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The Anatomy of Value and Growth Stock Returns

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Abstract

We break average returns on value and growth portfolios into dividends and three sources of capital gain, (i) reinvestment of earnings, (ii) convergence in price-to-book ratios (P/B) due to mean reversion in profitability, growth, and expected returns, and (iii) general upward drift in P/B during the 1963-2004 period. The contribution of drift to average returns is similar for value and growth portfolios, and relatively small. Dividends are important for value stocks, but reinvestment of earnings is a trivial factor in their capital gains. The high capital gains of value stocks trace mostly to convergence – P/B rises as value firms become more profitable and move to lower expected return groups. In contrast, dividends are less important for growth stocks, and reinvestment is the dominant positive factor in their capital gains. For growth stocks, convergence is negative – P/B falls because growth stocks do not always remain highly profitable with low expected returns.

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Value stocks (stocks with high ratios of book value to price) have higher average returns than growth stocks (stocks with low book-to-market ratios). (See, for example, Rosenberg, Reid, and Lanstein 1985, Fama and French 1992, Lakonishok, Shleifer, and Vishny 1994.) Our goal is a better understanding of the sources of this difference in average returns.

Returns are commonly broken into two components, dividends (D_{t+1}/P_t) and capital gains (P_{t+1}/P_t).

(1) $$1 + R_{t+1} = D_{t+}/P_t + P_{t+1}/P_t .$$

For a more complete understanding of the higher average returns of value stocks, we examine the different sources of capital gains. In our initial tests we break the capital gain return (P_{t+1}/P_t) into two pieces. The first is the growth rate of book equity due to reinvestment of earnings. This source of capital gain follows from the dividend irrelevance theorem of Miller and Modigliani (1961). Specifically, an additional dollar of time t+1 earnings reinvested rather than paid out as dividends should result in an additional dollar of capital value for old shareholders at t+1. Breaking the growth rate of book equity (B_{t+1}/B_t) due to reinvestment of earnings out of the capital gain return (P_{t+1}/P_t) leaves the growth rate of the price-to-book ratio ($P_{t+1}/B_{t+1} \div P_t/B_t$) as the remaining (multiplicative) piece of the capital gain return,

(2) $$1 + R_{t+1} = \frac{D_{t+1}}{P_t} + \left[\frac{B_{t+1}}{B_t}\right] x \left[\frac{P_{t+1}/B_{t+1}}{P_t/B_t}\right] .$$

(We use more precise notation below.)

On average, value stocks have higher dividend yields (D_{t+1}/P_t) than growth stocks, and value stocks (especially small value stocks) also have higher average rates of capital gain (P_{t+1}/P_t). More interesting, the capital gains of value and growth stocks split much differently between growth in book equity and growth in the price-to-book ratio. In the year after firms are allocated to a value portfolio, the growth rate of book equity due to retention of earnings is on average near zero. Thus, the high average rates of capital gain of value stocks are almost entirely due to growth in the price-to-book ratio (P/B). In contrast, firms invest heavily in the year after they are allocated to growth portfolios, and on average the growth rate of book equity due to retention of earnings far exceeds the growth rate of the stock price. Thus, price-to-book ratios on average decline after firms are identified as growth stocks, and the rather

large average rates of capital gain of growth portfolios are due to earnings retention (growth in book equity) that more than offsets the decline in P/B.

The interesting economic question is: why do price-to-book ratios rise after firms are identified as value stocks and why do they fall after firms are identified as growth stocks? We suggest a simple story that is driven by standard economic forces. At the time firms are allocated to value and growth portfolios, they tend to occupy opposite ends of the profitability spectrum. Growth firms tend to be highly profitable and fast-growing, while value firms are less profitable and grow less rapidly if at all (Lakonishok, Shleifer, and Vishny 1994, Fama and French 1995). High profitability and growth combine with low expected returns (discount rates) to produce high price-to-book ratios for growth stocks, while low profitability, slow growth, and high expected returns combine to produce low P/B for value stocks.

Competition from other firms, however, tends to erode the high profitability of growth stocks, and profitability also declines as they exercise their most profitable growth options. Thus, each year some growth stocks cease to be highly profitable fast-growing firms that are rewarded by the market with low discount rates (expected stock returns). As a result, the price-to-book ratios of growth portfolios tend to fall in the years after portfolio formation. Conversely, the price-to-book ratios of value portfolios tend to rise in the years after portfolio formation, as some value stocks restructure, their profitability improves, and they are rewarded by the market with lower discount rates (expected stock returns).

The tendency of price-to-book ratios to become less extreme after firms are allocated to value and growth portfolios is what we call convergence. If general market conditions did not change during our 1963-2004 sample period, convergence would be the complete story for the average rates of growth of P/B for value and growth portfolios, and breaking capital gain returns into the growth rate of book equity and the growth in the price-to-book ratio would suffice to capture the sources of capital gains. There has, however, been general upward drift in price-to-book ratios during 1963-2004 due to some combination of higher expected cashflows and lower expected returns (discount rates) at the end of the sample period than at the beginning.

Whatever the explanation for why price-to-book ratios are higher at the end of the sample period, the upward drift means average growth rates of P/B have two sources, the convergence effect for value and growth stocks discussed above and general upward drift, which we label the drift effect. Thus, in our second set of tests we examine the breakdown of capital gain returns into (i) growth of book equity due to reinvestment of earnings, (ii) convergence, due to the mean reversion of the profitability, growth, and expected return characteristics of value and growth stocks, and (iii) drift, due to the general upward drift of price-to-book ratios during the sample period.

The cumulative increase in price-to-book ratios during the sample period is substantial, but the contribution of this drift to average annual returns is relatively small and similar (about one percent per year) for value and growth portfolios. The differences between the average annual rates of change of the price-to-book ratios of value and growth portfolios are thus due almost entirely to convergence.

