Asset Returns and Economic Growth

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Abstract

We in America are probably facing a demographic transition—a slowdown in the rate of natural population increase—and possibly facing a slowdown in productivity growth as well. If these two factors do in fact push down the rate of economic growth in the future, is it still prudent to assume that the past performance of assets is an indication of future results? We argue "no." Simple standard closed-economy growth models predict that growth slowdowns are

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likely to lower the marginal product of capital, and thus the long-run rate of return. Moreover, if you assume that current asset valuations represent rational expectations, simple arithmetic tells us that it is next to impossible for past rates of return to continue through a forthcoming growth slowdown. Only a large shift in the distribution of income toward capital or current account surpluses larger than those of nineteenth century Britain sustained for generations give promise for reconciling a slowdown in future economic growth with a continuation of historical asset returns.

I. Introduction

Projections of rates of return on capital in general, and equity in particular, play important roles in economic policy debates. Opinions on many policy issues substantially depend on whether historical rates of return—especially the 6.5% or so average real realized rate of return on equities—are likely to persist. We are probably undergoing a transition from a twentieth century in which the American population's rate of natural increase was high to a twenty-first century in which many suspect that fertility will be at or near zero-population-growth levels. And some (although definitely not Robert Gordon (2004)) are projecting a slowdown in productivity growth. The Social Security Administration, for example, sees economy-wide labor productivity growing at only 1.6% per year in 2011 and thereafter. But between 1990 and 2004 economy-wide productivity growth grew at 2.2% per year.

We are somewhat skeptical of forecasts of slowing population growth. We cannot forecast natural increase. In most futures we can think of, the world in 2050 or 2100 contains a great many people outside the U.S. whose productivity would be amplified if they were able to move to the U.S., and so we suspect that for at least the next century immigration will play as large a role in America's future than it has in its past. We are somewhat skeptical of forecasts of persistent productivity slowdowns as well, for the reasons set out by Gordon (2004), Oliner and Sichel (2003), and Kremer (1993). Nevertheless, we believe that *if* such forecasts of slowed real GDP growth come to pass, *then* returns to capital and particularly returns to equity are highly likely to be significantly below past historical averages. In our view, the links between asset returns and economic growth are likely to be relatively strong: the arithmetic of payout yields, investment, and capital stock growth rates; the algebra of capital accumulation and the production function; and the standard analytical models economists use as their finger exercises all suggest this.

We make our case in seven additional sections that follow this introduction. Section II lays out what we see as the major issues. Section III discusses how arithmetic tells us that rates of return and rates of growth are linked: starting from where we are now, we find it arithmetically very difficult to construct scenarios in which asset returns are at their historic average values and real GDP growth is markedly slowed.

Section IV discusses how the algebra of the production function and capital accumulation suggests that rates of return and rates of growth are linked. And section V analyzes the standard very simple aggregate economists use for their finger exercises, and finds that they too lead us to not be surprised by a positive relationship between economic growth and asset returns.

Section VI turns to the most interesting possibility for escape. In the late nineteenth century slowed growth in the British economy was accompanied by no reduction in returns on British assets as Britain exported capital on a scale relative to the size of its economy never seen before or since (see Edelstein (1973)). Could the U.S. follow the same trajectory? Yes. Is it likely to? Not without a huge boost to national savings.

In section VII we turn to a brief analysis of the equity premium. Once one has conditioned on the level of the capital-output ratio, returns on balanced portfolios in the long run depend only on the physical return to capital and the margins charged by financial intermediaries.[2] They do not depend on the equity premium and the price of risk. But much argument and some analysis of the dilemmas of America's social insurance system points to the large historical value of the equity return premium in America and sees this as a potential source of excess returns.

Section VIII provides our conclusions. We conclude that *if* economic growth over the next century falls as far as forecasts like those contained in the Social Security *Trustees Report* (2005) are envisioning, *then* it is possible but not likely that asset returns will match historical experience. If the stock market today is significantly overvalued and about to come back to earth, if the distribution of income undergoes a significant shift away from labor and toward capital, or if the United States massively boosts its national savings rate and runs surpluses on the relative scale of pre-World War I Britain for more than twice as long as Britain did—then a growth slowdown need not entail a significant reduction in asset returns. But these seem to us to be possible scenarios, not the central tendency of the distribution of possible futures that is a real economic forecast.

Economic growth and asset returns are linked. Falls in growth rates are very likely to be accompanied by declines in asset returns. These declines in asset returns that are likely to be larger if the fall in growth comes from a productivity slowdown than from a population growth slowdown. But we would be very surprised if future growth in either productivity or population were slower than in the past and yet asset returns in the future matched those of the past.

[2] However, attitudes toward risk do affect the long-run capital-output ratio.

II. The Issues

Projections of rates of return on capital in general, and equity in particular, have come to and will continue to play a major role in economic policy debates. The key question in such discussions is whether historical rates of return—especially the 6.5% or so average real realized rate of return on equities—are likely to persist into the future. We are probably undergoing a major demographic transition from a twentieth century in which the American population's rate of natural increase was high to a twenty-first century in which many suspect that fertility will be at or near zero-population-growth levels, and in which the bulk of population growth is likely to come from immigration. From 1958 to 2004 hours worked grew at 1.6% per year as the entrance of baby-boomers—male and female—and their successors into the labor force vastly outweighed a decline in average hours. The Social Security Administration is currently projecting that hours worked will grow at only 0.3% per year form 2015 on (SSA (2005)).

