

14.02 – Principles of Macroeconomics

Quiz 2 Solutions

SECTION I: TRUE or FALSE?

Explain your answer in one or two sentences. (20 points total, 2 points each)

1. There are 2 countries in the world, Home and Foreign; Foreign's interest rate is fixed, and the expected future exchange rate is exogenously fixed. Given these conditions, a rise in the Home interest rate today will lead to a stronger Home currency today (i.e. an appreciation of the Home currency.)

True – Per the Interest Rate Parity condition, $i = i^* + (E^e - E)/E$ or $E = E^e / (1 + i - i^*)$. If E^e and i^* are given, when $i \uparrow \rightarrow \downarrow E$. This means there will be a stronger domestic currency (i.e. a currency that buys more in terms of foreign currency).

2. When a J-Curve situation exists, a depreciation of the US dollar relative to the yen causes a prompt improvement in nominal US net exports, but a delayed, more gradual improvement in real US net exports.

False – According to the J-Curve, a depreciation of the US dollar relative to the yen causes the quantities of imports to and exports from Japan to adjust gradually over the midterm (5-7 months). Quantities of imports will fall and quantities of exports will rise, so real Net Exports will gradually improve. However, in the very short run, the price effect (change in the nominal exchange rates) dominates, causing Nominal Net Exports to fall: $NX = X - e \cdot Q$, so if e rises and X and Q are fixed, NX worsens. Eventually, if the Marshall-Lerner condition holds, the quantity effect will dominate, and nominal NX will increase as well.

3. The average propensity to consume (APC) is equal to the change in consumer spending divided by the change in income.

False – $APC \equiv Y/C$. It is the marginal propensity to consume (MPC) described above.

4. There is strong empirical evidence that consumers spend income from tax cuts, largely ignoring potentially large future deficits.

True – While the Ricardian Equivalence hypothesis predicts that individuals will un-do the effects of government tax cuts, anticipating the future deficits that may come from these policies, there is no evidence in the data that people actually behave this way. Instead, the marginal propensity to consume is quite stable over time, even in the presence of tax cuts.

5. According to the Life Cycle model, a relaxation of borrowing restrictions (i.e. when it becomes easier to borrow money) should have no effect on consumption smoothing.

False – The Life Cycle model states that individuals will try to smooth their consumption, borrowing and saving over time in order to keep consumption levels constant. However, if they are unable to reach the optimal C^* due to borrowing restrictions in some period ($t=1$), then they are forced to currently consume less than they would like. Instead, they consume the maximum they can afford, $C_1 < C^*$; therefore, in later periods they have $C_2 > C^*$. If borrowing restrictions are relaxed, consumers can set $C=C^*$ in every period and improve smoothing.

6. The growth rate of investment is about as volatile as the growth rate of consumption.

False – The growth rate of investment is more volatile than that of consumption – unlike consumers, firms have no desire to smooth their spending over time. Instead, firms need to adjust the capital stock in advance in order to accommodate expected future growth.

7. All else equal, firms' optimal levels of capital are higher when the interest rate is higher.

False – In equilibrium, the optimal capital (K^*) is chosen such that $MPK=MCK$, i.e. the marginal product of capital must equal marginal cost of capital. Since $MCK = r + \delta$ (where δ is the depreciation rate) and $\partial MPK / \partial K < 0$ (by the diminishing return to factor assumption), if $r \uparrow \rightarrow \downarrow K^*$. Intuitively, the interest rate is the cost of capital – if the cost of something increases, you consume less of it.

8. In the U.S., the capital stock is about 10% of GDP.

False – The size of the capital stock is about 100% of GDP. Note that $\Delta K^* = I_N = 10\% \text{ GDP}_{US}$.

9. If the money supply does not grow as fast as the price level, output will tend to fall and interest rates tend to will rise.

True – If $\Delta M < \Delta P \rightarrow M/P \downarrow \rightarrow LM$ curve shifts to the left $\rightarrow i \uparrow$ & $Y \downarrow$.

