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ABSTRACT

Expected long-term earnings growth rates are crucial inputs to valuation models and for cost of capital estimates. We analyze historical long-term growth rates across a broad cross-section of stocks using several operating performance indicators. We test whether growth persists, and whether it is forecastable. Cases of very high growth have occurred, but are relatively rare. There is scant persistence in growth beyond chance, and limited ability to identify firms with high future long-term growth. IBES forecasts are too optimistic, and have low predictive power for long-term growth. Regressions using a variety of predictors confirm the low predictability in growth. Valuations that assume persistently high growth over prolonged periods rest on shaky foundations.

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Valuation problems pose constant, thorny challenges in financial management and investment analysis. Two variables play key roles in any valuation exercise — the growth rate of future cash flows, and the discount rate applicable to such cash flows. Financial economists have developed a rich variety of models about the determination of discount rates, and documented extensively the behavior of asset returns. In comparison, the financial literature has devoted scant attention to the behavior of growth in earnings.

Although it has been relatively overlooked in prior work, the expected rate of growth in future cash flows plays a pivotal role in several important lines of research. In the context of aggregate market valuation, projections about future growth are instrumental in predicting the equity risk premium. Much current controversy surrounds the appropriate level of the equity risk premium, and whether recent market valuation levels (at least as of year-end 1999) can be justified (Asness (2000), Fama and French (2000a), Welch (2000)). Debate also revolves around how much of the performance of equity asset classes, such as large glamour stocks, can be attributed to changes in profitability growth (Chan, Karceski and Lakonishok (2000), Fama and French (1995)). When applied to the valuation of individual stocks, projected growth rates have implications for the cross-sectional distribution of cost of capital estimates (Fama and French (1997), Gebhardt, Lee and Swaminathan (1999)) as well as widely-followed indicators such as price-to-earnings and price-to-book ratios.

To take as an illustration, price-to-earnings multiples vary greatly across stocks. For the IBES universe of U.S. firms, at year-end 1999 the distribution of the ratio of stock price to analyst consensus forecasts of the following year's earnings, has a 90-th percentile of 53.9 while the 10-th percentile is 7.4, yielding a difference of 46.5. Firms with a record of sustained, strong past growth in earnings are heavily represented among those rewarded with rich multiples. Security analysts issue glowing recommendations for these stocks, and forecast rosy future prospects. Other stocks with a history of disappointing past growth are the dogs of the investment community. They are priced at low multiples and analysts are unexcited about their outlook. One reason for the disparity in multiples is differences in risk. Given the weak documented relation between risk and expected return for individual stocks, however (Fama and French (1992)), the large dispersion is unlikely to be driven primarily by risk (the evidence in Beaver and Morse (1978) also supports this view). Rather, most of the cross-sectional variation probably reflects differences in expected

growth rates. Indeed, one measure of the market's expectations, security analysts' forecasts of long-term growth in earnings, also displays large differences across stocks. For example, the 90-th percentile of the distribution of IBES five-year forecasts is 40 percent as of year-end 1999, compared to the 10-th percentile of 8.9 percent. If analysts and investors do not believe that future earnings growth is forecastable, they would predict the same growth rate (the unconditional mean of the distribution) for all companies, and it is unlikely that the dispersion in forecasts or price-earnings ratios would be as large as it actually is.

Evidently, then, market valuations and analysts' forecasts suggest that many market participants believe that future earnings growth is highly predictable. Studies in psychology suggest that individuals may be prone to extrapolate past trends too far into the future, placing too little weight on the base case. Analysts and investors may suffer from such judgmental biases (see the discussions in Kahneman and Riepe (1998), and Shleifer (2000)). Further, analysts' forecasts may be colored by personal career considerations and incentives, such as maintaining favorable relations with investment banking clients. Importantly, the belief that growth is persistent runs counter to the economic intuition that there should not be much consistency in a firm's profitability growth. Following superior growth in profits, competitive pressures should ultimately tend to dilute future growth; similarly exit from an unprofitable line of business should tend to raise the remaining firms' future growth rate. Some support for this logic comes from Fama and French (2000a). Their evidence for the aggregate market suggests that while there is some short-term forecastability, earnings growth is in general unpredictable.

In short, there may be a sharp discrepancy between share valuations along with analysts' predictions on the one hand, and realized operating performance growth on the other. Current market conditions emphasize the potential magnitude of the disconnect. For instance, take a firm with a ratio of price to forecasted earnings of 100. Such cases are by no means minor irregularities: based on values at year-end 1999, they represent about 11.9 percent of total market capitalization. To see what growth expectations are implicit in such a price-earnings ratio, we adopt a number of conservative assumptions. In particular, suppose the high multiple reverts to a more representative value of 20 in ten years, during which time investors are content to accept a rate of return on the stock of zero (assume there are no dividends). A multiple of 20 is conservative, since Siegel (1999) notes that the long-term average value of the price-earnings ratio is 14. Further, an

adjustment period of ten years is not short, in light of the fact that many of the largest firms at year-end 1999 did not exist ten years ago. These assumptions imply that earnings have to grow by a factor of five, or at a rate of about 17.5 percent per year, for the next ten years. Alternatively suppose investors put up with a paltry ten percent rate of return. Welch (2000) reports that financial economists' consensus expected return is considerably higher. Then earnings must grow at an even more stellar rate (29.2 percent per year) over ten years to justify the current multiple.

The above example highlights the two questions we tackle in this paper. How plausible are investors' and analysts' expectations that many stocks will be able to sustain high growth rates over prolonged periods? Are firms that can consistently achieve such high growth rates identifiable ex ante? We begin by documenting the distribution of growth rate levels realized over horizons of one, five and ten years. This lets us evaluate the likelihood of living up to the expectations of growth that are implicit in market valuation ratios. To justify rich valuations, investors must believe that high growth persists over many years. Accordingly, we also examine whether there is persistence in operating performance growth. Individual firms' earnings and incomes can be very erratic, so a robust empirical design is a crucial consideration. We employ non-parametric tests on multiple indicators of operating performance across a large cross-section of stocks over relatively long horizons. In addition, we focus our tests for persistence by examining subsets of firms where future growth is more likely to be predictable (for example, stocks in the technology sector and stocks which have displayed persistence in past growth). To give the benefit of the doubt to the possibility of persistence, we relax the definition of consistency in growth and redo our tests. Finally, we expand the list of variables to forecast growth beyond past growth rates. In particular, security analysts' earnings forecasts are widely used as another measure of the market's expectations of growth in future earnings. As a check on the quality of analysts' predictions, we see how well realized growth rates align with IBES consensus forecasts.

Prior research has covered some of these issues. Among the earliest studies are Little (1962), Little and Rayner (1966), who examine the growth in earnings of a limited sample of U.K firms in the 1950s. Related, early evidence for U.S. firms are described by Lintner and Glauber (1967), and Brealey (1983). Beaver (1970), Ball and Watts (1972) start a long line of papers that apply time-series models to earnings. However, few firms have sufficiently long earnings histories to allow precise estimation of model parameters, and the

emphasis in this line of work has been on short-term forecasting. More recently, Fama and French (2000a) examine the time-series predictability of aggregate earnings for the market. Our work is closest in spirit to that of Fama and French (2000b) who look at the cross-sectional predictability of firms' earnings, but even they focus on one-year horizons.

There are also numerous studies by academics and practitioners that apply models of stock valuation, or estimate firms' cost of capital. A selective list includes Bakshi and Chen (1998), Gebhardt, Lee and Swaminathan (1999), and Lee, Myers and Swaminathan (1999). A crucial input into all these studies is the expected long-term growth rate of future earnings. Our examination of the historical record of firms' growth rates provides one basis for estimates of expected future growth. Alternatively, long-term consensus IBES forecasts are widely used. It is generally recognized that analysts' forecasts of earnings per share over short horizons are subject to biases. Since IBES long-term estimates are such a vital component of many valuation exercises, it is important to evaluate their predictive power for realized growth rates.

Our main results are as follows. Our median estimate of the growth rate of operating performance corresponds closely to the growth rate of gross domestic product over the sample period. Although there are instances where firms achieve spectacular growth, they are fairly rare. For instance, only about ten percent of firms grow at a rate in excess of 18 percent per year over ten years. While sales growth shows some persistence, there is essentially no persistence in growth of earnings across the entire sample of firms. Signs of persistent growth in earnings are slim even in cases that are popularly associated with dazzling growth (pharmaceutical and technology stocks, growth stocks and firms that have experienced persistently high past growth). While security analysts' long-term estimates point in the same direction as realized growth over short horizons, they are over-optimistic and do poorly in predicting realized growth over longer horizons. An expanded set of forecasting variables also has little success in predicting future earnings growth. On a broader note, our results suggest that investors should be wary of stocks that trade at very high multiples. Very few firms are able to live up to the high hopes for consistent growth that are built into such stellar valuations.

The rest of the paper is organized as follows. Section 1 discusses our sample and some basics of the methodology. The cross-sectional distribution of firms' growth rates is reported in section 2. Section 3

presents the results of runs tests for consistency in growth of operating performance. Section 4 takes up the issue of survivorship bias. We compare IBES long-term forecasts with ex post growth rates in section 5. Section 6 uses cross-sectional regressions to forecast future growth using variables including past growth and IBES estimates. A final section concludes.

1 Sample and methodology

Our sample of firms comprises all domestic common stocks with data on the Compustat Active and Research files. Firms are selected at the end of each calendar year from 1951 to 1997.[1] The number of eligible firms grows from 359 in the first sample selection year to about 6825 in the last year; on average the sample comprises about 2900 firms.

We consider three indicators of operating performance: net sales (Compustat annual item number 12), operating income before depreciation (item 13), and income before extraordinary items available for common (item 237). While researchers and practitioners tend to focus exclusively on income before extraordinary items, measuring growth in this variable is beset with pitfalls. In many cases earnings before extraordinary items is negative, so prospective growth rates are undefined (for our sample, in an average year 29 percent of firms have negative values for earnings before extraordinary items). In other cases, firms grow from low positive values of base-year net income, introducing large outliers.[2] These include such disparate cases as beaten-down companies with depressed earnings, and growing startup companies that are beginning to generate profits. In order not to hang all our inferences on such a noisy variable, therefore, we also consider growth in net sales and growth in operating income before depreciation. Sales is a relatively clean indicator of operating performance. Operating income before depreciation takes the profit margin on sales revenues into account, but is better-behaved than income before extraordinary items.

[1] The earlier years are included for the sake of completeness, even though there is a backfill bias in the earlier part of the sample period (see Chan, Jegadeesh and Lakonishok (1995)). When the coverage of firms by Standard & Poor's Compustat was incomplete, as firms were added to the database, they came with previous years' data. To the extent that the added firms had relatively good past performance, there is a potential upward bias in operating performance growth.

[2] Some of these complications may be alleviated by averaging earnings over a number of years and measuring growth in these averages. Since our focus is on point-in-time growth rates, we do not explore this alternative procedure.

We take the perspective of an investor who buys and holds one share of a stock over some horizon, so we track the year-to-year growth in sales or income that accrue to one share. Accordingly, all the indicators are expressed on a per share basis, and adjusted for stock splits and dividends. Two firms can offer the same expected return, but have different earnings growth rates because of their dividend payout policies. From an investor's standpoint these two stocks would be considered equivalent. In order to put firms with different dividend policies on an equal footing, all cash dividends as well as any special distributions (such as when a firm spins off assets) are reinvested in the stock.

2 The distribution of growth rates of operating performance

Estimates of long-term future growth play a critical role for valuation and cost of capital analyses. Accordingly, we begin by documenting the distribution of historical growth rates over relatively long horizons (five and ten years). For the sake of completeness, results are also provided for one-year horizons. At each calendar year-end over the sample period we measure rates of growth in future operating performance for all eligible stocks. Percentiles are calculated for the distribution obtained at each year-end, and then the percentiles are averaged across years in the sample period. Table 1 reports the results.