In addition, some forecasters are projecting a slowdown in productivity growth. The Social Security Administration sees economy-wide labor productivity growing at only 1.6% per year in 2011 and thereafter. But between 1995 and 2004, economy-wide labor productivity grew at 2.8%, between 1990 and 2004 at 2.2%, and between 1958 and 2004 economy-wide productivity grew at 1.9%.[3]

Thus less than a decade from now the forecasters at the Social Security Administration at least see a significant change: a fall of

[3] An alternative breakdown would distinguish 1958-73, during which economy-wide labor productivity growth grew at 2.6%; the productivity slowdown period of 1973-95, during which economy-wide productivity grew at 1.0%, and the post-1995 "new economy" period, during which economy-wide productivity growth has been 2.8%. Clearly an enormous amount depends on whether we interpret the 1973-95 productivity slowdown period as an anomalous freak disturbance to the economy's normal structure, or as just one of those things we can expect to see every half century or so.

1.3 percentage points per year in the rate of growth of labor input, and a fall of between 0.3 and 1.2 percentage points, depending on whether one takes the long 1958-2004 or the short 1995-2004 baseline, in labor productivity growth. The total growth slowdown forecast to hit in a decade or less is thus in the range of 1.6-2.5 annual percentage points.

What implications will this growth slowdown—if it comes to pass—have for asset values and returns? One position, taken implicitly by the Social Security Administration and explicitly by others, is that there is no reason to expect asset returns to be lower in the future. Economic growth, after all, is determined by productivity growth and labor force growth in the United States. Asset returns are determined by time preference, the marginal utility of wealth as it declines over time, and attitudes toward risk. Why should these be connected?[4] Thus, we here, past asset performance is still the best guide to future returns.

We take a contrary position. Yes, safe asset returns are equal to the marginal utility of savings, stock market returns are safe asset returns plus the cost of bearing equity risk, and the United States is part of a world economy. Yes, economic growth is equal to productivity growth plus labor force growth. But only in the case of a small open economy are asset returns determined independently of the rate of economic growth. In a closed or in a large open economy, they will be linked.

Perhaps an analogy will be helpful. In international trade, the trade balance is the difference between exporters' ability to sell abroad and home demand for imports. In international finance, the trade balance is the difference between national saving and national investment. How can this be? Why should a change in exporters' success at marketing abroad change either national savings or national investment? Great confusion has been caused throughout

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[4] Council of Economic Advisers (2005).

international economics over how, exactly, to think of the connection. We believe that claims that national growth is unconnected with asset returns are a similar failure to grasp the whole problem.

This is an especially important issue to get straight now because it affects how one evaluates different approaches to social insurance. The relative attractiveness of pay-as-you-go versus prefunded social-insurance systems depends to some degree on the gap between the return on capital r and the rate of real economic growth n+g—the sum of the rate of growth of employment n and the rate of growth of labor productivity g. The larger is the rate of economic growth n+g relative to the return on capital r, the more attractive do pay-as-you-go social-insurance systems become. When n+g approaches r, they appear to be cheap and effective ways of increasing social welfare by passing resources down from the (rich and numerous) future to the (poor and relatively small) present.

The larger is r relative to n+g, the greater are the benefits of prefunding social insurance systems. Prefunded systems can use high rates of return and compound interest to reduce the wedge between productivity and after-contribution real wages. They thus sacrifice the possibility of raising social welfare by moving wealth from the richer far future to the near future and the present, but in return they gain by reducing the social insurance tax rate and thus its deadweight loss.

To the extent that the political debate over the future of social insurance in America is conducted in the language of rational policy analysis, getting the gap between r on the one hand and n+g on the other hand right is important. Policies predicated on a false belief that r is much larger relative to n+g than it is will unduly burden the current and future young, and leave many disappointed when returns on assets turn out to be less than anticipated and prefunding leaves large unexpected holes in financing. Policies predicated on a false belief that n+g is higher relative to r than it in fact is pass up opportunities to lighten the overall tax burden and still provide near-equivalent income security benefits in the long run.

III. Arithmetic

Yields, Returns, and Economic Growth

Begin by considering the determinants of equity prices. And begin with the Gordon equation:

$$P = \frac{D}{r_e - g} \tag{1}$$

Where D are the dividends paid on a stock or an index, P is the corresponding price, r_e is the expected real rate of return *on equities*, and g is the expected permanent real growth rate of dividends.

By choosing to begin with this equity-pricing equation, we have already made a number of intellectual bets. By taking this r—the return on equities—as the variable of interest, we are implicitly assuming that there are no significant large or interesting shifts in the equity premium, and thus that changes in returns on equities will be associated with similar changes in returns on debt. We are also assuming that the stock market knows what it is doing: that current market prices do accurately discount what are (or perhaps what ought to be) expectations of future cash flows at what is (or perhaps what ought to be) the appropriate rate. These assumptions could be questioned. We will relax the assumption of a stable equity premium in section VII. And we will occasionally wonder whether the current market might be overvalued.