10. When unemployment is below the natural rate, prices rise and thus the IS curve shifts significantly to the left while the LM curve may not shift significantly.

False – If $U < U_{NAIRU}$, then Y is above the natural rate. This means there will be an increase in the price level. In the conventional AS-AD framework, this is equivalent to a shift left in the AS curve – if $Y > Y_{NAIRU}$, then prices are higher than expected prices. This leads to increases in expected prices, which shifts the AS curve in, moving along the AD curve, until the economy lands back at the natural rate of Y . When prices rise, this means the LM curve must be shifting in. You can also see this outcome by looking at the modified Philips Curve given in Prof. Brinner's slides. When $Y > Y_{NAIRU}$, there is an

increase in the inflation rate which shifts the LM curve back until the economy hits the natural rate of output again.

SECTION II: MULTIPLE CHOICE

1. If the nominal interest rate is 20% per year, how much money can an individual borrow for a year if she wants to repay \$100 (total, i.e. in both principle and interest) in one year?
 - a. \$80.00
 - b. \$83.33
 - c. \$120.00
 - d. \$78.00
 - e. \$121.00

(b) $100/(1+20\%) = 83.33$

2. The “Life-Cycle” and “Permanent Income” theories of consumption share which of the following features?
 - a. Consumption spending depends on income rather than wealth.
 - b. Consumption spending should vary widely from year to year.
 - c. Consumers look ahead to the future in making current spending decisions.
 - d. All of the above.
 - e. None of the above.

(c) *Consumers look ahead to the future in making current spending decision in both of these models – in both cases, consumers try to smooth their consumption from year to year. In order to do this, they must look ahead and estimate their total wealth/ lifetime income.*

3. If the price of output is P, the cost of renting a unit of capital is R, and a firm’s production function is $Y=AK^B$, then its optimal level of capital is:
 - a. $(R/PAB)^{1/(1-B)}$
 - b. $(Y/A)^{1/B}$
 - c. $(PAB/R)^{1/(1-B)}$
 - d. $(R/PAB)^{1-B}$
 - e. none of the above

(c) *Firms choose their optimal level of capital by maximizing profits with respect to capital. Profits are equal to revenues minus costs – here, that means Profits = $P*Y - R*K$, or $P(AK^B) - R*K$. Taking the derivative of this expression with respect to capital, setting your answer equal to zero, and solving for K^* gives you (c). (Note that you have*

to rearrange your answer a bit to get this.) Intuitively, the optimal level of capital (K^*) is chosen such that $MPK = MCK$, i.e. the marginal product of capital must equal the marginal cost of capital. This is the condition profit maximization gives you.

4. If Congress passes new labor laws giving more bargaining power to the firm, which of the following will probably be true?
- (i) The natural rate of unemployment will decrease.
 - (ii) Real wages in equilibrium will increase.
 - (iii) The natural rate of unemployment will increase
- a. Just (i).
 - b. Just (iii).
 - c. (i) and (ii).
 - d. (ii) and (iii).
 - e. None of the above.

(a) The most straightforward way to answer this question is to use the labor market model that lies behind the AS curve. Changes in firm bargaining power affect the “z” term in the wage setting equation. This shifts the WS curve inward, and lowers the natural rate of unemployment. Since there is no change in the price setting equation, the real wage will not change. Equivalently, at every level of unemployment, wage growth will be lower (workers are not able to bargain for large raises). But we know that real wage growth does not depend on bargaining power in the long run (rearrange the price setting equation to see $W/P = K/A$). So long run unemployment must be lower because the rate of change of wages is negatively correlated with unemployment.

5. A low sensitivity of unemployment to output growth could be associated with:
- a. pro-cyclical labor supply.
 - b. pro-cyclical productivity.
 - c. labor hoarding.
 - d. All of the above.
 - e. (a) and (b) only.

