



GORDON INSTITUTE  
OF BUSINESS SCIENCE

University of Pretoria

# Does the PEG ratio add value?

**Dean Hodgskiss**

**11369150**

A research project submitted to the Gordon Institute of Business Science, University of Pretoria, in partial fulfilment of the requirements for the degree of Master of Business Administration

7 November 2012

© University of Pretoria

## **Abstract**

Warren Buffet started an investment partnership of \$100 in 1956 and has gone on to accumulate a personal net worth of over \$60 billion. He started primarily as a value investor, and gradually changed over time to a strategy which uses the PEG ratio as its main tool. Peter Lynch, one of the most successful fund managers in history and had a compound annual growth rate of 29% for 13 years, was the man to first introduce the world to the PEG ratio. With such prominence, however, widespread use of previously successful strategies tend to render them ineffective due to everyone using them, and today the PEG ratio's effectiveness as a valuation tool remains a topical debate between market commentators.

This study sets out to determine if the PEG ratio adds value using JSE Main Board data from 2002 to 2012. Returns from five portfolios constructed directly from share quintiles based on PEG ratio magnitude are compared to returns of a portfolio constructed from the optimum quintile of value shares. The PEG ratio portfolio returns are examined based on 3 rebalancing period strategies, and on relative performance between the quintiles within each strategy.

It is found that a 24 monthly rebalancing strategy provides superior returns to that of 3 or 12 monthly rebalancing for PEG quintiles of selected stocks. Furthermore, the lowest PEG ratio quintile in this strategy outperforms the value portfolio by a compound annual growth rate of 4.3%. The second lowest PEG ratio quintile portfolio performs slightly better to ensure that 40% of stocks selected based on the PEG ratio produced sustained superior returns to the optimum quintile value portfolio.

## **Keywords**

PEG ratio, P/E ratio, analyst forecasts, value shares, compound annual growth rate, rebalancing period, portfolio, returns.

## Declaration

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.



Dean Hodgskiss

7 November 2012

## Acknowledgements

I would like to thank Professor Mike Ward for his support and input as my research supervisor. Also to Chris Muller who gave up numerous hours of his time to assist me. Mike and Chris, thank you for your help and guidance, especially when I was going off on tangents and complicating things way more than they needed to be.

Thank you to my work colleagues for your patience during this journey and to Philips for your financial support.

Thank you to my little family, which will be one more soon.

Finally, thank you to GIBS for a life-changing experience, one that I hope to translate into the well-being of many more people than myself, while having fun along the way.

## Contents

Abstract.....	ii
Keywords.....	ii
Declaration.....	iii
Acknowledgements.....	iv
List of Figures .....	vii
List of Equations .....	viii
Chapter 1. Definition of the Problem .....	1
1.1 Introduction .....	1
1.1.1 Research Title.....	1
1.1.2 Why the PEG ratio.....	1
1.1.3 Growth Forecasts .....	2
1.1.4 Expected rate of return and risk with the PEG ratio.....	2
1.2 Research Problem .....	3
Chapter 2. Theory and Literature Review.....	4
2.1 Investing styles.....	4
2.1.1 Financial ratio-based styles.....	4
2.1.2 Market-based styles.....	5
2.1.3 Behavioural Finance based styles .....	5
2.2 Growth versus Value stocks .....	6
2.3 Growth at a reasonable price (GARP) .....	7
2.4 The PEG ratio.....	8
2.4.1 Earnings per Share .....	9
2.4.2 Numbers of Shares.....	10
2.4.3 Forecasted Growth.....	10
2.5 Should we Benchmark the PEG ratio? .....	11
2.6 Historical growth rate as a differentiator for PEG stocks .....	13
2.7 Risk, return and the PEG Ratio.....	16
Chapter 3. Research hypotheses .....	23
3.1 Hypothesis 1: Returns of PEG ratio portfolios depend on the forecasting and rebalancing period used.....	23
3.2 Hypothesis 2: A low PEG ratio portfolio outperforms a higher PEG ratio portfolio ...	23
3.3 Hypothesis 3: A low PEG ratio portfolio outperforms a low P/E portfolio .....	23

Chapter 4.	Method.....	24
4.1	Research design .....	24
4.2	Scope.....	24
4.3	Research Instrument.....	25
4.4	Data Analysis .....	26
4.5	Quality Control Measures .....	27
4.6	Research Limitations .....	27
Chapter 5.	Results .....	28
5.1	Data Description.....	28
5.1.1	Data for 3 month strategy.....	28
5.1.2	Data for 12 month strategy.....	30
5.1.3	Data for 24 month rebalancing period.....	32
5.2	Performance of the three strategies.....	34
5.3	Comparison of high PEG versus low PEG portfolios.....	38
5.4	How does a low P/E ratio portfolio compare? .....	39
Chapter 6.	Discussion.....	41
6.1	Properties of the data .....	41
6.2	Hypothesis 1: Returns of PEG ratio portfolios depend on the forecasting and rebalancing period used.....	41
6.1	Possible Reasons for unexpected results.....	43
6.2	Hypothesis 2: A low PEG ratio portfolio outperforms a higher PEG ratio portfolio ...	47
6.3	Hypothesis 3: A low PEG ratio portfolio outperforms a low P/E portfolio .....	49
Chapter 7.	Conclusion .....	50
7.1	Future Research .....	52
References.....		53

## List of Figures

<b>Figure 1</b> GARP stocks occupy the middle ground between growth and value stocks (Investopedia Staff, 2012a) .....	7
<b>Figure 2</b> Schnabel (2009) plotted an expected curve for the PEG benchmark which was dependent on historical growth .....	13
<b>Figure 3</b> Trombley (2008) shows a relationship between PEG and variations in historic 1 year growth rate .....	14
<b>Figure 4</b> l'Ons (2010) confirming Trombley's (2008) findings using data from 160 companies on the JSE .....	15
<b>Figure 5</b> l'Ons (2010) demonstrating how a benchmark curve for an individual company was derived from numerous years of data .....	15
<b>Figure 6</b> An example of growth rate used in the model by (Gode & Ohlson, 2006) .....	20
<b>Figure 7</b> Relation of $\gamma$ to variations in first year growth (G) while P/E ratio is at 10 .....	21
<b>Figure 8</b> Relation of $\gamma$ to variations in P/E ratio while first year growth is at 12% .....	22
<b>Figure 9</b> Number of stocks for the 3 month strategy .....	28
<b>Figure 10</b> Total market capitalisation of stocks used for the 3 month strategy .....	29
<b>Figure 11</b> Growth of stocks meeting criteria every 3 months versus all stocks in the J203T .....	29
<b>Figure 12</b> Number of stocks for the 12 month strategy .....	30
<b>Figure 13</b> Market Capitalisation of stocks used for the 12 month strategy .....	30
<b>Figure 14</b> Growth of stocks meeting criteria every 12 months versus all stocks in the J203T ...	31
<b>Figure 15</b> Number of stocks for the 24 month strategy .....	32
<b>Figure 16</b> Market Capitalisation of stocks used for the 12 month strategy .....	32
<b>Figure 17</b> Growth of stocks meeting criteria every 24 months versus all stocks in the J203T ...	33
<b>Figure 18</b> Returns of five PEG portfolios rebalanced every 3 months.....	34
<b>Figure 19</b> Returns of five PEG portfolios rebalanced every 12 months.....	35
<b>Figure 20</b> Growth of five PEG portfolios rebalanced every 24 months .....	36
<b>Figure 21</b> Comparison of growth of lowest PEG value portfolios of the three rebalancing periods .....	37
<b>Figure 22</b> Relative-value plots of lowest-PEG ratio quintile versus highest-PEG ratio quintile (PEG 5 / PEG 1) for each strategy investigated .....	38
<b>Figure 23</b> Lowest-PEG ratio quintile of each rebalancing period and lowest-P/E ratio quintile	39
<b>Figure 24</b> Lowest-PEG ratio quintile of 24 month rebalancing period and various portfolio styles from (Muller & Ward, 2012) .....	40
<b>Figure 25</b> Average P/E ratios for stock of each portfolio of every rebalancing of the 24 month strategy .....	44
<b>Figure 26</b> Stacked line graph indicating the frequency of occurrences of P/E ratios for each portfolio .....	45
<b>Figure 27</b> Average PEG ratio per portfolio of each rebalancing year of the 24 month strategy	48
<b>Figure 28</b> PEG 4 and 5 of 24 month strategy versus momentum strategy of Muller and Ward (2012) .....	51

## List of Equations

<b>Equation 1</b> .....	8
<b>Equation 2</b> .....	18
<b>Equation 3</b> .....	19
<b>Equation 4</b> .....	19
<b>Equation 5</b> .....	20
<b>Equation 6</b> .....	20
<b>Equation 7</b> .....	22



## Chapter 1. Definition of the Problem

### 1.1 Introduction

#### 1.1.1 Research Title

Does the PEG ratio add value?

#### 1.1.2 Why the PEG ratio

Efficient Market Hypothesis (EMH) predicts that the market responds immediately to new market information, and at all times the share price of a stock is representative of all information available regarding that stock (Bodie, Kane, & Marcus, 2005). Despite this, for decades investors have pursued strategies whereby they can take advantage of stocks which are incorrectly priced due to not having responded immediately to information that is available. The reason for this is that many investors who achieve abnormal returns (returns greater than those of the market) do so by exploiting these kinds of anomalies to the EMH (Hirschey & Nofsinger, 2010). This can only be done for a limited period as these anomalies tend to be removed from the market once information regarding them has been published (Schwert, 2003).

Two juxtaposed investment strategies which have persisted over the decades are the 'growth' and 'value' strategies. The 'growth' strategy is described as a strategy pursuing "glamour" stocks (Schatzberg & Vora, 2008). The shares have high prices relative to the company book value (high P/B ratio) or annual earnings (high P/E ratio), and are so because investors believe that they will experience rapid growth (G) in the future. In contrast, 'value shares have low P/B or P/E ratios and value investors see an opportunity to buy stocks which are undervalued by a pessimistic market. Numerous researchers have found the value investing strategy to outperform the growth investing strategy and have attempted to explain this phenomenon (Arshanapalli, Coggin, & Doukas, 1998; Doukas, Kim, & Pantzalis, 2002; Eugene & French, 1992; E. Fama & French, 1996; E. F. Fama & French, 1993; Kothari, 2001; Lakonishok, Shleifer, & Vishny, 1994; Chan, Jegadeesh, & Lakonishok, 1995; La Porta, Lakonishok, Shleifer, & Vishny, 1997; Pontiff & Schall, 1998; Y. Zhang, 2005; L. Zhang, 2005; Montier, 2009).

In 1989 the PEG ratio (Price to Earnings to Growth ratio) was made famous by Peter Lynch (Lynch, 1989), the famous Wall Street fund manager. He employed a strategy known as growth at a reasonable price (GARP), of which the PEG ratio is a key metric. This strategy was focussed on growth stocks which were relatively inexpensive. Schatzberg and Vora (2008), however, found that PEG is a profitable investment strategy which “extends its reach beyond the domain of growth stocks” (p 5). Thus low P/E stocks with good growth prospects were found to perform better than expected, and when compared to P/E effects the PEG effects were found to be separable (Schatzberg & Vora, 2008). It was concluded that the interaction of price to earnings (P/E) and growth (G) provides an advantage that is not available for these separately.

### **1.1.3 Growth Forecasts**

The way in which growth prospects are measured for the PEG ratio is that analyst forecasts for company earnings are used to predict growth. Typically the median of all forecasts made for a particular period is used to calculate an expected growth for the PEG ratio (Schatzberg & Vora, 2008).

An alternative method of obtaining earnings forecasts is to use any one of a number of mathematical time series models which use parameters such as trends, cyclicity, seasonality and other properties present in historical data to predict future earnings. Many studies have shown that analysts’ forecasts are superior to time-series forecasting methods (Bradshaw, Drake, Myers, & Myers, 2012), some attributing this to the fact that analysts were exposed to more information (Fried & Givoly, 1982) and had a timing advantage over time-series models (L. D. Brown, Hagerman, Griffin, & Zmijewski, 1987).

### **1.1.4 Expected rate of return and risk with the PEG ratio**

Both Trombley (2008) and Schnabel (2009) developed theoretical models which pointed to a distortion in the PEG ratio as the cost of equity of a company changes in that, as cost of equity (equivalent to expected rate of return) of a share decreases, the absolute PEG value increases. This was also found in numerous other studies which used a range of methods for calculating the expected rate of return (P. D. Easton, 2004; P. Easton, 2002; Ohlson & Juettner-Nauroth, 2005; Peters, 1991; Schatzberg & Vora, 2008).

Varying relationships between expected rate of return and risk are described by different equity valuation models, each of which has promoters and detractors. Although risk is a highly complex topic, quite often the measure used for risk is the standard deviation of the volatility of returns (Bodie et al., 2005).

Schatzberg and Vora (2008) controlled for risk factors which may be present by taking into account measures of systematic risk (Doukas et al., 2002), the Fama and French 3 factor model (E. F. Fama & French, 1993) as well as Carhart's momentum factor (Carhart, 2012), and found that PEG was significant in explaining the return across the sample, and risk did not add additional value to the measure.

James Montier, a strong critic of the EMH, from which much of the risk calculation is derived, lambastes numerous models for determining risk (Montier, 2009) and concludes that although risk is important it is not a number but more a notion or concept. He advocates assessing three types of risk: Valuation risk (low P/E is better than high P/E), Business/Earnings risk (danger of deterioration of earnings due to economic changes or management decline) and Balance sheet/Financial risk (risk found through analysis of financial statements).

## **1.2 Research Problem**

This study will seek to gain a deeper insight into the PEG ratio in terms of the value of its principal components. The research will seek to determine if the PEG ratio significantly differentiates stocks in terms of their return. It will furthermore attempt to establish if the addition of a growth component adds value to the P/E ratio. Finally, it will set forth a scope for future work on the topic based on the literature review and results of the study.

## Chapter 2. Theory and Literature Review

### 2.1 Investing styles

The purpose of research into developing new investment styles and strategies is to find ways to consistently beat the market (Muller & Ward, 2012). To this end many differing styles have been developed over decades of research and investing activity. Muller & Ward (2012) categorise the wide range of investing strategies or styles into financial ratio-based styles, market-based styles, and behavioural finance-based styles.

#### 2.1.1 Financial ratio-based styles

Financial ratio-based styles form part of a field known as fundamental analysis which is based on the analysis of company metrics and financial statements (Hirschey & Nofsinger, 2010). Analysis of company financial ratios gives clues to the degree of risk that the company faces relative to an industry or market (Montier, 2009) and trends thereof can often reflect the ability of management of the company. Without being able to assess individual managers, some financial ratios can give an indication of levels and directions of operational efficiency and strategy and/or product strength in the market (Bodie et al., 2005; Hirschey & Nofsinger, 2010).

Growth investing is a strategy relevant to this dissertation which appears to be a financial ratio-based style. Growth investors pursue “glamour” stocks which are often expensive but have very good growth outlooks (Bodie et al., 2005). Thus the investors are concerned with where the stock is going in the future, and are forward-looking. With fast growth it is believed that the stock price will increase. As the companies are growing fast, profits are ploughed back into the company for growth and thus the profits are realised through capital growth (Hirschey & Nofsinger, 2010).

The National Association of Investors Corporation (NAIC) advises to assess growth stocks according to (amongst others): historical earnings growth; pre-tax profit margins; analysts’ growth predictions; and efficiency measures such as return on investment (ROE) (Investopedia Staff, 2012b). All of these criteria are based on financial ratios, although the efficiency measures are often considered in the context of the industry or market, and analysts’ predictions could have influences from market-based styles and behavioural finance-based

styles (Jegadeesh, Kim, Krische, & Lee, 2005; Investopedia Staff, 2012b). Thus the author would classify growth strategy as predominantly a financial ratio-based style.

### **2.1.2 Market-based styles**

Market-based styles rely more on information about the competitive environment. A very common style which is market-based is known as value investing (Bodie et al., 2005; Hirschev & Nofsinger, 2010). Effectively a value stock is a stock which is trading below its intrinsic value. A popular metric to assess value shares is the share price to earnings per share ratio (P/E ratio). Efficient Market Hypothesis (EMH) predicts that market prices are always indicative of all underlying information, and thus accurate (Bodie et al., 2005). Numerous studies suggest that value investing is premised on the opposite; there are anomalies in market pricing to value; and it seeks to exploit these anomalies to its benefit (Lakonishok et al., 1994; Chen & Zhang, 1998; Arshanapalli et al., 1998; Arshanapalli et al., 1998). It is sometimes referred to as a “contrarian investment philosophy based on the premise that investors can profit by betting against the overly emotional crowd” (Hirschev & Nofsinger, 2010, p 328). So if a stock’s P/E ratio is below that of other stocks in the same industry it may be a value stock since its earnings are a relatively higher percentage of its price. Value investors would perform a more in-depth analysis of, for instance, the health and management of the company and/or positioning of the company and its products in the industry, as advocated by James Montier (Montier, 2009) (see section 1.1.4). Value stocks can often be found in an industry which has recently fallen on hard times, or industries which have been overly negatively affected by bad news (Hirschev & Nofsinger, 2010). In contrast to growth investors, value investors are more focused on the here and now, in that having accurately identified a market anomaly, the market will eventually realise a share is undervalued and adjust accordingly.

### **2.1.3 Behavioural Finance based styles**

The third style category is behavioural finance based styles. This involves analysis of activity of share prices such as trends and patterns. Momentum investing is one such style in which, say, the last 12 months of stock price activity is used to predict the following 3 months (Bodie et al., 2005).

