Adjusting P/E Ratios by Growth and Risk: The PERG Ratio

Javier Estrada *

IESE Business School, Av. Pearson 21, 08034 Barcelona, Spain
Tel: +3493 253 4200, Fax: +3493 253 4343, Email: jestrada@iese.edu

Abstract

P/E ratios are one of the tools most widely-used by analysts and the key variable in many value strategies. PEG ratios, an increasingly-popular valuation tool among analysts, improve upon P/E ratios by adjusting the latter by growth. This article proposes a new tool, the PERG ratio, that adjusts P/E ratios by both growth and risk, or, similarly, PEG ratios by risk. The evidence reported shows that PERG-based value strategies outperform, on a risk-adjusted basis, value strategies based on P/E ratios and PEG ratios.

1. Introduction

The now-called Internet bubble became, in a way, the short-lived revenge of growth-oriented investors. For many years, first practitioners and then academics showed over and over again the superiority of value strategies over growth strategies. Then, all of a sudden, in the second half of the '90s even Warren Buffett seemed to have gone out of fashion.

We know better by now. Warren Buffett is back on top of the world and value investors have come back with a vengeance. Growth investors, on the other hand, seemed to have gone AWOL. Growth companies are being punished in the market, and even long-forgotten dividends are making a strong come back.

Despite this roller coaster of the last few years, there seems to be a wide consensus about the fact that value strategies outperform growth strategies both in the US and in other countries. Capaul, Rowley, and Sharpe (1993) report that value outperformed growth in the U.S., Japan, and Europe by an average of 40% over the 1981-1992 period.[1] Bauman, Conover, and Miller (1998) extend the previous study in terms of time (1985-96) 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.

* I would like to thank Ed Altman, Mark Kritzman, Paul O'Connell, Juan Palacios, and Xavier Santomá for helpful comments. Alfred Prada provided valuable research assistance. The views expressed below and any errors that may remain are entirely my own.

[1] Incidentally, value outperformed growth by a larger margin in Japan (69.5%) and in Europe (31.9%) than it did in the U.S. (15.6%).

The debate, then, is not so much about whether value outperforms growth (it does), but on *why* this happens. Fama and French (1992, 1996) argue that value strategies outperform growth strategies because the former are riskier. In their view, efficient markets simply deliver the higher returns that riskier strategies are supposed to. Chen and Zhang (1998) subscribe to this view and report results showing that value outperforms growth in the U.S., Japan, Hong Kong and Malaysia, *and* that value is riskier than growth.

Lakonishok, Shleifer, and Vishny (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, Coggin, and Doukas (1998) support 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 the study is not to compare the performance of low-P/E and high-P/E 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 (or, similarly, that adjusts the PEG ratio by risk).

Thus, the purpose of this article is twofold: First, to propose a new tool, the PERG ratio, that can be used for stock valuation and, by extension, for implementing trading strategies. Second, 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 P/E ratios and PEG ratios. The results reported also cast some doubts on strategies based on the popular PEG ratio, which are generally outperformed by strategies based on P/E 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] 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.

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 determines 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 determining a company's earnings, some analysts use net income, some others omit one-time charges, and yet some others use EBITDA. Finally, when comparing the P/Es of companies in different countries, different accounting systems add an additional obstacle to the standardization of earnings. In short, 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's 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, which basically comes down to 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

---

[3] Growth strategies, on the other hand, 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 sometimes-called "Fed's stock-valuation model" could be included in this category. In this model, the earnings yield of the S&P500 based on one-year forward estimated earnings should not depart significantly from the yield on

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 second problem. When comparing a company's P/E with its appropriate benchmark, an analyst may find a substantial difference between the two. If this is the case, the analyst's main task is to determine whether there any good reasons that explain this difference. If there are not, then the stock is mispriced and therefore a good buying or selling opportunity; if there are, then the stock is properly priced and therefore no trading opportunity exists.

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

$$P/E = \frac{DPR \cdot (1 + g_D)}{R_E - g_D} \ , \tag{1}$$

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 good 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 priced properly.

