PEG Investing Strategy: A Revisit

John D. Schatzberg
Anderson School of Management, University of New Mexico

Gautam Vora
Anderson School of Management, University of New Mexico

The favorite investment strategies used by both individual investors and professional money managers include those that are based on the PE and PEG ratios. While much popular as well as academic attention has been bestowed upon the former, the sole previous research documents the extraordinary performance of a PEG-based investment strategy for growth stocks during the 1980s. Here we examine the robustness of this anomalous finding to an expanded sample during a subsequent period. Our findings suggest that PEG investing remains a profitable investment strategy, and that it extends its reach beyond the domain of growth stocks. Additionally, we document a risk profile for PEG-based strategies that is likely to be counterintuitive for most value investors.

Introduction

The traditional metric for measuring the richness of equity valuation since Graham and Dodd has been the price-to-earnings ratio (PE).[1] By definition, stocks with low PE ratios have earnings per share (EPS) trading at a discount compared with competing equities in the financial market. Discounted-cash-flow models suggest that firms with higher growth prospects and lower required rates of return should have their equity trade at larger multiples of earnings relative to equities with contrary characteristics. Thus, a comparison of PE ratios with various benchmarks has become a favorite tool for investors who desire a value-style of investing. In an attempt to modify the PE to account for the first of these factors, investors have standardized the PE ratio by the firm's growth rate, giving rise to a compound metric known as the PEG ratio. This ratio is now commonly reported alongside the PE and other relevant firm characteristics on many web-based financial news services. The PEG ratio is considered the premier metric for the investment style popularly known as *growth at a reasonable price* (GARP).

[1]See Cottle, Murray, and Block (1992).

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Growth-based valuation has a distinguished history in the academic literature. Clendenin and van Cleave (1954) open their article:

> For almost a generation the identification and appraisal of 'growth' stocks has been a topic of absorbing interest to investors. An almost unlimited volume of literature has discussed the features of growth industries and growth stocks and the advantages to be found in them.

Holt (1962) and Malkiel (1963) provide further foundation for valuation and impetus for research into theory and empirics of stock valuation. Based on dividend capitalization, Holt presents a model for determining the appropriate relative PE ratio for a growth stock as compared to other stocks, whereas Malkiel presents an independent approach for valuing a growth stock relative to a non-growth stock. An examination as well a synthesis is presented by Robichek and Bogue (1971). Research in stock valuation for explaining market anomalies received a boost from the research of Banz (1981), Reinganum (1981), and numerous others. A series of papers by Fama and French (1992, 1993, 1995, 1996, 1998) starting with an examination of cross-section of returns and culminating with an examination of returns on value versus glamour stocks has led to a resurgence of this literature. This research[2] posits that multiple relative characteristics of stocks (value versus glamour) can explain a large proportion of the variability in asset returns.

This growing research has brought in sharper focus the viewpoint of investment professionals that investment strategies based on stocks with low prices relative to dividends, earnings, book value, or other measures of value produce higher returns. These value-based investment strategies have been extensively studied in the academic literature. One such series of studies [Fama and French (1992, 1993, 1996), Lakonishok, Shleifer, and Vishny (1994), Chan, Jegadeesh, and Lakonishok (1995), La Porta, Lakonishok, Shleifer, and Vishny (1997), Kothari and Shanken (1997), Arshanapalli, Coggin, and Doukas (1998), Pontiff and Schall (1998), Doukas, Kim, and Pantzalis (2002) and Zhang (2005)] has focused upon explanations for the premium earned by high book-to-market value stocks relative to glamour stocks. The interpretation of, and explanations for, why value-strategies outperform growth-strategies remain unsettled. In a popular corporate finance textbook, Grinblatt and Titman (2001, p. 392) assert:

> Growth opportunities are usually the source of high betas…because growth options tend to be most valuable in good times and have implicit leverage, which tends to increase beta, they contain a great deal of systematic risk.

Gomes, Kogan, and Zhang (2003) demonstrate that growth options are always riskier than existing assets because these options are leveraged on the existing assets. The

[2]For an excellent bibliography, see footnote 1 in Conrad, Cooper, and Kaul (2003).

implication is that growth stocks, which derive market values more from growth options, must be riskier than value stocks, which derive market values more from existing assets.