Under these maintained assumptions, however, we can move back and forth between different rates of return: things that raise or lower the return on stocks will also raise or lower the return on bonds and (after the capital stock has adjusted) the physical marginal product of capital as well.

Equation (1) can be inverted to solve for the expected real rate of return *on equities*:

$$(2) \qquad r_e = \frac{D}{P} + g$$

If the economy were on its long-run steady-state growth path and if P were the price of a broadly-diversified representative index of equities, the returns on the index could differ from the current dividend yield plus the growth rate of economy-wide corporate earnings for only two possible reasons:

- First, g would be less than the growth rate of economy-wide corporate earnings to the extent that those earnings are the earnings of newly-created companies that were not in the index last period. Corporate earnings are a return to entrepreneurship as well as capital, hence the rate of growth of economy-wide earnings will in general outstrip those of the earnings of the companies represented in a stock index.

- Second, dividends are not the only way firms pump cash to shareholders. Stock buybacks decrease the equity base, and thus push the rate of growth of the earnings on the index (as opposed to the earnings of the companies in the index) up.

It is convenient to think of both of these factors as affecting the payout ratio rather than the growth rate, and to replace (2) above with:

(3) $$r_e = \frac{D + B}{P} + g$$

where B are net share buybacks—buybacks less IPOs. Subtracting IPOs ensures that the ratio of total economy-wide earnings to the earnings of companies in the index does not grow. Adding gross buybacks takes account of the anti-dilution effects of narrowing the equity base of companies currently in the index.

Now comes the arithmetic:

Consider the 2005 *Trustees Report* of the Social Security System. The *Report* projects that 1.9 percent per year will be the average annual rate of long-run real GDP growth measured using the GDP deflator (Table V.B2). The *Report* projects that labor and capital shares remain constant in the long-run.[5] With a gap of 0.3 percentage points between between the CPI and the GDP deflator (Table V.B1), and with an auxiliary assumption that capital structures are in balance, this is a forecast that the variable g in the Gordon equation will be 1.6 percent per year.

Current dividend yields on the S&P 500 are 1.9% per year. Current net stock buybacks are 1.0% per year. Long-run dividend growth g is 1.6% per year. The sum of the three is 4.5% per year. That's the expected real rate of return r. That's significantly lower than the 6.5% real rate of return that is our historical experience with the American stock market.

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[5] The assumption of constant income share follows from the derivation of real wage growth from productivity growth, which is discussed on pages 85-88 of the *Trustees' Report*.

Possible Ways Out

Are there ways to escape from this arithmetic? Yes. The U.S. economy is not on a steady state growth path. Three potential ways out seem most worth exploring:

- Perhaps the distribution of world investment will shift in a way allowing U.S. companies to earn greater and greater shares of their profits abroad.

- Perhaps the stock market is currently overvalued, and will decline and so significantly raise payout yields.

- Perhaps payout growth will be unusually rapid in the near term before slowing to its long-term forecast trend rate of 1.6% per year.

Defer the first possibility—which we regard as the most interesting—to the "open economy" section later on in the paper, noting here only unless the U.S. runs a current-account surplus in the long run corporate earnings earmarked for U.S. residents in fact grow more slowly than U.S. real GDP.

The second possibility has been advocated by Peter Diamond (2000). The arithmetic does rely on the stock market knowing what it is doing: that there are no large windfall profits or losses out there to be reaped by those who have better, more rational expectations than the marginal trader. A decline in the stock market relative to the economy's growth trend of 40% would carry payout yields up to the 4.9% consistent with a long-run real return of 6.5% per year and real profit and dividend growth (on a CPI basis) of 1.6% per year. With an average CPI inflation rate of 2.5% and real profit and dividend growth of 1.6% per year, such a 40% decline relative to trend would require thirteen years of nominal stagnation in equity prices. Such a scenario is certainly possible: it was the stock market's experience between the late 1960s and the early 1980s. But we have a hard time seeing at as the central tendency of the distribution of possible futures.[6]

The third possibility requires what seems to us at least to be another unlikely scenario. If payouts—both dividends and net stock buybacks—were to grow rapidly over the next decade in order to validate a subsequent real growth rate of 1.6% per year and a current expected real return of 6.5% per year, the real payouts of the companies in the index would have to grow at an average of 8.6% per year. Over the past fifty years, the earnings on the S&P 500 have grown at an average rate of 2.1% per year. Once again, it could happen: perhaps we are in the middle of a permanent shift in the distribution of income away from labor and toward capital that would allow equity payouts to permanently double as a share of GDP over the next decade. But once again we regard this as a possible scenario, not as the central tendency of the distribution of possible futures.

Our view that such a boom in payouts is possible but not likely is reinforced by considering current price earnings ratios. Today's ratio of prices to properly-adjusted corporate earnings is approximately 19 (see Siegel (2005)). With earnings equal to 5.23% of share prices, the sum of dividend payouts, net buybacks, and investment financed by retained earnings must be 5.23% percent. Firms that have traditionally paid out roughly 60 percent of their accounting profits through dividends and buybacks and that rely on retained earnings to finance a substantial share of increases in their capital stocks have little room to massively expand payouts without massive earnings growth as well.

