Adjusting P/E ratios by growth and risk: the PERG ratio

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Abstract

Purpose – The purpose of this study is to compare the performance of a low-P/E strategy relative to that of two alternative *value* strategies, one based on the PEG ratio and another on the PERG ratio (a magnitude introduced in this article).

Design/methodology/approach – The data used consists of a sample of 100 US companies between January 1975 and September 2002. Portfolios are formed on the basis of different valuation ratios, and their performance is compared in order to determine the best-performing strategy.

Findings – Portfolios sorted by PERG ratios outperform, on a risk-adjusted basis, those sorted by both P/E ratios and PEG ratios. This outperformance occurs regardless of whether portfolios are not rebalanced, rebalanced every ten years, or rebalanced every five years.

Research limitations/implications – The sample of stocks is not large. The results could be validated by using a larger sample of US stocks and a longer time period, as well as by using a sample of stocks from several international markets.

Practical implications – The PERG ratio proposed in this article improves on the PEG ratio, adjusting the latter by risk. That, plus the fact that PERG-based strategies outperform on a risk-adjusted basis strategies based on both P/Es and PEGs, should make it an attractive tool to add to the arsenal of valuation tools used by analysts.

Originality/value – A new valuation tool is proposed, called the PERG ratio, that adjusts P/E ratios by both growth and risk (or, similarly, PEG ratios by risk).

Keywords Price earning ratio, Business development, Strategic objectives, Numerical analysis

Paper type Research paper

1. Introduction

The so-called internet bubble became, in a way, the short-lived revenge of growth-oriented investors. For many years, practitioners and academics produced a vast number of studies showing the superiority of value strategies over growth strategies. Then, in the second half of the 1990s, even Warren Buffett seemed to have gone out of fashion.

After three consecutive down markets (2000, 2001, and 2002), however, value investors came back with a vengeance. At the same time, growth investors went AWOL, growth companies gave up most of the gains accumulated during the bull market, and even long-forgotten dividends came back into fashion.

Despite this rollercoaster of up and down markets, there seems to be a wide consensus about the fact that value strategies outperform growth strategies in both the US and in other countries. Capaul *et al.* (1993) report that value outperformed growth in the US, Japan, and Europe by an average of 40 percent over the period 1981-1992[1]. Bauman *et al.* (1998) extend the previous study in terms of time (1985-1996) and coverage (21 countries) and confirm that value outperforms growth, though not necessarily in every country or every year. Many other studies report results consistent with these findings.

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The debate, then, is not so much about whether value outperforms growth (it does), but about *why* this happens. Fama and French (1992, 1996) argue that value strategies outperform growth strategies simply because the former are riskier. In their view, this is the logical consequence of market efficiency. Chen and Zhang (1998) subscribe to this view, and report results showing that value outperforms growth in the US, Japan, Hong Kong and Malaysia, *and* that value is riskier than growth.

Lakonishok *et al.* (1994), on the other hand, argue that value strategies yield higher returns because they exploit the suboptimal behavior of investors. In their view, inefficient markets underprice out-of-favor (value) stocks, and therefore investing in them does eventually pay off[2]. Arshanapalli *et al.* (1998) subscribe to this view, and report results showing that value outperforms growth in international markets, *and* that value strategies are not riskier than growth strategies.

This article is not a "value versus growth" study but an inquiry into the much-less explored "value versus value" issue. The purpose of this study is not to compare the performance of low P/E (value) and high P/E (growth) strategies. Rather, it is to compare the performance of a low P/E strategy relative to that of two alternative *value* strategies. One is based on the PEG ratio, a valuation tool widely used by analysts, that adjusts the P/E ratio by growth. The other is based on the PERG ratio, a magnitude introduced in this article that adjusts the P/E ratio by both growth and risk.

Thus, the purpose of this article is two-fold:

(1) to propose a new tool, the PERG ratio, that can be used for stock valuation and, by extension, for implementing trading strategies; and

(2) to assess the performance of strategies based on the proposed tool relative to that of strategies based on existing and widely used measures of value.

The sample is limited but the results are encouraging: portfolios sorted by PERG ratios outperform, on a risk-adjusted basis, those sorted by both P/E ratios and PEG ratios. The results reported also cast some doubts on strategies based on the popular PEG ratio, which is generally outperformed by strategies based on both P/E ratios and PERG ratios.

The rest of the article is organized as follows. Section 2 briefly reviews the basics of P/E ratios and PEG ratios; section 3 introduces the PERG ratio; section 4 reports and discusses the empirical evidence; and section 5 provides an assessment. An Appendix concludes the article.

2. Relative valuation: the P/E ratio and the PEG ratio

Value strategies are largely based on selecting stocks that are cheap relative to some fundamental variable. P/E ratios are used to select stocks that are cheap relative to earnings per share (EPS); price-to-cash flow ratios to select stocks that are cheap relative to cash flow per share; price-to-book ratios to select stocks that are cheap relative to book value per share; and so on[3]. Of all the tools of relative valuation, P/E ratios are arguably the most widely used by analysts.