In comparing numerous different styles Muller & Ward (2012) found a momentum strategy to yield the highest returns from their JSE-based style engine. Value styles based on cash flow to

price ratio, P/B ratio, and earnings yield (the inverse of P/E ratio) were found to have reliable and high returns (Muller & Ward, 2012), but their yields were still inferior to the momentum strategy employed. It was found that although P/B ratio performed well, at times it underperformed, and thus timing would be an important factor in achieving consistent returns. Cash-flow to price is similar to earnings yield and thus showed similar results. The success of earnings yield implies that a P/E ratio style is equally effective.

## 2.2 Growth versus Value stocks

As mentioned in 1.1.2, there has been much research into the comparative performance of growth and value stocks. While analysts appear to favour growth stocks (Jegadeesh et al., 2005), there is a great deal of literature which shows value stocks outperforming growth stocks, and attempts to explain this occurrence (Chan et al., 1995; Eugene & French, 1992; E. Fama & French, 1996; E. F. Fama & French, 1993; E. F. Fama & French, 2008; Kothari & Shanken, 1997; La Porta et al., 1997; Lakonishok et al., 1994; Petkova & Zhang, 2005; Pontiff & Schall, 1998; L. Zhang, 2005).

Fama and French (1993) argue that as a product of market efficiency, the reason that value stocks outperform growth stocks is that they are inherently riskier. Chen and Zhang (1998) find that value stocks outperform growth stock in numerous markets, but their results show that value stocks are in fact *less* risky than growth stocks. Lakonishok et al. (1994) support the findings of Chen and Zhang (1998) and attribute the superiority of value stocks' performance to market anomalies related to behavioural investing. Arshanapalli et al. (1998) also finds evidence of value stocks outperforming growth stocks and also that they are less risky than growth stocks.

Petkova and Zhang (2005) found that betas (as used in the Capital Asset Pricing Model to approximate risk) tend to co-vary with the expected market risk premium. The explanation was that the differences in returns were symptomatic of anomalies to the EMH in that investors tend to be excessively pessimistic with value stocks and excessively optimistic with glamour stocks. In other words, it is not only that value stocks do well, but also that glamour stocks perform poorly as compared to expectations and pricing of the stocks.

### 2.3 Growth at a reasonable price (GARP)

Warren Buffett started out his investment life as a pure value investor, and over time his strategy changed to one known as growth at a reasonable price (GARP) (Dorfman, 1995). He was once noted as saying: "growth and value investing are joined at the hip" (Dorfman, 1995, p A3). GARP effectively leads investors to avoid extreme value or growth investing and points to stocks with relatively high growth but comparatively low P/E ratios (Investopedia Staff, 2012a).

Therefore, the GARP strategy marries both growth and value stock investing principles, and exhibits a combination of their types of returns (Investopedia Staff, 2012a). While a growth investor will do very well in bullish conditions, and a value investor will achieve good results in a bearish market, a GARP investor will be rewarded with more consistent and predictable returns across bull and bear markets.



**Figure 1** GARP stocks occupy the middle ground between growth and value stocks (Investopedia Staff, 2012a)

With reference to 2.1.1 and 2.1.2 above, unlike growth and value investors, GARP investors are concerned with both the present valuation of a stock as well as its future growth trajectory.

## 2.4 The PEG ratio

The PEG ratio is seen as the GARP investor's primary tool. It is the share price (P) divided by earnings per share (EPS), divided by growth of the share (G) (Bodie et al., 2005; Lynch, 1989):

$$PEG\ ratio = \frac{P}{\frac{EPS}{G\%}}$$

### Equation 1

As articulated by Bodie et al. (2005, p 625), "P/E ratios are commonly taken as proxies for the expected growth in dividends or earnings". Lynch (1989) suggested that a stock with a PEG ratio below 1 was undervalued, and over 1 was overvalued. In other words, if a share was valued correctly the P/E ratio should be the same magnitude as the growth percentage of the share:

"If the P/E ratio of Coca Cola is 15, you'd expect the company to be growing at about 15% per year, etc. but if the P/E ratio is less than the growth rate, you may have found yourself a bargain" (Lynch, 1989, p 198).

If the P/E ratio divided by the growth is more than one, then the growth is lower than the P/E ratio and the return on shares would not be as good as shares for which the P/E ratio equals the growth. It follows that if the P/E ratio divided by the growth is less than one, then the growth is higher than the P/E ratio and the return on shares would be greater than the return on shares with a lower P/E to growth ratio (Hirschey & Nofsinger, 2010).

There are numerous circumstances under which a stock's PEG ratio can be low (Schatzberg & Vora, 2008), for example:

1. Investors may not realise the growth potential of a share;
2. The share has been unfairly punished due to recent negative events;
3. The environment might be dominated by momentum investors while the stock is in an industry which is currently underperforming.

For the remainder of section 0 the author will provide more background information around the elements which make up the PEG ratio.



### 2.4.1 Earnings per Share

The two constituents of the P/E ratio are the share price and the earnings per share. Although the share price is determined by the market, earnings per share (EPS) can represent a number of different measures (Hirschey & Nofsinger, 2010). EPS is thus susceptible to manipulation and is only as strong as the quality of the underlying earnings value.

High quality EPS means that the number is a good representation of the money actually earned. Low quality EPS mean the opposite (Bao & Bao, 2004). Even attempts to standardise EPS reporting have not achieved trustworthy high quality EPS reporting (Francis & Wang, 2008). The danger with low quality EPS is that investors can make bad investment decisions and investment styles such as the PEG ratio may not perform in a way which represents the true characteristics of the style.

Reported EPS is the number derived from generally accepted accounting principles (GAAP) (Choi, Lin, Walker, & Young, 2007). The earnings of this measure can be manipulated by opaque practices around transitory operating items or manipulation of classifications such as around discontinued operations (Choi et al., 2007). Information about this kind of activity is usually available in footnotes and not necessarily easy to find. Beneish (1999) developed a model known as the Beneish “M” score whereby it was possible to, by use of publicly available accounting data, identify roughly half of earnings manipulations prior to public detection. This provides the investor with a useful tool to avoid share price crashes which accompany public disclosure of such illegal practices.

Nonetheless, Operating Cash Flow per Share is a measure which is often used to validate the quality of the numerator of an EPS number (Bodie et al., 2005). Because this measure quantifies cash coming in it is much more tangible than other measures. A comparison of this measure to earnings is thus effective in learning more about EPS quality. If the Operating Cash Flow per Share is higher than the EPS then the EPS number is said to be of high quality and vice versa (Ross, Westerfield, & Jordan, 2008). A cause of lower Operating Cash Flow per Share can however be related to strategic investment such as R&D or marketing and can also be related to industry cycles. To avoid undervaluing an EPS number due to this kind of factor, trends of Operating Cash Flow per Share can be observed and compared to industry.

### **2.4.2 Numbers of Shares**

Both the denominator and numerator of the earnings per share calculation can be manipulated. The denominator (number of shares) can either be the number of shares outstanding, or the number plus all options, outstanding warrants and other forms of potential shares (Ross et al., 2008). The latter measure when used for EPS results in what is known as diluted earnings per share. This method will be used in the dissertation as it appears to be a common measure in the literature (Schnabel, 2009; Trombley, 2008).

### **2.4.3 Forecasted Growth**

As mentioned in 1.1.3 the growth (G) used in the PEG ratio is derived from analyst forecasts of earnings for stock.

The area of accuracy of analysts' earnings forecasts is a widely researched topic and was first discussed in the seminal work of (Ball & Brown, 1968). After 2 decades of research into the topic, L. D. Brown et al. (1987) concluded that analysts' forecasts were indeed superior to time-series forecasts. The reasons were two-fold: firstly that analysts were exposed to more information (Fried & Givoly, 1982); and secondly, had a timing advantage over time-series models (L. D. Brown et al., 1987). Other researchers found similar conclusions to Brown (Bradshaw et al., 2012) and as such analysts' forecasts have been widely employed, to the extent that literature on time-series of earnings dwindled in the face of "the easy availability of a better substitute" (Kothari, 2001, p 185).

While analysts' forecasts were used widely, weaknesses have been exposed in studies on the topic. There have been numerous studies which point to biases in analysts' forecasts, many of them pointing to positive biases (Abarbanell, 1991; P. Brown, Foster, & Noreen, 1985; Stickel, 1990). Furthermore, many of the studies supporting forecasted earnings as being superior to time-series predicted earnings used very small samples by current research standards. Fried and Givoly's (1982) study reported one of the more extensive samples which used forecasts for 424 firms over an eleven year period from 1969 to 1979, but in comparison to today's studies this is relatively small (Bradshaw et al., 2012). Another example is the study by L. D. Brown and Rozeff (1978) where forecasts of only 50 firms were used over four years, 1972 to 1975. The forecasts available for the early studies also tended to be for larger, more mature firms (Bhushan, 1989) or firms with comprehensive and more frequent disclosures (Lang & Lundholm, 1996).

More recent studies examine the extent of analysts' forecast superiority present in different stock characteristics. Brown, Richardson, and Schwager (1987) show a positive correlation between superiority and firm size, and a negative relationship with forecast dispersion. Brown et al. (1987) and subsequently Kross, Ro, and Schroeder (1990) also found that superiority is negatively correlated to forecast horizon. Lim (2002) finds that forecasts are positively yet predictably biased and that early studies too hastily dismissed such biased forecasts as inaccurate. Numerous studies find an optimistic bias associated with companies with large variability on previous earnings and earnings forecast uncertainty (Ackert & Athanassakos, 1997; Das, Levine, & Sivaramakrishnan, 1998; Han, Manry, & Shaw, 1998), while Peters (1993) concluded that pessimistic forecasts occurred less frequently with smaller firms.

Bradshaw et al. (2012) set out to test the assertion that analysts' forecast superiority was negatively related to forecast horizon, and used a random walk time-series model as a comparison. The reason for choosing the random walk was that there was little evidence of more complex time-series methods having superior performance and the method was computationally less demanding than other methods such as ARIMA (Bradshaw et al., 2012). The results confirmed the findings of Kross et al. (1990) and Brown et al. (1987) in that forecast superiority was negatively related to the forecast horizon. Furthermore, it was found that in some cases time-series can be superior to analysts' forecasts, particularly when the forecast horizon is greater than a year in advance (Bradshaw et al., 2012). Interestingly, the most accurate earnings forecasting method for longer time horizons was found to be a crude extrapolation of the earnings predicted by analysts' 1 year forecast horizon to the more advanced date.

## **2.5 Should we Benchmark the PEG ratio?**

(Lynch, 1989) suggested that the PEG ratio be used in isolation for a stock, and that an apparently "ad hoc" (Schatzberg & Vora, 2008, p 10), albeit elegant, benchmark of 1 be applied to determine if the stock was a good buy. Furthermore, to make allowance for error, it was suggested that an investor should buy a stock with a PEG ratio below 0.5 and sell a stock with a PEG ratio above 2. Thus it appears that yet another arbitrary factor was chosen to buffer the investor against a failure in the PEG investing strategy. Trombley (2008) and Schnabel (2009) argued that a single benchmark as suggested by Lynch was not optimal, and that accuracy of identified undervalued and overvalued stocks could be improved if factors such as risk (e.g.

Beta), historical and long-term future company growth rates, and duration of growth rates were taken into account.

The result of the research was that the benchmark used was dependent upon numerous factors, none of which were very clearly defined nor understood, and was applied in isolation on a stock to determine whether to buy, sell, or hold a stock.

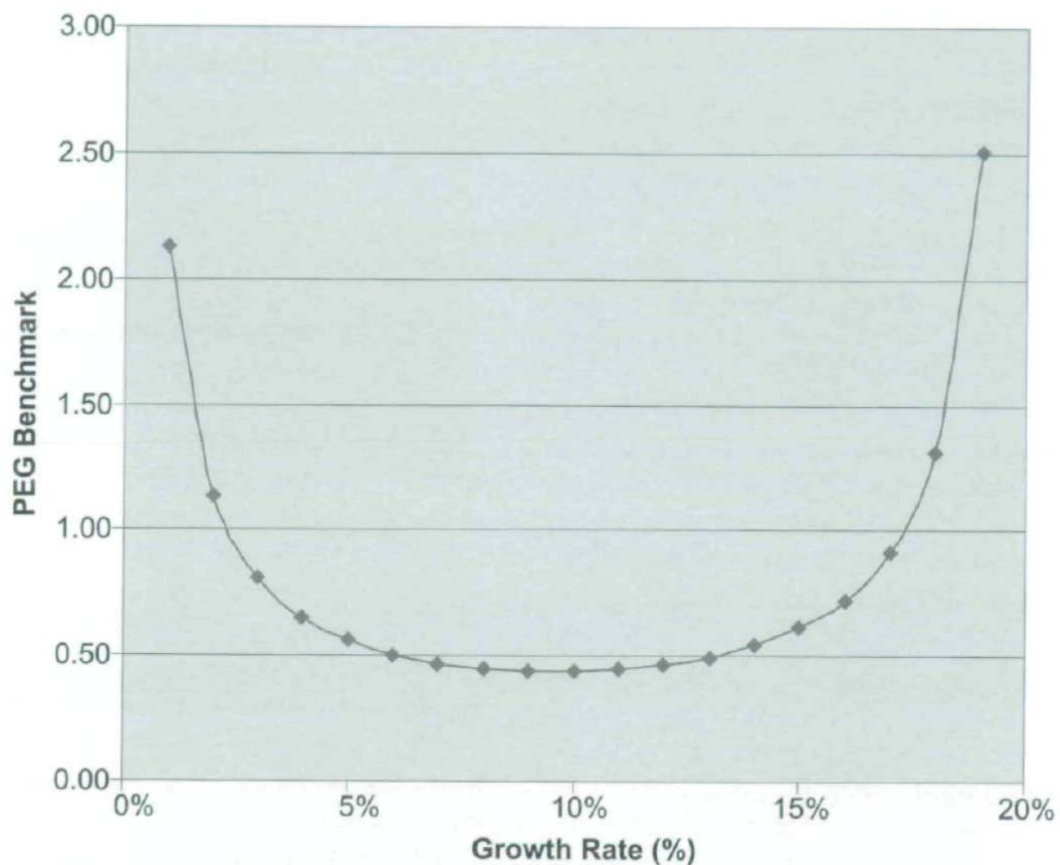
A contrasting methodology used to compare investing styles is that employed by Muller and Ward (2012), amongst many others. For the use of their style engine, stocks are ranked according to a specific investment style and then divided into 5 portfolios or quintiles. Each of these portfolios is held for a preselected time span, and periodically the portfolios are rebalanced by re-ranking the stocks using the parameters relevant to the investment style in question, and once again splitting the shares into 5 portfolios. The difference of this method from the methodologies of l'Ons and Ward (2012), Schnabel (2009) and Trombley (2008) is that shares are not chosen for a portfolio in isolation, but rather relative to each other, and are therefore ranked. There are a number of benefits to such a methodology:

1. The Muller and Ward (2012) methodology ensures that each portfolio always has the same number of shares, and the top quintile constitutes the top 20% of shares according to the investment style. With the absolute benchmark methodology, at any one time there may be very many shares which meet the criteria, or very few.
2. Since the measurement is relative to all shares being considered, if the style works, one is ensured of beating the market by having above-average returns. With an absolute benchmark measure one cannot ensure consistent returns above the market.
3. In a ranking system where all measurements are relative, absolute numbers are much less important. For instance, to determine if a PEG value is low, one simply needs to compare it to the other shares, as opposed to employing arbitrary absolute numbers as has been done by l'Ons and Ward (2012), Schnabel (2009) and Trombley (2008).
4. Finally, errors such as analysts' forecasts' positive biases have no effect on the ranking of the stocks as long as the bias is uniform. In the case where it is not uniform, weightings can be applied to simulate uniformity, and this will ensure that the ranking method is still effective.

Nonetheless, despite the opposition to benchmarking using absolute values in the PEG ratio, the author recognises that l'Ons and Ward (2012), Schnabel (2009) and Trombley (2008) still uncover some interesting properties of the PEG ratio which will be discussed in the next section.

## 2.6 Historical growth rate as a differentiator for PEG stocks

Schnabel (2009) built a theoretical model based on the Gordon growth model (Gordon, 1962), which predicted that stocks with lower historical growth rate could have a higher PEG ratio but still be undervalued. In contrast, a higher historical growth rate resulted in a PEG benchmark well below Lynch's 1, but going into a super growth region the benchmark once again climbed as can be seen in **Figure 2** below.

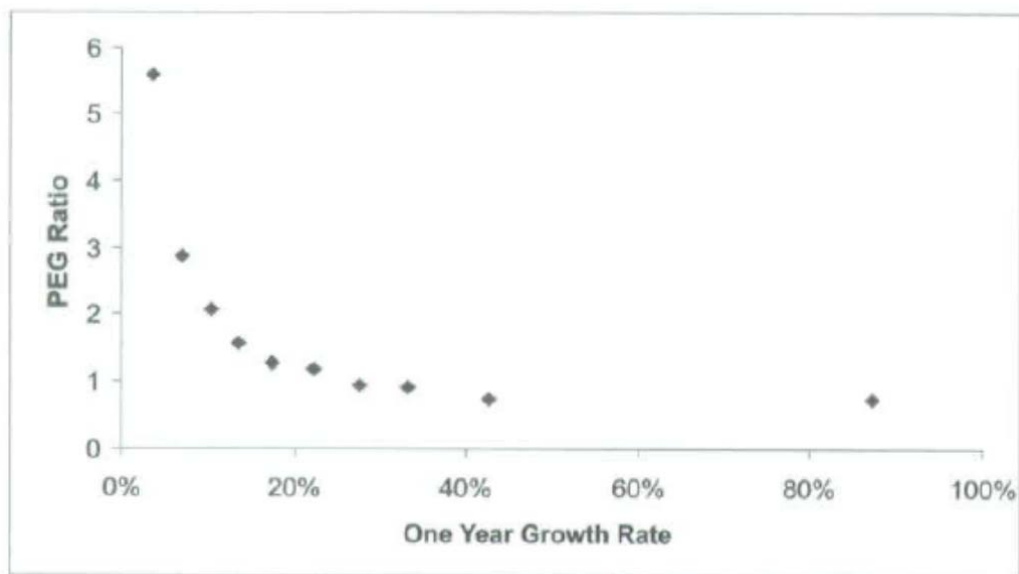


**Figure 2** Schnabel (2009) plotted an expected curve for the PEG benchmark which was dependent on historical growth

Based on the two stage dividend discount model, Trombley (2008) provided empirical evidence of the relationship between PEG and 1 year historical growth for a point in time and

stocks divided into 10 growth deciles. The difference between the model used by Schnabel and that by Trombley is that Schnabel's model expects constant growth into perpetuity, while that of Trombley predicts high growth initially, whereafter growth is muted but still at a constant rate into perpetuity.

