CONSTANT GROWTH INVESTMENT STRATEGIES FOR NON-DIVIDEND PAYING LARGE CAP US COMPANIES

by

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ABSTRACT

This paper evaluated constant growth investment strategies for non-dividend paying large cap US companies. We constructed portfolios based on constant growth expected returns, P/E and PEG ratios. The respective performance of the portfolios over a twenty-year period (1987 – 2006) was measured and compared to each other and a benchmark (S&P 500). We found that on a risk-adjusted basis, the CGER strategy out-performed the S&P 500 as well as P/E and PEG strategies as it produced the highest Sharpe ratio.

Keywords: Constant Growth, Expected Returns, Mean Returns, Price/Earnings ratio; Price Earnings to Growth ratio; Sharpe Ratio, S&P 500 index, Regression

Subject Terms:

Constant Growth Expected Returns; Investment Strategy; Non-Dividend Paying; Large Cap

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GLOSSARY

WRDS — Wharton Research Data Services (WRDS) is a database management service provided by Wharton School of the University of Pennsylvania for academic and non-commercial research. The databases cover several fields of business including finance, accounting, banking, economics, management, marketing and public policy. Some of the databases available on WRDS and used in this paper are I/B/E/S, Compustat North America and CRSP.

I/B/E/S — The Institutional Brokers' Estimate System, maintained by Thomson Financial, warehouses summary and individual analyst forecasts of company financial information including earnings, cash flows, and recommendations.

CRSP — Centre for Research of Security Prices a comprehensive collection of security prices, returns, and volume data for the NYSE, AMEX and NASDAQ stock markets.

Compustat North America — A database of U.S. and Canadian fundamental and market information (including quarterly and annual financial statements) on more than 30,000 active and inactive publicly held companies provided by Standard and Poor's.

FPI	Forecast period Indicator. "1" denotes a forecast made for the end of the current fiscal period.
Market-to-Book	The ratio of a company's share price, at a given point in time, to its Book Value per share. This ratio is an indicator of the market value of a company's share relative to the value of existing shareholders' investment in the company.
Price/Earnings Ratio	The ratio of a company's share price to its forward earnings per share. Widely used by investors as a crude valuation metric.
Price/Earning to Growth Ratio	Price earnings ratio divided by earnings growth rate. Generally preferred to P/E ratio because it takes growth into account in determining the potential value of a stock.
Book Value per Share	The ratio of a company's total equity (Assets – Debt) to the total number of shares outstanding.
Realized returns	The actual return earned over a given holding period. It is typically computed as capital appreciation plus dividend (if any).
High Portfolio	A portfolio of the top ranked half of stocks in our sample.
Long Portfolio	A portfolio of the bottom ranked half of stocks in our sample.
Long-Short Portfolio	A portfolio of comprising a long position in the bottom ranked half of stocks and a short position in the bottom ranked half of our sample.

CHAPTER 1: INTRODUCTION

Investment managers use various asset pricing models and metrics to value and select stocks for inclusion in their portfolios depending on several factors, such as investment strategies, skills, personal/organizational preferences and valuation resources. The most popular valuation models forecast dividends, free cash flow or residual income and discount them at a cost of equity deemed appropriate for the company whose stock is being valued. While these models are useful and widely used by analysts, they can be computationally cumbersome to the investor on Main Street. Even with analysts, the valuation models' accuracy depends largely on the onerous task of assessing individual company risk and determining an appropriate discount rate given the sensitivity of the models to small variations in discount rates. As a result, simpler Ratios such as the Price/Earning (P/E) ratio are also widely used for "quick" and "crude" valuations and often in conjunction with the discounted cash flow models.

In this paper, we will evaluate a modified version of the discounted dividend valuation model (DDM) for constant growth companies - Constant Growth Expected Return (CGER) model developed by George Blazenko in a yet to be published work. The model offers a simple, forward-looking measure that investors can use to value stocks of constant growth companies using variables

that are easy to forecast or access. As it is essentially an expansion of the DDM,

the model, It retains the advantages of the DDM but circumvents the drawbacks

associated with estimating discount rates. Our focus is on non-dividend paying

constant growth large cap US companies. We construct three portfolios based on

P/E, the PEG ratio and CGER and compare their performance to a benchmark

(S&P 500).   The paper is divided into five sections. A brief literature review

follows this introduction in Chapter 2. In Chapter 3, we describe our methodology

and present our results. Chapter 4 concludes the paper.

CHAPTER 2: LITERATURE REVIEW

In this paper, we study the returns of large cap companies with constant growth to construct portfolios which contain both long and short strategies. Constant Growth Expected Return (CGER) is the market capitalization rate when applied to these large cap firms. Portfolio construction according to the CGER model is the crux of this study. We review the literature on CGER and other financial models from which expected return can be determined in this chapter.

2.1   The Gordon Growth Model and CGER

The discounted dividend model (Gordon 1962) estimates the share price (P_0) of a constant growth company as the expected dividend (D) in one period's time divided by the difference between its market capitalization rate (r) and its sustainable growth rate (g).

$$P_0 = \frac{Div}{(r - g)} \qquad .... (i)$$

George Blazenko, in a yet to be published work, proposes an extension to the Gordon growth model, that investors can use to easily calculate expected return for common shares for which the constant growth assumption is reasonable. As we demonstrate below, Blazenko's model redefines the terms of the DDM for constant growth companies using variables that are relatively easy to forecast. This model eliminates the intricate statistical estimation process that analysts employ in the determination of a given company's riskiness and the appropriate cost of equity (r) to apply to in the DDM. Based on this model, we will show that Market Capitalization Rate (MCR or r in the DDM) for non-dividend paying constant growth companies should be equal to a firm's forward Return on Equity (ROE).

From equation (i), $r = (D/P_0) + g$ ... (ii), where $(D/P_0) = dy$

This equation says that expected return in the constant growth model is forward dividend yield plus growth. A company's sustainable growth rate (g) is equal to the product of its earnings retention rate (b) and its Return on Equity (ROE).

