UCLA - Econ 102 - Fall 2018
Instructor: François Geerolf
Midterm Exam
November 5, 2018
Time Limit: 1 hour 15 minutes

Last Name: ____________________

First Name: ____________________

Student ID Number: ______________ Signature ____________________

Midterm Exam

This exam contains 11 pages (including this cover page). You can earn 100 points.

Instructions:

1. Print your Last name, First Name, Student ID Number and Signature at the top of this page.
2. The only items which should be on your desk are pencils and/or pens. NO other items are allowed. Place any other item UNDER your desk. Calculators are NOT allowed.
3. Once the exam begins, you are not allowed to leave the room until you hand in your exam.

Good luck ! Budget your time wisely ! (skip the question or even the exercise if you get stuck)

Do not write below this line (Grader use only)

Question	Points	Score
1	40	
2	20	
3	20	
4	20	
Total:	100	

20 Multiple Choice Questions (40 points)

1. (40 points) Each multiple choice question has only one right answer. Use the Scantron to mark your answers.

   (1) (2 points) In the formula $C(Y-T) = c_0 + c_1(Y-T)$, what is the Marginal Propensity to Consume ?

   A. $C(Y-T)$
   B. $Y-T$
   C. c_0
   D. c_1

   (2) (2 points) For the US economy, which of the following represents the largest component of GDP?

   A. imports
   B. investment
   C. government spending
   D. exports
   E. none of the above: there exists a component of GDP that is greater than all the above in the US economy

   (3) (2 points) What is an endogenous variable?

   A. A variable that depends on other variables in the model
   B. A parameter
   C. A variable not explained within the model but that is instead taken as given
   D. A consumption function

   (4) (2 points) Which of the following would tend to make the government expenditure multiplier smaller?

   A. an increase in the marginal propensity to consume
   B. an increase in the marginal propensity to save
   C. a reduction in taxes
   D. a reduction in government spending
   E. none of the above

   (5) (2 points) Which of the following would tend to make the tax multiplier smaller?

   A. an increase in the marginal propensity to consume
   B. an increase in the marginal propensity to save
   C. a reduction in taxes
   D. a reduction in government spending
   E. none of the above

(6) (2 points) Based on our understanding of the paradox of thrift, we know that a reduction in the desire to save will cause:

A. an increase in equilibrium GDP.
B. a reduction in GDP.
C. an increase in government spending.
D. no change in equilibrium GDP.
E. a permanent reduction in the level of saving.

(7) (2 points) Suppose that the consumption function is given by $C(Y_D) = 250 + 0.75Y_D$, where $Y_D \equiv Y - T$ is disposable income. Then private saving S is:

A. $-250 + 0.25Y_D$**.**
B. $-250 + 0.75Y_D$.
C. $-1000 + 0.25Y_D$.
D. $-1000 + 0.75Y_D$.
E. $-250 - 0.75Y_D$.

(8) (2 points) If $C(Y_D) = 2000 + .9Y_D$, investment is exogenous, and the economy is closed, what decrease in taxes must occur for equilibrium output to increase by 1000?

A. 900.
B. 111.111**...**
C. 100.
D. 1000.
E. 500.

(9) (2 points) Which of the following will not increase equilibrium output in the short run?

A. increases in R&D
B. increases in consumer confidence
C. increases in investment demand
D. increases in government spending
E. decreases in taxes

(10) (2 points) Based on the Keynesian Cross model, an equal and simultaneous reduction in G and T will cause:

A. an increase in output.
B. no change in output.
C. a reduction in output.
D. an increase in investment.

(11) (2 points) Suppose that the marginal propensity to consume is 0.8. Given this information, which of the following events will cause the largest increase in output?

A. G increases by 200.
B. T decreases by 200.
C. I increases by 150.
D. both A and B.

(12) (2 points) Which of the following is true about the share of goods VS services in GDP ?

