Finance 30220  
Solutions to Practice Midterm #1

1) Suppose that the return on a 90-day T-Bill is .6% while return on a 180 day T-Bill is 1.1%. Which of these two assets has the better annualized return?

We need to make these returns comparable by expressing them both as annual returns:

\[ (1.006)^4 = 1.024 \Rightarrow 2.4\% \]

\[ (1.011)^2 = 1.022 \Rightarrow 2.2\% \]

On an annualized basis, the 90 Day T-Bill is the better return.

2) Consider the following data on movie grosses:

<table>
<thead>
<tr>
<th>Year</th>
<th>Movie</th>
<th>Lifetime Gross</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1972</td>
<td>Godfather</td>
<td>$135M</td>
<td>#210</td>
</tr>
<tr>
<td>2002</td>
<td>Spiderman</td>
<td>$404M</td>
<td>#7</td>
</tr>
</tbody>
</table>

What’s wrong with this ranking? Use the following price data to calculate the real grosses in 2008 dollars:

<table>
<thead>
<tr>
<th>Year</th>
<th>CPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1972</td>
<td>42</td>
</tr>
<tr>
<td>2002</td>
<td>180</td>
</tr>
<tr>
<td>2008</td>
<td>216</td>
</tr>
</tbody>
</table>

These ranking don’t take into account the fact that prices were a lot higher in 2002 than they were in 1972. By scaling up both grosses to reflect 2008 prices, we can compare these grosses on equal terms.

\[ Godfather: \quad 135M \left( \frac{216}{42} \right) = 694M \]

\[ Spiderman: \quad 404M \left( \frac{216}{180} \right) = 485M \]

Sorry Spidey, but you lose!
3) Suppose that you have the following information on an economy:

- Gross Domestic Product: $1,000
- Government Purchases: $200
- Tax Revenues: $150
- Current Account: -$200
- Net Factor Payments: $50
- Depreciation: $20
- Consumption Expenditures: $780


First, we can convert GDP (gross domestic product) to GNP (gross national product) by adding net factor payments:

\[ GNP = 1,000 + 50 = 1,050 \]

Now, to get National Income, we subtract depreciation

\[ \text{National Income} = 1,050 - 20 = 1,030 \]

The current account is given by net exports plus net factor payments, so Net Exports would be the current account minus net factor payments:

\[ \text{Net Exports} = -200 - 50 = -250. \]

Personal savings equals national income minus taxes minus consumption:

\[ \text{Personal Savings} = 1,030 - 150 - 780 = 100 \]

Gross savings is GNP – Consumption – Government

\[ \text{Gross Savings} = 1,050 - 780 - 200 = 70 \]

Gross Savings equals Gross Investment + Current Account

\[ 70 = \text{Gross I} - 200 \]

Solving for I, we get

\[ \text{Gross Investment} = 270 \]

Net Investment is Gross Investment minus depreciation

\[ \text{Net Investment} = 270 - 20 = 250 \]
The Government Deficit is Government Spending minus Taxes

**Government Deficit = $200 - $150 = $50**

4) In the economy of Oz, there are only two commodities: Broomsticks and crystal balls. Below is some data for the country of Oz.

<table>
<thead>
<tr>
<th></th>
<th>Quantity</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broomsticks</td>
<td>50</td>
<td>$40</td>
</tr>
<tr>
<td>Crystal Balls</td>
<td>20</td>
<td>$100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Quantity</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broomsticks</td>
<td>30</td>
<td>$50</td>
</tr>
<tr>
<td>Crystal Balls</td>
<td>30</td>
<td>$90</td>
</tr>
</tbody>
</table>

a) Using 2012 as the base year, calculate the CPI for 2012 and 2013

First, we need to calculate expenditure shares:

**Broomsticks:**

\[
\frac{50 \times 40}{50 \times 40 + 20 \times 100} = .50
\]

**Crystal Balls:**

\[
\frac{20 \times 100}{50 \times 40 + 20 \times 100} = .50
\]

Now, the price index:

**2012:**

\[
P = .50 \left( \frac{40}{40} \right) + .50 \left( \frac{100}{100} \right) = 1.00
\]

**2013:**

\[
P = .50 \left( \frac{50}{40} \right) + .50 \left( \frac{90}{100} \right) = 1.075
\]

b) Calculate Nominal GDP in each year.

