of smoothed earnings was implemented to estimate the metric by Campbell and Shiller (1988, 2001). They used 10-year moving average earnings to current stock prices. Their justification is that average cumulative earnings in a long term reduce the cyclical noise in volatile periods such as recessions where earnings drop to historical low levels and do not provide a clear image for the prediction of the future. Therefore, using their method would help to generate a higher power prediction than the regular ratio that uses current earnings. In the research, it was found that the decile composed with averaged low-PE outperforms the extreme high PE one. This opened the view to further research adopting a similar approach.

The historical cyclically-adjusted price-to-earnings ratio (CAPE) or Shiller PE employed in Campbell and Shiller (1988) is graphed in Figure 3 among with the historical ratio of the market and its average. The alternative ratio is claimed to be a more adequate indicator of overvaluation due to the smooth earnings component. The discrepancies between the metrics are explained by the cyclical elements excluded through the use of permanent earnings (Taboga, 2011).

In a subsequent paper, Campbell and Shiller (2001) follow the line of studies employing long-term ratios to forecast future growth. The authors reveal a relation between PE ratios and the increase in stock prices in the long run. An alternative of the classic metric was used; they computed the average of the past ten-year's earnings. It was found that the smoothed PE as able to explain a third of the long-term growth (10 years) in the share price.

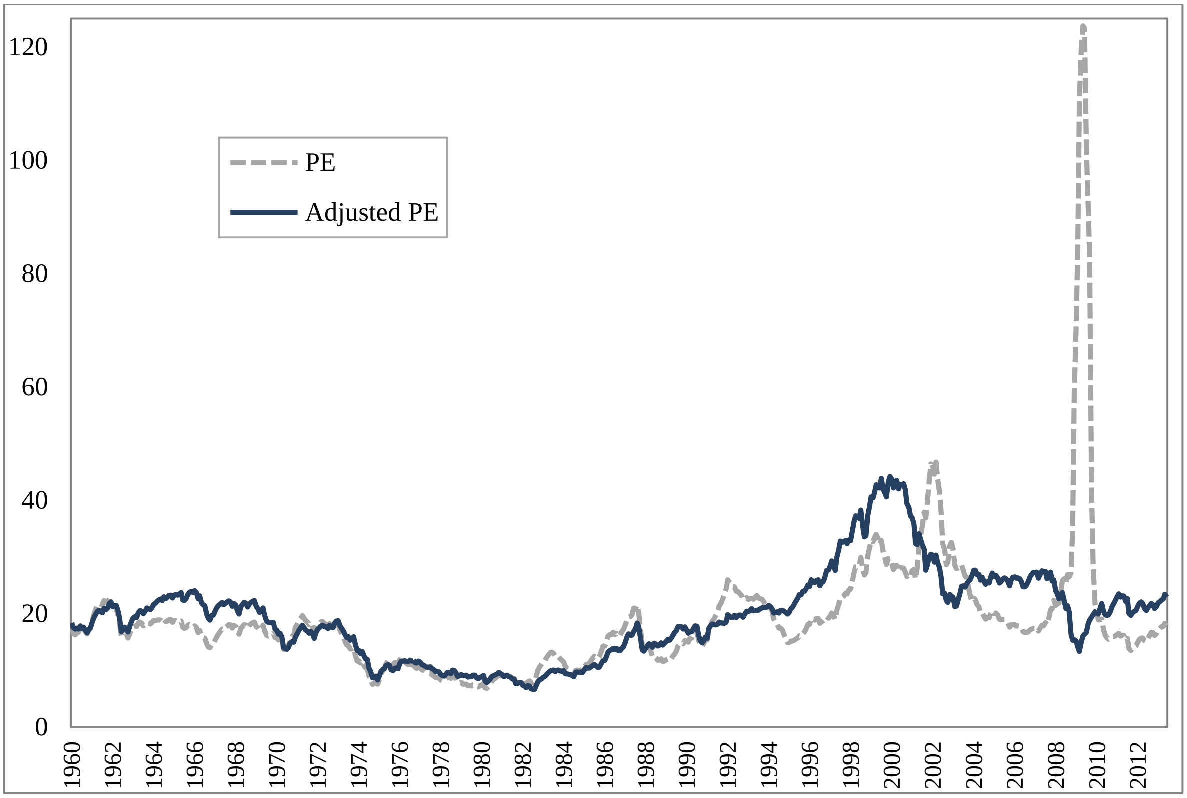

Figure 3. Historical cyclical-adjusted PE 1960-2013. Source: Schiller data.

Anderson and Brooks (2006a) investigates alternative weighting methods by gathering E/P ratios of several years to get superior returns than using only economic data of the previous year. They find that the best combination was getting the average of the earnings from the immediately previous year and earnings from eight years in the past. Overall, the combination delivered on average returns twice high than by using only recent earnings from the past year.

In the previously mentioned investigation, the authors used UK data to evaluate the strategy and created independent portfolios by grouping deciles with high and low E/P stocks for each year and calculate the return of those yearly portfolios. Then, they utilized a weighted average of the last eight periods divided by the actual price per share as in the following formula:

$$EP_i = \frac{\sum_{j=1}^{8} Wt_j EPS_{ij}}{P_i \sum_{j=1}^{8} Wt_j} \qquad (6)$$

where Wt_j represents the weight of earnings for the j year and EPS_{ij} is the normalized earnings per share at $t = 1$. Their results confirmed the price-earnings anomaly since the stocks with low P/E ratio outperformed those with high P/E in all of the portfolios taking earnings from any year. Furthermore, they found that the biggest/largest difference in the annual return between the deciles portfolios with high P/E and low of is displayed when the earnings of the last year and the earnings of eight years ago are taken to calculate the P/E ratio. The empirical results showed that by constructing the portfolios in this way it was possible to double the returns than if used only the last year earnings data.

In a recent study Taboga (2011) develops a state-space time-series model to estimate the persistent element of the earnings and compute an adjusted metric. The method, built using long-term earnings, converts the ratio value into probabilities if the market is overvalued or undervalue at certain level. The author notices that the medians from model created and the Shiller PE differ at numerous point of time. The model also records a peak in the probability of the market to be overvalued before the tech bubble and the 2008 financial crisis.

3.2 Determinants of the PE

The literature about the price-to-earnings ratio has been extended on trying to determine the components of the ratio. A large number of studies have utilized different proxies for variables such as risk, discount rate, dividend payout, growth, inflation, short-term and long-term earnings growth, among others. The purpose of finding the fundaments that move the metric is to identify associations of variables with the multiple over time and make predictions based on them.

Beaver and Morse (1978), analyze the composition of the multiple taking as a reference the dividend discount model (DDM). They argue that uncertainty is implied in the DDM equation due to the variables included. For instance, dividend payout and growth of earnings per share are variables considered in the model, which are usually based on analyst's predictions. They found that market beta, used as proxy for risk, dividend payout and EPS growth rate are components of the PE ratio. The study demonstrated that the portfolio risk represented by beta and the earnings growth (negative association) are two factors able to explain half of the cross-section variation in the PE ratios in the 14 years sample. Moreover, they find that the effect on the ratio disperses after the third year of the portfolio construction. This was showed since the correlation between the portfolio ratio at year one and the subsequent years gradually decreases from 0.96 to 0.83 in the fourth year and the difference between the highest and lowest PE portfolio sink from a ratio of 8.6 times to 1.8 in the third one. Part of the dissipation was concluded to be explained by differential growth in earnings.

Further determinants of the metric were disclosed on Griggs, and Wong (1983) paper. By using quarterly data of firms trading in the S&P400 during the years 1963 to 1980, they investigated the relationship between PE and other variables that justify its variation over time. They found positive associations between PE and the dividend payout ratio, previous period earnings growth and dividend growth. Additionally, they obtained significant negative relations of the multiple with a business failure rate, risk-free return, inflation and earnings volatility.

Since the net earnings are affected by the accounting techniques used, these have been considered as well as another factor that modifies ability to predict returns of the multiple. The prior element is investigated in Craig, Johnson and Joy (1987) who finds size and dividend payout highly significant at explaining the variations of the metric. Also, accounting elements such as the accounting method using for inventory, depreciation and investment tax credit have an association with the final metric.