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 so-called PEG ratio, which is defined as

10-year Treasury notes. In this regard, the yield on the 10-year note can be thought of as the equilibrium level of (the inverse of) the market's P/E.

[5] This expression is, of course, the constant-growth version of the dividend-discount model, with both sides divided by earnings per share.

$$PEG = \frac{P/E}{g}\ , \qquad (2)$$

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%, and A at only 5%, 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." The Gardner brothers, in their Fool.com Web site, 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."

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 focuses on the compounding power of PEG-sorted portfolios. He finds that between Jan/82 and Jun/89, $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) finds that PEG ratios and stock returns are negatively related during the period Jul/83-Jun/00, 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 (2000), on the other hand, 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. It thus follows 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 reasons 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 then the PEG give an incomplete picture of relative value?

Go back to companies A (P/E=10 and g=5%) and B (P/E=20 and g=10%) 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 then the PEG, again, give an incomplete picture of relative value?

3.1. The PE RG 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 its two main determinants, growth and risk. Thus, let a PERG ratio be defined as

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

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 (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 (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 expected to grow fast (high g), or 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 (β=0.5) is less risky than A (β=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 Empirical Example

Consider the data reported in Exhibit 1 for two of the companies in the sample, Johnson & Johnson (J&J) and Ely Lilly, both in the pharmaceutical industry. The exhibit shows for both companies their P/E, their expected growth in EPS, their risk quantified by beta, and both their PEG and their PERG.

Exhibit 1. P/E, PEG, and PERG

	P/E	g	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

P/E on Sep/02. Expected growth in EPS (g) based on observed annual growth for the previous 10 years. Beta (β) estimated on the basis of the previous 60 months. PEG and PERG follow from (2) and (3), respectively.

As the exhibit shows, a simple comparison of P/Es indicates that Ely Lilly is cheaper than J&J and therefore more attractive. However, once that 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 much 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 significantly 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 way 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 ($ß$), the sensitivity of a company's returns to fluctuations in the market returns. In this case, the PERG would be given by $\{(P/E)/g\}\cdot ß$.

An alternative measure of risk that stems from a downside risk framework is the downside beta ($ß^D$), 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

$$b_i^D = \frac{S_{iM}}{S_M^2} = \frac{E\{\text{Min}[(R_i - m_i), 0]\cdot \text{Min}[(R_M - m_M), 0]\}}{E\{\text{Min}[(R_M - m_M), 0]^2\}}, \quad (4)$$

where S_{iM} denotes the cosemivariance between the returns of company i and the market (indexed by M), S_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 $\{(P/E)/g\}\cdot ß^D$.

There is a huge 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 (3). Alternatively, risk could be measured by the required return that stems from a pricing model.

4. The Evidence

There are at least two types of analysis that could be performed when assessing the impact of a given variable on returns. The standard *statistical* analysis is designed to answer whether the variable considered significantly explains the variability of returns. An *economic* analysis, on the other hand, focuses on assessing the returns generated by a trading strategy

[6] A downside risk framework is 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).

based on the variable of interest, compared to the returns generated by strategies based on other variables. The analysis in this article belongs to the latter category.[7]

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 that were selected with the only restriction that they had returns available for the full sample period Jan/1975 – Sep/2002.[8] Exhibit A1 in 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 are the earnings observed the year before. Given the dismal record of analysts in predicting earnings, this naïve 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 beta and downside beta 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 is done the following way. At the beginning of each investment period, stocks are ranked by one of the three ratios considered (P/E, PEG, and PERG).[9] The top-30 stocks 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 10-year periods (plus a shorter 3-year period), and four 5-year periods (plus a shorter 3-year period).

---

[7] Of course, these two types of analyses complement each other and both are useful in their own right. However, investors are usually more interested in economic (as opposed to statistical) analyses.

[8] The analysis is actually performed over the Jan/1980 – Sep/2002 period, but the Jan/1975 – Dec/1979 period is required to estimate the parameters needed to form portfolios at the beginning of 1980.

[9] 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.