This exhibit plots the average PEG ratio for stocks in 10 growth deciles as of December 31, 2004. PE was calculated as December 31, 2004 price divided by 2005 actual diluted EPS before extraordinary items, embedding an assumption of accurate forecasting by market participants. Growth was calculated based on 2005 vs. 2004 EPS. Data was trimmed by excluding a) firms with negative 2004 EPS, b) firms with negative growth rates, c) firms with PEG below 0.1, and d) firms with PEG greater than 15.



**Figure 3** Trombley (2008) shows a relationship between PEG and variations in historic 1 year growth rate

Trombley's high growth theoretical model agreed with that of Schnabel only in the case where high growth was sustained for numerous years. l'Ons and Ward (2012) confirmed Trombley's observation on data from the JSE, and further investigated this relationship on data from 2005 to 2010 where data gathered on a share over numerous years was regressed to a share-specific power function relating PEG to historical growth.

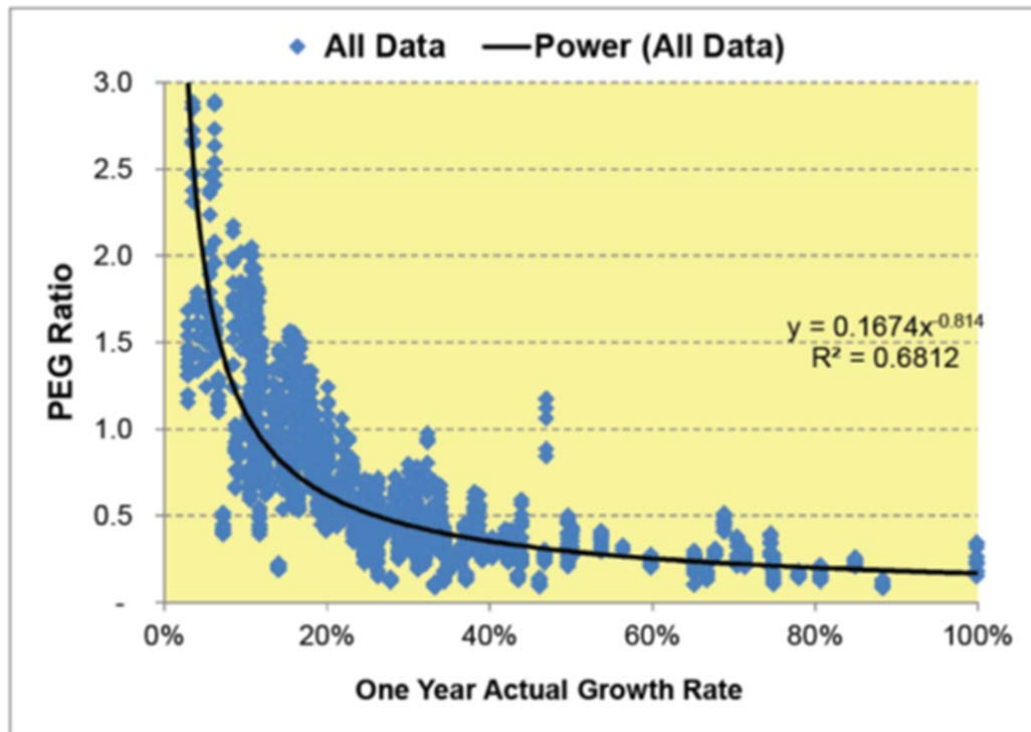


Figure 4 l'Ons (2010) confirming Trombley's (2008) findings using data from 160 companies on the JSE

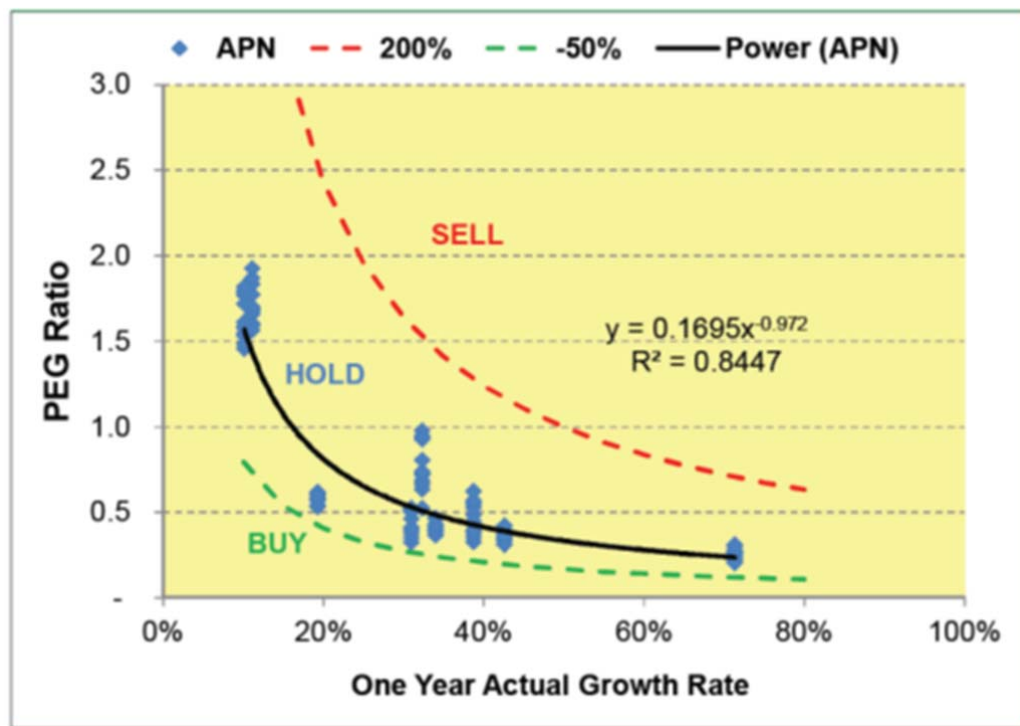


Figure 5 l'Ons (2010) demonstrating how a benchmark curve for an individual company was derived from numerous years of data



l'Ons and Ward (2012) found that taking this effect into account he was able to achieve a 4% improvement in returns on an annual basis. l'Ons's methodology employed a trading rule whereby the absolute value of PEG was measured and compared to a benchmark as defined by the power regression line indicated in **Figure 5** in order to determine a resulting trading activity or response.

## **2.7 Risk, return and the PEG Ratio**

Schatzberg and Vora (2008) set out to examine the risk and return features with respect to the PEG ratio. One of the few earlier studies to examine the return characteristics of PEG ratio strategies was that by Peters (1991). This study suggested that a PEG investing strategy may also benefit from the value premium experienced by value stocks. Schatzberg and Vora (2008) used this study as a point of departure for their paper. The sample used was for all stocks which meet specific requirements, and not only ones with strong growth prospects. Adjustments were made using the Fama and French 3 factor model (E. F. Fama & French, 1993; Peters, 1991) to ensure no information was masked by any of these factors, and profitability of a PEG strategy using forward earnings was compared to one using recently published earnings as done by Peters (1991). Furthermore, risk characteristics of the PEG strategy were reported which were "likely to be counterintuitive" (Schatzberg & Vora, 2008, p 8) to value investors, and finally, the separability of the PEG ratio from returns associated with value or growth effects was explored.

Schatzberg and Vora (2008) suggest that by construction P/E and PEG value strategies will share common characteristics, but that through their study it emerges that the risk profile of the two techniques differ. This is due to the uncertainty introduced by high growth rates of many of the stocks which have a low PEG ratio. Standard deviation of earnings volatility was used as a measure for risk.

The following criteria were used to screen the data for Schatzberg and Vora (2008, p 11):

1. Both the one-year-ahead EPS forecast and the actual EPS for the current year must be positive;
2. The five-year growth forecast of EPS must be positive;
3. At least three analysts report the forecasts;



4. Stock returns data for the 12-month period beginning seven months after the fiscal year-end are available from CRSP;
5. The primary SIC code must indicate that the firm is not within the financial or utility sectors.

The sample selection included the month of the fiscal year end for every firm listed on the I/B/E/S database from 1990 to 2003. A total of 13060 firm-year observations were used. For the growth, 5-year forecasts of earnings were used where the average number of analysts tracking a stock was 10, with a median of 8. The stocks are divided into quintiles and returns are characterised by earnings after a 12-month holding period.

It is found by the study that after controlling for the Fama and French 3 Factor Model as well as Carhart's Momentum factor, PEG is significant in explaining the yield across the samples (Schatzberg & Vora, 2008). When examining the data to ascertain if the combination of constituents of the PEG provide an advantage not present as separate components, it is found that for the data, both the PEG and P/E ratio investing strategies prove to be advantageous. Also, the PEG and P/E ratio strategies are found to be separable. Furthermore, it is found that a combination of the PE and PEG strategies can be exploited to produce greater returns. Similarly, when compared with growth, it is found that there exists an advantage for the PEG strategy due to the interaction of its constituents as compared to growth (Schatzberg & Vora, 2008).

Of particular interest for this section, is that for both measures of PEG used across all the data, the standard deviation of returns on the lowest PEG quintile (with the greatest returns) was the highest and decreased uniformly as the Peg ratio increased through quintiles, except for one exception on the 4<sup>th</sup> PEG quintile. Thus, Schatzberg and Vora (2008, p15) find the PEG ratio investment strategy to be "counter-intuitive" to existing value strategies. In a typical value strategy stocks of lower than average risk are normally chosen, while the stocks in the superior PEG quintile had the highest mean standard deviation of returns, indicating the highest risk (Bodie et al., 2005).

It would be remiss of the author not to point out the criticism meted out by James Montier at the use of standard deviation of returns as a proxy for risk:

“At the most basic level, finance theorists equate risk with standard deviation. I believe this to be ludicrous. However, suspending my disbelief and using their measures I find that value stocks have generally had higher returns and lower risks than growth stocks. This is a violation of the basic tenet that risk and return should be related.” (Montier, 2009, p 57)

Without trying to explain a relationship between risk and return, Ohlson and Juettner-Nauroth (2005) attempt to relate P/E ratio to growth in terms of earnings per share on a theoretical basis, thereby attaining a measure of expected returns.

The point of departure is that expected dividends per share (dps) must form part of the model which has earnings growth; firstly because dividends per share is the main source of value; and secondly because the expected dps and eps routes must be related to each other in order to make economic sense. Unlike most models however, Ohlson and Juettner-Nauroth (2005) model does not fix the dividend payout ratio and is thus independent of a company’s dividend policy.

Ohlson and Juettner-Nauroth (2005) use a residual income valuation model which has its origins in Bell (1961), Peasnell (1982) and Ohlson (1995). The basic principal of this model is that an investor expects a certain return on his investment which is related to the opportunity cost of that investment, including consideration of the risk of the investment. Thus, shareholder value is created by returns above the expected return which is termed economic profits (Bodie et al., 2005).

Ohlson and Juettner-Nauroth (2005) demonstrated that their model subsumes the constant growth model used by Schnabel (2009) (see section 2.6) when a constant payout ratio (k) exists:

$$\frac{P}{E} = \frac{k}{R - G}$$

**Equation 2**

The broader formula however can be manipulated to a form where the expected rate of return ( $r$ ) can be articulated:

$$r = \frac{\gamma - 1}{2} + \sqrt{\left(\frac{\gamma - 1}{2}\right)^2 + \frac{E}{P} * (G - (\gamma - 1))}$$

**Equation 3**

Where  $\gamma$  is a variable which expresses the degree at which the future earnings grow relative to preceding-period earnings. In effect it is an expression of tapering off of earnings growth (Gode & Ohlson, 2006) and as such in some ways is a generalisation of the constant growth model, and of which the constant growth model forms a special case. Growth in this model however has two degrees of freedom as compared to the one degree of freedom for growth in the constant growth model (Ohlson & Juettner-Nauroth, 2005). The two degrees of freedom are the first year growth rate and the growth rate as  $t$  tends toward infinity.

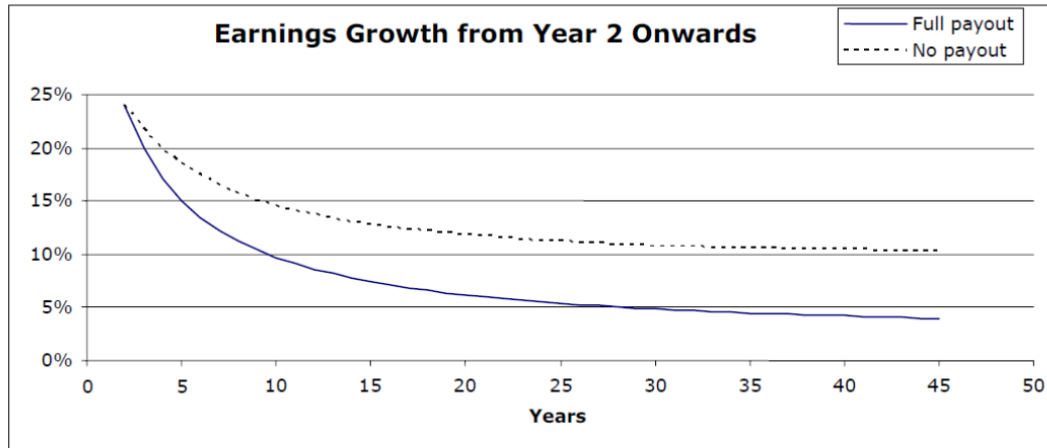
$$\gamma = \frac{eps_t - eps_{t-1}}{eps_t}$$

As  $t \rightarrow \infty$

**Equation 4**

Unlike Trombley's (2008) model (see section 2.6) where two growth rates are defined, one for the first few years of fast growth, the second for growth thereafter into perpetuity, the model used by Gode and Ohlson (2006) and Ohlson and Juettner-Nauroth (2005) use a more realistic model where growth tapers off. An example of such growth appears in **Figure 6**.

$eps_1 = 100$ ;  $eps_2 = 124$ ;  $r = 10\%$ ;  $\gamma = 1.03$ ; dividend payout ratio = 100% and 0%.



**Figure 6** An example of growth rate used in the model by (Gode & Ohlson, 2006)

Gode and Ohlson (2006) propose a unified valuation framework for dividends, free cash flows, residual income, and earnings growth-based models, which itself subsumes the model of Ohlson and Juettner-Nauroth (2005) and is expressed by the following formulae:

$$r = A + \sqrt{A^2 + \frac{E}{P} * (G - (\gamma - 1))}$$

**Equation 5**

Where

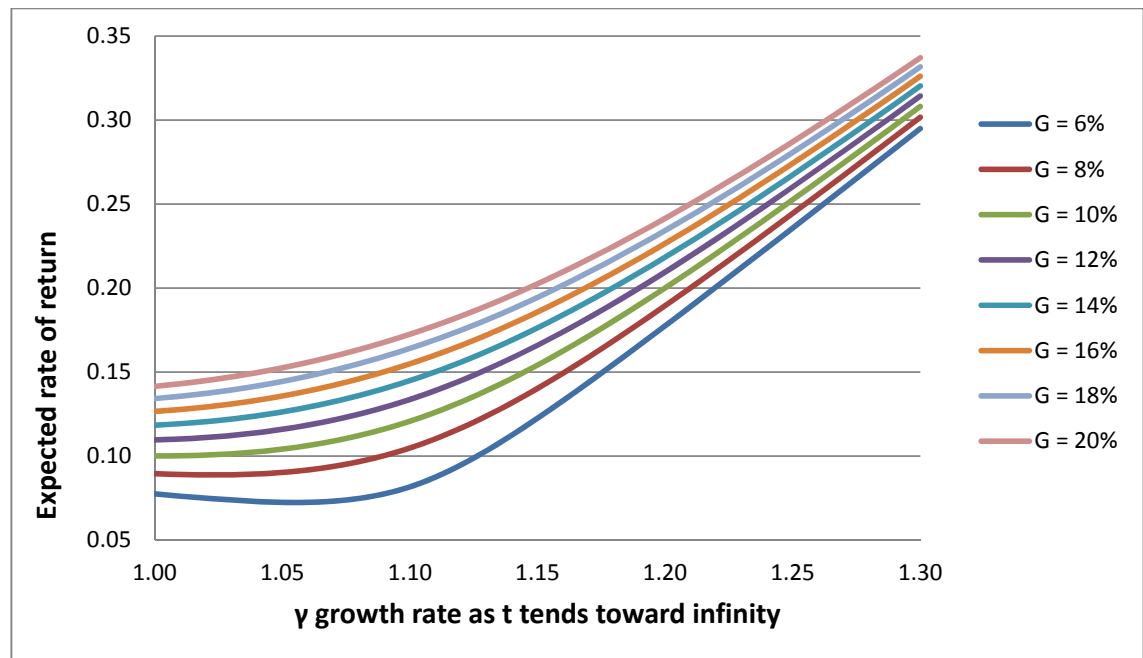
$$A \equiv \frac{1}{2} * \left( \gamma - 1 + \frac{dps}{P} \right)$$

**Equation 6**

Where dps = dividends per share

**Equation 5** is an extension of **Equation 3** in that it incorporates a measure of dividends paid out.

To express more clearly the behaviour of  $\gamma$ , **Figure 7** shows curves for a variety of  $\gamma$  for a fixed PE but varying growth, with zero dividends (Gode & Ohlson, 2006).