A. In both 1945 and 2018, goods are a larger share of GDP than services.
B. In both 1945 and 2018, services are a larger share of GDP than goods.
C. In 1945, goods were a larger share of GDP than services. It's the opposite in 2018.
D. In 1945, services were a larger share of GDP than goods. It's the opposite in 2018.

(13) (2 points) In the overlapping generations model, why do people save?

A. To leave bequests.
B. For prestige.
C. Because of religious beliefs.
D. They have too much money.
E. To plan for retirement.

(14) (2 points) If GDP per capita grows at 2% per year, how long does it take for it to double?

A. 50 years.
B. 35 years.
C. 20 years.
D. 65 years
E. 80 years.

(15) (2 points) Which of the following cannot increase long-run growth?

A. Patents.
B. Capital accumulation.
C. Government funded research.
D. Prizes.
E. Privately funded research.

(16) (2 points) The **five** following multiple choice questions are based on the Bathtub model. In the Bathtub model, what is the law of motion for unemployment?

A. $\Delta U_{t+1} = fU_t - sE_t$
B. $\Delta U_{t+1} = sE_t - fU_t$
C. $U_{t+1} = sE_t - fU_t$
D. $\Delta U_{t+1} = fL - sE_t$
E. $U_{t+1} = fU_t - sE_t$

(17) (2 points) What is the steady-state unemployment rate u^*?

A. $sL/(s+f)$
B. $s/(s+f)$
C. $fL/(f+s)$
D. $f/(f+s)$

(18) (2 points) Assume a monthly job separation rate equal to $s = 1\%$, and a monthly job finding rate equal to $f = 19\%$. Assume that the labor force is given by $L = 100$ million. What is the steady-state unemployment rate?

A. 4.8%
B. 4%
C. 5%
D. 5.8%
E. 5.2%

(19) (2 points) Assume that initially, the unemployment rate is given by $u_0 = 10\%$. How many people lose their jobs each month initially?

A. 900,000
B. 1,000,000
C. 10,000,000
D. 1,900,000
E. 190,000

(20) (2 points) Assume that initially, the unemployment rate is given by $u_0 = 10\%$. How many people find a job each month initially?

A. 900,000
B. 1,000,000
C. 10,000,000
D. 1,900,000
E. 190,000

Exercise 1 (20 points)

2. (20 points) Consider the basic goods market model of Lecture 7: consumption is linear in disposable income with a Marginal Propensity to Consume equal to c_1, disposable income is income minus taxes. However, we make three modifications to this model: we assume an accelerator effect of demand on investment (investment depends on sales) so that $I = b_0 + b_1 Y$; we assume that government spending depends on the level of output $G = g_0 + g_1 Y$; and finally we assume the presence of automatic stabilizers $T = t_0 + t_1 Y$.

   (a) (4 points) Solve for equilibrium output.

   Solution: We write that Output = Demand:

$$\begin{aligned} Y = Z &= C + I + G \\ Y &= c_0 + c_1 (Y - T) + b_0 + b_1 Y + g_0 + g_1 Y \\ &= c_0 + c_1 (Y - (t_0 + t_1 Y)) + b_0 + b_1 Y + g_0 + g_1 Y \\ &= c_0 + c_1 Y - c_1 t_0 - c_1 t_1 Y + b_0 + b_1 Y + g_0 + g_1 Y \\ Y &= (c_0 - c_1 t_0 + b_0 + g_0) + ((1 - t_1) c_1 + b_1 + g_1) Y \\ &\Rightarrow \quad (1 - (1 - t_1) c_1 - b_1 - g_1) Y = (c_0 - c_1 t_0 + b_0 + g_0) \\ &\Rightarrow \quad \boxed{Y = \frac{1}{1 - (1 - t_1) c_1 - b_1 - g_1} (c_0 - c_1 t_0 + b_0 + g_0)}. \end{aligned}$$

   (b) (4 points) Find a condition on b_1, c_1, g_1 and t_1 such that the multiplier stays finite.