Before discussing the results in Table 1 the following should be noted. Since we include reinvestment of dividends and special distributions, the growth rates we report are typically higher than conventionally measured growth rates. The median dividend yield for our sample (averaged across all years) is about 2.5 percent. Another caveat is that the tabulated growth rates are based only on firms who survive for the following one, five or ten years. The survivorship bias probably induces an upward bias in our reported growth rates. Moreover, we follow the conventional approach and do not calculate growth rates for operating income before depreciation or income before extraordinary items when the base-year value is negative.[3] To illustrate the potential magnitude of these complications, on average there are about 2900 firms available for inclusion in the sample at each year-end. Of these, 2782 firms survive at the end of the next year and have a reported value for income before extraordinary items. The calculations for one-year growth in earnings

[3]Note, however, that even if we are unable to calculate growth in income before extraordinary items in such a case, we still get a reading on a firm's operating performance growth from sales (or operating income before depreciation if it is positive).

before extraordinary items are based on 1994 of these firms; the remaining 788 firms have negative values for income in the base year. At the five year horizon, there are on average 1884 surviving firms. Growth rates are calculated for 1398 of these; 486 have negative base-year values. At the ten-year horizon, there are 1265 surviving firms: 1002 and 263 with positive and negative base-year values, respectively. In a subsequent section we examine the performance of non-surviving firms.

Since negative base-year values are quite common for income before extraordinary items, valid growth rates are unavailable in many cases. These observations are symptomatic of another problem. In particular, the high frequency of cases with negative base values suggests that the neighboring portion of the distribution (with low, positive base-year values) contains a large fraction of the observations as well. These instances give rise to very high growth rates. For growth over five years, for example, the 98-th percentile value for growth in income before extraordinary items averages 62.4 percent per year. Hence while growth in income before extraordinary items captures much of the investment community's interest, its behavior is the most questionable. While the same problem applies to operating income before depreciation, the frequency of negative base-year values is comparatively lower and growth in this variable is less problematic.[4] For growth in this variable, the 98-th percentile is 51.2 percent on average. In comparison, sales growth is relatively well-behaved, with a 98-th percentile value of 40.5 percent on average. These comparisons suggest that looking at other indicators beyond income before extraordinary items helps to give a more robust picture of growth in operating performance.

Table 1 provides a sobering reality check for analysts and investors who flock to stocks with rich price-earnings multiples. Take our original example of a stock with a current price-earnings multiple of 100, which declines to 20 in ten years' time with an expected return of ten percent per year. Earnings must grow at 29.2 percent per year over ten years to justify the current multiple. This is a tall order by historical standards. In particular the required growth rate corresponds to about the 95-th percentile of the distribution of ten-year growth rates, even putting aside the inclusion of dividends. Put differently, suppose earnings grow at a historically more representative, but still healthy, annual rate of 14.7 percent (the 75-th percentile

[4]For example, of the firms surviving after one year and with a reported value for income before depreciation, about 14 percent on average have negative base year values. The corresponding percentage for income before extraordinary items is 29 percent.

of the distribution from part I). Then the current ratio of 100 would be justified if the time it takes for the multiple to fall to 20 is stretched out to 38 years.

Small firms start from a smaller scale of operations and so have more room for potential growth, possibly justifying a high current multiple. However, high multiples also apply to many large, well-known firms. To see whether large firms in general can also achieve high growth, Table 2 reports the distribution of growth rates for large firms (companies ranked in the top two deciles of year-end equity market capitalization, based on NYSE breakpoints). Bigger firms have a larger scale of operations and hence are more likely to face limits on their growth, so extremely high growth rates are less prevalent in Table 2 compared to Table 1. For example, the 90-th percentiles of growth rates over 10 years for income before extraordinary items, operating income before depreciation and sales are all close to 16 percent per year. This represents a reduction of at least two percent from the corresponding percentiles for all firms in Table 1. Also note that dividend yields are generally higher for large firms.

Our estimated median growth rate is reasonable when compared to the overall economy's growth rate. On average over the sample period, the median growth rate over ten years for income before extraordinary items is about 10 percent for all firms. The behavior over the last three ten-year periods in the sample roughly matches the overall average. Growth in the other two indicators also exhibit comparable medians. After deducting the dividend yield (the median yield is 2.5 percent) as well as inflation (which averages 4 percent per year over the sample period), the growth in real income before extraordinary items is roughly 3.5 percent per year. This is consistent with the historical growth rate in real gross domestic product, which has averaged about 3.4 percent per year over 1950–98. It is difficult to see how over the long term profitability of the business sector can grow much faster than overall gross domestic product.

Looking forward, if we project future growth using the median of the distribution of historical growth rates, the implication is that the expected future return on stocks is not very high. For example, in a simple dividend discount model with constant growth rates and constant payout ratio, the expected return is equal to the dividend yield plus the expected future growth rate of earnings. Given the low level of current dividend yields (below 1.5 percent), the expected return is only about 7.5 percent. This is lower than the consensus forecast of professional economists (see Welch (2000)) and probably lower than what much of the investing

public expects, but is in line with Fama and French (2000a).

3 Persistence in growth

It takes more than just one or two years of high growth to ignite investors' enthusiasm for a stock. Rather, many high-flier stocks generally have a track record of consistently superior growth over several years. Conversely stocks that have done poorly over prolonged periods are shunned and trade at low multiples. The differences in valuations indicate a pervasive belief that stocks with high or low future growth are easily identifiable ex ante. For example, analysts and investors seem to believe that a firm whose past growth puts it in the top tier of growth rates for several years in a row is highly likely to repeat this performance in the future. This section checks whether there is consistency in growth. We examine whether past growth or other characteristics (such as industry affiliation or firm size) help to predict future growth.

3.1 Consistency across all firms

Tables 1 and 2 suggest that year-to-year growth in income can take on quite extreme values. As a result multi-year growth rate levels may look impressive because of one or two isolated years of sharp growth, although growth in other years may be unremarkable. However many of the high-flying firms with lofty multiples grow rapidly every year for several years. Accordingly we test for consistency in growth using a design that does not rely heavily on the magnitude of growth rates.[5] In our first tests for consistency, we define consistency as achieving a growth rate above the median for a consecutive number of years: such cases are labeled as runs. Since we are concentrating on cases where a firm grows for several years at high rates relative to other firms, we want to avoid discarding an entire sequence of observations because one year's growth rate cannot be calculated when earnings are negative. Instead, we handle such cases as follows, taking growth in operating income per share (OI_t) as an example. In addition to calculating the percentage growth rate of operating income as (OI_{t+1}-OI_t)/OI_t for each firm, we also scale the change in operating income by the stock price as of the base year t, (OI_{t+1}-OI_t)/P_t. All firms in a given year are

[5] Brealey (1983) uses a similar procedure.

ranked by their values of change in income relative to stock price. For any firm with negative income in a base year, we take the firm ranked above it by income change relative to price, as well as the firm ranked below it, and average their percentage growth rates of income (assuming these are valid). This average growth rate is then assigned to the firm with negative base-year income. Since all available firms in each year come with a growth rate under this second procedure, all firms become eligible for inclusion in the sample.[6]

At each year-end over the sample period we calculate how many firms achieve runs over horizons of one to ten years in the future. A run over five years, for example, denotes a case where in each of the subsequent five years a firm's growth rate exceeds the median growth rate that year. Each year's median is calculated over all growth rate observations available in that year. Again, note that survivorship bias affects our runs tests. To see how many firms achieve runs above the median for five years in a row, we (necessarily) look at firms that survive over the full five years. In each of these years we compare the survivors to a median which is based on all available firms that year (including those that do not survive for the full five years, and newly listed firms). Since the survivors are likely to have better performance than the population, they tend to have a greater chance of being above the median. Section 4 examines differences between the growth rates of surviving and non-surviving firms.

Table 3 reports the counts of runs, averaged across the year-ends. For growth in sales (panel A), for example, out of an average number of 2900 firms available for sample selection at each year-end, 2771 firms on average survive until the end of the following year. Over the following ten years there are on average 1265 surviving firms. Of these, 11 have sales growth rates that exceed the median in each of the ten years, representing 0.9 percent of the eligible firms. If sales growth is independent over time, we should expect to see 0.5^{10} (about 0.1 percent) of the surviving firms achieve runs above the median over ten years (see the last row of the table). To give a flavor of what happens in the most recent years, we also report the

[6] At the same time, it would be dangerous to pin our estimates of growth over a five or ten-year horizon in Tables 1 and 2 on some imputed value of base-year earnings. Accordingly, we do not impute growth rates in those tables for cases with negative base-year values. In unreported work, we also experiment with other ways to calculate growth rates. These include value-weighted growth rates for portfolios, estimated growth rates from least-squares fits of linear and quadratic time trends through sales and income, and growth rates without dividend reinvestment. Generally speaking the results are robust to how we measure growth rates.

percentage of firms with runs over the ten-year periods ending in the last three years of our sample period.

There is a great deal of persistence in sales growth. Over a five-year horizon, for example, on average 118 firms, or 6.3 percent of the 1878 firms who exist over the full five years, turn in runs above the median. The number expected under the hypothesis of independence over time is about 59 (3.1 percent of 1878), so roughly twice more than expected achieve runs over five years.

The persistence in sales growth may reflect shifts in customer demand, which are probably fairly long-lasting. A firm can also sustain momentum in sales by expanding into new markets and opening new stores, by rolling out new or improved products, or by granting increasingly favorable credit terms. Persistence in sales may also arise from managers' "empire-building" efforts, such as expanding market share regardless of profitability. In all these cases, however, costs are also likely to rise at the same time, so profits may not show as much persistence as sales.

It may be relatively easy for a firm to generate growth in sales (by selling at a steep discount, for example), but this is a far cry from generating growth in profits. The recent experience of Internet companies, where sales grew at the same time losses were accumulating, provides a stark example. Panel B confirms that there is less persistence in operating income before depreciation compared to sales. On average 67 firms a year, or 3.6 percent of 1833 surviving firms, have above-median runs for five consecutive years. The expected frequency of runs is 3.1 percent or 57 firms. There are thus 10 firms more than expected out of 1833, so the difference is unremarkable. An average of 4 firms a year (or 0.3 percent of 1223 survivors), which is only 3 more than expected, pull off above-median growth for ten years in a row. The patterns in the more recent years do not deviate markedly from the averages across the entire sample period.

Any sign of persistence vanishes as we get closer to the bottom line (panel C). On average the number of firms who grow faster than the median for several years in a row is not different from what is expected by chance. An average of 57 firms out of 1884 survivors (3 percent) beat the median for five years in a row, while 59 (3.1 percent) are expected to do so. Runs above the median for ten years occur in 0.2 percent of 1265 cases (or 2 firms), roughly matching the expected frequency (0.1 percent, or 1 firm). To sum up, analysts and investors seem to believe that many firms' earnings can consistently grow at high rates for several years. The evidence suggests instead that the number of such occurrences is not much different from

what might be expected from sheer luck. The lack of consistency in earnings growth agrees with the notion that in competitive markets abnormal profits tend to be dissipated over time.

3.2 Consistency for subsets of firms

While there may not be much consistency in growth across all firms, as Table 3 suggests, it is possible that consistency may show up more strongly in subsets of firms. Table 4 focuses our tests by looking at the performance of subsamples of firms. For a subsample such as small stocks, we consider a "run" as a case where the firm's growth rate exceeds the median for a consecutive number of years, where each year the median is calculated across all firms in the entire sample (not just small stocks).[7]

Many observers are quick to single out technology and pharmaceutical firms as instances of consistently high growth over long horizons. Such firms may be able to maintain high growth rates because of their intangible assets, such as specialized technological innovations or drug patents. Panel A examines firms in these sectors. Specifically the sample comprises firms that are relatively heavily engaged in research and development activity, and are predominantly drawn from the computer equipment, software, electrical equipment, communications and pharmaceutical industries.[8] Growth in sales and operating income for the set of technology firms both display strong persistence. However, the percentage of runs in income before extraordinary items does not differ markedly from the expected frequency. For example, over a five-year horizon 14 firms (or 4.1 percent of the 331 surviving technology stocks) have above-median runs. This is only 4 more than the expected number of runs (10 firms, or 3.1 percent). The recent experience of Internet companies provides numerous examples where sales grow rapidly for several years, at the same time that losses are mounting.

