

14.02 Principles of Macroeconomics

Problem Set 7 Solutions

Fall 2017

Question 1 (Chapter 15)

Consider a consumer who lives for three periods: youth, middle age and old age. When young, the consumer earns \$20,000 in labor income. Earnings during middle age are uncertain. There is a 50% chance that the consumer will earn \$40,000 and a 50% chance the consumer will earn \$100,000. When old, the consumer spends savings accumulated during the previous periods. Assume that inflation, expected inflation, and the real interest rate equal zero. Ignore taxes for this problem.

(a)

What is the expected value of earnings in the middle period of life? Given this number, what is the present discounted value of expected lifetime labor earnings? If the consumer wishes to maintain constant expected consumption over her lifetime, how much will she consume in expectation in each period? How much will she save in expectation in each period?

Solution: Expected value of earnings during middle age is

$$0.5 \times (\$40,000 + \$100,000) = \$70,000$$

EPDV of lifetime earnings is:

$$\$20,000 + \$70,000 = \$90,000$$

The consumption plan is \$30,000 per year.

Comparing expected income to consumption in each period we conclude that the consumer will:

- *save –\$10,000 in the first period of life, i.e., the consumer will borrow \$10,000;*
- *save \$40,000 in the second period, i.e., paying off her \$10,000 debt and saving an extra \$30,000 for old age;*
- *save –\$30,000 in the last period, i.e, drawing down her bank account by \$30,000 to pay for consumption in old age;*

(b)

Now suppose the consumer wishes, above all else, to maintain a minimum consumption level of \$20,000 in each period of her life. To do so, she must consider the worst outcome. If earnings during middle age turn out to be \$40,000, how much should the consumer spend when she is young to guarantee consumption of at least \$20,000 in each period? How does this level of consumption compare to the level you obtained for the young in part (a)?

Solution: In the worst case, the lifetime earnings will be \$60,000. Consumption will be \$20,000, and saving will be zero in the first period of life. Consumption is lower than part (a), and saving is higher.

(c)

Given your answer in part (b), suppose that the consumer's earnings during middle age turn out to be \$100,000. How much will she spend in each period of her life? Will consumption be constant over the consumer's lifetime?

[Hint: when the consumer reaches middle age, she will try to maintain constant consumption for the last two periods of life, as long as she can consume at least \$20,000 in each period.]

Solution: Consumption in youth is \$20,000; in middle age it will be \$50,000; and in old age is \$50,000. Consumption will not be constant over the consumer's lifetime.

(d)

What effect does uncertainty about future labor income have on saving (or borrowing) by young consumers in parts (b) and (c)?

Solution: The uncertainty leads to higher saving by consumers in the first period of life. This is a stylized example of precautionary savings.

Question 2 (Chapter 16)

Using the information available in Chapter 16 and on the corresponding slides, mark each of the following statements as True, False, or Uncertain, and explain why in no more than three lines.

(a)

Changes in the current one-year real interest rate are likely to have a much larger effect on spending than changes in expected future one-year real interest rates.

Solution: FALSE/UNCERTAIN

The idea is that, given unchanged expectations about the future interest rates, current real rate changes will only change the PDV of future earnings/profits by little. This is not true if we assume that current rate changes also modify expectations.

(b)

The introduction of expectations in the goods market model makes the IS curve flatter, although it is still downward sloping.

Solution: FALSE

The new IS curve is much steeper than before. Put in another way, changes in the current real interest rate only changes output by little compared to before.

(c)

Investment depends on current and expected future interest rates.

Solution: TRUE

As we have seen in Chapters 14 and 15, investment depends on current interest rate but also on the PDV of future profits, which crucially is affected by expectations of future interest rates.