$g = b * ROE$ ... (iii)

Plugging equation (iii) into (i), we get:

$$P_0 = \frac{Div}{(r-g)} = \frac{(1-b) * E}{r - b * ROE} \qquad ... (iv)$$

Dividing through by E get: $P_0/E = \dfrac{(1-b)}{r - b * ROE}$ ... (v)

Equation (v) is a firm's price to forward earnings ratio. The numerator of equation (v) is the payout ratio while the denominator [the difference between expected return (r) and growth (b*ROE)] is the forward dividend yield. We can thus rewrite equation (v) as:

$P_0/E = \dfrac{(1-b)}{dy}$ ... (vi)

Given that ROE = Net Income/Equity and BVE = Equity/Number of shares outstanding; forward Earnings Per Share (EPS) = Net Income/ Number of shares outstanding = ROE * BVE. Substituting into equation (iv):

$P_0 = \dfrac{(1-b) * ROE * BVE}{r - b * ROE}$ ... (vii)

Divide through by BVE to get Market to Book ratio=

$\dfrac{P_0}{BVE} = \dfrac{(1-b) * ROE}{r - b * ROE}$ ... (viii)

Plug (v) into (viii) to show that the market to book ratio and the price to forward earnings ratio are proportional to one another. Market to Book = Price to Forward Earnings * ROE

$\dfrac{P_0}{BVE} = \dfrac{P_0}{E} * ROE$ ... (ix)

In the light of our definition of P_0/E in equation (vi), we can restate (ix) as:

$$\frac{P_0}{BVE} = \frac{(1-b) * ROE}{dy} \qquad \text{... (x)}$$

Multiplying through by dy, we rewrite (x) as:

$$\frac{P_0}{BVE} * dy = (1-b) * ROE = ROE - b*ROE = ROE - g \qquad \text{... (xi)}$$

Rearrange (xi) to:

$$g = ROE - \left(P_0 / BVE \right) dy$$

Recall from equation (ii) that expected return (r) is the sum of dividend yield and growth $[r = (D/P_0) + g]$, therefore:

$$r = dy + ROE - \frac{P_0}{BVE} * dy \qquad \text{... (xii)}$$

Collecting like terms in (xiii) we arrive at our Constant Growth Expected Return (CGER) expression:

$$\mathbf{r = ROE + \left(1 - P_0/BVE \right) * dy} \qquad \text{... (xiii)}$$

where ROE = Forward Return on Equity; P_0 = Current Share Price; BVE = Book Value of Equity per share; and dy = Dividend Yield, P_0/BVE = Market to Book ratio.

Equation (xiii) may be an attractive financial measure for investor investment strategies because it uses terms that are either easily forecast (ROE) or can be easily retrieved from most recent stock trading (P_o/BVE and dy).

2.2 Related Studies

Easton (2004) describes a model of earnings and earnings growth and demonstrates how this model may be used to obtain estimates of the cost of capital. Here the author goes on to state that if the price is not equal to the book value, future abnormal earnings growth adjusts for the difference between next period's accounting earnings and next period's economic earnings. However, it is stated that analysts' reports tend to focus on earnings rather than a book value focus. In this article, Easton (2004) also focuses on demonstrating a procedure for simultaneously estimating the implied market expectation of the rate of return and the implied market expectation of the long run change in abnormal growth in earnings for a particular portfolio of stocks. The article aknowledges that the PEG ratio has become a popular tool in combining prices and earnings and earnings growth into a ratio that is used as a base for stock recommendations.   The paper used the PEG ratio to rank stocks (higher PEG imply a lower rate of return). This particular methodology was applied to the portfolio of stocks that had been formed according to the magnitude of the PEG ratio. Finally the article states that the downward bias in the estimate of the expected rate of return based on the PEG ratio is higher for firms with higher PE, lower book to market ratios and

lower expected short term earnings growth rates. The PEG ratio is a classic example to show how growth was used in the valuation process before.

An earlier study by Timme and Eisemann (1989) analyzes a constant growth model that is often used for estimating the cost of equity capital in utility rate setting proceedings. By Using an approximation to a constant growth valuation model, this study examined the informational content of the commonly used I/B/E/S consensus growth forecast relative to selected individual analyst's forecasts provided by Salomon Brothers and Value Line. The informational content of each growth estimate is tested by performing pair-wise likelihood ratio tests. Historically used growth rates are also analyzed in this paper. The selected individual analysts' forecasts consistently contained significant amounts of information not reflected in the consensus data. The results demonstrate that in research and regulatory proceedings, analyses similar to that performed in this study should be conducted to establish the adequacy of forecasts used as proxies for growth conclusions drawn from the empirical findings are the same regardless of the proxy for normalized earnings. Since this study is only pertaining to utility stocks investor expectations are best proxied from some combination of GSB (the Solomon Brothers' projected 5-year normalized growth) and GVLD (5-year forecasted growth in dividends). The study concludes by stating that additional evidence persist that historical growth rates are poor proxies for investor expectations.

A Further study by Easton, Taylor, Shroff & Sougiannis (2001), develop a method to concurrently estimate the cost of equity capital and the growth in residual earnings that are implied by current stock prices, current book value of equity and short term forecasts of accounting earnings. This Simultaneous estimation of these expected rates provides a means of adjusting for the reliance on book value of equity and forecasts of accounting earnings for a short horizon. They state that unlike other papers on this topic that assume a rate of growth, they estimate the rate of growth that is implied by market prices, book values, and the finite period forecasts of accounting earnings. The study's implied estimates of the equity premium turn out to be higher than other studies based on the residual income valuation model. With this they find that the industry return-on-equity will change from being high to low as the stage of the life-cycle of the firms in the industry changes from the growth phase through the stable phase and then decline. They conclude that this difference occurs because the study estimates rather than assumes rates of growth in residual income.