Panel A may exaggerate the degree of persistence in growth for technology stocks on two accounts. First, the technology stocks are evaluated against the median growth rate of the entire sample of firms (which would include, for example, utility stocks with relatively unexciting growth rates). Second, technology stocks are relatively more volatile, so survivorship bias may be a particularly acute problem in this

[7] This explains why the percentage of runs is not identically fifty percent in the first year.

[8] Specifically, the sample includes all firms whose SIC codes begin with 283, 357, 366, 38, 48 or 737. See Chan, Lakonishok and Sougiannis (2001).

subsample.

Technology stocks that are intensive in research and development also tend to be glamour stocks with low ratios of book-to-market value of equity. The popular sentiment that there is persistence in growth extends to glamour stocks generally. These stocks typically enjoy higher past growth in operating performance than value stocks with high book-to-market ratios (see Lakonishok, Shleifer and Vishny (1994)). The evidence from psychology suggests that individuals tend to use simple heuristics in decision-making. As La Porta, Lakonishok, Shleifer and Vishny (1997) argue, investors may think that there is more consistency in growth than actually exists, so they extrapolate glamour stocks' past good fortunes (and value stocks' past disappointments) too far into the future. Panels B and C of Table 3 ask whether any consistency in growth exists for value and glamour stocks respectively. Value stocks include all stocks that are ranked in the top three deciles by book-to-market ratio (based on NYSE breakpoints), while glamour stocks represent an equivalent number of stocks with the lowest positive book-to-market ratios. Growth in sales displays persistence for both sets of stocks. The results for the other measures of operating performance, however, are not markedly different across the two sets of stocks.

The remaining panels perform our runs tests for large, mid-capitalization, and small stocks respectively. Large stocks include stocks in the top two deciles of market capitalization based on NYSE breakpoints as of June in the sample selection year; mid-capitalization stocks fall in the next five deciles; small stocks include the bottom three deciles. While sales growth tends to be more persistent for large firms, it does not translate into persistent growth in the bottom-line income numbers. Of the large stocks, 2.2 percent achieve five-year runs in growth of income before extraordinary items, while 3.2 percent of small stocks achieve the same result (the expected fraction is 3.1 percent).

3.3 Runs tests conditional on past growth

It might be expected that firms who have demonstrated consistently superior past growth would be able to maintain their growth in the future. In the case of firms such as Microsoft and EMC, their valuations at year-end 2000 reflected investors' bets that these firms will beat the odds and continue the streak. Table 5 checks whether firms that have demonstrated consistently high (or low) past growth have continued success

in the future.

Part I of Table 5 applies runs tests to those firms that have achieved superior past growth. In panel A, at every year-end we select those firms with above-median growth in each of the prior five years (or three years), and examine their subsequent growth. Superior past growth in sales carries over into the future. In panel A1, out of all firms whose sales grow above the median rate each year over the prior three years, on average 305 firms survive over the three years following sample selection. Of these, 70 firms have above-median growth rates in each of the three post-selection years. They represent 22.8 percent of the survivors, compared to the 12.5 percent that is expected by chance. Growth in income, on the other hand, is an entirely different matter (panels A2 and A3). For example, there are 222 firms with above-median growth in income before extraordinary items over each of the three prior years, and that survive over the following three years. The past track record of these firms is impressive. Yet over the post-selection period, only 28 or 12.5 percent manage to repeat and beat the median over all available firms each year. This matches the number expected under the null hypothesis of independence. Although sample sizes become much smaller in the case of firms with favorable growth over the past five years, the findings are similar. Starting out with roughly 2900 eligible firms on average, 43 firms enjoy a run over the preceding five years for growth in income before extraordinary items and survive over the subsequent five years. In these five years the percentage of firms who manage to repeat the run is 5.1 percent, while the percentage expected by chance is 3.1 percent. This corresponds to only one run more than expected, however, so the difference is not outstanding. The results caution against extrapolating past success in income growth into the future.

A firm may have extraordinary past growth even though it slips below the median for one or two years, as long as growth in the other years is very high. To check that such cases are not overlooked in our sample of past high-fliers, we use a different criterion for what qualifies as superior past growth. In particular we look at an average growth rank to help pick up cases where growth is erratic but generally above par. At every calendar year-end over the sample period we assign each firm a score based on its past growth. The score is obtained by looking back over each of the preceding five (or three) years, ranking the firm's growth rate each year relative to all available firms (where the firms with the highest growth rate and the lowest growth rate get ranks of one and zero respectively), and then averaging the ranks over five (or three) years. Firms whose

average ranks fall in the top quartile are classified as firms with superior past growth in panel B. While high past sales growth foretells high future sales growth, there are still no signs of persistence in growth of income before extraordinary items in panel B3. Out of the firms who survive for three years following sample selection, 103 firms have an average rank based on growth over the preceding three years falling in the top quartile. Only 11 or 10.4 percent of them have above-median runs in the three post-selection years, amounting to two less than the expected number.

In part II of Table 5, panel C performs the same analysis for firms with below-median growth over each of the past five or past three years. However, survivorship bias is a particularly grave concern here. After a long period of lackluster performance, the firms that are left standing at the end of the following period are particularly likely to be those who post relatively high growth rates. From panel C1, future sales growth is persistently low. The fraction of above-median runs in sales growth is notably lower than the expected percentage. On the other hand, they are not less likely to achieve favorable above-median runs with regard to future growth in income. For example, looking at firms with a below-median run for the past three years, over the following three- and five-year horizons the actual (expected) proportions of above-median runs are 15.3 (12.5) and 3.4 (3.1) percent for growth in income before extraordinary items. Similarly, firms whose five- or three-year average rank by growth in income before extraordinary items falls in the bottom quartile are not less likely to enjoy runs in above-median growth over the following years (panel D). While survivorship bias makes it difficult to draw a definitive conclusion, it does not appear that going forward the firms with disappointing past growth differ notably from the high-fliers with respect to growth in income. To summarize, the runs tests suggest that while there is persistence in sales growth, the persistence generally does not carry over into growth of operating income or income before extraordinary items.

3.4 Alternative criteria for consistency in growth

Given the large transitory component of earnings, investors may consider a firm to show persistent growth even if its growth fades for a few years, as long as there is rapid growth for the rest of the time. Even a celebrated example of a growth stock such as Microsoft, for instance, falls short of delivering above-median

growth in income before extraordinary items for ten years in a row.[9]

In Table 6 we adopt more relaxed criteria for defining consistency in growth. In particular, we check whether a firm beats the median for most years over the horizon, but allow it to fall short of the median for one or two years. For example, looking forward from a sample selection date, 269 firms on average have sales growth rates that exceed the median in five out of the following six years. These firms represent 15.6 percent of the surviving firms, more than the expected value of 9.4 percent. In the case of income before extraordinary items, the departures from what is expected under independence are quite slender, especially over longer horizons. For instance, an average of 171 firms (or 9.9 percent of the survivors) have income before extraordinary items growing at a rate above the median for 5 out of 6 years, which is close to the expectation of 9.4 percent. Similarly if we let a firm falter for two years, 4.8 percent of the surviving firms have growth in income before extraordinary items that exceeds the median in 8 out of 10 years, compared to an expected value of 4.4 percent.

As another way to single out cases of sustained high growth while allowing for some slack, we require a firm to post an average annual growth rank over the subsequent five years that falls in the top quartile (where in any year a growth rank of one denotes the highest realized growth rate that year, and zero denotes the lowest rate). The results for this definition of consistency are provided in the last column of Table 6. On average 1.4 percent of the surviving firms (amounting to 27 firms) pass this criterion with respect to growth of income before extraordinary items. Under the null hypothesis of independence, the expected value is 2.5 percent.

In summary, analysts' forecasts as well as investors' valuations reflect a widespread belief in the investment community that many firms can achieve streaks of high growth in earnings. Perhaps this belief is akin to the notion that there are "hot hands" in basketball or mutual funds.[10] While there is persistence in sales growth, there is no evidence of persistence in terms of growth in the bottom-line as reflected by operating income before depreciation and income before extraordinary items. Instead, the number of firms delivering sustained high growth in profits is not much different from what is expected by chance. The results for

[9] Looking back ten years from the most recent sample selection date in our sample period, Microsoft's growth rank of 0.49 in 1994 barely falls short of the median that year.

[10] See Camerer (1989), and Hendricks, Patel and Zeckhauser (1993).

subsets of firms, and under a variety of definitions of what constitutes consistently superior growth, deliver the same verdict. Put more bluntly, the chances of being able to identify the next Microsoft are about the same as the odds of winning the lottery. This finding is what would be expected from economic theory: competitive pressures ultimately dissipate excess earnings, so profitability growth reverts to a normal rate.

4 The behavior of non-survivors

Survivorship bias is a serious concern in our tests. By necessity, we condition on surviving into the future in order to calculate growth rates and to carry out our runs tests. Moreover, in our runs tests the survivors are compared each year to all firms (survivors and non-survivors) available that year. To gauge the potential magnitude of the problem, in this section we replicate some of our tests on firms who do not survive over the entire future horizon.

Specifically we examine two sets of stocks. Given our focus on long-horizon growth, we first select at each year-end a sample of firms who survive over the full ten-year following period. The behavior of these (the survivors) is compared to a second set (the "non-survivors") that includes firms who do not last for the full period. To strike a balance between the mix of survivors and nonsurvivors in this second set, we require firms to survive for the first five years after sample selection, but they may drop out between the sixth to tenth year of the post-selection period.

The results are reported in panels A and B of Table 7. The survivors have a higher chance than expected for achieving runs above the median in growth of income before extraordinary items. Conversely the fraction of runs is lower for the set of non-survivors. Of the survivors, for example, 3.4 percent sustain runs for five years of growth in income before extraordinary items above the median (where the expected proportion is 3.1 percent). The corresponding percentage for non-survivors is 2.3 percent. Nonetheless, the differences across the two sets are generally not eye-catching. Panels C and D apply the same procedure to the technology stocks considered in Table 4. Here the differences across the two sets are more substantial. At the five-year horizon, for example, 5.2 percent of the survivors achieve runs above the median for growth in income before extraordinary items, compared to 3.2 percent of the non-survivors.

Finally, panels E and F of Table 7 give the distribution of one-year growth rates for the two sets of firms (where the percentiles are averaged across all sample selection years). The results confirm that survivors realize higher growth rates than non-survivors. For example, the median growth in income before extraordinary items for the survivors averages 10.6 percent, compared to 8.2 percent for nonsurvivors.

5 Comparisons with IBES consensus forecasts

Historically some firms have enjoyed torrid growth rates in excess of thirty percent a year for prolonged periods. If such firms are identifiable ex ante, then price-to-earnings ratios in excess of a hundred might not be unwarranted. The previous sections seek to uncover cases of persistently high future growth using information such as past growth, industry affiliation, book-to-market ratio and firm size with only limited success. In this section we expand the search by turning to two other variables: expert forecasts of earnings, and current dividend yield.

Security analysts' estimates of near-term earnings are widely disseminated and receive much attention. Dramatic movements in a stock's price can arise when an influential analyst issues a revised earnings estimate. Possibly, therefore, analysts' estimates of long-term earnings growth may also be useful in forecasting future growth over longer horizons. Analysts are not shy about making aggressive growth forecasts either (the dispersion between the top and bottom decile of IBES long-term forecasts is about 31 percent), so they apparently are confident in their own ability to pick the future success stories.

The current dividend yield on a stock may also have predictive power for future earnings growth. Standard textbook analysis suggests that, given a firm's investment policy and ignoring tax effects, it is a matter of indifference to a shareholder whether earnings are paid out as current dividends or retained for growth in future dividends. In other words, high current dividends come at the expense of future growth (while low dividends generate high growth). Using a simple constant-growth dividend discount model as an illustration, future growth will adjust and offset the dividend yield by enough to generate the rate of return required by investors. More generally, a firm's dividend payout may signal whether it has attractive investment projects available to fuel future growth.

Since we want to explore the predictive power of dividend yields, in the remainder of the paper we drop our convention of reinvesting dividends, so growth rates are calculated without dividends. This also allows a cleaner comparison with analysts' forecasts, which do not include dividends. Analysts' predictions refer to growth in income before extraordinary items, but realized growth in this variable is highly prone to measurement problems (such as the exclusion of cases with negative base-year values for income). For this reason we also report realized growth in sales and operating income before depreciation. Growth rates in these variables are correlated with growth in income before extraordinary items, but are better-behaved and are available for a much larger fraction of the sample.