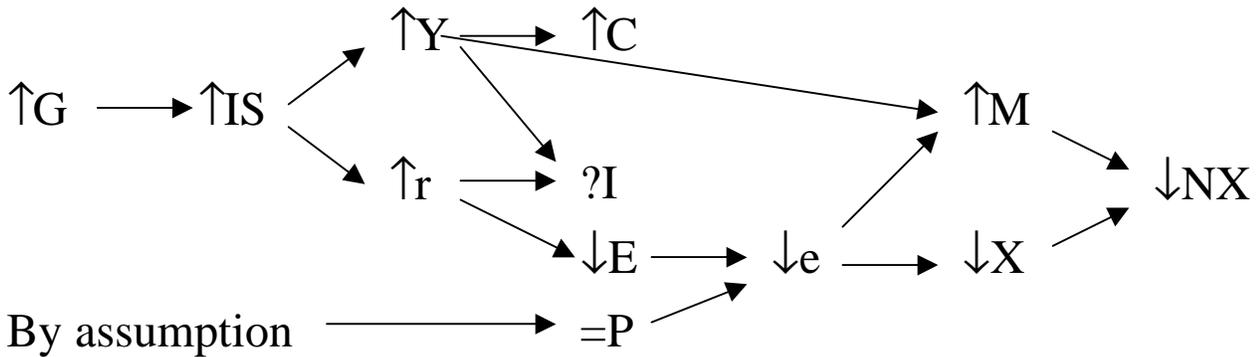
(d) All of the above are true. If labor supply is pro-cyclical, then L (the labor force) increases when Y increases – since U tends to fall when Y increases (Okun’s Law gives you an estimated, negative relationship between U and Y), the growth in L dampens this effect. If productivity is pro-cyclical, increases in output are matched by increases in productivity, so there is less need to increase workers (and thus less change in U .) Finally, labor hoarding means that firms keep their work force constant across business cycles. Obviously, if companies don’t adjust employment when output changes, unemployment will be less sensitive to ΔY .

6. A country with fixed exchange rates and permanently high inflation relative to other countries
- will have nominal interest rates higher than the rest of the world.
 - will gain competitiveness in world markets.
 - will have its consumers' purchasing power deteriorated.
 - All of the above.
 - None of the above.

(a) This question was a bit tricky. Although the country described above has fixed exchange rates, their fixed E regime cannot be credible if they have permanent high inflation. This means E^e does not always equal E , i.e. the country has to devalue occasionally in order to maintain purchasing power parity (PPP). Therefore, $(E^e - E)/E > 0$, and using the Interest Rate Parity condition, $i = i^* + (E^e - E)/E$, you can see that $i > i^*$.

7. What is the effect of a fiscal expansion on the equilibrium Y, C, G, I, X, M, NX, r and E , given fixed prices (midterm)?
- $\uparrow Y, \uparrow C, \uparrow G, ?I, \downarrow X, \uparrow M, \downarrow NX, \uparrow r, \downarrow E$.
 - $\uparrow Y, \uparrow C, \uparrow G, \downarrow I, \downarrow X, \uparrow M, \downarrow NX, \uparrow r, \downarrow E$.
 - $\uparrow Y, \uparrow C, \uparrow G, \uparrow I, \downarrow X, \uparrow M, \downarrow NX, \uparrow r, \downarrow E$.
 - $\uparrow Y, \uparrow C, \uparrow G, ?I, \uparrow X, \downarrow M, \uparrow NX, \uparrow r, \uparrow E$.

(a) See the chart below – note that Investment is a function of both output and interest rates, so its change is ambiguous.



8. When one year German bonds pay 7% and the one-year American T-bills pay only 5%, then:
- All the Americans should save in German bonds.
 - The market expects 2% depreciation of the USD in one year.
 - The market expects 2% appreciation of the USD in one year.

- d. None of the above is correct

(c) Use the Interest Rate Parity condition to answer this question. Since $i = i^* + (E^e - E)/E$, $(E^e - E)/E = i - i^* = 5\% - 7\% = -2\%$. Remember that if E falls by 2%, this is an appreciation.