In a more recent study, Easton and Monahan (2005) develop an empirical method that allows the evaluation of the reliability of expected returns proxy via its association with realized returns even if realized returns are biased and noisy measures of expected returns. One of the proxies used is equal to the square root of the inverse of the PEG ratio. However, they continue to state that the assumption of constant abnormal growth in earnings is too restrictive. They further state that the adjustment provided by taking short-term earnings growth

into account causes the median estimate of expected returns to increase. In their findings they conclude that for the entire cross-section of firms, the accounting-based proxies they consider are not reliable measures of expected returns. Further analysis of theirs suggests that certain proxies are reliable for nontrivial subsets of the data. They also mention that their study has a couple of main implications; the first being that Easton and Monahan demonstrate that the approach described in this study can be extended and used in other contexts. Second, given the general lack of reliability of the proxies that they evaluate the extant evidence in the accounting and finance literatures based on these proxies should be interpreted with caution.

Frankel & Lee (1998) study the residual income model using analyst earnings forecasts and examine its usefulness in predicting cross-sectional stock returns in the U.S. The residual income model has proven to be the most popular model used for this process thus far. In the study, they find some evidence that analysts tend to be more overly-optimistic in firms with higher forecasted earnings growth and higher forecasted ROEs relative to current ROEs. In the study it also states that the most important and difficult task in the valuation exercise is forecasting future ROEs. Frankel and Lee (1998) counteract this issue by using prior periods earnings (or ROEs), or using analysts' earnings forecasts. They also believe that their findings are also related to the finance literature on the predictability of stock returns. The authors believe that their evidence suggests that firm value

estimates based on a residual income model may be a useful starting point for predicting cross-sectional stock returns.

Ohloson & Juettner-Nauroth (2005) develop a model relating a firm's share price to the firm's next year expected earnings per share, short-term growth in EPS, and long-term growth in EPS. The central idea of this study is that in practical equity-valuation the focus is on firms' near term expected EPS and its subsequent growth. It is therefore stated that making money in the stock market reduces to the idea that investors want to buy future earnings. This paper reconsiders how next-period EPS and EPS growth relate to a firm's current share price. In the study, the authors state that one can relate the PEG-ratio, which is the P/E ratio relative to the growth of expected EPS to the above factors. They find that the so defined PEG-ratio relates directly to the cost of capital or expected return.

Finally in a study by Gebhardt, Lee & Swaminathan (2000) where they propose an alternative technique for estimating the cost of equity capital they find that the industry target ROE is a moving median of past ROEs from all firms in that particular industry. Furthermore, by using I/B/E/S (Institutional Brokers Estimate System) earnings forecasts they are able to generate explicit forecasts of future book values and ROEs using clean surplus accounting. The authors also assume that firms' ROEs mean revert toward the median ROE of the industry. In conclusion, they mention that the study's goal is to demonstrate the feasibility of

an alternate technique that does not depend on average realized returns or company stock price to estimate the implied cost of capital.

As mentioned above, the processes reviewed in this section of our study are similar to the CGER model. However, it must be mentioned that those particular studies focus on measuring expected returns and equating the expected returns to the realized returns of a particular company. This is done for the purposes of estimating the cost of capital. The process of equating expected returns to the realized returns does not play a role in our study. As shown in our model (CGER), we circumvent this tedious process of estimating cost of capital that dominates accounting literature on valuation. In other word, we eliminate the estimation of risk as and use a forward looking model that for constructing our investment portfolio. This marks a major difference between our work and existing literature.

2.3   Contribution to Literature

With equation (xiii) we have demonstrated that the market capitalization rate for companies with constant growth can be expressed in terms of forward ROE, Market to Book and dividend yield. As mentioned in the preceding paragraph, this model eliminates the need for the complex estimation methods currently used in estimating risk and market capitalization rate (r) in the DDM. In contrast with these statistical estimation methods, forward ROE is easy to forecast with reasonable accuracy, share price is readily available on a real time basis on

stock exchanges, trading terminals such as Bloomberg and Reuters and several websites including google finance and yahoo finance. Book Value of Equity and dividends are also easily accessible from historical financial statements.

2.3.1   Implications of CGER Model for Non-Dividend Paying Firms

In rest of this paper, we focus on a special case of equation (xiii) for non-dividend paying companies where dividend yield (dy) = 0 and equation (xiii) becomes:

$$r = ROE + \left(1 - P_0/BVE\right) * 0 = ROE \qquad \text{... (xiv)}$$

As demonstrated in equation (xiv), non-dividend paying companies, assuming constant growth, should have an expected return (r) that is equal to ROE as the expression to the right of the plus sign is eliminated with a zero multiplier.

Next, we develop a second implication of the constant growth valuation model for non-dividend-paying companies.

Recall from equation (viii) that:

$$\frac{P_0}{BVE} = \frac{(1-b) * ROE}{r - b * ROE}$$

If r = ROE then, Market to Book ratio (P_0/BVE) should be equal to one since equation (viii) breaks down into:

$$\frac{P_0}{BVE} = \frac{(1-b) * ROE}{ROE - b * ROE} \qquad \text{collecting like terms in the denominator, we get:}$$

$$\frac{P_0}{BVE} = \frac{(1-b) * ROE}{(1-b) * ROE} = 1 \qquad \text{... (xv)}$$

Equation (xv) says that market to book ratio should be one (1) for constant growth, non-dividend paying companies.

However, we know from casual observation that most companies have market to book ratios less than 1, some have market to book ratios greater than 1, and few have market to book ratios equal to 1. This discrepancy between theory and observation suggests the possibility of forming investment strategies to take advantage of possible market mispricing.

From a theoretical perspective therefore, a market to book ratio that is greater than or less than one for a non-dividend paying, constant growth company is indicative of a mispricing possibly due to the existence of some private information that the market has yet to price-in. A market to book ratio greater than one implies that the share is over-price while a market to book that is less than one suggests that the share is under-priced. This presents a new investment strategy that an investor could deploy in equity portfolio construction for non-dividend paying, constant growth stocks. By buying non-dividend paying, constant growth stocks with a combination of high CGER=ROE and low market to book and selling otherwise, an investor can earn abnormal returns.