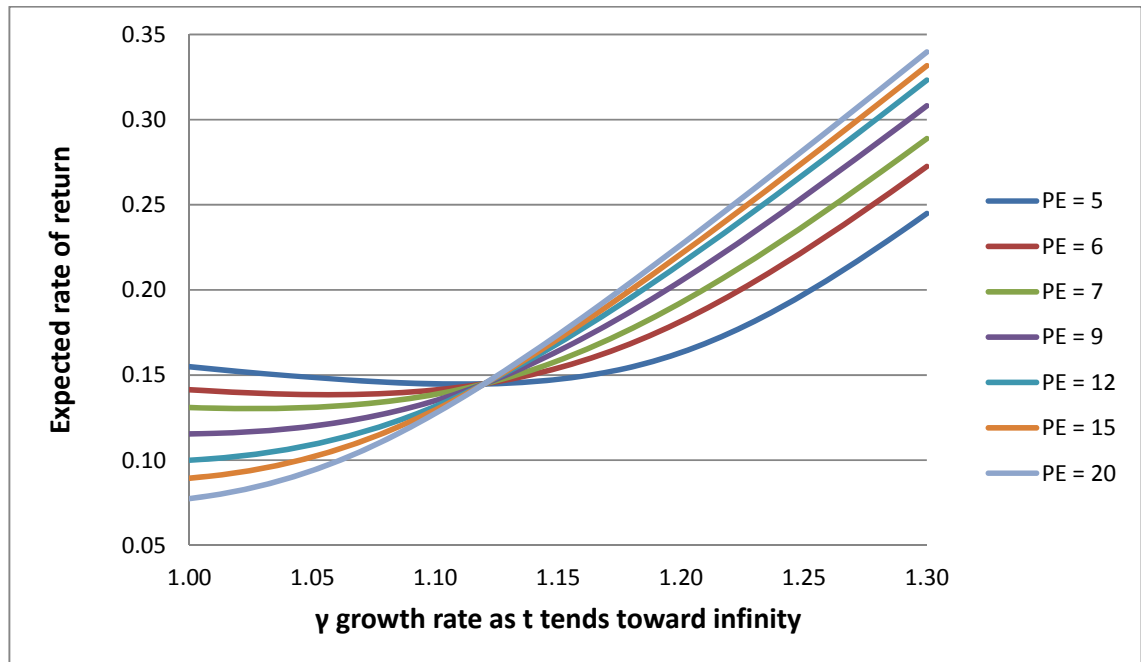


**Figure 7** Relation of  $\gamma$  to variations in first year growth (G) while P/E ratio is at 10

Similarly **Figure 8** shows the relation of  $\gamma$  to changes in the P/E ratio. Interestingly, if  $\gamma$  is less than the 1 year growth rate, low P/E firms have a higher expected rate of return than high P/E firms. This contradicts Schatzberg and Vora's (2008) observation that:

“Typically, high P/E companies can be expected to have both higher than average earnings growth rates and required rates of return.” (Schatzberg & Vora, 2008, p 9)

When  $\gamma$  (growth rate as t tends toward infinity) is higher than the immediate 1 year growth forecast then the high P/E firms tend to have a higher expected rate of return. When a company has high growth, in order for the company to justify not paying out the earnings as dividends, it has to ensure that the return on that growth is greater than the cost of equity. In the case of Figure 8 the dividend payout ratio is set at zero and as such it may go some way to explaining why the first year growth rate is where the P/E vs expected rate of return relationship flips over.



**Figure 8** Relation of  $\gamma$  to variations in P/E ratio while first year growth is at 12%

In the case where earnings are not expected to grow beyond the immediate period,  $\gamma = 1$ , and the expected rate of return ( $r$ ) is a function of the PEG ratio:

$$r = \sqrt{\frac{1}{PEG * 100}}$$

**Equation 7**

This would be the solution when applying the constant growth model and reflects the intercept of the  $\gamma$  axis of **Figure 8**. According to Hirschey and Nofsinger (2010, p 110) “investors favour investments with higher levels of expected return and lower levels of risk”.

The levels of risk are not so easy to ascertain however, which brings us back to Montier’s point of view that risk is more a notion than a number, and that instead of trying to use a single formula to determine risk, the risk inherent in a company should be evaluated by weighing up a multitude of factors which are difficult to describe by a single formula (see section 1.1.4).

## Chapter 3. Research hypotheses

### 3.1 Hypothesis 1: Returns of PEG ratio portfolios depend on the forecasting and rebalancing period used

The null hypothesis states that the returns of PEG ratio portfolios will be independent of the forecasting and rebalancing period. The alternative hypothesis therefore states that the returns of PEG ratio portfolios will be dependent on the forecasting and rebalancing period.

$$H10: PEG_{\text{Short}} \mu_{AR} - PEG_{\text{Extended}} \mu_{AR} = 0$$

$$H1A: PEG_{\text{Short}} \mu_{AR} - PEG_{\text{Extended}} \mu_{AR} \neq 0$$

### 3.2 Hypothesis 2: A low PEG ratio portfolio outperforms a higher PEG ratio portfolio

The null hypothesis states that a low PEG ratio portfolio will not outperform a higher PEG ratio portfolio. The alternative hypothesis therefore states that a low PEG ratio portfolio will outperform a higher PEG ratio portfolio.

$$H20: PEG_{\text{Low}} \mu_{AR} - PEG_{\text{High}} \mu_{AR} \leq 0$$

$$H2A: PEG_{\text{Low}} \mu_{AR} - PEG_{\text{High}} \mu_{AR} > 0$$

### 3.3 Hypothesis 3: A low PEG ratio portfolio outperforms a low P/E portfolio

The null hypothesis states that a PEG ratio portfolio using a growth factor based on median analysts' forecasts will not generate greater returns than a low P/E ratio portfolio which uses low P/E ratios to identify value stocks. The alternative hypothesis therefore states that a low PEG ratio portfolio using the median of analysts' forecasts will generate greater returns than a low P/E ratio portfolio.

$$H30: PEG \mu_{AR} - P/E \mu_{AR} \leq 0$$

$$H3A: PEG \mu_{AR} - P/E \mu_{AR} > 0$$

## **Chapter 4. Method**

### **4.1 Research design**

A quantitative, causal and experimental investigation into the research hypotheses will be conducted using secondary data (Zikmund, Carr, Griffin, Babin, & Carr, 2000). Historical stock market data will be utilised to backward test the hypotheses.

### **4.2 Scope**

The data used in this study is limited to the top 160 companies on the Johannesburg Stock Exchange (JSE) at any one time in terms of market capitalisation as chosen by the style engine developed by Muller and Ward (2012). The stocks must have earnings consensus forecasts as published by INET, the earliest of which are in 2002. The data include share prices over the period of 31 December 2002 to 30 September 2012 and in order to achieve meaningful results have the characteristics and undergo the manipulations described below:

1. P/E ratios must be positive and less than 30;
2. Earnings consensus growth must be positive and less than 50%;
3. Share price changes due to share splits or consolidations are backward adjusted in time-series data;
4. Returns from unbundling are included with the original company for that quarter whereafter they are treated as a new entity;
5. Dividend pay-outs are included in share returns using INET historical time series of cash dividend pay-outs;
6. Newly listed shares are included at the start of the next quarter and delisted shares are excluded at the end of the quarter in which they delisted.

Company financial statement data from INET for this 10 year period are included in this dataset.

The data sampling techniques employed above are convenient and judgemental (Saunders & Lewis, 2012). Selecting the largest 160 companies by market capitalisation allows us to target companies which are most likely of interest to institutional investors due to their size and liquidity (Muller & Ward, 2012). Furthermore, the companies for which there are earnings



consensus forecasts are even more closely followed by the market to the extent that market analysts derive value from providing forecasts on these stocks.

The unit of analysis is a single share on the JSE that has price, historical reported EPS and in order to calculate a single PEG ratio it must have historical earnings consensus forecast by financial analysts (T. A. l'Ons, 2010).

### **4.3 Research Instrument**

A “style engine” has been developed in Excel by Mr Chris Muller who is an associate of Professor Mike Ward, the supervisor of this dissertation. The engine uses VBA code to access and manipulate data from Access databases populated with the JSE data mentioned in section 4.2 above.

Parameters such as start and end date for a period of data to be tested can be chosen by a user. Furthermore, parameters such as number of portfolios to divide the data into, and review period, can be chosen (Muller & Ward, 2012).

All style characteristics proposed in section 3.1, 3.2 and 3.3 will be defined in the style engine. As with Muller and Ward (2012) the number of portfolios will be 5. PEG ratios will be calculated for all suitable stocks on the first day of a relevant period, starting 31 December 2002. All the stocks will be ranked according to the PEG ratio of each and the stocks will then be split into quintiles where “PEG Ratio 1” quintile or portfolio holds the highest 20% of stocks by PEG ratio, down to “PEG ratio 5” which holds the lowest 20% of stocks by PEG ratio. The duration of the period (holding period) for which these portfolios are held will be 3 months, 12 months, or 24 months, as per Hypothesis 1. After the holding period has elapsed, a new PEG ratio will be calculated for every entity, the entities ranked according to PEG ratio magnitude, and once again split into 5 equally weighted portfolios according to rankings (the portfolios will be rebalanced). The way in which each PEG ratio is calculated is dependent upon the duration of the holding period, as the consensus earnings forecast for the same forecast horizon (3, 12, or 24 months) will be extrapolated by a simple temporal interpolation between the closest available analyst forecasts before and after the forecast horizon.

#### 4.4 Data Analysis

On the last day of each holding period the growth of each portfolio will be retained, upon which new growth of the rebalanced portfolio will be added on a monthly basis, and this process will be repeated for the full duration of the 10 year period under review.

The approach used by Muller and Ward (2012) will be employed in that cumulative returns over the 10 year period will be compared visually. This is opposed to other methods where average periodic returns are subjected to, for example, t-tests in order to determine significant differences. Muller and Ward (2012) find the methodology comparatively weak and compare it to the corresponding usefulness of average abnormal returns in event studies compared to that of cumulative abnormal returns.

In order to provide further insight into the variations of PEG styles, a “relative-value” plot will be constructed by dividing the value of the lowest ranked PEG portfolio (PEG ratio 5) by the value of the highest ranked PEG portfolio (PEG ratio 1), every month on an on-going basis. This will show the excess returns experienced by an investor in “PEG ratio 5” versus the returns for an investor who is holding stocks of “PEG ratio 1”, and is an indicator of how successfully a style distinguishes between strong and weak stocks (Muller & Ward, 2012).

In addition to the “relative-value” plot, an additional comparative plot will be constructed where the value PEG ratio portfolio which is expected to exhibit the greatest returns (PEG ratio 5) is divided by the corresponding value of the market capitalisation weighted ALSI total return index (J203T). Thus the excess returns produced by “PEG ratio 5” over the J203T can also easily be viewed.

When comparing 5 portfolios on the basis of each outperforming the others, pair-wise comparisons will be made resulting in 10 comparisons between the 5 portfolios.

Finally, in order to provide context, the returns of the momentum style employed by (Muller & Ward, 2012) which was found to have the greatest returns of the numerous styles implemented will be plotted.

#### 4.5 Quality Control Measures

The methodology is tested by Muller and Ward (2012) in that exactly the same data selection and portfolio strategy is employed, except that the ranking of the selected shares is randomised before being allocated to portfolios. This was done at every rebalancing occurrence, and it was found that there was no meaningful difference between portfolios constructed in this manner.

One factor which needs to be accounted for is that different stocks will be held by the comparative PEG strategies which have different holding periods. This is due to there being different numbers of stocks which meet the selection criteria at different times. The average performance of these stocks will be measured over the whole duration of the period examined in this dissertation to provide some insight into the average growth of stocks which qualified for the various strategies.

#### 4.6 Research Limitations

The following limitations may be relevant to this study:

1. The research will be limited to stocks which receive sufficient following to warrant forecasts by analysts over the test period, and thus will not be representative of all stocks;
2. The style engine does not account for transactional costs and since the rebalancing period differs there will be more transactions for a shorter rebalancing period than a longer rebalancing period over the 10 years of data;
3. An assumption of infinite trading capital will be made which may result in impractical actions by the style engine;
4. Assessment and trading of shares will only occur at discrete moments in time and thus there will be a limitation with respect to real life simulation and application of the trading strategies;
5. The outcomes will only be applicable to this data set, and the experiment would need to be repeated on other more extensive data sets in order to reach conclusion on properties which can be said to describe PEG trading strategy in general.

## Chapter 5. Results

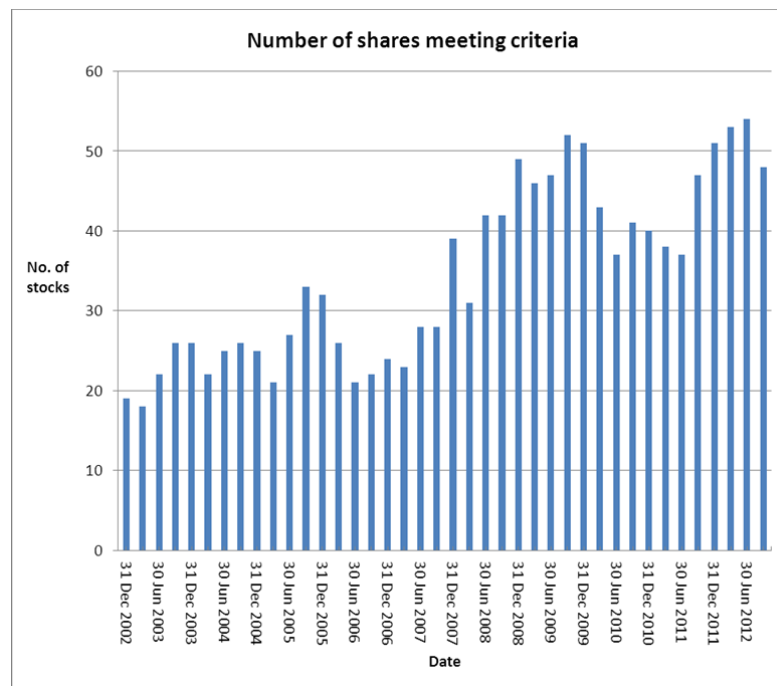
### 5.1 Data Description

The analyst forecast data was obtained from a database built up by Chris Muller originally obtained from INET.

During the period from 2002 the stocks used varied depending on what companies met the criteria described in section 4.2.

For the sake of simplicity and consistency, the 3 strategies employed wherein the PEG portfolios were rebalanced every 3, 12, or 24 months will henceforth be referred to as the 3 month, 12 month, and 24 month strategies.

#### 5.1.1 Data for 3 month strategy



**Figure 9** Number of stocks for the 3 month strategy

The number of companies included after every 3 months are shown in **Figure 9**. At no time was the same number of companies selected as the previous period. There was a general increase in number of companies which met the criteria as time went on.

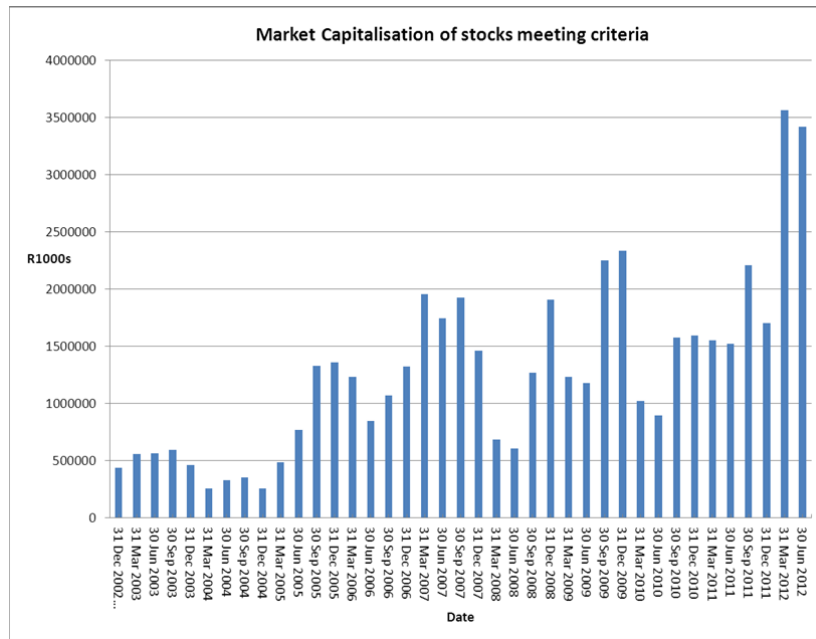


Figure 10 Total market capitalisation of stocks used for the 3 month strategy

Total market capitalisation of all the companies represented in Figure 9 is shown in Figure 10. There is a corresponding upward trend in total market capitalisation.

