14.02 Principles of Macroeconomics
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Problem Set 5
Posted: April 25, 2002
Due: May 2, 2002

Please remember to write your TA's name and your section time, below your name, on the front of your solutions

99 Points, 3 points for each question (Part I) or sub-part (Parts II-IV)

Part I. True/False Questions.

Answer "true" or "false", and justify your answer with a short argument. (Points are awarded based on the *explanation only*.)

1. The savings rate has no effect on living standards.

2. Country A has weaker patent laws than Country B. We therefore expect that Country A will have lower per-capita GDP growth than Country B.

3. In theory, increasing savings will increase consumption in the long-run.

4. Per capita income growth never increases along with the savings rate.

5. By definition, production per-worker and capital per-worker do not grow in steady-state.

6. Arbitrage implies that stock prices associated with historically low dividend-price ratios cannot persist.

7. In a world without risk, we wouldn't expect to see downward-sloping yield curves in practice, since we always expect short-term rates to exceed long-term rates.

8. Output and investment are neutral with respect to monetary policy in the medium-run. (Answer this using our new enriched IS-LM model that allows for different nominal and real interest rates).

II. Growth (steady-state)

Consider the following description of an economy

- The aggregate production function is: $Y = (K)^{0.5}(NA)^{0.5}$, where K is capital, N is the number of workers, and A is the state of technology.
- Remember that you can think of NA as the amount of effective labor in the economy.
- Capital depreciates at rate δ.
- The rate of technological progress is g_A.
- Population and the labor force grow at rate g_N.
- The saving rate is s.
- The economy is closed (i.e., no trade of goods, services, or ideas)

a) Does the aggregate production function exhibit constant returns to scale? Explain your answer, and show mathematically.

b) Suppose you doubled capital, keeping effective labor constant. What would be the effect on output? What does this imply about returns to capital?

c) Rewrite the production function so that you have output per effective worker on the left-hand side. Now solve for investment per effective worker.

d) Explain what the "required level of investment" is and solve for it.

e) Solve for the steady-state *levels* of capital per effective worker and output per effective worker.

f) What are the steady-state *growth rates* of capital per effective worker and output per effective worker?

Now consider two different countries that share the above characteristics, but differ in the following ways:

- Country X has $g_N = 3\%$, and $g_A = 0$
- Country Z has $g_A = 2\%$, and $g_N = 0$

g) What is the steady-state growth rate of output in Country X? What is the steady-state growth-rate of output *per worker* in Country X?

h) What is the steady-state growth rate of output in Country Z? What is the steady-state growth-rate of output *per worker* in Country Z?

i) If X and Z initially have the same output per worker, which country will end up with a higher standard of living in the long-run? (Assume that that the savings rate is below the "golden rule" level.)

III. Growth (with dynamics)

Consider the aggregate production function $xY = F(xK, xNA)$

a) Graph production, investment, and required investment in effective worker units; i.e., in (Y/NA) and (K/NA) space. Assume that investment per effective worker equals required investment initially.

Now use the graph to help develop answers to parts b)–f).

b) Illustrate the effects of a reduction in the saving rate.

c) Explain what happens to K/NA and Y/NA over time

d) What are the long-run effects on the levels of Y/NA and K/NA?

e) Prior to the drop in s, what was the rate of growth in output per worker?

f) What are the short-run effects of this reduction in s on the growth rate of output per worker?

g) Once the new steady state is reached, what is the rate of growth in output per worker?

IV. Financial Markets: Short Problems

1. Prices, Yields, and Interest Rates

Consider bonds that make $1000 payments upon maturity. The one-year interest rate is 10%, and the expected one-year rate for next year is 8%.

Note: these problems require only simple, one-equation calculations!

a) What is the price of a one-year bond today?

b) What is the price of a two-year bond today?

c) What is the price of a two-year bond one year from now?

2. The Yield Curve

Suppose the yield curve is initially upward sloping. Use IS-LM to help explain what effect each of the following events will have on the shape of the yield curve (i.e., "steeper", "flatter", or " unchanged":

Hints:
i) Consider the effect of the given events on the future one-year rate.
ii) You should be able to answer these in 3 short sentences or less!

a) financial markets expect a future Fed monetary expansion

b) financial markets expect a future tax cut

c) financial markets expect a future reduction in consumer confidence which results in a reduction in consumer spending

3. Policy and Stock Prices

Use the IS-LM model to determine the impact of each of the following scenarios on stock prices. If the effect is ambiguous, explain what additional information would be needed to reach a conclusion.

Note: You should be able to answer these in 3 sentences or less!

a) An unexpected expansionary monetary policy with no change in fiscal policy.

b) A fully expected expansionary monetary policy with no change in fiscal policy.

c) A fully expected expansionary monetary policy with unexpected expansionary fiscal policy.