Congressional Budget Office

Background Paper

How Slower Growth in the Labor Force Could Affect the Return on Capital

October 2009

THE CONGRESS OF THE UNITED STATES

How Slower Growth in the Labor Force Could Affect the Return on Capital

October 2009

The Congress of the United States ■ Congressional Budget Office

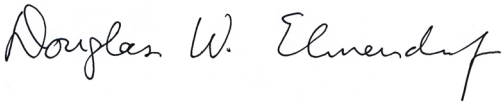
Preface

The Congressional Budget Office (CBO) produces regular reports on the state of the U.S. economy as well as 10-year and long-term projections of the nation's budget and economic outlook. In those analyses, CBO examines a range of developments that could have short- or longer-term consequences for the budget and the economy. In the decades to come, one such development will be a slowing of the rate of growth of the labor force. That projected slowdown is expected to occur because of lower fertility rates, the leveling off of a sizable increase in women's labor force participation, and the aging and retirement of large numbers of baby boomers.

Although slower growth in the workforce might affect the U.S. economy in many ways, this background paper focuses on what could happen in just one area: the rate of return paid on assets such as stocks and bonds. A number of theoretical models and simulations suggest that slower growth in the supply of labor could lead to lower rates of return, although that effect could be offset by rising budget deficits, capital outflows, or other factors. A decline in rates of return could have a significant effect on the federal budget through its impact on interest payments. In addition, a shift in the rate of return (and related shifts in wages) would alter the long-term outlook for the Social Security program.

This paper was prepared by Ben Page of CBO's Macroeconomic Analysis Division, under the direction of Robert Dennis, Douglas Hamilton (formerly of CBO), and William Randolph. Jonathan Huntley, Mark Lasky, Joyce Manchester, Noah Meyerson, Frank Russek, Marika Santoro, and Michael Simpson provided helpful comments.

Loretta Lettner edited the paper, and John Skeen proofread it. Chris Howlett prepared the paper for publication. Lenny Skutnik produced the printed copies, Linda Schimmel coordinated the print distribution, and Simone Thomas prepared the electronic version for CBO's Web site (www.cbo.gov).



Douglas W. Elmendorf
Director

October 2009

Contents

How Slower Growth in the Labor Force Could Affect the Return on Capital

The labor force in the United States is expected to grow at a significantly reduced rate in coming decades for several reasons: a long-term decline in fertility rates, the leveling off of a substantial rise in women's labor force participation, and the aging and retirement of large numbers of people from the baby-boom generation. The Congressional Budget Office (CBO) projects that the growth of the labor force, which averaged 1.6 percent per year from 1950 to 2007, will slow to about half a percent per year over the next 20 years. Most mainstream economic models predict that the slowdown is likely to boost the ratio of capital to labor and thereby make the rate of return on capital—as reflected in the rate of interest on bonds or other borrowing, and the rate of return on stocks—lower than might otherwise be expected. Wages will be higher than would otherwise be the case for the same reason, although that effect will be much smaller than the increase in wages that is projected to result from productivity growth. Various economic models and simulations project that, other things being equal, the coming slowdown in labor force growth could subtract between 0.8 and 2.6 percentage points from the rate of return on capital within the next several decades; wages would rise by somewhat less than half the percentage decline in the rate of return on capital.

Shifts in wages and rates of return on capital would have budgetary implications, both for the overall federal budget and for individual programs such as Social Security. The lower interest rates that would result from a slowdown in labor force growth would tend to reduce federal interest payments and slow the growth of debt relative to output. Lower interest rates would also reduce the interest income of the Social Security trust fund and increase the actuarial imbalance of the system (because future deficits in the system would be "discounted" at a lower rate of interest), although the accompanying higher wages would tend to increase payroll tax revenues somewhat.[1]

The rate at which the labor supply grows is, however, only one factor influencing wages and rates of return on capital. Therefore, it is not clear whether, on balance, future wages and rates of return will be higher or lower than today's. For example, budget deficits reduce national saving—the sum of private and government saving—and tend to crowd out investment in productive capital (office buildings, factories, machines, computers, and other equipment, which support future production

1. The actuarial imbalance in the system is a measure of the gap between Social Security's projected tax revenues and expenditures over some future period, with both taxes and expenditures adjusted by a discount factor to account for the time value of money. The discount factor has the effect of reducing the impact of future flows of funds the farther in the future that they occur.

and consumption). That crowding out implies a smaller capital stock and, other things being equal, lower wages and a higher rate of return on capital. If current laws remained unchanged, rising health care costs and the aging of the population would lead to substantial increases in budget deficits in the longer term, which would tend to offset the effect of slower growth in the labor force on the rate of return on capital. Increases in capital outflows—the net amount of savings that flows to other countries—would also tend to increase the domestic rate of return on capital.

