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Economic Growth and Equity Investing

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Abstract

The performance of equity investments in the aggregate is inextricably linked to economic growth. Nonetheless, few papers on investing explicitly take account of research on economic growth. This paper bridges that gap by examining the implications of both theoretical models and empirical results from growth theory for equity investing. The result of the analysis is the conclusion that over the long run investors should anticipate real returns on common stock to average no more than about 4%.

1. Introduction

The performance of equity investments in the aggregate is inextricably linked to economic growth. Earnings, the source of value for equity investments, are themselves driven by aggregate economic activity. Unless corporate profits rise as a percentage of GDP, something that cannot continue indefinitely, earnings growth is constrained by GDP growth. This means that the same factors that determine the rate of economic growth will also place bounds on earnings growth and, thereby, the performance of equity investments. Despite these obvious facts, few papers on equity investing explicitly take into account the literature on economic growth. This is not meant to imply that there is sparse research relating economic growth to equity returns. There are numerous contributions in that arena including several provocative pieces by Arnott and Bernstein (2002), Arnott and Asness (2003), and Bernstein and Arnott (2003) published in the *Financial Analysts Journal* about which I have more to say below. Nonetheless, it is rare for this research to be explicitly tied to the literature on the theory of economic growth. By bridging that gap, further insight can be gained into the relation between economic growth and equity returns and forecasts regarding future returns can be placed on a more solid foundation.

To anticipate the conclusion, the results imply that economic growth places both lower and tighter bounds on long-run earnings growth than is widely appreciated. For the United States, the analysis suggests that long-run real growth in aggregate earnings per share will be on the order of 1%. This, in turn, implies that investors cannot reasonably expect real stock returns to much exceed 4 to 5% over the long run.

Arriving at these conclusion involves three steps. The first is forecasting long-run growth in real per capita GDP. Identifying and measuring the factors that influence per capita GDP growth is the central focus of development economics. Section two draws on that literature to estimate future real per capita GDP growth rates for the countries that issue most of the world's equity.

Because corporate earnings depend on aggregate economic activity, not real GDP per capita, the second step involves estimating future population growth. For this, I rely on forecasts from the United Nations. However, the variation in population growth forecasts for the countries of interest are so small that the source of the data has almost no impact on the results.

The final step involves analyzing the relation between real earnings and real GDP. Here there are two issues. First, is the ratio of earnings to GDP stationary? If it is, then long-run growth in aggregate earnings will converge to long-run growth in GDP. Second, from the standpoint of investors, account must be taken of the fact that share issuances and repurchases drive a wedge between the growth rate of aggregate earnings and the growth rate of earnings per share. These issues are addressed in section four.

The final section of the paper puts all the pieces together and analyzes their implications for future returns on common stocks. The bottom line is long-run real returns on common stocks more than one percentage point above the average dividend yield are unlikely.

2. Economic Growth: Theory and Data

The focus of economic growth theory is explaining expansion in the standard of living measured by real per capita GDP. In the neoclassic model of economic growth, developed originally by Solow (1956), per capita GDP growth over the long run is entirely attributable to exogenous technological innovation.[1] To those not steeped in growth theory this conclusion may seem surprising because it seems intuitive that output per capita can always be increased simply by adding more capital. While it is true that adding capital does increase output per capita, it does so at a declining rate. Consequently, rational producers will stop adding capital when the marginal product of capital drops to its marginal cost. When the economy reaches this point, it is said to be in a steady state. Once the economy reaches the steady state growth path, the capital-labor ratio remains constant, and per capita GDP growth ceases unless the production function changes so as to increase the marginal product of capital.

The source of change in the production function is technical innovation. By increasing the marginal product of capital, technical progress breaks the deadlock imposed by diminishing returns and makes profitable further growth in per capita output. As long as the technical innovation continues, so does the growth in per capita GDP.

This conclusion is not limited to early models such as Solow's in which the rate of technical change is exogenous. Following Romer (1990), a variety of growth models have been developed in which the amount of investment in research and development and, thereby, the rate of technical progress is endogenous. However, even in these more sophisticated models, the declining marginal product of capital ensures that long-run per capita growth is bounded by the rate of technical progress. The word bounded is important because the ability of a society to exploit modern technology effectively is not a foregone conclusion. For example, over the period from 1960 to 2005 all of the countries of sub-

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[1] For details on the Solow model and more recent elaborations see Barro and Sala-i-Martin (2004).

Saharan Africa, with the exception of South Africa, experienced little or no growth. This failure of certain poor countries to grow is one of the fundamental mysteries of economics, but it is not a relevant consideration here.[2] Virtually the entire world stock market capitalization is concentrated in a relatively few highly developed countries. For those countries, the impediments to effective adoption of technology have proven to be minor, at least to date.

Before turning to the data on economic growth, there is one remaining issue to address. The conclusion that growth is due exclusively to technological innovation is based on the assumption that the economy has reached the steady state. If the capital stock is below the steady state, so that the marginal product of capital exceeds its marginal cost, then there is still room for capital deepening. In that situation, a country's growth rate can exceed the steady state growth rate because it is spurred by capital deepening as well as by technological innovation. As the capital-labor ratio rises toward its steady state value, the growth rate converges to the steady state level attributable to technical change.