The long-term earnings growth rate (5-years) was found as another element contained in the multiple. Fairfield (1994) observed a negative correlation between PE and current earnings changes. The correlation is consistent with previous literature and interpreted as stocks with low earnings growth, present the tendency to have high PE ratios. Additionally, she gives another interpretation of the PE ratio considering the variations in earnings during business cycles. She maintains that a high (low) multiple is a sign of unusual or transitory low (high) earnings at the point in time when it is computed. Therefore, she implies that a low short-term earnings growth (1-year) is associated with high PE.

A deeper examination of the earnings growth and PE association is conducted in Penman (1996). In his paper, it is explained that the multiple reveals that future growth of the earnings since it is positively associated with the future return of equity. The study revealed that value stocks with low PE present a direct relation with high cost of capital. Despite the fact that the association has been found statistically significant, he advises that it cannot be taken as a sufficient indicator of the future growth on equity under accounting principles.

Nikbakht and Polat (1998) found the country's risk and economic growth as components of the PE ratio. They explain the components of the model by considering that the P/E ratio is derived from the dividend discount model. Therefore, they determine positive associations between the P/E and the expected growth and divided payout, and a negative relation with the required rate of return. Finally, they point out that the growth component has a greater effect than the risk on the ratio.

In a subsequent paper by Zarowin (1990) reviews the findings in Beaver and Morse (1978) and gives a different interpretation to the results. He argues that the ratios are indeed determined in a considerable proportion by the differences in forecasted long-term earnings. Likewise, factors such as beta, expected short-term growth and the account method are determinants in a minor magnitude.

The industry where the firm belongs is also found by Alford (1992) as a significant component that explains the ratios. In the study that examines the accuracy of the PE multiple used for valuation purposes, the author denotes that the firm's industry justify a high portion of the cross sectional variation in PE multiples. Hence, the metric of a firm is compared with others belonging to the same industry. For instance, the contrast of two stocks of different sectors might be ambiguous since specific existing conditions affect their firms differently.

Siegel (2002:80) documents a negative association existing among the PE ratio and the inflation rate. He explains that when the inflation is high, the market multiple tends to decrease due to the increasing inflation reduce the quality of the announced earnings. He complements his thought by introducing the "Rule of 19" which expresses that the ratio of the markets approximate to the outcome from the operation, 19 units minus the inflation rate.

Kane, Marcus & Noh (1996) find a negative relationship between PE multiple and the market volatility using U.S. data. The ARCH model was used to estimate the volatility and observed that for each one percent increase in the market volatility, the multiple reduces by 1.8 points. They suggest that multiple is lower when the uncertainty in the market is greater. Therefore, the increase in discount rates and risk premium affects directly the prices of securities. They also explain that macroeconomic factors that affect the discount rate such inflation have a significant impact on the perception of earnings. The market interprets an increase in inflation as a bad signal for earnings reported as the quality and real value of these is diminished.

The detrended industrial production is claimed to be a determinant of the PE multiple throughout the history (Kane, et al., 1996). Defined as the negative deviation in the industrial production index trend line, the detrended industrial production is interpreted as a signal of recession in the economy. This variable have a significant impact on the market multiple, as when economy exhibits a downturn, the earnings tend to fall and rise the multiple.

White (2000) documents a positive relationship between risk-free rate and EP using S&P500 data. In the study that extends from the period 1986-1997, he constructs a model with different variables that explain in a large proportion the deviations of the ratio. In that sense, the model takes into consideration macroeconomic and fundamental aspects and generates a fair or rational value for the metric. Similarly, it can be interpreted as a guide to determine whether, at certain point in time, the market is driven into an inaccurate level. Therefore, under certain conditions, it is inferred an undervalued or overvalued market. Inflation and interest rates are seen as highly relevant variables in the fluctuation of the multiple. He suggests that on one hand earnings and the multiple are affected by the rise in interest rate as it increases the cost of borrowing. On the other hand, the stock prices suffer an indirect impact during high inflation lapses as the demand for more safe securities like bonds grows. The model is able to explain a large portion of the changes presented. The R-squared adjusted in this model is as high as 83%.

The components of the ratio are examined in the emerging markets context in Ramcharran (2002). The methodology employed is adjusted compared with previous studies and the author uses seemly unrelated regression procedures. Using data obtained from Euromoney, it was found economic country-specific variables such as economic growth and credit risk determinants of the metric. The results are consistent with findings in Nikbakht and Polat

(1998) and these indicate that the variables explain portion of the multiple variation across countries.

Additional elements that explain the PE effect have been found. The level of average of the market ratio by year, the sector where the firm belongs and the firm size are identified as factors that influence the metric in Anderson and Brooks (2006b). They suggest that the level of the ratio of the market at certain time represents the confidence of the market at that time; it also relates with the individual stock ratio. They found all these three factors highly significant and determinants of the PE. The size factor, specifically, presents a stronger association which is consistent with previous studies. This relation is explained by the high correlation exhibited with the PE. However, it is not explored whether the PE effect persists after controlling for size.

In a recent papers, Dudney, et al (2008) notices that there are fundamental factors that make a significant influence on EP ratio such as dividend payout ratio, short-term bonds yield, the spread between high grade and lower medium grade corporate bonds, expected growth, implied tax rate, and the FF two factor model SMB and HML. The results determined that short term interest rate (default spread), default risk premium, tax rates, inflation and forecasted growth in the index are associated with EP. They took a sample quarterly data from the S&P 500 index in the interval 1953-2003 and ran a regression with the residuals of the original model which included the variables previously mentioned. Nevertheless the study seems to have weaknesses as the authors did not consider the use of lagged EP and calculated the multiples with the closing price of the index of the last day of the quarter and the adjusted earnings for respective quarter. The results also were described as a signal of overreaction in the markets due to there was found periods of excessive optimism or pessimism.

The firm’s growth opportunities variable is another element implied in the PE multiple. Bodie, et al., (2009:615) explain the relevance of this component in the level of the ratio based on the following formula

$$\frac{P_0}{E_1} = \frac{1}{r} + \frac{PVGO}{E} \quad (7)$$

where current price is (P_0), E_1denotes the current earnings of a company, r is the required rate of return and $PVGO$ represents the present value of growth opportunities. From the equation, it is inferred that an increase in growth opportunities will be translated in an increase of the metric. Therefore, they interpreted that when the future growth of firms is overvalued, that generates that their stocks hold high PE ratios. They maintain as well that the riskiness of a firm is highly associated with the metric.

In a more recent publication, Zorn, Dudney and Jirasakuldech (2009) build a new model based on previous research about variables determinants of the PE multiple. They add the investor sentiment and taxes into the model and find a negative association with the metric. Along with their findings, a negative relation of dividend payout and growth forecast to the multiple was confirmed. More interestingly, the previously mentioned parameters are found to be nonstationary and a cointegrating relationship was noticed. The cointegration is interpreted as “a stable long-term relation among the variables”. Additionally, the results reported also confirm a positive relation of the EP multiple with variations in government bonds rates, as well as with the spread of the short and the long-term risk free rate, represented by the 1-year and 20-years US Treasury Note.

3.3 Value Strategies

Value stocks are known for having a low book-to-market, cash-to-price, earnings-to-price ratios and high growth sales, while glamour stocks present the opposite characteristics. Lakonishok, et al. (1994) tried to explain why value strategies outperform the market by examining a sample composed by firms in the NYSE from 1963 through 1990. They formed value and glamour portfolios and found considerable differences in average annual return between the lowest and highest deciles as he sorted by BM, EP, cash-to-price and growth in sales measure. Based on the empirical evidence obtained, they concluded that the result was caused by the particularly high expectations about the glamour stocks generated by overestimation of future growth rates, in comparison for the value ones. The benefits obtained from value strategies are caused by investors who overpay stocks that are performing well in the previous periods. The overpayment on those stocks generates a glamour component in the price and drives it away from its underlying valuation. Additionally, it was notice that value portfolios outperform glamour and market especially during negative periods of the market. The risk did not appear to be the determinant for such a difference between portfolios.

In related studies, Zarowin (1990) finds that the winner versus losers' phenomenon, documented by Bondt and Thaler (1987), was not derived by the overreaction of the market as they explained it. Reexamining the same evidence taken by the formers and controlling for size differences; Zarowin (1990) revealed the small firm anomaly was the main reason of these variations. Lastly, the author concluded that when losers are smaller, they outperform winners and when winners are smaller, they outperform losers, similarly as in Chan, et al (1994).