On the other hand, however, Fama and French (1996) argue that value strategies are fundamentally riskier because the higher average returns of high book-to-market stocks reflect compensation for risk. Petkova and Zhang (2005) find empirical support for this argument. They find that time-varying risk as measured by betas tend to co-vary positively (negatively) for value (growth) stocks with the expected market risk premium.[3] While not disputing the conclusion, Lakonishok, Shleifer, and Vishny (1994) attribute the superior returns of value strategies to a consistent overestimation by investors of future growth rates of glamour stocks relative to value stocks. They argue that investors are consistently and perhaps excessively pessimistic (optimistic) about value (glamour) stocks because they behaviorally anchor their expectations of future growth in earnings to past poor (superior) earnings. In other words, value strategies outperform glamour strategies because actual future growth rates in earnings of glamour stocks relative to value stocks turn out to be consistently lower than they were in the past or than what the multiples on those stocks suggest the market expected them to be.[4]

In an interesting contrast to the academic research studies, individual and professional investors have taken into consideration the competing claims of different metrics of multiples and variables to develop a heuristic for their investment strategies. Arak and Foster (2003) develop some implications for the PEG ratio to explain the observed high PE and PEG ratios during the late 1990s. Because the earnings-to-price ratio, the reciprocal of the firm's PE, is positively correlated with the book-to-market measure used in the aforementioned studies,[5] this literature suggests also that a value premium may equally accrue to low-PEG investing. To the best of our knowledge, only Peters (1991) has examined the returns characteristics from PEG-based portfolios.[6] The underlying rationale for his study is that selected hot growth

[3]They additionally find that this beta-premium covariance is too small to explain the observed magnitude of the value premium within the conditional capital asset pricing model.

[4]Needless to say, such an explanation contradicts rational expectations.

[5]The earnings-to-price and the book-to-market ratios have an induced positive correlation due to the denominator of each measure being a positive function of the share price.

[6]The accounting literature has examined from numerous different perspectives the roles of PE, PEG, other market- and fundamental-multiples, as well as accounting and accrual information. For example, Easton (2002, 2004) examines relationships between valuation ratios and return on equity capital; Bradshaw (2004) examines the analysts' use of valuation multiples in determining their stock recommendations; and Liu, Nissim, and Thomas (2002) examine equity valuation using multiples. For three readily-available examples of parallel finance literature, see Jegadeesh, Kim, Krische, and Lee (2004), and Hong, Kubik, and Solomon (2000) for examinations of analysts' recommendations, and Eberhart (2004) on valuation using various multiples.

stocks tend to be overvalued vis-à-vis alternatives with similar growth potential. His results, using a sample of firms with I/B/E/S (formerly Institutional Brokers Estimate System, now a part of Thomson Financial) growth rates of at least 12 percent from 1982 to 1989, are dramatic. The low decile PEG portfolio (the value segment within his sample) earns a compounded raw return of 1,536 percent in the 30 quarters examined compared to 138 percent for the high decile portfolio. This extraordinary performance is approximately 500 percent greater than the comparable metric on the S&P 500 over the same calendar period.

Whenever anomalous findings, such as those reported by Peters are published, it is natural to speculate whether the results will persist in the future. For example, Schwert (2003) provides evidence that numerous examples of apparent mispricing within the cross-section of stock returns (e.g., effects related to size, value, the week-end, and the dividend yield) disappear in subsequent time periods after the initial results had been published. [7]

Using Peters' work as the point of departure, we examine the risk and return characteristics of a PEG-based investment strategy. Our work provides a number of extensions using data of a subsequent sample period. First, our sample includes all stocks that meet specific data requirements, thereby not limiting the analysis to only those stocks with strong growth prospects. Second, we report risk characteristics of PEG investing strategy that are likely to be counterintuitive to most value investors. Third, because an analysis restricted to raw returns may mask important variation in risk across PEG levels, we provide adjustments using the Fama and French (1993) three-factor model.[8] Fourth, we examine the relative profitability of PEG investing strategy using forward-looking earnings as compared to the most recent reported historical measure used by Peters. Finally, the fifth enhancement examines the sepa-

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Footnote 13 from Bradshaw (2004) is worth reproducing verbatim to illustrate the use of PEG by investors:

…John G. Kinnard (1999) states: [we] believe the company deserves a PEG ratio near the top of the industry given its market dominance, broad product line and customer base, growth initiatives, and solid financial position. We value Dialogic's shares based on one times its long-term growth rate of 15 percent. We are initiating coverage of DLGC with a BUY rating for aggressive growth investors and a $32 price target based on 15 times our 2000 EPS estimate of $2.14 (reported dated January 15, 1999)

The actual trading price as of the date of the report was $24.50, well below the analyst's $32 valuation, which justifies the BUY recommendation.

[7]A parallel debate about the suitable method for examining risk-adjusted excess returns continues unabated and unresolved. See Fama (1998) for the origin of forming calendar-time portfolios and Mitchell and Stafford (2000) for an excellent application of the approach.

[8]In general, a positive HML factor beta indicates a value-oriented asset, whereas a negative HML factor beta indicates a growth-oriented asset.

rability of a PEG effect in stock returns contrasted to alternative value strategies based solely upon PE or growth characteristics.

