Exam 1: Version B, M/W
Spring 2019

Do not open this exam until instructed to do so.

- You have 75 minutes to complete this exam
- You may use a calculator; you may **not** use any other device (cell phone, etc.)
- You may consult one page of notes (both sides); you may not use books, notebooks, etc.
- Show your work

Solutions

I understand that the honor code applies: I will not lie, cheat, or steal to gain an academic advantage, nor tolerate those who do.

Signature

Michael Waugh

Printed Name

For each question below, **write the letter of the most correct answer to the left of the question.**

1. (3 pts.) If the marginal propensity to consume is 0.85, then
   A. a one dollar increase in disposable income leads to 0.85$ decrease in consumption.
   B. a one dollar increase in disposable income leads to 0.85$ increase in consumption.
   C. consumers are very uncertain about the future and save a lot.
   D. a one dollar increase in disposable income leads to 0.15$ increase in consumption.

2. (3 pts.) Using the model of Chapter 3, when government spending increases and taxes are increased by and equal amount, then:
   A. interest rates fall
   B. interest rates rise
   C. capital in the future will increase as higher interest rates incentivize investment.
   D. no change in anything, this policy is deficit neutral.

3. (3 pts.) An implication of constant returns to scale is that a doubling capital and labor implies
   A. the marginal product of labor is unchanged.
   B. the marginal product of capital falls.
   C. output increases, but by more than double.
   D. output increases, but by less than double.

4. (3 pts.) Using the model of Chapter 3, but now assume that consumption decreases when interest rates increase. If there is a decrease in investment demand, then:
   A. quantity of investment decreases and the interest rate rises.
   B. investment is unchanged and the interest rate falls.
   C. quantity of investment decreases and the interest rate falls.
   D. investment and the interest rate are both unchanged.

5. (3 pts.) If 7 million workers are unemployed, 133 million workers are employed, and the adult population equals 200 million, the unemployment rate is
   A. 5.3 percent
   B. 5 percent
   C. 3.5 percent
   D. 2.1 percent.

6. (3 pts.) Suppose there are two types of workers, high-skill and low-skill. The idea of diminishing marginal products implies:
   A. that less low-skilled workers increases the marginal product of labor for low-skilled workers.
   B. that less low-skilled workers decreases the marginal product of labor for low-skilled workers.
   C. that less low-skilled workers decreases the real wage for low-skilled workers.
   D. that less low-skilled workers increases the marginal product of capital.

7. (3 pts.) Following up on the previous question with two types of workers, high-skill and low-skill. One would suspect less high-skilled workers would result in:
   A. higher capital formation in the future.
   B. a lower marginal product of capital.
   C. more output.
   D. a higher marginal product of capital.

8. (3 pts.) In problem set 1, when you computed the difference between the interest rate on a risk free Government bond and the inflation rate you...
   A. computed the real interest rate, i.e. the interest rate after taking into account changes in prices.
   B. computed the risk free interest rate, i.e. adjusted the Government bond for risk characteristics.
   C. computed real GDP, i.e. GDP after taking into account changes in prices.
   D. computed the effects of monetary policy.

9. (3 pts.) The CPI is determined by computing
   A. an average of prices of all goods and services
   B. the price of a fixed basket of goods and services, relative the the price of the same basket in a base year
   C. the price of a basket of goods and services that changes ever year, relative to the same basked in a base year
   D. nominal GDP relative to real GDP

10. (3 pts.) If the adult population equals 250 million, of which 145 million are employed and 5 million are unemployed, the labor force participation rate is
   A. 50 percent
   B. 58 percent
   C. 60 percent
   D. 67 percent

11. (35 pts.) **The Power of Productivity.** This is the title of a book written by a former Mckinsey consultant and it emphasizes that improvements in productivity are very powerful... it just leads to a lot of good outcomes. Lack of productivity can lead to bad outcomes. Let's see this ourselves by considering the following situation

    - Due to technological advances, total factor productivity (TFP) **increases.**

    Given this information, please answer the following questions.

    a. (7 pts.) How would an increase in TFP affect GDP? Carefully explain your answer.

Simple....

$$GDP = Y = A k^{\alpha} L^{1-\alpha}$$

This is TFP, if TFP ↑, the Y, (GDP) increases... The idea being that we are now more productive, thus given K, L, we can now produce more stuff.

b. (7 pts.) How does an increase in TFP affect real wages and the real rental rate of capital? Carefully explain your answer.

Real wages $= \frac{W}{P} = MPL = (1-\alpha)\frac{Y}{L}$

So if Y is going up, L is same, k is same, this means MPL ↑, and thus the Real wage ↑. Super intuitive, TFP ↑, we are now more productive and earnings reflect this...