5.1 Individual firm growth rates

Table 8 relates IBES consensus long-term growth forecasts to realized future growth. At each year-end we rank all domestic firms with available IBES long-term forecasts and sort them into quintiles. IBES long-term estimates do not become available until 1982, so the sample period in Table 8 runs from 1982 to 1998. The breakpoints for the sort use all NYSE firms available as of the sample selection date (regardless of whether they survive in the future). In Table 8 we track the subsequent growth rates of firms who survive over the next one, three or five years in each quintile. The median realized growth rate over firms in each quintile is then averaged across all sample selection dates.

The dispersion in IBES consensus growth forecasts is large, so analysts are boldly distinguishing between firms with high and low growth prospects. The median estimate in quintile 1 averages 6 percent, while the median estimate in quintile 5 is 22.4 percent on average.[11] Notably, analysts' estimates are quite optimistic. Over the period 1982–98, the median of the distribution of IBES growth forecasts is about 14.5 percent, a far cry from the median realized five-year growth rate of about 9 percent for income before extraordinary items.[12]

[11] Note that since the breakpoints are based on NYSE stocks only, the number of stocks differs across the quintiles. In particular, many firms penetrate the top quintile.

[12] To sharpen the point, note that the median realized growth rate of 9 percent (without dividends reinvested) is based on all firms, including smaller firms that tend to be associated with somewhat higher growth rates. IBES forecasts, on the other hand, predominantly cover larger firms.

Near-term realized growth tends to line up closely with the IBES estimate (panel A). In the first post-ranking year, the median growth rate in income before extraordinary items is 18.3 percent on average for quintile 5, and 5.1 percent on average for quintile 1. The difference between the growth rates for the other quintile groups is much milder, however. Comparing quintiles 4 and 2, median growth rates in income before extraordinary items are apart by only 2.5 percent.

A naive model for predicting future growth uses the dividend yield, and is based on the trade-off between current dividends and future growth. Supposing, as a first approximation, that all stocks have the same long-term expected return, the naive model forecasts a spread in future growth across stocks that is identical to the spread in their current dividend yields (but in the opposite direction). The naive forecast is quite successful at picking up differences in growth across the intermediate quintiles. Over the first post-ranking year, the difference between the dividend yields of quintiles 2 and 4 (3.4 and 1.5 percent, respectively) corresponds roughly to the difference in their growth rates. Once differences in the dividend yield are taken into account, then, IBES estimates have forecast power for realized growth over the first year only at the extremes.

In general IBES long-term forecasts refer to a three- to five-year horizon, so the behavior of realized growth over these horizons is more interesting. Median realized growth rates over three years and over five years are reported in panels C and D. These panels highlight the upward bias in analysts' long-term growth estimates. In every quintile median forecasts exceed median realized growth rates, with the most pronounced bias in quintile 5. For five-year growth in income before extraordinary items, for example, the median forecast in the top quintile is 22.4 percent, much higher than the median realized growth rate, which is only 9.5 percent. Furthermore, the realized growth rate for the firms in the top quintile should be taken with a grain of salt. In the highest-ranked quintile the percentage of firms who survive for the full five post-ranking years is lower than any of the other quintiles. For example, there are 849 firms on average who survive in the first post-ranking year in quintile 5 but this drops to 526 by the fifth year; for quintile 3 the corresponding counts are 326 and 251, respectively. The upshot is that realized growth in income before extraordinary items is likely to be somewhat overstated for firms in the top quintile.

Over longer horizons analysts' growth estimates still do not add much information beyond what is contained in the dividend yield. For example, the median realized five-year growth rate is 9.5 percent for

the highest-ranked quintile by IBES forecasts, compared to 2 percent for the lowest-ranked quintile. The difference of 7.5 percent is not very different from the difference in their dividend yields (the yields are 0.1 percent and 6 percent for the highest and lowest-ranked quintiles, respectively). The results for growth in operating income before depreciation yield similar conclusions.

5.2 Portfolio growth rates

Issues of survivorship bias and low or negative base-year values for income before extraordinary items are major concerns. Table 8 takes another approach to measuring growth rates that tries to work around these concerns. Specifically, after ranking stocks by IBES long-term forecasts at each year-end we form a value-weighted portfolio of the stocks in each quintile. Value-weighting affords some degree of robustness to our measures, to the extent that problems in measuring growth are less severe for large companies. We then track over the post-formation period the income before extraordinary items of the portfolio as a whole. If a stock is delisted in a year after portfolio formation, we assume it generates the average income of the remaining firms in that year. Then at the end of the year we take the proceeds from liquidating non-surviving firms and re-allocate them proportionally across the surviving stocks. As a result, we are able to use all eligible companies to calculate growth rates, regardless of whether they survive over the full growth horizon, or whether they have positive earnings in the base year.[13] The portfolio approach, however, is not without its drawbacks. As firms drop out of the sample and the funds from their liquidation are reinvested in the remaining firms, over time the portfolio can build up large stakes in a relatively small number of surviving firms who tend to have comparatively high growth rates. The implication is that long-term portfolio growth rates for cases where survivorship bias is acute (such as the high-fliers in the top quintile by IBES forecasts, as noted above) should be interpreted with caution.

The results for the portfolios' long-term growth rates are in line with our earlier findings. IBES long-term forecasts are essentially unrelated to realized growth in income before extraordinary items beyond one or two years out. For example, over the five post-formation years (panel D), the bottom and top quintile

[13]The portfolio approach to measuring growth rates is described further in Chan, Karceski and Lakonishok (2000), and Chan, Lakonishok, and Sougiannis (2001).

portfolios on average experience growth rates of 8 percent and 11.3 percent per year, respectively. The spread of 3.3 percent in the portfolios' growth rates is smaller than the gap between their dividend yields (5.6 percent).

One difference between our results for individual stocks' growth rates and the portfolios' growth rates concerns the performance of the bottom quintile in the first post-ranking year. In the year immediately following portfolio formation, the bottom quintile portfolio experiences a strong recovery. Its short-term growth rate (12.6 percent) falls slightly short of the top quintile portfolio's growth (13.6 percent). This difference from the earlier results based on individual stocks may reflect several methodological details: the use of value-weights, the inclusion in the portfolios of non-surviving firms as well as firms with negative income, and the use of a time-series average of the yearly portfolio growth rates rather than the cross-sectional medians. In particular, since firms with low IBES forecasts generally tend to start with low or negative values of income before extraordinary items at the portfolio formation date, the growth rate over the following year is likely to be high.[14]

Analysts' forecasts substantially overstate realized long-term growth in the top three quintile portfolios. In the top-ranked quintile, for example, the median projected future growth rate is about 22.4 percent, but the portfolio's realized growth is only 11.4 percent over three years and 11.3 percent over five years. These results suggest that in general caution should be exercised before relying too heavily on IBES long-term forecasts as estimates of expected growth in valuation studies. The bottom quintile portfolios by IBES forecasts predominantly comprises firms in mature industries whose growth prospects are relatively unexciting, so analysts' estimates come closer to the mark here. For instance, about 25 percent of the firms in the first quintile are utilities.

The long-term estimates of analysts may be overly optimistic for several reasons. One explanation draws on evidence from studies in psychology that individuals' forecasts are susceptible to cognitive biases.[15] For example, the confirmation bias suggests that individuals tend to focus on evidence that supports their beliefs while downplaying "ugly" data that is inconsistent. In this regard, analysts' estimates will be particularly

[14] Our results parallel the findings for the prospective earnings growth of beaten-down value stocks documented in Lakonishok, Shleifer and Vishny (1994).

[15] See Fisher and Statman (2000) for a review of this evidence.

rosy for glamour stocks that have shown strong past growth and which have caught investors' enthusiasm. In addition, an analyst is employed by a brokerage firm and is expected to make contributions beyond predicting earnings. Bullish forecasts may encourage trading by investors and thereby raise commission income, as well as generate investment banking business from firms that receive favorable analyst coverage. The general perception is that these aspects of the brokerage and investment banking business are larger, and their links to analysts closer, in the U.S. market than overseas. As one piece of evidence that such considerations may lead to inflated forecasts, the most recent IBES estimates for U.S. companies project long-term growth of about 18 percent on average. At the same time, in non-U.S. markets analysts are forecasting long-term growth for companies of roughly the same size to average 11 percent. Perhaps the stiffer competition for commissions and investment banking income, as well as the structure of analysts' compensation schemes, in the U.S. market leads analysts to err on the side of optimism.

6 Regression models

We close out our analysis by gathering all the variables we have previously considered individually into one model in order to take our best shot at forecasting growth. Table 9 reports the results from cross-sectional regressions to predict future growth in operating performance. The model is:

$$\begin{aligned} y_{it+j} &= \beta_0 + \beta_1 PASTGS5_{it} + \beta_2 TECH_{it} + \beta_3 BM_{it} \\ &\quad + \beta_4 PASTR6_{it} + \beta_5 IBESLTG_{it} + \beta_6 DP_{it} + \epsilon_{it+j}. \end{aligned} \tag{1}$$

The dependent variable, y_{it+j} is the rate of growth for firm i over year $t+j$ in: sales (SALES); operating income before depreciation (OIBD); and income before extraordinary items available to common equity (IBEI). We forecast growth over each of the first two years following sample selection; and over the three and five years subsequent to sample selection.

To see whether high past growth is a precursor to future growth, we use $PASTGS5$, the growth rate in sales over the five years prior to the sample selection date. Sales growth is correlated with earnings growth, but is much less erratic and so should yield a relatively more reliable verdict on whether past

growth helps to predict future growth.[16] The forecast equation also incorporates variables that are popularly thought to connote high growth. Firms in technologically innovative industries, or more generally growth stocks as measured by low book-to-market ratios, are widely associated with high growth. High past returns for a stock may signal upward revisions in investors' expectations of future growth. Analysts' long-term forecasts are another proxy for the market's expectations of future growth. Finally, the dividend yield may provide information on the firm's investment opportunities and hence ability to grow future earnings. Correspondingly, the other forecasting variables are: $TECH$, a dummy variable with a value of one for a stock in the pharmaceutical and technology sectors (defined as in panel A of Table 4) and zero otherwise; BM, the firm's book-to-market value of equity; $PASTR6$, the stock's prior six-month compound rate of return; $IBESLTG$, the IBES consensus forecast of long-term growth; and DP, the ratio of regular dividends per share cumulated over the previous twelve months to current price. To be eligible for inclusion in the regression at a given horizon, a firm must have non-missing values for all the predictors. In addition it must have a positive base-year value for the operating performance indicator in question, so as to calculate a growth rate. To screen out outliers due to low values in the base year, we exclude cases where the ratio of the price to the operating performance variable exceeds 100 in the base year.[17]

The model is estimated each year-end, yielding a time series of estimated coefficients and the adjusted R^2. Means for the time series, and 't'-statistics based on the standard error from the time series, are reported in Table 9.

In line with our earlier results that sales growth is the most predictable of our operating performance indicators, the model for sales growth yields the best fit. Over a one-year horizon (panel A), for example, the forecasting equation for sales growth has an average adjusted R^2 of 5.92 percent. The coefficient of $PASTGS5$ is positive and statistically significant. As we move down to the bottom line, however, the regression's forecasting ability progressively worsens. For one-year growth in income before extraordinary items ($IBEI$), the average $\bar{R}^2$ is only 1.35 percent.

[16] Results using past five-year growth in $OIBD$ or $IBEI$ as predictor variables indicate that these variables do a worse job in capturing any persistence in growth.

[17] As another robustness check, we replicate the regressions using growth rate ranks (from zero for the firm with the lowest growth rate to one for the firm with the highest growth rate). These regressions yield similar conclusions.