The PE and PEG ratio

The PE ratio is a well-known measure of valuation requiring little introduction. Assume, for illustrative purposes and for the sake of simplicity, a constant-growth firm. Under such an assumption, we may rewrite the PE ratio as

$$\frac{P}{E} = \frac{1-b}{k - ROE \times b} = \frac{1-b}{k-g}, \quad (1)$$

where:

k = The required rate of return;
g = The assumed constant growth in earnings and dividends;
ROE = The return on equity; and
b = The plough back rate.

It is instructive to note that this measure varies positively with growth (for a given level of plough back) and negatively with the required rate of return. Typically, high PE companies can be expected to have both higher-than-average earnings growth rates and required rates of return.

Note, however, that growth is not desirable for its own sake. When a company has good investment prospects, the market will reward it with a higher PE multiple only if it believes that the growth is value enhancing. Specifically, this condition requires that the return earned on growth exceed the firm's cost of funds. When this is not the case, investors would prefer that that company pay out earnings as dividends or repurchase shares rather than reinvest in projects at an inadequate rate of return. While the assumption of constant growth is both simplistic and constraining, these implications are robust to more realistic settings where the growth rates in earnings and dividends may both differ from each other and vary over time.

The ratio of PE to growth is called the PEG ratio and has become a prominent analytical tool for stock selection. Its origin may be traced to Lynch and Rothschild (1990) who state for their general investor readership:

> The P/E ratio of any company that's fairly priced will equal its growth rate. I'm talking…about growth rate of earnings here…If the P/E ratio of Coca Cola is 15, you'd expect the company to be growing at about 15 percent per year, etc. But if the P/E ratio is less than the growth rate, you may have found yourself a bargain.

According to this assertion, equilibrium pricing exists whenever

$$\frac{P}{E} = g, \text{ or equivalently, } \frac{\frac{P}{E}}{g} \equiv PEG = 1 \quad (2)$$

where:

P = The stock price of a company;
E = The earnings per share (EPS); and
g = The growth-rate in EPS.

If PEG > 1, the market has overvalued the stock relative to its growth prospects. Symmetrically if PEG < 1, the market has undervalued the stock as the market expectation of growth exceeds the PE.[9] Potential conditions that may lead to this type of underpricing can include: (1) investors have not yet recognized the growth potential of the stock; (2) investors have overly punished the stock's price due to recent events (e.g., over-reaction to negative news); or (3) the stock may be situated in a currently out-of-favor industry when momentum investing is fashionable.

To the best of our knowledge, the specific equilibrium criterion of Lynch and Rothchild is ad hoc.[10] Nevertheless, regardless of the specific numerical benchmark used for stock selection, it is possible, if not likely, that pricing errors may still be systematically related to PEG.[11]

By construction, a positive correlation exists between value strategies based upon PE and PEG. Nevertheless, as our subsequent analysis would demonstrate, the risk profile between the two techniques differs. This is largely due to low PE stocks obtaining their status due to their low growth prospects and concomitant low risk measures. Alternatively, stocks can be classified as low PEG due to a low PE in the numerator, a high growth rate in the denominator, or a combination of the two measures leading to a low quotient. We subsequently show that for our sample firms, low PEG values typically arise in the presence of high expected earnings growth rates. Hence, the risk profile of low PEG stocks is highly influenced by the uncertainties present in high growth situations.

The popularity of the PEG ratio as a stock-picking tool has been enhanced by the popular investment-oriented website of the Motley Fool where the concept has

[9]Bradshaw (2002) documents prevalent use of a valuation heuristic, PEG ratio, among security analysts.

[10]For details on various valuation models, Damodaran (1996) is a good source.

[11]This point may be illustrated by way of an analogy to the regression-to-the-mean phenomenon with estimated betas. In particular, it is the high (low) estimates of beta which are thought to contain positive (negative) estimation error. Subsequent estimations using an unbiased estimator will likely result in an observed regression towards the mean. In a similar fashion, the use of a relative valuation metric, be it the P/E ratio or the PEG ratio, may equally be subject to a similar phenomenon whereby extreme values may appear to self-correct over time.

been made accessible to a wide readership.[12] The *Wall Street Journal* (2006a, 2006b) regularly runs columns, screens, and commentaries on PEG. [See also Hough (2006).] The PEG ratio has also received much attention from the practitioner community (Sturm, 1996). According to Sturm, several unpublished studies from Wall Street have cited a significant relationship between PEG ratios and growth-stock performance. Within this class of richly-valued stocks, stocks with high PEGs tend to be poor performers relative to stocks with low PEGs.

