Economics 222: Macroeconomic Theory 1
Midterm
October 18, 2007
Solutions

Section 0: Freebies (Do both - 2 marks)

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Section 1: Short Answer (Do 4 of 5 - 28 marks)

For each statement, claim whether it is TRUE, FALSE, or UNCERTAIN, and justify your claim.

1. TRUE. Savings in a closed economy model is defined as:

$$S = Y - C - G$$

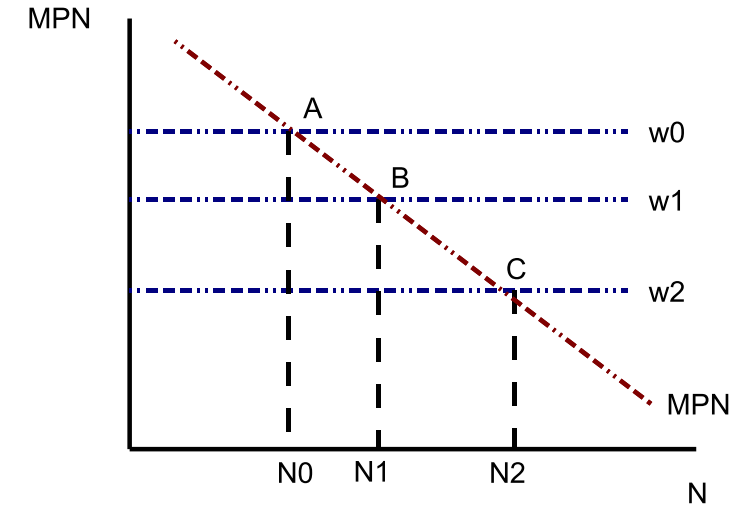
As G rises there is a direct negative effect on S as evident by the formula. C however can have an indirect effect from the rise in G. If spending is financed by permanenly higher taxes then either: (1) private consumption falls because permanent income is lower; or (2) if G is financed only through future taxes, then a consumption smoothing motive will cause consumption to fall today to allow savings to accumulate, and thus offset the future tax increases.

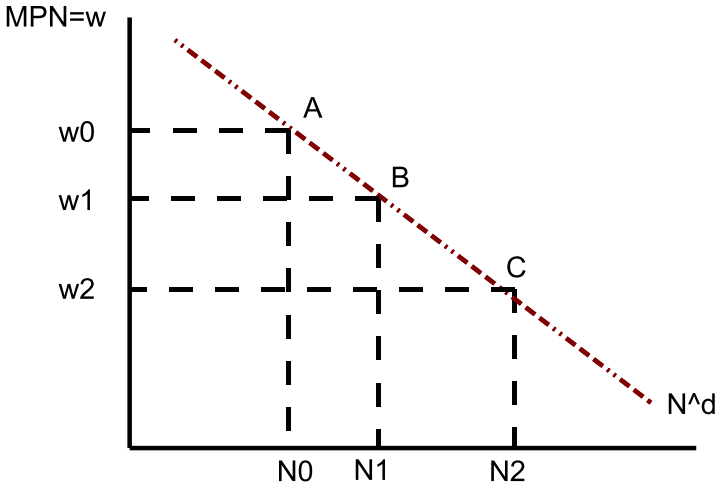
2. FALSE. The classical model of the labour market is governed by wages that adjust immediately to always maintain full employment in the macroeconomy. Clearly this could not explain the Great Depression. The Keynesian approach on the other hand assumes wages do not adjust instantly (i.e.: they are rigid), which an lead to persistent short run unemployment, of the type that was observed during the Great Depression. A macroeconomist should therefore use a Keynesian model to characterize this time period.

3. TRUE. In the classical model, firms are making profit-maximizing choices to determina how much labour to employ, N, for a given level of capital (K) and technology (A). This is determined where:

$$MPN = w$$

Because of diminishing marginal products, a plot of MPN versus N yields a downward sloping curve. To obtain the demand curve from this equation, we fix the production technology and capital level (which leaves the downward sloping MPN curve unchanged) and vary the wage level. The optimal demand points are at A, B, C for w_0, w_1, and w_2. Plotting these points yields a labour demand curve. The following two figures illustrate the result.