Just as the efficient market hypothesis indicates, the security prices should adjusts quickly through new released reports correcting the ratios as well. Yet this does not seem to happen immediately as new information is not immediately absorbed in prices as reported in Dreman (1995). He claims that stocks remain mispriced and do not fully adjust to new information briefly after earnings surprises due to an under reaction by investors. The author suggests that the mispricing correction hypothesis and there he abounds that overvaluation of the best stocks and undervaluation of the worst performers use to be a generalized practice in the markets. Through his hypothesis, he predicts that after an even trigger or relevant news, the effect in these two kinds of stocks will be asymmetric.

The explanation of the superior returns gained by value stocks is brought by Chen and Zhang (1998). The research demonstrates that risks related to leverage, financial distress and uncertainty are characteristics of value stock and these factors are the cause of the abnormal returns of this type of shares. In the study, value stock was determined by book-to-market and size factors and five Asian markets plus US market were examined.

A simple clarification of the explanatory properties of the PE and other analysis ratios regarding securities returns is given by Lewellen (2004). He claims that some of the most commonly used financial ratios such as dividend yield, book-to-market and earnings-to-price include the component price in the denominator. Therefore the measures should be positively related to expected returns.

From Barker (1999), we learn another interpretation related with the valuation of a stock. They believe that the multiple of a security can be compared with the average of the market at certain point of time or with the industry in order to know whether a stock is valuated in the correct level. A relative low (high) PE is a signal for undervaluation (overvaluation). The study presents evidence that the PE ratio is a better valuation instrument than the dividend yield in certain sectors.

Similarly, Barker (2001:13) provides a related interpretation for raise in price of certain stocks. He coincides that the increment in price derived of high expectations about future earnings. The increasing in price of an asset does not mean the raise in wealth but they reflect the higher confidence created around future returns and dividends of that security.

Errors in the estimation of the expected earnings performance is found as a cause of the value premium by Skinner & Sloan (2002). They find evidence that growth stocks present an asymmetric reaction to earnings surprises than value stocks. This is interpreted as the negative returns exhibited after negative surprises are larger than the positive returns subsequent to positive earnings surprises. Therefore, the returns of the growth stocks are consistently smaller than the value ones.

In Lewellen (2004) paper, the dividend yield was found to be a stronger predictor of returns compared with the BM and EP multiples which hold a minor powerful predicting ability.

These results are valid only for the sample period 1963-1994 since it was observed that the high volatility shown during the years 1994 to 2000 had a significant impact on the regression coefficients which interfere with the predictability of the multiples in that specific range of time.

Zhang (2005) examines the causes of the value premium. He explains that value stocks are much more associated with risk especially during economic downturns “when the price of risk is high”. Then, he develops a model utilizing the costly reversibility and countercyclical price of risk. It implies that small or value companies present problems to decrease its capital stocks than glamour firms during recessions. Therefore, he concludes that earnings and dividends of value firms are more associated with economy stages.

4. EMPIRICAL PART

The current section introduces in detail the characteristics of the sample and data utilized for the portfolios formation and test the test of the strategy based on price-to-earnings ratio. The features of the data sample are revised, such as sample period, periodicity of the observations, the focused market and source from where it was obtained, are all described in the current section. In addition, it explains on detail the procedures utilized for the construction of the portfolios, variations of the multiple utilized and the results of the tests.

4.1 Data

Monthly stock prices and market capitalization value of the current firms components of the S&P 500 index have been collected. The data sample utilized extends in time period from the first quarter of 1998 to the third quarter of 2013 and it was obtained from Datastrem database. Additionally, for the formation of the portfolios, quarterly net earnings and earnings per share of all the firms in the index were collected. The interval of the sample consisting of 15 entire years is a limitation for the construction of annual portfolios at the moment to statistically significant results.

To be consistent with the literature (Zarowin, 1990; Lewellen, 2004; Ang and Bekaert, 2007), the study uses the reciprocal of the PE multiple, the earnings-to-price metric (EP) or earnings yield. The justification for this is provided by Litzenberger and Rao (1971), who in a leverage and cost of capital related study, they demonstrated that the EP exhibits linearity, since it is a function of beta and growth. Moreover, the metric presents the inverse associations that the PE does.

In Beaver and Morse (1978) and Zarowin (1990), the authors used normalized earnings per share to calculate the measures. The normalized or diluted EPS are defined as the earnings before extraordinary items and discontinued operations. These provide a clearer image of the firms operations since unusual items are removed. The equivalent data is adopted in this investigation.

Likewise, in the present investigation for the annual portfolios, the EP yield is specified as the diluted annual EPS divided by the close price of the stock in March. Following Jacobs and Levy (1988) approach, a potential look-ahead bias has been controlled by using lagged variables. The multiple have been estimated with earnings reported at the end of the year and the price traded four months later, on the first day of April when most of the annual statements are published; the date also coincides with the portfolio formation.

Also, in this paper, the PE effect is examined similarly as in Fama and French (1996) who controlled for market, value and size premiums. In consequence, monthly data for the small size firm premium, book-to-market, momentum, and market earnings have been collected from Kenneth French database for the period 1998-2013. Additionally, monthly data of consumer price index, S&P500 index price, the long-term interest rate represented by the 10-Year Treasury Constant Maturity Rate GS10, is obtained to implement the Shiller PE, a variation of the multiple. The data is extracted from the data collection of Professor Robert Shiller.

Table 1 reports the characteristics of the ratios estimated for the subsample excluding negative ratios. Panel A illustrated the evolution of the sample’s EP-multiple across the years. For a more comprehensive interpretation of the metric, Panel B reports the mean and standard deviation of the traditional PE or the reciprocal of the EP. The traditional ratio is estimated based on the net earnings of the previous four quarters and the trading price at the moment that the portfolio is formed. Therefore, the statistics are presented starting on 1999.

The mean PE of the subsample presents a large variation over time. The metric reached the highest point 77,09 units in 1999 when a high price was paid for stocks with depressed earnings. Meanwhile, the average metric of the subsample for the year 2009 was 13,05 when the securities prices in general dropped implying underpriced assets. As mentioned previously, the meaning of the inverse of the PE metric is the opposite than the regular ratio. Low (high) levels of the earnings yield imply overvaluation (undervaluation) of the assets.

Table 1. Summary statistics of the EP and PE metrics in the subsample.

Panel A: Earnings yield (EP)							Panel B: Price-earnings ratios	
	Mean	Median	Max.	Min.	Std. Dev.	Obs.	Mean	Std. Dev.
1999	0,373	0,042	48,384	0,000	3,960	149	77,089	575,374
2000	0,245	0,046	28,159	0,001	2,303	149	46,653	91,526
2001	0,389	0,048	50,207	0,004	4,109	149	28,429	28,855
2002	0,117	0,037	10,996	0,000	0,898	149	63,170	336,020
2003	0,497	0,053	65,395	0,001	5,353	149	38,707	140,088
2004	0,619	0,042	85,326	0,002	6,986	149	29,904	48,773
2005	0,609	0,048	83,211	0,014	6,813	149	22,974	10,066
2006	0,670	0,049	91,932	0,010	7,527	149	23,460	13,749
2007	0,712	0,049	98,132	0,002	8,035	149	26,542	46,130
2008	0,701	0,056	95,553	0,013	7,823	149	19,694	9,910
2009	0,476	0,083	57,163	0,019	4,676	149	13,047	6,657
2010	0,599	0,080	77,864	0,005	6,373	149	19,392	24,493
2011	0,691	0,055	94,799	0,004	7,762	149	25,361	28,847
2012	0,573	0,058	76,587	0,010	6,269	149	20,209	12,020
2013	0,632	0,052	86,152	0,004	7,053	149	24,221	25,135
Sample	0,519	0,052	98,132	0,000	6,002	2086	32,474	185,288

From the 14 years examined, three years recorded negative returns as it can be seen in Table 2. The low variation in the stock returns among the sample, measured with standard deviation, is related with positive years for the market. The negative skewness indicates a higher probability of market decline, as explained in Hong & Stein (2003). Also, the sample is normally distributed as noted from this statistic and kurtosis. Since the subsample is restricted to those firms that reported only positive earnings for the whole period examined, it does not represent entirely the S&P500 index. Following Anderson and Brooks (2006a), the stocks which reported negative earnings during the years analyzed are excluded from the first sample. Also, those stocks for which price or market value is not available are excluded.