Table 1—Frequency Distribution of Sample Observations by Fiscal Year-end

The sample consists of 13,060 observations from the I/B/E/S Summary File from January 1990 through December 2003 during the month of each firm's fiscal year-end. The sample is derived from the following screens: (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

Month	Frequency	Percent
January	821	6.29
February	253	1.94
March	731	5.60
April	226	1.73
May	339	2.60
June	1,072	8.21
July	223	1.71
August	294	2.25
September	880	6.74
October	384	2.94
November	172	1.32
December	7,665	58.69
Total	13,060	100.00

The Data

Our sample selection begins with the I/BE/S summary database where we examine each record from 1990 through 2003 during the month of the fiscal year-end for every firm listed. We impose the following conditions on a firm to be included in our final sample: (1) the forecast of one-year-ahead EPS and the subsequently reported EPS for the current year are both positive; (2) the five-year growth forecast of EPS is positive; (3) at least three analysts report; (4) stock return data for the 12-month period beginning seven months after the fiscal year-end are available from CRSP; and (5) the firm has a primary SIC code indicating other than the financial or utility sectors. Our sample consists of a total of 13,060 firm-year observations that meet

[12]See Ashton (2002), Khattab (2006), Motley Fool (2006). Nevertheless, on another individual investor-oriented web site, multexInvestor.com, Gerstein alerted the investment community about the uses and abuses of PEG through his web article (Gerstein, 2002a) and book (Gerstein, 2002b).

these requirements. Table 1 gives the frequency distribution of these observations by the month of the fiscal year-end. As expected, the month with the largest number of fiscal year-ends is December, followed by June, September, and March.

Table 2—Sample Descriptive Statistics

The table provides basic descriptive statistics for the sample of 13,060 observations with forecast data obtained from the I/B/E/S Summary File for the period from January 1990 through December 2003. The EPS forecast refers to the I/B/E/S median forecast which is for the next fiscal year, the EPS historical refers to the actual EPS reported by I/B/E/S for the current year, the growth forecast refers to the I/B/E/S median forecast for the next five years, the stock price is the actual market price on the I/B/E/S report date, PE (expectational) refers to the ratio of the stock price to the EPS forecast, PE (hybrid) refers to the ratio of the stock price to the historical EPS, PEG (expectational) refers to the ratio of the PE (expectational) to the growth forecast, PEG (hybrid) refers to the ratio of the PE (hybrid) to the growth forecast, and analysts reporting refers to the number of analysts reporting their forecasts

Variable	Mean	Std. Dev.	25th Percentile	Median	75th Percentile
EPS Forecast ($)	1.476	1.679	0.720	1.170	1.800
EPS Historical ($)	1.253	1.477	0.550	0.970	1.560
Growth Forecast (%)	18.100	7.800	12.600	16.000	22.000
Stock Price ($)	22.460	29.934	11.000	18.000	27.925
PE (Expectational)[1]	18.125	21.983	11.469	14.932	20.000
PE (Hybrid)[2]	25.171	48.072	13.528	18.102	25.618
PEG (Expectational)[3]	1.058	1.095	0.696	0.929	1.230
PEG (Hybrid)[4]	1.445	3.445	0.849	1.134	1.510
Analysts Reporting	10.410	7.468	5.000	8.000	14.000

Notes:

1. $PE_t(\text{expectational}) = \dfrac{\text{Price}_t}{E_t\left(EPS_{t+1}\right)}$

2. $PE_t(\text{hybrid}) = \dfrac{\text{Price}_t}{EPS_t}$

3. $PEG_t(\text{expectational}) = \dfrac{PE_t(\text{expectational})}{g_t}$

4. $PEG_t(\text{hybrid}) = \dfrac{PE_t(\text{hybrid})}{g_t}$

where: g_t = The forecast of the five-year growth in EPS as of time t.

Table 2 provides a stylized picture of the sample in terms of the mean, the median, the standard deviation, and interquartile values of selected measures. The table shows two measures of EPS [the historical one and the forward (or forecast) one], the I\B\E\S five-year forecast of growth,[13] the stock price, two measures of the

[13]One may dispute the use of I/B/E/S growth rates based on the research of Chan, Karceski, and Lakonishok (2000, 2003) who conclude that "IBES growth forecasts are overly optimistic and add little predictive power." While examining PE and price-to-book ratios, they conclude "Valuation ratios also have limited ability to predict future growth." One, however, would be hard-pressed to find another set of readily-available and widely-followed estimates of growth rates.

price-to-earnings (PE) ratio relative to the two definitions of EPS, two corresponding measures of the PEG ratio, and the number of analysts reporting. The PEG ratios are defined as either expectational (if the forecast EPS is used) or as hybrid (if the historical EPS estimate is used) as follows:

$$PE_t \text{ (expectational)} = \frac{Price_t}{E_t\left(EPS_{t+1}\right)} \text{ and}$$

$$PEG_t \text{ (expectational)} = \frac{PE_t\left(\text{expectational}\right)}{g_t}, \tag{3}$$

where:

g_t = The forecast of the five-year growth in EPS as of time t.