There are a variety of reasons why the capital stock of a country may be below its steady state level. An obvious example is warfare. Another is the opening of a previously closed society. Whatever the cause, growth theory predicts that a country starting with a capital-labor ratio below the steady state level will grow more rapidly during the period of capital deepening. Growth theorists refer to this "catch-up" as convergence.

Convergence is important to bear in mind when analyzing historical growth rates with the goal of forecasting future growth. If the historical sample includes growth rates for countries that are still in the process of converging to a steady state, then the historical

[2] Hall and Jones (2000) describe the problem in further detail and offer an intriguing solution.

growth rates will exceed the future rates that will apply once the steady state has been achieved.

Convergence also helps explain why long-run growth rates for a individual country are remarkably constant. To illustrate, Figure 1 plots the log of real per capita GDP in the United States from 1802 through 2008. The long-run average growth rate of 1.8% is also shown. Over this time scale, even the largest downturns associated with the Civil War and the Great Depression appear only as temporary dips in a remarkably smooth progression. That smooth progression is due in part to the fact that following the dips, which were associated with a drop in the capital stock below its steady state level, there were accelerations in economic growth associated with capital accumulation.

With that background, Table 1 presents Barro's (2009) update of Maddison's (2003) compilation of information on world economic growth from 1923 to 2006. The starting point in Table 1 is 1923 because that is the first year for which Barro has data for all the countries in his sample. Extending the sample backwards for those countries that had longer time series available does not affect the basic nature of the findings. Growth rates are also reported for a shorter sample period beginning in 1960 to take account of the possibility of nonstationarity in the data.

The results are reported in terms of compound growth rates. An example illustrates why it is preferable to use compound growth rates as opposed to averages of annual growth rates. Suppose that the ratio of corporate profits to GDP is stationary, but not constant. In particular, assume, as the data will later show, that corporate profits are more variable than GDP. In that case, even though the compound growth rates of the two variables must converge in the long run, the arithmetic mean of annual growth rates for corporate profits will exceed that for GDP due to the variance effect.[3] The higher mean growth rate in earnings is illusory, however, because it fails to take account of the mean reversion in earnings growth that must occur for the ratio to be stationary.

The results reported in Table 1 are divided into two groups. The first group is composed of more mature economies that were already developed before the Second World War. These are the countries that account for virtually the entire world stock market capitalization and are the focus of this study. The second group consists of economies that developed more recently or are still considered to be developing. Results for the second group are presented for completeness and to provide perspective on the impact of convergence.

Consistent with the hypothesis that a common rate of technological advance is driving growth in all the developed countries, the results for the first group are remarkably homogeneous. Virtually all of the growth rates for the full sample are close to the average of 2.19%. The exceptions are the United States on the low end and Japan on the high end. The lower rate of 1.42% for the United States reflects the fact that the U.S. was the closest to steady state growth in 1923 having emerged from World War I unscathed. The higher growth rate for Japan reflects convergence. At the start of the sample period, Japan was a relatively undeveloped country with a capital stock below the steady state level. Convergence is also evident in the shorter sample period beginning in 1960. The European countries and Japan, whose capital stocks were damaged in World War II, grew more

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[3] As a first order approximation, the annual arithmetic mean equals the compound growth rate plus one-half the standard deviation of the annual growth rates.

rapidly than the United States, Switzerland and Australia all of which avoided war-related domestic destruction.

The results for the second group are more heterogeneous reflecting the fact that growth in some countries like Peru and Venezuela has stalled for reasons not fully understood, while in others like South Korea and Taiwan there has been rapid convergence. Despite the heterogeneity, however, the average growth rates of 2.32% for the sample period beginning in 1923 and 2.79% for the sample period beginning in 1960 are close to the averages for the first group of countries.

The averages reported in Table 1 are simple averages. If the growth rates for the first group of countries are weighted by market capitalization, the average falls to about 2.0% in both periods because of the predominant role of the United States. Giving the U.S. a higher weight is reasonable not only because of its large market capitalization, but because it is the economy closest to steady state. Given the long period of time since the Second World War, it is reasonable to assume that all the countries in the first group will have converged to steady state growth going forward. For that reason, they are likely to grow at rates more comparable to the historical experience of the United States, rather than at their own historical rates. This suggests that 2% real per capita growth, which exceeds recent U.S. growth rate by 0.5%, is the most that investors can reasonably expect in the long run going forward. Furthermore, whereas growth could be stalled by a catastrophe, such as another world war, the speed of technical innovation has proven virtually impossible to meaningfully accelerate. In the remainder of this paper, therefore, 2% is used as the estimate of future per capita GDP growth. This number should be thought of as an achievable, but not necessarily expected outcome.