4.2. A Preliminary Assessment of Performance: Holding-Period Returns

Exhibit 2 displays the returns of portfolios ranked by P/Es, PEGs, and PERGs for all investment periods, as well as the market returns as measured by the S&P500. Had portfolios been formed on the basis of these three ratios at the beginning of 1980 and held through the end of Sep/02, a low-P/E strategy would have outperformed the other two strategies considered and the market. As Panel A shows, the 5,311.7% holding-period return (HPR) for the low-P/E portfolio is larger than that delivered by the low-PEG portfolio (4,927.6%), the low-PERG portfolio (5,040.5%), and the market (1,444.5%).

Exhibit 2. Performance (I): Returns

Investment Period	P/E	PEG	PERG	Market
Panel A: No rebalancing				
1980-2002 (HPR)	**5,311.7%**	**4,927.6%**	**5,040.5%**	**1,444.5%**
Panel B: Rebalancing every 10 years				
1980-89	748.1%	720.2%	790.6%	403.9%
1990-99	699.5%	798.3%	648.2%	432.8%
2000-02	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 5 years				
1980-84	219.2%	220.8%	191.3%	99.0%
1985-89	157.8%	151.5%	196.8%	153.2%
1990-94	101.3%	102.7%	98.4%	51.7%
1995-99	310.1%	337.0%	289.5%	251.1%
2000-02	19.3%	0.8%	8.5%	-42.5%
HPR	**8,007.0%**	**7,105.4%**	**7,146.7%**	**1,444.5%**

HPR: Holding-period return. HPR computed as the compound return over all subperiods.

Relative results are not significantly different under rebalancing. Regardless of whether portfolios are rebalanced every 10 years (panel B) or every 5 years (panel C), value strategies based on P/Es outperform the other two strategies, in some cases by a significant margin, and the market. Exhibit 3 complements Exhibit 2 by displaying the evolution of a $1,000 investment at the beginning of 1980, compounded at the returns shown in Exhibit 2.

Exhibits 2 and 3 together seem to imply that there may be no need to replace the P/E ratio as a tool to implement value strategies. However, these exhibits 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. In other words, a correct evaluation of performance needs to account for both returns *and* risk.

Exhibit 3: Evolution of a $1,000 Investment

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

All figures follow from an initial investment of $1,000 on Jan/1/1980 compounded at the returns displayed in Exhibit 2.

4.3. A Better Assessment of Performance: Sharpe Ratios

Exhibit 4 shows the missing side of the coin by reporting information about the risk of each portfolio as measured by the monthly standard deviation of returns. It also shows the (arithmetic) mean monthly return and the Sharpe ratio of each portfolio, the latter defined as the portfolio's mean return divided by its standard deviation. As the exhibit shows, the picture now is significantly different.

Exhibit 4. Performance (II): Sharpe Ratios

Investment	P/E			PEG			PERG			Market		
Period	MR	SD	SR	MR	SD	SR	MR	SD	SR	MR	SD	SR
Panel A												
1980-02	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												
1980-89	1.9%	5.2%	37.09	1.9%	5.1%	37.04	2.0%	4.8%	40.83	1.5%	4.7%	31.01
1990-99	1.9%	5.1%	36.86	2.0%	5.3%	37.30	1.8%	4.9%	36.87	1.5%	3.9%	38.13
2000-02	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			**33.98**			**33.04**			**35.05**			**26.82**
Panel C												
1980-84	2.1%	4.8%	42.77	2.1%	4.8%	42.89	1.9%	4.1%	45.85	1.2%	4.4%	28.51
1985-89	1.7%	5.0%	34.53	1.7%	5.7%	30.22	2.0%	5.2%	37.64	1.7%	5.1%	33.14
1990-94	1.3%	4.5%	28.28	1.3%	4.9%	26.74	1.2%	4.3%	28.76	0.8%	3.6%	21.06
1995-99	2.5%	5.4%	46.85	2.6%	5.3%	49.94	2.4%	4.8%	49.65	2.2%	4.0%	54.53
2000-02	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			**34.98**			**33.29**			**36.48**			**26.59**

MR: (Arithmetic) mean return; SD: Standard deviation of returns; SR: Sharpe ratio (×100). WAvg: Weighted average. SR=MR/SD. Monthly magnitudes.