Over longer horizons (panels C to D), the predictability in future growth of $OIBD$ and $IBEI$ is also meager. For the full model, the $\bar{R}^2$ for five-year growth in $IBEI$ is 2.06 percent (the last row in panel D). Past growth in sales turns out to be negatively related to future five-year growth in income before extraordinary items over three- and five-year horizons: the coefficients of $PASTGS5$ are negative and statistically significant. The apparent reversal in growth rates, however, may be driven by outliers where income grows from low base-year values. When past sales have been declining, past growth in income is likely to be poor so income in the base year is low. Even a modest recovery in subsequent income is likely to be associated with a relatively high future growth rate.[18]

Panel D extends the earlier experiment in Table 8 to see if there is any association between IBES forecasts, dividend yields, and long-term growth. To tease out the role of analyst forecasts, the models are estimated with and without the dividend yield variable. In the equation for growth in $IBEI$ when dividend yield is omitted, the coefficient for analyst estimates is 0.1284, with a 't'-statistic of 2.0. Including the dividend yield, however, knocks down the importance of analysts' estimates. The coefficient for $IBESLTG$ drops to 0.0966 and becomes statistically insignificant. The coefficient for dividend yield is negative, and of roughly the same magnitude as the coefficient for the consensus estimate. The results for five-year growth in $OIBD$ suggest that analysts do not fare much better at predicting growth in operating income. In terms of predicting long-term growth, therefore, the forecasts of highly-paid security analysts are about as helpful as the dividend yield, a piece of information that is readily available in the stock listings of any newspaper.

Of the other variables in the equation for five-year growth in $IBEI$, neither the technology industry dummy nor book-to-market ratio reliably predict future growth. Contrary to the conventional notion that high past returns signal high future growth, the coefficient of $PASTR6$ is negative. In summary, even when we bring to bear a wide range of variables to forecast growth of income before extraordinary items, there is little if any predictability over long horizons.

[18]The effect of extreme outlier values is mitigated to some extent because we drop from the regression cases where the ratio of the price to operating performance indicator exceeds 100 in the base year. However this is only a partial solution.

7 Summary and conclusions

We analyze historical long-term growth rates across a broad cross-section of stocks using a variety of indicators of operating performance. All the indicators yield a median growth rate of about 10 percent per year (with dividends reinvested) over the 1951–1998 period. With dividends taken out, the median estimate is the same magnitude as the growth rate of gross domestic product over this period, or roughly between 3 and 3.5 percent in real terms. Given the survivorship bias underlying the growth rate calculations, the expected growth rate is probably somewhat lower. Based on these historical values and the low level of the current dividend yield, looking forward the expected return on stocks in general does not appear to be high.

Expectations about long-term growth are also crucial inputs in the valuation of individual stocks and for estimating firms' cost of capital. At year-end 1999, a sizeable portion of the market commanded price-earnings multiples in excess of a hundred. Justifying such a multiple under some relatively generous assumptions requires that earnings grow at a rate of about 29 percent per year for ten years or more. Historically, some firms have achieved such dazzling growth. These instances are quite rare, however. Going by the historical record, only about five percent of surviving firms do better than a growth rate of 29 percent per year over ten years. In the case of large firms, less than one percent would meet this cutoff. On this basis, historical patterns raise strong doubts about the sustainability of such valuations.

Nonetheless, market valuation ratios reflect a pervasive belief among market participants that firms who can consistently achieve high earnings growth over many years are identifiable ex ante. The long-term growth expectations of one influential segment of the market, security analysts, boldly distinguish between firms with strong and weak growth prospects. To see whether this belief that many firms can achieve persistently high growth holds up in reality, we use an experimental design that singles out cases where a firm consistently delivers favorable growth for several years in a row. Our results suggest that there is some persistence in sales revenue growth. The persistence in sales does not translate into persistence of bottom-line earnings, however. Even though we measure consistency against a hurdle that is not particularly challenging (the median growth rate), there are few traces of persistence in growth of operating income before depreciation, or in income before extraordinary items. For example, on average 3 percent of the

available firms manage to have streaks in growth above the median for five years in a row. This matches what is expected by chance. The evidence for persistence is still slim under more relaxed criteria for consistency in growth. All in all, the evidence suggests that the odds of an investor successfully uncovering the next highflier growth stock are about the same as correctly calling coin tosses.

A skeptic might argue that while there is little persistence for the population at large, specific segments of the market are able to improve earnings steadily over long periods. In particular, popular sentiment views firms in the pharmaceutical and technology sectors, along with glamour stocks, as being able to maintain consistently high growth rates. To accommodate this argument we narrow our search to these subsets of firms. While there is persistence in sales growth, when it comes to growth in bottom-line income, over long horizons the likelihood of achieving streaks is not much different from sheer luck. Conversely, value firms who are out of favor do not seem to do much worse, although survivorship bias makes it difficult to deliver a definitive verdict. To narrow the search even more, we check whether firms with consistently high past growth manage to maintain their performance going forward. While past growth carries over to future sales growth, the income variables do not display strong persistence.

There is a widespread belief that one group of informed participants, security analysts, may have some predictive power for future growth. The dispersion in analysts' forecasts trumpet their willingness to distinguish boldly between high- and low-growth prospects. IBES long-term growth estimates are associated with realized growth in the immediate short-term future. Over long horizons, however, there is little forecastability in the bottom-line earnings numbers, and analysts' estimates tend to be overly optimistic. The spread in predicted growth between the top and bottom quintiles by IBES forecasts is 16.4 percent, but the dispersion in realized five-year growth rates is only 7.5 percent. On the basis of earnings growth for portfolios formed from stocks sorted by IBES forecasts, the spread in realized five-year growth rates is 3.3 percent. In any event, analysts' forecasts do not do much better than a naive model that predicts a one-for-one tradeoff between current dividend yield and future growth. A regression forecasting model which brings to bear a battery of predictor variables (past sales growth, technology sector affiliation, book-to-market, past stock return, the consensus estimate and the dividend yield) confirms the lack of predictability in long-term growth. Only about two percent of the variation in five-year growth rates is captured by the model. The results

highlight the powerful pressures competitive markets exert to rein in excessively high or low profitability growth.

References

Asness, Clifford, 2000, Bubble logic, unpublished manuscript.

Bakshi, Gurdip, and Zhiwu Chen, 1998, Stock valuation in dynamic economies, working paper, University of Maryland.

Ball, Ray, and Ross Watts, 1972, Some time-series properties of accounting income, *Journal of Finance* 27, 663–682.

Beaver, William H., 1970, The time series behavior of earnings, *Journal of Accounting Research* 8, Supplement: 62–99.

Beaver, William H., and Dale Morse, 1978, What determines price-earnings ratios?, *Financial Analysts Journal* 34, 65–76.

Brealey, Richard A, 1983, An introduction to risk and return from common stocks (2nd edition), Cambridge: MIT Press.

Camerer, Colin, 1989, Does the basketball market believe in the "hot hand"?, *American Economic Review* 79, 1257–1261.

Chan, Louis K. C., Narasimhan Jegadeesh, and Josef Lakonishok, 1995, Evaluating the performance of value versus glamour stocks: The impact of selection bias, *Journal of Financial Economics* 38, 269–296.

Chan, Louis K. C., Jason Karceski, and Josef Lakonishok, 2000, New paradigm or same old hype in equity investing?, *Financial Analysts Journal* 56, 23–36.

Chan, Louis K. C., Josef Lakonishok, and Theodore Sougiannis, 2001, The stock market valuation of research and development expenditures, *Journal of Finance*, forthcoming.

Fama, Eugene F., and Kenneth R. French, 1992, The cross-section of expected stock returns, *Journal of Finance* 47, 427–465.

Fama, Eugene F., and Kenneth R. French, 1995, Size and book-to-market factors in earnings and returns, *Journal of Finance* 50, 131–155.

Fama, Eugene, F., and Kenneth R. French, 1997, Industry costs of equity, *Journal of Financial Economics* 43, 153–193.

Fama, Eugene F., and Kenneth R. French, 2000a, The equity premium, working paper, Graduate School of Business, University of Chicago.

Fama, Eugene F., and Kenneth R. French, 2000b, Forecasting profitability and earnings, *Journal of Business* 73, 161–175.

Fisher, Kenneth L., and Meir Statman, 2000, Cognitive biases in market forecasts, *Journal of Portfolio Management* 27, 72–81.

Gebhardt, William R., Charles M. C. Lee, and Bhaskaran Swaminathan, 1999, Toward an implied cost of capital, working paper, Johnson Graduate School of Management, Cornell University.

Hendricks, Darryll, Jayendu Patel, and Richard Zeckhauser, 1993, Hot hands in mutual funds: Short-run persistence of relative performance, 1974–1988, *Journal of Finance* 48, 93–130.

Kahneman, Daniel, and Mark W. Riepe, 1998, Aspects of investor psychology, *Journal of Portfolio Management* 24, 52–65.

La Porta, Rafael, Josef Lakonishok, Andrei Shleifer, and Robert Vishny, 1997, Good news for value stocks: Further evidence on market efficiency, *Journal of Finance* 52, 859–874.

Lakonishok, Josef, Andrei Shleifer, and Robert W. Vishny, Contrarian investment, extrapolation, and risk, *Journal of Finance* 49, 1541–1578.

Lee, Charles M. C., James Myers, and Bhaskaran Swaminathan, 1999, What is the intrinsic value of the Dow?, *Journal of Finance* 54, 1693–1741.

Lintner, John, and Robert Glauber, 1967, Higgledy piggledy growth in America, reprinted in James Lorie and Richard Brealey (eds.), Modern developments in Investment management, Hinsdale: Dryden Press.

Little, I. M. D., 1962, Higgledy piggledy growth, *Bulletin of the Oxford University Institute of Economics and Statistics* 4, 387–412.

Little, I. M. D., and Arthur C. Rayner, 1966, Higgledy piggledy growth again, Oxford: Basil Blackwell.

Shleifer, Andrei, 2000, Inefficient markets: An introduction to behavioral finance, Oxford: Oxford University Press.

Siegel, Jeremy J., 1999, The shrinking equity premium, *Journal of Portfolio Management* 26, 10–17.

Welch, Ivo, 2000, Views of financial economists on the equity premium and on professional controversies, *Journal of Business* 73, 501–537.

Table 1
Distribution of growth rates of operating performance
over 1, 5 and 10 years: All firms

At every calendar year-end over the sample period growth rates in operating performance are calculated over each of the following one, five and ten years for all firms in the sample. The sample period is 1951–1998, and the sample includes all domestic firms listed on the New York, American and Nasdaq markets with data on the Compustat files. Operating performance is measured as sales, operating income before depreciation, or income before extraordinary items available to common equity. Growth in each variable is measured on a per share basis as of the sample selection date, with the number of shares outstanding adjusted to reflect stock splits and dividends; cash dividends and special distributions are also reinvested. Percentiles of the distribution are calculated each year-end; the simple average over the entire sample period of the percentiles is reported, along with the distribution of growth rates over horizons ending in the last three years of the sample period.