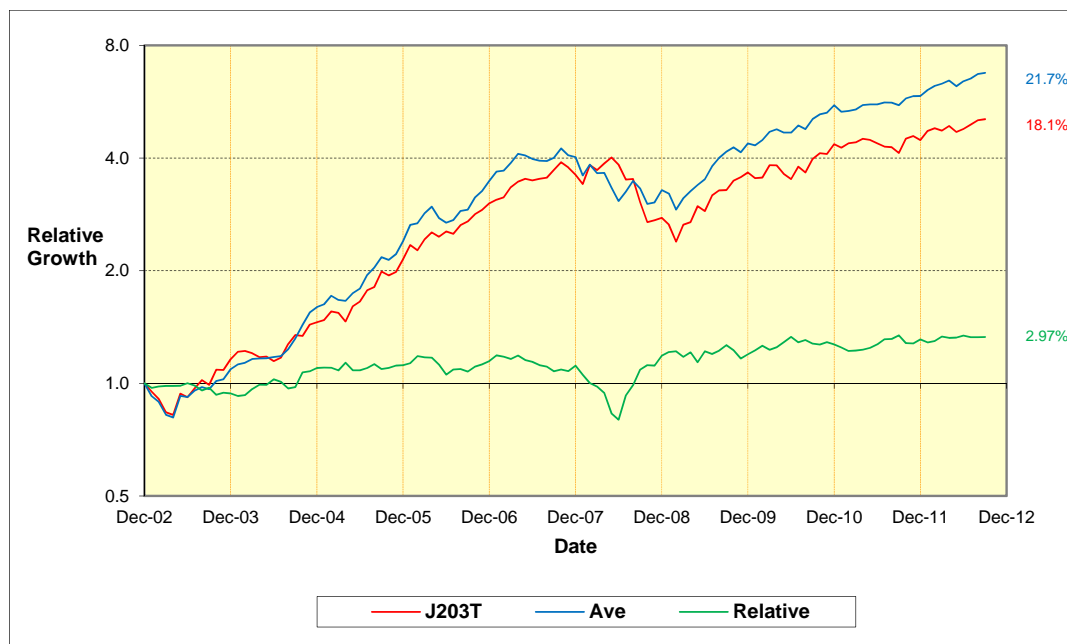
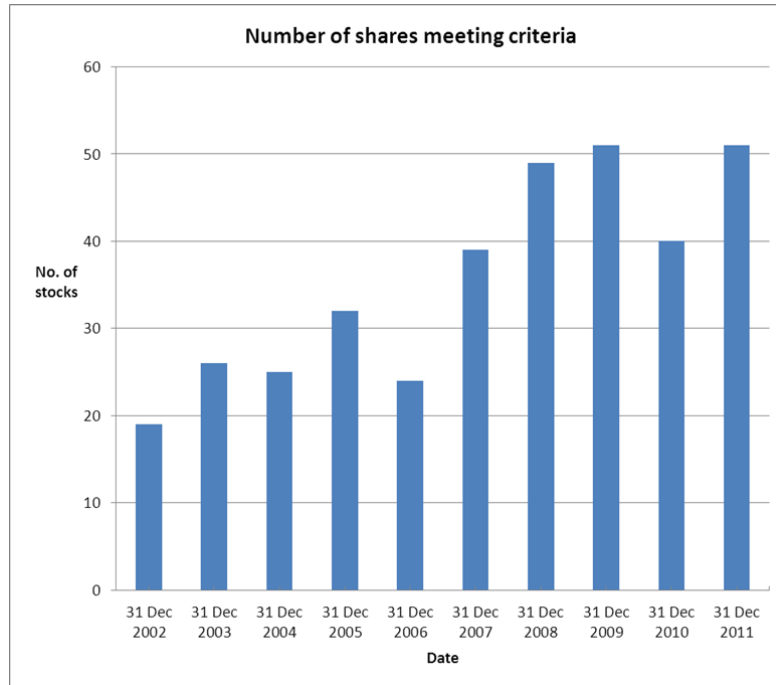


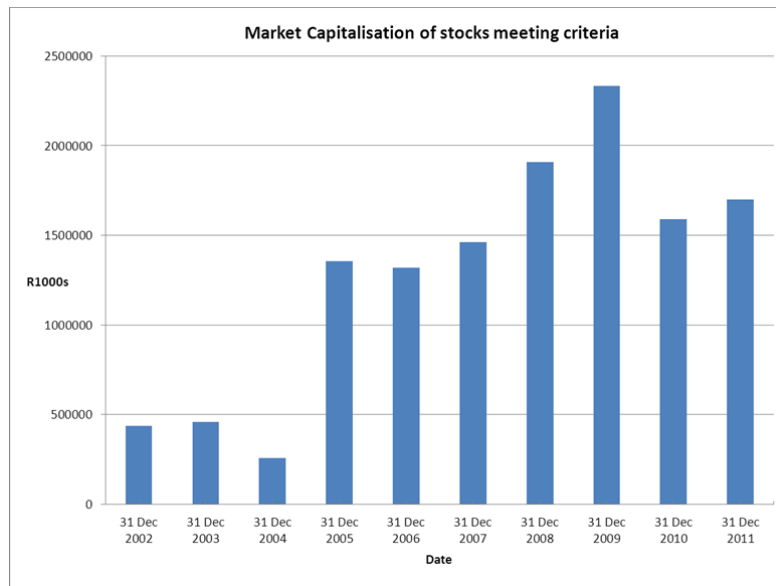
Figure 11 Growth of stocks meeting criteria every 3 months versus all stocks in the J203T

Average growth of all stocks selected for the PEG ratio portfolios is shown in **Figure 11** against the returns over the same period of the J203T. A plot describing the relative growth is also present in order to provide clarity for the comparison.

### 5.1.2 Data for 12 month strategy

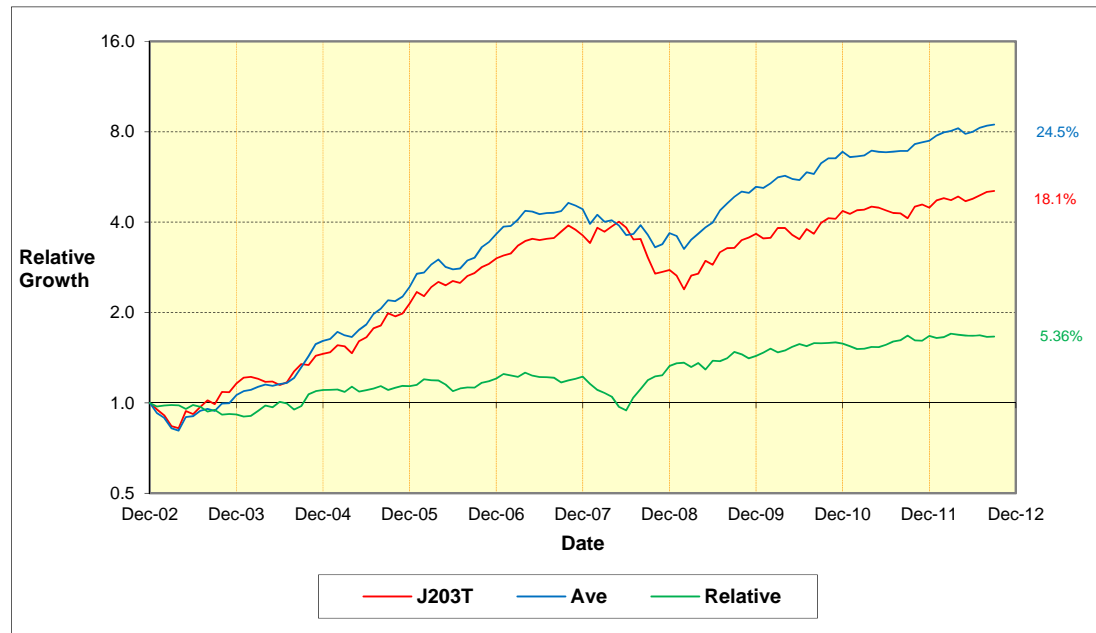


**Figure 12** Number of stocks for the 12 month strategy



**Figure 13** Market Capitalisation of stocks used for the 12 month strategy

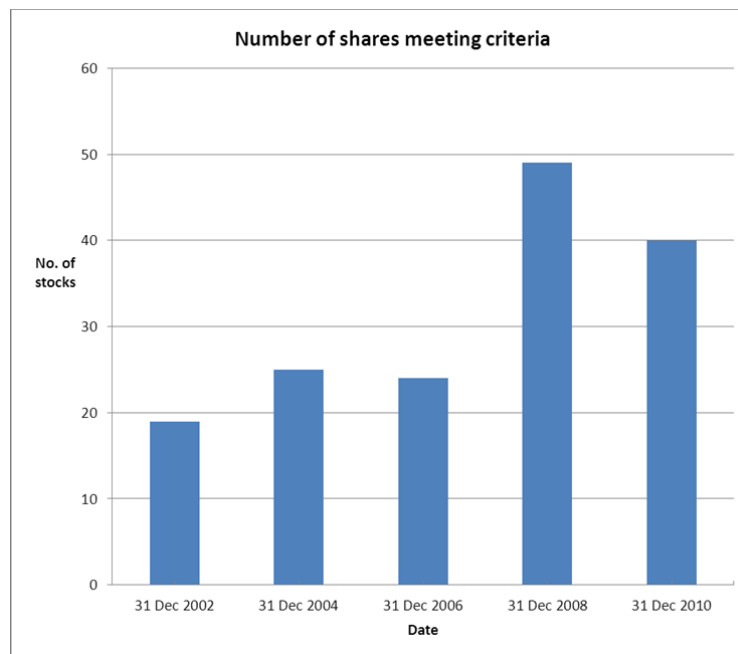
The number of shares which met the criteria every 12 months for the 12 month strategy and corresponding market capitalisations are depicted in **Figure 12** and **Figure 13**. These data are subsets of the data described by **Figure 9** and **Figure 10**



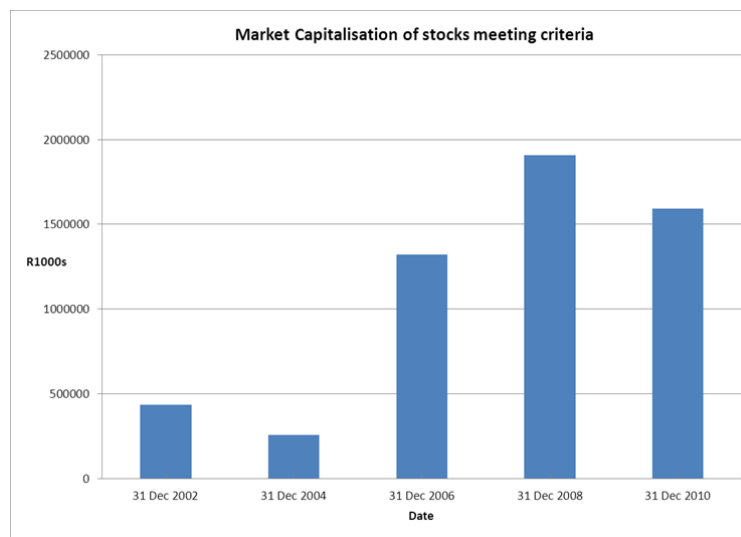
**Figure 14** Growth of stocks meeting criteria every 12 months versus all stocks in the J203T

The growth of the stocks selected every 12 months is compared to that of the J203T over the same period and a relative plot is provided as **Figure 14** which shows that the stocks outperformed the J203T by a compound annual growth rate (CAGR) of 5.36%.

### 5.1.3 Data for 24 month rebalancing period



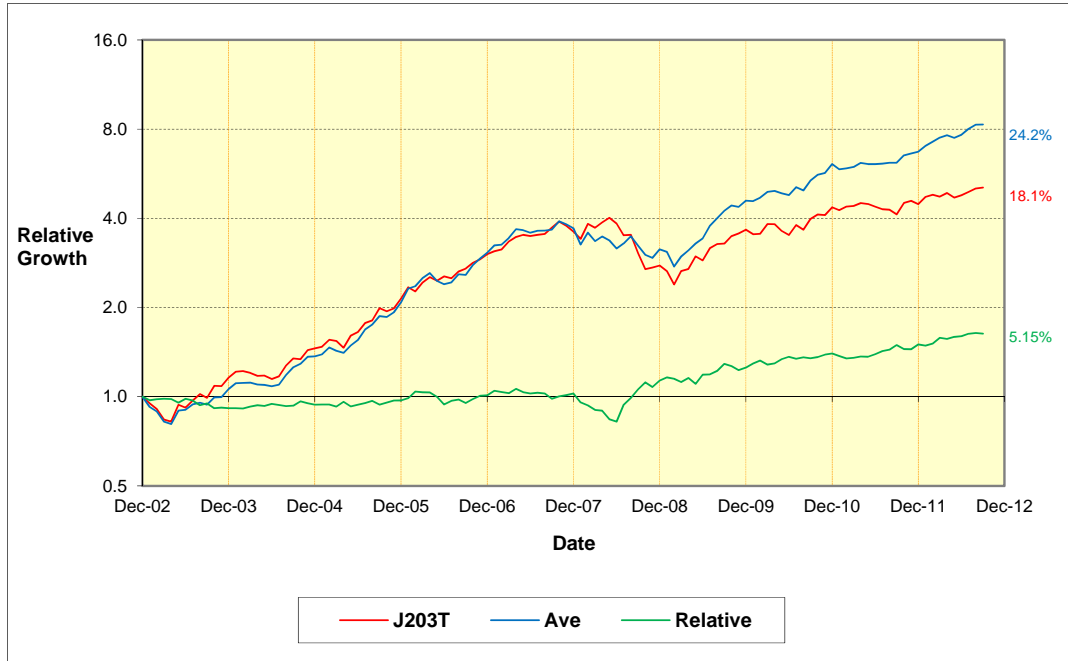
**Figure 15** Number of stocks for the 24 month strategy



**Figure 16** Market Capitalisation of stocks used for the 12 month strategy

Once again **Figure 15** and **Figure 16** are subsets of the previous data provided and they show the number of shares and corresponding market capitalisation thereof at the time of rebalancing.

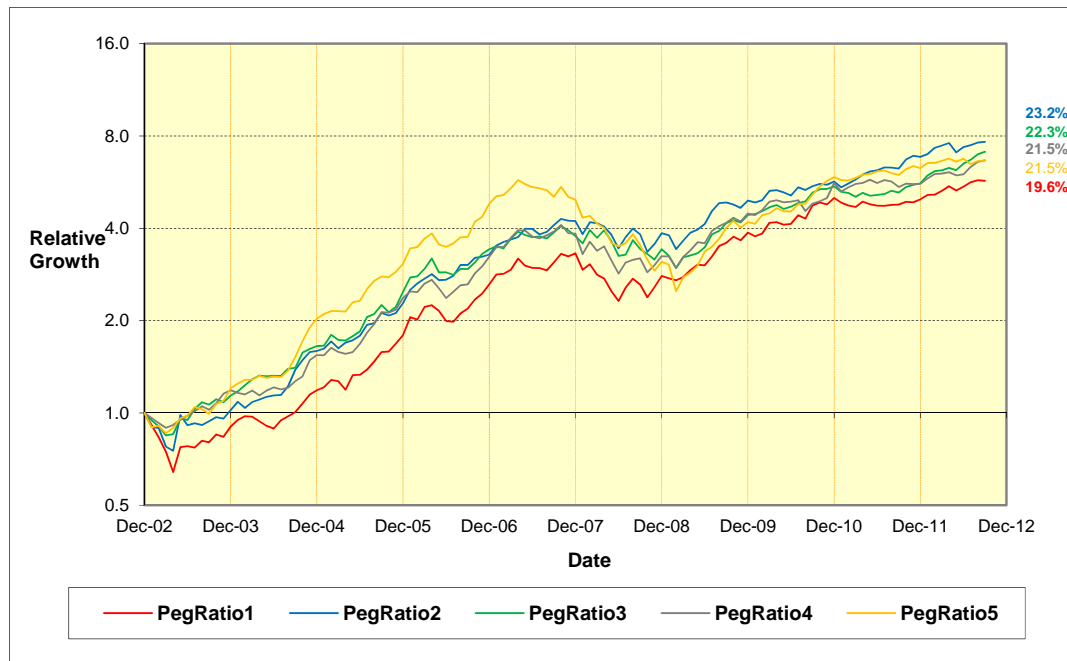




**Figure 17** Growth of stocks meeting criteria every 24 months versus all stocks in the J203T

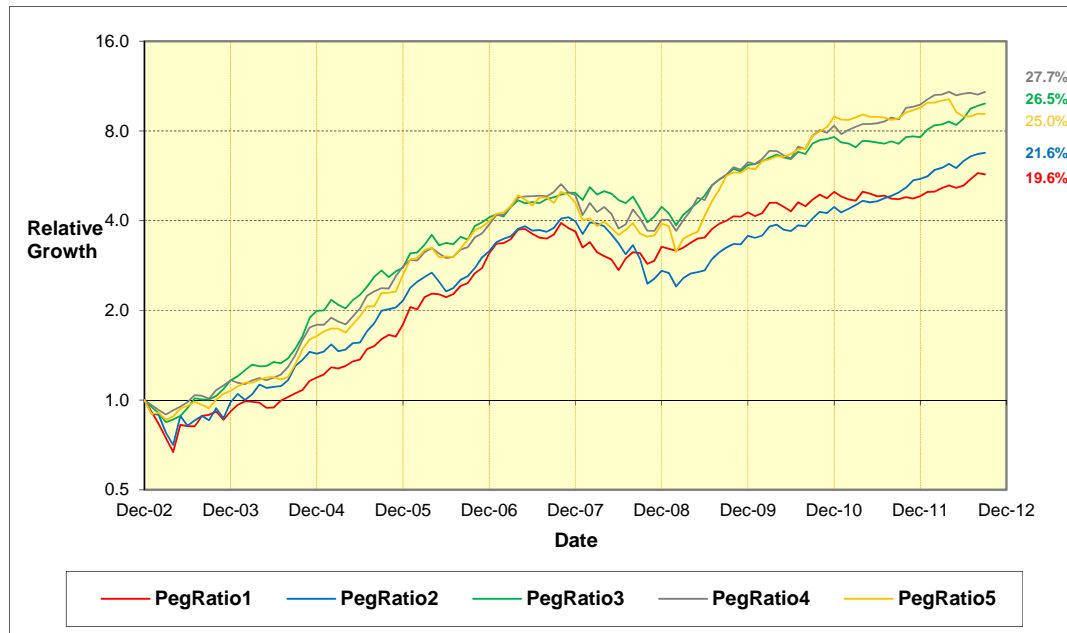
The growth of the stocks meeting the criteria for the 24 month strategy portfolios outstripped that of the J203T by 5.15% CAGR.