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[6]Moreover, no investment advisor who anticipates that real equity returns will average –0.6% per year over the next decade has any business suggesting that their clients shift their portfolio in the direction of equities. If the U.S. government is the advisor and relatively young future beneficiaries of Social Security are the clients…

A first approximation is that such companies have to make net investments out of retained earnings equal to roughly 1.9 percent of the value of their equity each year to maintain their 1.6 percent per year rate of earnings growth. If earnings are equal to 5.23% of the share price, this leaves an amount equal to 3.33% percent of the share price to be paid out to shareholders as dividends and buybacks. This gives a total return of 4.93% per year[7]—in the absence of supernormal returns on investments made out of retained earnings, or of accounting earnings that significantly understate true Haig-Simons economic earnings.

The arithmetic of earnings reinforces the arithmetic of payouts plus growth—as, indeed, it should.

Should this reduction in expected rates of returns on equity capital that the arithmetic tells us is coming (at least if the growth slowdown is as large as is currently being forecast) strike us as a surprise? Is there an underlying economic logic that would lead us to expect slower growth to bring lower rates of profit and returns on assets with it, or is this something that economists cannot successfully model? To explore these questions, we turn first to the algebra of the simple Solow growth model—in which savings and accumulation are mechanical—and then to analyzing the standard Ramsey and Diamond models.

IV. Algebra

Start with Robert Solow (1956): a constant-returns Cobb-Douglas production function with α as the diminishing-returns-to-capital parameter, and with Y, K, L, and E as aggregate output, the capital stock, the supply of labor, and the level of labor-augmenting technology, respectively:

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[7] Recall the wedge between the GDP deflator and the CPI.

(4) $$Y = K^{\alpha}\left(EL\right)^{1-\alpha}$$

Assume constant rates of labor force growth n, of labor-augmenting technical change g, of depreciation δ, and of gross savings-investment s. And recall that we can write the rate of return on capital as:

(5) $$r = \frac{\alpha Y}{K}$$

Note that this r is here a physical gross marginal product of capital. Only under the assumption of constant depreciation rates δ, constant financial markups, and a constant price and amount of risk is the mapping between the *gross* physical marginal product of capital r, the average *net* return on a balanced financial portfolio r_f, and the *net* return on equities r_e completely straightforward.

In the closed-economy case, in which all of domestic capital K is owned by domestic residents and in which all of national savings goes into increasing the domestic capital stock. Then we know that along a steady-state growth path of the economy:

(6) $$\frac{K}{Y} = \frac{s}{n + g + \delta}$$

This tells us that along any steady-state growth path:

(7) $$r = \alpha\left(\frac{n + g + \delta}{s}\right)$$

If permanent shocks that reduce n+g cause the economy to transit from one steady growth path to another, the rate of return on capital falls, with the change in r being:

(8) $$\Delta r = \left(\frac{\alpha}{s}\right)(\Delta n + \Delta g)$$

As long as α is greater than or equal to s—that is, as long as the economy is not dynamically inefficient—the reduction in r will be greater than one-for-one. From this algebra, we would expect the roughly1.5% reduction in the rate of real GDP growth that is being forecast by the Social Security Administration to carry with it a greater than 1.5 percentage point reduction in r.

These are steady-state results. How relevant are they for, say, the 75-year standard forecast horizon used in analyses of the Social Security system? In the Solow model, the capital-output ratio approaches its steady-state value at an exponential rate of $-(1-\alpha)(n+g+\delta)$: roughly 3.6% per year. That is a 1/e time of 28 years. After 75 years the capital-output ratio has closed 93 percent of the gap between its initial and its steady-state value.

In this simple Solow set-up, only three things can operate to prevent a permanent downward shock to n+g from reducing the rate of return on capital r. Perhaps the depreciation rate δ could fall. We have been unable to think of a coherent reason why a reduction in labor force growth n or labor productivity growth g should independently carry with it a reduction in the depreciation rate δ. (However, the reduction in r could plausibly carry with it an extension of the economic lives of equipment and buildings, and so carry with it a partially offsetting fall in δ that would moderate the decline in r.) Perhaps the production function could shift to increase the capital share of income α. We have been unable to think of a coherent reason why a reduction in labor force growth n or labor productivity growth g should independently carry with it a reduction in the depreciation rate α.

Last, perhaps a permanent downward shock to n+g could also carry with it a reduction in the savings rate s. If it were the case that:

$$(9) \qquad ds = -\left(\frac{s}{n+g+\delta}\right)(dn+dg)$$

then the rate of return r would be constant. There is a reason to think that a fall in the labor force growth rate n would carry with it a reduction in s: an economy with slower labor force growth is an older economy with relatively fewer young people and, presumably—if the young do the bulk of the savings—a lower savings rate. (A decline in g, however, would tend to work the other way: the income effect would tend to raise s.) Are such effects plausibly large enough to keep the rate of return on capital constant as the rate of economic growth? To assess that we need to model savings decisions, which requires that we move from algebra to analysis.