Part I: Annualized growth rate over 10 years

	Percentile								
Sample period	2%	10%	25%	40%	50%	60%	75%	90%	98%
(A) Sales									
Average	-9.6	0.1	5.5	8.7	10.2	11.5	13.8	18.0	27.6
Ending 1996	-20.5	-3.7	3.0	6.7	8.4	10.4	13.6	20.2	36.2
Ending 1997	-21.0	-3.6	3.1	6.6	8.4	10.3	13.5	20.8	36.8
Ending 1998	-16.1	-3.4	2.9	6.2	7.9	9.5	12.7	19.2	32.9
(B) Operating income before depreciation									
Average	-13.3	-2.3	4.1	7.6	9.5	11.2	14.1	19.4	31.3
Ending 1996	-16.7	-3.8	3.4	7.6	9.5	11.4	15.3	22.5	39.2
Ending 1997	-16.8	-3.2	3.6	7.6	9.3	11.4	15.1	23.9	41.9
Ending 1998	-14.6	-3.3	3.3	7.2	9.0	10.9	14.1	21.5	38.6
(C) Income before extraordinary items									
Average	-15.6	-3.1	3.9	7.7	9.7	11.6	14.7	20.4	33.4
Ending 1996	-17.2	-4.2	3.6	8.1	10.2	12.4	16.7	26.6	48.1
Ending 1997	-18.2	-3.6	3.7	8.1	10.3	12.6	17.6	27.3	48.5
Ending 1998	-21.2	-6.3	2.3	6.9	9.0	11.4	15.3	24.4	48.8

Part II: Annualized growth rate over 5 years

	Percentile								
Sample period	2%	10%	25%	40%	50%	60%	75%	90%	98%
(A): Sales									
Average	-18.7	-4.1	4.3	8.2	10.2	12.0	15.3	22.1	40.5
Ending 1996	-32.3	-9.9	0.4	5.5	7.9	10.1	14.9	25.8	52.1
Ending 1997	-30.4	-8.3	1.3	6.6	9.2	11.4	16.4	27.9	64.2
Ending 1998	-22.7	-6.2	2.9	8.0	10.2	12.4	17.1	27.6	56.3
(B) Operating income before depreciation									
Average	-26.8	-8.4	1.9	7.2	9.8	12.4	17.1	26.7	51.2
Ending 1996	-30.8	-9.3	2.1	8.4	11.3	14.2	20.4	34.9	73.8
Ending 1997	-31.3	-9.9	3.0	9.1	11.9	14.8	21.8	35.2	71.7
Ending 1998	-24.4	-7.8	3.5	8.7	11.5	14.4	19.9	33.4	64.4
(C) Income before extraordinary items									
Average	-30.9	-10.3	1.5	7.4	10.5	13.4	18.8	30.4	62.4
Ending 1996	-35.1	-10.5	3.2	10.2	13.8	17.4	26.9	47.7	108.1
Ending 1997	-36.1	-10.4	3.6	9.9	13.2	16.8	25.8	45.5	92.5
Ending 1998	-35.1	-11.5	2.8	9.1	12.4	15.7	23.1	40.1	88.2

Part III: 1-year growth rate

Sample period	Percentile								
	2%	10%	25%	40%	50%	60%	75%	90%	98%
(A) Sales									
Average	-47.3	-12.9	1.2	7.6	10.9	14.2	21.0	38.7	121.7
Ending 1996	-61.0	-20.2	-1.8	6.4	10.5	14.6	24.8	50.0	176.2
Ending 1997	-60.4	-20.8	-1.0	7.0	11.0	15.6	26.1	57.8	204.6
Ending 1998	-58.3	-20.8	-1.4	6.3	10.3	14.5	24.9	54.1	181.9
(B) Operating income before depreciation									
Average	-69.4	-30.7	-5.6	5.9	11.8	17.7	30.6	67.4	253.3
Ending 1996	-74.1	-30.8	-2.6	9.0	14.7	21.3	36.7	88.7	334.3
Ending 1997	-77.6	-31.0	-0.9	9.8	15.2	21.4	37.0	83.2	314.8
Ending 1998	-74.1	-34.7	-4.9	6.7	12.2	18.5	32.2	76.5	273.2
(C) Income before extraordinary items									
Average	-76.8	-37.9	-7.4	6.9	13.3	19.9	35.8	90.2	435.3
Ending 1996	-87.8	-46.8	-9.5	9.6	17.4	25.5	47.7	140.2	720.8
Ending 1997	-88.0	-47.1	-6.4	11.4	19.2	28.0	53.1	137.0	631.0
Ending 1998	-87.3	-48.2	-13.7	5.4	13.7	21.3	40.4	115.0	727.2

Table 2
Distribution of growth rates of operating performance
over 1, 5 and 10 years: Large firms

At every calendar year-end over the sample period growth rates in operating performance are calculated over each of the following one, five and ten years for large firms (in the top two deciles of year-end equity market capitalization, based on NYSE breakpoints). The sample period is 1951–1998, and the sample includes all domestic firms listed on the New York, American and Nasdaq markets with data on the Compustat files. Operating performance is measured as sales, operating income before depreciation, or income before extraordinary items available to common equity. Growth in each variable is measured on a per share basis as of the sample formation date, with the number of shares outstanding adjusted to reflect stock splits and dividends; cash dividends and special distributions are also reinvested. Percentiles of the distribution are calculated each year-end; the simple average over the entire sample period of the percentiles is reported, along with the distribution of growth rates over horizons ending in the last three years of the sample period.

Part I: Annualized growth rate over 10 years

	Percentile								
Sample period	2%	10%	25%	40%	50%	60%	75%	90%	98%
(A): Sales									
Average	-3.4	2.5	6.8	9.4	10.7	11.7	13.3	16.3	22.0
Ending 1996	-4.6	1.0	6.2	8.7	9.6	10.5	12.3	16.3	26.2
Ending 1997	-7.5	1.5	5.8	8.4	9.7	10.5	12.1	16.2	24.8
Ending 1998	-7.7	-0.2	4.4	6.7	8.5	9.5	11.1	15.0	21.5
(B) Operating income before depreciation									
Average	-8.3	0.6	5.4	8.1	9.5	10.8	12.9	16.1	22.6
Ending 1996	-5.3	2.9	7.0	9.2	10.3	11.4	14.2	19.0	34.5
Ending 1997	-10.5	2.3	6.8	8.8	9.6	11.0	13.4	18.4	33.6
Ending 1998	-11.6	-1.7	4.3	7.4	8.7	10.4	11.8	16.3	21.4
(C) Income before extraordinary items									
Average	-12.8	-0.9	4.5	7.5	9.3	10.8	13.1	16.6	23.8
Ending 1996	-8.8	-1.1	5.9	8.7	10.6	12.3	15.0	21.4	49.9
Ending 1997	-22.6	-2.8	4.0	7.3	9.2	11.4	14.5	23.5	43.8
Ending 1998	-25.6	-3.8	1.7	6.1	8.2	9.9	13.3	18.5	36.4

Part II: Annualized growth rate over 5 years

	Percentile								
Sample period	2%	10%	25%	40%	50%	60%	75%	90%	98%
(A): Sales									
Average	-9.7	-0.6	6.9	9.4	10.8	11.9	14.1	18.1	27.9
Ending 1996	-11.3	-3.4	4.3	7.3	8.4	9.9	12.3	16.7	31.2
Ending 1997	-10.8	-1.8	5.2	8.3	9.5	10.8	13.2	18.3	30.1
Ending 1998	-13.6	-3.0	4.0	8.8	10.2	11.5	13.7	19.6	32.5
(B) Operating income before depreciation									
Average	-16.9	-3.5	4.3	7.9	9.8	11.5	14.3	19.3	32.1
Ending 1996	-14.0	-1.8	5.9	9.2	11.2	12.4	15.8	22.7	45.2
Ending 1997	-10.4	-1.5	6.6	9.6	11.0	12.7	15.7	22.4	42.4
Ending 1998	-13.6	-6.6	4.5	7.5	10.8	12.7	15.6	19.9	32.0
(C) Income before extraordinary items									
Average	-26.4	-6.4	2.8	7.6	9.8	12.0	15.3	21.3	37.2
Ending 1996	-18.9	-3.9	3.4	10.5	12.7	14.8	20.0	42.8	89.3
Ending 1997	-32.8	-6.9	2.5	8.5	11.7	14.2	18.6	28.0	53.2
Ending 1998	-39.5	-10.1	4.3	9.5	11.8	14.4	19.6	30.4	57.4

Part III: 1-year growth rate

Sample period	Percentile								
	2%	10%	25%	40%	50%	60%	75%	90%	98%
(A): Sales									
Average	-36.4	-2.4	5.7	9.3	11.3	13.3	17.0	25.2	47.7
Ending 1996	-46.9	-9.3	3.6	8.4	11.2	13.5	17.5	29.3	68.5
Ending 1997	-42.7	-11.5	2.3	7.5	10.3	13.3	18.6	35.5	65.4
Ending 1998	-49.8	-14.7	1.5	6.6	8.9	11.8	18.1	29.1	53.0
(B) Operating income before depreciation									
Average	-52.3	-15.2	0.2	7.1	10.6	13.8	19.8	33.7	82.3
Ending 1996	-58.8	-17.5	1.5	8.3	12.2	15.2	21.5	34.5	69.9
Ending 1997	-44.8	-20.1	0.1	8.4	11.4	14.5	19.8	37.8	104.1
Ending 1998	-60.0	-30.3	-1.9	6.6	11.1	14.0	20.8	33.4	73.1
(C) Income before extraordinary items									
Average	-67.5	-25.3	-2.8	6.9	11.0	14.9	23.1	45.9	216.6
Ending 1996	-81.3	-38.1	-6.8	10.0	15.7	18.5	31.2	95.4	395.0
Ending 1997	-88.0	-44.2	-11.7	5.4	11.7	16.3	26.1	61.0	196.6
Ending 1998	-80.0	-46.9	-13.5	4.7	11.5	15.5	27.1	56.7	213.6

Table 3
Persistence in growth rates of operating performance: All firms

At every calendar year-end over the sample period growth rates in operating performance are calculated over each of the following one to ten years (or until delisting) for all firms in the sample. The sample period is 1951–1998, and the sample includes all domestic firms listed on the New York, American and Nasdaq markets with data on the Compustat files. Operating performance is measured as sales (panel A), operating income before depreciation (panel B), or income before extraordinary items available to common equity (panel C). Growth in each variable is measured on a per share basis as of the sample formation date, with the number of shares outstanding adjusted to reflect stock splits and dividends; cash dividends and special distributions are also reinvested. For each of the following ten years the number of firms with valid growth rates; the number of firms whose growth rate exceeds the median growth rate each year for the indicated number of years; the percentage these firms represent relative to the number of valid firms; and the percentage expected under the hypothesis of independence across years, are reported. Statistics are provided for the entire sample period, and for the ten-year horizons corresponding to the last three sample formation years, 1987–1989.

Variable	Firms with above-median growth each year for number of years: 1	2	3	4	5	6	7	8	9	10
(A): Sales										
Average number of valid firms	2771	2500	2263	2058	1878	1722	1590	1471	1364	1265
Average number above median	1386	721	382	209	118	70	42	26	17	11
Percent above median	50.0	28.8	16.9	10.2	6.3	4.0	2.7	1.8	1.3	0.9
1987–1996	50.0	29.2	17.5	11.6	7.9	5.5	3.8	2.7	1.8	1.3
1988–1997	50.0	29.1	17.9	11.6	7.8	5.4	3.9	2.4	1.7	1.2
1989–1998	50.0	30.0	18.6	11.9	7.8	5.6	3.4	2.4	1.5	1.2
(B) Operating income before depreciation										
Average number of valid firms	2730	2456	2219	2014	1833	1678	1546	1428	1322	1223
Average number above median	1365	628	290	136	67	34	18	10	6	4
Percent above median	50.0	25.6	13.0	6.8	3.6	2.0	1.2	0.7	0.5	0.3
1987–1996	50.0	25.5	13.1	7.5	4.5	2.7	1.7	1.0	0.7	0.5
1988–1997	50.0	25.2	13.1	7.1	4.0	2.3	1.3	1.0	0.6	0.4
1989–1998	50.0	25.0	13.1	7.0	4.0	2.1	1.3	0.8	0.5	0.5
(C) Income before extraordinary items										
Average number of valid firms	2782	2509	2271	2065	1884	1727	1593	1473	1365	1265
Average number above median	1391	625	277	125	57	28	14	7	4	2
Percent above median	50.0	24.9	12.2	6.0	3.0	1.6	0.9	0.5	0.3	0.2
1987–1996	50.0	24.7	12.1	6.7	3.8	1.9	1.0	0.6	0.3	0.2
1988–1997	50.0	24.1	12.1	6.1	2.7	1.3	0.7	0.4	0.3	0.1
1989–1998	50.0	24.8	12.2	5.7	2.6	1.3	0.8	0.5	0.2	0.0
Expected percent above median	50.0	25.0	12.5	6.3	3.1	1.6	0.8	0.4	0.2	0.1

Table 4
Persistence in growth rates of operating performance: Selected equity classes

At every calendar year-end over the sample period growth rates in operating performance are calculated over each of the following one to ten years (or until delisting) for all firms in the sample. The sample period is 1951–1998, and the underlying sample includes all domestic firms listed on the New York, American and Nasdaq markets with data on the Compustat files. Operating performance is measured as sales, operating income before depreciation, or income before extraordinary items available to common equity. Growth in each variable is measured on a per share basis as of the sample formation date, with the number of shares outstanding adjusted to reflect stock splits and dividends; cash dividends and special distributions are also reinvested. For each of the following ten years the number of firms whose growth rate exceeds the median growth rate each year for the indicated number of years is expressed as a percentage of the number of firms with valid growth rates. Statistics are provided for the following sets of stocks: technology stocks (panel A), comprising stocks whose SIC codes begin with 283, 357, 366, 38, 48, or 737; value stocks (panel B), comprising stocks ranked in the top three deciles by book-to-market value of equity; glamour stocks (panel C), comprising an equivalent number as in panel B of the lowest-ranked stocks by book-to-market value of equity; large stocks (panel D), comprising stocks ranked in the top 2 deciles by equity market value; mid-cap stocks (panel E), comprising stocks ranked in the third through seventh deciles by equity market value; and small stocks (panel F), comprising stocks ranked in the bottom three deciles by equity market value. All decile breakpoints are based on domestic NYSE stocks only.