Our story proceeds as follows. Section I motivates the simple breakdown of returns into dividends and capital gains due to growth in book equity and growth in P/B, and discusses some problems of estimation. Section II presents estimates of the simple breakdown for value and growth portfolios and presents background evidence on the behavior of profitability in the years around portfolio formation. Section III examines the more detailed breakdown of capital gain returns which involves splitting growth in price-to-book ratios between convergence and drift. Section IV concludes.

I. The Components of Returns: Preliminaries

Our tests center on six portfolios formed on size and book-to-market equity. As in Fama and French (1993), at the end of June each year t from 1963 to 2003, we form six portfolios as the intersections of sorts of firms into two size groups, S (small, that is, NYSE, AMEX, and, after 1972, Nasdaq firms with market capitalization below the NYSE median) and B (big, market cap above the NYSE median), and three book-to-market (B/P) groups, G (low B/P growth firms, that is, NYSE, AMEX, and Nasdaq firms in the bottom 30% of NYSE B/P), N (neutral, in the middle 40% of NYSE B/P), and V (value, in the top 30% of NYSE B/P). The result is six portfolios, SG, SN, SV, BG, BN, and BV,

refreshed at the end of June each year, where SG and BG are small and big growth portfolios, SN and BN are small and big neutral portfolios, and SV and BV are small and big value portfolios.

A. Concepts

Though the concepts used in the dissection of returns are straightforward, precise description requires a bit more notation. The one-year (gross) return from July of year t through June of t+1 for one of the six portfolios is,

$$1 + R_{t,t+1} = D_{t,t+1} / P_t + P_{t,t+1} / P_t, \quad (3)$$

where,

P_t = market value at time t of the securities allocated to the portfolio when it is formed at time t,

$P_{t,t+1}$ = market value at time t+1 of the securities allocated to the portfolio at t,

$D_{t,t+1}$ = dividends paid between t and t+1 on the securities allocated to the portfolio at t.

For simplicity, we omit the subscript that should appear on each variable to identify the portfolio. The two time subscripts on most variables indicate (i) the time when the portfolio is formed, and (ii) the time when the variable is observed. For example, $R_{t,t+1}$ is the return observed at the end of June of year t+1 on a portfolio formed at the end of June of t. To simplify the notation, we drop a time subscript if the variable is observed when the portfolio is formed. For example, we use P_t, rather than $P_{t,t}$, as the market value of a portfolio when formed at time t.

As a first step toward identifying the components of value and growth stock returns, we incorporate the implications of the dividend irrelevance theorem of Miller and Modigliani (1961). The basis of the theorem is a one-for-one tradeoff between dividends paid to old shareholders at time t+1 and the market value of their shares at t+1. Specifically, given a firm's investment outlays, an accounting identity says that $1 less in dividends at t+1 is $1 less of market value the firm must cede to new outside financing, and so it is $1 more of capital value for the old shareholders at t+1. Equivalently, $1 more of book equity due to an additional $1 of reinvested earnings at t+1 is $1 more of capital value for old

shareholders at t+1. Based on this logic, our first (simple) breakdown of the capital gain return isolates the growth in book equity,

$$(4) \qquad \frac{P_{t,t+1}}{P_t} = \left[\frac{P_{t,t+1}/B_{t,t+1}}{P_t/B_t}\right] x \left[\frac{B_{t,t+1}}{B_t}\right] = \left[\frac{PB_{t,t+1}}{PB_t}\right] x \left[\frac{B_{t,t+1}}{B_t}\right],$$

where,

B_t = book value at time t of stocks allocated to the portfolio when it is formed at t,

$B_{t,t+1}$ = book value at time t+1 of the stocks allocated to the portfolio at t,

$PB_{t,t+1}$ = $P_{t,t+1}/B_{t,t+1}$, the aggregate price to book ratio (the sum of market values divided by the sum of book values) at t+1 of the stocks allocated to the portfolio at time t.

In words, the (gross) capital gain return on the portfolio from t to t+1 is the (gross) rate of growth of the price-to-book ratio for the stocks allocated to the portfolio at time t, times the (gross) rate of growth of book equity due to reinvestment of earnings by these firms. Note that $PB_{t,t+1}$ is the price-to-book ratio at t+1 for the stocks allocated to the portfolio at t. This is not the price to book ratio of the refreshed version of the portfolio formed at t+1, PB_{t+1}, since some stocks allocated to the portfolio at t move to different portfolios at t+1 and other stocks are added to the refreshed portfolio at t+1.

B. Motivation

For perspective on (4), suppose the price-to-book ratio for the stocks allocated to a portfolio at t is not expected to change from t to t+1. Then (3) and (4) imply that the portfolio's expected (gross) return is just the expected dividend yield, $E_t(D_{t,t+1})/P_t$, plus the expected (gross) rate of growth of book equity due to reinvestment of earnings, $E_t(B_{t,t+1})/B_t$, where $E_t(\cdot)$ is the expectation at time t..

For the market as a whole it may be reasonable to expect that the price-to-book ratio doesn't change much from one year to the next, so the expected capital gain return is close to the expected growth rate of book equity. And we shall see that the average capital gain return for the market portfolio of NYSE, AMEX, and Nasdaq stocks is indeed close to the average growth rate of book equity.