Aside from the possibility of a catastrophe, there are two additional reasons why 2% may prove to be an optimistic growth forecast. First, national income accounting does not deduct costs associated with pollution and environmental degradation in the calculation of GDP. Whereas, those costs have been a tiny fraction of GDP in the past, there is widespread concern that they are growing rapidly. If that is so, properly accounting for these costs will reduce the future growth rate of GDP per capita. Second, it is far from clear that the historical rate of technological innovation is sustainable. Weil (2009, p. 260) notes that over the period from 1950 to 2005 the rate of growth of real per capita GDP attributable to technological progress remained largely constant, but in that period of time the number of researchers in the G-20 countries grew from 251,000 to 2.6 million. This suggests a declining marginal product of research as finding and applying new discoveries becomes more difficult. If this trend continues, it could lead to falling rates of growth in GDP per capita.

3. Population Growth

The opportunities available to businesses depend on total economic activity, not per capita output. To see why, consider a hypothetical example involving an economy for which technological innovation and, therefore, productivity growth are zero but which is experiencing five percent population growth. Firms providing goods and services in this economy will, on average, experience five percent growth in real revenues. Assuming that their margins remain constant this translates into a five percent growth in real earnings. Of course, in a dynamic economy, existing firms could lose business to new start-ups resulting in possible dilution for existing investors, but that is a separate issue which is addressed in section. For firms in the aggregate, real earnings should be tied to real GDP as data presented below reveals is the case.

Converting per capita growth to aggregate growth requires adding an estimate of population growth. Fortunately, population growth rates are even more slowly changing and more predictable than growth rates of real per capita GDP.

Data on population growth for the sample countries are reported in Table 2. The first column presents historical growth rates from 2000 to 2007 taken from the CIA World Fact Book. The second column presents United Nations forecasts of population growth rates over the period from 2005 to 2010. The fact that the two columns are very similar reflects the slowly changing nature of population growth.

The data in Table 2 are consistent with the widely documented fact that population growth is negatively correlated with GDP per capita.[4] The average population growth rate for the first group of countries is less than half that for the second group. Even for the second group, however, both the average historical growth rate and the average projected future growth rate are less than 1%. Presumably as GDP per capita continues to rise, these growth rates will decline further.

On the basis of the data presented in Table 2, population growth can be expected to add no more than 1% to the growth rate in GDP per capita. In fact, assuming a long-run future growth rate of zero would not be unreasonable for the developed countries. Given real per capita growth of 2%, this implies that investors cannot reasonably expect long-run future growth in real GDP to exceed 3%.

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[4] See, for example, Weil (2009), chapter 4.

4. Earnings and GDP

It is earnings, not GDP, that is the fundamental source of value for equity investors. The fact that long-run real GDP growth is reasonably bounded at 3% does not necessarily mean that the same is true of earnings. It depends upon whether the ratio of earnings to GDP is stationary. To test that hypothesis requires data on aggregate earnings.

In the United States, there are two primary measures of aggregate earnings. The first is derived from the national income and product accounts, henceforth NIPAs, produced by the Bureau of Economic Analysis. The NIPAs contain an estimate of aggregate corporate profits based on data collected from corporate income tax returns. The second measure of aggregate earnings is derived by Standard & Poors from data collected from corporate financial reports. Because the two measures are not identical, it is important to distinguish what is included in each before using the data.

The NIPAs profit measure is designed to provide a time series of the income earned from the current production of all U.S. corporations. The sample is not limited to publicly traded companies. The tax rules on which the NIPAs are based are designed to expedite the timely and uniform completion of corporate tax returns. For that reason, a highly uniform set of rules is used across all corporations in tax accounting.

Because the NIPAs are designed to measure economic activity associated with current production, the NIPA definition of corporate profits includes only receipts arising from current production, less associated expenses. The NIPA definition therefore excludes transactions that reflect that acquisition or sale of assets or liabilities. Dividend receipts from domestic corporations are also excluded from receipts to avoid a double-counting of profits. For the same reason, bad debt expenses and capital losses are also excluded.

The Standard and Poors' estimate of aggregate earnings is derived from reported financial statements. Rather than being based on a unified set of tax-based rules, financial accounting is based on Generally Accepted Accounting Principles (GAAP) which is designed to allow management to tailor financial statements in a fashion that reveals information which is useful for a particular company. Furthermore, financial accounting provides for depreciation and amortization schedules that allow companies to attempt to match expenses with the associated stream of income.

The aggregate earnings data available from Standard and Poor's is for the S&P 500 companies. Each year's data consist of the aggregate GAAP after-tax earnings for the 500 companies in the S&P 500 index for that year. Thus, the sample of companies in the aggregate is constantly changing as the index is updated. Because the S&P 500 earnings reflect a shifting sample of corporations, the series of reported earnings can be discontinuous over time. Fortunately, given the size of the index these discontinuities are small and have little impact on estimated earnings growth.