CHAPTER 3:   EMPIRICAL METHODOLOGY AND RESULTS

3.1   Scope and Assumptions

Our investment horizon spans a twenty-year period from January 1987 to December 2006. We assume the semi-strong form of Efficiency Markets hypothesis. In other words, we assume that some relevant information may not be publicly available and may therefore, not be reflected in stock prices pending their publication. The implication is that the affected stocks are mispriced, enabling active investors to beat the market through fundamental and technical analysis. Obviously, such opportunities are often small and short-lived as markets promptly price-in the information as soon as it becomes public. All companies whose stocks are included in our portfolios are assumed to have constant expected growth into the indefinite future. To ensure a uniform measuring point and avoid any seasonal biases, we assumed a December 31 measuring point for all companies and used closing prices on that date to compute Market to Book, Price/Earnings and Price/Earnings to Growth ratios for our sample of companies. The effects of taxes, transaction and financing costs are ignored. All stocks are assigned equal weights in our portfolios and we evaluate all statistical tests at the 95% confidence level.

3.2 Data

The major sources of data for this project are Wharton Research Data Services (WRDS) databases - I/B/E/S, Compustat and CRSP. Our sample of non-dividend paying large cap US stocks is drawn from I/B/E/S. Fiscal Period Indicator (FPI), fiscal period end dates, statistical period end dates (forecast dates), actual and forward Earnings Per Share (EPS) forecasts for one, two, three and four years hence are also collected from I/B/E/S. A forecast for one year hence refers to a forecast of the results for the current fiscal year. However, due to the paucity of forecasts beyond one year forward, we limit our analysis to current year forecast, i.e. (FPI = 1). However, wherever current year forecast is unavailable or widely off the mark, we use forecast for the following (second) year if it is available and more reasonable. We do not consider this a major limitation to our analysis considering that the accuracy of forecasts generally declines as the period between the forecast date and fiscal period end date increases. We find the medians of the most recent EPS forecasts relative to the fiscal period end date and use these in our analysis to smooth out any analyst biases and enhance accuracy. Book value per share (BKV), end of month closing prices (PRCC), market capitalization (MKTCAP), and dividend yield have been downloaded from Compustat North America, while realized monthly returns on the stocks in our sample have been obtained from CRSP.

Our benchmark portfolio returns (S&P 500) and risk free rates (US treasury bills rates) are pooled from Bloomberg. We will also refer to the benchmark portfolio as "the market" or "the index" in this work.

3.4   Investment Strategy

In this section, we develop an investment strategy for non- dividend paying constant growth companies in line with the principles established in section 2.1.1 and compare realized returns from this strategy to those of two alternative strategies (Price/Earnings and Price/Earning to Growth strategies) as well as to a benchmark (S&P 500). First, we construct portfolios of stocks ranked according to Constant Growth Expected Returns (CGER, which is equal to ROE for non-dividend paying companies) and market to book. Then we construct two other sets of portfolios, one set ranked according Price/Earnings ratios and the other according Price/Earnings to Growth (PEG) ratios. We compare realized returns for each of these three sets of portfolios over a twenty-year period (1987 – 2006) to one another and to a benchmark (S&P 500).

Our original sample comprised the largest one thousand (1000) companies (by market capitalization) for each year. This sample was sorted according to dividend yield (dy) and all companies with dy not equal to zero excluded. The result was that different years now had varying numbers of companies. We notice an increasing trend in the number of companies across the years from twenty-eight (28) companies in 1987 to seventy-four (73) in 2006 as shown in the table below. This trend may have been the result of improving information system and data collection enabled by advancements in, and access to, information technology over the years. The sample in one year is not necessarily a subset of the sample in other years i.e. the companies in 1987 were not necessarily included in 1988 or any other year. Companies were included in the sample only

if they were in the top one thousand companies, by market capitalization, in the relevant year and had a dividend yield of zero.

SAMPLE SIZE (No of Stocks in Final Sample per Year)									
Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
No of Companies	28	31	31	34	37	41	40	42	42	46
Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
No of Companies	46	50	37	56	54	56	58	62	68	73

For the remaining companies in our sample, we computed the following measures:

a. Return on Equity (ROE) = $\dfrac{\text{Forward Earning Per Share}}{\text{Book Value per Share (BKV)}}$

Forward Earning Per Share (EPS) used in (a.) above is the median of the latest analysts' forecasts for the relevant year as obtained from I/B/E/S database. As mentioned in the data section, we used EPS forecasts for the current fiscal year wherever it was available and appeared reasonable. In a few cases where current year forecast was unavailable, we used forward EPS for the next year. Book Value per Share refers to Book Value Equity for the immediate past year end divided by no of shares outstanding on the same date. We got this figure from Compustat North America database.

b. Market to Book (M/B) = $\dfrac{\text{Year end closing stock price (PRCC12)}}{\text{Book Value per Share (BKV)}}$

Year end closing stock price (PRCC12) is the share price at the close of trading on 31 December of the relevant year as found in Compustat North America database.

c. Price/Earnings ratio (P/E) = $\dfrac{\text{Year end closing stock price (PRCC12)}}{\text{Forward Earning Per Share}}$

d. Price/Earnings Growth ratio (PEG) = $\dfrac{\text{Price/Earnings Ratio}}{\text{EPS Growth Rate}}$

Price/Earnings Ratio is the quotient of year-end closing stock price (on 31 December) divided by forward EPS. EPS Growth Rate is the annualized growth rate of forward EPS computed by the formula in (e.) below.

e. Annual Earnings Per Share Growth Rate = $\left[\dfrac{(\text{Earnings Per Share})_n}{[\text{EPS (Prior Year Actual)}]} \right]^{\wedge(1/n)} - 1$

Where n = number of years and Prior Year Actual EPS is the reported earnings for the immediate past financial year divided by the number of shares outstanding. This figure is pooled from I/B/E/S database. For most companies in our sample, n=1 i.e. the EPS figure used for each year was the forecast for the end of that year. Where the forecast for the current year was unavailable or unreasonable, we used n=2 i.e. the forecast for the end of the following financial year.

f. Quarterly Return = $[(1+r_1)*(1+r_2)*(1+r_3)] - 1$

Where r_1 = return for the month of January, r_2 = return for February etc.

g. Annual Return = $[(1+r_1)*(1+r_2)*(1+r_3)*(1+r_4)*(1+r_5)]*(1+r_6)*(1+r_7)*(1+r_8)*$
$(1+r_9)*(1+r_{10})*(1+r_{11})*(1+r_{12})] - 1$

h. Constant Growth Expected Return (CGER) = ROE + (1-M/B)*dividend yield as shown in our model above. Recall that since dividend yield = 0 for non-dividend paying companies, CGER = ROE.