2.1. The P/E ratio

The P/E ratio of a company indicates the number of dollars investors are willing to pay for a dollar of the company's EPS. Although there is no ambiguity about the numerator, there are many possibilities for the denominator. Forward-looking P/Es are estimated on the basis of expected EPS (usually for the next four quarters) and trailing

P/Es on the basis of observed EPS (usually the last four quarters). Furthermore, when calculating a company's earnings, some analysts use net income, others omit one-time charges, and still others use EBITDA. Finally, when comparing the P/Es of companies in different countries, different accounting standards add an additional obstacle to the standardization of earnings. In short, then, when dealing with P/E ratios it is important to read the small print.

Besides dealing with these matters, an analyst using P/E ratios as a valuation tool has at least two additional key issues to deal with:

(1) to determine the appropriate benchmark of comparison; and

(2) to determine the reasons for which a given P/E ratio may be different from its appropriate benchmark.

Let us very briefly discuss the first problem, which is *not* the focus of this article.

There are at least three possibilities for the appropriate benchmark. First, a company's current P/E ratio could be compared to a *temporal* benchmark; that is, the average P/E ratio of the company over the previous several years. Second, a company's current P/E ratio could be compared to a *cross-sectional* benchmark; that is, the average current P/E ratio of comparable companies (usually companies in the same industry). Finally, a company's current P/E ratio could be compared to a *theoretical* benchmark; that is, the P/E ratio the company should have given (some of) its fundamentals[4]. Whitbeck and Kisor (1963) pioneered the use of this type of benchmark by estimating an equilibrium P/E based on a company's expected growth in EPS, the variability (standard deviation) of its EPS, and its dividend payout ratio. Each of these benchmarks (temporal, cross-sectional, and theoretical) has several pros and cons, but it is not the purpose of this article to address this issue.

2.2. The PEG ratio

Now to the second problem. When comparing a company's P/E with its appropriate benchmark, an analyst may find a substantial difference between the two. When this is the case, the analyst's main task is to determine whether the difference in P/Es can be explained by differences in fundamentals. If that is possible, then the stock is properly priced and no trading opportunity exists; if that is not possible, then the stock is mispriced and a trading opportunity exists.

Two of the main fundamental factors that may explain differences between the P/Es of comparable companies (or, more generally, between a company's P/E and its appropriate benchmark) are growth and risk. This can be easily seen from the following expression:

$$\mathrm{P/E} = \frac{\mathrm{DPR} \cdot (1 + g_{\mathrm{D}})}{R_{\mathrm{E}} - g_{\mathrm{D}}},$$

where DPR, g_{D}, and R_{E} denote the dividend-payout ratio, the long-term growth rate of dividends, and the required return of equity, respectively[5].

Of these two variables, consider growth first. It is perfectly possible (and plausible) that two comparable companies may have a different P/E because, everything else equal, one is expected to grow its earnings faster than the other. Assume that company A has a P/E of 10 and (comparable) company B has a P/E of 20. It would be premature to conclude that A is relatively cheaper and therefore a better buying opportunity. It

may well be the case that B is expected to grow its earnings at a faster rate than A: hence, investors are willing to pay more for a dollar of EPS of B than for a dollar of EPS of A. In other words, even though these two comparable companies have a different P/E, they both may be properly priced.

In order to account for differences in growth, a P/E ratio can be adjusted by the expected growth in EPS. This adjustment gives way to the PEG ratio, which is defined as:

$$\mathrm{PEG} = \frac{\mathrm{P/E}}{g}, \tag{2}$$

where g denotes the expected growth in EPS.

Going back to companies A and B above, if B was expected to grow its EPS over the next five years at an annual rate of 10 percent, and A at only 5 percent, then both companies would have a PEG ratio of 2. In other words, once the higher P/E of B is adjusted by its higher expected growth in EPS, both companies have the same growth-adjusted multiple. Looked at in this way, the PEG ratio improves upon the P/E ratio because it adjusts the latter by one of its main determinants (growth).

Although there does not seem to be a widely accepted benchmark for the PEG, practitioners tend to look for value in stocks with a PEG lower than 1. In *Beating the Street*, the legendary manager of the Fidelity Magellan fund, Peter Lynch, argues that as "a rule of thumb, a stock should sell at or below its growth rate – that is, the rate at which it increases its earnings every year" (Lynch, 1993). The Gardner brothers, in their Fool.com website (Fool.com, n.d.), argue that in "a fully and fairly valued situation, a growth stock's price-to-earnings ratio should equal the percentage of the growth rate of its company's earnings per share." Finally, SmartMoney.com warns investors about the fact that any PEG "above 1 is suspect since that means the company is trading at a premium to its growth rate. Those looking for growth at a reasonable price usually look for a PEG of 1 or below" (SmartMoney.com, n.d.)

2.3. Previous studies on the PEG ratio

Despite its increasing popularity as a valuation tool, the academic literature on the PEG ratio is scarce. The pioneering study seems to be by Peters (1991), who focused on the compounding power of PEG-sorted portfolios. He found that between January 1982 and June 1989, \$1 invested in the lowest-PEG portfolio, rebalanced quarterly, would have turned into \$15.36, whereas \$1 invested in the highest-PEG portfolio, also rebalanced quarterly, would have turned into just \$1.38. (In the same period, \$1 invested in the S&P500 turned into \$3.56.)