Table 2. Summary statistics of annual returns for stocks with positive earnings.

	Mean	Median	Max.	Min.	Std. Dev.	Skew	Kurtosis	Obs.
1999	2,361	- 3,123	133,35	- 104,69	36,265	0,389	3,759	149
2000	5,772	2,885	187,77	- 119,48	42,766	1,366	7,550	149
2001	7,992	10,252	104,01	- 159,37	36,582	- 0,869	5,941	149
2002	15,678	14,473	89,90	- 53,28	21,718	- 0,004	4,459	149
2003	- 21,383	- 20,915	27,85	- 116,10	23,090	- 0,858	4,846	149
2004	31,723	28,295	145,17	- 15,98	21,800	1,377	8,288	149
2005	11,427	10,005	145,52	- 66,18	22,597	1,326	11,626	149
2006	12,166	13,244	46,93	- 30,06	13,507	- 0,074	3,131	149
2007	12,931	10,091	143,63	- 23,04	21,317	1,902	11,567	149
2008	- 3,235	- 4,107	60,17	- 59,96	21,520	0,036	3,170	149
2009	- 43,701	- 40,532	53,72	- 241,82	34,210	- 1,514	10,232	149
2010	40,185	37,751	188,86	- 7,93	27,005	1,406	8,087	149
2011	13,609	13,722	66,96	- 24,39	16,387	0,324	3,064	149
2012	6,371	3,446	72,36	- 42,71	15,982	0,624	5,120	149
2013	11,700	12,340	77,43	- 27,05	15,247	0,194	5,000	149
Sample	7,231	9,260	188,86	- 241,82	31,936	- 0,290	8,236	2086

4.2 Research Method and Results

In this section, Anderson and Brooks (2006a) is the central paper and all the methods are adopted from that investigation. Therefore, for the construction of the portfolios, stocks that reported negative annual earnings are excluded from the sample for the first part of the procedure. Also, stocks with data not available for any of the years in the examined period are excluded. For the second part of the analysis, the portfolios are constructed utilizing negative earnings as well. Then, the sample is restricted to those stocks for which 15 years of annual positive earnings are available.

The next step is the calculation of the earnings yields (EP), inverse of the price-to-earnings ratio, for the stocks in the subsample and each year. The sum of earnings of the past four quarters is divided by the price of the stock at the moment of the portfolio selection. Then, the ratios are sorted from high to low for each of the years and classified into ten deciles.

Each of the deciles represents one equally weighted portfolio. The first decile contains stocks with high P/E ratio (or low E/P) and the tenth decile incorporates the stocks with the lowest ratio which are apparently undervalued.

The same procedure is repeated utilizing the same data sample but variations in the estimation of the ratio are used. The sum of annual earnings from one up to eight past years is used as numerator for the calculation of the ratio. Equation 8 illustrates the procedure:

$$EPn_i = \frac{\sum_{j=1}^{n} EPS_{ij}}{P_i} \quad (8)$$

where *EP* is the inverse of the PE ratio for firm *i*, *n* is the number of annual earnings used in the estimation, $\sum_{j=1}^{n} EPS$ stands for the sum of the earnings per share reported for firm *i* from year 1 to *n*, and *P* is the price of stock *i* when the portfolio is created. The results of the procedure are reported in Table 3. Each column represents the variations of the multiple employed, for instance EP5 stands for the sum of earnings of the past five years divided by the stock price at the moment of the portfolios formation.

Table 3. Annual returns P/E portfolios with sum of past earnings.

Decile	EP1	EP2	EP3	EP4	EP5	EP6	EP7	EP8
High P/E	5,006	2,939**	4,137	3,240	6,029	5,162	6,589	2,794
D2	5,003	3,414	5,354	6,525	9,489	7,071	3,791	0,695
D3	7,477	6,427	4,826	4,287	8,232	5,818	5,700	6,157
D4	6,561	5,724	7,068	6,704	9,282	5,787	5,410	5,499
D5	5,292	6,130	7,467*	5,740	8,127	5,519	4,587	2,494
D6	5,696	8,155	5,967	5,770	6,245	3,188	4,767	5,117
D7	7,434	7,755	7,262	5,589	10,337	9,216	7,945	6,925
D8	8,355	11,309	8,401	7,283	10,099	7,723	6,161	6,498
D9	7,983	7,739	11,306	10,564	12,778	8,206	7,080	7,536
Low P/E	13,401***	13,897***	11,018**	9,516**	12,355*	10,351**	10,404**	9,267**
D10-D1	8,394	10,958	6,882	6,276	6,327	5,189	3,815	6,474
Obs.	2086	1937	1788	1639	1490	1341	1192	1043

Portfolios formed computing the ratio with the average of past earnings from one to eight years. The significance of the deciles' means is verified through two-sided equality tests of means. The notation *, ** and *** represent the significance levels of 10%, 5% and 1% respectively.

As expected, deciles portfolios that contain stocks with low PE outperform the high PE deciles in any of the cases. Evidence that the low PE effect is present in the same is found as the returns of the decile-10 are significant mostly at 5% level. The finding is consistent with previous studies (Basu, 1977; Dreman, 1995; Bondt and Thaler, 1985; Whilte, 2000) that attribute this behavior to the investor's overreaction to financial news.

From the set of variations implemented only the combination of earnings from the past two years (EP2) gained higher returns than the traditional multiple (Table 3). This variation of the ratio also makes the largest difference between the high and low PE deciles among the combinations. It is also observed that the low PE portfolio gradually reduces its performance as additional annual earnings are incorporated in the metric estimation. While the first two combinations present annual returns above 13%, when more than 6 years of earnings are utilized, the power of the ratio is reduced. This finding contrasts with the central paper Anderson & Brooks (2006) who finds a performance increase when the metric is calculated using more than six years of previous earnings.

In the next experiment, only earnings from one year, from one to eight years old, is considered to compute the ratio and form the deciles. For instance, EP7 represents the ratio computed with only earnings reported seven years ago and the price at the formation of the portfolio. The results are reported in Table 4. Notice that the outcome of the EP1 ratio is already reported in Table 3. The coefficients stand for the average annual return of the decile. This procedure is symbolized in equation 9, where *EP* is the inverse of the PE ratio, *n* is the antiquity of the earnings employed in the estimation, *EPS* is the earnings per share reported for firm *i* at time j and *P* is the price of stock *i* when the portfolio is created.

(9) $$EPn_i = \frac{EPS_{ij}}{P_i}$$

In the scenario where only the earnings from the previous two years are used to calculate the multiple (EP2), the performance of the decile-10 was considerable higher than the rest. In all of the combinations, the deciles that represent low PE stocks outperformed the medium and high PE deciles. The EP2 variation displays the highest return with 14,6% significant at 1% level, and 12,1% as the largest difference between the low and high PE. The outperformance of the EP2 can be explained by the Beaver & Morse (1978) who argue that the PE multiple represents the future growth in the following three years.

Table 4. Annual returns using individual past earnings.

Decile	EP2 Alone	EP3 Alone	EP4 Alone	EP5 Alone	EP6 Alone	EP7 Alone	EP8 Alone
High P/E	2,557**	5,975	5,024	9,745	8,565	9,852	4,997
D2	5,649	8,417	5,081	8,679	5,747	4,425	4,462
D3	6,355	5,305	5,095	7,691	4,111	6,645	4,630
D4	6,601	4,632	7,039	4,779	5,161	3,079	3,581
D5	6,720	4,090	5,118	10,326	6,475	5,407	5,617
D6	4,707	5,404	3,924	9,134	5,801	4,812	8,240
D7	6,929	6,387	7,637	10,406	10,119	5,328	0,509
D8	10,289**	10,050	7,590	9,540	6,705	4,807	7,234
D9	8,825	10,841*	7,363	9,698	4,317	7,814	6,967
Low P/E	14,626***	11,668**	11,223**	13,167*	11,213*	10,269	6,954
D10-D1	12,069	5,693	6,199	3,421	2,647	0,416	1,957

Two-sided equality tests of means applied. The notation *, ** and *** represent the significance levels of 10%, 5% and 1% respectively.