MPN
A
B
C
w0
w1
w2
MPN
N0
N1
N2
N


MPN=w
w0
w1
w2
A
B
C
N^d
N0
N1
N2

4. TRUE: Savings is defined as the sum of private and government savings:

$$S = S_{pvt} + S_{gov}$$

These are two components of savings are defined as:

$$S_{pvt} = (Y + NFP - T + TR + INT) - C$$

$$S_{govt} = (T - TR - INT)_G$$

Adding these up, we see the T, TR, INT cancel out giving:

$$S = Y + NFP - C - G$$

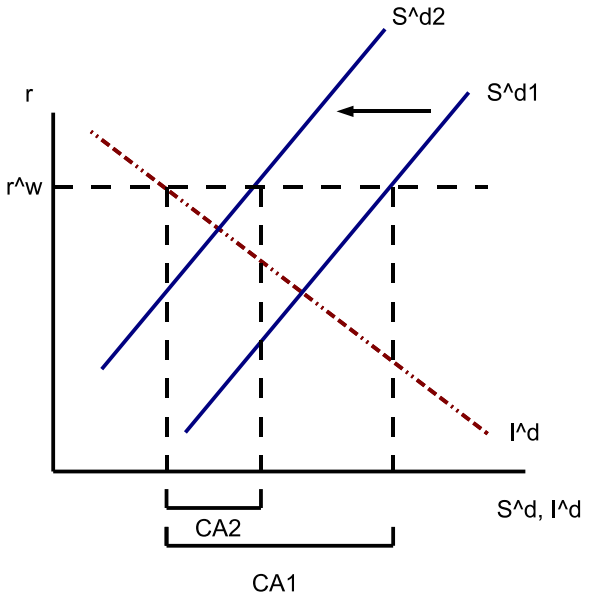
We know from the expenditure approach to GDP accounting:

$$Y = C + I + G + NX$$

Substituting this in for Y into the savings equation, and noting $CA = NFP + NX$, gives the desired result:

$$S = Y + NFP - C - G = (C + I + G + NX) + NFP - C - G = I + NFP + NX = I + CA$$

5. FALSE. We see from the figure below that the negative supply shock causes the current account to *fall* from CA_1 to CA_2. This makes sense - if the pool of goods and services to send abroad in exchange for cash shrinks, then the current account should indeed fall.



Section 2: Long Answer (Do 3 of 4 - 90 marks)

1. Firm XYZ invests in capital (K) to earn profits. Capital investment yields a marginal product of capital (MPK) given by:

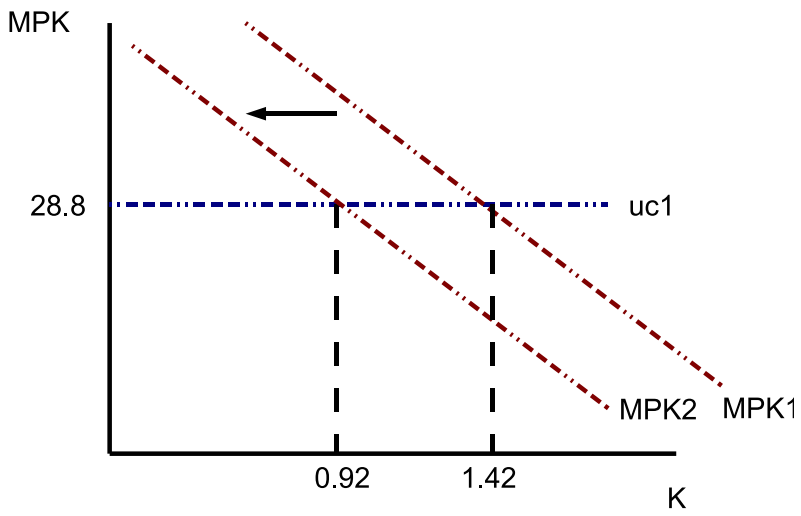
$$MPK = 100 - 50K \tag{1}$$

The price of a unity of capital is given by $p_K = 180$, capital depreciates at a rate of $d = 0.12$ and the real interest rate is $r = 0.04$.