V. Analysis

The Ramsey Model

Move from Robert Solow (1956) to Ramsey-Cass-Koopmans (see Romer (2000). Consider a version of this Ramsey model in which the representative household has the utility function:

$$(10) \qquad \sum_{t=0}^{\infty}(1+\beta)^{-t}\left(U\left(C_t\right)\right)N_t^{1-\lambda}$$

Where β is the pure rate of time preference, C_t is consumption per household member, and N_t is the number of members of the representative household, growing according to:

$$(11) \qquad N_{t+1} = (1+n)N_t$$

In the standard Ramsey-model setup, the parameter λ is equal to zero: the household utility function is:

$$\text{(12)} \qquad \sum_{t=0}^{\infty}(1+\beta)^{-t}\big(U(C_t)\big)N_t$$

This choice drives the result that changes in labor-force growth do not have long-run effects on steady-state capital/output ratios or rates of return. But, to us at least, this assumption seems artificial. If it is indeed the case that the utility function is (12) above, then the more members of the household the merrier: household utility is linear in the number of people in the household but suffers diminishing returns in per-capita consumption. A household with this utility function that had control over its own fertility would choose to grow as rapidly as possible: that would be the way to make individual units of consumption contribute as much as possible to total household utility.

It seems reasonable to allow λ to be greater than zero, and so have a utility function which has diminishing returns both with respect to household per-capita consumption and with respect to household size.

There is another reason to be uncomfortable with the assumption that $\lambda=0$. If the term, “golden rule” were not already taken in the growth theory literature, we would use it here, for $\lambda=0$ requires that those household makers making decisions in period t love others (the new household members joining in period t+1) as they love themselves. They assemble the household utility function by treating the personal utility that others receive in the future from their per capita consumption as the equivalent of their own personal utility. But we can’t call this the “golden rule,” all we can do is call this *perfect familial altruism*. If $\lambda>0$ but less than one, there is *imperfect familial altruism*—those making period-t decisions care about the personal utility of extra family members in period t+1, but not as much as they care about their own. And if λ=1, period t decision-makers act as if they care only about their own personal utility. We are comfortable with altruism; we are uncomfortable with *perfect familial altruism:*

In this version of the Ramsey-Cass-Koopmans model, the first-order condition for the representative household's consumption-savings decision is:

$$(13) \qquad U'(C_t)dC_t = \frac{(1+n)^{1-\lambda}}{(1+\beta)}U'(C_{t+1})dC_{t+1}$$

If the household faces a net rate of return on financial investments of r_f, then:

$$(14) \qquad \frac{1+r_f}{1+n}dC_t = dC_{t+1}$$

because period t+1 resources must be split among more members of the expanded household.

For log utility, we then have:

$$(15) \qquad \frac{C_{t+1}}{C_t} = \frac{(1+n)^{1-\lambda}(1+r_f)}{(1+n)(1+\beta)}$$

Along the economy's steady-state growth path with per-worker consumption growing at the rate of labor augmentation g, this becomes:

$$(16) \qquad r_f = (1+g)(1+n)^{\lambda}(1+\beta) - 1$$

And in the continuous-time limit:

(17) $r_f = \beta + g + \lambda n$

Looking across steady-state growth paths, reductions in the rate of output per worker growth g reduce r_f one-for-one in the case of log utility. (They reduce r_f by a multiplicative factor γ of the change in g in the case of constant relative risk aversion utility: $U(C_t) = [(C_t)^{1-\gamma}]/[1-\gamma]$.) Reductions in the rate of labor force growth n also reduce r_f except in the case of *perfect familial altruism,* the case in which $\lambda=0$. If $\lambda>0$ but less than one, the case of *imperfect familial altruism*, slower rates of labor force reduce r_f, but not one-for-one. And if $\lambda=1$, period t decision-makers are not altruistic at all: they act as if they care only about their own personal utility, and reductions in n reduce r_f one-for-one, as reductions in g do in the case of log utility.

In the case of the Ramsey model, the fact that the model's dynamics attract it to a balanced-growth steady state and the assumption of the representative agent all by themselves nail down the relationship between economic growth and asset returns. In steady-state per capita consumption is growing at rate g, and so the relative marginal utility of per capita consumption one period in the future is:

(18) $(1+\beta)^{-1}(1+g)^{-1}$

in the case of log utility. And the rate at which per-capita consumption can be carried forward in time is:

(19) $(1+r_f)(1+n)^{-\lambda}$

To drive the rate of return on capital r_f away from:

(20) $r_f = (1+g)(1+n)^{\lambda}(1+\beta) - 1$

in a model with log utility and a rate of per-capita consumption growth of g requires that the consumption of those agents marginal in making the period-t consumption-savings decision grow at a rate different than per-capita consumption growth. This requires heterogeneous agents. And the simplest model with heterogeneous agents that is suitable is the Diamond model.

The Diamond Model

In the overlapping-generations Diamond model, each agent lives for two periods, works and saves when young, and earns returns on capital and spends when old. Thus for a given generation that is young in period t, their per-capita labor income when young w_t, their per-capita consumption when young c_{yt}, their per-capita consumption when old c_{ot+1}, the *net* rate of return on capital r_{t+1}, and the economy's period-t+1 per-capita capital stock k_{t+1} are all linked:

(21) $$w_t = c_{yt} + k_{t+1}$$

(22) $$c_{ot+1} = (1 + r_{t+1})k_{t+1}$$

With a Cobb-Douglas production function, output per (young) capita when the period-t generation are young—in period t—is:

(23) $$y_t = E_t^{1-\alpha}\left(\frac{k_t}{1+n}\right)^{\alpha}$$

where E is our measure of the efficiency of labor, growing at proportional rate g each period, and where the (1+n) appears in the denominator because n is the per-generation rate of population growth. With this production function, labor income is a constant fraction of output per capita:

(24) $w_t = (1-\alpha)y_t$

And the real return on capital will be the residual—capital income divided by the capital stock:

(25) $r_t = \frac{\alpha y_t}{k_t} = \alpha E_t^{1-\alpha} k_t^{\alpha-1}$

Once again time-separable log utility for our utility function:

(26) $U = \ln(c_{yt}) + \frac{\ln(c_{ot+1})}{1+\beta}$

And looking for steady-states in capital per effective worker by requiring that:

(27) $k_t = E_t k^*$

From this, we get the steady-state first-order condition:

(28) $\frac{1}{c_{yt}} = \frac{(1+r)}{(1+\beta)} \frac{1}{c_{ot+1}}$

And can solve the model by substituting in the budget constraint:

(29) $\frac{1}{\left[(1-\alpha)E^{1-\alpha}\left(\frac{k_t}{1+n}\right)^{\alpha} - k_{t+1}\right]} = \frac{(1+r)}{(1+\beta)} \frac{1}{(1+r)k_{t+1}}$

to get:

(30) $$\frac{1}{\left[\frac{1-\alpha}{1+g}\left(\frac{k*}{1+n}\right)^{\alpha} - k*\right]} = \frac{1}{(1+\beta)k*}$$

which leads us to:

(31) $$k* = \left(\frac{(1-\alpha)}{(1+g)(1+n)^{\alpha}(2+\beta)}\right)^{\left(\frac{1}{1-\alpha}\right)}$$

And, recalling that $r = \alpha k*^{\alpha-1}$:

(32) $$r = \left(\frac{\alpha(1+g)(1+n)^{\alpha}(2+\beta)}{(1-\alpha)}\right)$$

Analysis: Conclusion

Thus in the Diamond overlapping-generations model as well as in the Ramsey model and the Solow model, slower economic growth comes with lower net returns on capital r_f. In both the Diamond and the Ramsey model, there is reason to think that reductions in labor productivity growth have a greater effect on rates of return than do reductions in labor force growth, :

- In the basic Solow algebra, the reduction in gross returns r is proportional to (α/s) times the reduction in growth.

- In the Diamond model, the reduction in net returns r_f is equal to ($\alpha/(1-\alpha)$) times the reduction in labor productivity growth g and, to first order, equal to ($\alpha^2/(1-\alpha)$) times the reduction in labor force growth n.

- In the Ramsey model, the reduction in r_f is equal (with log utility) to the reduction in labor productivity growth g and, to first order, to λ times the reduction in labor force growth n (where λ is the degree to which familial altruism is imperfect).

At some level, the same thing is going on in all three setups—in the simple algebra of Solow and in the analyses of Ramsey and Diamond. Reductions in economic growth in these setups are all declines in the rate of growth of effective labor relative to the capital stock provided by previous investments. Effective labor becomes relatively scarcer, and capital becomes relatively more abundant. The terms of trade move against capital—and so the return to capital falls.[8]

These models say that there is some economic reason to believe that a slowdown in economic growth would carry a reduction in asset returns with it.

But even though these models are the standard models that economics graduate students and their professors use for their finger exercises. We are leery of putting too much weight on them. They are oversimplified. They are abstract. They are ruthlessly narrow in their conceptions of human motivation and institutional detail. Their relevance to the real world is something that is asserted by professors in economic theory courses—not something that has been successfully and convincingly demonstrated.

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[8] Why, then, does a fall in labor force growth not reduce rates of return in the Ramsey model in the case of perfect familial altruism? Because a reduction in population growth also reduces the utility value of moving consumption forward in time—an important component of the value of saving in the Ramsey model with perfect familial altruism comes from the possibility of dividing the saving among more people in the future and thus escaping the diminishing marginal utility of consumption. Thus the marginal household utility of saving falls in the Ramsey model when population growth falls. This reduces the effective supply of capital by as much as the fall in population growth reduces the effective supply of labor.

Therefore we tend to put more weight on the arithmetic than on the analysis. We believe in the flow of funds and in payout ratios and growth rates more than we believe in simple growth theory. It is, however, important to note that section III and sections IV and V of this paper have answered different questions. Section III asked whether, conditional on current asset valuations and on the rationality of financial markets, forecasts of slower growth arithmetically entailed forecasts of lower equity returns as well. Sections IV and V have asked the unconditional question: without conditioning current asset market valuations, what would we expect the relationship between growth and asset returns—an average of bond and stock returns—to be?

Moreover, the analysis of sections III-V has assumed a closed economy. How do the conclusions change when we consider an open United States economy embedded in a world that has the potential to grow more rapidly?

VI. The Open-Economy Case

Return to the steady-state Gordon equity-valuation equation, where P is the price of a stock index, D and B are dividends and net buybacks, respectively, and g_k is the permanent rate of growth of payouts, of earnings, and of the value of the capital stock:

(33) $$r_e = \frac{D+B}{P} + g_k$$

In the open-economy case g_k is not the rate of growth of the domestic corporate capital stock. It is the rate of growth of the capital stock owned by American companies. If foreign companies on net invest in America—if the U.S. on average runs a current account deficit—then the rate of growth of the earnings of American companies in our domestic stock-market index will be slower than the rate of growth of economy-wide earnings and of real GDP. The open economy will then deepen rather than resolve the problem of combining slow expected growth with high expected returns. If it is American companies that on net invest abroad—then the rate of growth of the capital stock and thus the earnings of companies in the index will be larger than the rate of growth of the domestic economy g.