   Solution: A condition such that the multiplier stays finite is that:

$$(1 - t_1) c_1 + b_1 + g_1 < 1$$

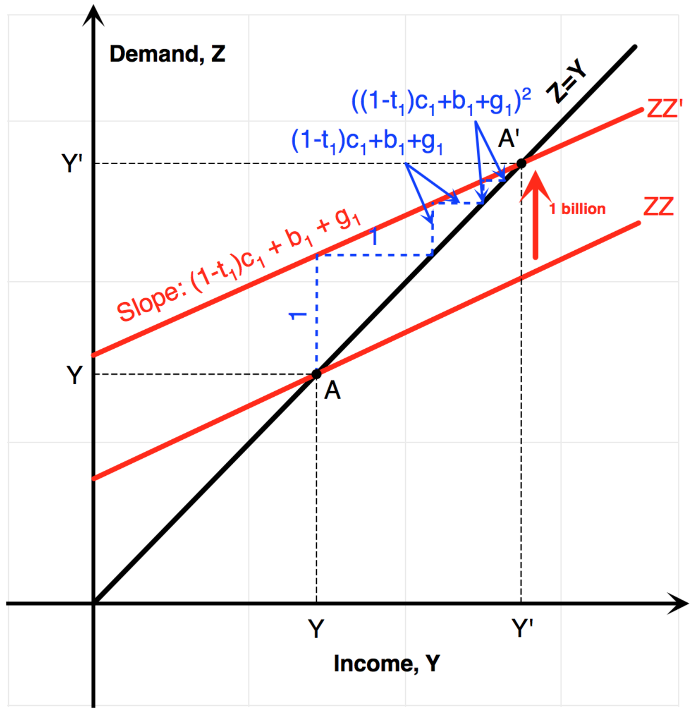
   (c) (4 points) What happens if the multiplier is infinite? Does GDP become infinite?

   Solution: When $(1 - t_1) c_1 + b_1 + g_1 \geq 1$, each new round of spending leads to an even greater new round of new income and new spending. Therefore, the tax multiplier is infinite. Of course, GDP cannot become infinite: there only is a finite amount of resources in the economy.

   Therefore, this just means that output cannot be demand-determined and that it is always constrained by supply (the amount of inputs there is in the economy). The Keynesian model does not apply anymore.

   (d) (4 points) Give both a graphical as well as an algebraic justification for the value of the multiplier.

Solution: The (ZZ) curve has a slope equal to $(1-t_1)c_1 + b_1 + g_1$.



Algebraically, out of 1 dollar of income, $(1-t_1)$ is disposable income, $c_1(1-t_1)$ is consumed. Moreover, b_1 is invested and government spending also increases by g_1. Thus the first indirect effect is equal to $c_1(1-t_1)+b_1+g_1$. This indirect effect leads to a second effect of $(c_1(1-t_1)+b_1+g_1)^2$, etc. so that:

$$1 + (c_1(1-t_1)+b_1+g_1) + (c_1(1-t_1)+b_1+g_1)^2 + ... = \frac{1}{1-(c_1(1-t_1)-b_1-g_1}.$$

(e) (4 points) Assume that $c_1 = 2/3$, $b_1 = 1/6$, $g_1 = 1/6$ and $t_1 = 1/4$. What is the change in output if government spending (g_0) increases by 1 billion dollars? If taxes (t_0) decrease by 1 billion dollars?

Solution: The government spending multiplier is:

$$\text{G Multiplier} = \frac{1}{1-(1-t_1)c_1-b_1-g_1} = \frac{1}{1-1/2-1/6-1/6} = 6.$$

If government spending increases by 1 billion dollars, output rises by 6 billion dollars.

The tax multiplier is:

$$\text{T Multiplier} = -\frac{c_1}{1-(1-t_1)c_1-b_1-g_1} = -\frac{2/3}{1-1/2-1/6-1/6} = -4.$$

If taxes decrease by 1 billion dollars, output rises by 4 billion dollars.