Panel A 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 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.[10]

Furthermore, Exhibit 4 casts doubt on the usefulness of the popular low-PEG strategy, which is outperformed (on average and in most subperiods) by a strategy based on 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 Exhibit 4 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 is a given strategy relative to another. However, a slight modification of the Sharpe ratio enables a better comparison.

As defined above, the Sharpe ratio of portfolio p (SR_p) is given by $SR_p = \mu_p / s_p$, where μ and s represent the (arithmetic) mean return and standard deviation of portfolio p. If the Sharpe ratio is multiplied by the standard deviation of returns of the market portfolio (s_M) we obtain the risk-adjusted return of portfolio p (RAR_p) given by $RAR_p = (s_M / s_p) \cdot \mu_p$.[11]

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 measured in % and therefore easier to interpret. Second, because RARs are obtained by multiplying Sharpe ratios by a constant (note that $RAR_p = s_M \cdot SR_p$), any ranking of stocks based on RARs preserves the 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 Exhibit 2 that compare portfolios of different volatility.

Panels A-C of Exhibit 5 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 Exhibit 4 but the figures in Exhibit 5 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

[10] Because in panels B and C 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.

[11] This definition of risk-adjusted returns is slightly different from the RAP (risk-adjusted performance) measure proposed by Modigliani and Modigliani (1997).

no rebalancing, by 5 (10) basis points when portfolios are rebalanced every 10 years, and by 7 (16) basis points when portfolios are rebalanced every 5 years, all figures on a monthly basis. The market is outperformed by all three strategies on average though not in every subperiod.

Exhibit 5. Performance (III): Risk-Adjusted Returns

Investment Period	P/E	PEG	PERG	Market
Panel A				
1980-02	**1.33%**	**1.42%**	**1.44%**	**1.11%**
Panel B				
1980-89	1.76%	1.76%	1.94%	1.47%
1990-99	1.43%	1.45%	1.43%	1.48%
2000-02	0.63%	0.16%	0.38%	-1.53%
WAvg	**1.48%**	**1.43%**	**1.53%**	**1.11%**
Panel C				
1980-84	1.87%	1.87%	2.00%	1.25%
1985-89	1.76%	1.54%	1.92%	1.69%
1990-94	1.02%	0.97%	1.04%	0.76%
1995-99	1.89%	2.01%	2.00%	2.20%
2000-02	0.63%	0.16%	0.38%	-1.53%
WAvg	**1.51%**	**1.42%**	**1.58%**	**1.11%**
Panel D				
No rebalancing	$36,945	$46,783	$49,889	$20,426
Rebalancing every 10 years	$54,839	$47,796	$62,410	$20,426
Rebalancing every 5 years	$60,545	$47,572	$71,755	$20,426

WAvg: Weighted average. Panels A-C show monthly returns. Panel D shows risk-adjusted dollars at Sep/02.

Panel D of Exhibit 5 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 the end of Sep/02. Note that these terminal values are expressed in risk-adjusted dollars; that is, they take into account both the returns delivered by each strategy and a penalty (reward) for being more (less) volatile than the market.

4.5. Robustness: Treynor Ratios

The results reported and discussed in the previous section clearly point in the same direction: 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 beta 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.

Exhibit 6 reports the Treynor ratios of all three strategies and the market,[12] 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).[13] 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 from the measure of risk used to estimate risk-adjusted returns.

Exhibit 6. Performance (IV): Treynor Ratios

Investment Period	P/E	PEG	PERG	Market
Panel A				
1980-02	**1.62**	**1.69**	**1.72**	**1.11**
Panel B				
1980-89	2.01	2.00	2.16	1.47
1990-99	1.57	1.55	1.52	1.48
2000-02	1.14	0.19	0.67	-1.53
WAvg	**1.71**	**1.58**	**1.70**	**1.11**
Panel C				
1980-84	2.26	2.31	2.36	1.25
1985-88	1.84	1.58	2.03	1.69
1990-94	1.14	1.03	1.09	0.76
1995-99	2.09	2.12	2.15	2.20
2000-02	1.14	0.19	0.67	-1.53
WAvg	**1.75**	**1.57**	**1.76**	**1.11**

WAvg: Weighted average. All numbers in the table show Treynor ratios defined as mean return over beta.