For value and growth portfolios, however, we expect non-zero changes in the price-to-book ratio in the capital gain return (4). Oversimplifying, a constant price-to-book ratio implies that the expected profitability of investments and the discount rates that price expected cashflows are constant through time (Vuolteenaho 2002). At the extremes of P/B occupied by growth and value stocks, this is unlikely. Thus, firms tend to be fast-growing and highly profitable when allocated to high P/B growth portfolios (Lakonishok, Shleifer, and Vishny 1994, Fama and French 1995). Two forces are likely to erode this high profitability: (i) competitive responses from other firms and (ii) lower average returns on investment as the firm exercises its growth options. Both imply eventual declines in the high P/B (market value per dollar of investment) of growth stocks.

Conversely, firms tend to be relatively unprofitable when allocated to low P/B value portfolios. They are likely to respond by cutting back on unprofitable activities and taking other actions that improve profitability. As a result, we can expect that P/B rises after stocks are allocated to value portfolios. We also know from the value effect in average returns that expected returns and thus discount rates for expected cashflows are negatively related to P/B. Thus, the expected decline in P/B for growth stocks associated with declining profitability tends to be reinforced by an increase in discount rates, and the expected increase in P/B for value stocks due to higher profitability is reinforced by lower discount rates.

The expected change in price-to-book ratios that comes about because some growth stocks cease to be (fast growing, highly profitable, low expected return) growth stocks and some value stocks are not permanently burdened with low profitability and high expected returns is what we call convergence. It captures price effects (capital gains) due to convergence of growth, profitability, and expected returns.

We also know (for example, Fama and French 2002) that for the market as a whole, P/B rises during our 1963-2004 sample period due to some combination of higher expected cashflows and lower discount rates (expected returns) at the end of the sample period. General changes in P/B during the sample period give rise to what we call the drift effect in capital gains.

The cumulative upward drift in price-to-book ratios during the 1963-2004 period is substantial, but we shall see that the contribution of drift to annual average returns is relatively small, and it is similar

(about one percent per year) for value and growth portfolios. Thus, differences in average growth rates of P/B for value and growth portfolios are due almost entirely to convergence. And attributing all the average growth of P/B to convergence is a reasonable approximation, at least for describing differences in average returns. This fact justifies focusing much of the paper on the simple breakdown of the capital gain return in (4).

Finally, the breakdown of the capital gain return in (4) is a tautology. But it gets to the core of the forces that generate prices and expected returns. Moreover, this is true whether pricing is rational or irrational. Setting rational time t prices for the stocks allocated to a portfolio requires rational assessments of (i) the expected payoff on the portfolio at t+1, $E_t(D_{t,t+1} + P_{t,t+1})$, (ii) the risk of the payoff, and (iii) the expected return implied by this risk. Assessing $E_t(D_{t,t+1} + P_{t,t+1})$ and the risk of $D_{t,t+1} + P_{t,t+1}$ requires predictions of how the profitability and growth of firms of the type (value or growth) allocated to the portfolio at t are likely to change and what the changes imply for future expected returns. This is what convergence is meant to capture – convergence in expected profitability and growth, and related convergence in expected returns due to the fact that growth stocks are not growth stocks forever and value stocks do not always remain value stocks. The growth in book equity for the firms in the portfolio is in part simply the result of dividend policy, but it is also depends on the profitability and growth opportunities of the firms in the portfolio, and predictions of profitability and investment are central in pricing. In short, in a world of rational pricing the breakdown of the capital gain return in (4) captures the salient factors in the pricing of stocks.

The rational view of asset pricing outlined above has a well-known competitor. Behaviorists like Lakonishok, Shleifer, and Vishny (1994) argue that the premium in the average returns on value stocks relative to growth stocks is due to irrational pricing. Their hypothesis centers on convergence. The behaviorists argue that investors never come to understand the convergence in profitability and growth that occurs after firms are allocated to value and growth portfolios. Investors are continually surprised by the deterioration in profitability and growth that tends to occur after firms are allocated to growth portfolios and by the improvement after firms are allocated to value portfolios. The result is lower capital

gains (and negative convergence) for growth stocks in the years after portfolio formation and higher capital gains (positive convergence) for value stocks. In this view, convergence is largely unexpected, at least by the irrational investors that dominate asset pricing.

For our purposes the important point is that along with the dividend yield in (3), the breakdown of the capital gain return in (4) captures the core sources of average returns, irrespective of one's view about whether pricing is rational or irrational.

C. Estimation Details

We want to estimate how dividends and the two components of the capital gain return in (4) contribute to the average returns on value and growth portfolios. The components of the simple capital gain return are, however, multiplicative, and the average of a product is not the product of the average components. If we switch to continuously compounded (CC) capital gain returns, (4) becomes,

$$\begin{aligned} \ln(P_{t,t+1}/P_t) &= [\ln(P_{t,t+1}/B_{t,t+1}) - \ln(P_t/B_t)] + \ln(B_{t,t+1}/B_t) \\ &= \ln(PB_{t,t+1}/PB_t) + \ln(B_{t,t+1}/B_t) \ . \end{aligned} \tag{5}$$

Thus, the components of the CC capital gain return are additive, and the average CC capital gain return is the sum of the average values of its components. CC returns also give direct perspective on the cumulative wealth generated by value and growth portfolios during our sample period.

A complication in estimating the terms of (5) is that the stocks allocated to a portfolio at the end of June of year t do not all survive to the next formation point at the end of June of t+1. Our solution to this problem follows the logic of the calculation of the annual capital gain returns we seek to explain.

We compute the annual capital gain return on a portfolio by compounding monthly value weight capital gain returns. This linking of returns implies that when stocks delist, their market value in the portfolio at delisting is used to increase investments in the stocks that remain, in proportion to the portfolio weights of the remaining stocks. We value weight within portfolios, so the value of delisted stocks is allocated to the remaining stocks in the portfolio in proportion to the market capitalizations of

the remaining stocks at the time of delisting. As a result, at the end of the year after portfolio formation (time t+1), we hold more shares of the stocks that still trade than when the portfolio was formed (time t).