With the required inputs computed, we now rank our sample according to the three measures outlined earlier:

a. Constant Growth Expected Return (CGER): we rank according to a combination of CGER (ROE) & Market to Book Ratio. Because CGER = ROE for non-dividend paying companies. Note that we use CGER and ROE interchangeably to refer to this ranking measure in this paper.

b. Price/Earnings (P/E) Ratio

c. Price/Earnings to Growth (PEG) Ratio

We invest in nine portfolios, six long-only and three long-short. The portfolios are rebalanced annually over our investment horizon and, as highlighted above, may not necessarily contain the same number of stocks as the previous year. The first three portfolios, two long-only and one long-short are constructed by selecting stocks with high CGER (ROE) and low Market to Book. This is done by adding ROE to the reciprocal of Market to Book (i.e. Book to Market) and ranking them according to the value obtained, from highest to lowest where highest is best. Our preference is for stocks with high expected return (CGER) and low market to book. The ranked list of stocks is divided into two halves. The top half (best performers, in terms of CGER and market to book, are invested in a portfolio referred to as "High", while the bottom half is invested in the "Low" portfolio. A

third (long-short) portfolio is constructed by taking a long position in the top half of the list and short selling the bottom half. Three similar portfolios (two long-only and one long-short) are constructed with stocks ranked according to their P/E ratios and another three with stocks ranked according to their PEG ratios. With the P/E and PEG rankings, lower is better i.e. companies are ranked from low P/E or PEG to high and the top half is included in the High portfolio while the bottom half is invested in the Low portfolio.

We decided to compare the performance of our CGER portfolios to those of P/E and PEG portfolios for two reasons. First, it affords us a comparison to alternative strategies using the same universe of stocks as the CGER strategy, given that the S&P 500 index comprises companies that may differ from our sample in several respects including size, level of risk and dividend paying attributes. Second, P/E and PEG ratios, are commonly used by individual investors because, like the CGER model, they are simple to calculate and easy to measure/use.

For consistency, if there is an odd number of stocks in any given year, the High portfolio (top half) is allocated one stock more than the Low. For example, if there are 31 stocks for 1987, the High portfolio is allocated the top 16 stocks and the Low gets the bottom 15. Using the realized monthly returns from CRSP and formulae in f & g above, the quarterly and annual portfolio returns are calculated and compared to the realized returns of the benchmark. Performance is also compared across the different ranking measures. We compute mean returns and standard deviations for the portfolios over the twenty-year period and use these

together with the risk-free rate (US treasury bills rates) to compute Sharpe ratios for our portfolios. Finally, we estimate alphas and betas for each of our portfolios first by regressing realized returns on benchmark returns, and then excess portfolio returns on excess benchmark returns. Excess returns are calculated by subtracting the risk-free rate from realized portfolio and benchmark returns.

3.5   Results

PORTFOLIO PERFORMANCE (MEAN ANNUAL RETURNS)					
		High	Low	Long Short	S&P 500
CGER & MB Ranked	Mean Return	0.1913	0.1456	0.0457	0.1019
	Std Deviation	0.2769	0.3049	0.1730	0.1620
	Sharpe Ratio	0.5145	0.3174	- 0.0177	0.3281
P/E Ranked	Mean Return	0.1685	0.1712	- 0.0027	0.1019
	Std Deviation	0.2532	0.3215	0.1648	0.1620
	Sharpe Ratio	0.4730	0.3808	- 0.3123	0.3281
PEG Ranked	Mean Return	0.2026	0.1426	0.0599	0.1019
	Std Deviation	0.3019	0.2651	0.1217	0.1620
	Sharpe Ratio	0.5095	0.3540	0.0917	0.3281

The table above summarizes the average annual performance of our nine portfolios from 1987 to 2006. All six long-only portfolios earned significantly higher mean returns than the benchmark. In accordance with the "high risk, high returns" principle, they also all had considerably higher standard deviations than the index. This is not very surprising as our sample of non-dividend paying stocks is likely to have introduced a bias for smaller, riskier companies (relative to the S&P 500) which are expected to offer higher returns to compensate for higher risk. On a risk-adjusted basis, five out of six long-only portfolios out-performed the benchmark with higher Sharpe ratios. On the other hand, all three long-short portfolios under-performed the benchmark index both on a nominal and risk-adjusted basis understandably because our short positions were not necessarily in stocks with negative expected returns. As expected, however, they achieved significant reduction in portfolio risk (standard deviation) relative to their corresponding long only portfolios reflecting the hedging effect of the long-short strategy.

Across all ranking measures, the High portfolios recorded superior Sharpe ratios in comparison to the Low portfolios indicating that the former earned higher risk adjusted returns than the latter. The CGER ranked High produced the best Sharpe ratio (0.5145) of all nine portfolios. As expected, the CGER (19.13%) and PEG (20.26%) ranked High portfolios earned higher mean annual returns than their respective Low portfolios (CGER = 14.56%; PEG = 14.26%). Conversely, the PE ranked Low portfolio earned a higher mean return (17.12%) than the High

(16.85%), albeit with a disproportionately larger standard deviation (High = 0.2532; Low = 0.3215). Our decision not to estimate risk in the ranking process is likely to have resulted in the PE ranked Low portfolio (of high P/E stocks) comprising riskier companies offering higher returns compared to those in the PE ranked High portfolio. It is interesting to note that the CGER ranking resulted in the clearest dichotomy between the performance of the High and Low portfolios. The CGER ranked High portfolio earned a higher mean annual return (19.13%) than the Low portfolio (14.56%) even though the former with a standard deviation of 0.2769 was less risky than the latter, which had a standard deviation of 0.3049. It was the only one of the three ranking measures to result in the portfolio with the higher mean return also having a lower standard deviation.