The differences between financial and tax accounting create two dissimilarities between the measures of earnings for the same companies.[5] First, intertemporal differences arise because of the timing of revenue and expense recognition often differs between the two systems. The best example is depreciation because tax rules generally allow for more rapid depreciation than companies choose to report under GAAP. Second, permanent differences exist because the revenues and expenses recognized under the two systems are not the same. While important in the short-run, these differences tend to cancel out over

[5] For further details on the relation between reported earnings and NIPA profits see Mead, Moulton and Petrick (2004).

long horizons, so that long-run growth rates in the two measures are similar. For example, the average growth rate in NIPA real corporate profits over the period from 1947 to 2008 was 3.23% compared to a growth rate of 3.17% in S&P real aggregate earnings.

To examine the behavior of the ratio of earnings to GDP, Figure 2a plots after-tax corporate profits from the NIPAs as a fraction of GDP for the period from 1947 to 2008. The figure reveals that there is no trend overall. The fraction is approximately the same at the end as at the beginning so that the growth rate of corporate profits is almost identical to that of GDP. The same is largely true of S&P aggregate earnings as a fraction of GDP which is plotted in Figure 2b. Figure 2b is normalized to start at 8.23% to facilitate comparison with Figure 2a. The actual fraction for the S&P earnings is smaller because the S&P measure is less comprehensive. Unlike the NIPA data, there is a slight downward trend in the S&P ratio, reflecting the fact that as the economy has grown the S&P 500 companies have become a progressively smaller fraction of total earnings. Taking account of that fact, the data are generally consistent with the hypothesis that over the long run aggregate earnings are a stationary fraction of GDP. Certainly, there is no evidence of a persistent increase in the ratio no matter which measure of earnings is chosen. This implies that the long-run growth rates of GDP place a limit on the long-run growth rate in earnings.

Though the data largely support the hypothesis that the earnings-GDP ratio is stationary, it is far from constant. Figure 2a shows that corporate profits vary between 3% and 11% of GDP. The variability of the ratio for S&P earnings is even greater. This variation in the ratio implies that when earnings are low relative to GDP they grow more quickly with the reverse occurring when earnings are relatively high. It is this mean reversion that in the growth rate of earnings that maintains the stationarity of the earnings to GDP ratio.

It should be noted that in an efficient market, the mean reversion in earnings growth would have no impact on stock returns because it would be impounded into current prices. However, Campbell and Shiller (1998) provide evidence that long-run average earnings are, in fact, predictive of future stock returns. Specifically, when the ratio of price to the average earnings over the previous 10 years is high, future stock returns tend to be low and the reverse is true when the ratio is low. This suggests that the market does not fully account for the mean reverting nature of long-run earnings growth.

The fact that the ratio of aggregate earnings to GDP is stationary implies that investors can expect aggregate real earnings growth to match, but not exceed, real GDP growth in the long run. Unfortunately, the same is not true of the earnings to which current investors have a claim. There are two reasons for this discrepancy.

First, an investor's pro rata portion of a company's earnings will be affected by company share issuances and repurchases. If this dilution (or accretion) is on-going, growth in aggregate earnings and earnings per share will diverge. Second, and more importantly, current investors do not participate in the earnings of new businesses unless they dilute their current holdings to purchase shares in start-ups. This drives a wedge between the growth in aggregate earnings and the growth in the earnings to which current investors have a claim.

To illustrate the second effect, consider a simple example in which all companies in the economy are identical and earn $10 per share per period. Furthermore, assume that each company has a market value of $100 per share and has 1,000 shares outstanding. All earnings are paid out, so the values of the companies remain constant. Finally, assume that at the outset there are only two companies in the economy so that aggregate earnings are $20,000. If a current investor holds 1% of each company, his pro rata share of aggregate earnings is $200. Now assume that the economy grows and a third company is started. As a result, aggregate earnings rise to $30,000, but the current investor does not participate in that growth. He still holds 1% of the first two companies with rights to earnings of $200. To add the third company to his portfolio, without investing new cash, the current investor would have to dilute his holdings of the first two companies. After the dilution, the investor would hold 0.67% of each of the three companies and, thereby, still have rights to earnings of $200. Thus, the growth in earnings experienced by the current investor does not match the growth in aggregate earnings.

Bernstein and Arnott (2003) suggest an ingenious procedure for estimating the combined impact of both effects on the rate of growth of earnings to which current investors have a claim. They note that total dilution on a market-wide basis can be measured by the ratio of the proportionate increase in market capitalization to the value weighted proportionate increase in stock price. More precisely, each period net dilution is given by the equation,

Net dilution = (1+c)/(1+k) – 1,

where c is the percentage capitalization increase and k is the percentage increase in the value weighted price index. It should be noted that this dilution measure holds exactly only for the aggregate market portfolio. For narrower indexes, the measure can be artificially affected if securities are added to or deleted from the index.

To account for the impact of dilution, the Bernstein-Arnott measure was estimated using monthly data for the entire universe of CRSP stocks over the period from 1926 to 2008. There is one problem with using the CRSP data for this purpose. The CRSP universe was expanded twice during the sample period: in July 1962 when Amex stocks were added and in July 1972 when Nasdaq stocks were added. Both these additions caused significant increases in market capitalization not accompanied by a corresponding increases in the value weighted price. To eliminate the impact of these artificial discontinuities, the estimate of net dilution is set equal to zero for both July 1962 and July 1972.