We use the reinvestment logic implicit in the capital gain return on the left hand side of equation (5) to estimate the variables on the right hand side. Thus, in calculating the growth of book equity from t to t+1, B_t is the aggregate, for all stocks allocated to the portfolio at the formation point t, of shares held at t times book equity per share at t. And $B_{t,t+1}$ is the aggregate, for stocks allocated to the portfolio at t that still trade at t+1, of shares held at t+1 (including reinvestment of proceeds from delisted stocks) times book equity per share at t+1. P_t and $P_{t,t+1}$ are calculated in the same way, but with price per share at t and t+1 substituted for book equity per share.

Finally, our CC capital gain returns use CRSP (Center for Research in Securities Prices) returns without dividends. The CC total returns use CRSP returns with dividends. The contribution of dividends to the CC total return is taken to be the total return minus the return without dividends. Since monthly total returns are compounded to get annual returns, the dividend contribution includes dividends and the reinvestment return earned from the time a dividend is paid to the end of the annual return period.

II. The Simple Breakdown of Returns: Dividends, Reinvestment, and Growth in P/B

Table 1 shows average values of continuously compounded total returns, the contribution of dividends to total returns, capital gain returns, and the two components of capital gain returns of (5). Results are shown for the CRSP NYSE-AMEX-Nasdaq value weight market portfolio and the six value-weight size-B/P portfolios.

A. The Market Portfolio

To set the stage for the results for value and growth portfolios, it is interesting to examine the components of the average return on the market portfolio. The total CC market return for 7/1963–6/2004 **(Ken: Is this the time period throughout?) (henceforth 1963-2004) is 10.35% per year. Of the total, the dividend yield is 3.15% per year and the capital gain return is 7.20%. More interesting, in the breakdown of the CC capital return of (5), the average growth rate of the price-to-book ratio for the market portfolio

is only 0.23% per year, so the average capital gain return is just a bit higher than the average growth rate of book equity due to reinvestment of earnings, 6.97% per year.

The growth in P/B in (5) is for the un-refreshed market portfolio – the portfolio formed at the end of June of year t and held to the end of June of t+1. It is more common to examine the price-to-book ratio for the refreshed version of the market portfolio, which includes all stocks available in June of year t and then all stocks available in June of t+1. The average annual growth in P/B for the refreshed market, 0.77%, is slightly higher than for the un-refreshed market, 0.23%. Since the two approaches use the same firms in June of t, the difference is caused by new companies, which are in the refreshed market at t+1. Since these new companies are typically growth firms with high P/B when they enter the market portfolio, the growth in P/B for the refreshed market is slightly higher than for the un-refreshed market.

The interesting finding, however, is that growth in book equity due to reinvestment of earnings accounts for almost all the average capital gain return on the market portfolio, and growth in the price-to-book ratio is negligible. This is in sharp contrast to the results for value and growth portfolios, examined next, where growth in P/B is important in average capital gain returns, though it is opposite in sign for value (positive) and growth (negative) portfolios.

B. Dividends

Table 1 shows that, controlling for book-to-market equity group, dividends contribute more to the returns of large stocks. And given size, dividends contribute more to the returns of value stocks. Dividends add 4.77% to the average CC return on the big value portfolio, versus 2.93% for the small value portfolio. Dividends add 2.32% to the average return on the big growth portfolio, versus 1.19% for the small growth portfolio.

The differences in average dividend yields are also apparent in the year-by-year results summarized in Table 2. Among the six size-B/P portfolios, the SG portfolio has the lowest yield in all 41 years of 63-03, and BG has the second lowest yield in 63.4% of the years. Similarly, the big value portfolio has the highest yield 78.0% of the time and it is in the top two every year.

Because dividend yields are higher for the value portfolios, the spreads between the capital gain returns on value and growth portfolios are narrower than the spreads between total returns. The gap between the average continuously compounded total returns for big value and big growth is a healthy 3.12%, but the difference between their average CC capital gain returns is only 0.67% (Table 1). The average rate of capital gain for the small value portfolio, 13.75% per year, is, however, near twice that of the small growth portfolio, 7.13%.

C. Capital Gain Returns: Growth in Book Equity and Growth in P/B

The more interesting results center on equation (5), the breakdown of CC capital gain returns into the growth rate of book equity and the growth rate of the price-to-book ratio. Firms invest a lot in the year after they are allocated to the two growth portfolios. The CC growth rate of book equity averages 12.90% for the big growth portfolio (BG) and 18.30% for the small growth portfolio (SG). Average rates of capital gain for the two growth portfolios are much lower, 7.22% and 7.13%. Substantially higher growth rates for book equity than for price imply sharply declining price-to-book ratios. In the year after portfolio formation, P/B on average declines at a continuously compounded rate of 5.69% for BG and 11.17% for SG.

In contrast to the high reinvestment rates of growth stocks, on average book equity for the big value portfolio (BV) increases by only 1.35% in the year after portfolio formation, and book equity for small value (SV) shrinks by 2.43%. Thus, firms retain little or no earnings in the year after they are allocated to value portfolios. Average CC rates of capital gain for the two value portfolios, 7.89% for BV and 13.75% for SV, far exceed average growth rates of book equity. As a result, the average continuously compounded rates of increase in P/B in the year after portfolio formation, 6.55% for BV and 16.19% for SV, are larger than the average declines in P/B for the comparably-sized growth portfolios.

In short, the split of average capital gain returns between growth rates of book equity and growth rates of P/B produces near opposite results for growth and value portfolios. The capital gain returns of growth portfolios are due to high rates of reinvestment of earnings that more than offset declines in P/B.