As previously seen, the performance of the ratios diminishes as remote information is employed (Table 4). The low PE deciles reduce its performance throughout time while the high PE ones increase its outcome. The pattern can be interpreted as the undervalued stocks from the past five to eight years, eventually recovered its fair value and lower returns were obtained from those stocks in the subsequent years. On the other hand, the overpriced decile gradually decrease it value, turning into an opportunity for investors. Beaver & Morse (1978) state that the behavior is caused by transitory factors, such as market risk over time, variations in accounting methods and earnings growth differential, which are incorporated in the earnings element.

Further variations of the multiple, based on the central paper, are implemented based. Anderson & Brooks (2006) discovered that the performance of the PE was doubled by using the immediately previous earnings plus those from eight years ago. Table 5 displays results of portfolios based on a metric computed as the sum of two annual earnings. The earnings from the immediate previous year plus remote earnings reported in the past either two to eight years.

Equation 10 indicates the ratio EP1+EPn where EPS_1 is the earnings per share of firm *i* one year in the past. EPS_{ij} is the earnings per share of firm *i*, where *j* indicates the years in the past and goes from 2 to 8; finally, the price of stock *i* at the creation of the portfolio is represented by P. To clarify, EP1+EP4 is the sum of earnings reported one and four years in the past.

(10) $$EP1 + EPn_i = \frac{EPS_{i1} + EPS_{ij}}{P_i}$$

Table 5. Annual returns of portfolios using historical earnings.

Decile	EP1+EP2	EP1+EP3	EP1+EP4	EP1+EP5	EP1+EP6	EP1+EP7	EP1+EP8
High P/E	2,939**	3,984	2,608*	6,214	2,968	3,541	0,306*
D2	3,414*	3,880	5,126	8,441	7,669	6,550	4,798
D3	6,427	8,319	4,416	8,870	6,191	8,451	3,457
D4	5,724	7,217	8,863	8,141	6,749	6,335	6,714
D5	6,130	5,827	6,340	10,267	7,664	5,061	6,747
D6	8,155	6,150	5,778	9,390	7,159	6,019	5,931
D7	7,755	6,426	5,309	7,660	4,827	2,544	4,703
D8	11,309**	9,079	8,740	10,713	8,119	8,563	7,201
D9	7,739	10,685	7,045	12,278	6,902	5,520	4,813
Low P/E	13,897***	11,251*	10,993**	11,207	10,056	9,935	8,366
D10-D1	10,958	7,267	8,386	4,993	7,088	6,393	8,060

Two-sided equality tests of means applied. The notation *, ** and *** represent the significance levels of 10%, 5% and 1% respectively.

In Table 5, it can be noticed that the modification in the calculation of the ratio does not affect substantially the performance of the low PE portfolios. The average of the previous two annual earnings reported used as numerator of the multiple (EP1+EP2) exhibits the highest annual return 13.9% in the tenth decile. This combination shows also the greatest difference considering long and short positions in the low and high PE deciles. The growth decile of the EP1+EP2 variation presents also one of the lowest returns from all the combinations tested.

The results showing a high performance of the portfolio based on the ratio that combines earnings of the previous two years can be explained because the short-run cyclical noise in annual firm earnings is reduced. As stated by Campbell and Shiller (1988, 2001) the reduction of the noise should increase the forecasting power of the ratio. They argue that use of moving average of earnings can provide a fair estimator for the fundamental value.

The largest change is presented in the EP5 to EP8 variations when these ratios are combined with the earnings from the most recent period. Its performance notably increases than when only the remotes earnings are used to estimate the multiple. The improvement is caused because of the inclusion of the most recent earnings forming the ratio since these represent a more adequate proxy for expected growth rate as used in Lakonishok, et al. (1994).

The results of the preceding numerous combinations showed that the effect of the PE ratio is not increased when remote financial information is taken in consideration contrasting with Anderson and Brooks (2006a). A possible explanation given for the long-term portfolios underperformance against EP2 is due to the sample limitations and the characteristics of the period examined. Since it requires the past 8 annual earnings reported to compute the metric, the strategy was evaluated for 7 years starting on 2007 to 2013, in comparison with 15 years where EP1 is examined. The interval where the EP8 was tested also presents two years of with large negative returns for the sample, depressed earnings and high fluctuations in prices which influences on the portfolio performance.

Additionally, Anderson and Brooks (2006a) suggests that the increase in power of the metric when historical earnings are used is due to the low correlation between the ratios formed with the most recent and remote information. In their study, the correlation of EP1 and EP8 is much lower (0,276) compared with the correlation of these two variables (0,880) in this study (Table 6). Therefore, it can be suggested that the high correlation among past and current earnings inhibit the increase of metric's capacity.

Table 6. Correlation of past earnings.

	EP1	EP2	E3	EP4	EP5	EP6	EP7	EP8
EP2	0.891	1.000						
EP3	0.892	0.936	1.000					
EP4	0.922	0.903	0.912	1.000				
EP5	0.858	0.896	0.859	0.896	1.000			
EP6	0.807	0.914	0.899	0.874	0.954	1.000		
EP7	0.826	0.828	0.864	0.893	0.945	0.936	1.000	
EP8	0.880	0.763	0.745	0.806	0.866	0.845	0.874	1.000

4.3 Examination of best performance PE variation

So far, after several attempts to find the combination with the highest return, the EP2-alone happens to be the best metric with 14.6% annually. The EP1+EP2 records the second highest return with 13.9% and the traditional ratio EP1 stands third with 13.4%. Therefore, a deeper investigation is focused exclusively on the EP2-alone variation. The long-term performance of that metric is examined and illustrated in Table 7. Holding periods of one up to five years are measured for each of the ten deciles.

Evidence that the low PE effect remains throughout time is found, however the capacity of the EP2 multiple decreases as the holding period extends (Table 7). In a buy-and-hold implementation, the PE effect persists over time consistent with existing literature (Dreman, 1995; Anderson and Brooks 2006). The returns measured for the low PE decile diminish when the asset is held during a longer period in line with Dreman (1995) who advises it is due to prior mispricing. Also, the performance of the high PE decile gradually increases as the length prolongs.

Table 7. Annual returns of long run EP2-alone strategy. Holding period from 1 to 5 years.

Decile	1 year	2 years	3 years	4 years	5 years
High P/E	2.557**	4.483**	4.664	5.648	4.515
D2	5.649	6.897	6.144	4.975	4.059**
D3	6.355	6.170	5.137	4.701	3.573**
D4	6.601	5.653	5.408	4.375	4.891
D5	6.720	5.424	5.500	4.214	5.233
D6	4.707	5.513	4.922	4.239	4.549
D7	6.929	7.379	7.054	6.684	6.611
D8	10.289	10.737**	9.334	8.199**	7.934**
D9	8.825	8.190	7.411	7.194	6.450
Low P/E	14.626***	12.569***	12.032**	10.023***	9.400***
D10-D1	12.069	8.086	7.368	4.375	4.885
Obs.	1937	1788	1639	1490	1341

Two-sided equality tests of means applied. The notation *, ** and *** represent the significance levels of 10%, 5% and 1% respectively.

In a deeper examination of the best performing portfolios, monthly observations were estimated for the period 1998 to 2013. A summary of the monthly performance of the low PE deciles are presented in Table 8. The highest mean returns were obtained with the EP2-Alone variation with 1.05%; however this also reported the highest standard deviation among the observations. The traditional PE displayed lower gains but these were less volatile.

Following Rinne and Vähämaa (2011), the sharpe ratio was estimated for each monthly observation and the average is observed in the last row (Table 8). The sharpe ratio indicates that the traditional PE earns higher returns per risk unit. Based on this indicator, the EP2-alone provides lower returns than EP1+EP2 and the traditional ratio for an investor with an average aversion to risk. Yet, this is still considerable higher than the returns gained from the market benchmark.

Table 8. Summary statistics of monthly excess returns of strategies.

	Traditional EP	EP1+EP2	EP2 Alone	Market
Mean	0.868 ***	0.991***	1.055 ***	0.166 **
Median	1.328	1.155	1.283	0.825
Maximum	14.015	29.813	32.302	11.340
Minimum	-18.659	-16.990	-18.116	-17.230
Std. Dev.	4,127	5.151	5.357	4.762
Obs.	168	156	156	156
Mean Sharpe Ratio	0.210	0.197	0.192	0.035

Sharpe ratios estimated as the monthly excess return of the strategies divided by the standard deviation of the excess returns. The notation *, ** and *** represent the significance levels of 10%, 5% and 1% respectively.