Figure 3 plots the compounded estimate of net dilution from 1926 to 2008. It rises continuously except for downturns in the early 1990s and in 2006-2008. The average rate of dilution over the entire period is 2.0%. The primary source of dilution is the net creation of new shares as new companies capitalize their businesses with equity. The impact of start-ups is not surprising in light of the fact that more than half of economic growth in the United States comes from new enterprises, not the growth of established businesses. Given the continuing importance of new start-ups, there is no reason to believe that the rate of dilution will subside unless the rate of innovation slows. However, if the rate of innovation slows, GDP growth will also decline. Consequently, it is reasonable to conclude that rate of growth of earnings, net of dilution, will remain largely constant. It follows that in order to estimate the growth of rate of earnings to which current investors have a claim, approximately 2% must be deducted from the growth rate in aggregate earnings.

Putting the pieces together, growth theory predicts that current investors should count on a long-run growth in real earnings of no more than 1%. This equals real growth of 3% in aggregate earnings adjusted downward by 2% to account for dilution.

In their work, Arnott and Bernstein (2002) and Bernstein and Arnott (2003, p. 49) observed that "earnings and dividends grow at a pace very similar to that of per capita GDP." This observation correctly summarizes U.S. history, but it may not be true for other countries and it may not hold for the U.S. going forward. In terms of the analysis presented here, the reason that earnings and dividends mirror per capita GDP is that population growth and dilution have both been about 2% in the period between 1870 and 2008. Consequently these two terms cancel each other when moving from estimated growth in real per capita GDP to estimated growth in real earnings per share. However, there is no theoretical reason why this cancellation should necessarily occur. For instance, population growth in Western Europe has fallen essentially to zero. If the United States were to follow suit in that regard, but dilution were to continue at about 2% per year, growth in real earnings would be two percentage points *less* than growth in per capita GDP. In short, the Arnott-Bernstein observation is a short-cut that has historically held in the United States, but is not a necessary condition. Therefore, a more complete analysis that takes account of both population growth and dilution is generally preferable. That analysis is not presented here because of limitations on dilution data for countries other than the United States.

5. Implications for Economic Growth Theory for Expected Stock Returns

The story thus far is that economic growth places a limit on the long-run growth of real earnings per share available to investors. Based on the data analyzed here, that limit is what many investors might consider to be a relatively anemic 1%. The next step is to explore the implications of that limitation for future returns on common stocks.

By definition, the rate of return on stock in period t is given by

$$R_t = D_t/P_{t-1} + GP_t \,, \qquad (2)$$

where D_t is the dividend for year t, P_{t-1} is the price at the end of year t-1, and $GP_t = (P_t-P_{t-1})/P_{t-1}$. Following Fama and French (2002), equation (2) can be written in terms of long-run average values, denoted by A(), as

$$A(R_t) = A(D_t/P_{t-1}) + A(GP_t). \quad (3)$$

Equation (3) states that the long-run average return, equals the average dividend yield plus the average capital gain.

Equation (3) holds ex-ante as well as ex-post. It implies that the long-run future average return equals the future average dividend yield plus the future average capital gain. Assuming that the earnings price ratio is stationary, the long-run average earnings growth rate, $A(GE_t)$ can be substituted for the average capital gain rate giving,

$$A(R_t) = A(D_t/P_{t-1}) + A(GE_t). \quad (4)$$

The analysis in the preceding sections implies that $A(GE_t)$ in equation (4) should be no more than about 1% going forward. In addition, as of December 2008 the current dividend yield was 3.1% and the previous fifty-year average was 3.3%. Because the two are nearly equal, substituting either into equation (4) as a proxy for the future average yield implies that investor should not expect long-run real returns on common stocks to much exceed 4%. It is worth stressing that this calculation does not need to be adjusted for repurchases, because the impact of repurchases is already accounted for in the dilution calculation. Only if future repurchases are expected to exceed their past average is an adjustment required.

Equation (4) can also be used to approximate the equity risk premium. Because the real return on short-term government securities has averaged about 1% over the last 80 years, equation (4) implies that the equity risk premium measured with respect to short-term government securities turns out to be approximately equal to the expected average dividend yield. Using either the current yield or the past average yield, this translates into a long-run average equity risk premium of just over 3%. If the premium is measured with respect to longer maturity government securities with greater expected real returns, the equity premium is commensurately less. This result is markedly less than the average historical risk premium measured over the period beginning in 1926 that is commonly referenced. However, it is consistent with a long running body of empirical work that provides evidence that the ex-ante risk premium is significantly smaller than the historical average.[6]

Thus far, all the results have been stated in terms of compound growth rates. For many purposes, however, the object of interest is the annual expected return. For example, discounted cash flow valuations typically required annual estimates of the discount rate. To convert compound growth rates, which are geometric averages, into arithmetic averages requires taking account of the variance effect. This can be well approximated by adding one-half of the annual variance of returns to the compound growth rate.