In the table above, we computed Sharpe ratios as $(r_p - r_f)/\sigma_p$ for all portfolios in line with industry practice. However, given that the long-short portfolios are implicitly hedged, the long position relative to the short position, it can be argued that it is unnecessary to deduct the risk free rate in the computation of Sharpe ratios for these portfolios. Consequently, we recomputed Sharpe ratios as r_p/σ_p (i.e. without deducting risk free rates from portfolio returns) and obtained higher values across board compared to those obtained using our earlier formula (see table below). Although this adjustment is not industry practice and does not change our conclusion, it appears to yield more reasonable Sharpe ratios than industry practice.

SHARPE RATIOS FOR LONG-SHORT PORTFOLIOS = r_p/σ_p		
CGER & MB Ranked	**P/E Ranked**	**PEG Ranked**
0.2642	- 0.0164	0.4924

3.6   Regression

The above table has some interesting results, but we cannot be certain that they do not arise simply because of risk differences between the portfolios. Thus, in this section, we risk adjust the portfolios and look for "abnormal" returns compared to our benchmark portfolio, the S&P 500 index.

As stated earlier, excess returns represent the difference between realized returns and the risk free rate for the corresponding period. Our regression models are presented below. Equation (a) describes the regression of portfolio returns on benchmark returns and (b) is the regression equation for excess portfolio returns against excess market returns.

$$r_p = \alpha + \beta r_m + e \qquad\qquad\qquad\qquad \text{... (a)}$$

$$r_p - r_f = \alpha + \beta(r_m - r_f) + e \qquad\qquad\qquad \text{... (b)}$$

where r_p = realized portfolio return;

 r_m = realized market return (mean returns on the S&P 500);

e = error term;

$r_p - r_f$ = excess realized portfolio return over the risk free rate

$r_m - r_f$ = excess realized market return over the risk free rate

α = abnormal rate of return on a portfolio in excess of what would be predicted by an equilibrium model like the Capital Asset Pricing Model (CAPM) which assumes that returns are reward for risk and that any premium earned above the risk free rate arises from additional risk taken.

β = beta of portfolio representing how risky/sensitive mean portfolio returns are to changes in mean market returns. Betas can be negative, zero or positive. The sign of a beta indicates the direction of movement in portfolio returns. A beta of one (1) means that for every percentage point rise or in market returns, there is also a percentage point rise in portfolio returns and vice versa. A minus one (-1) beta means that for every percentage point rise or in market returns, portfolio returns fall by one percentage point and vice versa. In other words, portfolio returns have the same level of risk as market returns. A zero beta indicates that there is no relationship between movements in portfolio returns and market returns. Beta values greater one (1) imply a higher level of risk than market and those lower that one imply less risk.

		REGRESSION RESULTS (Y=Total or Excess Realized Returns; X = S&P 500)					
		Alpha		Beta		Alpha	Beta
		High	Low	High	Low	Long Short	
CGER & MB Ranked	Mean Return Regression	0.0507	- 0.0074	1.3795	1.5008	0.0581	- 0.1212
	t-stat	1.1322	- 0.1472	5.7925	5.6019	1.2353	- 0.4845
	Excess Return Regression	0.0674	0.0155	1.4131	1.5292		
	t-stat	1.7110	0.3490	5.8569	5.6181		

	Mean Return Regression	0.0409	0.0054	1.2523	1.6270	0.0355	-	0.3747
	t-stat	*0.9868*	*0.1071*	*5.6788*	*6.0678*	*0.8469*	*-*	*1.6801*
P/E Ranked	Excess Return Regression	*0.0518*	*0.0341*	*1.2790*	*1.6624*			
	t-stat	*1.4150*	*0.7697*	*5.7065*	*6.1245*			
	Mean Return Regression	0.0399	0.0136	1.5963	1.2661	0.0263		0.3302
	t-stat	*0.9355*	*0.2957*	*7.0385*	*5.1758*	*0.8788*		*2.0749*
PEG Ranked	Excess Return Regression	*0.0675*	*0.0249*	*1.6236*	*1.2974*			
	t-stat	*1.7986*	*0.6138*	*7.0619*	*5.2193*			

The table above shows the output of regressions estimated for the returns of our original nine portfolios against the returns of the benchmark. Also shown are the results of the regression of excess returns above the risk free rate on our six long-only portfolios against excess benchmark returns above the risk free rate.

The results of regressions of realized mean portfolio returns on benchmark returns show statistically significant betas for all six long-only portfolios. All six are greater than one, corroborating our conclusion from our portfolio standard deviations that all our long-only portfolios are riskier than the benchmark.

We note the discordance between the performance of our CGER portfolios and the CAPM. As mentioned in the definition of α above, the CAPM

$[r_p = r_f + \beta(r_m - r_f) + e]$ states that returns are reward for risk and that any premium earned above the risk free rate arises from, and is proportional, to additional risk taken. Contrary to this argument, our CGER High portfolio earns a higher return (19.13%) with a lower risk (beta = 1.3795) than the Low portfolio (14.56%; beta =

1.5008) indicating that returns are not necessarily always proportional to risk as abnormal returns in excess of risk might be possible. Furthermore, the CGER model produces results that are in contrast with the Fama French (1992) model which, like the CAPM, argues that high returns are the reward for high risk. Fama & French added that if returns increase with book to market ratio, then stocks with a high book to market ratio must carry a relatively higher level of risk. In other words high book to market stocks are fallen angels, which will should perform well as they are restored to glory. Recall that our CGER High portfolio, which comprised high book to market (low market to book) stocks earned higher returns (19.13%) with a lower beta (1.3795) and lower standard deviation (0.2769) than the Low portfolio (made up of low book to market i.e. high market to book) stocks, which earned 14.56% with a beta of 1.5008 and standard deviation of 0.3049.