**2012:**

\[GDP = 50 \times 40 + 20 \times 100 = 4,000\]

**2013:**

\[GDP = 30 \times 50 + 30 \times 90 = 4,200\]

c) Use the CPI to express real GDP in 2013 dollars.
2012: \[ RGDP = 4,000 \left( \frac{1.075}{1.00} \right) = 4300 \]

2013: \[ RGDP = 4,000 \left( \frac{1.075}{1.075} \right) = 4200 \]

Now, let’s construct a GDP Deflator

d) Calculate Real GDP each year using 2013 prices

2012: \[ RGDP = 50(50) + 20(90) = 4,300 \]

2013: \[ RGDP = 30(50) + 30(90) = 4,200 \]

e) Using your answers to (b) and (d), calculate the GDP deflator

2012: \[ P = \left( \frac{4000}{4300} \right) = .93 \]

2013: \[ P = \left( \frac{4200}{4200} \right) = 1.00 \]

5) Consider the following data from the US economy.

<table>
<thead>
<tr>
<th>Year</th>
<th>Real GDP (Billions)</th>
<th>Real Capital Stock (Billions)</th>
<th>Employment (Thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950</td>
<td>2,273</td>
<td>6,328</td>
<td>43,528</td>
</tr>
<tr>
<td>1960</td>
<td>3,123</td>
<td>9,410</td>
<td>54,274</td>
</tr>
</tbody>
</table>

Assume that production can be represented by the following production function:

\[ Y = AK^{\frac{1}{3}}L^{\frac{2}{3}} \]

Calculate the average annual rate of productivity growth during the 1950’s.

First, calculate the average annual growth rates...

\[ \% \Delta Y = \left[ \frac{\ln (3,123) - \ln (2,273)}{10} \right] * 100 = 3.2 \]
\[
% \Delta K = \left[ \frac{\ln(9,410) - \ln(6,328)}{10} \right] * 100 = 3.9
\]

\[
% \Delta L = \left[ \frac{\ln(54,274) - \ln(43,528)}{10} \right] * 100 = 2.2
\]

Now, find productivity growth:

\[
% \Delta A = (3.2) - \frac{1}{3}(3.9) - \frac{2}{3}(2.2) = 0.4\%
\]

6) Consider the following economy:

\[
Y = AK^\frac{1}{3}L^\frac{2}{3}\]

FYI: For this production function, \(\frac{Y}{K} = A \left(\frac{K}{L}\right)^{\frac{2}{3}}\)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment Rate</td>
<td>8%</td>
</tr>
<tr>
<td>Depreciation rate for capital</td>
<td>5%</td>
</tr>
<tr>
<td>Rate of Population Growth</td>
<td>2%</td>
</tr>
<tr>
<td>Productivity Level</td>
<td>12</td>
</tr>
<tr>
<td>Productivity Growth</td>
<td>3%</td>
</tr>
</tbody>
</table>

Currently, the economy has a labor force of 8,000 and a capital stock equal to 24,000.

a) Calculate this country’s current rate of economic growth.

First, calculate the average product of capital:

\[
\left( \frac{Y}{K} \right) = A \left( \frac{K}{L} \right)^{\frac{2}{3}} = 12 \left( \frac{24,000}{8,000} \right)^{\frac{2}{3}} \approx 5.75
\]

Now, plug everything else in.

\[
g_k = \theta \left( \frac{Y}{K} \right) - \delta - g_L
\]

\[
g_k = .08(5.75) - .05 - .02 = .39
\]

This economy has a capital stock per capita that is growing at 39% per year. The capital stock grows at 39% + 2% = 41%

We have that GDP growth is given by
\[
g_Y = g_A + \left( \frac{1}{3} \right) g_K + \left( \frac{2}{3} \right) g_L = 3 + \left( \frac{1}{3} \right)(.41) + \left( \frac{2}{3} \right)(.02) = .179
\]

This economy has GDP growth of 17.9% 
**GDP per capita** grows at 17.9% - 2% = 15.9%

b) How fast will this country grow annually once its steady state is reached?