More recently, Sun (2001) found that PEG ratios and stock returns were negatively related during the period July 1983-June 2000, though the significance of the relationship largely stems from the first half of the sample. He also finds a hump-shaped relationship between PEG-sorted portfolios and returns, with low-PEG portfolios and high-PEG portfolios earning lower returns than medium-PEG portfolios. These results are not very supportive of the PEG as a valuation tool and cast doubt on a low-PEG value strategy.

Easton (2002), in contrast, reports more optimistic results. He proposes a method to simultaneously estimate expected returns and earnings growth (thus refining PEG-based rankings), and finds that expected return estimates based on the PEG are highly correlated with those based on the refined methodology. He concludes from

these results that PEG ratios are a reasonable first-order approximation to a ranking on expected returns.

3. A new tool of relative valuation: the PERG ratio

It was mentioned above that two of the main fundamentals that may explain differences in P/E ratios across comparable companies are growth and risk. PEG ratios adjust P/E ratios by growth, thus removing the impact of this factor. But what about risk? Take two comparable companies with the same P/E and expected growth in EPS but different risk. Would the fact that these two companies have the same PEG necessarily lead you to conclude that they are equally attractive? If not, doesn't the PEG then give an incomplete picture of relative value?

To illustrate, go back to companies A ($P/E = 10$ and $g = 5$ percent) and B ($P/E = 20$ and $g = 10$ percent) above. Recall that, given their P/Es, A appeared to be more attractive than B, but after adjusting by growth both companies appeared to be equally attractive. But what if company A had a beta of 1 and company B a beta of 0.5? Would a rational investor still consider A to be more attractive than B? If not, doesn't the PEG then give an incomplete picture of relative value?

3.1. The PERG ratio

Although there is a widely accepted method to adjust P/E ratios by growth (the PEG ratio), there is no widely accepted method to adjust P/E ratios by risk. This article attempts to fill that void by proposing a new valuation tool, the PERG ratio, that adjusts P/E ratios by *both* of their two main determinants, growth and risk. Thus, let a PERG ratio be defined as:

$$\text{PERG} = \frac{\text{P/E}}{g} \cdot R, \tag{3}$$

where R denotes risk. Although the obvious candidate to proxy for R is beta, some other parameters could be plausibly considered (more on this below).

Note from equation (2) that, given two stocks with the same P/E, the higher the expected growth in EPS, the lower the PEG, and the more attractive the stock. Similarly, note from equation (3) that given two stocks with the same PEG, the lower the risk, the lower the PERG, and the more attractive the stock. In other words, when using the PERG as a valuation tool, the best stocks are those with the lowest PERG; that is, those that are either cheap (low P/E), or that are expected to grow fast (high g), or that are not very risky (low R).

Going back once again to companies A and B above, recall that A appears to be more attractive in terms of P/E, and that both companies appear to be equally attractive in terms of PEG. However, once the fact that B ($\beta = 0.5$) is less risky than A ($\beta = 1$) is taken into account, then B (PERG = 1) becomes more attractive than A (PERG = 2). Hence, the relative value of A and B as assessed by their P/Es is exactly reversed once their differential growth and risk are taken into account by comparing their PERGs.

3.2. An example

Consider the data reported in Table I for two of the companies in the sample, Johnson & Johnson (J&J) and Ely Lilly, both in the pharmaceutical industry. Table I shows the

P/E, expected growth in EPS, risk quantified by beta, PEG and PERG of both companies. As Table I shows, a simple comparison of P/Es indicates that Ely Lilly is cheaper than J&J, and therefore more attractive. However, once the much higher expected growth of J&J is accounted for, J&J becomes more attractive than Ely Lilly on the basis of their PEGs. And yet, once the higher risk of J&J is taken into account, Ely Lilly becomes more attractive than J&J on the basis of their PERGs.

This simple example shows that assessing companies on the basis of their P/Es, PEGs, or PERGs may imply different rankings. In other words, the relative attractiveness of companies may change substantially depending on the valuation ratio considered. The results reported in the next section confirm and complement the results of this simple example.

3.3. Assessing risk

It was briefly discussed above that although analysts and investors use P/E ratios regularly, not all of them define this ratio in the same way. Earnings, as was briefly discussed, can be defined in a variety of ways. Furthermore, the g that analysts and investors use to adjust P/E ratios by growth can also be thought of in more than one way. At the very least, there is no clear consensus on whether g should be the expected growth in EPS one or more years forward.

Similarly, the R used to adjust PEG ratios by risk, thus giving rise to the PERG ratio, can also be thought of in more than one way. Risk is, after all, the most elusive concept in finance. The most widely used measure of risk, and the obvious proxy for R, is beta (β), the sensitivity of a company's returns to fluctuations in the market returns. In this case, the PERG would be given by $[(\mathrm{P/E})/g]\cdot\beta$.