CBO's 10-year economic projections illustrate some of those offsetting effects. They incorporate lower rates of return from a slackening in labor force growth, but that effect is outweighed by the impact of budget deficits and economic recovery, resulting in a projection that real (inflation-adjusted) interest rates will increase over the 10-year period. (CBO's 10-year projections also suggest that wages will rise, but that development stems from rising productivity rather than changes in the relative size of the capital stock.)

How the Growth Rate of the Labor Force Affects Rates of Return

The rate of growth of labor supplied in the economy can affect wages and rates of return on capital by influencing the long-run ratio of the stock of productive capital to the quantity of labor.[2] That effect stems from a simple mathematical relationship: If the economy begins in a stable long-run equilibrium, a slowdown in the growth of the supply of labor, together with the same rate of saving and investment, implies a rising ratio of capital to labor. Fewer additional productive capital goods would be required to preserve the same ratio because those incoming cohorts of workers would be smaller than they would be if the labor supply grew more quickly.

Standard economic theory predicts that, all else being equal, a larger quantity of capital per worker translates into a lower marginal product of capital—the amount added to production by a small additional amount of capital—and a higher wage rate. As there would be more machines for each worker to utilize, the productivity of workers (and therefore wages) would go up, but the contribution to output provided by each additional piece of machinery (and therefore the marginal product of capital) would fall.[3]

---

2. For simplicity, this discussion refers to the ratio of labor to capital. When technological progress raises productivity, it is actually the ratio of capital to output that must be stable in the long run to be consistent with a stable rate of return.

3. The ratio of capital to labor would not rise indefinitely because, eventually, the rising depreciation that resulted from a larger stock of capital would increase faster than the additional capital's contribution to output. As the ratio of capital to labor rose, capital would continue to depreciate at the same rate, but each increment added to capital would contribute less and less to output. Eventually, an increasing share of saving would be required to replace depreciating capital, offsetting some of the effect of slower labor growth. In the long run, the ratio of capital to labor would rise to a point at which the rate of saving was just sufficient to maintain it.

Rates of return in the economy—such as the return on equity (in the form of dividends or capital gains) and the interest rate on bonds or other borrowing—are related, in varying degrees, to the contribution to output that is attributable to capital and therefore tend to move in the same direction as the marginal product of capital. Equities represent an ownership stake in the capital and other assets of a corporation, so when the marginal product of capital declines, the return on equities tends to fall as well. The return earned on equities is tied to long-term interest rates because people with savings can choose whether to invest in equities or interest-bearing assets such as bonds. Pricing in financial markets adjusts so that equities provide a higher return, on average, than relatively safe assets such as bonds because the return on equities is more uncertain. The difference between the return on equities and the interest rate paid on government bonds is referred to as the equity premium; that premium compensates investors for the additional risk associated with holding equities. Given a constant equity premium, the interest rate on government bonds would change by the same number of percentage points as the return on equities. Of course, the equity premium might not remain constant because changes in the return on equities could also alter the perceived riskiness of equities relative to bonds; in most cases, though, a change in the rate of return on equities would tend to move the interest rate in the same direction.