But for value portfolios, reinvestment of earnings is on average near zero in the year after portfolio formation, and high average rates of capital gain show up almost entirely as growth in P/B.

Average growth rates of price-to-book ratios combine the effects of convergence and drift. We shall see that drift is relatively small and similar for our portfolios, so differences in the average growth rates of P/B for value and growth portfolios largely reflect convergence. The high P/B ratios of growth portfolios decline after portfolio formation because some growth stocks cease to be highly profitable, fast-growing firms with low expected stock returns. And the low P/B ratios of value portfolios rise after portfolio formation because some value stocks are no longer low profitability firms with few investments and high expected stock returns.

D. P/B in the Years around Portfolio Formation

Figure 1 summarizes the evolution of price-to-book ratios before and after portfolio formation. Specifically, the figure shows averages (across portfolio formation years) of P/B from five years before to five years after portfolio formation for the stocks allocated to the value and growth portfolios at time t (year 0 in the figure). For the two growth portfolios, P/B rises in the five years before portfolio formation, peaks in the portfolio formation year (or the preceding year), and falls thereafter.[1] Five years after portfolio formation, P/B for the growth portfolios is at about the same level as five years before portfolio formation. Still, throughout the eleven years around portfolio formation, average P/B is above 2.6 for the growth portfolios. Thus, the stocks allocated to growth portfolios at time t are judged to have good prospects (expected cashflows with market value far in excess of the historical cost of assets) long before and after t.

The price-to-book ratios of stocks allocated to the two value portfolios have the opposite pattern, falling in the five years before portfolio formation and rising thereafter. For the value portfolios (as for the growth portfolios), P/B five years after portfolio formation is about where it was ten years earlier.

[1] Since Figure 1 is meant to show the evolution of P/B coinciding with returns, the price in the numerator of P/B for year zero is the price at the time of portfolio formation (end of June of year t). In contrast, the book-to-market ratio used to form portfolios in June of t uses the price as of the end of December of t-1. As a result, the P/B in Figure 1 need not peak in year 0.

The recovery in the price-to-book ratios of value stocks after portfolio formation is, however, relative. Throughout the eleven years around portfolio formation, P/B for the value portfolios is far below P/B for the growth portfolios. And five years after portfolio formation the prospects of value stocks remain mediocre; that is, P/B is close to 1.0, so the market value of expected cashflows barely covers the cost of past investments.

E. Year-by-Year Results

Table 2 summarizes year-by-year results on the behavior of the capital gain return and its two components in (5), growth in book equity and growth in P/B, in the year after portfolio formation. Capital gains are highly volatile, with standard deviations similar to those of raw returns. Because of this high volatility, the large differences in average capital gain returns are difficult to see in the year-by-year results. For example, the small growth portfolio has the lowest average capital gain return, and SG has the lowest capital gain in 34.1% of the sample years, but its capital gain is the highest in 26.8% of sample years. Small value, which has the highest average capital gain, is the only portfolio with a big difference between the fraction of years it has the maximum (34.1%) and minimum (7.3%) capital gain return.

Annual rates of change in book equity are much less volatile than either capital gains or rates of change in P/B. As a result, the large differences between the average CC growth rates of book equity for growth and value stocks (12.90% versus 1.35% for the big portfolios and 18.30% versus -2.43% for the small portfolios) are apparent in the year-by-year results. The small growth portfolio has the highest rate of change in book equity in 85.4% of sample years and it is in the top two every year. The BG and SG portfolios grow faster than the other four portfolios in 90.2% of the years. The value portfolios are at the other extreme. The SV portfolio has the lowest growth rate of book equity in about two thirds of sample years, and the big value portfolio has the lowest growth rate in all but one of the years in which SV is not the lowest. In short, in the year after portfolio formation the typical growth firm almost always reinvests more earnings than the typical value firm.

With continuous compounding, the percent change in a portfolio's price-to-book ratio is its capital gain return minus its percent change in book equity. Thus, the positive differences between the average capital gain returns of value and growth portfolios are magnified by the large negative spreads between their book equity growth rates, producing larger differences in average rates of change in P/B. For example, the average CC capital gain for SV exceeds the average for SG by 6.62% per year, but SV's rate of growth in book equity is 20.73% lower than SG's (Table 1). The result is a dramatic difference of 27.36% between the average CC rates of change in P/B for the small value and small growth portfolios.

Though annual growth rates of P/B are about as volatile as raw returns, the large differences between the average growth rates of P/B for value and growth portfolios are apparent in the year-by-year results in Table 2. The small growth portfolio, for example, has the lowest growth rate of P/B in 56.1% of sample years, and one of the two growth portfolios has the lowest in 85.4%. Similarly, the small value portfolio has the highest change in 78.0% of the years, and one of the two value portfolios has the highest in all but three years. Thus, even on a year-by-year basis, the price-to-book ratios of firms assigned to the value portfolios usually grow faster than the ratios of firms assigned to the growth portfolios.

In sum, when we break capital gains into growth of book equity (due to earnings retention) and growth in P/B (largely due to convergence in profitability, growth, and expected returns), we find rather consistent year-by-year separation between growth and value portfolios. Growth rates of book equity are almost always higher for the growth portfolios than for the value portfolios. Clean separation of the growth rates of book equity for value and growth portfolios helps produce rather clean separation in year-by-year growth rates of P/B, which are typically higher for value portfolios than for growth portfolios.

F. Profitability and P/B: Perspective

Changes in price-to-book ratios must be due to some combination of changes in expectations about future cashflows (profitability) and changes in future expected returns (Vuolteenaho 2002). Since growth in price-to-book ratios is important in the difference between average returns for value and growth portfolios, it is interesting to ask whether the behavior of profitability after portfolio formation is in line

with the behavior of P/B. Comparing the behavior of profitability, Y_{t+1}/B_t (earnings divided by book equity), in the eleven years around portfolio formation (Figure 2) with the behavior of P_t/B_t (Figure 1) suggests a clear positive answer to this question.