An alternative measure of risk that stems from a downside risk framework is the downside beta (β^{D}), which measures the sensitivity of a company's returns to the market returns when both returns fall below a given benchmark[6]. More precisely, a downside beta for company i can be defined as:

$$\beta_i^{\mathrm{D}} = \frac{\Sigma_{iM}}{\Sigma_M^2} = \frac{E\{\min[(R_i - \mu_i), 0]\cdot\min[(R_M - \mu_M), 0]\}}{E\{\min[(R_M - \mu_M), 0]^2\}}, \tag{4}$$

where Σ_{iM} denotes the cosemivariance between the returns of company i and the market (indexed by M), Σ_M^2 denotes the semivariance of the market returns, and μ represents mean returns (just one of the many possible benchmarks used in a downside risk framework). If the downside beta is used as a proxy for R, then the PERG would be given by $[(\mathrm{P/E})/g]\cdot\beta^{\mathrm{D}}$.

	P/E	g (percent)	β	PEG	PERG
J&J	27.3	12.9	0.4	2.1	0.9
Ely Lilly	24.5	6.7	0.2	3.7	0.6

Notes: P/E as at September 2002; expected growth in EPS (g) based on observed annual growth for the previous ten years; beta (β) estimated on the basis of the previous 60 months; PEG and PERG follow from equations (2) and (3), respectively

Table I.
P/E, PEG, and PERG

There is an overwhelming number of studies that attempt to identify the variables that explain the cross-section of stock returns. Although the analysis below focuses on beta and downside beta as proxies for risk, alternative risk factors identified in the literature as explaining returns could in principle be used as proxies for R in equation (3). Alternatively, risk could be measured by the required return that stems from a pricing model.

4. The evidence

There are at least two approaches designed to assess the impact of a given variable on returns. The standard *statistical* analysis intends to answer whether the chosen variable significantly explains the variability of returns. An *economic* analysis, on the other hand, intends to assess the performance of portfolios based on the chosen variable relative to the performance of portfolios based on alternative variables. The analysis in this article belongs to the latter category.

A caveat, however, is in order. It is well known that statistical inference is highly dependent on the existence of outliers. In response, many researchers implement economic analyses (usually with monthly rebalancing) with the sole purpose of verifying and strengthening the results of statistical analyses (see, for example, Fama and French (1998); Barry *et al.*, 2002). That is *not* the goal of the economic approach in this paper, which does not seek to reassess the validity of statistical results. Rather, it seeks to determine which of the portfolio-selection tools considered generates the best medium- and long-term portfolios.

The central question in this article is whether PERG-ranked portfolios outperform portfolios ranked by P/E ratios and PEG ratios. The data used consists of a sample of 100 companies selected with the only restriction that they had returns available in Datastream for the full sample period of January 1975-September 2002[7]. The Appendix shows all the companies in the sample as well as the industry they belong to.

4.1. Parameter estimates and portfolio formation

Computation of all the relevant ratios for each company requires estimates of EPS, expected growth in EPS, and risk. P/E ratios as downloaded from Datastream are based on trailing EPS. Because PEG ratios are usually defined in terms of expected earnings, the implicit assumption in the analysis is that the best estimate of expected earnings is the earnings observed the year before. Given the dismal record of analysts in predicting earnings, this naive assumption may be more plausible than it may appear at a first glance.

A similar assumption is made for the expected growth in EPS: At every relevant point in time, expected growth rates are estimated as the mean annual compound growth rate over the previous five years. Similarly, the risk parameters β and β^{D} are also estimated, at every relevant point in time, using returns from the previous five-year period.

The construction of portfolios and the assessment of their performance are done as follows. At the beginning of each investment period, stocks are ranked by one of the three ratios considered (P/E, PEG, and PERG)[8]. The top 30 stocks (i.e. the 30 stocks with the *lowest* ratios) are then assigned to a portfolio that is held through the end of the investment period. Portfolio returns during this period are computed as an equally weighted average of returns of all the stocks in the portfolio. In order to obtain robust results, the analysis is performed for one 23-year investment period, two ten-year

periods (plus a shorter three-year period), and four five-year periods (plus a shorter three-year period).

4.2. A preliminary assessment of performance: holding-period returns

Table II displays the returns of portfolios ranked by P/Es, PEGs, and PERGs for all investment periods, as well as the market returns (those of the S&P500). Had portfolios been formed on the basis of these three ratios at the beginning of 1980 and held through to the end of September 2002, a low-P/E strategy would have outperformed the other two strategies considered and the market. As Panel A in Table II shows, the 5,311.7 percent holding-period return (HPR) for the low-P/E portfolio is larger than that delivered by the low-PEG portfolio (4,927.6 percent), the low-PERG portfolio (5,040.5 percent), and certainly the market (1,444.5 percent).

Relative results are not significantly different under rebalancing. Regardless of whether portfolios are rebalanced every ten years (panel B, Table II) or every five years (panel C, Table II), value strategies based on P/Es outperform the other two strategies, in some cases by a substantial margin, and the market. Table III complements Table II by displaying the evolution of a $1,000 investment at the beginning of 1980, compounded at the returns shown in Table II.

Tables II and III together seem to imply that there may be no need to replace the P/E ratio as a tool to implement value strategies. However, Tables II and III give an incomplete picture of what investors focus on when making investment decisions. Rather than focusing just on returns, investors do care also about risk. All models of modern portfolio theory are, in fact, solidly based on a trade-off between risk and return. It follows logically, then, that a correct evaluation of performance needs to account for both returns *and* risk.