None of our portfolios neither long-only nor long-short) produced statistically significant alphas. In line with our earlier conclusion that the long-short strategy reduced portfolio risk, all the betas from our regression of realized long-short portfolio returns are much less than one although only the PEG ranked portfolio had a statistically significant beta (beta = 0.3302; t-stat = 2.0749) at the 95% level of confidence.

We obtain similar results from regressing excess portfolio returns on excess benchmark returns for our long portfolios. Like the results of the earlier regressions, all the betas and alphas of the long-only portfolios along with their respective t-statistics increase in magnitude in the excess return regression

compared to the total returns regression. As with the total returns regressions, all the betas of our six long portfolios remain significant, while the alphas remain insignificant at the 95% level of confidence.
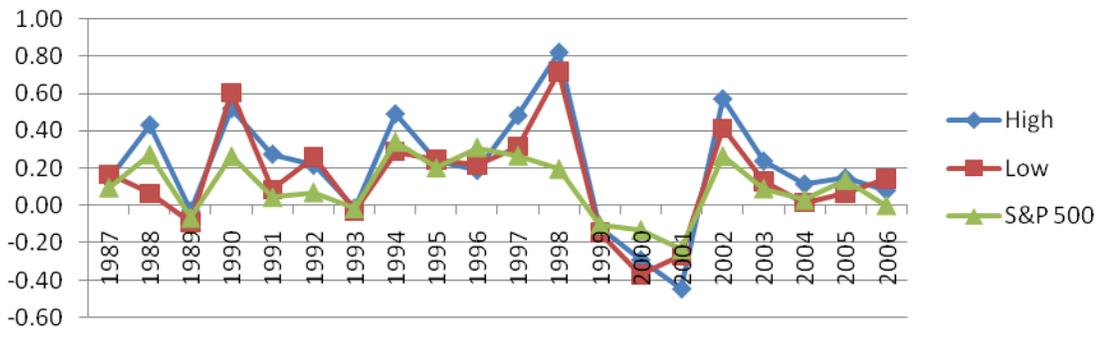
The following charts present our portfolios' mean annual returns for each of the two year investment period. Our long-only portfolio returns tracked the trends of rises and falls in the benchmark (S&P 500) returns to a reasonable extent.
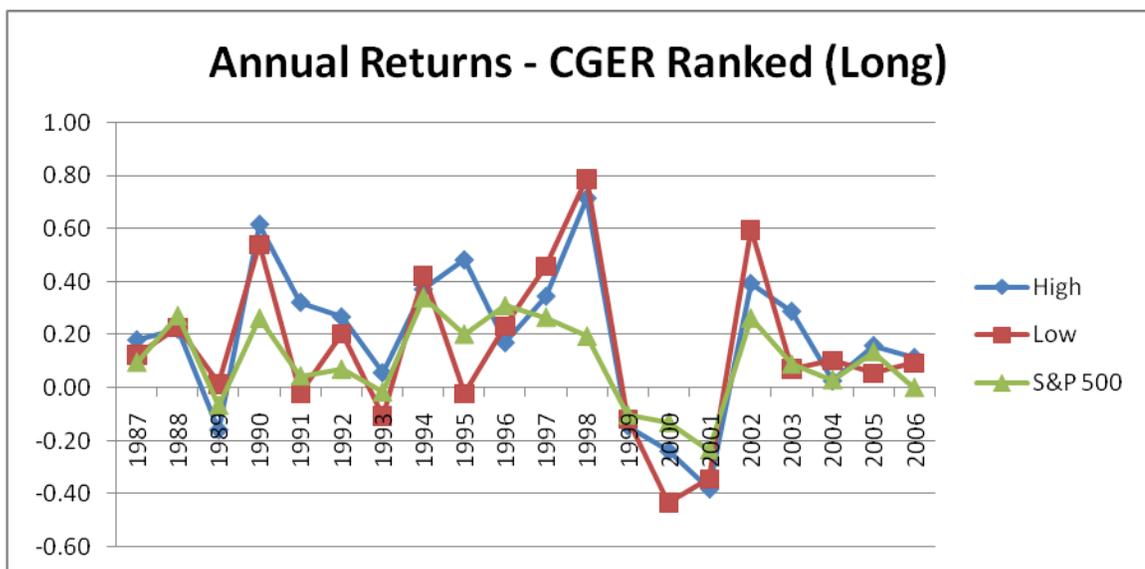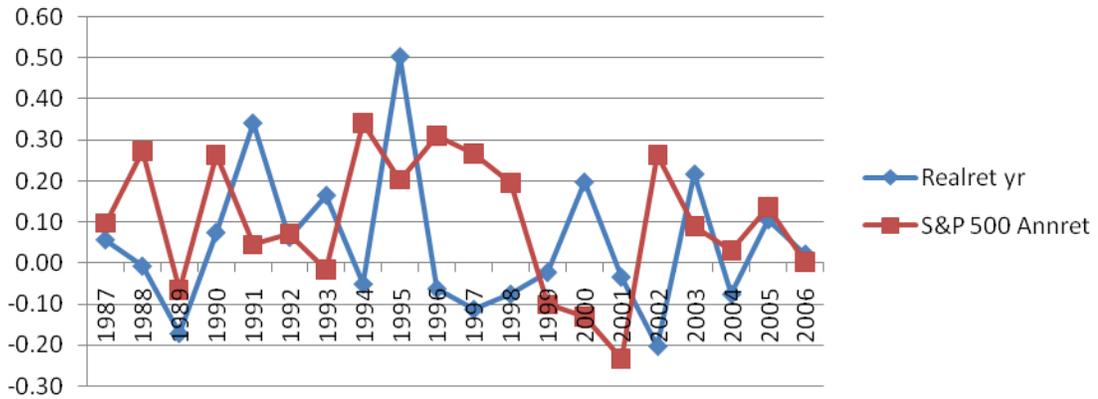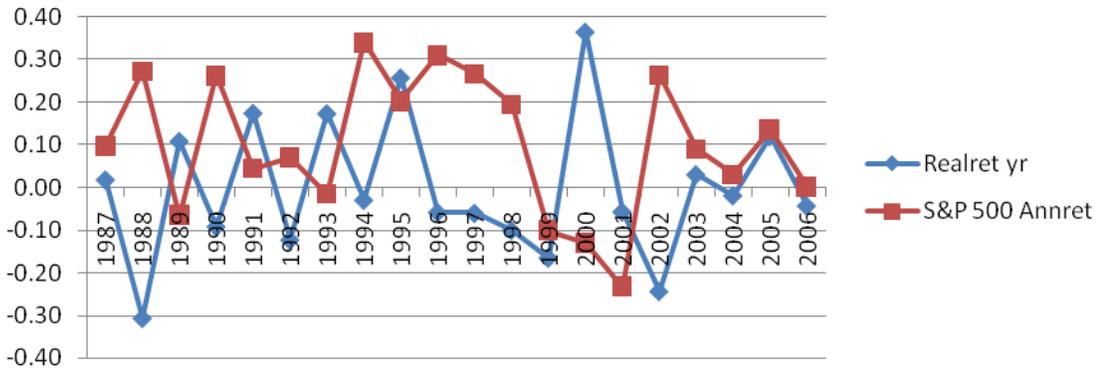
Annual Returns - PE Ranked (Long)
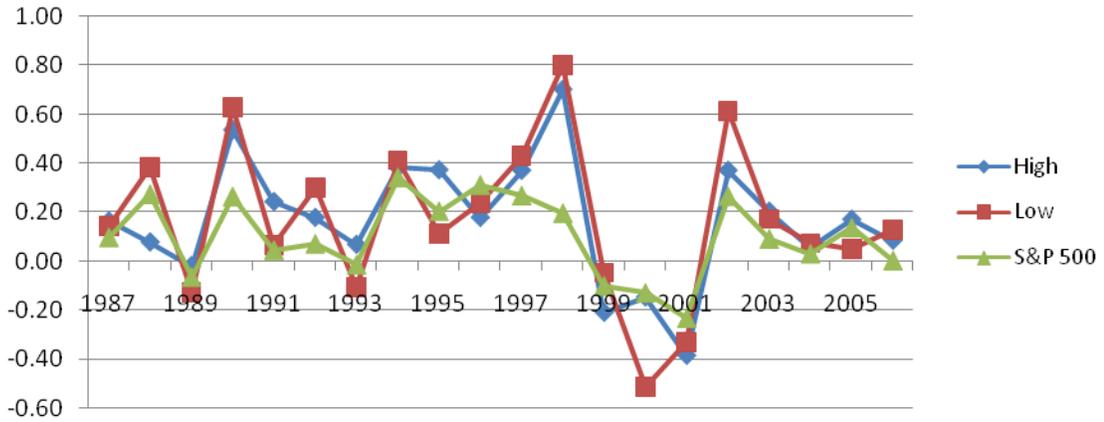
Annual Returns - PEG Ranked (Long)