Similarly,

$$PE_t \text{ (hybrid)} = \frac{Price_t}{EPS_t} \text{ and}$$

$$PEG_t \text{ (hybrid)} = \frac{PE_t\left(\text{hybrid}\right)}{g_t}. \tag{4}$$

The locational measures for earnings shown in Table 2 reveal that the mean one-year-ahead forecast across firms is about 22 cents or 18 percent higher than the historical measure. An examination of the respective medians and interquartile levels is generally consistent with this difference. The larger expectational measure is anticipated, as we have constrained our sample to require positive five-year growth forecasts. It follows that the expectational PE and PEG means are systematically lower than their hybrid counterparts. The average number of analysts tracking a stock is approximately ten, with a median of eight, suggesting that our sample firms have a reasonably strong following among the analyst community.

Table 3 shows the salient mean characteristics of the sample when it is sorted by PEG ratios into increasing quintiles. The table is divided into two panels. The top panel shows the statistics for the hybrid PEG, and the bottom panel shows those for the expectational PEG. Because the PEG ratio, by construction, is increasing in the PE ratio and decreasing in earnings growth rate, it is not surprising that our data show this strict monotonicity across quintiles for both components. We observe also that the stock-price means mimic those of the PE ratios and are likewise increasing in PEG. One potential explanation for this association will be provided by our finding of a strong size effect in market capitalization across quintiles; and ceteris paribus, market capitalization increases with the stock price. The data reveal a sub-

Table 3—Select Mean Characteristics by PEG Quintile

The table provides statistics sorted by PEG quintiles across the sample of 13,060 observations with forecast data obtained from the I/B/E/S Summary File for the period from January 1990 through December 2003. Quintiles are obtained for each month in the sample period and aggregated over time. The quintile classification is increasing in PEG with 1 being the lowest and 5 being the highest. EPS in Panel A refers to the historical measure for the Hybrid PEG and in Panel B to the forecast measure for the Expectational PEG. Return refers to the raw 12-month holding-period stock-return beginning seven months after the fiscal year-end. Std. Dev. refers to the standard deviation of the returns and beta refers to the index of systematic risk. They are estimated from the identical 12-month interval. The market capitalization (Market Cap) is measured as the stock price times the shares outstanding as provided by I\B\E\S during the reporting month. *F*-statistic is from one-way analysis of variance for five quintiles.

Panel A: Hybrid PEG

Quintile	PEG	PE	Growth	Stock Price	EPS	Return	Std. Dev.	Beta	Market Cap (millions $)
1	0.625	12.991	0.211	16.005	1.433	0.204	0.544	0.918	1115.174
2	0.911	17.026	0.187	19.694	1.314	0.150	0.476	0.873	1889.424
3	1.137	20.239	0.178	21.760	1.248	0.148	0.447	0.892	3213.629
4	1.433	24.049	0.168	25.762	1.249	0.138	0.420	0.910	5950.826
5	3.129	51.742	0.164	29.006	1.022	0.113	0.436	0.952	12943.663
All	1.445	25.171	0.181	22.460	1.253	0.150	0.464	0.909	5012.593
F-Stat	266**	288**	155**	76.23**	26.56**	8.50**	132**	7**	157**

Panel B: Expectational PEG

Quintile	PEG	PE	Growth	Stock Price	EPS	Return	Std. Dev.	Beta	Market Cap (millions $)
1	0.512	11.182	0.223	15.867	1.553	0.201	0.576	0.943	954.894
2	0.748	14.582	0.196	18.896	1.420	0.152	0.494	0.897	1660.521
3	0.937	16.583	0.177	21.297	1.449	0.144	0.446	0.885	2725.190
4	1.174	19.242	0.164	25.746	1.529	0.142	0.413	0.905	5537.616
5	1.920	29.042	0.147	30.450	1.429	0.114	0.395	0.915	14260.202
All	1.058	18.125	0.181	22.460	1.476	0.150	0.464	0.909	5012.593
F-Stat	776**	265**	403**	98.00**	3.40**	7.62**	306**	4 **	206**

Notes: * Significant at five percent level; ** Significant at one percent level

stantial difference in mean capitalization between quintile 5 and quintile 1 of 1060 percent for Panel A and 1394 percent for Panel B.

We now turn our attention to the risk profile of low-PEG investing strategy. Interestingly, this profile proves counterintuitive when compared to those of existing value strategies. Techniques based upon low PE ratios, or high book-to-market measures, typically select securities with lower-than-average risk. Here, however, we find the value segment of the PEG profile (quintile 1) to have the highest mean standard deviation of returns, and the most richly-valued segment (quintile 5) to have the lowest. This finding is consistent with the growth figures shown in Table 3 where low (high) PEG stocks have the highest (lowest) mean estimates of earnings growth. The mean beta values shown in the Table 3 are roughly consistent with this scenario, apart from the relatively high value observed for quintile 5. We suspect that these latter betas are highly influenced by the interaction of the observed size effect across quintiles and by the use of the CRSP value-weighted index in obtaining the estimates.