Investment period	P/E (percent)	PEG (percent)	PERG (percent)	Market (percent)
Panel A: no rebalancing				
1980-2002 (HPR)	5,311.7	4,927.6	5,040.5	1,444.5
Panel B: rebalancing every ten years				
1980-1989	748.1	720.2	790.6	403.9
1990-1999	699.5	798.3	648.2	432.8
2000-2002	19.3	0.8	8.5	−42.5
HPR	7,989.5	7,327.8	7,128.3	1,444.5
Panel C: rebalancing every five years				
1980-1984	219.2	220.8	191.3	99.0
1985-1989	157.8	151.5	196.8	153.2
1990-1994	101.3	102.7	98.4	51.7
1995-1999	310.1	337.0	289.5	251.1
2000-2002	19.3	0.8	8.5	−42.5
HPR	8,007.0	7,105.4	7,146.7	1,444.5

Table II.
Performance (I): returns

Notes: HPR, holding-period return; HPR in panels B and C computed as the compound return over all subperiods

Investment period	P/E ($)	PEG ($)	PERG ($)	Market ($)
Panel A				
By December 2002	54,117	50,276	51,405	15,445
Panel B				
By December 1989	8,481	8,202	8,906	5,039
By December 1999	67,809	73,679	66,635	26,845
By September 2002	80,895	74,278	72,283	15,445
Panel C				
By December 1984	3,192	3,208	2,913	1,990
By December 1989	8,230	8,069	8,645	5,039
By December 1994	16,569	16,356	17,151	7,645
By December 1999	67,956	71,472	66,805	26,845
By September 2002	81,070	72,054	72,467	15,445

Note: All figures follow from an initial investment of $1,000 on January 1, 1980 compounded at the returns displayed in Table II

Table III.
Evolution of a $1,000 investment

4.3. A better assessment of performance: Sharpe ratios

Table IV shows the missing side of the coin by reporting information about the risk of each portfolio measured by the monthly standard deviation of returns. It also shows the mean monthly return and the Sharpe ratio of each portfolio, the latter defined as the portfolio's mean return divided by its standard deviation, i.e. $S_p = \mu_p/\sigma_p$, where S_p, μ_p and σ_p denote the Sharpe ratio, the (arithmetic) mean return, and the standard deviation of portfolio p, respectively. As Table IV shows, the picture now is significantly different.

Panel A in Table IV shows that the low-P/E strategy is outperformed, on a risk-adjusted basis, by the other two strategies. This panel shows, in fact, that for the whole sample period, the best strategy is based on the PERG ratio proposed in this article. Panels B and C in Table IV further confirm the superiority of the low-PERG strategy, which outperforms the other two strategies (not only on average but also in most subperiods) and the market[9].

Furthermore, Table IV casts doubt on the usefulness of the popular low-PEG strategy, which is outperformed (on average and in most subperiods) by strategies based on both P/Es and PERGs. These results reinforce those of Sun (2001) questioning the validity of value strategies based on PEG ratios.

4.4. A more intuitive approach: risk-adjusted returns

The Sharpe ratios displayed in Table IV appropriately assess the risk-adjusted performance of each strategy but suffer from the problem of lacking intuition. Expressing returns in units of risk does not make it easy to determine intuitively *how much* better a given strategy is relative to another. However, if the Sharpe ratio is multiplied by the standard deviation of returns of the market portfolio (σ_M) we obtain the risk-adjusted return of portfolio p (RAR_p) given by $RARp = (\sigma_M/\sigma_p) \cdot \mu_p$[10].

This measure of risk-adjusted returns has two desirable characteristics. First, unlike Sharpe ratios, which are measured in units of risk, risk-adjusted returns are

Table IV.
Performance (II): Sharpe ratios

Investment period	P/E MR[a] (percent)	P/E SD[b] (percent)	P/E SR[c]	PEG MR[a] (percent)	PEG SD[b] (percent)	PEG SR[c]	PERG MR[a] (percent)	PERG SD[b] (percent)	PERG SR[c]	Market MR[a] (percent)	Market SD[b] (percent)	Market SR[c]
Panel A												
1980-2002	1.6	5.5	29.38	1.6	5.0	31.31	1.6	4.9	31.84	1.1	4.5	24.53
Panel B												
1980-1989	1.9	5.2	37.09	1.9	5.1	37.04	2.0	4.8	40.83	1.5	4.7	31.01
1990-1999	1.9	5.1	36.86	2.0	5.3	37.30	1.8	4.9	36.87	1.5	3.9	38.13
2000-2002	0.7	5.7	12.21	0.2	5.3	3.02	0.4	4.9	7.42	−1.5	5.2	−29.58
WAvg[d]			33.98			33.04			35.05			26.82
Panel C												
1980-1984	2.1	4.8	42.77	2.1	4.8	42.89	1.9	4.1	45.85	1.2	4.4	28.51
1985-1989	1.7	5.0	34.53	1.7	5.7	30.22	2.0	5.2	37.64	1.7	5.1	33.14
1990-1994	1.3	4.5	28.28	1.3	4.9	26.74	1.2	4.3	28.76	0.8	3.6	21.06
1995-1999	2.5	5.4	46.85	2.6	5.3	49.94	2.4	4.8	49.65	2.2	4.0	54.53
2000-2002	0.7	5.7	12.21	0.2	5.3	3.02	0.4	4.9	7.42	−1.5	5.2	−29.58
WAvg[d]			34.98			33.29			36.48			26.59