Further research of the EP2-alone is conducted. Monthly observations were estimated during the sample period 1998 to 2013. In order to find whether the abnormal returns can be earned with the implementation of the metric, the Fama and French (1993) three factor model plus Carhart (1997) momentum factor presented below is employed. The price-to-earnings effect has been analyzed by Fama and French (1996) and the results show that the anomaly disappears after controlling for size, value and market factors.

The expectation is that the four terms in the model capture the abnormal returns and not statistically and economically significance is found in the alpha term.

(11) $EP2r_{p,t} - r_{f,t} = \alpha + \beta_p(r_m - r_f) + s_pSMB_t + h_pHML_t + w_pWML_t + \varepsilon_{p,t}$

where $EP2\, r_{p,t}$-$r_{f,t}$ represents the monthly excess return of the EP2-alone portfolio after subtracting the risk free rate, α is the intercept of the CAPM model, while the following terms $\beta_p(r_m - r_f)$, SMB_t(small minus big market value), HML_t(high minus low book-to-market ratio), WML_t(winner minus loser), stand for the market, size, value and momentum factors respectively.

Table 9. Four-factor regressions of the EP2-alone multiple.

	CAPM	2-factor	3-factor	4-factor
Alpha	0.931***	0.446*	0.496**	0.523 **
	(2.888)	(1.818)	(2.003)	(2.318)
β(Rm-Rf)	0.746***	0.819***	0.848***	0.716***
	(10.985)	(15.972)	(15.288)	(12.902)
HML		0.817***	0.800***	0.785***
		(11.021)	(10.656)	(11.481)
SMB			-0.123	-0.063
			(-1.339)	(-0.751)
WML				-0.232***
				(-5.691)
Adj. R^2	0.436	0.683	0.685	0.739
F-stat.	120.670	168.272	113.361	110.676
Obs.	156	156	156	156

An ordinary least squared regression is run where the dependent variable is the monthly return at time t for the low PE decile of the EP2-alone multiple. The explanatory variables are the three factors (Fama & French, 2003) and momentum Carhart (1997). T-statistics are shown in brackets below the parameters. The notation *, ** and *** denotes for significance levels of 10%, 5% and 1% respectively.

Table 9 reports the results from the regression which shows that the effect is not totally captured by the model. The first column tells that the portfolio's market beta is equal to 0,75 which means it goes in the same direction than the market but the changes are more stable. Also, consistent with the findings in Fama and French (1996), the CAPM does not capture the PE effect as abnormal returns, represented by alpha, are highly significant at 1% level. The outcome of the 2-factor model indicates that the value factor explains a portion of the returns and alpha parameter is significant at 10% level. Furthermore, it can be observed that the value and alpha term remain significant in the third model. When the size factor is included, this is not able to capture the portfolio returns.

The most interesting results are perceived from the 4-factor model. A strong positive association is found between the portfolio returns with both market beta and value factor. This is in line with Fama and French (1996) who found that the high PE returns are positively related with the returns of value stocks (high B/M). Similarly as in the 3-factor model, the size factor does not exhibit a significant relation with the monthly returns. A slight negative relationship between the additional momentum factor and EP2 portfolio returns is exposed in the fourth column. This is interpreted as the momentum factor has explanatory power about the portfolio returns. Then, it can be suggested that the PE effect is more related to the loser stocks' returns. Finally, the magnitude of alpha decreases compared with the market model, but the significance at 5% level of alpha component indicates an inefficiency of the market and abnormal monthly returns of 0,52% can be gained.

The anomaly found with the four-factor model, contrasts with Fama and French (1996) who concludes that the effect is explained by controlling for market, value and size premium. A suggestion for the behavior observed is due to the considerable difference in size of the samples. On one hand, this section of the research uses only the 150 stocks that reported only positive annual earnings during the sample period. Also, small stocks are excluded since the set examined belongs to the S&P500 index. This fact would explain why the size factor is not significant at explaining the portfolio returns as well. On the other hand, the sample utilized in Fama and French (1996) contains all stocks listed on the NYSE, AMEX, and NASDAQ including small stocks.

4.4 Analysis with negative ratios

A weakness of Anderson and Brooks (2006a) paper is the exclusion of stocks that reported negative earnings, and in consequence the lack of analysis of negative ratios. The examination of negative ratios has been reported in Fama and French (1992) who found that negative ratios consistently outperform the market in the following year. In this investigation, it was obtained the data regarding firms with annual negative earnings and the issue is re-examined. The size of the sample has increased from 150 to 302 stocks compared with the previous section and the best performing strategies have been analyzed.

Table 10. Summary statistics of the EP including negative ratios.

	Mean	Median	Max.	Min.	Std. Dev.	Obs.
1999	0,168	0,039	48,384	- 7,324	2,820	302
2000	0,144	0,043	28,159	- 0,564	1,620	302
2001	0,209	0,048	50,207	- 0,775	2,888	302
2002	0,055	0,034	10,996	- 2,431	0,653	302
2003	0,235	0,048	65,395	- 2,399	3,767	302
2004	0,313	0,039	85,326	- 0,536	4,909	302
2005	0,321	0,047	83,211	- 0,245	4,786	302
2006	0,353	0,049	91,932	- 0,440	5,288	302
2007	0,374	0,051	98,132	- 0,852	5,644	302
2008	0,367	0,058	95,553	- 0,782	5,496	302
2009	0,169	0,081	57,163	- 13,232	3,397	302
2010	0,292	0,072	77,864	- 2,071	4,482	302
2011	0,365	0,054	94,799	- 0,392	5,452	302
2012	0,313	0,057	76,587	- 0,134	4,404	302
Sample	0,267	0,050	98,132	- 13,232	4,283	4228

Table 10 presents the statistics of the sample including stocks negative ratios. The size of the sample considerable increased to 302 stocks, after the restriction of stocks only with positive earnings is removed. The mean EP ratio of the sample is, by consequence, lower than the sample without negative multiples. A lower earnings yield is associated with overpriced stocks. The variation of the multiples among the sample declines compared with the sample reported in Table 1.

Table 11 displays the statistics of the annual returns belonging to the stocks sorted in the second subsample similarly as in Table 2. By adding the returns of the negative ratios, the overall mean of the sample decreases from 7,23% to 6,36%. The variability of the sample suffers an opposite change as it rises from 31,9 to 41,0. Moreover, in this sample four out of the 14 years examined present negative returns on average.

Table 11. Summary statistics of annual logarithmic returns of sample with negative ratios.

	Mean	Median	Max.	Min.	Std. Dev.	Skew	Kurtosis	Obs.
1999	0,647	- 4,329	249,146	- 293,942	52,102	- 0,309	10,232	302
2000	10,474	3,871	226,223	- 125,844	56,209	0,988	5,145	302
2001	- 0,476	8,770	169,257	- 238,701	52,246	- 1,232	6,222	302
2002	12,558	13,168	176,723	- 121,302	29,324	- 0,071	8,706	302
2003	- 28,351	- 22,113	59,899	- 174,107	35,085	- 1,440	6,258	302
2004	37,832	33,553	145,166	- 20,048	25,402	0,998	5,283	302
2005	12,655	9,896	145,517	- 97,740	26,036	0,562	6,708	302
2006	17,103	12,908	143,628	- 36,972	25,532	1,382	6,784	302
2007	10,750	11,522	76,733	- 69,408	17,107	- 0,270	4,818	302
2008	- 6,661	- 6,316	78,379	- 98,002	27,704	- 0,139	3,474	302
2009	- 54,871	- 47,021	53,724	- 258,056	45,930	- 1,438	6,157	302
2010	47,342	41,033	201,611	- 11,290	33,331	1,254	5,514	302
2011	16,112	15,710	73,583	- 41,889	18,948	0,072	3,432	302
2012	2,052	1,893	95,359	- 78,470	20,914	- 0,200	5,559	302
2013	12,561	13,587	82,724	- 85,220	18,733	- 0,348	6,384	302
Sample	6,363	9,063	226,223	- 258,056	41,022	- 0,606	7,933	4228

This investigation adopts the methodology from Fama and French (1992) who included stocks with negative ratios in a separate portfolio. The experiment tested shows that the inclusion of negative ratios reduces the magnitude of the effect. As observed in Table 12, when the traditional multiple is utilized, the value decile outperforms the rest of the portfolios with a highly significant 11,6% annual return. The outcome confirms that the low PE effect remains even when negative earnings are utilized. Nonetheless, when it is compared with the same ratio EP1 reported previously in Table 3, the gains clearly decline from 13,4% observed in the previous subsample.