In the steady state, the average product of capital is constant (Y/K), so the capital stock grows at the same rate as GDP. Using the growth accounting equation…

\[
g_Y = g_A + \left( \frac{1}{3} \right) g_K + \left( \frac{2}{3} \right) g_L
\]

\[
g_Y = g_K
\]

\[
g_Y = g_A + \left( \frac{1}{3} \right) g_Y + \left( \frac{2}{3} \right) g_L
\]

Solve for GDP growth

\[
g_Y = \left( \frac{3}{2} \right) g_A + g_L
\]

Plug in the numbers…

\[
g_Y = \left( \frac{3}{2} \right) g_A + g_L = \left( \frac{3}{2} \right)(.03) + .02 = .065
\]

This economy grows at 6.5% per year in terms of GDP. GDP per capita grows at 6.5% - 2% = 4.5%.

7) The main empirical fact we see across countries is that on average, rich countries tend to grow slower than poor countries. Given the mechanics of economic growth, how would you explain this observation?

*Wealthy countries (in terms of GDP per capita) have high levels of capital per capita. As capital per capita rises, diminishing returns to capital start to kick in and slow down growth.*

8) Suppose that there are 100 people in the economy. Of these, 90 people are either working or actively looking for a job. Each month, 5 people lose their job, and take one month to find a new one. Each January, 3 people lose their job and take a year to find a new job.

a) What is the unemployment rate in the economy?
Labor Force = 90

Unemployed = 8

UR = (8/90)*100 = 8.8%

b) What is the participation rate?

Eligible = 100

Labor Force = 90

PR = (90/100)*100 = 90%

c) What is the average duration of unemployment?

Note that there are a total of 63 people unemployed over the course of a year (5 per month times twelve months plus 3 for the full year).

(60/63)*4 + (3/63)*52 = 6.3 weeks

9) Suppose you have the following information regarding the production of Hula-Hoops

<table>
<thead>
<tr>
<th># of Hours</th>
<th># of Hula-Hoops</th>
<th>(a) MPL</th>
<th>(c)MPL</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>1</td>
<td>16</td>
<td>16</td>
<td>32</td>
</tr>
<tr>
<td>2</td>
<td>28</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td>3</td>
<td>38</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>44</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>5</td>
<td>48</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>6</td>
<td>50</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

Hula-Hoops cost $2 apiece, and the nominal wage rate is $12/hr.

a) Calculate the marginal product of labor.

b) How many hours of labor would the firm hire?
At a real wage of \((12/2) = 6\), 4 hours are hired.

c) Suppose that through computerization, the firm is able to increase labor’s productivity by 100% (i.e., each hour of labor produces 100% more hula hoops). What would be the firm’s new demand for labor?

Now, at a real wage of 6, the firm hires 5 hours (labor demand shifts right)

10) Suppose the nominal wage rate is $10/hr., and the average price of consumption goods is $2. You have 80 hours per week available to work.

   a) Sketch your budget constraint and indicate a labor choice.

   ![Budget Constraint and Labor Choice](image1)

   b) Now, suppose that you receive an unexpected inheritance of $100 from a long lost aunt. Show the effect of this gift on your budget constraint and your labor choice.

   ![Budget Constraint and Labor Choice with Gift](image2)
Given the extra income, you would most likely work less (labor supply shifts left)

c) Suppose that your firm adds a “time and a half” overtime premium. That is, any hours over 40 hrs/wk. Pay $15 dollars rather than $10. What happens to your budget set? What happens to your labor supply decision? (Be careful here!)

Given that you are currently working exactly 40 hours, there is no income effect from the wage increase. With only a substitution effect, you will respond by working more (Labor supply shifts right). Note that is you were currently working more than 40 hours; the result is ambiguous because there is both an income effect and a substitution effect. Finally, if you were initially working less than 40 hours, you are unaffected.

11) Empirically, average labor productivity is positively correlated with output while the real wage has little or no correlation with output. Can we explain these empirical facts using our labor market model? Explain.

Our labor market model assumes that fluctuations in employment and output are caused by changes in productivity that shift labor demand. The fact that the correlation between wages and output suggests that labor supply is really flat.
12) Suppose the government passes some new legislation that makes it easier for foreigners to immigrate to the US. As a result, thousands of new immigrants flood into the United States. What should happen in the labor market as a result of the large influx of workers? What happens to the real wage and employment? What should happen to GDP?

*The increase in immigration increases labor supplied (labor supply shifts right). The real wage should fall while employment rises.*