Notes: [a]MR, (arithmetic) mean return; [b]SD, standard deviation of returns; [c]SR, Sharpe ratio (× 100); [d]WAvg, weighted average; SR = MR/SD; figures shown are monthly magnitudes

measured in percentages and therefore easier to interpret. Second, because RARs are obtained by multiplying Sharpe ratios by a constant (note that $RAR_p = \sigma_M \cdot S_p$), any ranking of stocks based on RARs preserves a ranking based on Sharpe ratios.

Note that, by construction, the RAR measure penalizes (rewards) the return performance of any portfolio more (less) volatile than the market. In this regard, the RAR measure enables an apples-to-apples comparison of returns, unlike the returns displayed in Table II, which compare portfolios of different volatility.

Panels A-C of Table V display the monthly risk-adjusted returns of all three strategies and the market. The relative performance of the strategies is of course the same as that displayed in Table IV, but the figures in Table V provide more intuitive results. The strategy based on the PERG ratio outperforms that based on the P/E (PEG) ratio by 11 (2) basis points when there is no rebalancing, by 5 (10) basis points when portfolios are rebalanced every ten years, and by 7 (16) basis points when portfolios are rebalanced every five years (all figures on a monthly basis). The market is outperformed by all three strategies on average, although not in every subperiod.

Panel D of Table V displays the terminal value of a $1,000 investment at the beginning of 1980, compounded at the average risk-adjusted returns shown in panels A-C through to the end of September 2002. Note that these terminal values are expressed in risk-adjusted dollars, i.e. they take into account both the returns delivered by each strategy and a penalty (reward) for being more (less) volatile than the market.

Investment period	P/E (percent)	PEG (percent)	PERG (percent)	Market (percent)
Panel A				
1980-2002	1.33	1.42	1.44	1.11
Panel B				
1980-1989	1.76	1.76	1.94	1.47
1990-1999	1.43	1.45	1.43	1.48
2000-2002	0.63	0.16	0.38	−1.53
WAvg[a]	1.48	1.43	1.53	1.11
Panel C				
1980-1984	1.87	1.87	2.00	1.25
1985-1989	1.76	1.54	1.92	1.69
1990-1994	1.02	0.97	1.04	0.76
1995-1999	1.89	2.01	2.00	2.20
2000-2002	0.63	0.16	0.38	−1.53
WAvg[a]	1.51	1.42	1.58	1.11
Panel D[b]				
No rebalancing	36,945	46,783	49,889	20,426
Rebalancing every ten years	54,839	47,796	62,410	20,426
Rebalancing every five years	60,545	47,572	71,755	20,426

Notes: [a]WAvg, weighted average; [b]panel D shows risk-adjusted dollars at September 2002; panels A-C show monthly magnitudes

Table V.
Performance (III): risk-adjusted returns

4.5. Robustness: Treynor ratios

The results reported and discussed in the previous section indicate that PERG-based strategies outperform those based on P/Es and PEGs on a risk-adjusted basis. However, it could be argued that returns should be adjusted by risk as measured by each portfolio's β rather than by its standard deviation. In other words, it could be argued that risk-adjusted returns should be assessed with Treynor ratios rather than with Sharpe ratios, the former defined as a portfolio's mean return divided by its beta, i.e. $T_p = \mu_p/\beta_p$, where T_p and β_p represent the Treynor ratio and β of portfolio p, respectively.

Table VI reports the Treynor ratios of all three strategies and the market[11], and largely confirms the results discussed above: A PERG-based strategy outperforms a P/E-based strategy when portfolios are held for the whole sample period and when they are rebalanced every five years (panels A and C, Table VI)[12]. It also outperforms a PEG-based strategy in all three scenarios. In short, the superiority of the PERG ratio over the P/E ratio and the PEG is largely independent of the measure of risk used to estimate risk-adjusted returns.

4.6. Downside risk

The final step of the analysis consists of exploring a PERG ratio based on a different measure of risk, namely, on the downside beta defined in equation (4). As stated in section 3.2, if the downside beta is used as a proxy for risk, then the PERG would be given by $[(\mathrm{P/E})/g] \cdot \beta^{\mathrm{D}}$. Table VII reports, for the strategies based on this redefined PERG, all the figures reported in the previous exhibits for strategies based on P/Es, PEGs, and beta-based PERGs.

