Problem Set 1, Economics 202, Fall 1998

1. The War. Suppose we have an economy described by the Solow growth model, with a Cobb-Douglas production function, a capital share $\alpha = 0.5$; with population, labor-augmenting productivity growth, and depreciation rates given by $n = 0.01$ per year, $g = 0.02$ per year, and $\delta = 0.045$ per year; and with a savings rate $s = .225$ of output Y.

Suppose that the economy is initially at its steady-state growth path, but that a major disaster--a war, say--suddenly destroys 75% of its capital stock. How long before output per worker exceeds output per worker on the eve of the disaster? How long before output per worker returns to within 10% of its steady-state growth path level? How long before output per worker returns to within 1% of its steady-state growth path level?

2. The Productivity Slowdown. Suppose we have an economy described by the Solow growth model, with a Cobb-Douglas production function, a capital share $\alpha = 0.5$; with population, labor-augmenting productivity growth, and depreciation rates given by $n = 0.01$ per year, $g = 0.02$ per year, and $\delta = 0.045$ per year; and with a savings rate $s = .225$ of output Y.

Suppose that g suddenly and permanently falls from 2% per year to 0% per year. Calculate the paths over time after the slowdown of k, the ratio of capital to effective labor; of y, the ratio of output to effective labor; of K/Y, the capital-output ratio; and of Y/L, output per worker. How do these paths compare to the paths had the slowdown in productivity growth not occurred?

3. **Policy Analysis.** A senator wants to know what the long-run impact of the productivity slowdown will be on the living standards of constituents in his district. You have two paragraphs--200 words--to try to make your conclusions in (2) clear to someone *who has forgotten all of their calculus, and knows nothing of the Solow growth model.*

4. The Federal Deficit. Suppose we have an economy described by the Solow growth model, with a Cobb-Douglas production function, a capital share $\alpha = 1/3$; with population, labor-augmenting productivity growth, and depreciation rates given by $n = 0.01$ per year, $g = 0.015$ per year, and $\delta = 0.035$ per year; and with a savings rate $s = .18$ of output Y.

Suppose that the Federal government starts spending on B-2 bombers--which, as Senator Feinstein said on the floor of the senate, "carry a large payroll." Suppose that the government refuses to tax in order to pay for this spending program, and that as a result it runs a *permanent* deficit that reduces saving available for capital formation by 3.00% of total output Y.

Calculate the changes in the time paths of Y/L, output per worker, and K/Y, the capital-output ratio, as a result of this permanent increase in the federal deficit.

5. Consumption. Suppose that we have the same economy as in (4), with the same budget deficit--but suppose that the deficit is created not by a military spending program but by a massive tax cut that returns money to households which they then spend on increasing their consumption.

Calculate the time path of C/L, where consumption C = (1-s)Y, assuming (counterfactually) that the budget had remained balanced, and with the increase in the budget deficit. For how many years is consumption in the deficit scenario above what it would have been in the no-deficit scenario?

Suppose that you work for a politician who faces a new election in three years, and faces an electorate that in the past has regularly voted against politicians under whom its consumption had declined. If his or her administration has inherited a large deficit, would you advise him or her to take steps to close the deficit now, or to legislate program and tax changes that will boost taxes and cut spending three or more years from now?

6. Solow (1956) and Solow (1957) (From Chad Jones (1998)).

Suppose that in the Solow model, with a Cobb-Douglas production function, with α, n, g, δ, and s fixed, and with the economy initially on its steady-state growth path, total factor productivity--output for any given labor and capital input--suddenly and instantaneously jumps upward by 10%.

a. How much "higher" in terms of additional output per worker is the new steady-state growth path than the old one?

b. Assume that the economy has finished transiting from the old steady-state growth path to the new one. Perform the Solow (1957) growth-accounting exercise for this transition. How much of the increase in steady-state output per worker is "due" in a growth-accounting sense to an increase in capital per worker? How much is "due" in a growth-accounting sense to a change in total factor productivity?

c. In what sense does the growth-accounting exercise in part (b) produce a misleading picture of what happened?

d. In what sense does the growth-accounting exercise in part (b) produce an accurate picture of what happened?