## 5.2 Performance of the three strategies



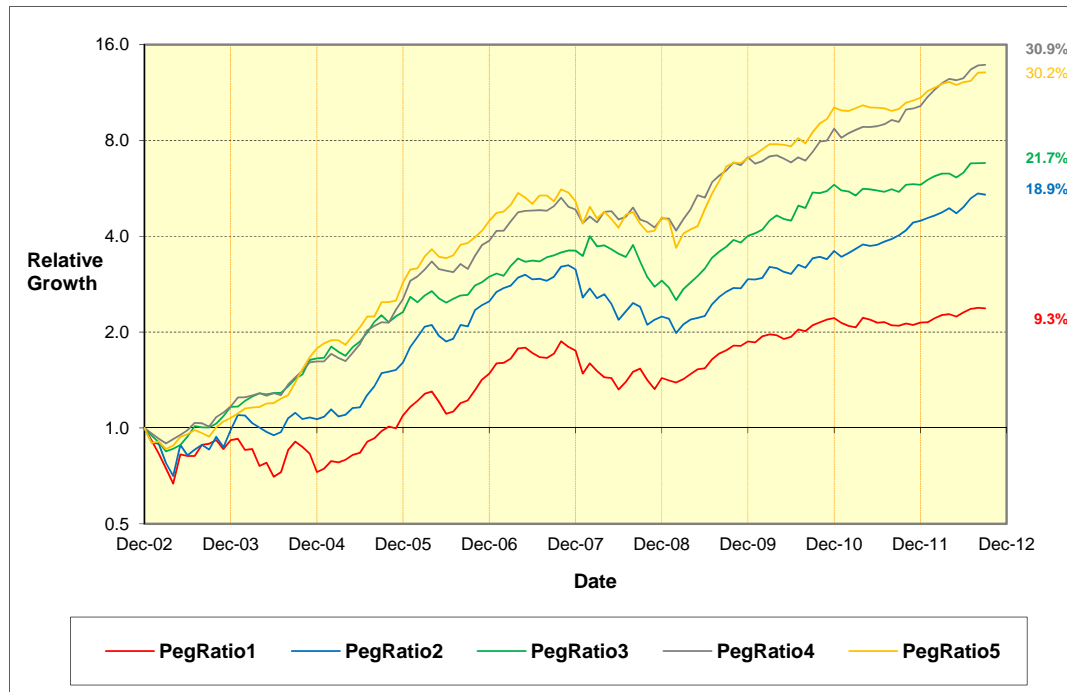
**Figure 18** Returns of five PEG portfolios rebalanced every 3 months

The growth of the five portfolios of the stocks which were rebalanced every 3 months is shown in **Figure 18**. The different portfolios all have CAGRs of between 19.6% and 23.2%. Pair-wise comparisons reveal that in four out of the ten cases, a portfolio with lower ranked PEG stocks (lower PEG ratios) have superior growth to higher ranked portfolios, while in 6 cases they do not.



**Figure 19** Returns of five PEG portfolios rebalanced every 12 months

The returns of the five PEG portfolios which were rebalanced on a 12 monthly period are presented in **Figure 19**. The range of CAGR for these portfolios is greater than that of **Figure 18** with a maximum of 27.7% and minimum of 19.6%. The pair-wise comparisons in this case reveal that in eight out of ten cases, lower PEG ratio portfolios outperform higher PEG ratio portfolios.



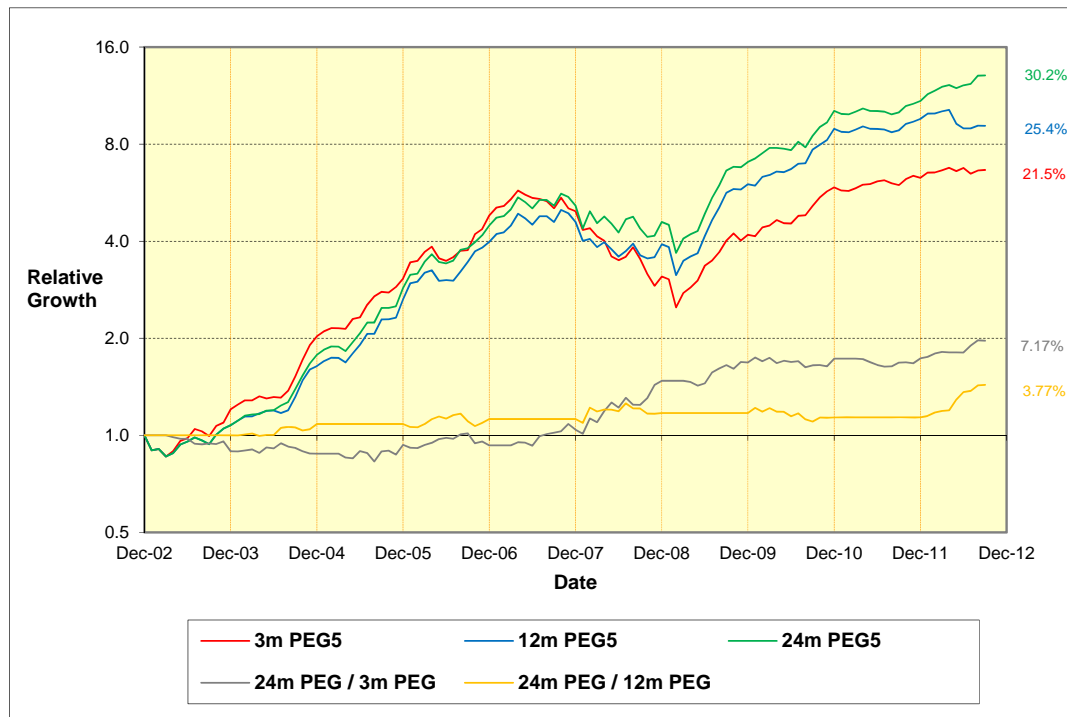
**Figure 20** Growth of five PEG portfolios rebalanced every 24 months

While the lowest CAGR of **Figure 18** and **Figure 19** were both 19.6 %, the minimum CAGR of the portfolios which are rebalanced every 24 months is 9.3% as can be seen in **Figure 20**. The Maximum CAGR is a great deal higher than either of the previous values 30.9%, so the range over which the portfolio returns are spread is considerably larger than either of the previous examples. Pair-wise comparisons show that with the 24 month strategy, nine out of ten portfolios with lower PEG ratio stocks outperform higher PEG ratio portfolios.

Since theory suggests that portfolios with low PEG ratios will produce higher returns than those with higher PEG ratios, **Figure 21** presents the returns of the PEG 5 portfolios which represent the returns of the portfolios holding the stocks with the lowest PEG ratios. Although these returns have not been the highest in any of **Figure 18**, **Figure 19**, or **Figure 20** they are compared to each other to ensure that in comparing the different timing strategies like is compared with like.

The best performing PEG 5 portfolio is that of the 24 month strategy and thus plots showing the relative performance against the PEG 5 of the 3 month and 12 month strategies are included in **Figure 21**.

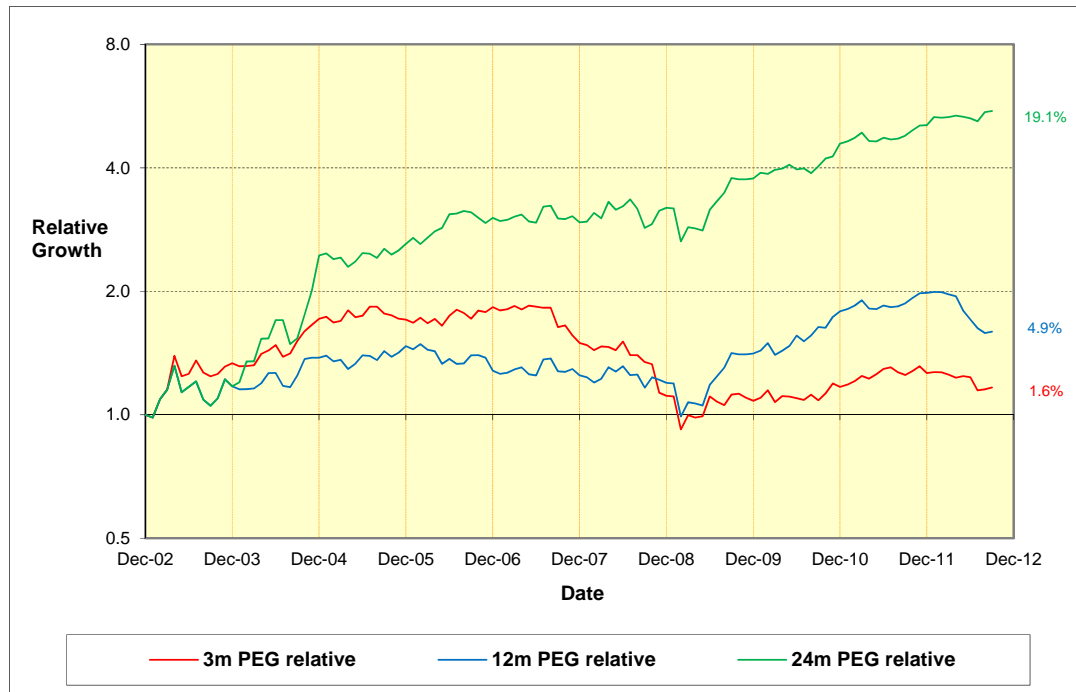
While the comparison between growth of the 12 month and 24 month strategies reveals a straight line of consistent increase, the comparison between the 3 month and 24 month rebalancing strategies shows a much less linear relationship. It would appear that the 24 month rebalancing strategy achieved most of its gains over the 3 month strategy in 2008 and 2009, while returns over the before and after periods show much less divergence, if at all.



**Figure 21** Comparison of growth of lowest PEG value portfolios of the three rebalancing periods

### 5.3 Comparison of high PEG versus low PEG portfolios

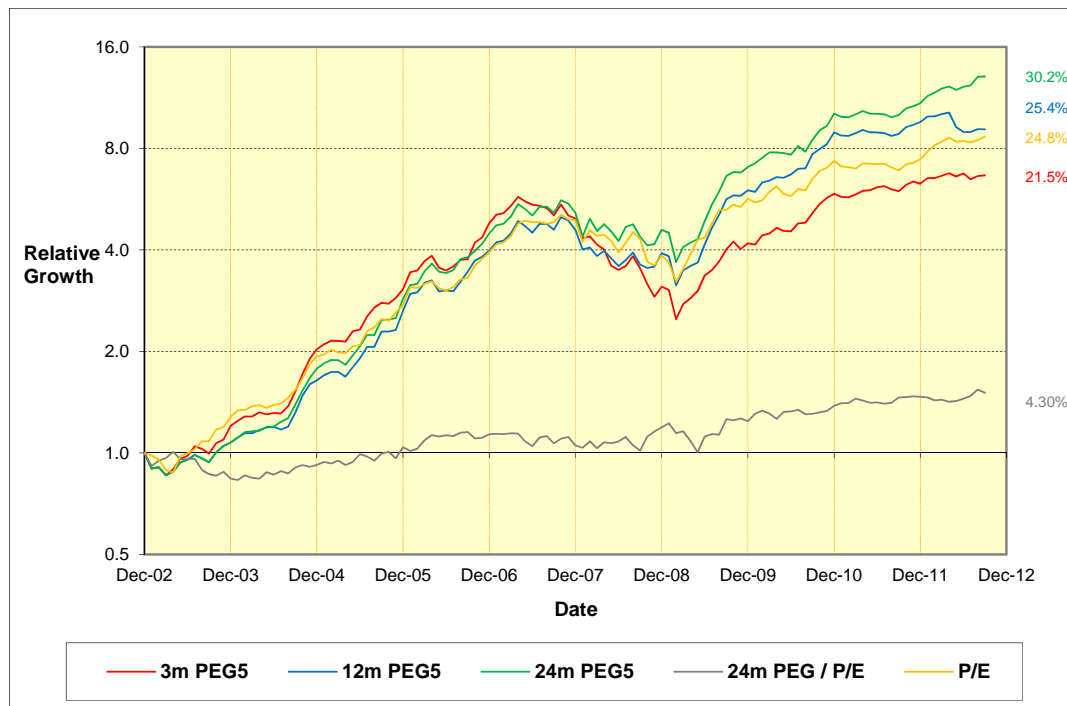
**Figure 18**, **Figure 19**, and **Figure 20** each show the returns of five portfolios which are determined based on the values of the PEG ratios of the stocks, which are then rebalanced every 3 months, 12 months, or 24 months respectively. In each, PEG 1 holds the stocks with the highest PEG ratios, while PEG 5 holds the stocks with the lowest PEG ratios.



**Figure 22** Relative-value plots of lowest-PEG ratio quintile versus highest-PEG ratio quintile (PEG 5 / PEG 1) for each strategy investigated

The plots in **Figure 22** represent the degree to which the PEG 5 portfolios consistently outperform the PEG 1 portfolios in each case. The only occasions where the PEG 5 portfolios did not outperform the PEG 1 portfolios were in February 2009 for the 12 month rebalancing strategy and February to April 2009 for the 3 month rebalancing strategy.

### 5.4 How does a low P/E ratio portfolio compare?

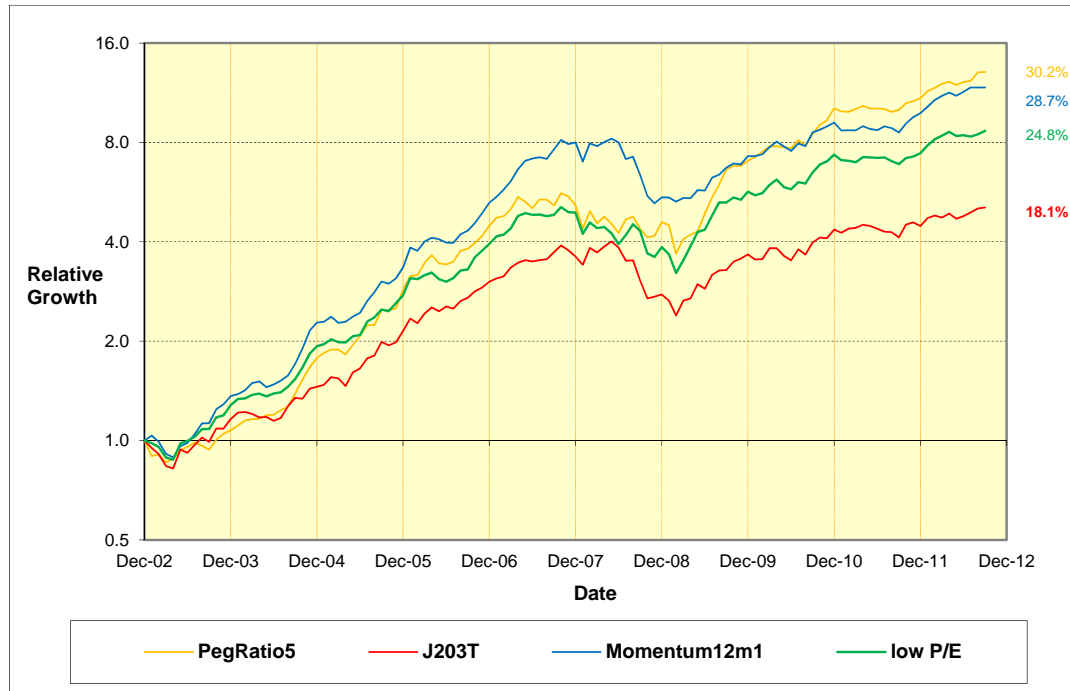


**Figure 23** Lowest-PEG ratio quintile of each rebalancing period and lowest-P/E ratio quintile

The three PEG 5 portfolios are compared to a low P/E ratio portfolio in **Figure 23**. The 12 month and 24 month rebalancing strategies achieve growth rates which are superior to that of the low P/E ratio portfolio, and the 3 month rebalancing low PEG ratio portfolio has the lowest returns at 21.5% CAGR.

A curve is plotted to show the rate at which the 24 month rebalancing PEG 5 portfolio outperforms the low P/E portfolio. After a year where the low P/E ratio portfolio outperforms the PEG 5, it appears that the PEG 5 then grows at a consistently faster rate than the low P/E ratio stocks.

As a final measure of the performance of the 24 month rebalancing low PEG strategy, a comparative plot is made which compares the low PEG, low P/E, J203T, and the momentum strategy used by Muller & Ward (2012). **Figure 24** shows the comparison of these different stock strategies and it is shown that the low PEG strategy slightly outperforms the momentum strategy, while being significantly higher than the other two.



**Figure 24** Lowest-PEG ratio quintile of 24 month rebalancing period and various portfolio styles from (Muller & Ward, 2012)



## **Chapter 6. Discussion**

### **6.1 Properties of the data**

While the selection criteria were designed to exclude stocks with characteristics that would either be problematic with our formulae or were deemed to be outliers, a larger number of the original 160 large market capitalisation shares were excluded than originally expected. As with any data selection which is convenient and judgemental, there are consequences due to the selection process, in this case positive selection biases were discovered, and the sample sizes were greatly reduced. The revelation of the small sample sizes were only made very late in the write-up stage of the dissertation and consequently any opportunity to investigate the drivers and repercussions thereof was extremely limited.

### **6.2 Hypothesis 1: Returns of PEG ratio portfolios depend on the forecasting and rebalancing period used**

There has been a great deal of research on the superiority of analysts' forecasts over time series methods of forecasting, and the conclusion is generally that analysts' forecasts are superior due to exposure to more information than time series models, and the timing advantage when making the forecasts.