SECTION III: LONG QUESTIONS

PART 1: FUNDAMENTALS OF THE IS CURVE (12 points total)

Define in one-to-two brief sentences each the primary reason or reasons each of the major private final demand components is directly sensitive to interest rates, and the direction of the impact (i.e. the sign of the derivative).

A. REAL CONSUMPTION

Source of change (3 points):

When the real interest rate is high, then it means that today's consumption costs consumers more in terms of future consumption.

Direction (1 point): *Negatively correlated.*

B. RESIDENTIAL REAL INVESTMENT

Source of change (3 points):

Residential investment is sensitive to interest rates for the same reason as real consumption.

Direction (1 point): *Negatively correlated.*

C. REAL IMPORTS

Source of change (3 points):

Real imports (the quantity of goods imported) are sensitive to the exchange rate – changes in E change the price of imports for the domestic population. When E rises (a depreciation of the domestic currency), real imports fall. By the interest rate parity equation, we know that when E rises, domestic interest rates fall, so interest rates and real imports move in the same direction.

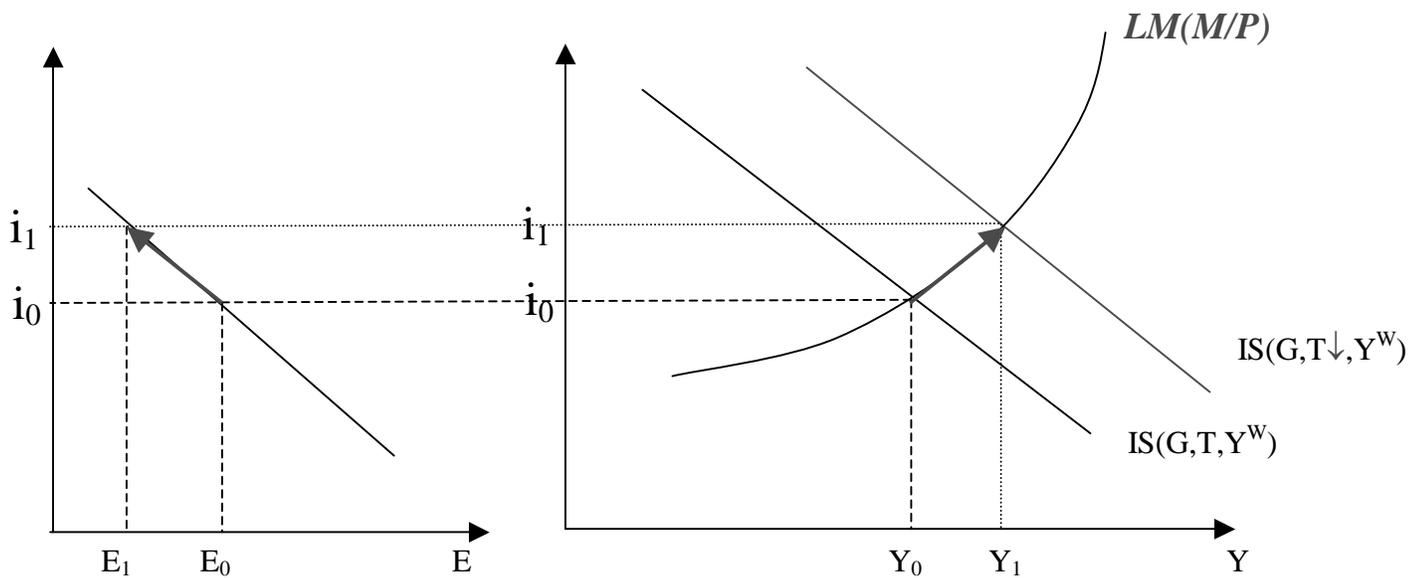
Direction (1 point): *Positively correlated.*

PART 2: TAX CUTS IN THE OPEN ECONOMY (14 points total)

Explain how a fiscal stimulus through a personal tax cut would influence the real and nominal trade balance. Throughout this question, assume no effect on domestic output prices.

