Macroeconomics 2026
Shanghai Jiao Tong University
Summer School 2026
Quiz 3
With Solutions

Reading time: 10 minutes. **Writing time:** 60 minutes.
Total marks: 100. **Calculators are permitted.**
Instructions: Answer **all** questions. In Section A, circle the letter of the single best answer. In Sections B and C, show your working and write in clear sentences.

Structure:

- **Section A** — Multiple choice: 20 questions, 2.5 marks each (**50 marks**).
- **Section B** — One analytical problem in five parts (**30 marks**).
- **Section C** — One short interpretation (**20 marks**).

Useful formulas. Short-run output $\tilde{Y}_t = \dfrac{Y_t - \bar{Y}_t}{\bar{Y}_t} \times 100$; IS curve $\tilde{Y}_t = \bar{a} - \bar{b}\,(R_t - \bar{r})$, with $\bar{a} = \bar{a}_c + \bar{a}_i + \bar{a}_g + \bar{a}_{ex} - \bar{a}_{im} - 1$; investment share $\dfrac{I_t}{\bar{Y}_t} = \bar{a}_i - \bar{b}(R_t - \bar{r})$; Fisher $i_t = R_t + \pi_t$ (so $R_t = i_t - \pi_t$); Phillips curve $\pi_t = \pi_{t-1} + \bar{v}\,\tilde{Y}_t + \bar{o}$, change form $\Delta\pi_t = \bar{v}\,\tilde{Y}_t + \bar{o}$, adaptive expectations $\pi_t^e = \pi_{t-1}$.

Section A: Multiple Choice (20 questions × 2.5 marks = 50 marks)

1. Which statement about potential output $\bar{Y}_t$ in the short-run model is correct?

(A) It is the maximum output the economy could produce if every input were pushed to its physical limit.

(B) It is simply the level of output reached at the most recent business-cycle peak.

(C) It is determined inside the short-run model, jointly with current output.

(D) It is the output produced with inputs at their long-run sustainable levels, taken as given by the short-run model.

Solution. (D). Potential output is what the economy would produce with all inputs used at their long-run, sustainable levels. It is a smooth trend, determined by the long-run (Solow) model and treated as *exogenous* by the short-run model. It is sustainable, not maximum, output, so (A) is wrong; it is not a recent peak (B); and it is given from outside, not solved for inside the short-run model (C).

2. Potential output is $\bar{Y} = 500$ and actual output is $Y = 480$. Short-run output (the output gap) is:

(A) -20%, and the economy is in a recession.

(B) $+4\%$, and the economy is in a boom.

(C) -4%, and the economy is in a recession.

(D) -4%, and the economy is in a boom.

Solution. (C). $\tilde{Y} = (480 - 500)/500 \times 100 = -20/500 \times 100 = -4\%$. A negative gap means actual output is below potential: a recession. Option (A) reports the level gap of -20 as if it were a percentage; (B) has the wrong sign; (D) pairs the right number with the wrong label.

3. In the short-run model, short-run output $\tilde{Y}_t$ is:

(A) the gap between actual and potential output, written as a percentage of potential output.

(B) the level difference $Y_t - \bar{Y}_t$, measured in dollars.

(C) always positive, because actual output cannot fall below potential.

(D) the same thing as the long-run inflation rate $\bar{\pi}$.

Solution. (A). By definition $\tilde{Y}_t \equiv (Y_t - \bar{Y}_t)/\bar{Y}_t$, expressed in percent: it says how far actual output sits above or below potential. It is a percentage, not a dollar amount (B); it is negative in a recession (C); and it is an output concept, not an inflation rate (D).

4. The short-run model rests on three premises. Which of the following is one of them?

(A) The economy is almost never disturbed by shocks of any macroeconomic importance.

(B) Potential output is determined inside the short-run model.

(C) Monetary and fiscal policy cannot affect output, even in the short run.

(D) There is a dynamic trade-off between output and inflation, described by the Phillips curve.

Solution. (D). The three premises are: the economy is constantly hit by shocks; monetary and fiscal policy affect output in the short run; and there is a dynamic output–inflation trade-off (the Phillips curve), which is exactly (D). Option (A) denies the first premise, (C) denies the second, and (B) contradicts the model's assumption that potential output is exogenous.

5. In the IS setup $Y_t = C_t + I_t + G_t + EX_t - IM_t$, consumption, government purchases, exports and imports are each written as a share of potential output. Which component is modelled as depending on the real interest rate?

(A) Consumption.

(B) Government purchases.

(C) Investment.

(D) Exports.