(d)

The rational expectations assumption implies that consumers take into account the effects of future fiscal policy on output.¹

Solution: TRUE

The idea is that people will generally realize that future fiscal policy will be conducted coherently with current fiscal policy. For instance, an increase in Government spending today will probably require a fiscal consolidation in the future. Agents within a rational expectations model will realize this and will consequently expect a hike in taxes/cut in spending in the future. This changes the way in which the IS curve shifts around today. The main point, however, is that future fiscal policy matters if people are assumed to have rational expectations.

(e)

Expected future fiscal policy affects expected future economic activity but not current economic activity.

Solution: FALSE

¹In this question, the point is that future fiscal policy matters *if* we assume rational expectations. We are not implying the converse, i.e., that only rational expectations guarantee that future fiscal policy matters.

Expected future fiscal policy, to the extent that it changes future output, it alters the PDV of future income or profits, thus leading to changes in economic activity today.

(f)

Depending on its effect on expectations, a fiscal contraction may lead to an economic expansion.

Solution: TRUE

The idea is that a fiscal contraction, while it reduces disposable income (or aggregate spending) today, may actually lead people to expect lower taxes in the future. This implies that, at least in theory, fiscal consolidations might be expansionary even today.

Question 3 (Chapter 16)

For each of the changes in expectations in parts (a) through (d), determine whether there is a shift in the IS curve, the LM curve, both curves, or neither. In each case, assume that no other exogenous variable is changing.

(a)

A decrease in the expected future real interest rate.

Solution: IS curve shifts to the right, because people will feel richer. The PDV of future income is higher. The LM curve does not shift because the current policy rate is not affected.

(b)

An increase in the current real policy interest rate.

Solution: The LM curve will shift upwards, while the IS curve will stay the same. The idea is that here we are implicitly assuming that expectations about future rates are not affected by the policy of the Central Bank.

(c)

An increase in expected future taxes.

Solution: The IS curve shifts to the left. The PDV of future income is lower so people will want to spend less today. The LM curve is not affected.

(d)

A decrease in expected future income.

Solution: Same as (c) above.

Question 4 (Chapter 16)

A new president has been elected, and she promised she would cut taxes. People trust that she will keep her promise, but expect that the tax cuts will be implemented only in the future, i.e., $\Delta T^e < 0$. Determine the impact of the election on current output, the current interest rate, and current private spending under each of the assumptions in parts (a) through (c). In each case, indicate what you think will happen to Y^e , and r^e , and then how these changes in expectations affect output today. In what follows, assume that expectations on future policy rates are independent of current policy by the Central Bank.

(a)

The Central Bank will not change its current real policy interest rate, but will act so as to leave future output unchanged.

Solution: in this case, the LM curve does not shift today. In the future, we know that the fiscal expansion will be counteracted by a hike in interest rates by the Central Bank, so that $\Delta r^e > 0$. At the same time, by assumption we know that $\Delta Y^e = 0$. Therefore, we conclude that the current interest rate will remain unchanged, while private spending (and consequently output) will change today according to which is larger, namely the effect of $\Delta r^e > 0$ and that of $\Delta T^e < 0$.

(b)

The Central Bank will act to prevent any current or future change in output.

Solution: We know that $\Delta Y^e = 0$. Once again, we have $\Delta r^e > 0$ and $\Delta T^e < 0$, but the Central Bank will either raise or lower the interest rate today to keep current output unchanged. Therefore, if the effect of $\Delta T^e < 0$ dominates and the IS shifts to the right today, then the Central Bank will raise the interest rate. Viceversa, if $\Delta r^e > 0$ dominates, then the IS curve will shift to the left and the Central Bank will lower the interest rate today to prevent a recession from happening.

(c)

The Central Bank will not change either the current real policy interest rate, or the future real policy interest rate.

Solution: here we have $\Delta r = \Delta r^e = 0$. Therefore, the LM curve does not change either today or tomorrow. This means that $\Delta T^e < 0$ implies $\Delta Y^e > 0$, which unambiguously pushes the current IS to the right. Therefore, both current output, and current private spending, will be higher today.