Comparing the figures in Table VII with those reported in the previous tables for the other three ratios, it follows that the PERG based on downside beta performs, relative to the P/E and the PEG, much as the beta-based PERG does. This implies that strategies based on the PERG based on downside beta:

Investment period	P/E	PEG	PERG	Market
Panel A				
1980-2002	1.62	1.69	1.72	1.11
Panel B				
1980-1989	2.01	2.00	2.16	1.47
1990-1999	1.57	1.55	1.52	1.48
2000-2002	1.14	0.19	0.67	−1.53
WAvg[a]	1.71	1.58	1.70	1.11
Panel C				
1980-1984	2.26	2.31	2.36	1.25
1985-1988	1.84	1.58	2.03	1.69
1990-1994	1.14	1.03	1.09	0.76
1995-1999	2.09	2.12	2.15	2.20
2000-2002	1.14	0.19	0.67	−1.53
WAvg[a]	1.75	1.57	1.76	1.11

Table VI.
Performance (IV): Treynor ratios

Notes: [a]WAvg, weighted average; all numbers show Treynor ratios, defined as mean return over β; monthly magnitudes

Investment period	Return (percent)	TV ($)	MR (percent)	SD (percent)	SR	RAR (percent)	RA-TV ($)	TR
Panel A								
1980-2002	4,796.6	48,966	1.6	4.8	32.19	1.46	52,085	1.72
Panel B								
1980-1989	745.7	8,457	1.9	4.9	39.36	1.87		2.16
1990-1999	646.7	63,149	1.8	5.0	36.30	1.41		1.52
2000-2002	6.8	67,422	0.3	4.9	6.44	0.33	55,080	0.67
HPR/WAvg	6,642.2				34.04	1.48		1.70
Panel C								
1980-1984	210.5	3,105	2.0	4.4	45.12	1.97		2.36
1985-1988	175.6	8,556	1.8	5.2	35.27	1.80		2.03
1990-1994	97.5	16,901	1.2	4.4	28.11	1.02		1.09
1995-1999	241.4	57,703	2.2	4.6	47.16	1.90		2.15
2000-2002	6.8	61,608	0.3	4.9	6.44	0.33	59,933	0.67
HPR/WAvg	6,060.8				34.99	1.51		1.76

Notes: HPR, holding period return; WAvg, weighted average; TV, terminal value; MR, (arithmetic) mean return; SD, standard deviation of returns; SR, Sharpe ratio (× 100); RAR, risk-adjusted return; RA-TV, risk-adjusted terminal value; TR, Treynor ratio; HPR applies only to the "Return" column; WAvg applies to the SR, RAR, and TR columns; TV shows the terminal value of a $1,000 investment in January 1980; MR, SD, SR, RAR, and TR are in monthly figures; RA-TV shows the risk-adjusted terminal value of a $1,000 investment in January 1980

Table VII.
Downside risk

- are outperformed by a P/E-based strategy in terms of returns; and
- generally outperform P/E-based (and PEG-based) strategies in terms of risk-adjusted returns.

5. Conclusions

For many years academics and practitioners have been debating the "value versus growth" issue. Although there seems to be a consensus on the fact that, in the long term, value outperforms growth, there is no agreement about why this is the case. This article tackles a related but different topic, which can be thought of as a "value versus value" issue.

P/E ratios are one of the valuation tools most widely used by analysts, and are the key variable in many value strategies. The simplicity of P/E ratios, however, can be deceptive. There is nothing trivial about choosing an appropriate benchmark P/E, or determining whether the difference between a given P/E and its appropriate benchmark is due to fundamentals or to mispricing.

Differences across P/E ratios may be due to many factors, but are largely driven by differences in growth and risk. The PEG ratio improves upon the P/E ratio by adjusting the latter by growth. However, the PEG ratio does not make any adjustment for risk; the PERG ratio proposed in this article does.

The sample used to assess the empirical usefulness of the PERG ratio is limited, and therefore the results reported should be considered tentative. Still, the evidence reported and discussed does show that PERG-based strategies outperform, on a

risk-adjusted basis, value strategies based on P/E ratios and PEG ratios. This outperformance occurs regardless of whether portfolios are not rebalanced, rebalanced every ten years, or rebalanced every five years.

These results could certainly be validated by using a larger sample of US stocks and a longer time period. They could also be reinforced by assessing the performance of all the strategies considered with a sample of stocks from several international markets. Both are possible and are certainly valuable lines of future research.

Due to its simplicity and plausibility, the PEG ratio rapidly became a popular and widely used valuation tool. However, this ratio ignores the fact that differences in P/Es may be due not only to growth but also to risk, which in turn ignores the fact that all modern financial theory is based on a risk-return trade-off. Furthermore, the evidence reported above does not support using the PEG as the basis of a value strategy.

The PERG ratio proposed in this article, which adjusts the P/E ratio by both growth and risk, has an advantage over the PEG ratio: it does take risk into account. That, plus the fact that PERG-based strategies outperform on a risk-adjusted basis strategies based on both P/Es and PEGs, should make it an attractive tool to add to the arsenal of valuation tools used by analysts.