This research, however, has tended to be done with small samples compared to the samples size available presently. Bradshaw et al. (2012) found that for a 1 year forecast, analyst forecasts were superior, but over a longer period, a simple extrapolation of this one year forecast was more accurate than the longer term forecast itself.

Since PEG portfolios are derived by rankings of stocks' PEG ratios and are not dependent on the absolute PEG values, for our purposes the accuracy of analysts' forecasts is not as important as the consistency of any errors which may be part of the forecasts. For instance, if all forecasts have a positive bias of the same percentage, then because all stocks' P/E ratios are divided by forecasted growth, all the absolute PEG ratios will be smaller than the correct PEG ratio, but all by the same percentage. Thus if they are ranked, they will still have the same order as the correct PEG values' rankings.

The portfolio which is expected to achieve the highest returns is the one with the lowest PEG ratio, and thus the lowest 20% ranked PEG ratios. Using this as a comparative measure would give some insight as to whether or not the different forecast and rebalancing periods have an effect on the returns of the PEG ratio portfolio.

Another method used to assess the performance of a style is employed by Muller and Ward (2012) where the outperformance of the quintile with the highest expected returns versus that with the lowest expected returns is measured. Using a second method such as this allows the outcome of the high return portfolio method to be either supported or opposed.

The absolute returns of the three forecast and rebalancing strategies can however not be taken without some investigation into the nature of the stocks in each of the strategies.

Sections 5.1.1, 5.1.2 and 5.1.3 explore the shares and market capitalisations of the stocks meeting the criteria for each of the three strategies at each rebalancing, and there are found to be large differences.

For this reason the average growths of these stocks are plotted in **Figure 11**, **Figure 14** and **Figure 17** and the CAGR of the stocks over the 10 year period are found to be 21.7%, 24.5%, and 24.2% for the 3, 12, and 24 month strategies respectively. Thus, the selection of the stocks introduced a positive selection bias of 2.97%, 5.36% and 5.15% CAGR for the 3, 12 and 24 month strategies.

When focus is shifted to the portfolios within each strategy, it is found that the CAGRs of the lowest PEG portfolio (PegRatio5) are 21.5%, 25.0%, and 30.2% for the 3, 12, and 24 month strategies respectively. While the returns of the 3 and 12 month strategies are very similar to the average returns of all the stocks in their portfolios, the CAGR returns of PegRatio5 for the 24 month rebalancing period is around 6% higher. In terms of annual investment returns, this is indeed a large number. Thus the 24 month rebalancing strategy performed very differently to the 3 and 12 month strategies in this measure. In **Figure 21** the measure of this outperformance is plotted across the 10 year period under investigation. While the outperformance of the 12 month rebalancing strategy is consistently increasing, that of the 3 month rebalancing period has a period where rapid growth occurs in 2008 and 2009. This was

an extremely volatile period over the financial crisis, and until then, the 3 month strategy was consistently outperforming both the 12 and 24 month strategies.

In terms of the measures used by Muller and Ward (2012) where the high and low expected return portfolios are measured, **Figure 22** shows three plots which represent the CAGR by which PegRatio5 out performed PegRatio1 in each of the strategies. All three indicate that the PegRatio5 portfolios outperformed the PegRatio1 portfolios, but with differing degrees of success. The 3 month rebalancing strategy showed only a 1.6% difference, the 12 month, a 4.9% difference, and the 24 month strategy a great deal higher at 19.1% CAGR of the PegRatio5 over the PegRatio1.

The alternative hypothesis states that returns of PEG ratio portfolios will be dependent on the forecasting and rebalancing period, and the null hypothesis states that the returns of PEG ratio portfolios will be independent of the forecasting and rebalancing period.

It is clear from the above that there is a difference between returns and spreads of portfolios of the different rebalancing periods, particularly where the 24 month strategy has very different outcomes to those of the 3 and 12 month strategies, and the alternative hypothesis is thus supported.

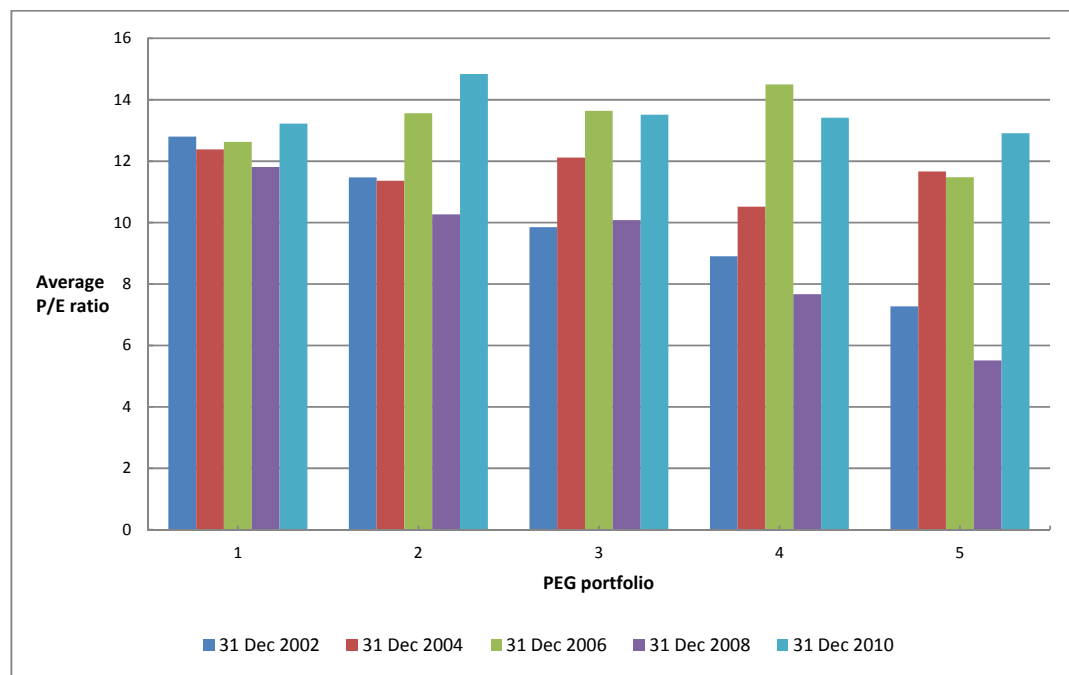
### **6.1 Possible Reasons for unexpected results**

While the growth exhibited by the portfolio with the lowest PEG stocks (PegRatio5) was equivalent to the average stock growth for the 3 and 12 month strategies, the PegRatio5 growth for the 24 month strategy was clearly superior to the average stock growth. Also, the spread of the portfolios, captured by the PegRatio5/PegRatio1 CAGRs in **Figure 22** increase according to the number of months used for the strategies.

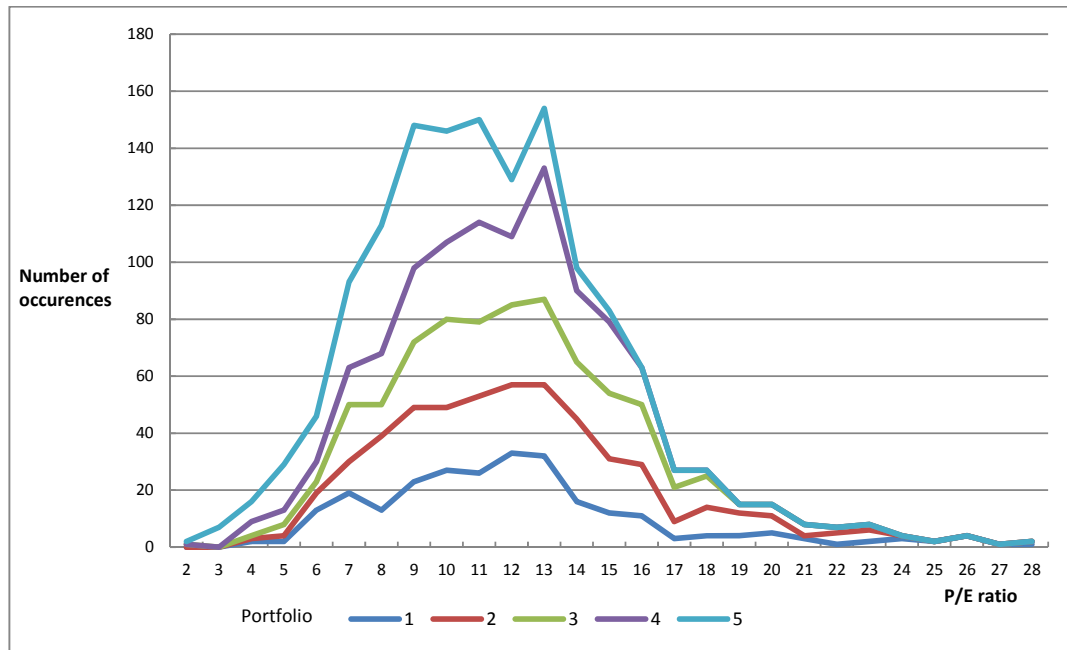
Because literature points to a one year horizon (or even shorter term) analyst forecast as being the most accurate (Bradshaw et al., 2012), it would be expected that a portfolio holding period based on this would produce superior returns. However, as mentioned above it is not the accuracy of the forecasts which is important, but the consistency of the forecast biases which will ensure that the stocks are ranked correctly. (Lim, 2002) finds that forecast bias varies predictably with the richness of a company's information environment, with companies which have fared poorly being associated with greater uncertainty or inferior disclosures. The

selection criteria in section 4.2 are such that poorly performing companies are excluded and thus in terms of forecast bias, the resulting sample is more homogenous. Consequently forecasts can be expected to yield accurate PEG ratio ranking, even over the longer term, where forecast bias is usually more varied.

An alternative approach would be to analyse the stocks of which the portfolios consist. **Figure 25** shows the average P/E ratio per quintile for each of the rebalancing occasions in the 24 month strategy. The comparison between portfolios shows that portfolio 5 generally had lower P/E ratios than the rest, and that the P/E ratios increased as the PEG ratios rankings increased. In order to reflect the spread of the P/E ratios which make up the averages in **Figure 25**, **Figure 26** is a stacked line graph which shows the frequency of P/E ratio occurrences for each portfolio. In evaluating this graph, care must be taken to see that the number of any occurrences is cumulative. For example, the y-axis value for any portfolio 5 data point is the total of all portfolios, and the number of occurrences for the portfolio 5 at this P/E ratio is this y-axis value minus the y-axis value of the portfolio 4 plot. The reason that such an unusual graph has been used is that the data are very difficult to express using conventional graphs.



**Figure 25** Average P/E ratios for stock of each portfolio of every rebalancing of the 24 month strategy



**Figure 26** Stacked line graph indicating the frequency of occurrences of P/E ratios for each portfolio

Nonetheless, it can be said that portfolio 5 stocks tend to be value stocks, and as the PEG ratios increase in ranking, so the nature of the stocks tends towards the nature of growth stocks.

As was articulated by (Bodie et al., 2005), P/E ratios are primarily an indication of future growth, and thus stocks with low P/E ratios may be so because of investor pessimism and low historic growth. In this case, in order for the PEG ratio to be ranked in portfolio 5, forecasted growth should be relatively strong compared to previous investor expectations, and thus the effect of a comparatively low historical growth as discussed in section 2.6 may play a factor here.

To tie this in with the selection of an optimal rebalancing period, (Pierson, 2011) found evidence of companies and industries undergoing profit cycles which were attributed to “time-to-build” or roughly, time taken in an industry to expand capacity. In the context of such findings, it is likely that the value stocks selected for portfolio 5 were accelerating in terms of earnings, and were thus on a positive trend. (Pierson, 2011) finds industry cycles to have periods varying from 2 to 36 quarters, with a mean of 21 quarters.

If stocks selected for portfolio 5 had a profit cycle of around 20 quarters, and rebalancing occurred after 1 quarter or 4 quarters, the P/E ratios may have significantly increased along with the PEG value, and thus these stocks would mostly be left out of portfolio5, even though they are experiencing strong growth that will continue for some time still. By rebalancing too early the portfolio misses the opportunity to ride out the strong growth and reap the rewards for picking a good value stock which was just turning the corner into extended earnings growth.

## 6.2 Hypothesis 2: A low PEG ratio portfolio outperforms a higher PEG ratio portfolio

Previous research tells us that we should expect a high return in value from a low PEG ratio stock. We set out to empirically test this notion to see if it applies to the selection of data available, that is, all stocks on the Main board of the JSE to meet certain criteria between December 2002 and September 2012.

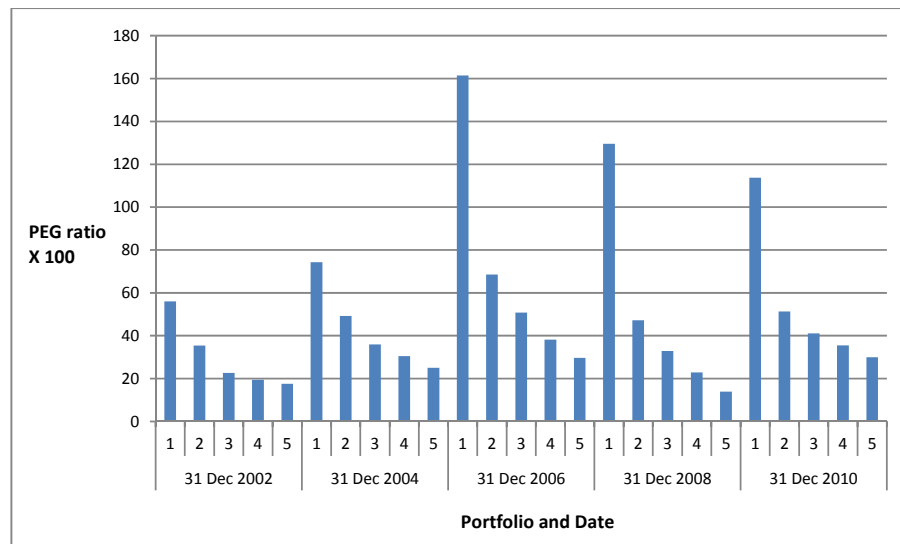
At face value, the hypothesis does not appear to hold water when employing the 3 month strategy. The CAGR returns over the period were 19.6%, 21.5%, 21.5%, 22.3%, and 23,2% for the portfolios 1, 4, 5, 3, and 2 respectively, where 5 is the portfolio with the lowest PEG ratios and 1 with the highest (see **Figure 18**).

Using the method employed by (Muller & Ward, 2012) to visually compare the cumulative returns, **Figure 18** presents a picture which is anything but clear. The plots of the five portfolios are most often very close to each other and regularly cross. It would appear that the order of the outcome of magnitude of cumulative returns is random. Even though portfolio 1 has the lowest return as is expected, portfolio 2 has the highest. Portfolios 4 and 5, which should be performing well, show returns which are together the second lowest. Pair-wise comparisons of each portfolio's final returns versus those of each of the others' reveal that only four support the alternative hypothesis, and the null hypothesis is supported by six out of the ten cases.

The picture changes somewhat when **Figure 19** is observed. The spread of returns for the 12 month rebalancing strategy is a great deal larger than that of the 3 month strategy. The returns follow an order of 1, 2, 5, 3, 4 from lowest to highest. Other than the positioning of portfolio 5, the portfolio returns follow the order as expected by theory and research. When one looks at the graph to visually assess the data it is evident that, as with **Figure 18**, the rank in which portfolios find themselves changes frequently. For portfolios 1 and 2, the returns are relatively close to each other. Also for portfolios 3, 4, and 5, the returns appear to be very closely tied. It is however observable that portfolios 1 and 2 perform consistently worse than portfolios 3, 4 and 5. In eight out of ten cases, a lower PEG ratio portfolio outperforms a higher PEG ratio portfolio, the only exceptions in this case are where portfolios 3 and 4 outperform portfolio 5.

When the forecast and rebalancing period is stretched to 24 months, a clearer picture emerges. The order in which the portfolios provide returns is now 1, 2, 3, 5 then 4, from lowest to highest. The CAGRs, which can be seen in **Figure 20**, are 9.3%, 18.9%, 21.7%, 30.2%, and 30.9% respectively. The range is thus comparatively vast between the low and high return portfolios, and the order in which they are expected to occur from theory is almost exactly correct. The only case where this does not occur is where portfolio 4 outperforms portfolio 5 by a small margin. In fact, these two portfolios have consistently produced very similar returns over the 10 year period of the study. In the case of the 24 month rebalancing strategy it would appear that the alternative hypothesis can be supported in 9 out of 10 cases, the only case being where portfolio 4 produces higher returns than portfolio 5.

In the absence of other data, it would appear that the lowest 40% of stock PEG ratios perform equally well. Indeed, the PEG 4 portfolio was the highest performing portfolio in both the 12 and 24 month strategies. A closer look at the magnitude of PEG ratios in each portfolio does not yield any unexpected information (**Figure 27**).



**Figure 27** Average PEG ratio per portfolio of each rebalancing year of the 24 month strategy

As expected, the values increase fairly uniformly from portfolio 5 to portfolio 2 in all cases. The fact that we are left with 40% of the PEG stocks performing that well, leads one to believe that there is an opportunity to further refine the strategy in order to improve the outcome.



### 6.3 Hypothesis 3: A low PEG ratio portfolio outperforms a low P/E portfolio

Since PEG is often described as a hybrid strategy using both growth and value strategies, it is important to ascertain if PEG itself provides value that is not captured by either growth or value stocks.

Since a great deal of literature exists to suggest that value stocks outperform growth stocks, it was decided that the easiest way to determine if the PEG ratio adds value, was to compare it to value stock returns.