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 (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 $\{(P/E)/g\}\cdot\beta^{D}$. Exhibit 7 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 Exhibit 7 with those reported in the previous exhibits 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 the PERG based on downside beta 1) is outperformed by a P/E based strategy in terms of returns; and 2) generally outperforms a P/E-based (and a PEG-based) strategy in terms of risk-adjusted returns.

[12] 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.

[13] P/E-based portfolios, however, slightly outperform those based on PERG ratios when portfolios are rebalanced every 10 years. Note that most of this outperformance is due to the results of the short 2000-02 period.

Exhibit 7. Downside Risk

Investment Period	Return	TV	MR	SD	SR	RAR	RA-TV	TR
Panel A								
1980-02	4,796.6%	$48,966	1.6%	4.8%	32.19	1.46%	$52,085	1.72
Panel B								
1980-89	745.7%	$8,457	1.9%	4.9%	39.36	1.87%		2.16
1990-99	646.7%	$63,149	1.8%	5.0%	36.30	1.41%		1.52
2000-02	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								
1980-84	210.5%	$3,105	2.0%	4.4%	45.12	1.97%		2.36
1985-88	175.6%	$8,556	1.8%	5.2%	35.27	1.80%		2.03
1990-94	97.5%	$16,901	1.2%	4.4%	28.11	1.02%		1.09
1995-99	241.4%	$57,703	2.2%	4.6%	47.16	1.90%		2.15
2000-02	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

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 Jan/1980. MR, SD, SR, RAR, and TR in monthly figures. RA-TV shows the risk-adjusted terminal value of a $1,000-investment in Jan/1980.

5. Conclusions

For many years academics and practitioners have been discussing 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 the key variable in many value strategies. The simplicity of P/E ratios, however, can be deceiving. 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 10 years, or rebalanced every 5 years.

Due to their simplicity and plausibility, the PEG ratio rapidly became a popular and widely-used valuation tool. However, this ratio ignores the fact that differences across 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 a PERG-based strategy outperforms on a risk-adjusted basis those based on P/Es and PEGs, should make it an attractive tool to add to the arsenal of valuation tools used by analysts.