The preceding discussion assumes that, as the growth rate of the labor supply slows, the rate of saving remains unchanged. In fact, saving rates could fall with lower growth in the labor force as the ratio of working-age people (who tend to save) to people of retirement age (who tend to spend from their savings) falls. However, models incorporating the effect of changes in demographics on saving rates suggest that the net effect would still be an increase in the relative size of the capital stock and a decrease in the rate of return on capital. In addition, a variety of evidence suggests that the elderly do not draw down their savings as much as some economic models imply, which suggests that the impact of an aging population on the rate of saving would not be large.[4]

How Rates of Return Affect the Federal Budget

Changes in rates of return (on both debt and equity instruments) and wages affect the federal budget. The most significant effect would occur because changes in interest rates have a direct effect on the amount of interest paid on federal debt, which will rise much more slowly for a given path of the primary (or noninterest) deficit if interest rates are lower. Similarly, the balances of the Social Security trust fund, or privately held savings accounts, will rise much more slowly given lower rates of return.[5]

4. See Congressional Budget Office, *Will the Demand for Assets Fall When the Baby Boomers Retire?* Background Paper (September 2009).

5. The higher wages that would result from slow growth in the labor force would improve Social Security's finances by boosting payroll tax revenues. However, that effect would be relatively minor because it affects the level, rather than the growth rate, of wages and because higher wages eventually imply higher benefit payments.

Calculations involving "present values," which discount future flows of income and expenses by interest rates, are also quite sensitive to interest rates. That type of calculation includes the actuarial imbalance of the Social Security system. A lower interest rate means that future outlays and receipts are discounted by less and, therefore, figure more prominently in present-value calculations. In cases such as Social Security, where outlays are projected to rise more than revenues, a lower interest rate thus implies a larger actuarial imbalance.[6]

By contrast, the impact of changes in rates of return on primary (or noninterest) budget deficits would probably be small. Income earned on capital investments is taxed at a lower effective rate, on average, than income earned from participating in the labor force.[7] Therefore, government revenues would be higher if a decline in the rate of return on capital shifted income shares so that the share of labor compensation rose and that of capital income fell. However, typical estimates suggest that changes in rates of return do not affect the balance between the amount of total income that is paid in returns on capital versus the amount that is paid in labor compensation. When an increase in the relative abundance of capital reduces the return on capital, there are two opposing effects on the fraction of overall income that is paid as capital income: Although each increment added to the capital stock generates less income, there are proportionately more units of capital earning income. (There are corresponding, but opposite, effects on the fraction of output paid as labor earnings.) Many economic models assume that the two effects exactly balance, leaving the total fraction of output paid as capital income (and labor earnings) unchanged.[8]

---

6. Although changes in projected interest rates alter present-value calculations, they do not necessarily affect the proper weight to place on current versus future costs and benefits, especially when the trade-offs span different generations.

7. Although income taxes are levied on both capital income and labor income, capital income faces lower taxes, on average, because much of labor income is subject to payroll taxes and a substantial share of capital income (including returns earned in tax-free savings accounts or by pension funds, charities, colleges, and other nonprofit institutions) is not taxable. In addition, depreciation of fixed capital—a sizable portion of capital income—is not taxed.

8. Technically, the assumption that economic output is based on a "Cobb-Douglas production function" implies that capital and labor income shares are constant. Many economic projections assume that type of production function. Such an assumption is supported by the fact that income shares in the United States have been fairly constant, even as the ratio of capital to labor has risen over time. However, some studies have suggested that the effect on the rate of return outweighs an increase in relative abundance of an input. See Eric Miller, *An Assessment of CES and Cobb-Douglas Production Functions,* Congressional Budget Office Working Paper 2008-5 (June 2008). That paper evaluates which is more consistent with historical economic data, the Cobb-Douglas function or a more generalized formulation called the constant elasticity of substitution (CES) function. The paper finds that the data are more consistent with a specification of the CES type in which projected decreases in the rate of return on capital would lead to a somewhat smaller share of capital income in output and a larger share of labor income.

Estimated Impact Using Simple Theoretical Models

One standard, simple model of economic growth assumes that a fixed fraction, *s,* of output is saved; that the population grows at rate *n*; that the stock of productive capital depreciates at the rate δ; and that a fraction, α, of output is received by owners of capital. Under those assumptions, the rate of return on capital *(r)* in the long run is