Solution. (C). Only investment is interest-sensitive: $I_t/\bar{Y}_t = \bar{a}_i - \bar{b}\,(R_t - \bar{r})$. The other four, C_t, G_t, EX_t, IM_t, are each written as a fixed share of potential output $\bar{Y}_t$. This is why the short-run model puts investment at the centre of how interest rates move output.

6. Because $C_t = \bar{a}_c \bar{Y}_t$ depends on potential output (a smooth trend), the model implies that:

(A) consumption is smoother than actual GDP; in a recession households keep spending steady by drawing on savings, as in the permanent-income hypothesis.

(B) consumption is more volatile than actual GDP over the business cycle.

(C) consumption falls one-for-one with actual output during a recession.

(D) consumption depends mainly on the real interest rate.

Solution. (A). Consumption tracks potential output $\bar{Y}_t$, which the long-run model holds steady through a recession, so consumption is smoother than actual GDP. Households smooth a temporary income fall by saving less or borrowing, which is the permanent-income hypothesis. Options (B) and (C) reverse this; (D) describes investment, not consumption, in this model.

7. In the investment equation $I_t/\bar{Y}_t = \bar{a}_i - \bar{b}\,(R_t - \bar{r})$, investment is high when:

(A) the real interest rate R_t is well above the marginal product of capital $\bar{r}$.

(B) the demand parameter $\bar{a}_i$ is zero.

(C) inflation is above its long-run rate.

(D) the marginal product of capital $\bar{r}$ is above the real interest rate R_t.

Solution. (D). Investment depends on the gap between the marginal product of capital $\bar{r}$ and the real interest rate R_t. When $\bar{r} > R_t$, firms can borrow at R_t and earn more, $\bar{r}$, on new capital, so they invest heavily. When $R_t > \bar{r}$ (A) they would rather save, so investment is low. Inflation (C) does not enter the investment equation directly.

8. In the IS curve $\tilde{Y}_t = \bar{a} - \bar{b}\,(R_t - \bar{r})$, the parameter $\bar{a}$:

(A) is the slope of the IS curve.

(B) combines the demand shares, equals zero in the long run, and is pushed away from zero by shocks; it is the aggregate demand shock.

(C) is the marginal product of capital.

(D) is the real interest rate the central bank sets.

Solution. (B). Here $\bar{a} \equiv \bar{a}_c + \bar{a}_i + \bar{a}_g + \bar{a}_{ex} - \bar{a}_{im} - 1$. When output is at potential the demand shares sum to one, so $\bar{a} = 0$ in the long run; shocks push it away from zero, so it is the *aggregate demand shock*. The slope is governed by $\bar{b}$ (A); $\bar{r}$ is the marginal product of capital (C); and R_t is the policy rate (D).

9. On the IS curve $\tilde{Y} = \bar{a} - \bar{b}\,(R - \bar{r})$ with $\bar{a} = 0$ and $\bar{b} = 0.4$, the central bank sets the real rate three points above $\bar{r}$, so $R - \bar{r} = +3$. The output gap is:

(A) $\tilde{Y} = -1.2\%$.

(B) $\tilde{Y} = +1.2\%$.

(C) $\tilde{Y} = -7.5\%$.

(D) $\tilde{Y} = -3\%$.

Solution. (A). $\tilde{Y} = 0 - 0.4 \times (+3) = -1.2\%$. A real rate above $\bar{r}$ makes borrowing dear, cuts investment, and opens a negative gap: $\uparrow R \Rightarrow\downarrow I \Rightarrow\downarrow \tilde{Y}$. Option (B) has the sign wrong; (C) divides by $\bar{b}$ instead of multiplying; (D) ignores the interest sensitivity $\bar{b}$.

10. Which of the following moves the economy *along* a fixed IS curve, rather than shifting the curve?

(A) A collapse in consumer confidence that lowers the demand parameter $\bar{a}$.

(B) A change in the real interest rate set by the central bank.

(C) An investment boom that raises $\bar{a}_i$.

(D) A boom abroad that raises exports.

Solution. (B). The real interest rate R is the variable on the vertical axis of the IS diagram, so a change in R is a movement *along* the curve; it is the central bank's lever. Anything that changes the demand parameter $\bar{a}$, confidence (A), an investment boom (C), or stronger exports (D), shifts the whole curve.

11. A higher value of the parameter $\bar{b}$ means:

(A) investment is more sensitive to the interest rate, so the IS curve is flatter and a given rate change moves output more.

(B) the IS curve is steeper.

(C) $\bar{b}$ shifts the IS curve rather than changing its slope.

(D) a given change in the interest rate moves output by less.