How much larger? If we look over spans of time long enough for adjustment costs in investment not to be a major factor, then the value of the capital stock will be proportional to the size of the capital stock.[9] If we assume in addition that companies maintain stable debt-equity ratios, then we have:

$$g_k = g + x\left(\frac{Y}{K}\right) \tag{34}$$

where x is that component of the current-account surplus (as a share of GDP) that corresponds to American companies' net investments abroad,[10] and Y/K is the current output-to-corporate capital ratio.

Here, again, we return to arithmetic. Our rate of equity return is:

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[9] Note that we here dismiss the possibility that investments overseas might provide higher risk-adjusted rates of return in the long run than domestic investments: Tobin's q=1 both here and abroad. The BEA reports that as of the end of 2003 the market value of foreign direct investment in the United States is $9,166.7 billion, compared to direct investment abroad by U.S. corporations of $6,369.7 billion, yet the associated income flows are about the same. We attribute this to a difference in risk. The experience of nineteenth century British investors with such landmarks of effective corporate governance as the Erie Railroad suggests that while there are supernormal returns to be earned in the course of rapid economic development, people with offices separated by oceans are unlikely to be the ones who reap them.

[10] The phrase "corresponds to American companies' net investment abroad" is needed to abstract from current-account deficits that finance net government consumption or net household consumption

$$(35) \qquad r_e = \frac{D+B}{P} + g + x\left(\frac{Y}{K}\right)$$

From section III, this is:

$$(36) \qquad r_e = 4.5\% + x\left(\frac{Y}{K}\right)$$

For a capital-output ratio of 3, we then have:

$$(37) \qquad x = 3(r_e - 4.5\%)$$

Determine how much you want the rate of return on equities to exceed the 4.5% per year closed-economy benchmark case calculated in section III, and triple that: that is the current-account surplus associated with net corporate investment overseas needed to produce the higher return.

Note that, for a constant rate of return, the needed surplus x grows over time. In equation (37), Y/K is not the physical domestic output-to-capital ratio: it is the ratio of domestic output to total American company-owned capital—including capital overseas. As overseas assets mount, the needed surplus for constant payout yields mounts as well.

Now such enormous current-account surpluses are possible. Great Britain had them in the quarter-century before World War I, when it ceased to be the workshop of and became for a little while the financier of the world (see Edelstein (1973)). Slowing economic growth in the late Victorian and Edwardian eras and reduced investment relative to national savings was cause (or consequence, or both?) of the direction of Britons' saving and of British companies' investment overseas. We, however, see no signs that the United States will undertake a similar trajectory over the next several generations. And we are impressed by the scale: to be consistent with current payout yields, the 1.9% per year forecast real GDP growth rate, and 6.5% returns the current account surplus produced by American net corporate investment abroad would have to begin at 6% of GDP, and grow thereafter.

Moreover, the assumption that America could cope with slowing economic growth and maintain domestic asset returns at high historical average levels by diverting capital overseas rests, to some degree, on the belief that the United States is a small open economy: that U.S. investments abroad induced by a domestic growth slowdown will raise the rate of return here while not lowering rates of return there. But the U.S. is not a small open economy. It is a large open economy. Blanchard, Giavazzi, and Sa's (2005) estimates are that U.S. financial assets are currently half of the world total. This share will fall over time. But fast enough to make the assumption that the U.S. is a small open economy a reasonable approximation?

We doubt it. Once again, the potential escape from arithmetic and analysis seems to us to be a possible scenario, but not the central tendency of the distribution of possible futures that is a forecast.

VII. The Equity Premium

Economists do not have a good explanation of the equity premium. Rajneesh Mehra and Edward Prescott (1985) is entitled, "The Equity Premium: A Puzzle," for good reason. Stocks have outperformed fixed-income assets by more than 5% per year as far back as we can see. As Martin Feldstein has said in conversation, it's as if the market's attitude toward systematic equity risk is that of a rich 65 year old male with a not-very-healthy lifestyle whose doctor has told him that he is likely to live less than a decade. Yet we believe that properly-structured markets should—and can—mobilize a much deeper set of risk-bearers with a much greater risk tolerance. That they do not appear to have done so is a significant mystery.

One potential explanation is that the extremely large equity premium is a thing of the past, not the future.[11] In the distant past fear of railroad and other “robber baron” scandals, and in the more recent past the memory of the Great Depression kept some excessively averse to stocks. In addition, the U.S. had remarkably good economic luck. And, over time—as people realized that their predecessors had been excessively averse to equity risk—rising price-dividend ratios pushed a further wedge between stock and bond returns. But today the arithmetic of section III gives us stock returns of 4.6%: an equity premium of perhaps 2.5 percentage points, not 5.