**Figure 23** shows the returns of the PEG 5 portfolios of the three strategies compared to the low P/E quintile used by Muller and Ward (2012). It is evident that since the end of 2008, both the 12 and 24 month rebalancing strategies outperform the low P/E portfolio, but the 3 month rebalancing strategy returns the lowest growth of all at a CAGR of 21.5%.

The relative growth of the 24 month PEG 5 portfolio versus that of the low P/E portfolio is also plotted on **Figure 23** as '24m PEG / P/E'. After an initial outperformance by the low P/E ratio over the low PEG ratio, the low PEG ratio portfolio delivers consistent outperformance of the low P/E ratio portfolio.

In the case of the 12 and 24 month rebalancing period strategies the alternative hypothesis is thus supported, while for a 3 month rebalancing period, the alternative hypothesis is rejected and the null hypothesis supported.

What is especially relevant in this case is that, as can be seen in **Figure 25**, the PEG 5 portfolio has the lowest average P/E ratio in four of the five rebalancing periods. It would appear that in this case the PEG 5 portfolio was able to select the pick of the value stocks, while the other portfolios also had some value stocks, but evidently those with far weaker performance over the 24 month holding period. **Figure 26** provides some insight into this spread of P/E ratios.

One area of concern is that the Value portfolio had a 3 month rebalancing period, and although it performed well, it may, like the PEG strategy performed optimally at a longer rebalancing period.

## Chapter 7. Conclusion

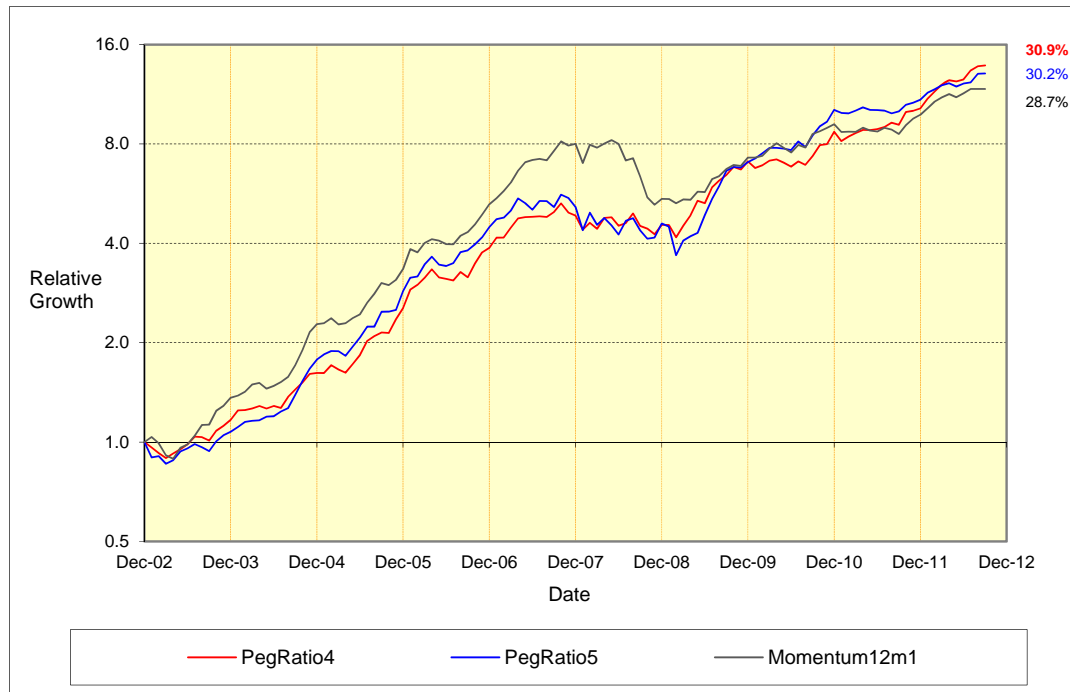
The three strategies point to the 24 month strategy being the most successful in terms of growth and spread of the different portfolios within the strategies. In fact, when taking into account the positive selection bias for each sample, the performance of the 3 and 12 month strategies appear to offer little value above the value gained by selection of the sample. This suggests that the performance of PEG ratio based portfolios is highly dependent on a suitable holding period for the shares.

The apparent grouping of portfolios PEG 3, 4, and 5, and PEG 1 and 2 in the 12 month strategy does show that there is a differentiation at this holding period between low and high PEG ratio stocks, but that there is much space for optimisation.

The 24 month strategy results show that some of this optimisation is achieved by doubling the holding period. Portfolios PEG 4 and 5 are still however very close together, and this would hint at yet further opportunity for style optimisation. Alternatively, this observation could support the methodology employed by l'Ons and Ward (2012), Schnabel (2009) and Trombley (2008) where a threshold is employed to determine which stocks to buy, and it could be coincidental that in our study, 40% of these stocks were more or less in the appropriate PEG ratio band.

As the holding period increased, the spread of the portfolios and the alignment to the expected rank in terms of growth of each portfolio increased. This is a positive sign which once again points to the importance of a suitable holding period of the PEG stocks in order to realise maximum returns.

The spread of CAGRs for the 5 portfolios of the 24 month strategy was very reassuring indeed that there is value in employing a PEG ratio based strategy. The high CAGR achieved by PEG 4 and 5, albeit partly due to selection bias, was very impressive indeed, and when compared to the momentum strategy which Muller and Ward (2012) found to deliver the highest returns of all investing styles which they examined, the PEG 4 and 5 portfolios achieved higher CAGRs overall (see **Figure 28**).



**Figure 28** PEG 4 and 5 of 24 month strategy versus momentum strategy of Muller and Ward (2012)

Although the momentum strategy consistently outperformed the PEG strategy up until 2008, performance subsequent to this has been superior for the PEG portfolios. One reason may be that the momentum strategy suffers somewhat in a volatile environment such as has been the case particularly over the period where the PEG strategy's outperformance was greatest (mid 2008 to end 2009). Similarly, the PEG strategy enjoyed more gains against the value strategy from 2008 onwards, when there was much volatility and uncertainty in the market. This apparent success during trying investment times is very interesting, and warrants further investigation, because it is during such times that much investor value is destroyed, and the PEG ratio may be a way to mitigate such destruction.

The finding that mostly value stocks were in PEG 5 is in contrast to that of (T. A. l'Ons, 2010) who determined that the stocks picked using his PEG trading rule criteria in fact tended to be growth stocks. He found that they had high P/E ratios, and thus relied on high growth rates to ensure low PEG ratios. If this were the case, the discussion relating to PEG being a resilient strategy in times of economic hardship may be mute, as growth stocks are known to be more suited to a bull market, as mentioned in section 2.3.

The conclusion to the question of whether or not the PEG ratio adds value, is a conditional 'yes'. If the holding period for the low PEG portfolio is adequate then, as was found by Schatzberg and Vora (2008), the interaction of price to earnings (P/E) and growth (G) provides an advantage that is not available for these separately (see section 1.1.2).

### **7.1 Future Research**

During the course of the study, the author has come across a number of compelling ideas which may warrant future research in order to better understand the nature of the PEG ratio and returns achievable by employing it in an investment strategy. Some suggestions are as follows:

- In the discussion the author has repeatedly pointed to the fact that the success of the PEG ratio is highly dependent on the holding period used. It would be recommended that the effect of a much larger sample of holding periods on PEG ratio returns be investigated to determine if there is a sweet spot, or a range which is optimal;
- The success of PEG 4 and 5 of the 24 month strategy hints at there being an opportunity to further optimise the selection of these top 40% of PEG stocks. One method with which l'Ons (2010) experienced success was by using the historical growth rate as a differentiator, and thus the earnings acceleration based on historical growth rate and projected growth could prove to be a differentiating factor;
- The relative success of the PEG strategy over the volatile period in the market may warrant further investigation to determine if the PEG strategy is indeed a way to minimise losses after in a market crash.
- The low P/E curve against which the PEG portfolios were compared had a holding period of 3 months. It would be advisable to extend the holding period of these shares to see if there is a corresponding increase in returns for the low P/E portfolio. If this is the case, it may eliminate any perceived value attributed to the PEG strategy in this dissertation.

## References

- Abarbanell, J. S. (1991). Do analysts' earnings forecasts incorporate information in prior stock price changes? *Journal of Accounting and Economics*, 14(2), 147-165.
- Ackert, L. F., & Athanassakos, G. (1997). Prior uncertainty, analyst bias, and subsequent abnormal returns. *Journal of Financial Research*, 20(2), 263-273.
- Arshanapalli, B. G., Coggin, T. D., & Doukas, J. (1998). Multifactor asset pricing analysis of international value investment strategies. *The Journal of Portfolio Management*, 24(4), 10-23.
- Ball, R., & Brown, P. (1968). An empirical evaluation of accounting income numbers. *Journal of Accounting Research*, , 159-178.
- Bao, B. H., & Bao, D. H. (2004). Income smoothing, earnings quality and firm valuation. *Journal of Business Finance & Accounting*, 31(9-10), 1525-1557.
- Bell, P. W. (1961). *The theory and measurement of business income* Univ of California Press.
- Beneish, M. D. (1999). The detection of earnings manipulation. *Financial Analysts Journal*, , 24-36.
- Bhushan, R. (1989). Firm characteristics and analyst following. *Journal of Accounting and Economics*, 11(2), 255-274.
- Bodie, Z., Kane, A., & Marcus, A. J. (2005). *Investments* (international edition).

- Bradshaw, M. T., Drake, M. S., Myers, J. N., & Myers, L. A. (2012). A re-examination of analysts' superiority over time-series forecasts of annual earnings. *Review of Accounting Studies*, , 1-25.
- Brown, L. D., Hagerman, R. L., Griffin, P. A., & Zmijewski, M. E. (1987). An evaluation of alternative proxies for the market's assessment of unexpected earnings. *Journal of Accounting and Economics*, 9(2), 159-193.
- Brown, L. D., Richardson, G. D., & Schwager, S. J. (1987). An information interpretation of financial analyst superiority in forecasting earnings. *Journal of Accounting Research*, , 49-67.
- Brown, L. D., & Rozeff, M. S. (1978). The superiority of analyst forecasts as measures of expectations: Evidence from earnings. *The Journal of Finance*, 33(1), 1-16.
- Brown, P., Foster, G., & Noreen, E. (1985). *Security analyst multi-year earnings forecasts and the capital market* Amer Accounting Assn.
- Carhart, M. M. (2012). On persistence in mutual fund performance. *The Journal of Finance*, 52(1), 57-82.
- Chan, L. K. C., Jegadeesh, N., & Lakonishok, J. (1995). Evaluating the performance of value versus glamour stocks the impact of selection bias. *Journal of Financial Economics*, 38(3), 269-296.
- Chen, N., & Zhang, F. (1998). Risk and return of value stocks\*. *The Journal of Business*, 71(4), 501-535.

- Choi, Y. S., Lin, S., Walker, M., & Young, S. (2007). Disagreement over the persistence of earnings components: Evidence on the properties of management-specific adjustments to GAAP earnings. *Review of Accounting Studies*, 12(4), 595-622.
- Das, S., Levine, C. B., & Sivaramakrishnan, K. (1998). Earnings predictability and bias in analysts' earnings forecasts. *Accounting Review*, , 277-294.
- Dorfman, J. R. (1995, Feb 15, 1995). Big investor still reaps major gains, but stock-picking style has changed. *Wall Street Journal*, pp. A3.
- Doukas, J. A., Kim, C. F., & Pantzalis, C. (2002). A test of the Errors-in-Expectations explanation of the Value/Glamour stock returns performance: Evidence from analysts' forecasts. *The Journal of Finance*, 57(5), 2143-2165.
- Easton, P. (2002). Does the PEG ratio rank stocks according to the market's expected rate of return on equity capital? *Ohio State University Working Paper*,
- Easton, P. D. (2004). PE ratios, PEG ratios, and estimating the implied expected rate of return on equity capital. *Accounting Review*, 79(1), 73-95.
- Eugene, F., & French, K. (1992). The cross-section of expected stock returns. *Journal of Finance*, 47(2), 427-465.
- Fama, E., & French, K. (1996). Multi factor model explanation of asset prices. *Journal of Finance*, 50
- Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, 33(1), 3-56.

Fama, E. F., & French, K. R. (2008). Dissecting anomalies. *The Journal of Finance*, 63(4), 1653-1678.

Francis, J. R., & Wang, D. (2008). The joint effect of investor protection and big 4 audits on earnings quality around the world\*. *Contemporary Accounting Research*, 25(1), 157-191.

Fried, D., & Givoly, D. (1982). Financial analysts' forecasts of earnings: A better surrogate for market expectations. *Journal of Accounting and Economics*, 4(2), 85-107.

Gode, D. D., & Ohlson, J. (2006). A unified valuation framework for dividends, free cash flows, residual income, and earnings growth based models. *James A., A Unified Valuation Framework for Dividends, Free Cash Flows, Residual Income, and Earnings Growth Based Models (February 14, 2006)*,

Han, B. H., Manry, D., & Shaw, W. (1998). Uncertainty about future earnings as a determinant of bias in analysts' earnings forecasts. *Available at SSRN 2574*,

Hirschey, T., & Nofsinger, J. (2010). *Investments* McGraw-Hill.

Investopedia Staff. (2012a). *Stock-picking strategies: GARP investing*. Retrieved 10/24, 2012, from <http://www.investopedia.com/university/stockpicking/stockpicking5.asp#axzz2AG8bMhNK>

Investopedia Staff. (2012b). *Stock-picking strategies: Growth investing*. Retrieved 10/25, 2012, from <http://www.investopedia.com/university/stockpicking/stockpicking4.asp#axzz2AG8bMhNK>



I'Ons, T., & Ward, M. (2012). The use of price-to-earnings-to-growth (PEG) ratios to predict share performance on the JSE. *South African Journal of Business Management*, 43(2), 1-10.

I'Ons, T. A. (2010). Prof M ward supervisor.

Jegadeesh, N., Kim, J., Krische, S. D., & Lee, C. (2005). Analyzing the analysts: When do recommendations add value? *The Journal of Finance*, 59(3), 1083-1124.

Kothari, S. (2001). Capital markets research in accounting. *Journal of Accounting and Economics*, 31(1), 105-231.

Kothari, S., & Shanken, J. (1997). Book-to-market, dividend yield, and expected market returns: A time-series analysis. *Journal of Financial Economics*, 44(2), 169-203.

Kross, W., Ro, B., & Schroeder, D. (1990). Earnings expectations: The analysts' information advantage. *Accounting Review*, , 461-476.

La Porta, R., Lakonishok, J., Shleifer, A., & Vishny, R. (1997). Good news for value stocks: Further evidence on market efficiency. *Journal of Finance*, , 859-874.

Lakonishok, J., Shleifer, A., & Vishny, R. W. (1994). Contrarian investment, extrapolation, and risk, the journal of finance, december 1994.

Lang, M. H., & Lundholm, R. J. (1996). Corporate disclosure policy and analyst behavior. *Accounting Review*, , 467-492.

Lim, T. (2002). Rationality and analysts' forecast bias. *The Journal of Finance*, 56(1), 369-385.

Lynch, P. (1989). With john rothchiid, one up on wall street: How to use what you already know to make money in the market.

- Montier, J. (2009). *Value investing: Tools and techniques for intelligent investment* Wiley.
- Muller, C., & Ward, M. (2012). Style-based effects on the johannesburg stock exchange: A graphical time-series approach. *Available at SSRN 2018203*,
- Ohlson, J. A. (1995). Earnings, book values, and dividends in equity valuation\*. *Contemporary Accounting Research*, 11(2), 661-687.
- Ohlson, J. A., & Juettner-Nauroth, B. E. (2005). Expected EPS and EPS growth as determinantsof value. *Review of Accounting Studies*, 10(2), 349-365.
- Peasnell, K. V. (1982). Some formal connections between economic values and yields and accounting numbers. *Journal of Business Finance & Accounting*, 9(3), 361-381.
- Peters, D. J. (1991). Valuing a growth stock. *The Journal of Portfolio Management*, 17(3), 49-51.
- Peters, D. J. (1993). The influences of size on earnings surprise predictability. *The Journal of Investing*, 2(4), 54-59.
- Petkova, R., & Zhang, L. (2005). Is value riskier than growth? *Journal of Financial Economics*, 78(1), 187-202.
- Pierson, K. P. (2011). *Profit Cycle Dynamics*,
- Pontiff, J., & Schall, L. D. (1998). Book-to-market ratios as predictors of market returns. *Journal of Financial Economics*, 49(2), 141-160.
- Ross, S. A., Westerfield, R., & Jordan, B. D. (2008). *Fundamentals of corporate finance* Tata McGraw-Hill Education.

- Saunders, M. N. K., & Lewis, P. (2012). *Doing research in business and management: An essential guide to planning your project* Financial Times Prentice Hall.
- Schatzberg, J., & Vora, G. (2008). PEG investing strategy: A revisit. *Quarterly Journal of Finance and Accounting (Spring 2009)*, 48(2), 5-22.
- Schnabel, J. A. (2009). Benchmarking the PEG ratio. *The Journal of Wealth Management*, 12(3), 89-94.
- Schwert, G. W. (2003). Anomalies and market efficiency. *Handbook of the Economics of Finance*, 1, 939-974.
- Stickel, S. E. (1990). Predicting individual analyst earnings forecasts. *Journal of Accounting Research*, , 409-417.
- Trombley, M. A. (2008). Understanding the PEG ratio. *The Journal of Investing*, 17(1), 22-25.
- Zhang, L. (2005). The value premium. *The Journal of Finance*, 60(1), 67-103.
- Zhang, Y. (2005). Individual skewness and the cross-section of average stock returns. *Yale University, Working,*
- Zikmund, W. G., Carr, B. J. B. J. C., Griffin, M., Babin, B. J., & Carr, J. C. (2000). *Business research methods* Dryden Press Fort Worth, TX.