Exercise 2 (20 points)

3. (20 points) Consider the neoclassical labor market model. On the demand side, we assume a Cobb-Douglas production function for $f(l)$, such that: $f(l) = Al^{1-\alpha}$. On the supply side, we assume a linear utility for consumption as well as a power function of disutility for work $U(c,l) = c - B \cdot l^{1+\epsilon}/(1+\epsilon)$.

   (a) (4 points) Assume that the price of consumption is p, and that the wage is w. Derive the labor demand curve assuming that firms maximize their profits $pf(l)-wl$.

   Solution: We solve:

   $$\max_l \quad pf(l) - wl = \max_l \quad pAl^{1-\alpha} - wl$$

   This implies:

   $$pA(1-\alpha)l^{-\alpha} = w \quad \Rightarrow \quad \boxed{\frac{w}{p} = A(1-\alpha)l^{-\alpha}}.$$

   This is a labor demand curve: a (negative) relationship between the real wage and the quantity of employment demanded.

   (b) (4 points) Derive the labor supply curve assuming that workers' budget constraint is given by $pc = wl$ (you can use whichever of the 4 methods you prefer).

   Solution: Let us replace out c in the utility function using the budget constraint and the maximize over l:

   $$\max_l \quad \frac{w}{p}l - B\frac{l^{1+\epsilon}}{1+\epsilon}$$

   This implies:

   $$\boxed{\frac{w}{p} = Bl^{\epsilon}}.$$

   This is a labor supply curve: a positive relationship between the real wage and the number of hours supplied.

   (c) (4 points) Calculate the equilibrium quantity of labor l.

   Solution: Equating the two above expressions, to find the intersection of the labor demand curve and the labor supply curve allows to find:

$$A(1-\alpha)l^{-\alpha} = Bl^{\epsilon} \quad \Rightarrow \quad \frac{A(1-\alpha)}{B} = l^{\epsilon+\alpha}$$
$$\Rightarrow \quad \boxed{l = A^{1/(\epsilon+\alpha)}(1-\alpha)^{1/(\epsilon+\alpha)}B^{-1/(\epsilon+\alpha)}}.$$

(d) (4 points) Calculate the equilibrium real wage w/p.

Solution: Substituting in either of the labor supply or labor demand curves, for example the labor supply curve:

$$\begin{aligned}\frac{w}{p} &= Bl^{\epsilon} \\ &= BA^{\epsilon/(\epsilon+\alpha)}(1-\alpha)^{\epsilon/(\epsilon+\alpha)}B^{-\epsilon/(\epsilon+\alpha)} \\ &= A^{\epsilon/(\epsilon+\alpha)}(1-\alpha)^{\epsilon/(\epsilon+\alpha)}B^{1-\epsilon/(\epsilon+\alpha)} \\ \frac{w}{p} &= A^{\epsilon/(\epsilon+\alpha)}(1-\alpha)^{\epsilon/(\epsilon+\alpha)}B^{\alpha/(\epsilon+\alpha)}\end{aligned}$$

This gives us the result:

$$\boxed{\frac{w}{p} = A^{\epsilon/(\epsilon+\alpha)}(1-\alpha)^{\epsilon/(\epsilon+\alpha)}B^{\alpha/(\epsilon+\alpha)}}.$$

(e) (4 points) We consider a fall in log productivity $\Delta \log A$, where log is the natural log. What is the change in log employment $\Delta \log(l)$, and the change in the log real wage $\Delta \log(w/p)$, as a function of $\Delta \log A$?

Solution: Taking natural logs of the expression in question 3:

$$\log l = \frac{1}{\epsilon+\alpha}\log A + \frac{1}{\epsilon+\alpha}\log(1-\alpha) - \frac{1}{\epsilon+\alpha}\log B$$

This implies that the change in log employment is:

$$\boxed{\Delta \log l = \frac{\Delta \log A}{\epsilon+\alpha}}.$$

Taking natural logs of the expression in question 4:

$$\log\left(\frac{w}{p}\right) = \frac{\epsilon}{\epsilon+\alpha}\log A + \frac{\epsilon}{\epsilon+\alpha}\log(1-\alpha) + \frac{\alpha}{\epsilon+\alpha}\log B$$

This implies that the change in the log real wage is:

$$\boxed{\Delta \log\left(\frac{w}{p}\right) = \frac{\epsilon\Delta \log A}{\epsilon+\alpha}}.$$

Exercise 3 (20 points)

4. (20 points) Consider the standard Solow growth model. We assume that the economy's production function is $Y = F(K, L) = K^{1/3}L^{2/3}$. Assume no population growth.