Aside from differential risk profiles, a second primary finding of Table 3 relates to the observed mean values of the 12-month holding period stock returns beginning seven months after the fiscal year-end for each sample observation. Like the aforementioned Peters study, the results shown are strongly consistent with the continued profitability of PEG-based investing strategy, where growth selling at a discount outperforms more expensive alternatives. Return statistics across PEG categories from each of the two panels are similar, with means of approximately 20 percent for quintile 1 that decrease to about 11 percent for quintile 5. Moreover, these averages are monotonically decreasing across quintiles, with the differences being highly statistically significant. One rather surprising implication of these findings is that the apparent profitability of a PEG-based strategy across the two panels is similar despite the forward-looking nature of the expectational EPS measure used in Panel B. It should be noted, however, that neither the tests of raw returns here nor the earlier results of Peters adjust for potential differences in risk.

It is theoretically possible that the raw return differences observed in Table 3 across quintiles are related to systematic risk factors and therefore should be expected. This would be the case if the securities comprising the low PEG quintile had the highest priced risk factors and those of quintile 5 had the lowest. To test for this possibility, we explicitly control for the three empirical factors identified by Fama and French (1993). These factors include the market risk premium (MRP), the return difference on a portfolio of small-cap minus big-cap stocks (SMB), and the return difference on a portfolio of high book-to-market minus low book-to-market stocks (HML). We employ a pooled time-series and cross-sectional regression

approach: The dependent variable is the yearly raw return and the independent variables are the firm's PEG ratio and the three control variables.[14]

Results for our tests employing risk adjustments are provided in Table 4 for both the hybrid and the expectational PEG. By construction, these tests are sensitive to variation both within and across PEG quintiles. Our findings indicate that the univariate implications of Table 3 are robust to controls for systematic risk.[15] In particular, returns continue to be significantly related to PEG regardless of the measure of PEG used. Additionally, these risk-adjusted findings indicate a higher level of statistical significance for the expectational PEG variable (t = –4.72) than for the hybrid measure (t = –2.46).

Table 4—Regressions Controlling for Known (Fama-French) Systematic Risk Measures

The table provides the estimates of a pooled time-series cross-sectional regression for the sample of 13,060 observations with forecast data obtained from the I/B/E/S Summary File for the period from January 1990 through December 2003. The dependent variable is the raw return for a 12-month holding-period beginning seven months after the fiscal year-end. The independent variables are the PEG ratio, the market risk premium (MRP), the return difference on a portfolio of small minus big stocks (SMB), and the return difference on a portfolio of high minus low book-to-market stocks (HML). F-statistic is for the regression equation

	Hybrid PEG		Expectational PEG	
	Coefficient	t value	Coefficient	t value
Intercept	0.052	7.38**	0.070	8.42**
PEG	-0.004	-2.46*	-0.021	-4.72**
MRP	0.856	22.15**	0.851	22.02**
SMB	0.756	15.72**	0.758	15.77**
HML	0.220	8.06**	0.220	8.06**
R^2	0.04		0.04	
F-Stat	142.13**		146.36**	

Notes: * Significant at the 5 percent level; ** Significant at the 1 percent level

Within the sample, a value PEG portfolio that provides growth at a reasonable price achieves its classification through the interaction of a low PE ratio and a high growth rate (Table 2). To test the robustness of the results,[16] we augment the three Fama-French factors with Carhart's momentum factor (UMD).[17] The results[18] show

[14]The Fama and French Quarterly Factor File is obtained from
http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html
The quarterly data are converted to annual equivalents corresponding to our return sampling period for each security.

[15]Because the return on a portfolio of high minus low book-to-market (HML) stocks might be related PEG, the regressions presented in Table 4 are rerun without the HML variable. The results are similar to those shown in the table and are available from the authors upon request.

[16]We thank an anonymous referee for suggesting the inclusion of the momentum factor.

[17]See Carhart (1997). More information on the data file can be found at the French web site at http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_mom_factor.html.

[18]These additional results are available from the authors upon request.

that (1) the momentum factor is not significant in a four-factor model and (2) the Jensen alpha is not significant in any PEG quintile.[19] This reinforces the earlier conclusion that PEG is significant in explaining return across the sample (even after controlling for the four risk-factors).