For the growth portfolios, Y_{t+1}/B_t rises in the years before portfolio formation and falls thereafter – a pattern like that observed for P_t/B_t. And profitability is on average much higher for the big growth portfolio (BG) than for the small growth portfolio (SG). Like P/B, the profitability of value portfolios follows the opposite pattern; Y_{t+1}/B_t falls in the years before portfolio formation and rises thereafter. In the year of portfolio formation, profitability is on average much higher for the big value portfolio (BV) than for the small value portfolio (SV), but Y_{t+1}/B_t rises more sharply for SV than for BV, and five years after portfolio formation SV and BV have about the same profitability.

Interestingly, on average the stocks allocated to the small value and small growth portfolios in year t have similar profitability both five years before and five years after t. But the profitability of the two portfolios follows opposite paths in the intervening years. The profitability of the SV portfolio plummets in the years leading up to portfolio formation and rises sharply thereafter, whereas the profitability of SG stocks rises as portfolio formation approaches and falls thereafter. (Stop?)

For a different perspective, Figure 3 shows time-series plots of the profitability of value and growth portfolios in the portfolio formation year. Confirming and updating Fama and French (1995), Figure 3 shows that the high profitability of large growth stocks relative to small growth stocks in Figure 2 is a post-1979 result. Until 1979 SG stocks have about the same profitability in the portfolio formation year as BG stocks. After 1979 the profitability of BG stocks continues at about the same (high) level, but there is progressive deterioration in the profitability of SG stocks.

There is a similar pattern in the profitability of the small and big value portfolios. Until 1981 SV stocks are just slightly less profitable in the portfolio formation year than BV stocks. From 1982 to 2001, the profitability of BV stocks continues at about the same modest level, but Y_{t+1}/B_t becomes more variable across yearly cohorts. After 1981 the formation year profitability of SV stocks falls relative to

BV stocks. And after 1984 the average profitability of SV stocks in the portfolio formation year is typically negative. In contrast, the profitability of the BV portfolio is negative in only three years.

Perhaps the most striking result in Figure 3 is the sharp decline and subsequent recovery of the profitability of the growth and value portfolios formed in 2000-2003. The formation year profitability of the big growth portfolio falls from 21.3% in 1999 to 18.2% in 2000 and 13.5% in 2001, before recovering to 21.3% in 2003. The other three portfolios suffer sharper declines. The formation year profitability of the small growth portfolio falls from -1.43% in 1999 to a calamitous -19.6% in 2000, then rises to 6.4% over the next three years. The value portfolios experience dramatic declines in profitability in 2001. Y_{t+1}/B_t for the small value portfolio plunges from -6.0% in 2000 to -17.8% in 2001, and profitability for big value drops from 5.8% to -7.0%. The value portfolios formed in 2002 and 2003 recover much of this lost profitability.

III. Drift and Convergence

Equation (5) splits the capital gain return on a portfolio between growth in its book equity due to reinvestment of earnings and growth in its un-refreshed price-to-book ratio (the latter defined as the growth from t to t+1 of P/B for the stocks allocated to the portfolio at t). Our last task is to split the average growth in un-refreshed price-to-book ratios between drift and convergence.

For a given type of portfolio (for example, small value stocks) the drift component of average returns is meant to capture the effects of changes from the beginning to the end of the 1963-2004 sample period in the price-to-book ratios of firms of that type. Thus, we estimate drift as the average value of $\ln(PB_{t+1}/PB_t)$, the CC growth rate of P/B for the refreshed version of the portfolio, formed at t and then reformed at t+1. In economic terms, drift measures the effect of long-term changes in the expected growth, profitability, and discount rates used to price the six refreshed portfolios each year.

In contrast, convergence focuses on the average return due to movement of firms across types in the year after they are allocated to a portfolio of a given type. The average growth rate of the un-refreshed price-to-book ratio for a portfolio (the average value of $\ln(PB_{t,t+1}/PB_t)$), is in part due to

convergence, but it also includes the effects of drift. To split the two, we define convergence as the average difference between the CC growth rates of a portfolio's un-refreshed and refreshed P/B, that is, the average value of $\ln(PB_{t,t+1}/PB_t) - \ln(PB_{t+1}/PB_t) = \ln(PB_{t,t+1}/PB_{t+1})$. In words, for a portfolio of a given type formed at time t, convergence from t to t+1 is the percent difference between the portfolio's un-refreshed price-to-book ratio at t+1 and the P/B it would have in the absence of migration of stocks across types from t to t+1 (for example, as some value stocks prosper and migrate toward growth and some growth stocks falter and migrate toward value).

The estimates of drift, in Table 3, are modest and similar for the six size-B/P portfolios. The average rates of growth in refreshed P/B range from 0.78% per year for the big neutral portfolio (BN) to 1.33% for the small value portfolio (SV). Figure 4 plots the time series of refreshed price-to-book ratios that generate these averages. The differences between the beginning (1963) and ending (2004) price-to-book ratios in Figure 4 are testimony to the power of compounding. Despite modest average annual changes (and thus modest estimates of drift), the cumulative (41-year) CC growth in P/B for the six portfolios varies from 31.9% (BN) to 55.2% (SV). If the sample stopped in 1998, estimates of average drift would be larger. And it is perhaps surprising that five of the six portfolios have their highest P/B at that time – two years before the drop in the overall market in 2000. Only the big growth portfolio peaks in 2000, but BG is a large fraction of the value-weight market portfolio.