When the best performing strategy of the previous sections, the EP2 variation is tested, the effect remains as the mean of the low PE decile is larger than the rest but it is considerably lower than the performance of the same ratio and the traditional metric presented already in Table 3. The returns observed for the EP2 in the sample with negative ratios, 10,3%, clearly contrasts with the returns displayed in the previous sample 14,6% annually. The difference between the value and growth deciles is diminished as well.

Table 12. Average annual returns of portfolios using negative ratios.

			2-yrs holding period			Negative deciles	
Panel A	EP1	EP2	EP1	EP2	Panel B	EP1	EP2
High P/E	4,383	0,711***	3,703*	3,507**	High PE	2,977	3,276*
D2	3,396	2,425*	3,881*	4,076	D2	4,248*	3,646*
D3	6,166	6,312	4,543	5,656	D3	3,538	4,852
D4	3,541	4,359	4,102	5,005	D4	3,927	6,520
D5	6,465	6,376	7,354	5,437	D5	7,425	5,052
D6	4,579	6,371	4,579	5,772	D6	5,042	5,056
D7	6,754	8,367	6,825	8,023	D7	6,381	5,606
D8	7,092	7,764	7,211	7,890	D8	6,748	8,757
D9	8,460	6,336	6,670	8,226	D9	6,652	7,831
Low P/E	11,569***	10,332**	9,773***	6,322**	Low PE	6,981*	6,042
					Negative PE	10,606**	9,848***
Low-High	7,186	9,621	6,071	4,719	Low-High	4,004	2,766

Two-sided equality tests of means applied to the high and low deciles. The notation *, ** and *** represent the significance levels of 10%, 5% and 1% respectively.

The increase of the holding period has negative effect on the portfolio's performance. As noticed in Table 12 Panel A, the returns obtained by both EP1 and EP2, fall from 11,6% to 9,8% and from 10,3% to 6,3% respectively, compared with the one-year holding period scenario. The difference between the high and low PE drops as well. Then, further research is conducted to answer whether the PE effect can be increased by the reduction of the holding period.

The firms that reported negative annual returns trend to increase its value during the following year. As it can be observed in Table 12 Panel B, the decile which contains only negative ratios delivers 10,6% yearly significant at 5% level. Apparently, overreaction about reported negative earnings occurs and the stock price drops below its fair value, turning undervalued. As observed by Bondt and Thaler (1985) and Zarowin (1990) with the best returns in the same period.

Fama & French (1992) documented that stocks with negative EP earn superior returns than the average with 0.57% monthly. In this investigation, the results demonstrate a similar pattern. Employing either the traditional EP or the EP2 variation, the returns obtained outperform the average and the other of portfolio deciles. These are even higher than the low PE decile.

Table 13. Annualized returns of 6-months holding period portfolios.

Decile	10 portfolios Negatives Included	20 portfolios Including Negatives	9 portfolios + 1 Negative	19 portfolios +1 Negative
High	2,646**	3,341	2,646*	3,341
P2	4,404	1,950	4,404	1,950
P3	5,288	3,673	5,288	3,673
P4	3,207	5,086	3,207	5,086
P5	5,842	4,824	5,842	4,824
P6	7,167	5,752	7,167	5,752
P7	6,701	2,655	6,701	2,655
P8	6,756	3,723	6,756	3,723
P9	8,843	7,236	8,522	7,236
P10	11,647***	8,063		4,448
P11		6,331		8,063
P12		6,860		6,331
P13		6,542		6,860
P14		6,160		6,542
P15		7,313		6,160
P16		10,390		7,313
P17		7,296		10,196
P18		14,076***		6,418
Low		9,522		2,712
Neg.			11,573**	13,969***
Low-High	9,001	6,181	5,876	0,629
Low-Neg.	-		8,927	10,628
Obs.	8288	8288	8288	8288

Two-sided equality tests of means applied. The notation *, ** and *** represent the significance levels of 10%, 5% and 1% respectively.

Table 13 reports the results of the supplementary investigation considering shorter holding period of only six months. Tests using stocks distributed into 10 and 20 equally weighted portfolios are conducted. The examination of portfolios containing exclusively stocks with negative ratios is done as well. These figures can be found in the third and fourth columns. Additionally, in the sixth column are displayed the outcomes of the implementation of a variation of the metric done by Robert Shiller documented in Campbell and Shiller (1988).

The reduction in the holding period has a minimal positive effect in the portfolio performance. The value decile gains 11,65% yearly for a six-months holding while the 12-months test reported 11,57% (Table 13). The glamour decile showed a meaningful drop from 4,38% on average to a significant 2,65%. The separated examination of the stocks with negative ratios shows that the negative portfolios experience a slight increase in the performance. The negative decile goes from 10,6% to 11,6% when the holding period is reduced.

In order to analyze the behavior of the stocks with the extreme PE, the number of portfolios is incremented to 20, so only 5% of the stocks are allocated in each group. The evidence obtained displays a similar pattern observed with the deciles test. The negative groups are larger than the average as previously noticed. More interestingly, a U-shaped effect is seen on the top and bottom deciles.

The highest and lowest PE deciles do not show the most extreme returns; these values are seen in the G2 and G18 in the third and fifth columns and the returns increase in the negative groups. The U-shaped patter was first documented in Jaffe, et al. (1989) who also explained that the returns for stocks with negative earnings are not contained by controlling for size. The large return obtained by the negative earnings group were examined by Fama and French (2002) and concluded that the trend is caused by the size and book-to-market premiums. Once controlled for these two factors, the significance of the returns disappeared.

Due to the existence of relevant economic events, such as the high-tech bubble and the financial crises, during the period studied, an alternative version of the PE is used in order to reduce the fluctuations of the earnings reported. Following Campbell and Shiller (1988), it is employed the cyclical-adjusted ratio which claims to reduce the cyclical noise of the yearly earnings. The multiple is estimated using the real price and the 10-years smoothed real earnings. For instance, the benchmark price and the consumer index price are used to compute the real price of the market. The real earnings are calculated with the similar method and obtained the 10-years moving average as denominator. The number of observations in the test is lower compared with the other tests reported due to the first 10-years of data are used for the estimation of the smoothed earnings.

Table 14. Annual returns of cyclical-adjusted ratio.

Decile	1yr HP Adjusted PE	6-m HP Adjusted PE
High	1,835	2,350
P2	1,850	5,033
P3	0,446	0,425
P4	-0,143	-2,652
P5	0,082	-0,114
P6	1,636	4,614
P7	3,410	2,663
P8	7,882*	-2,682
P9	4,415	-0,158
P10/Low	6,215	3,192
P11		5,798
P12		3,940
P13		2,549
P14		5,326
P15		4,059
P16		6,501
P17		4,146
P18		5,846
Low		7,040*
Low-High	4,380	4,691
Obs.	1480	1480

One-sided equality tests of means applied. The notation *, ** and *** represent the significance levels of 10%, 5% and 1% respectively.

Table 14 presents the results of the test which indicate that the smoothed earnings-price ratio does not increase the performance of the value decile. The cyclical-adjusted version of the ratio clearly underperforms the traditional form. Looking at the outcomes of Table 13, the common form of the ratio earns over 11,5% compared with 6,2% on average of the Shiller ratio in the 1-year holding period test. The difference between the low and high PE decile is slightly lower than in the previous experiment.

The cyclical-adjusted low PE portfolio gained 7,0% annually compared with 9,5% on average of the regular ratio in the six-months holding period scenario (Table 14). The growth group suffered an increase of its performance of about 1%; however, the means of these portfolios are not statistically significant. A possible explanation is that the most extreme ratios are smoothed affecting the distribution of the stocks metrics. Then, the highest ratios are combined with medium-high, decreasing the performance of the top and bottom portfolios. Also, as Taboga (2011) points out, the CAPE is not effective at high overvaluation levels that lead to market crashes.