a. $uc = (r+d) * p_K = (0.16) * 180 = 28.8$. r is included for one of two reasons: (1) it represents the cost of borrowing if the capital is financed by debt; or (2) it is the opportunity cost, should a firm's internal equity be used to finance the capital investment.

b. Profit maximization implies: $MPK = uc \Rightarrow 100 - 50K^* = 28.8 \Rightarrow K^* = \frac{100-28.8}{50} = 1.42$

c. Profit maximization implies: $MPK = uc \Rightarrow 75 - 50K^* = 28.8 \Rightarrow K^* = \frac{75-28.8}{50} = 0.92$
A figure depicting the outcomes for parts b. and c. is given by:



d. So we want the τ such that $K^* = 0.92$, under the original MPK function. The after tax user-cost of capital is $\frac{(r+d)*p_K}{1-\tau}$. $MPK = 100 - 50(0.92)$ under the K^* from part c. Profit maximization implies $MPK = \frac{(r+d)*p_K}{1-\tau}$, implying $100 - 50(0.92) = \frac{28.8}{1-\tau} \Rightarrow (1-\tau) = \frac{28.8}{(100-50(0.92))} = 0.54 \Rightarrow \tau = 0.46$.

2.

a. Product approach=$130:

Orange Farm's value added: $\$20 + \$40 = \$60$

Orange Juice Company's value added: $\$110 - \$40$ (intermediate goods) =$70

Expenditure approach=$130:

Oranges: Orange Farm's sales to public: $20

Orange Juice: Orange Juice Company's sales to public: $110

b. Income approach=$130:

Labour income=$40 (Orange Farm workers)+ $35 (Orange Juice Company workers)

Corporate profit=$35:

Orange Farm: $\$20 + \$40 - \$5 - \$40 = \$15$

Orange Juice Company: $\$110 - \$35 - \$40 - \$10 - \$5 = \$20$

Interest income: $5

Indirect tax: $10

Depreciation: $5.

Net National Income=Labour Income+Corporate Profits+Interest Income=$115.

Net Domestic Product=Net National Income+Indirect Tax-Subsidy=$125.

GDP=Net Domestic Product+depreciation=$130

c. Labour income is increased by $10 in this case, so Net National Income now becomes: $\$85 + \$35 + \$5 = \$125$.

Net Domestic Product=$125 + $10 − $10(subsidy)=$125.

The GDP from income approach is still $130, and there is no change to the calculation using product and expenditure approach. This is simply because the market value of final goods does not change with the subsidy.

3.

a. $PVLR = \$500 - \$125 + \frac{\$200-\$35}{1+0.1} = \$525$.

Highest current consumption: set $c^f = 0$. So $c = PVLR = \$525$. You will spend all your current disposable income and borrow \$150. All the future disposable income will be used to pay back the principle plus interest ($\$150 \times (1 + 0.1) = \$165$).

Highest future consumption: set $c = 0$. So $\frac{c^f}{1+0.1} = PVLR$ and $c^f = 1.1 \times PVLR = \$577.5$. You save all the current disposable income \$375, which gives you principle plus interest \$412.5 in the future. Together with the future disposable income, your future consumption is $\$165 + \$412.5 = \$577.5$.

The graph will look like Figure 4.A.1, but with an x-intercept of \$525 and a y-intercept of \$577.5. The slope is -1.1.

b. Optimality implies $c = c^f = c^*$. So the optimal consumption plan c^* satisfies

$$c^* + \frac{c^*}{1 + 0.1} = PVLR = \$525.$$

Solving for c^* gives $c^* = \$275$. To achieve the optimal consumption level, you need to save $s = y - t - c^* = \$500 - \$125 - \$275 = \$100$ in the current period. There is no saving or borrowing in the future period. Your future consumption is financed by future disposable income(\$165) and the amount of saving plus interest (\$110).

