Due Date: Wednesday, December 7, 2005

1. Consider an economy in which consumers live for two periods, and have preferences given by:

$$U = \log C_1 + \log C_2.$$

Each consumer receives an endowment of 1 at the beginning of the first period. The pretax return available to consumers is 200%, so someone who saves $1 receives $3 at the beginning of the next period (the effective "period" is long!). The capital income tax rate is 50%. The government uses tax revenue to pay tribute to a foreign power.

(a) Find the optimal lifetime consumption profile of this consumer when the income tax rate is 50%, and contrast this with the profile that would result if there were no capital income tax.

(b) Now assume that the government introduces a "retirement saving program" that allows each consumer to save up to .20 in the first period in a tax-free account. Sketch the consumer's budget constraint with and without this saving program.

(c) Find the consumer's optimal lifetime consumption plan when the retirement saving program is in place, and explain how the introduction of this program affects first-period saving.

(d) When a new government takes power, it changes the structure of the saving incentive scheme to apply a 50% capital income tax on income from the first .50 of saving, but to exempt the income on any saving in excess of 0.50 from taxation. Sketch the budget set associated with this policy, and find the consumer's optimal consumption profile. Comment on the difference in incentives associated with this program and the program described in (b).

(e) In part (d), how would raising the threshold for tax-exempt saving from .50 to .51 affect personal saving? What would it do to national saving?

2. Assume that two durable capital inputs, equipment (E) and structures (S), are the sole inputs to a production process. The output of this process is given by

$$Y = E^{.25}S^{.25}.$$

Assume that the price of output is fixed at unity and that both equipment and structures are in infinitely elastic supply with a price of unity. Investors demand a required return of 10 percent on all capital investments. There is no inflation. Equipment depreciates at an exponential rate of 20 percent per year, while structures depreciate at 10 percent. Firms are 100 percent equity financed. Assume that the statutory tax rate on corporate profits is 50 percent, that equipment

investment can be expensed, and that investments in structures are eligible for depreciation allowances equal to true economic depreciation.

(a) What are the equilibrium values of the pretax marginal products of equipment and structures in this setting? What are the effective tax rates on equipment and structures, respectively?

(b) Now imagine that firms are allowed to depreciate structures using the 10 percent exponential decay rate, but that this must be applied to the structure's nominal initial purchase price. If prices are rising at 5% per year, what is the new equilibrium marginal product of capital and the effective tax rate in this setting.

(c) Policy-makers enact a new policy that will allow expensing of structures investment put into place after next year. How would the cost of capital for structures change this year as a result of this policy?

(d) Calculate the firm's output if both equipment and structures could be expensed, and compare this with the output in the case when equipment can be expensed while structures are depreciated using true economic depreciation (as in part a).

(e) Assuming that firms are in a steady state in which their gross investment is precisely equal to the depreciation on their existing capital stock, compare the revenue that would be collected by the corporate income tax when both types of investment can be expensed, and when only equipment can be expensed while structures receive true economic depreciation. Tax revenue is defined as τ*[F(E,S) - Depreciation Deductions].

3. Use the "tax-adjusted Q framework" sketched by Summers (1981 BPEA), to draw the "K = 0" and the "v= 0" loci in "K, v" space. Note that v is "simple" Tobin's q, the ratio of market value of equity to the replacement cost of corporate capital assets. Assume that all projects are equity financed and that tax policy includes depreciation allowances that are less generous than expensing and a corporate tax rate at rate τ. Assume that labor is not needed in the production process. Use saddlepoint stability diagrams like those on pages 81-85, which make it possible to uniquely evaluate the change in the shadow price of capital when policies change, to depict the effect of each of the following policy changes. Be sure to describe both the short-run asset market effects of each reform, and the longer-run effect of each reform on the size of the capital stock.

(a) A permanent increase in the generosity of depreciation allowances. Assume that the PDV of such allowances (τ*z) rises from .70 to .90.

(b) A temporary increase in the ITC from zero to 10 percent, with a sunset date of five years. (Be clear about both steady-state and transitional effects).

(c) A permanent increase in the corporate income tax rate, financing a revenue-neutral increase in the investment tax credit rate.