- A. (2 points) What is the likely short- to medium-term impact on the exchange rate: appreciation or depreciation, and why?

Use the IS-LM framework to answer this question – cutting taxes shifts the IS curve out. This increases output and interest rates, and leads to an appreciation of the currency because foreign investors buy domestic currency to purchase domestic bonds.



$T \downarrow \rightarrow Y^d \uparrow \rightarrow C \uparrow \rightarrow IS$ curve shifts to the right $\rightarrow i \uparrow \rightarrow E \downarrow$ (per the Interest Rate Parity condition) $\rightarrow e \downarrow$ (since P & P^* are constant).

- B. (8 points, 2 each) Briefly describe with one short sentence or phrase each the ultimate long-run impacts (i.e. source of change and direction of change after any possible temporary early J course outcome). *Sample answer structure to aid you: “(Real/Nominal) (exports/imports) would (rise/fall) in response to a (stronger/weaker) domestic currency. An additional (positive/negative) impact would flow from (positive/negative) changes in _____ spending.”*

i. **Real exports**

Real exports would fall in response to a stronger domestic currency. An additional positive impact would flow from positive changes in foreign spending (our increased imports boost foreign GDP).

ii. **Real imports**

Real imports would rise in response to a stronger domestic currency. An additional positive impact would flow from positive changes in domestic spending.

iii. Nominal exports

Since exports are in terms of domestic currency, when its real quantity increases then its nominal value increases as well.

iv. Nominal imports

Since the elasticity is greater than one, the percentage change in M is bigger than the percentage change in e . This means that eM , and thus nominal imports, increases, since the rise in M more than offsets the fall in e .

C. (4 points, 1 each) The J-Curve effect differentiates between short-run and long-run effects. Assume the long-run demand elasticities are all greater than one in absolute value. How does this J-curve phenomenon eventually (after the passage of several years) augment or reduce short-run impacts? Circle your choice below.