On the graph, the optimal consumption point is $(\$275, \$275)$.

c. Now $PVLR$ becomes $\$500 - \$100 + \frac{\$200-\$35}{1+0.1} = \$550$, so the new consumption plan satisfies $c^* + \frac{c^*}{1+0.1} = \$550$, which gives $c^* = \$288.10$. In this case, the highest current consumption $c = \$550$ and the highest future consumption $c^f = 1.1 \times PVLR = \$605$. Thus, the budget line shifts right but with no change to the slope.

d. The amount of saving in part (c.) is $s = y - t - c^* = \$500 - \$100 - \$288.10 = \$111.90$, which is \$11.90 higher than the saving amount in part (b.). Under the new tax policy, your current disposable income is higher than before, but your future income remains the same. To smooth consumption, you will increase the amount of saving. Note that this is only an income effect. The substitution effect happens when there is a change in the real interest rate, which is not the case in this question.

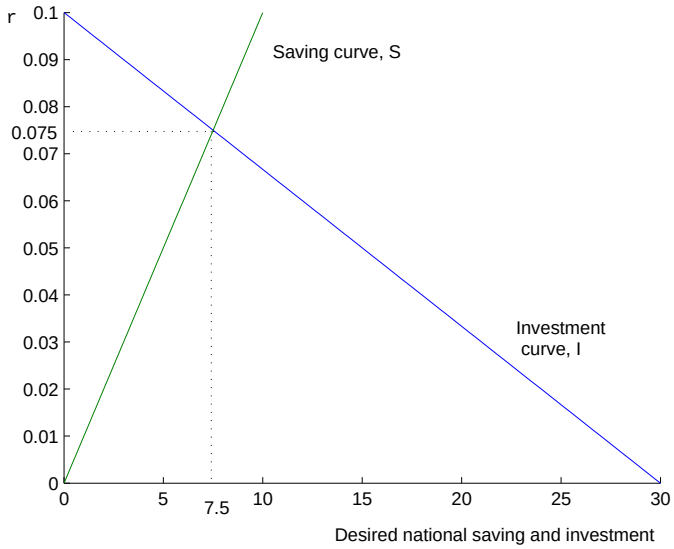
4.

a. $r = 0.075$, $I^d = 7.5$ and $C^d = 82.5$.

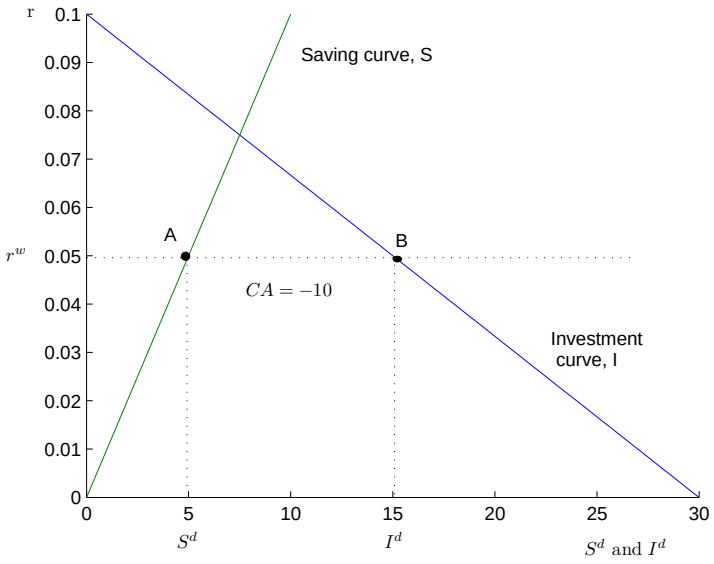
b. $CA = -10$, $I^d = 15$ and $C^d = 85$.

c. $CA = S^d - I^d$. To get $CA = 0$, we need $S^d = I^d$. This can be done by equating $Y - 10 - 0.8(Y - T) + 100r - G = 15$. Substituting the values for Y and G and solving for T yields $T = 12.5$. That is, the government should set a lump-sum tax of 12.5.

Question 4. a.


r
0.1
0.09
0.08
0.075
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Saving curve, S
Investment
curve, I
0
5
7.5
10
15
20
25
30
Desired national saving and investment

Question 4. b.


r
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
r^w
A
B
Saving curve, S
Investment
curve, I
$CA = -10$
0
5
10
15
20
25
30
S^d
I^d
S^d and I^d