Because earnings are volatile, the variance effect adds about 1% to the compound growth rates. This means that the growth theory approach implies that future annual real returns on common stocks should average no more than about 5% and that the annual equity risk premium over short-term government securities is about 4%.

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[6] Contributions in this area include, among many others, Rozeff (1984), Ross, Brown and Goetzmann (1995), Claus and Thomas (2001), Fama and French (2002) and Cornell and Moroz (2009).

Using annual data it is also possible to tie the growth theory analysis to the long-run performance of investments undertaken by companies. If a firm retains a fraction, b, of its earnings and invests those funds at a real rate of return, k, then basic finance theory teaches that the earnings per share will grow at the rate b*k. Growth theory predicts that the annual long-run average growth in real earnings per shares is about 2% per year, taking account of both dilution and the variance effect. Over the years, from 1960 to 2008 firms in the S&P 500 retained, on average, 54% of their earnings. Solving for k, this retention ratio implies a real return on corporate investments of about 4%.

There is one possible added adjustment to the foregoing results. Recall that the dilution calculation was based on the assumption of a stable repurchase rate throughout the sample period. In fact, repurchases accelerated following the passage in 1982 of SEC Rule 10b-18, which greatly reduced the legal risk associated with repurchases. More specifically, there has been a pronounced trend toward repurchases as the preferred form of marginal payout to shareholders. Brav, Graham, Harvey and Michaely (2005) report that following the SEC ruling managers began behaving as if there is a significant capital market penalty associated with cutting dividends, but not with reducing repurchases. Accordingly, dividends are set conservatively and repurchases are used to absorb variation in total payout. To the extent that this reliance on repurchases is expected to continue, the 2% dilution effect estimated previously might be too large and growth rates would have to be adjusted up accordingly. However, most of the 2% dilution is associated not with the actions of existing firms, but by start-ups financing their businesses with new equity. As a result, the adjustment in the overall rate of future dilution should not be large.

6. International Considerations

Thus far the analysis has been limited to the United States. This is an obvious shortcoming because most major corporations are becoming increasingly global. While a detailed examination of international data are beyond the scope of this paper, there are several general conclusions that can be drawn. First, with respect to the other developed countries, the data presented in Table 2 imply that real GDP per capita growth rates for the other developed countries should be comparable to the U.S. growth rate going forward. Second, for the other developed countries population growth rates are forecast to be lower. As a result, the implied limitations on earnings growth remain largely unchanged, and are perhaps even lower, when other developed countries in addition to the United States are included in the sample. Third, with respect to the developing countries, particularly India and China which are the most important by virtue of their size, convergence predicts that they will experience higher growth rates in real GDP per capita than the United States. In addition, most developing countries are forecast to have comparable or higher population growth rates than the United States. This implies that companies doing business in the developing world will potentially experience higher rates of earnings growth than observed in the developed world. Nonetheless, as those countries develop both real GDP and population growth rates should decline. Furthermore, currently the fraction of total earnings attributable to business in the developing world is relatively small for most companies. As a result, if a complete analysis were done on a global basis the earnings bounds derived from U.S. data and the related predictions regarding stock returns are unlikely to be affected markedly.

7. Conclusions

The long-run performance of equity investments is fundamentally linked to growth in earnings. Earnings growth, in turn, depends on growth in real GDP. This article demonstrates that both theoretical and empirical work in development economics imply that there are relatively strict limits on future growth. In particular, real GDP growth in excess of 3% in the long run is highly unlikely in the developed world. In light of on-going dilution in earnings per share, this fact implies that investors should anticipate real returns on U.S. common stock to average no more than about 4 to 5% in real terms going forward. Although more work needs to be done before equally definitive predictions can be made with respect to international equities, the basic outlook appears to be quite similar.

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Table 1: Real Growth Rates in Per Capita GDP

Country	1923-2006	1960-2006
Australia	1.85%	2.16%
Austria	2.53%	2.76%
Belgium	2.11%	2.62%
Canada	2.22%	2.27%
Denmark	1.97%	2.11%
France	2.28%	2.51%
Germany	2.41%	2.23%
Italy	2.57%	2.98%
Japan	3.11%	3.86%
Netherlands	2.01%	2.35%
Spain	2.30%	3.42%
Sweden	2.50%	2.25%
Switzerland	1.63%	1.51%
United Kingdom	1.95%	2.15%
United States	1.42%	1.14%
Average	2.19%	2.42%
Argentina	1.10%	1.16%
Brazil	2.68%	2.34%
Chile	1.95%	2.47%
Colombia	2.18%	2.24%
Egypt	1.45%	3.09%
Finland	2.91%	2.92%
Greece	2.77%	3.23%
Iceland	3.24%	2.87%
India	1.74%	2.88%
Indonesia	1.81%	3.08%
Korea	3.55%	5.72%
Malaysia	1.91%	2.14%
Mexico	2.70%	4.16%
New Zealand	1.51%	1.36%
Norway	2.86%	3.01%
Peru	1.44%	0.97%
Philippines	1.32%	1.46%
Portugal	2.75%	3.43%
S. Africa	1.53%	1.01%
Singapore	3.33%	5.72%
Sri Lanka	1.93%	3.06%
Taiwan	3.78%	6.24%
Turkey	2.75%	2.40%
Uruguay	2.19%	2.24%
Venezuela	2.54%	0.45%
Average	2.32%	2.79%