We next examine whether this interaction provides an advantage that is not available by examining the components separately. Table 5 shows a 5 × 5 matrix for the mean annual returns cross-classified by PEG and PE.[20] Like Table 3, the top panel of each table uses the hybrid definition of the PEG ratio and the lower panel uses the expectational form. The second-last column and the last row (both labeled "All") reveal that value-investing based upon either the PEG or the PE is advantageous during the sample period. Specifically, returns for the aggregate sample are monotonically increasing in the direction of value. As either the PEG or the PE quintile gets smaller, the return becomes higher. Consider the top panel: (1) for all PE quintiles, the return is highest (0.204) for PEG quintile 1 and lowest (0.113) for PEG quintile 5, (2) for all PEG quintiles, the return is highest (0.171) for PE quintile 1 and lowest (0.127) for PE quintile 5. For the lower panel, (1) for all PE quintiles, a similar monotonic pattern is observed, (2) for all PEG quintiles, however, PE quintile 4 breaks the monotonicity. The pattern of mean returns in the all column and row suggests additionally that for quintile 1 the PEG effect is slightly more pronounced than the PE effect (for the top panel 0.204 versus 0.171 and for the bottom panel 0.201 versus 0.168). For the remaining four quintiles, the situation is reversed.

The 5 × 5 design of Table 5 allows us to hold constant the level of one attribute (either the PE or the PEG) and examine potential differences in mean returns across quintiles of the alternative attribute. As an example, consider PEG quintile 1 (top row of both panels) across PE levels; this contains the least richly-valued PEG securities. We observe a range of 0.197–0.258 (difference of 0.061) in mean returns across PE levels. Now consider PEG quintile 5 (row 5 of both panels) across PE levels; this contains the most richly-valued PEG securities. We observe a range of 0.093–0.181 (a difference of 0.088). Overall, row 1 shows less dispersion than row 5. Statistically speaking, however, not all differences are significant. The F-statistics given in the last column (row) test the highest-and lowest-category portfolios for each row (column). We interpret the evidence to suggest that the PE ratio has relatively less impact on PEG-based value portfolios for less richly-valued securities than more richly-valued ones. A similar pattern can be observed between column 5 (high-PE portfolios) and column 1 (low-PE portfolios). For PE quintile 5, we

[19]Correlations between PEG and the four factors are negligible for the hybrid version, while they are relatively high for the expectational version. The Fama and French factors show correlations in the usual magnitude.

[20]Technically speaking, the quintile-by-quintile sort is a nested sort. The data are sorted first on PEG. Next each PEG quintile is sorted into five PE quintiles. The second-last column and the last row (both labeled "All") represent an independent sort on each variable.

observe a range of 0.093–0.235 (a difference of 0.142) and for PE quintile 1, a range of 0.123–0.197 (a difference of 0.074). Thus, within particular PEG or PE quintiles, specific value strategies have merit.

Table 5—Pooled Arithmetic Mean Returns Employing Monthly Rankings by PEG and PE Quintiles

The table provides the estimates of a pooled time-series for the sample of 13,060 observations with forecast data obtained from the I/B/E/S Summary File for the period from January 1990 through December 2003. The variable is the mean raw return for a 12-month holding-period beginning seven months after the fiscal year-end. Quintiles are obtained for each month in the sample period and aggregated over time. The quintile classification is increasing in PEG and PE with 1 being the lowest and 5 being the highest. Hybrid PEG refers to the ratio of the hybrid PE to the growth forecast, where hybrid PE is calculated from the historical EPS. Expectational PEG refers to the ratio of the expectational PE to the growth forecast, where expectational PE is calculated from the one-year-ahead forecast EPS. Growth forecast refers to the five-year forecast of growth. F-statistic is from one-way analysis of variance for the two extreme quintiles

	PE Quintile						
PEG Quintile	1	2	3	4	5	All	F-Stat
Panel A: Hybrid PEG							
1	0.197	0.196	0.210	0.258	0.235	0.204	0.31
2	0.144	0.166	0.159	0.141	0.099	0.150	0.72
3	0.123	0.137	0.154	0.118	0.228	0.148	2.51*
4	0.135	0.136	0.124	0.147	0.144	0.138	0.19
5	0.181	0.154	0.168	0.103	0.093	0.113	2.41*
All	0.171	0.161	0.157	0.136	0.127	0.150	2.46*
F-Stat	2.23	1.06	1.73	3.15*	2.86*	8.50**	
Panel B: Expectational PEG							
1	0.186	0.225	0.206	0.229	0.175	0.201	0.34
2	0.148	0.186	0.133	0.170	0.080	0.152	2.04
3	0.142	0.135	0.142	0.164	0.131	0.144	0.38
4	0.128	0.120	0.135	0.117	0.193	0.142	2.12
5	0.184	0.148	0.153	0.154	0.062	0.114	7.16**
All	0.168	0.168	0.149	0.154	0.113	0.150	3.97**
F-Stat	1.00	3.00*	1.44	1.73	4.34**	7.62**	

Notes: * Significant at the 5 percent level; ** Significant at the 1 percent level

Does the aforementioned conclusion mean that the PE- and PEG-effects have separable components? An examination of the principal diagonals of the two panels reveals a true monotonicity. (For the top panel: 0.197, 0.166, 0.154, 0.147, 0.093; for the bottom panel: 0.186, 0.186, 0.143, 0.117, 0.062). This suggests that both PE and PEG can be simultaneously exploited. This interpretation actually highlights the emphatic statement of the Motley Fool and multexInvestor web sites to the effect that neither PEG ratio nor PE ratio *alone* should be used to make investment decisions.