Notes

1. Incidentally, value outperformed growth by a larger margin in Japan (69.5 percent) and Europe (31.9 percent) than it did in the US (15.6 percent).
2. They offer several behavioral explanations to justify the outperformance of value, such as the fact that investors overestimate the future growth of glamour stocks, or that investors have shorter time horizons than required by value strategies to outperform growth strategies.
3. Growth strategies, in contrast, focus on companies with substantial growth prospects, which usually happen to have a high price relative to earnings, cash flow, book value, dividends, or other fundamentals.
4. The so-called "Fed" valuation model could be included in this category. In this model, the earnings yield of the S&P500 based on one-year forward earnings should not depart substantially from the yield on ten-year Treasury notes. In this regard, the yield on the ten-year note can be thought of as the equilibrium level of (the inverse of) the market's P/E.
5. Note that this expression is simply the constant-growth version of the dividend-discount model with both sides divided by earnings per share.
6. A downside risk framework is particularly useful when returns distributions are non-normal, as is the case in, for example, emerging markets. The downside beta, in fact, explains the cross section of stock returns in emerging markets better than beta (see Estrada, 2002, 2005).
7. The analysis is actually performed over the period January 1980-Setember 2002, but the period January 1975-December 1979 is required to estimate the parameters needed to form portfolios at the beginning of 1980.
8. If at any point of portfolio formation the annualized growth in earnings for the previous five years of any company is negative, or its P/E ratio cannot be computed due to losses, then the stock is omitted from that ranking.
9. Because in panels B and C of Table IV the last subperiod is shorter than the previous subperiods, averages are calculated on a time-weighted basis; that is, weighting each subperiod by the proportion of months in the whole sample period.
10. This definition of risk-adjusted returns is slightly different from, but obviously related to, the RAP (risk-adjusted performance) measure proposed by Modigliani and Modigliani (1997).

11. Because the beta of the market portfolio is, by definition, equal to 1, the Treynor ratio for the market is equal to the market's mean return.
12. P/E-based portfolios, however, slightly outperform those based on PERG ratios when portfolios are rebalanced every ten years. Note that most of this outperformance is due to the results of the short 2000-2002 period.

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Appendix

Company	Industry
3M	Diversified industry
Abbott Laboratories	Medical supplies
Aflac	Life assurance
Albertson's	Food and drug retailers
Alcoa	Non-ferrous metals
Alltel	Telecom fixed line
American Electric Power	Electricity
American Express	Consumer finance
American International	Other insurance
Analog Devices	Semiconductors
Anheuser-Busch	Brewers
Applied Materials	Semiconductors
AT&T	Telecom fixed line
Automatic Data Processing	Business support
Bank of America	Banks
Bank of New York	Banks
Baxter International	Medical supplies
BB&T	Banks
Boeing	Aerospace
Bristol-Myers Squibb	Pharmaceuticals
Campbell Soup	Food processors
Caterpillar	Commercial vehicles
Chevron-Texaco	Oil integrated
Chubb	Insurance non-life
Clorox	Household products
Coca-Cola	Soft drinks
Colgate-Palmolive	Household products
Conagra Foods	Food processors
Conoco Phillips	Oil integrated
CVS	Food and drug retailers
Dow Chemical	Chemicals, commodity
Du Pont	Electricity
Duke Energy	Chemicals, commodity
Ely Lilly	Pharmaceuticals
Emerson Electric	Electrical equipment
Exelon	Electricity
Exxon Mobil	Oil integrated
Fannie Mae	Mortgage finance
FleetBoston Financial	Banks
Ford Motor	Automobile
Gannet	Publishing and printing
General Dynamics	Defense
General Electric	Diversified industry
General Mills	Food processors
General Motors	Automobile
Gillette	Personal products
H.J. Heinz	Food processors
Hewlett Packard	Computer hardware
Household International	Consumer finance
IBM	Computer services

(*continued*)

Table AI.
Companies and industries

Company	Industry
Illinois Tool Works	Engineers fabricators
Intel	Semiconductors
International Paper	Paper
Interpublic Group	Media agencies
Johnson & Johnson	Pharmaceuticals
J.P. Morgan	Banks
Kellogg	Food processors
Kimberly-Clark	Personal products
Limited Brands	Retailers, soft goods
McDonalds	Restaurants and pubs
McGraw-Hill	Publishing and printing
Masco	Building materials
Medtronic	Medical supplies
Mellon Financial	Banks
Merck	Pharmaceuticals
Merrill Lynch	Investment banks
Motorola	Telecom equipment
National City	Banks
Northrop Grumman	Defense
Omnicom	Media agencies
Pepsico	Soft drinks
Pfizer	Pharmaceuticals
Pharmacia	Pharmaceuticals
Phillip Morris	Tobacco
PNC Financial Services	Banks
Procter & Gamble	Household products
Progress Energy	Electricity
Progressive	Insurance non-life
Raytheon	Defense
Sara Lee	Food processors
Schlumberger	Oil services
Sears Roebuck	Discount stores
Southern Co,	Electricity
Southwest Airlines	Airlines and airports
Sprint Fon Group	Telecom fixed line
State Street	Other financial
Sysco	Food processors
Target	Discount stores
Tenet Healthcare	Hospital management
Texas Instruments	Semiconductors
TXU	Electricity
Union Pacific	Rail, road, and freight
United Technologies	Aerospace
Wachovia	Banks
Walgreen	Food and drug retailers
Wal-Mart Stores	Discount stores
Walt Disney	Leisure facilities
Wells Fargo	Banks
Wrigley William Jr	Food processors
Wyeth	Pharmaceuticals

Table AI.