Table 2: Historical and Projected Population Growth Rates

Country	**Historical: 2000-2007**	**Projected: 2005-2010**
Australia	1.22%	1.01%
Austria	0.06%	0.36%
Belgium	0.11%	0.24%
Canada	0.83%	0.90%
Denmark	0.30%	0.90%
France	0.57%	0.49%
Germany	-0.04%	-0.07%
Italy	0.00%	0.13%
Japan	-0.14%	-0.02%
Netherlands	0.44%	0.21%
Spain	0.10%	0.77%
Sweden	0.16%	0.45%
Switzerland	0.33%	0.38%
United Kingdom	0.28%	0.42%
United States	0.88%	0.97%
Average	0.34%	0.48%
Argentina	1.07%	1.00%
Brazil	1.23%	1.26%
Chile	0.91%	1.00%
Colombia	1.41%	1.27%
Egypt	1.68%	1.76%
Finland	0.11%	0.29%
Greece	0.15%	0.21%
Iceland	0.78%	0.84%
India	1.58%	1.46%
Indonesia	0.18%	1.16%
Korea	0.27%	0.33%
Malaysia	1.74%	1.69%
Mexico	1.14%	1.12%
New Zealand	0.97%	0.90%
Norway	0.35%	0.62%
Peru	1.26%	1.15%
Philippines	1.99%	1.72%
Portugal	0.31%	0.37%
S. Africa	0.83%	0.55%
Singapore	1.14%	1.19%
Sri Lanka	0.94%	0.47%
Taiwan	0.24%	0.36%
Turkey	1.01%	1.26%
Uruguay	0.49%	0.29%
Venezuela	1.50%	1.67%
Average	0.94%	0.96%