i. Real exports: augment reduce unchanged

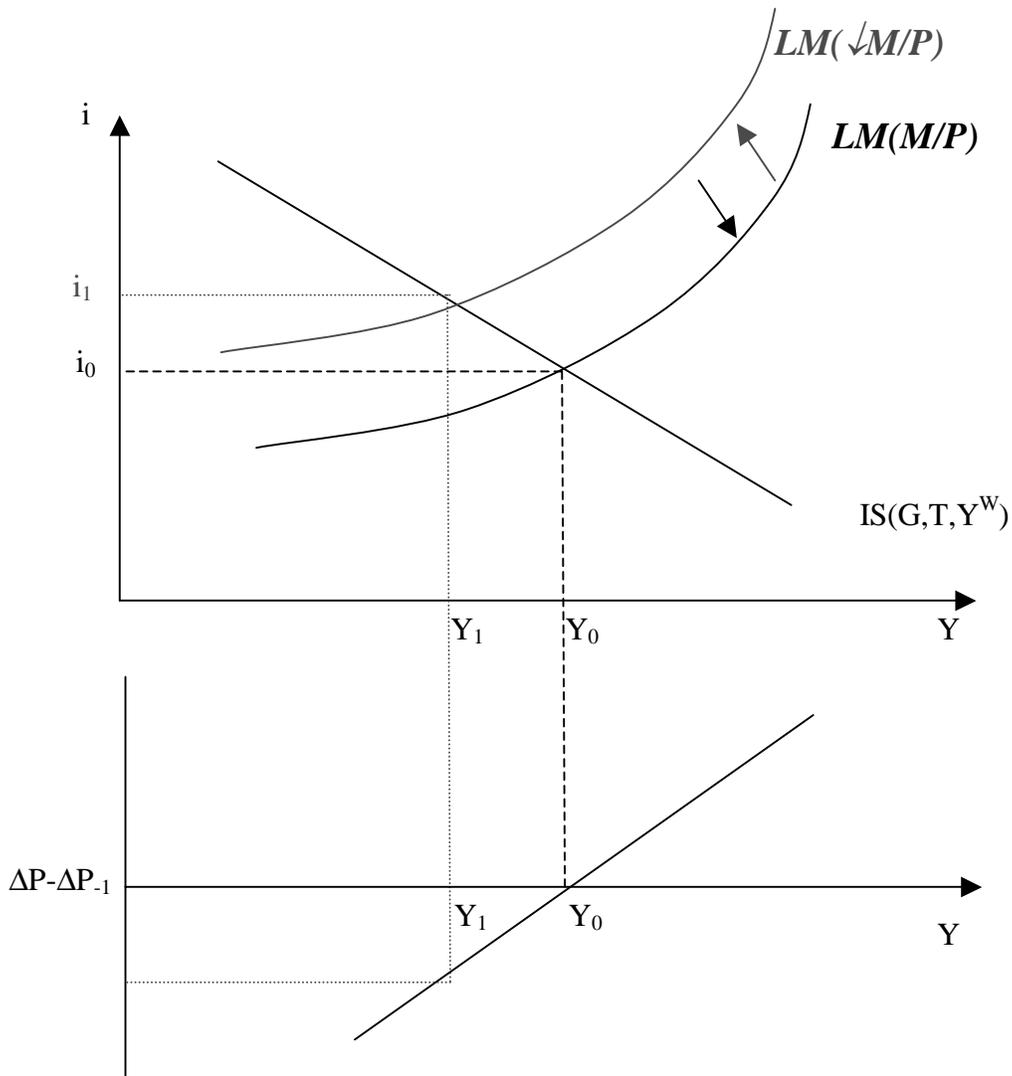
ii. Real imports: augment reduce unchanged

iii. Nominal exports: augment reduce unchanged

iv. Nominal imports: augment reduce unchanged

PART 3: INTEGRATING IS-LM WITH A MODERN MODEL OF INFLATION
(12 points total)

- A. (2 points) With a fixed price level, describe with IS LM curves the impact of a reduction in the money supply on equilibrium output and interest rates.



B. (4 points, 1 each) How would the new output level influence the price level?
(Circle your answer.)

i. Impact on labor demand: augment reduce unchanged

When output is low, the firms' demand for labor force decreases.

ii. Impact on labor supply: augment reduce unchanged

Because labor supply is pro-cyclical.

iii. Net initial impact on unemployment: augment reduce unchanged

Per Okun's law.

iv. Impact on inflation, hence the price level: augment reduce unchanged

See graph above.

C. (2 points) Explain the impact of this directional price level shift on the LM curve (assume no impact on the IS curve).

Since $\Delta M = 0$ (since M is fixed at the new level) and $\Delta P < 0 \Rightarrow M/P \downarrow \rightarrow LM$ shifts to the right.

D. (4 points) In what direction does this price shift move income and interest rates relative to the answer given in 3A?

Income and interest rates move in the opposite direction, income rises and interest rates fall.

PART 4: ACCELERATOR MODEL OF INVESTMENT (8 points total, 2 each)

Present the algebraic expressions defining the simple accelerator model of investment. No sentences are to be provided, just the math and the concepts referred to by each symbol you use.

A. Define the relationship between output and the capital stock.

$$K_t = aY_t \text{ (In the US, 'a' is about one.)}$$

B. Define the relationship between net and gross investment.

$$I_t = I_{Nt} + D_t = I_{Nt} + d_1K_t = I_{Nt} + dY_t$$

C. Define the relationship between net investment and output.

$$I_{Nt} = a(K_{t+1} - K_t) = a(Y_{t+1} - Y_t)$$

D. Combine your prior answers to define the relationship between gross investment and output.

$$I_t = a(Y_{t+1} - Y_t) + dY_t$$