The existing literature about the January effect and the PE ratio is divided. Investigations conducted in the US and Japanese market point out that the PE effect is caused by the abnormal returns obtained in January (Cook & Rozeff, 1984; Bondt and Thaler, 1985; Chan, et al., 1991). Further research have presented opposite evidence about the issue. Jacobs and Levy (1988) and Jaffe, Keim & Westerfield (1989) documented that the effect remains after controlling for January effect.

In this paper, it the January effect is also controlled using Chan, et al., (1991) approach:

$$(12)\ \mathrm{EPr}_{\mathrm{p,t}} - \mathrm{r}_{\mathrm{f,t}} = \alpha_{0j} D_{jt} + \alpha_{0r}\left(1 - D_{jt}\right) + \alpha_{1j} EP_{p,t}(D_{jt}) + \alpha_{1r} EP_{p,t}\left(1 - D_{jt}\right) + \alpha_{2j} \log(size) D_{jt} + \alpha_{2r} \log(size)\left(1 - D_{jt}\right) + \varepsilon_{\mathrm{p,t}}$$

where $\mathrm{EPr}_{\mathrm{p,t}} - \mathrm{r}_{\mathrm{f,t}}$ represents the monthly excess return after subtracting the risk free rate from the ten decile portfolios estimated with the regular multiple, D_j is a dummy variable that takes value equal to 1 for the returns obtained in January and zero otherwise. The average earnings yield of each portfolio is represented by *EP* and *log (size)* is the natural logarithm of the portfolio market value.

Table 15. January and PE effects.

	Intercept	EP	log(Size)
January	-0.771	0.025	0.072
	(0.675)	(0.231)	(0.000)***
Feb-Dec	-0.580	0.016	0.049
	(0.000)***	(0.010)***	(0.000)***
R2	0.041		
Obs.	1680		

Ordinary least squared regression is run where the dependent variable is the monthly returns of all the decile portfolios. The notation *, ** and *** denotes for significance levels of 10%, 5% and 1% respectively.

Table 15 displays the results of the regression and indicates that the January effect does not capture the PE effect. Consistent with Jacobs and Levy (1988) and Jaffe, Keim & Westerfield (1989), no statistically significant results are showed by the intercept and EP variables associated with January. The returns on this month represented by the coefficient 0.025 are higher than in the rest of the year though, these are not significant. The positive association between the EP ratio and monthly portfolio returns in the rest of the year implies that the PE effect is not caused by the returns of the seasonal anomaly. The magnitude of the EP coefficient 0.016 is much lower than the size variable, 0.049, indicating that the size factor has a higher impact on the portfolios returns than the metric.

Moreover, the size variable is strongly related with the performance of the portfolios and it does not subsume the capacity of the metric. The outcome contrasts with the regression using the 4-factor model (equation 11) where the size factor did not capture the PE effect. This is caused since EP2 monthly returns from the low PE decile are used as independent variable in equation 11 while data from all the 10 decile portfolios is employed for the model 12.

Further research of the PE effect is handled in the sense of combine it with other anomalies in order to increase the performance. For instance, the PE and momentum effects are combined in the first test. The stocks are sorted by PE metric and classified into quintiles;

the sample is also sorted by performance reported in the previous 12 months to form the momentum quintiles, following Dreman (1995).

Table 16. Annual performance of traditional PE plus momentum strategy.

	Loser	Q2	Q3	Q4	Winner
High PE	5,512	3,612	2,336	5,740	2,965
Q2	1,208	6,133	5,842	7,058	2,490
Q3	6,122	7,661	8,006	5,079	-1,519**
Q4	4,679	9,343	7,133	9,748	0,300
Low PE	12,359**	3,003	11,418	7,902	14,048**

Two-sided equality tests of means applied to high and low deciles. The notation *, ** and *** represent the significance levels of 10%, 5% and 1% respectively. Total observations: 4144 annual returns. Mean observations per portfolio: 165.

The results reported in Table 16 indicate that the performance of the low PE quintile is increased by combining the strategies. The raise goes from 11,6% of the traditional form presented in Table 13, to 14,0% for the low-PE-winner group. Notice that the ratio is a determinant factor in the results since both, loser and winner quintiles ranked with low PE outperform the regular version of the ratio by 0,8% and 2,5% significant at 5% level. The growth quintiles present lower returns however these results are not statistically significant.

Table 17. Annual performance of PE plus small-minus-large strategy.

	Small	Q2	Q3	Q4	Large
High PE	1,156*	9,028	4,117	2,114	3,483
Q2	1,989	7,146	5,986	8,008	0,737*
Q3	10,510	7,593	1,925	3,592	4,939
Q4	9,660	7,796	2,373	7,814	7,576
Low PE	14,918***	6,146	16,126	5,496	6,822

Two-sided equality tests of means applied to the high and low deciles. The notation *, ** and *** represent the significance levels of 10%, 5% and 1% respectively. Total observations: 4144 annual returns. Mean observations per portfolio: 165.

A similar approach is conducted by combining the size and PE effects. The value portfolio which mixes stocks with the lowest market capitalization and PE metric earns 14,9% significant at 1% level (Table 17). These returns obtained are superior to any other combination attempted in the present study. The finding can be explained by the risk factors associated with small stocks. For instance, Chen and Zhang (1998) suggest that the value premium is caused by financial leverage, distress and uncertainty of small firms. Conversely, the lowest return 1,16% is observed in the high-PE and small stocks portfolio, significant at 10% level. The groups with the most priced stocks are also consistently affected by the ratio in the extreme quintiles but the results are not statistically significant.

Table 17 reveals that the size factor is definitely associated with the returns obtained by the PE strategy. As it can be noticed, the returns in the small-low PE group are abnormally higher than in the large-low PE portfolio. This indicates that the size is related with the performance of the metric. The finding converses with the results obtained from the examination of the effect with the four-factor model reported in Table 9 where the size factor does not capture the returns obtained from the low PE portfolio.

5. CONCLUSION

This paper investigates whether the incorporation of long-term financial information is useful to increase the performance of financial ratios-based investment strategies in the US market. Previous studies documented that the use of remote earnings in the estimation of the price-to-earnings ratio can double the returns obtained by the regular form of the metric. The evidence obtained in this investigation reveals that the procedure does not conduct to similar results. Exclusively the metric which uses earnings from the previous two years at the formation of the portfolio as denominator in the multiple calculation, is able to outperform the traditional version of the PE ratio. However, the risk-reward analysis demonstrates that the regular PE presents higher Sharpe ratio than the EP2 version.

A deeper analysis of the best performing variation of the multiple was conducted in order to verify whether the PE effect is caused by the value, size, and momentum anomalies. The result shows that the effect is not contained by the 4-factor model. Value and momentum factor have a significant impact on the returns gained by the low PE decile. The regression reveals that the size factor does not capture the PE effect in the sample utilized.

The finding is explained by the characteristics of the stock used in the investigation. The significance of alpha term indicates that abnormal returns can be systematically obtained. However, this result is contradicted with the experiment where the PE and size effects are combined. Higher returns and statistically significant are presented only for the small firm groups while for the large firms quintiles a similar pattern is not present.

Distinct variations of the metric and holding periods were explored. In the examination of stocks that reported negative earnings, it was found that the portfolio containing shares with negative ratios lead to positive returns in the subsequent period. On one hand, the extension of the holding period presented a negative effect on the performance of the EP2 multiple. On the other hand, the short-run of the metric displayed an increase on the returns earned.

The examination of the January effect in conjunction with the PE is conducted as well. The evidence shows that the PE effect is not generated by the January effect. When January anomaly is controlled, the PE ratio is still able to explain the returns form the portfolios. No significant results were obtained for the January variables. In this experiment, it was also found evidence the size anomaly to explain returns from the ten decile portfolios.

In order to increase the performance of the metric, experiments were conducted by forming portfolios by PE ratio and two other effects, value and winner-loser. The outcome demonstrates that both anomalies contribute to improve significantly the low PE effect. Specifically, the quintile with the lowest PE and small market capitalization reported the highest returns from all the combinations attempted.

Exhaustive research has been conducted regarding financial ratios. The existent literature about the price-to-earnings ratio has been extended mainly as predictor of future returns, asset valuation and as part of value strategies, employing different forms of the metric. Therefore, new areas for expansion of investigation are somehow limited. The combination of financial ratios and volatility indicators might conduct to interesting results. Also, a similar analysis with the long-term version of the ratio applied to a larger sample, for instance using Russell3000 stocks, might improve the performance of the strategy.

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