Solution. (A). The parameter $\bar{b}$ measures how sensitive investment is to the interest rate. A high $\bar{b}$ makes the IS curve flatter, so a given rate change produces a *larger* change in output. Options (B) and (D) describe a *small* $\bar{b}$; and $\bar{b}$ sets the slope, it does not shift the curve (C).

12. With the central bank holding $R = \bar{r}$, an investment boom raises the investment share $\bar{a}_i$ by 2 percentage points. Short-run output:

(A) is unchanged, because the central bank keeps $R = \bar{r}$.

(B) rises by $2\bar{b}$ percentage points.

(C) rises 2 percentage points above potential.

(D) falls 2 percentage points below potential.

Solution. (C). A rise in $\bar{a}_i$ raises $\bar{a}$ one-for-one, from 0 to +2. With $R = \bar{r}$ the rate term is zero, so $\tilde{Y} = \bar{a} - \bar{b}(0) = +2\%$: aggregate demand shocks pass one-for-one into short-run output. The IS curve shifts out, not along, so (A) is wrong; the pass-through does not involve $\bar{b}$ (B); and the boom raises, not lowers, output (D).

13. In the short-run model, the bursting of the housing bubble in 2008 is best described as:

(A) a positive demand shock that shifts the IS curve outward.

(B) a fall in the demand parameter $\bar{a}$ that shifts the IS curve back, pushing output below potential, to which the central bank responds by cutting the interest rate.

(C) a price shock $\bar{o}$ that shifts the Phillips curve up.

(D) a movement along the IS curve caused by the central bank raising rates.

Solution. (B). Falling house prices cut household wealth and confidence, lowering the demand parameter $\bar{a}$. The IS curve shifts back, output falls below potential (A to B), and the central bank cuts the nominal rate so that the real rate drops below $\bar{r}$, reviving investment and returning output toward potential (point C). It is a negative demand shock, not a positive one (A) or a price shock (C), and the initial move is a shift of the curve, not a movement along it (D).

14. In the IS-MP diagram, the MP curve is:

(A) an upward-sloping line in output and the interest rate.

(B) the same line as the IS curve.

(C) a vertical line at potential output.

(D) a horizontal line at the real interest rate the central bank chooses.

Solution. (D). The central bank sets the short-term nominal rate (the fed funds rate); because inflation is sticky, this fixes the real rate, so the MP curve is drawn as a *horizontal* line at the chosen real rate R_t. Where it meets the IS curve determines short-run output. It is not upward-sloping (A), not the IS curve (B), and not vertical (C).

15. The central bank moves the *nominal* rate i, yet in the short run the course says it controls the *real* rate R. The reason is:

(A) by the Fisher equation $R = i - \pi$, and inflation is sticky in the short run, so a change in i passes through to R.

(B) the central bank sets the real interest rate directly by legal decree.

(C) inflation adjusts instantly and one-for-one with any change in the nominal rate.

(D) real and nominal interest rates are unrelated at short horizons.

Solution. (A). By Fisher, $R = i - \pi$. Because inflation is slow to adjust (sticky) over months and quarters, π barely moves when the bank moves i, so the change in the nominal rate passes through to the real rate. Central banks set i, not R by decree (B); if inflation adjusted instantly (C) the pass-through would fail; and the two rates are tied together by Fisher, not unrelated (D).

16. The central bank raises its interest rate. In the short-run model, the result is:

(A) output rises, because higher rates attract more investment.

(B) nothing happens, because monetary policy is neutral in the short run.

(C) the real rate rises above the marginal product of capital, investment falls, and output drops below potential.

(D) inflation rises immediately, because prices are fully flexible.

Solution. (C). A higher nominal rate raises the real rate (inflation is sticky). With R now above the marginal product of capital $\bar{r}$, firms and households cut investment, and output falls below potential: this is how the central bank can cause a recession. Higher rates lower, not raise, investment (A); money is *not* neutral in the short run (B); and prices are sticky, not flexible (D).

17. Inflation last year was $\pi_{t-1} = 4\%$. The Phillips curve is $\Delta\pi_t = \bar{v}\,\tilde{Y}_t$ with $\bar{v} = 0.5$, there is no supply shock, and the economy runs a gap of $\tilde{Y} = -2\%$ this year. Inflation this year is:

(A) 4%.

(B) 5%.

(C) 2%.

(D) 3%.

Solution. (D). $\Delta\pi = 0.5 \times (-2) = -1$ point, so $\pi_t = 4 - 1 = 3\%$. A slack economy pulls inflation down. Option (A) forgets that a non-zero gap changes inflation; (B) has the sign of the gap's effect wrong; (C) applies the gap one-for-one instead of using $\bar{v} = 0.5$.