$$r = \alpha(n + \delta)/s - \delta$$

According to this equation, for every percentage point that the rate of the growth of the labor force falls—that rate is assumed to be the same as the rate of population growth, *n*, in the long run—the rate of return on capital falls by α/s percentage points. In the United States today, the share (α) of income that goes to capital is roughly 0.3, and the gross rate of saving, *s* (the rate of saving before subtracting the share needed to cover the depreciation of existing capital), is roughly 20 percent of output, or 0.2; so α/s is about 0.3/0.2, or 1.5. That result implies that a decline of 1 percent in the growth rate of labor—roughly the amount that the growth rate is projected to decline, relative to its postwar average, over the next few decades—would lead to a long-run decline in the rate of return on capital of about 1.5 percentage points, or about 20 percent of the pretax rate of return on capital. (The pretax rate, as measured by profit and interest income divided by the value of the capital stock, has averaged roughly 7 percent over the past 40 years.) The percentage increase in the wage rate would be approximately α/(1- α), or 0.4 times as large as the decrease in the rate of return; or, compared with the level if the growth rate of labor stayed constant, roughly 8 percent.[9]

CBO uses a similar model to project the real rate of interest on Treasury notes over the 10-year budget horizon, although the projections incorporate productivity growth and, therefore, wages that rise over time even if the rate of return on capital is constant.[10] However, the implied impact of changes in the growth rate of labor on the rate of return on capital and wages is the same as those described above.

In the example described above, the rate of saving, *s*, is simply assumed. However, more complex models that incorporate explicit motives for saving imply similar results. For example, another class of economic models, overlapping generations models, incorporate successive generations that each save during their working years to finance retirement (and, in some cases, to provide insurance against unforeseen fluctuations in income). Those models also tend to predict that slower growth in labor inputs implies a lower rate of return on capital. For example, one textbook

9. More precisely, the multiplicative effect on wages should be the multiplicative effect on rates of return raised to the α/(1- α) power, which for relatively small effects implies a percentage increase roughly α/(1- α) times as large.

10. See Congressional Budget Office, *How CBO Projects the Real Rate of Interest on 10-Year Treasury Notes,* Background Paper (December 2007).

presentation of an overlapping generations model finds the steady-state rate of return is given by

$$r = (\alpha/(1-\alpha))(1+n)(2+\theta) - \delta$$

where the variables α, n, and δ are, as in the previous example, the share of income that goes to capital, the rate of growth of the labor force, and the rate of depreciation; and θ is a measure of people's impatience, or the rate at which they would trade consumption today for consumption tomorrow.[11] In this model, too, a higher rate of population growth, n, which translates into faster growth of the supply of labor, implies a higher rate of return, r. Under reasonable assumptions of $\alpha = 0.3$ and $\theta = .03$, a fall in the rate of growth of the labor force of 1 percentage point implies a decrease in the rate of return on capital of about 0.9 percentage points (or roughly 15 percent). The same assumptions imply a wage rate that is 6 percent higher than it would be without the slowdown in labor growth. The results are similar to those from the simpler example presented earlier because the principle is the same: With a slower rate of growth in the labor force, a stable rate of saving would imply a rising ratio of capital to labor. The decrease in the rate of return is smaller in this case, in part, because the drop in the rate of return reduces the saving rate, offsetting the initial effect somewhat.

There is one type of economic model in which the rate of growth of the labor force does not affect the long-run rate of return. In this "dynastic" model, there is intergenerational altruism: People's well-being depends, in part, on the well-being of their children and succeeding descendants. In the strongest version of this model, what people care about is the sum of all their children's well-being, and that well-being matters as much to them as their own. Under those assumptions, a slower rate of labor force growth—which indicates fewer children per parent, on average—would induce people to save less because there would be fewer heirs to receive bequests. In fact, that reduced saving would exactly equal the reduction in saving that is required to maintain the same ratio of capital to labor with lower population growth, leaving the rate of return unchanged.

However, there are reasons to doubt that altruism affects the relationship between the growth rate of the labor force and rates of return as profoundly as this model implies. First, the strongest version of the altruism model has economic implications that do not appear to be supported by the data.[12] Second, only the strongest forms of "altruistic linkage" imply that rates of return are unrelated to the growth rate of labor. For example, if parents cared about the average welfare of each generation of their

11. See Olivier Jean Blanchard and Stanley Fischer, *Lectures on Macroeconomics* (Cambridge, Mass.: MIT Press, March 1989), p.103.