PEG depends on both PE and growth rate. As demonstrated above, the PEG and PE effects are separable. We need to investigate whether PEG and growth effects are separable. Table 6 for PEG and growth is constructed in the same way as Table 5 for PEG and PE. The mean returns across PEG quintiles are identical to those shown in

both Tables 3 and 5. There is no growth effect evident across the entire sample (F-statistics are insignificant at 1.00) as contrasted to the PE effect observable in Table 5 (F-statistics are significant at 2.46 and 3.97). There does exist, however, specific instances of a PEG effect within numerous growth quintiles (1, 2, and 5) as well as for the entire sample (F-statistics are significant at 8.50 and 7.62). Alternatively, significant variation by growth occurs only in the highest PEG quintile. This leads us to conclude that the interaction of these components provides an advantage that is not available separately.

Table 6—Pooled Arithmetic Mean Returns Employing Monthly Rankings by PEG and Growth Quintiles

The table provides the estimates of a pooled time-series for the sample of 13,060 observations with forecast data obtained from the I/B/E/S Summary File for the period from January 1990 through December 2003. The variable is the mean raw return for a 12-month holding-period beginning seven months after the fiscal year-end. Quintiles are obtained for each month in the sample period and aggregated over time. The quintile classification is increasing in PEG and growth with 1 being the lowest and 5 being the highest. Hybrid PEG refers to the ratio of the hybrid PE to the growth forecast, where hybrid PE is calculated from the historical EPS. Expectational PEG refers to the ratio of the expectational PE to the growth forecast, where expectational PE is calculated from the one-year-ahead forecast EPS. Growth forecast refers to the five-year forecast of growth. F-statistic is from one-way analysis of variance for the two extreme quintiles

	Growth Quintile						
PEG Quintile	1	2	3	4	5	All	F-Stat
Panel A: Hybrid PEG							
1	0.233	0.201	0.163	0.213	0.220	0.204	0.61
2	0.179	0.118	0.189	0.142	0.134	0.150	1.73
3	0.133	0.122	0.156	0.134	0.199	0.148	1.48
4	0.128	0.138	0.136	0.164	0.127	0.137	0.35
5	0.151	0.112	0.122	0.114	0.024	0.113	5.05**
All	0.149	0.132	0.158	0.161	0.151	0.150	1.00
F-Stat	3.41**	2.85**	1.30	1.88	4.47**	8.50**	
Panel B: Expectational PEG							
1	0.320	0.194	0.159	0.197	0.216	0.201	0.98
2	0.193	0.137	0.185	0.136	0.135	0.152	1.12
3	0.150	0.099	0.169	0.171	0.136	0.144	2.20
4	0.117	0.125	0.139	0.152	0.220	0.142	2.32
5	0.148	0.148	0.104	0.111	-0.077	0.114	16.19**
All	0.149	0.132	0.158	0.161	0.151	0.150	1.00
F-Stat	7.59**	2.82*	1.65	1.22	7.58**	7.62**	

Notes: * Significant at the 5 percent level; ** Significant at the 1 percent level

Concluding Remarks

Although value investing has received a great deal of attention in the literature, published studies investigating the effectiveness of PEG-based investing have been relatively rare. We are aware of only one study (Peters, 1991) in the mainstream finance literature that documents the extraordinary effectiveness of this strategy during the 1980s using a sample of high growth stocks and a hybrid PEG ratio util-

izing both historical and expectational data. The current work tests the robustness of this finding using a subsequent sample period and provides a number of modifications to the original tests. Further, our sample is not restricted to only high growth firms, but includes all firms that meet simple data requirements.

Our primary finding is that there continues to be a PEG effect in equity returns whereby growth selling at a discount outperforms more expensive alternative investments. Reported differences in performance are robust to controls for differential risk as well as whether expectational or historical earnings per share measures are employed. Surprisingly, our study also demonstrates that PEG-based value investing has enhanced risk characteristics. This last finding derives from the composition of our value portfolios which are shaped by the high growth expectations observed in low PEG portfolios. Of course, a full-fledged scrutiny of risk profile of PEG-investing strategy is a topic reserved for a separate study.

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