Appendix

Exhibit A1. Companies and Industries

Company	Industry	Company	Industry
3M	Diversified Industry	Illinois Tool Works	Engineers Fabricators
Abbott Laboratories	Medical Supplies	Intel	Semiconductors
Aflac	Life Assurance	Interpublic Group	Media Agencies
Albertson's	Food & Drug Retailers	International Paper	Paper
Alcoa	Non-Ferrous Metals	Johnson & Johnson	Pharmaceuticals
Alltel	Telecom Fixed Line	JP Morgan	Banks
American Electric Power	Electricity	Kellogg	Food Processors
American Express	Consumer Finance	Kimberly-Clark	Personal Products
American International	Other Insurance	Ely Lilly	Pharmaceuticals
Analog Devices	Semiconductors	Limited Brands	Retailers, Soft Goods
Anheuser-Busch	Brewers	Masco	Building Materials
Applied Materials	Semiconductors	McDonalds	Restaurants & Pubs
AT & T	Telecom Fixed Line	McGraw-Hill	Publishing & Printing
Automatic Data Processing	Business Support	Medtronic	Medical Supplies
Bank of New York	Banks	Mellon Financial	Banks
Baxter International	Medical Supplies	Merck	Pharmaceuticals
BB&T	Banks	Merrill Lynch	Investment Banks
Bank Of America	Banks	Motorola	Telecom Equipment
Boeing	Aerospace	National City	Banks
Bristol-Myers Squibb	Pharmaceuticals	Northrop Grumman	Defense
Campbell Soup	Food Processors	Omnicom	Media Agencies
Caterpillar	Commercial Vehicles	Procter & Gamble	Household Products
Chevron-Texaco	Oil Integrated	Pepsico	Soft Drinks
Chubb	Insurance Non-life	Pfizer	Pharmaceuticals
Clorox	Household Products	Pharmacia	Pharmaceuticals
Coca-Cola	Soft Drinks	Phillip Morris	Tobacco
Colgate-Palmolive	Household Products	PNC Financial Services	Banks
Conagra Foods	Food Processors	Progress Energy	Electricity
Conoco Phillips	Oil Integrated	Progressive	Insurance Non-life
CVS	Food & Drug Retailers	Raytheon	Defense
Walt Disney	Leisure Facilities	Sara Lee	Food Processors
Dow Chemical	Chemicals, Commodity	Schlumberger	Oil Services
Duke Energy	Chemicals, Commodity	Sears Roebuck	Discount Stores
Du Pont	Electricity	Southern Co	Electricity
Emerson Electric	Electrical Equipment	Southwest Airlines	Airlines & Airports
Exelon	Electricity	Sprint Fon Group	Telecom Fixed Line
Exxon Mobil	Oil Integrated	State Street	Other Financial
Fannie Mae	Mortgage Finance	Sysco	Food Processors
FleetBoston Financial	Banks	Target	Discount Stores
Ford Motor	Automobile	Tenet Healthcare	Hospital Management
Gannet	Publishing & Printing	Texas Instruments	Semiconductors
General Electric	Diversified Industry	TXU	Electricity
General Dynamics	Defense	Union Pacific	Rail, Road, & Fright
General Mills	Food Processors	United Technologies	Aerospace
Gillette	Personal Products	Wachovia	Banks
General Motors	Automobile	Walgreen	Food & Drug Retailers
H.J. Heinz	Food Processors	Wal-Mart Stores	Discount Stores
Household International	Consumer Finance	Wells Fargo	Banks
Hewlett Packard	Computer Hardware	Wrigley William Jr.	Food Processors
IBM	Computer Services	Wyeth	Pharmaceuticals

References

Arshanapalli, Bala, Daniel Coggin, and John Doukas (1998). "Multifactor Asset Pricing Analysis of International Investment Strategies." Journal of Portfolio Management, Summer, 10-23.

Bauman, Scott, Mitchell Conover, and Robert Miller (1998). "Growth versus Value and Large-Cap versus Small-Cap Stocks in International Markets." Financial Analysts Journal, March/April, 75-89.

Capaul, Carlo, Ian Rowley, and William Sharpe (1993). "International Value and Growth Stock Returns." Financial Analysts Journal, January/February, 27-36.

Chen, Nai-fu, and Feng Zhang (1998). "Risk and Return of Value Stocks." Journal of Business, 71, 501-535.

Easton, Peter (2002). "Does the PEG Ratio Rank Stocks According to the Market's Expected Rate of Return on Equity Capital?" Working Paper.

Estrada, Javier (2002). "Systematic Risk in Emerging Markets: The D-CAPM." Emerging Markets Review, 3, 365-379.

Fama, Eugene, and Kenneth French (1992). "The Cross Section of Expected Stock Returns." Journal of Finance, 47, 427-465.

Fama, Eugene, and Kenneth French (1996). "Multifactor Explanations of Asset Pricing Anomalies." Journal of Finance, 51, 55-84.

Lakonishok, Josef, Andrei Shleifer, and Robert Vishny (1994). "Contrarian Investment, Extrapolation, and Risk." Journal of Finance, 49, 1541-1578.

Lynch, Peter (1993). *Beating the Street*. Simon & Schuster.

Modigliani, Franco, and Leah Modigliani (1997). "Risk-Adjusted Performance." JPM, Winter, 45-54.

Peters, Donald (1991). "Valuing a Growth Stock." Journal of Portfolio Management, Spring, 49-51.

Sun, Zhao (2001). "The PEG Ratio and Stock Valuation." Working paper.

Whitbeck, Volkert, and Manown Kisor (1963). "A New Tool in Investment Decision-Making." Financial Analysts Journal, May/June, 55-62.