12. See Joseph G. Altonji, Fumio Hayashi, and Laurence J. Kotlikoff, "Is the Extended Family Altruistically Linked? Direct Tests Using Micro Data," A*merican Economic Review,* vol. 82, no. 5 (December 1992), pp. 1171–1198.

descendants, rather than the sum of all welfares in each generation, faster population growth would once again imply higher rates of return in much the same way that it does in the other theories described above. Moreover, if changes to children's well-being at a given time were not as important to parents as changes to their own well-being at that same time, saving would not fully adjust to compensate for changes in the growth rate of labor, and rates of return would still be affected (albeit by a smaller amount than they would be otherwise).

Potential Offsetting Effects from Deficits and Capital Outflows

It is important to note that the implication that slower rates of labor force growth will result in lower rates of return and higher wages assumes that other factors are unchanged. However, when considering the coming decades, that "ceteris paribus" (other things being equal) assumption may not be valid. In particular, under current law, federal spending is projected to grow relative to gross domestic product as health care costs continue to rise and increasing numbers of the baby-boom generation become eligible for Social Security and Medicare benefits. In the absence of policies that reduced spending or increased revenues, federal budget deficits would grow substantially. Increased deficits would reduce the amount of national saving available for investment, just as decreased private saving would. Lower rates of investment would reduce the size of the capital stock, which would in turn tend to increase rates of return and decrease wages, moving in the opposite direction of the effect of slowing labor force growth. (In the context of the simple model presented earlier, higher deficits reduce the rate of national saving, s, thereby increasing the rate of return.)

The impact on rates of return would depend on the size of the deficits and the degree to which they crowded out investment. Under some budgetary assumptions, such as those of CBO's alternative fiscal scenario, together with CBO's typical assumption for the crowding out of investment, the effect of deficits would easily outweigh the effect of lower labor force growth, implying increases in rates of return in the coming decades.[13] Under other assumptions, such as those of CBO's extended baseline scenario, deficits would be much smaller but still would eventually outweigh the effect of slower labor force growth.

The impact of declining labor force growth on rates of return might also be offset by net outflows of capital from the United States to the rest of the world. The theories discussed above are built on the assumption of a closed economy—that is, one with no economic relations with other countries. That assumption precludes the possibility

13. See Congressional Budget Office, *The Long-Term Budget Outlook* (June 2009). The alternative fiscal scenario deviates from CBO's normal baseline projections, beginning in 2010, by incorporating some changes in policy that are widely expected to occur and that policymakers have regularly made in the past. The extended baseline scenario adheres closely to current law, applying the concepts underlying CBO's 10-year baseline budget projections.

that, in the event of a slowdown in the growth of labor supply, capital outflows from the United States to the rest of the world could offset the tendency for the relative prevalence of capital in the domestic economy to rise.

Clearly, capital can flow relatively freely to and from the United States, so international capital flows are likely to reduce, but not eliminate, the effect of slowing labor force growth on rates of return on capital. Falling rates of return in the United States could lead to outflows of capital from investors seeking higher rates of return elsewhere. However, the economy of the United States is large, and its interest rates influence interest rates around the world. Therefore, if those outflows were large enough, they could raise the capital stock and depress rates of return in the rest of the world as well, which would temper the outflow from the United States.

Furthermore, studies have found that despite the relatively free flow of capital across national borders, rates of national saving and domestic investment tend to be correlated—countries with higher rates of saving tend to have higher rates of investment.[14] That correlation suggests, for whatever reason, that the impact of domestic saving is not entirely undone by capital flows. Explanations for this phenomenon differ, but there appears to be a significant degree of home bias in investment—other things being equal, investors are more likely to invest their savings in assets based in their own country.

Finally, population growth in other developed countries and, especially, in the developing world is also projected to slow in the coming decades. For example, the United Nations projects that world population growth will slow from about 1.2 percent per year from 2005 through 2010 to about 0.3 percent per year between 2045 and 2050, which is similar to the slowdown expected for the United States over the same period.[15] If the slowdown in population growth and resulting fall in rates of return turned out to be a worldwide phenomenon, the changes in the United States would probably not be offset by capital flows because foreign investments would not become relatively more attractive. Indeed, some estimates indicate that accounting for capital flows could actually result in larger projected declines in rates of return because, on net, capital would flow into rather than out of the United States.