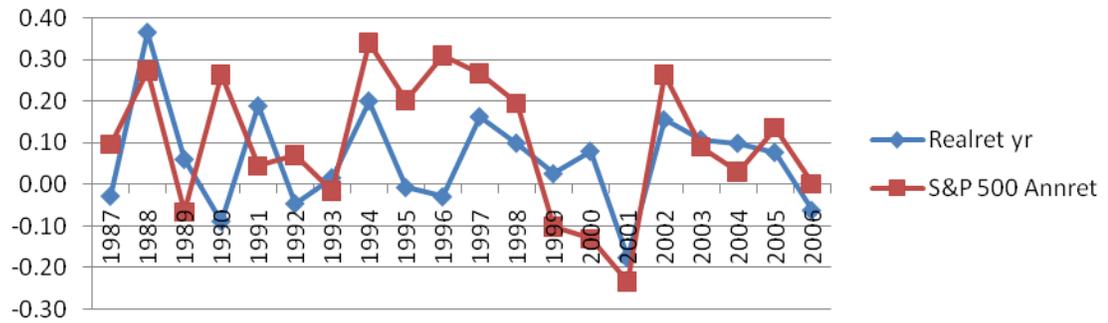Annual Returns - CGER RANKED (Long-Short)

Annual Returns - PE Ranked (Long-Short)

Annual Returns - PEG RANKED PORTFOLIOS (Long-Short)

CHAPTER 4: CONCLUSION

This paper evaluated constant growth investment strategies for non-dividend paying large cap US companies. We ranked stocks according to three measures - Constant Growth Expected Returns (CGER), Price Earnings (P/E) Ratios and Price Earnings to Growth (PEG) Ratios – and constructed three portfolios (two long-only and one long-short) for each ranking criterion and measured performance from 1987 to 2006. We found that our long-only portfolios were all riskier than the benchmark and accordingly earned higher mean returns than the index. The higher risk is attributable to the non-dividend paying feature of our sample, which may have introduced a bias for smaller, riskier stocks relative to the S&P 500. On a risk-adjusted basis, all our top-ranked (High) portfolios still out-performed the benchmark. The results of our analyses suggest that the CGER strategy is superior to the P/E and PEG strategies. The CGER-ranked High portfolio produced the highest risk adjusted mean return of all nine portfolios. The CGER strategy also yielded the clearest dichotomy between the top half and bottom half portfolios. It was the only ranking measure that generated higher mean returns and lower standard deviation for the High portfolio compared to the Low portfolio.

While we recognize that this strategy is potentially useful, we urge caution given the obvious limitations in the scope of our work. Obviously, our twenty-year

investment horizon is considerably shorter than the time frame typically covered

when testing financial models in academic literature. Also, a more robust analysis

testing the CGER model against the Fama-French model would be apposite. It

would be interesting to see the findings of further research correcting for these

limitations.

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