Modest estimates of drift lead to the inference that average growth rates of un-refreshed P/B for value and growth portfolios are largely due to convergence. And convergence is substantial. On average, increases in expected return and reductions in expected profitability and growth reduce the price to book ratios of the small and big growth portfolios by 12.00% and 6.73% in the year after portfolio formation (Table 3). The P/B ratios of the small and big value portfolios increase at CC rates of 14.86% and 5.73% due to increases in expected profitability and growth and declines in expected returns.

For perspective on the migration that drives convergence, we estimate transition vectors for the stocks allocated to each of the six size-B/P portfolios in June of year t. The transition vector for a portfolio is the vector of proportions of the aggregate book equity of the portfolio when formed at the end

of June of year t that fall into the six portfolios in June of t+1. (Weighting by book equity is appropriate, because we are interested in the convergence of P/B.) Table 4 shows the average transition vectors for the six portfolios.

Small value stocks and stocks in all three big portfolios are likely to stay put from one year to the next. On average, stocks accounting for 77.2% of the book equity of the SV portfolio formed at time t remain in SV at t+1. One-year persistence rates for the three big stock portfolios are 80.4% (BG), 74.1% (BN), and 78.4% (BV). Even after three years, stocks accounting for 63.4%, 66.2%, 59.3%, and 66.2% of the book equity of the stocks allocated to SV, BG, BN, and BV at t remain in the same groups. In contrast, one-year persistence rates for SG (small growth) and SN (small neutral) are just 55.6% and 58.4%, and they drop to 36.0% and 43.4% after three years.

When stocks migrate, it is mostly to other book-to-market groups in the same size group; there is much less migration from the small to the big size group or vice versa. Measured by book equity, less than 20% of the movement from the small value portfolio in the three years after portfolio formation at time t is to the big portfolios, and firms accounting for less than 15% of the book equity of the small growth portfolio cross the size boundary. There is even less migration from big to small groups. On average, firms accounting for 3.0% or less of each big portfolio's book equity at t move to a small portfolio between t and t+3.

Growth stocks that migrate within the same size group must move to either the neutral or value portfolio, and value stocks must move to the neutral or growth portfolio. Thus, migration for growth stocks tends to be a deterioration of type, from high to lower P/B, which gives rise to negative convergence in the price-to-book ratio. Migration by value stocks tends to be an improvement in type, from low to higher P/B. This produces positive convergence.

IV. The Bottom Line

Table 3 reports the contributions of six return components to the average continuously compounded returns on our size-B/P portfolios. The simplest allocation is between dividends and capital

gains. Then, using (5), we split the capital gain return into growth in book equity due to reinvestment of earnings and growth in the un-refreshed price-to-book ratio. Finally, we split the growth in P/B into drift and convergence.

On average, dividends contribute more to the returns on big stock portfolios and value portfolios. For the small stock portfolios, the contribution of dividends to average returns ranges from 1.19% per year for the small growth portfolio (SG) to 2.93% for the small value portfolio (SV). Dividends are especially important in the returns on the big value and big neutral portfolios. Dividends contribute 4.03% per year to average BN returns and 4.77% to BV returns.

Capital gains are the larger part of average returns for all our portfolios, but the way capital gains split between growth in book equity due to earnings retention and growth in price-to-book ratios is quite different for value and growth stocks. On average, book equity declines a bit in the year after stocks are allocated to the small value portfolio, and this disinvestment shrinks average SV returns by -2.43% per year. Big value firms grow a bit in the year after portfolio formation, and growth in book equity contributes 1.35% per year to average returns. Much more of the average returns on the value portfolios shows up as growth in price-to-book ratios. Growth in P/B contributes 16.19% per year to average SV returns and 6.55% to average BV returns. In contrast, reinvestment of earnings is the dominant positive source of return for the growth portfolios, adding 18.30% per year to SG average returns and 12.90% to BG returns. Reinvestment more than suffices to offset declines in P/B that reduce average SG and BG returns by -11.17% and -5.69% per year.

Growth in P/B has two parts, (i) drift due to general changes in expected profitability, growth, and discount rates (expected returns) from the beginning to the end of the sample period, and (ii) convergence in profitability, growth, and expected returns that occurs because the fortunes of firms change after they are allocated to portfolios. Drift is a small and relatively similar part of average returns on different portfolios, with contributions that range from 0.78% per year for the big neutral portfolio (BN) to 1.33% for the small value portfolio (SV). Thus, for the value and growth portfolios almost all growth in P/B in the year after portfolio formation is due to convergence. On average, the price-to-book

ratios of growth stocks decline because all growth stocks do not forever remain highly profitable, fast-growing firms with low expected stock returns. And P/B increases for value stocks because some of them experience improved profitability and growth, and are rewarded with lower expected stock returns. Specifically, convergence in P/B adds 14.86% and 5.73% per year to SV and BV average returns, but convergence returns for the growth portfolios SG and BG are -12.00% and -6.73% per year.

Realized returns are, of course, the sum of expected and unexpected returns. Although none of the return components are anticipated perfectly, the dividends of firms are quite smooth, so most of the contribution of dividends to returns is probably expected. On the other hand, since there is much uncertainty about earnings, even the average contribution of earnings retention to capital gain returns is probably subject to non-trivial noise. The drift component of the average growth in price-to-book ratios is probably largely unexpected, due to general changes in expected profitability, growth, and expected returns from the beginning to the end of the sample period.

The interesting question centers on how much of average convergence is expected and unexpected – and by whom. The answer depends on whether one leans toward a rational or a behavioral view of asset pricing. Rationalists (e.g., Fama and French 1995) would argue that convergence in the profitability, growth, and expected returns of value and growth stocks is somewhat predictable and so built into the forward-looking pricing of stocks. In this view, average convergence in price-to-book ratios is to a large extent the result of rational pricing that aligns expected returns and risk. And value stocks have higher expected returns because they are more risky.