18. Under adaptive expectations, $\pi_t^e = \pi_{t-1}$. This means:

(A) firms perfectly foresee next year's inflation.

(B) firms expect this year's inflation to equal last year's, so expectations adjust slowly and inflation is sticky.

(C) expected inflation always equals the central bank's target.

(D) expected inflation equals the size of the current oil shock $\bar{o}$.

Solution. (B). Adaptive expectations mean firms simply carry last year's inflation forward as their forecast for this year, so expectations adjust only gradually and inflation is sticky. It is backward-looking, not perfect foresight (A); it is not tied to the target (C); and it is separate from the price shock $\bar{o}$ (D).

19. An economy runs a sustained *positive* output gap, year after year (no price shocks). According to the Phillips curve $\Delta\pi_t = \bar{v}\,\tilde{Y}_t$, inflation:

(A) rises once to a higher level and then stays constant at that level.

(B) stays at its initial level for as long as the gap does not change.

(C) rises year after year, never settling at any new level.

(D) drifts slowly back to its long-run rate as expectations adjust.

Solution. (C). The left-hand side is $\Delta\pi$, the *change* in inflation, not its level. A constant positive gap therefore adds $\bar{v}\tilde{Y}$ points to inflation every year, so inflation keeps rising. This is why a permanent boom is not free. Options (A) and (B) read the change form as if it set the level, the most common error to guard against.

20. Inflation is 2% and the economy stays at potential ($\tilde{Y} = 0$) throughout. A one-year supply shock $\bar{o} = +4$ hits (then returns to zero), and expectations are adaptive ($\pi_t^e = \pi_{t-1}$). Two years after the shock, inflation is:

(A) 2%.

(B) 6%.

(C) 4%.

(D) 10%.

Solution. (B). In the shock year $\Delta\pi = \bar{v}(0) + 4 = +4$, so inflation jumps from 2% to 6%. Afterwards $\tilde{Y} = 0$ and $\bar{o} = 0$, so $\Delta\pi = 0$: inflation *stays* at 6%, because adaptive expectations bake last year's inflation into this year's. A temporary shock leaves a permanently higher level. Option (A) assumes the level reverts; (C) reports the shock size, not the resulting level; (D) adds the shock twice.

Section B: Analytical Problem (30 marks)

Consider one economy. Its IS curve is $\tilde{Y}_t = \bar{a} - \bar{b}\,(R_t - \bar{r})$ with interest sensitivity $\bar{b} = 0.5$ and marginal product of capital $\bar{r} = 3\%$. Its Phillips curve is $\pi_t = \pi_{t-1} + \bar{v}\,\tilde{Y}_t + \bar{o}$ with slope $\bar{v} = 0.5$ and adaptive expectations ($\pi_t^e = \pi_{t-1}$). The Fisher equation is $i_t = R_t + \pi_t$. The economy starts at potential ($\tilde{Y} = 0$) with inflation at $\pi = 2\%$, no shocks, and $R = \bar{r}$.

(a) **[6 marks]** A housing-bubble collapse destroys confidence: a demand shock $\bar{a} = -2$ hits while the central bank holds $R = \bar{r}$. Find the output gap $\tilde{Y}$. State which way the IS curve shifts and whether this is a boom or a recession.

(b) **[6 marks]** The central bank now wants to offset the shock fully and return output to potential ($\tilde{Y} = 0$). By how much, and in which direction, must it move the real rate? State $(R - \bar{r})$ and R itself, and use the Fisher equation to check that the implied nominal rate $i = R + \pi$ is feasible (not below zero), with $\pi = 2\%$.

(c) **[6 marks]** Suppose instead the central bank had left $R = \bar{r}$, so the gap from part (a) lasted one full year (with no price shock). Use the Phillips curve to find $\Delta\pi$ and the new level of inflation.

(d) **[6 marks]** Now start again from potential ($\tilde{Y} = 0$, $\pi = 2\%$). A one-year oil price shock $\bar{o} = +4$ hits and then returns to zero, and output stays at potential throughout. Using adaptive expectations, find inflation in the shock year and inflation two years after the shock.

(e) **[6 marks]** Return to the demand shock of part (a). Suppose this economy instead had $\bar{b} = 1.0$. Explain how the IS curve and the required policy response differ, and compute the $(R - \bar{r})$ needed to offset the same shock $\bar{a} = -2$.

Solution. (a) With $R = \bar{r}$ the rate term vanishes: $\tilde{Y} = \bar{a} - \bar{b}\,(R - \bar{r}) = -2 - 0.5 \times 0 = \mathbf{-2}\%$. The negative demand shock lowers output at every interest rate, so the IS curve shifts **back (left)**, and $\tilde{Y} < 0$ means a **recession**.