   (a) (2 points) What is the name of this production function?

   Solution: This production function is called a Cobb-Douglas production function.

   (b) (2 points) Show that this production function has constant returns to scale.

   Solution: This production function has constant returns to scale because for all x:

$$F(xK, xL) = (xK)^{1/3}(xL)^{2/3} = xK^{1/3}L^{2/3} = xF(K, L)$$

   (c) (4 points) For a given saving rate, s, and depreciation rate, δ, derive an expression for capital per worker in the steady state. Give the intermediate steps.

   Solution: We write the evolution of the capital stock as:

$$\begin{aligned} K_{t+1} &= (1-\delta)K_t + I_t \\ &= (1-\delta)K_t + sY_t \\ K_{t+1} &= (1-\delta)K_t + sK_t^{1/3}L^{2/3} \end{aligned}$$

   Dividing both sides by L :

$$\frac{K_{t+1}}{L} = (1-\delta)\frac{K_t}{L} + s\left(\frac{K_t}{L}\right)^{1/3}$$

   In steady state, $\frac{K_{t+1}}{L} = \frac{K_t}{L} = \frac{K^*}{L}$, so we have:

$$\delta\frac{K^*}{L} = s\left(\frac{K^*}{L}\right)^{1/3}$$

   Therefore:

$$\left(\frac{K^*}{L}\right)^{2/3} = \frac{s}{\delta}$$

   Finally, the capital per worker in the steady state is given by:

$$\boxed{\frac{K^*}{L} = \left(\frac{s}{\delta}\right)^{3/2}}.$$

(d) (4 points) Derive an expression for output per worker in the steady state. What is it equal to if $s = 24\%$ and $\delta = 6\%$?

Solution: Using that: $Y^* = K^{*1/3}L^{2/3}$, we have:

$$\frac{Y^*}{N} = \left(\frac{K^*}{L}\right)^{1/3} \quad \Rightarrow \quad \boxed{\frac{Y^*}{L} = \left(\frac{s}{\delta}\right)^{1/2}}.$$

The numerical application gives:

$$\frac{Y^*}{L} = \left(\frac{s}{\delta}\right)^{1/2} = \left(\frac{0.24}{0.06}\right)^{1/2} = 4^{1/2} = 2.$$

(since $2^2 = 4$)

(e) (4 points) Give an expression for consumption per worker in the steady state. What is it equal to if $s = 24\%$ and $\delta = 6\%$?

Solution:

$$\frac{C^*}{N} = (1-s)\frac{Y^*}{N} = (1-s)\left(\frac{s}{\delta}\right)^{1/2}.$$

The numerical application gives:

$$\frac{C^*}{N} = (1-s)\frac{Y^*}{N} = \frac{76}{100} * 2 = \frac{152}{100} = 1.52.$$

(f) (4 points) Derive the saving rate corresponding to the Golden Rule level of capital accumulation. Show the intermediate steps.

Solution: The Golden Rule level of capital accumulation is such that the level of steady-state consumption per capita C^*/N is maximized. Using the expression for consumption found above:

$$\max_s \quad (1-s)\left(\frac{s}{\delta}\right)^{1/2}.$$

This is equivalent to maximizing (although you can also take the derivative directly):

$$\max_s \quad (1-s)s^{1/2} = s^{1/2} - s^{3/2}$$

The first-order condition is:

$$\frac{1}{2}s^{-1/2} - \frac{3}{2}s^{1/2} = 0 \quad \Rightarrow \quad \boxed{s = \frac{1}{3} = 33.3\%}.$$