	Percent of firms with above-median growth each year for number of years:									
Variable	1	2	3	4	5	6	7	8	9	10
(A) Technology stocks										
Sales	51.6	30.7	19.1	12.5	8.5	5.9	4.2	3.0	2.3	1.7
Operating income	51.0	27.2	14.9	8.7	5.3	3.3	2.2	1.4	1.0	0.7
Income before extraordinary items	50.9	25.9	13.5	7.3	4.1	2.5	1.5	0.9	0.5	0.4
(B): Value stocks										
Sales	50.6	30.0	18.2	11.1	6.9	4.3	2.8	1.9	1.3	0.9
Operating income	49.3	25.3	13.2	6.8	3.5	1.8	0.9	0.5	0.3	0.2
Income before extraordinary items	48.3	23.8	11.4	5.4	2.5	1.2	0.7	0.4	0.3	0.2
(C) Glamour stocks										
Sales	48.3	26.6	15.1	8.5	4.7	2.7	1.7	1.0	0.8	0.6
Operating income	50.1	25.2	11.9	5.9	3.3	1.7	1.0	0.6	0.4	0.3
Income before extraordinary items	50.7	25.2	12.0	5.8	2.9	1.6	0.9	0.4	0.2	0.1
(D) Large stocks										
Sales	53.2	31.3	18.9	11.7	7.5	4.8	3.2	2.2	1.6	1.1
Operating income	49.4	25.2	13.0	6.9	3.7	2.0	1.1	0.6	0.4	0.3
Income before extraordinary items	46.7	21.9	10.0	4.7	2.2	1.2	0.7	0.4	0.3	0.2
(E) Mid-cap stocks										
Sales	53.9	32.4	19.8	12.1	7.6	4.9	3.3	2.2	1.5	1.0
Operating income	50.5	26.6	13.9	7.5	4.2	2.4	1.5	1.0	0.7	0.4
Income before extraordinary items	49.4	24.9	12.4	6.2	3.1	1.6	0.9	0.5	0.3	0.2
(E) Small stocks										
Sales	47.0	26.1	14.7	8.6	5.2	3.2	2.1	1.4	1.0	0.7
Operating income	50.1	25.2	12.6	6.4	3.3	1.8	1.0	0.6	0.4	0.2
Income before extraordinary items	51.0	25.5	12.6	6.3	3.2	1.7	0.9	0.4	0.2	0.1
Expected percent above median	50.0	25.0	12.5	6.3	3.1	1.6	0.8	0.4	0.2	0.1

Table 5
Persistence in growth rates of operating performance:
Firms with superior and poor past growth

At every calendar year-end over the sample period growth rates in operating performance are calculated over each of the following one to five years (or until delisting) for firms with superior (part I of the table) or inferior (part II) past growth in operating performance . Firms with superior (inferior) past growth include: firms with above-median (below-median) operating performance growth each year over the past five or past three years; firms whose average rank on growth rate each year over the past five or past three years falls in the top (bottom) quartile. The sample period is 1951–1998, and eligible firms include all domestic firms listed on the New York, American and Nasdaq markets with data on the Compustat files. Operating performance is measured as sales (panel 1), operating income before depreciation (panel 2), or income before extraordinary items available to common equity (panel 3). Growth in each variable is measured on a per share basis as of the sample formation date, with the number of shares outstanding adjusted to reflect stock splits and dividends; cash dividends and special distributions are also reinvested. For each of the following five years the number of firms with valid growth rates; the number of firms whose growth rate exceeds the median growth rate each year for the indicated number of years; the percentage these firms represent relative to the number of valid firms; and the percentage expected under the hypothesis of independence across years, are reported.

Part I: Firms with superior past growth
(A) Firms with past above-median run

	Firms with above-median growth each year for past 5 years and above-median growth each year for number of future years:					Firms with above-median growth each year for past 3 years and above-median growth each year for number of future years:				
	1	2	3	4	5	1	2	3	4	5
(A1): Sales										
Average number of valid firms	110	103	96	90	83	355	329	305	285	265
Average number above median	70	42	26	17	11	209	118	70	42	26
Percent above median	63.3	41.0	27.3	19.0	13.7	58.9	35.6	22.8	14.8	9.9
(A2) Operating income before depreciation										
Average number of valid firms	61	57	53	50	47	267	245	227	210	194
Average number above median	34	18	10	6	4	136	67	34	18	10
Percent above median	55.9	32.3	19.4	12.2	8.0	51.1	27.2	15.1	8.8	5.3
(A3) Income before extraordinary items										
Average number of valid firms	53	50	47	44	43	259	240	222	207	193
Average number above median	28	14	7	4	2	125	57	28	14	7
Percent above median	51.9	27.8	15.1	8.4	5.1	48.3	23.7	12.5	6.7	3.6
Expected percent above median	50.0	25.0	12.5	6.3	3.1	50.0	25.0	12.5	6.3	3.1

(B) Firms with past average growth rank in top quartile

	Firms with average growth rank over past 5 years in top quartile and above-median growth each year for number of future years:					Firms with average growth rank over past 3 years in top quartile and above-median growth each year for number of future years:				
	1	2	3	4	5	1	2	3	4	5
(B1): Sales										
Average number of valid firms	78	71	66	61	56	204	187	172	159	147
Average number above median	47	27	16	10	6	120	67	39	24	15
Percent above median	60.8	37.7	24.4	16.6	11.4	58.9	35.8	22.8	14.8	9.9
(B2) Operating income before depreciation										
Average number of valid firms	35	32	30	27	25	133	121	110	100	91
Average number above median	18	8	4	2	1	65	31	15	8	4
Percent above median	50.6	26.4	15.0	8.9	5.9	49.0	25.4	13.6	7.6	4.7
(B3) Income before extraordinary items										
Average number of valid firms	29	27	25	23	22	121	112	103	94	86
Average number above median	13	5	3	1	0	56	24	11	5	2
Percent above median	44.0	19.6	10.2	4.8	2.1	46.4	21.5	10.4	5.5	2.6

Part II: Firms with inferior past growth

(C) Firms with past below-median run

	Firms with below-median growth each year for past 5 years and above-median growth each year for number of future years:					Firms with below-median growth each year for past 3 years and above-median growth each year for number of future years:				
	1	2	3	4	5	1	2	3	4	5
(C1): Sales										
Average number of valid firms	106	92	82	73	66	343	302	270	244	221
Average number above median	35	15	7	4	2	125	59	28	14	7
Percent above median	33.0	16.3	8.6	4.9	2.5	36.4	19.4	10.6	5.9	3.4
(C2) Operating income before depreciation										
Average number of valid firms	39	35	32	30	28	229	206	186	170	156
Average number above median	20	9	5	2	1	122	58	27	13	6
Percent above median	51.4	25.7	14.3	6.3	3.5	53.3	28.0	14.7	7.6	3.6
(C3) Income before extraordinary items										
Average number of valid firms	33	30	28	26	25	220	201	184	170	157
Average number above median	18	9	4	2	1	127	61	28	13	5
Percent above median	56.2	30.2	14.8	6.7	3.0	57.7	30.4	15.3	7.7	3.4
Expected percent above median	50.0	25.0	12.5	6.3	3.1	50.0	25.0	12.5	6.3	3.1

(D) Firms with past average growth rank in bottom quartile

	Firms with average growth rank over past 5 years in bottom quartile and above-median growth each year for number of future years:					Firms with average growth rank over past 3 years in bottom quartile and above-median growth each year for number of future years:				
	1	2	3	4	5	1	2	3	4	5
(D1): Sales										
Average number of valid firms	86	74	65	57	51	202	175	154	137	123
Average number above median	29	12	6	3	1	71	32	14	6	3
Percent above median	33.1	16.7	8.6	4.4	2.3	35.2	18.1	9.3	4.5	2.3
(D2) Operating income before depreciation										
Average number of valid firms	23	20	17	15	14	111	97	86	77	70
Average number above median	15	7	3	1	1	68	33	15	7	3
Percent above median	63.8	34.8	19.8	8.9	4.2	61.8	33.7	17.5	8.7	4.1
(D3) Income before extraordinary items										
Average number of valid firms	18	16	14	13	12	100	89	80	72	66
Average number above median	13	7	4	2	1	68	34	16	7	3
Percent above median	73.5	47.1	25.1	12.1	5.3	68.1	38.9	20.7	10.3	4.8

Table 6
Distribution of firms classified by above-median growth in
operating performance over indicated horizon: All firms

At every calendar year-end over the sample period growth rates in operating performance are calculated over each of the following one to ten years (or until delisting) for all firms in the sample. The sample period is 1951–1998, and the sample includes all domestic firms listed on the New York, American and Nasdaq markets with data on the Compustat files. Operating performance is measured as sales (panel A), operating income before depreciation (panel B), or income before extraordinary items available to common equity (panel C). Growth in each variable is measured on a per share basis as of the sample formation date, with the number of shares outstanding adjusted to reflect stock splits and dividends; cash dividends and special distributions are also reinvested. The table reports the average number of firms with above-median growth in each of the indicated categories; the percentage these firms represent relative to the number of valid firms; the last row reports the percentage expected under the hypothesis of independence across years. Statistics are provided for the entire sample period, and for the ten-year horizons corresponding to the last three sample formation years, 1987–1989.

	Firms with above-median growth:							Firms with average growth
Variable	3 out of 4 years	4 out of 5 years	5 out of 6 years	6 out of 7 years	6 out of 8 years	7 out of 9 years	8 out of 10 years	rank in top quartile over 5 years
(A): Sales								
Average number	697	432	269	170	287	191	127	79
Percent	33.9	23.0	15.6	10.7	19.5	14.0	10.0	4.2
1987–1996	34.6	24.4	17.5	12.6	21.4	15.6	11.9	5.3
1988–1997	35.6	25.2	17.7	12.6	21.0	16.0	11.7	5.0
1989–1998	36.6	26.0	18.0	12.6	21.4	16.0	12.7	5.6
(B) Operating income before depreciation								
Average number	629	341	184	100	205	119	70	34
Percent	31.2	18.6	10.9	6.5	14.4	9.0	5.7	1.9
1987–1996	31.1	18.7	11.5	7.5	15.9	10.5	6.7	1.9
1988–1997	31.8	19.4	11.7	6.9	16.6	10.2	7.2	2.3
1989–1998	31.7	19.3	11.5	7.4	15.1	10.4	8.0	2.0
(C) Income before extraordinary items								
Average number	634	334	171	88	190	109	61	27
Percent	30.7	17.7	9.9	5.5	12.9	8.0	4.8	1.4
1987–1996	30.6	17.2	9.5	5.0	12.2	8.0	5.3	1.6
1988–1997	30.3	16.9	8.8	4.4	12.8	7.8	5.3	1.1
1989–1998	29.9	16.5	8.4	5.0	12.8	8.4	5.7	0.9
Expected percent	25.0	15.6	9.4	5.5	10.9	7.0	4.4	2.5

Table 7
Results for surviving versus non-surviving firms:
persistence tests and growth rates

At every calendar year-end over the sample period growth rates two sets of firms are selected: firms that survive over the following ten years (survivors), and firms that survive over the following five years but thereafter fail to survive until the tenth year (nonsurvivors). For each set of firms growth rates in operating performance are calculated over each of the following ten years. The sample period is 1951–1998, and all domestic firms listed on the New York, American and Nasdaq markets with data on the Compustat files are eligible. Operating performance is measured as sales, operating income before depreciation, or income before extraordinary items available to common equity. Growth in each variable is measured on a per share basis as of the sample formation date, with the number of shares outstanding adjusted to reflect stock splits and dividends; cash dividends and special distributions are also reinvested. Part I provides runs tests of persistence over each of the following ten years for the two sets of firms: the average number of firms whose growth rate exceeds the median growth rate each year for the indicated number of years is expressed as a percentage of the number of firms with valid growth rates. Part II reports the distribution of annualized growth rates realized over the sixth to tenth year (or until delisting) following sample selection for the two sets of firms. The simple average over the entire sample period of the percentiles is reported.