To the extent to which this past behavioral anomaly was the result of an excess fear of stocks and an excess attachment to bonds, it is not clear that its erosion should have an impact on the expected return on a balanced portfolio. The simplest, crudest, and most extremely ad-hoc model of the equity premium would embed the stock-vs-bond investment decision in the simplest possible Diamond-like OLG model, with the capital stock each period being the wealth accumulated when young by the old, retired generation. Assume that each generation, when it saves, invests a share e_h of its savings in equities and a share $1-e_h$ in bonds. Firms, however, are unhappy with such a capital structure. Unwilling to run significant risks of bankruptcy, they are unwilling to commit less than a share e_f, where $e_f > e_h$ of their payouts to equity. A smaller cushion—in the sense that a smaller cyclical decline in relative profits would run the risk of missing bond payments and an appointment with a bankrupty court—is simply unacceptable to entrenched managers.

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[11] In conversation Randall Cohen has been an especially forceful advocate of this point of view.

If a physical unit of savings when young yields returns to physical capital *1+r* when the savers are old, the rates of return on equity and debt are then:

(38) $$1+r_e = (1+r)\left(\frac{e_f}{e_h}\right)$$

and:

(39) $$1+r_d = (1+r)\left(\frac{1-e_f}{1-e_h}\right)$$

with the equity premium being:

(40) $$\frac{1+r_e}{1+r_d} = \frac{(e_h/(1-e_h))}{(e_f/(1-e_f))}$$

In this excessively-simple framework it does seem highly plausible that e_h has fallen with greater household willingness to hold equity—whether because of institutional changes, the fading memory of 1929, two decades of fabulous bull markets, or increased financial sophistication on the part of households. Thus even if there were no reasons connected with slowing growth to expect lower returns on capital, one might well expect to see lower returns on equity in the future than in the past. And we have seen the major institutional changes that we would expect, from a behavioral perspective, to boost the share of financial assets naturally channeled to equities: the rapid expansions of tax preferences for financial savings vehicles and the growth of 401(k) and other defined-contribution pension plans have been important parts of the last generation's changes in financial markets (see Barberis and Thaler (2003)).

A lower rate of return on the assets in a balanced portfolio has powerful implications on issues of economic policy. A lower equity premium seems to us at least to have powerful implications for only one issue: whether there is a large market failure in the stock market's apparent inability in the past to mobilize a large share of society's potential systematic risk-bearing capacity, and whether a government-run social insurance scheme can and should attempt to profit from and to at least partially repair this failure to mobilize society's risk-bearing resources. The government, after all, has the power to tax: it has the greatest ability to manage systematic risk of any agent in the economy. If others are not picking up their share—and if as a result there are properly adjusted excess returns to be earned by the government's taking a direct position itself or assuming an indirect position by reinsuring individuals' social-insurance accounts—why should the government not do so? The difference between the economists of the coast and the economists of the interior is that the first specialize in thinking up clever schemes to repair apparent market failures and the second specialize in thinking up clever reasons why apparent market failures are not really so. Even though we are from the coasts, we find that there are enough reasons to believe that the equity premium will be smaller in the future than in the past to wish that attempts to exploit the equity premium be implemented slowly and gingerly.

VIII. Conclusion

Economic growth here at home is determined by productivity growth and labor force growth here in the United States. Equity market and other asset returns determined by the overall cost of capital in the global economy and by the return investors require to bear the risk that comes with equity ownership. Yes. But. The United States is not a small open economy in which these two sets of factors are not linked. The United States is a large open economy, and so we would expect that shifts in the economy that reduce the rate of economic growth would be accompanied by reductions in the rate of return on assets as well.

We would expect the reduction in asset returns to be greater for reductions in productivity growth than for reductions in labor force growth. We think that this reduction in asset returns could be offset and neutralized by other factors—if there is a successful class war waged by capital against labor, if today's stock market values are not sober reflections of likely returns but are elevated by irrational exuberance, or if the United States cuts its consumption beneath its production for generations and follows Britain's pre-WWI trajectory as supplier of capital to the world. Nevertheless, we see these as unlikely (thought possible) scenarios. We do not take any of them—or some combination—to be the central tendency of the distribution of possible futures that is a proper economic forecast.

What, some have asked, is the relationship between our arithmetic demonstrations that equity returns as high in the future as in the past are unlikely and our analytical arguments that rates of return and rates of growth are likely to move together. We see these two strands as reinforcing each other. Returns must be consistent with the savings decisions of households, the investment decisions of firms, and the technologies of production. But it is also the case that returns must also equal payout yields plus capital gains—and that only in stock market bubbles can capital gains divorce themselves from economic growth, and then only for a little while.

Once again, return to our perhaps useful analogy from international economics. Given prices charged by foreigners, domestic consumers decide on how much of imports M to purchase; given prices charged by domestic firms, foreign consumers decide on how much of exports X to purchase; why then do we say that the trade balance X-M is determined by the national savings-investment balance, that X-M=S-I? The answer is that powerful economic forces work to make sure that what the economy's behavioral relationships produce is consistent with its equilibrium flow-of-funds conditions. The same general logic applies here: If slower economic growth reduces the arena for the profitable deployment of capital, rates of return will fall until less capital is deployed. By how much will they fall? Until—in steady state—payout yields plus retained earnings are equal to profits, and retained earnings are no larger than the sustainable growth of the capital stock permits.

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