(b) Set $\tilde{Y} = 0$: $0 = -2 - 0.5\,(R - \bar{r}) \;\Rightarrow\; 0.5\,(R - \bar{r}) = -2 \;\Rightarrow\; (R - \bar{r}) = \mathbf{-4}$. The central bank must **cut** the real rate four points below $\bar{r}$: $R = 3 - 4 = \mathbf{-1}\%$. Feasibility: $i = R + \pi = -1 + 2 = +\mathbf{1}\% \geq 0$, so the cut is deliverable. (Check: $\tilde{Y} = -2 - 0.5 \times (-4) = 0$.)

(c) With $\tilde{Y} = -2\%$ for one year and $\bar{o} = 0$: $\Delta\pi = \bar{v}\,\tilde{Y} = 0.5 \times (-2) = \mathbf{-1}$ point, so $\pi_t = \pi_{t-1} + \Delta\pi = 2 - 1 = \mathbf{1}\%$. The slack pulls inflation below its starting level.

(d) Shock year: output is at potential, so $\Delta\pi = \bar{v}(0) + \bar{o} = 0 + 4 = +4$, giving $\pi = 2 + 4 = \mathbf{6}\%$. Afterwards $\tilde{Y} = 0$ and $\bar{o} = 0$, so $\Delta\pi = 0$ each year: inflation **stays at 6%**. Two years after the shock, inflation is still **6%**, because adaptive expectations carry the higher inflation forward even though the shock itself has gone.

(e) A higher $\bar{b}$ makes investment more sensitive to the interest rate, so the IS curve is **flatter** and a given rate cut moves output by more. Offsetting the same shock therefore needs a *smaller* cut. Setting $\tilde{Y} = 0$: $0 = -2 - 1.0\,(R - \bar{r}) \Rightarrow (R - \bar{r}) = -\mathbf{2}$. With $\bar{b} = 1.0$ the bank needs to cut the real rate only two points (against four points when $\bar{b} = 0.5$) to return output to potential.

Section C: Interpretation (20 marks)

Read the following and answer in **no more than five sentences**. Use the concepts from the short-run model; you do not need any calculation.

By 1979, after two oil shocks and years of loose monetary policy, US inflation was above 10% *and appeared to be heading higher. Paul Volcker became chair of the Federal Reserve and tightened monetary policy sharply. Over the next several years a deep recession followed, and inflation gradually came down. A student says: "I do not see how raising interest rates lowers inflation, and I do not see why a recession had to happen at all."*

Question [20 marks]. Using only the short-run model (the IS, MP and Phillips curves) and adaptive expectations, explain the chain by which Volcker's tight monetary policy reduced inflation, why a recession was required, and how the episode ended. Answer in at most five sentences.

Solution. Model answer (the IS-MP-Phillips chain). Tight monetary policy is a sharp rise in the nominal interest rate, and because inflation is sticky the Fisher relation $R = i - \pi$ turns this into a higher **real** rate (the MP curve). With the real rate now above the marginal product of capital, firms and households cut investment, and by the **IS curve** output falls below potential: that is the recession, and it is not an accident but the mechanism itself. Through the **Phillips curve** $\Delta\pi = \bar{v}\,\tilde{Y}$, the negative output gap makes inflation fall, and because expectations are **adaptive** ($\pi^e_t = \pi_{t-1}$) inflation comes down only gradually, so the gap must be held open for several years. Once inflation has fallen far enough, the Fed lowers the real rate back to $\bar{r}$, output returns to potential, and inflation stabilises at the new, lower level. The recession was required because, with sticky adaptive expectations, the only way to force inflation down is a sustained period of output below potential.

Marking guide (20 marks).

- **5 marks** — MP/Fisher: tight policy raises the nominal rate, and because inflation is sticky this raises the *real* rate $R = i - \pi$.
- **5 marks** — IS: the higher real rate (above the marginal product of capital) cuts investment and pushes output below potential, i.e. causes the recession.
- **6 marks** — Phillips + adaptive expectations: the negative gap makes $\Delta\pi < 0$, and because $\pi^e = \pi_{t-1}$ inflation falls only gradually, so the recession must be sustained; the recession is the mechanism, not a side effect.
- **4 marks** — the ending (the Fed returns the real rate to $\bar{r}$, output returns to potential, inflation stabilises at the lower level) and clear writing within the five-sentence limit.

Answers that assert "higher rates lower inflation" without the real-rate, investment and output-gap steps earn only partial credit: the question asks for the chain through all three curves.