In contrast, behaviorists (e.g., Lakonishok, Shleifer, and Vishny 1994) argue that the investors who determine market prices never come to understand convergence in profitability and growth. Investors are thus surprised by the deterioration in profitability and growth that tends to occur after firms are allocated to growth portfolios and the improvement after firms are allocated to value portfolios. The result is lower prices (and negative average convergence) for growth stocks and higher prices (positive convergence) for value stocks. In this view, average convergence is largely unexpected, at least by the irrational investors that dominate asset pricing.

The important point, however, is that our breakdown of average returns into the contributions of dividends and capital gain returns due to reinvestment, drift, and convergence captures the core factors in asset pricing irrespective of one's views about whether pricing is rational or irrational.

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Table 1 – Components of Average Continuously Compounded Annual Returns, 1963-2004

	Total Return	Dividend Yield	Capital Gain	Growth in B	Growth in Un-Refreshed P/B
Market	10.35	3.15	7.20	6.97	0.23
SG	8.32	1.19	7.13	18.30	-11.17
SN	14.61	2.71	11.90	6.66	5.24
SV	16.69	2.93	13.75	-2.43	16.19
BG	9.54	2.32	7.22	12.90	-5.69
BN	10.94	4.03	6.91	6.51	0.40
BV	12.66	4.77	7.89	1.35	6.55

Table 2 – Summary Statistics for Components of Annual Continuously Compounded Returns

			Percent of Years Portfolio Has Extreme Values			
	Average	Std Dev	Minimum	Bottom 2	Top 2	Maximum
Total Return						
SG	8.32	26.97	39.0	51.2	34.1	22.0
SN	14.61	20.02	0.0	22.0	36.6	0.0
SV	16.69	18.64	9.8	14.6	56.1	34.1
BG	9.54	17.79	19.5	43.9	24.4	14.6
BN	10.94	14.97	17.1	34.1	17.1	7.3
BV	12.66	14.81	14.6	34.1	31.7	22.0
Dividend Yield						
SG	1.19	0.69	100.0	100.0	0.0	0.0
SN	2.71	1.20	0.0	19.5	0.0	0.0
SV	2.93	1.29	0.0	17.1	4.9	0.0
BG	2.32	0.85	0.0	63.4	0.0	0.0
BN	4.03	1.47	0.0	0.0	95.1	22.0
BV	4.77	1.76	0.0	0.0	100.0	78.0
Capital Gains						
SG	7.12	26.92	34.1	43.9	41.5	26.8
SN	11.90	20.06	0.0	17.1	34.1	0.0
SV	13.75	18.72	7.3	17.1	56.1	34.1
BG	7.22	17.82	19.5	39.0	29.3	19.5
BN	6.91	15.01	17.1	41.5	14.6	4.9
BV	7.89	14.69	22.0	41.5	24.4	14.6
Change in B						
SG	18.30	9.81	0.0	0.0	100.0	85.4
SN	6.66	6.87	2.4	4.9	9.8	2.4
SV	-2.43	8.63	65.9	97.6	0.0	0.0
BG	12.90	3.47	0.0	0.0	90.2	12.2
BN	6.51	2.88	0.0	7.3	0.0	0.0
BV	1.35	6.12	31.7	90.2	0.0	0.0
Change in P/B for Un-Refreshed Portfolio						
SG	-11.17	29.22	56.1	73.2	9.8	2.4
SN	5.24	20.66	0.0	17.1	29.3	0.0
SV	16.19	20.13	0.0	2.4	87.8	78.0
BG	-5.69	18.68	29.3	65.9	7.3	4.9
BN	0.40	14.96	14.6	31.7	14.6	0.0
BV	6.55	14.52	0.0	9.8	51.2	14.6

Table 3 – Full Breakdown of Average Continuously Compounded Annual Returns, 1963-2004

	Total Return	Dividend Yield	Capital Gain	Growth in B	Growth in Un-Refreshed P/B	Drift	Convergence
Market	10.35	3.15	7.20	6.97	0.23	0.77	-0.66
SG	8.32	1.19	7.13	18.30	-11.17	0.83	-12.00
SN	14.61	2.71	11.90	6.66	5.24	0.97	4.27
SV	16.69	2.93	13.75	-2.43	16.19	1.33	14.86
BG	9.54	2.32	7.22	12.90	-5.69	1.04	-6.73
BN	10.94	4.03	6.91	6.51	0.40	0.78	-0.38
BV	12.66	4.77	7.89	1.35	6.55	0.82	5.73

Table 4 – Average Transition Vectors, 1963-2004

	SG	SN	SV	BG	BN	BV	Negative B
One Year Ahead							
SG	55.6	29.9	4.5	8.6	1.3	0.1	0.9
SN	8.7	58.4	23.6	1.9	6.6	0.8	0.3
SV	1.3	14.2	77.2	0.3	2.4	4.6	0.6
BG	0.7	0.5	0.1	80.4	17.8	0.4	0.1
BN	0.1	0.8	0.5	9.8	74.1	14.7	0.1
BV	0.0	0.3	1.7	0.7	19.0	78.4	0.0
Three Years Ahead							
SG	36.0	34.5	13.5	13.7	2.2	0.1	2.0
SN	9.8	43.4	30.8	5.9	9.4	0.7	0.8
SV	3.7	19.4	63.4	1.5	6.4	5.6	1.6
BG	0.6	1.1	0.6	66.2	28.5	2.9	0.4
BN	0.1	0.8	1.6	14.6	59.3	23.6	0.2
BV	0.0	0.3	2.8	3.1	27.6	66.2	0.3