Figure 1: Logarithm of Real GDP per Capita 1802-2008

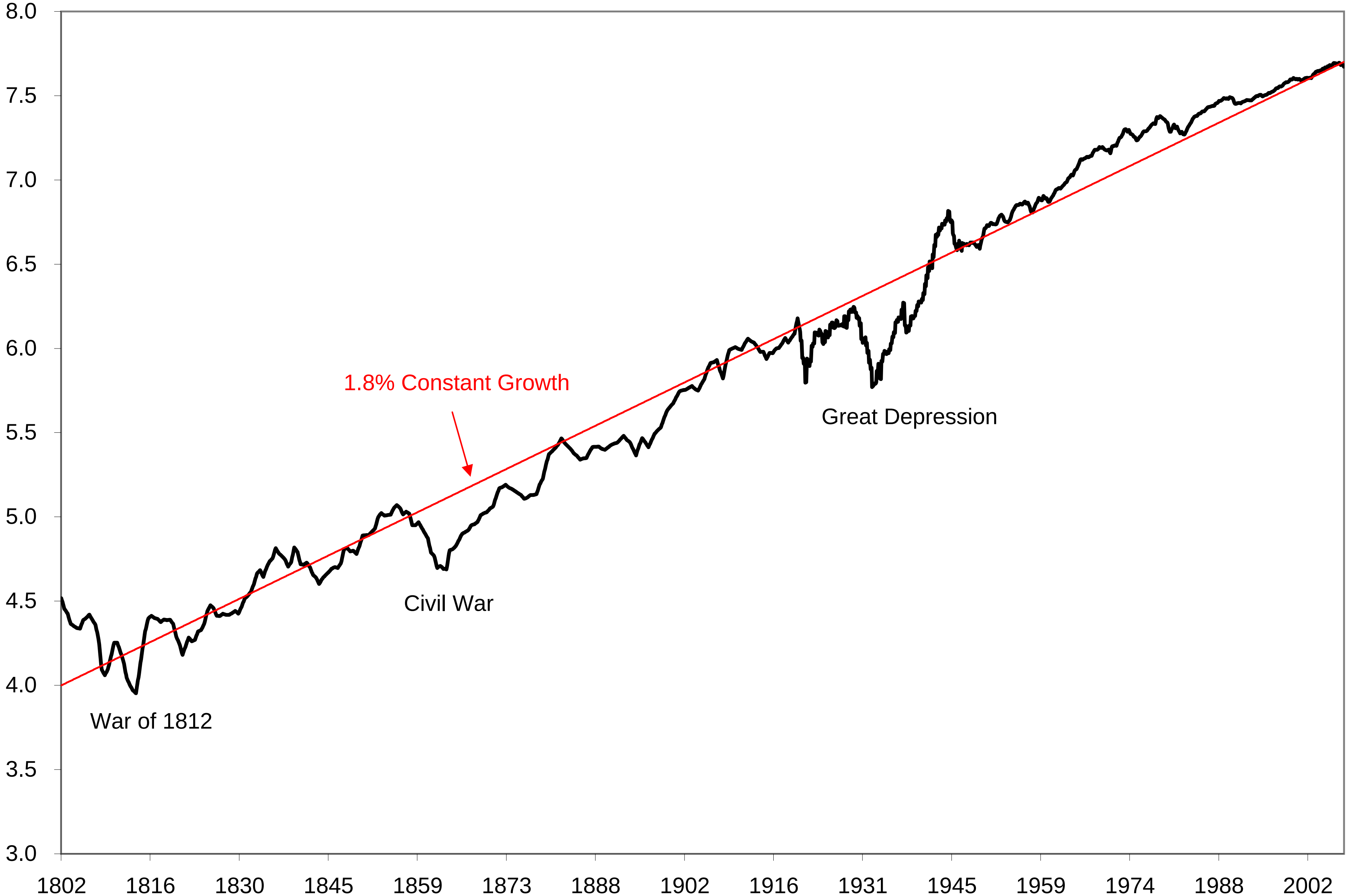

Figure 2a: Corporate Profits as a Percent of GDP 1947-2008

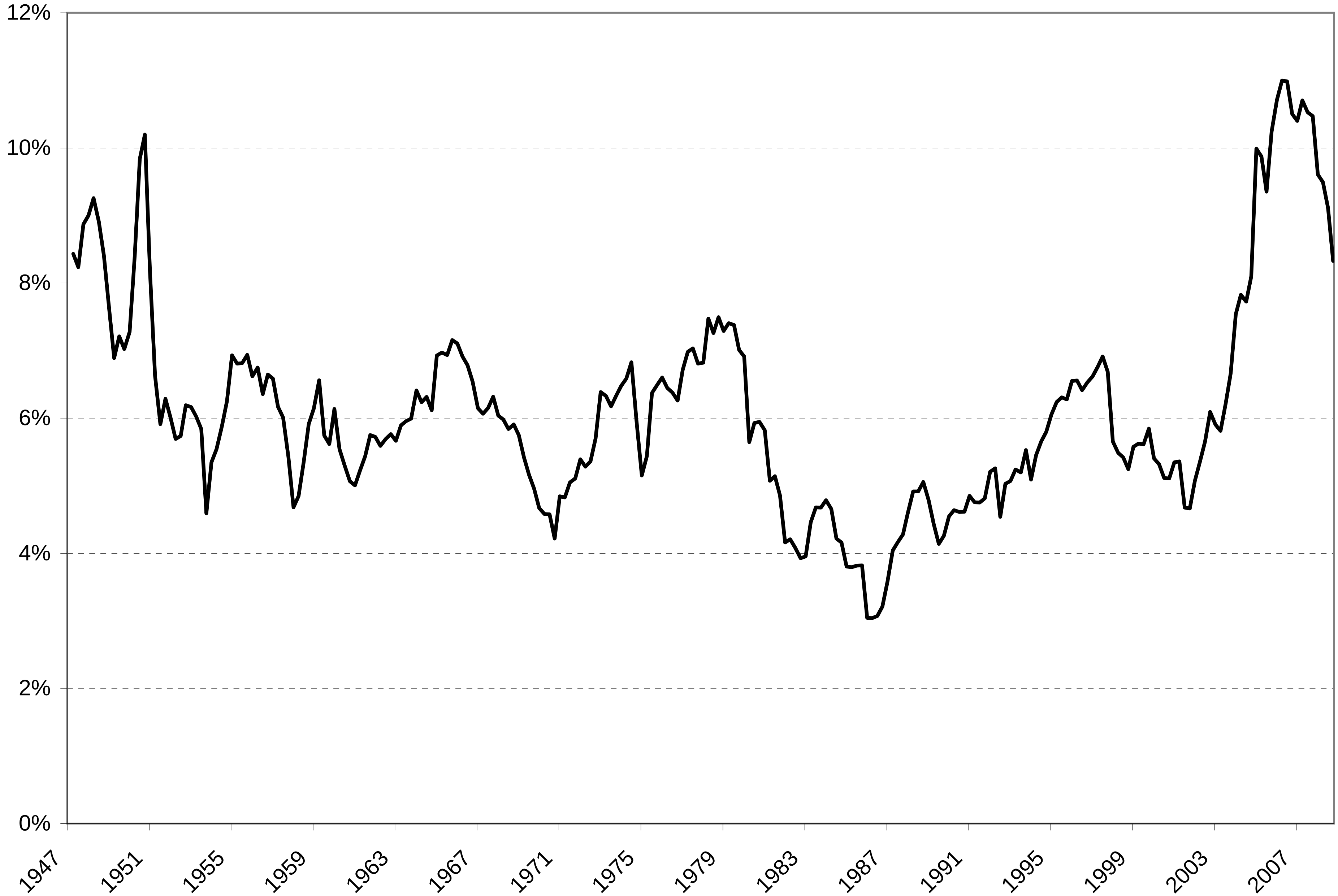

Figure 2b: Standard and Poors' Earnings as a Fraction of GDP 1947 to 2008

Figure 3: The Impact of Dilution on Investor Earnings 1926-2008