Part I: Runs tests for persistence

	Percent of firms with above-median growth each year for number of years:									
Variable	1	2	3	4	5	6	7	8	9	10
(A) Survivors (1265 firms)										
Sales	52.8	30.9	18.1	10.8	6.6	4.2	2.7	1.8	1.3	0.9
Operating income before depreciation	51.5	26.8	13.7	7.0	3.8	2.1	1.2	0.7	0.5	0.3
Income before extraordinary items	51.7	26.9	13.5	6.7	3.4	1.8	1.0	0.5	0.3	0.2
(B): Non-survivors										
Number of firms	445	445	445	445	445	344	250	165	86	0
Sales	48.7	26.6	14.6	8.1	4.5	2.8	1.7	1.1	0.8	—
Operating income before depreciation	50.0	24.2	11.5	5.5	2.5	1.3	0.7	0.5	0.3	—
Income before extraordinary items	49.1	23.8	11.1	5.1	2.3	1.1	0.6	0.3	0.1	—
(C) Survivors, technology (195 firms)										
Sales	54.6	33.2	20.5	12.9	8.4	5.8	4.2	3.0	2.3	1.7
Operating income before depreciation	53.6	29.7	16.5	9.6	5.9	3.6	2.2	1.4	1.0	0.7
Income before extraordinary items	54.1	29.9	16.3	9.0	5.2	3.1	1.9	1.1	0.6	0.4
(D): Non-survivors, technology										
Number of firms	100	100	100	100	100	77	55	37	20	0
Sales	51.5	28.6	16.7	10.6	6.5	4.6	3.1	2.0	1.4	—
Operating income before depreciation	49.5	24.3	12.4	6.6	3.3	2.0	1.4	1.3	1.0	—
Income before extraordinary items	50.1	25.0	12.4	6.7	3.2	1.7	1.0	0.5	0.0	—
Expected percent above median	50.0	25.0	12.5	6.3	3.1	1.6	0.8	0.4	0.2	0.1

Part II: Annualized growth rates

Variable	Percentile								
	2%	10%	25%	40%	50%	60%	75%	90%	98%
(E) Survivors									
Sales	-1.54	-2.0	5.6	9.1	10.9	12.5	15.5	21.7	37.6
Operating income before depreciation	-23.3	-6.8	2.8	7.6	10.1	12.5	16.9	25.5	48.0
Income before extraordinary items	-28.6	-8.6	2.1	7.7	10.6	13.3	18.1	28.4	56.4
(F) Nonsurvivors									
Sales	-18.5	-7.0	1.0	6.0	8.4	10.4	13.9	20.3	36.8
Operating income before depreciation	-26.1	-12.5	-2.6	4.7	8.1	11.5	16.3	25.7	47.9
Income before extraordinary items	-27.4	-14.5	-3.3	4.4	8.2	11.9	17.9	28.6	55.9

Table 8
Realized median growth rates of operating performance for stocks
classified by IBES long-term growth forecasts

At every calendar year-end t over the sample period stocks are ranked and classified to one of five groups based on IBES forecasts of long-term earnings growth. Results are reported for individual stocks and for portfolios. For individual stocks, growth rates in operating performance are calculated over each of the five subsequent years (years $t+1$ to $t+5$) for all firms in the sample with available data. The sample period is 1982–1998, and all domestic firms listed on the New York, American and Nasdaq markets with data on the Compustat files are eligible. Operating performance is measured as sales, operating income before depreciation, or income before extraordinary items available to common equity. Growth in each variable is measured on a per share basis as of the sample formation date, with the number of shares outstanding adjusted to reflect stock splits and dividends. The median realized growth over all stocks in each classification is calculated each year, and the simple average over the entire sample period is reported. For portfolios, a value-weighted portfolio is formed at each year-end from all the stocks in each quintile sorted by IBES forecasts. The portfolio's income before extraordinary items is calculated over each of the subsequent five years, with the proceeds from liquidating delisted stocks reinvested in the surviving stocks. Growth rates for each portfolio are calculated in each formation year, and the simple average over the entire sample period of the growth rates is reported. Also reported are the ratios of: the prior year's income before extraordinary items per share to current price; and the prior year's cumulative regular dividends per share to current price.

Growth in:	Quintile based on IBES forecast: 1 (Low)	2	3	4	5 (High)
(A): Growth rate in year $t+1$					
Sales	1.4	4.5	6.3	8.3	13.7
Operating income before depreciation	3.6	6.8	7.6	10.3	16.0
Income before extraordinary items	5.1	9.5	10.1	12.0	18.3
Portfolio income before extraordinary items	12.6	4.2	4.5	7.2	13.6
No. with positive base & survive 1 year	242	256	266	318	584
No. with negative base & survive 1 year	71	78	60	88	265
(B): Growth rate in year $t+2$					
Sales	1.7	4.5	6.4	7.8	11.6
Operating income before depreciation	3.2	7.0	8.4	9.9	14.0
Income before extraordinary items	4.7	9.9	10.5	12.2	16.4
Portfolio income before extraordinary items	6.9	7.5	6.1	9.1	10.6
No. with positive base & survive 2 years	225	235	244	296	497
No. with negative base & survive 2 years	62	75	59	85	252
(C): Annualized growth rate over 3 years					
Sales	1.1	4.0	5.6	7.3	11.3
Operating income before depreciation	2.5	5.2	6.8	8.1	10.9
Income before extraordinary items	3.1	7.4	7.0	9.0	11.5
Portfolio income before extraordinary items	9.0	7.3	5.2	7.1	11.4
No. with positive base & survive 3 years	202	209	230	263	439
No. with negative base & survive 3 years	67	70	56	82	217
(D): Annualized growth rate over 5 years					
Sales	1.2	3.4	5.1	6.9	9.9
Operating income before depreciation	2.2	5.1	6.8	7.3	9.2
Income before extraordinary items	2.0	6.5	6.5	8.0	9.5
Portfolio income before extraordinary items	8.0	10.7	7.2	7.7	11.3
No. with positive base & survive 5 years	182	179	201	233	356
No. with negative base & survive 5 years	57	63	50	68	170
Median IBES forecast	6.0	10.2	12.3	15.1	22.4
Median stock dividend yield, %	6.0	3.4	2.7	1.5	0.1
Portfolio dividend yield, %	6.9	4.6	3.3	2.5	1.3
Median stock earnings to price ratio, %	10.0	8.9	7.9	7.2	5.6

Table 9
Forecasting regressions for growth rates of operating performance

At every calendar year-end a cross-sectional regression model is used to forecast growth rates of operating performance, y_{it+j}, for firm i over the following one to five years for all firms in the sample with available data. The model is

$$y_{it+j} = \beta_0 + \beta_1 PASTGS5_{it} + \beta_2 TECH_{it} + \beta_3 BM_{it} + \beta_4 PASTR6_{it} + \beta_5 IBESLTG_{it} + \beta_6 DP_{it} + \epsilon_{it+j}$$

The dependent variable is growth in: sales (SALES); operating income before depreciation (OIBD); or income before extraordinary items available to common equity (IBEI). The variables used to forecast a firm's growth are: $PASTGS5$, the growth in sales over the five years prior to the sample selection date; $TECH$, a dummy variable with a value of one for a stock in the technology sector and zero otherwise; BM, book-to-market ratio; $PASTR6$, the stock's prior six-month compound rate of return; $IBESLTG$ the IBES consensus forecast for long-term growth; and DP the dividend yield, accumulated regular dividends per share over the last twelve months divided by current price per share.

Growth in:	PASTGS5	TECH	BM	PASTR6	IBESLTG	DP	R^2
(A): Growth rate in year $t+1$							
SALES	0.1212	-0.0019	-0.0198	0.0535	0.2986	-0.3935	0.0592
	(5.2)	(-0.3)	(-5.6)	(4.3)	(6.2)	(-4.4)	
OIBD	-0.1031	0.0071	0.0005	-0.0859	0.2812	-0.7036	0.0167
	(-1.7)	(0.6)	(0.1)	(-4.0)	(3.1)	(-4.8)	
IBEI	-0.1412	-0.0105	0.0076	-0.0929	0.1679	-1.1380	0.0135
	(-1.8)	(-0.5)	(0.4)	(-3.6)	(1.2)	(-3.9)	
(B): Growth rate in year $t+2$							
SALES	0.0672	0.0015	-0.0241	0.0432	0.2156	-0.3709	0.0398
	(2.4)	(0.3)	(-6.0)	(4.6)	(7.5)	(-3.4)	
OIBD	-0.0828	0.0094	0.0096	-0.0382	0.3156	-0.5417	0.0116
	(-1.4)	(1.0)	(1.7)	(-1.5)	(5.0)	(-2.3)	
IBEI	0.0029	-0.0174	0.0204	-0.0908	0.1427	-0.6077	0.0115
	(0.0)	(-1.2)	(1.5)	(-1.9)	(1.1)	(-1.5)	
(C): Annualized growth rate over years $t+1$ to $t+3$							
SALES	0.0813	0.0040	-0.0253	0.0444	0.1858	-0.4370	0.0827
	(2.4)	(1.3)	(-8.6)	(5.2)	(9.5)	(-7.3)	
OIBD	-0.0513	0.0030	-0.0085	-0.0164	0.1350	-0.4247	0.0161
	(-1.2)	(0.6)	(-1.7)	(-2.2)	(2.8)	(-2.3)	
IBEI	0.0014	-0.0021	-0.0089	-0.0430	0.1148	-0.1428	0.0121
	(0.1)	(-0.2)	(-0.8)	(-5.4)	(1.4)	(-0.6)	
(D): Annualized growth rate over years $t+1$ to $t+5$							
SALES	0.0635	0.0071	-0.0272	0.0274	0.2315		0.0908
	(2.1)	(2.1)	(-7.7)	(4.2)	(5.6)		
OIBD	-0.0578	0.0045	-0.0095	-0.0217	0.1947		0.0211
	(-2.0)	(1.9)	(-2.3)	(-4.3)	(2.8)		
IBEI	-0.0227	-0.0014	-0.0130	-0.0426	0.1284		0.0191
	(-3.1)	(-0.2)	(-1.2)	(-4.1)	(2.0)		
SALES	0.0513	0.0045	-0.0265	0.0342	0.1508	-0.4397	0.1005
	(1.7)	(1.3)	(-9.1)	(4.4)	(2.9)	(-18.6)	
OIBD	-0.0667	0.0035	-0.0090	-0.0189	0.1387	-0.2969	0.0242
	(-2.3)	(1.4)	(-2.5)	(-3.2)	(1.8)	(-5.2)	
IBEI	-0.0246	-0.0012	-0.0126	-0.0411	0.0966	-0.1455	0.0206
	(-2.4)	(-0.2)	(-1.2)	(-4.4)	(1.3)	(-1.1)	

Growth in each operating peformance variable is measured on a per share basis as of the sample formation date, with the number of shares outstanding adjusted to reflect stock splits and dividends. $PASTGS5$, $PASTR6$ are Winsorized at their 5-th and 95-th percentiles; $IBESLTG$ is Winsorized at its 1-st and 99-th percentiles; and DP is Winsorized at its 98-th percentile. Stocks with negative values of BM are excluded. In the regressions for $OIBD$ or

$IBEI$, firms with negative values of the operating performance variable in the base year are excluded, as are stocks with ratios of price to the operating performance variable above 100. The reported statistics are the averages over all years of the estimated coefficients, with t-statistics in parentheses, as well as the average R^2 of the model. In panels C and D, standard errors are adjusted for serial correlation.