Simulation Results

Economic simulations have led a number of researchers to conclude that the coming slowdown in labor force growth will reduce rates of return in the United States and other developed countries. Those estimates are based on economic models that are

14. George Georgopoulos and Walid Hejazi, "The Feldstein-Horioka Puzzle Revisited: Is the Home-Bias Much Smaller?" *International Review of Economics and Finance*, vol. 18, no. 2 (March 2009), pp. 341–350.

15. See United Nations Population Division, "World Population Prospects: The 2008 Revision Population Database," available at www.esa.un.org/unpp/index.asp.

more complex than the simple estimates discussed above. However, they incorporate the simpler models' logical connections and key assumptions, so it is not surprising that they produce broadly similar estimates.

Robin Brooks, for example, estimates that a shift in population growth mirroring that of the baby-boom generation would result in a decline in rates of return in the United States of about 0.8 percentage points between 2000 and 2020, rebounding to a net decline of about 0.3 percentage points in the longer run.[16] David Domeij and Martin Floden project that interest rates in countries in the Organisation for Economic Co-operation and Development will fall by about 1.5 percentage points between 2000 and 2050.[17] Dirk Krueger and Alexander Ludwig project a decline in the rate of return in the United States of 0.8 percentage points (assuming no capital flows) or 0.9 percentage points (assuming capital flows) between 2005 and 2080; under either assumption, wages would rise by about 4 percent.[18] Orazio Attanasio, Sagiri Kitao, and Giovanni L. Violante project a decline in interest rates of 1.9 percentage points in the developed world (assuming no capital flows) or 2.6 percentage points (assuming capital flows) between 2005 and 2040; wages would rise by 10 percent or 13 percent, respectively, under the same assumptions.[19] Although those estimates vary, in each case the rate of return on capital is projected to decline by a substantial amount. (Wages would also rise in each case, although those results were not published in some of the studies.)

Empirical Evidence

There is some empirical evidence in the historical record to support the idea that the rate of growth of labor affects rates of return. For example, equations predicting the equilibrium rate of return that include the growth rate of the labor force, such as the one presented on page 5, have been found to be broadly consistent with actual rates of return in both the United States and Japan.[20]

16. See Robin Brooks, "Asset-Market Effects of the Baby Boom and Social-Security Reform," *American Economic Review*, vol. 92, no. 2 (May 2002), Figure 1, p. 404.

17. David Domeij and Martin Floden, *Population Aging and International Capital Flows,* Stockholm School of Economics Working Paper No. 539 (November 2003), Figure 1.

18. Dirk Krueger and Alexander Ludwig, "On the Consequences of Demographic Change for Rates of Return to Capital, and the Distribution of Wealth and Welfare," J*ournal of Monetary Economics,* vol. 54, no. 1 (2007), Table 7, p. 79.

19. Orazio Attanasio, Sagiri Kitao, and Giovanni L. Violante, "Global Demographic Trends and Social Security Reform," *Journal of Monetary Economics,* vol. 54, no. 1 (2007), Table 2, p. 174.

20. See Kaiji Chen, Ayse Imrohoroglu, and Selahattin Imrohoroglu, "The Japanese Saving Rate Between 1960 and 2000: Productivity, Policy Changes, and Demographics," *Economic Theory,* vol. 32, no. 1 (July 2007), pp. 87–104; Kaiji Chen, Ayse Imrohoroglu, and Selahattin Imrohoroglu, *A Quantitative Assessment of the Decline in the U.S. Saving Rate and the Current Account Balance* (May 2008), available at www.sef.hku.hk/~kaijic/USeconomy.pdf; and Congressional Budget Office, *How CBO Projects the Real Rate of Interest on 10-Year Treasury Notes,* Figure 3, p. 6.

The evidence, however, is not definitive. One possible reason for that ambiguity is that there have not been enough major, sustained changes in the rate of growth of the labor force over the period for which reliable data are available to identify the effects. Also, over shorter time periods, other factors, such as cyclical fluctuations and monetary policy, may have a greater impact on rates of return than long-run factors such as the growth rate of labor supply. In the absence of clear evidence, substantial weight should be placed on the results of economic models and simulations in projecting the effects of labor force growth on rates of return.