Real Rental Rate of Capital $= \frac{R}{P}$

$= MPK = \alpha \frac{Y}{K}$

Same deal as above, Y ↑, so MPK, and $\frac{R}{P}$ must increase. Intuition is that Capital is also "more productive" and thus gets the benefit.

c. (7 pts.) How does an increase in TFP affect each expenditure component of GDP? To simplify matters assume that the demand curve for investment does not change and that government spending and taxes are unchanged.

$Y = C + I + G$

Unchanged

$C = \beta(Y - T)$

And we know $Y \uparrow$, so $\Rightarrow C \uparrow$

$I(r) = S$ ... what is up with S? Savings increase as well as private savings ...

$(Y - T) - \beta(Y - T)$ are $\uparrow\uparrow\uparrow$, So public savings unchanged, private savings $\uparrow \Rightarrow$ National savings $\uparrow \Rightarrow I \uparrow$

d. (7 pts.) If TFP increases by one percent today, **in the future (not today)**, how will wages change: one percent, less than one percent, or more than one percent? Please carefully explain why.

Lets think about this...

$$Y = A K^{\alpha} L^{1-\alpha}$$

$$\uparrow$$

up 1%

But Rember... I ↑ from previous page ⇒

K ↑ through capital formation ($K_{t+1} = (1-\delta)K_t + I_t$)

Thus output in the future will have gone up by more 1%

e. (7 pts.) You roommate is a Marxist and makes the following claim "Technological advances favors the owners of capital at the expense of workers...specifically capital owners will capture a larger share of national income and workers will capture a smaller share of national income" Carefully evaluate this claim using the tools we have developed in class.

Not... technologe is benefiting both as from (b)

$$Y = \underbrace{\frac{W}{P} \cdot L + \frac{R}{P} \cdot K}$$

This is the income side of GDP.

And TFP ↑, both real wages ~~(factors)~~ ↑. Returns on capital ↑. More over, we know that as a share of output... workers share and capilats share is fixed... so the share of National income is CONSTANT

$$\underbrace{\frac{\frac{W}{P} \cdot L}{Y}}_{(1-\alpha)} \quad \text{and} \quad \underbrace{\frac{\frac{R}{P} \cdot K}{Y}}_{\alpha}$$

12. (35 pts.) **Measuring GDP in the TECH Economy...** Often people wonder ask the question: how do TECH companies show up in GDP? Well, just like any other company. Bellow is some information about a representative economy with three companies: Google, Chipotle, and Nvidia. Some information to help assist your measurement:

    - Your friendly National Income Accountant tells you to treat advertising services like an intermediate input expense. That is just like tires as they go into a car from our first handout.
    - A GPU is a special type of computer chip that is used in special computing technologies like machine learning, and bitcoin mining. Google uses them to provide advertising services.

Nvidia

	Item	Value (in thousands)
Sales:	GPUs to Google	300
	Exports of GPUs to China	600
Outlays:	wages	400
	dividends	500

Chipotle

	Item	Value (in thousands)
Sales:	to consumers	1300
Outlays:	imported avocados	200
	advertising services from Google	900
	wages	200

Google

	Item	Value (in thousands)
Sales:	advertising services to Chipotle	900
Outlays:	Nvidia GPUs	300
	wages	600

a. (7 pts.) Compute value added for each of these companies. What is aggregate GDP?

Nividia	Sales	−	Intermidiate Input costs
900	300 + 600		0
Chipotle	Sales	−	Intermidiate Input costs
200	1300		200 + 900 Accountant told us.
Google	Sales	−	Intermidiate Input costs
900	900		0

Total GDP = 2000

b. (7 pts.) What are each companies income payments. Please break them down for both labor and capital.

	labor	Capital
Nvidia	400	500
900		
Chipotle	200	0
200		
Google	600	300
900		

This is the purchase of an investment good, thus a "payment" to capital

c. (7 pts.) Compute each expenditure component to GDP.

C + I + G + EX − IM

C 1300 ~ Burritos to consumers

I 300 ~ GPUs to Google

G 0

EX 600 ~ Exports

−IM −200 ~ Avocados

2000

d. (7 pts.) What is "labor's share" of income in this economy?

Labor's share is sum of payments to Labor, divided by GDP...

Total Wage payments =

400 + 200 + 600 (From ⓑ)

GDP = 2000

Labor's Share $\frac{1200}{2000} = 0.60$

e. (7 pts.) The National Income Accountant suggest that advertising maybe should be treated like an investment rather than an expense. Consider the following question:

If advertising was treated as an investment, how would GDP change?

Please attempt the question no matter what. But the most precise answer will show how value added changes, income changes, and then the expenditure side of GDP changes in a consistent way.

Here is what happens, the only place it changes from VA side or Income side is Chipotle...

Chipotle is... $1300 - 200 = 1100$

Now Advirtising is not an expense.

From income side, it is NOW... $200 + 900 = 1100$

Now Advirtising is an investment activity so it is a payment to capital

From Expenditure side...

C	I	G	EX	- IM	= 2900
1300	300	0	600	- 200	
	900				

Advirtising → 900

GDP ↑ by 900!!!