

Macroeconomics

1 Multiple Choice (30 points)

1. [6 points] An increase in domestic prices:

- (a) Depreciates the domestic currency.
- (b) Appreciates the domestic currency.
- (c) Has an ambiguous effect on the domestic currency.

Answer: c. See handout.

2. [6 points] In the short run, a contractionary monetary policy in an open economy...

- (a) Contracts output and generates a depreciation.
- (b) Contracts output and generates an appreciation.
- (c) Expands output and generates a depreciation.

Answer: b. See handout.

3. [6 points] There is a 30% tax levied on income above \$15,000. A person with income of \$18,000 faces:

- (a) A marginal tax rate of 30% and an average tax rate of 30%.
- (b) A marginal tax rate of 30% and an average tax rate of 25%.
- (c) A marginal tax rate of 30% and an average tax rate of 5%.

Answer: c. the person pays $30\% * (18000 - 15000) = 900$. The average tax rate is $900 / 18000 = 5\%$.

4. [6 points] Consider a 2 country world, countries A and B. If under autarky the interest rates satisfy $r^A > r^B$, after integration:

- (a) Savings and investment in country A decrease.
- (b) Savings decrease in country A and country B.
- (c) Savings in country A and investment in country B decrease.

Answer: c. The new interest rate will be higher for country B and lower for country A, therefore, savings in country A decrease and investment in country B decreases.

5. [6 points] Deposit insurance...

- (a) Is a successful tool in preventing bank runs but it is costly for the government.

- (b) Is a succesful tool in preventing bank runs and it may not be costly for the government.
- (c) Has not proven to be a succesful tool in preventing bank runs.

Answer: b. No need to intervene, just the threat off the equilibrium path may do the job.

2 Barro 1979 (35 points)

Consider the 2 period consumption model. Denote c_t consumption and y_t income at time $t = 1, 2$. Consumers and government may save and borrow at period $t = 1$ at a given interest rate r . Each period, the government collects lump sum taxes t_t and government expenditures are g_t . Income, taxes and government expenditures are exogenous for the consumer. Utility for consumers is given by $U(c_1, c_2) = u(c_1) + \beta u(c_2)$. Assume $\beta(1+r) = 1$.

1. [2 points] Obtain the intertemporal budget constraint for the consumer.

Answer:

$$\begin{aligned} c_1 + b &= y_1 - t_1 \\ c_2 &= y_2 - t_2 + b(1+r) \\ c_1 + \frac{c_2}{1+r} &= y_1 - t_1 + \frac{y_2 - t_2}{1+r} \end{aligned}$$

2. [2 points] Obtain the intertemporal budget constraint for the government.

Answer:

$$\begin{aligned} g_1 &= t_1 + b^g \\ g_2 + (1+r)b^g &= t_2 \\ g_1 + \frac{g_2}{1+r} &= t_1 + \frac{t_2}{1+r} \end{aligned}$$

3. [6 points] Combine the previous expressions to sketch a proof of the statement "The timing of taxes does not affect consumption choices as long as the present value of consumption is not affected".

Answer: The consumer solves

$$\begin{aligned} \max U(c_1, c_2) \text{ s.t.} \\ c_1 + \frac{c_2}{1+r} &= y_1 - t_1 + \frac{y_2 - t_2}{1+r} \end{aligned}$$

The budget constraint can be expressed as

$$c_1 + \frac{c_2}{1+r} = y_1 + \frac{y_2}{1+r} - \left[g_1 + \frac{g_2}{1+r} \right]$$

And therefore, the optimal choices of consumption are unaffected by the timing of taxes as long as $g_1 + \frac{g_2}{1+r}$ does not change.

4. Let us consider the case in which taxation is no longer a one-to-one transfer of purchasing power from consumers to the government. In particular, assume that when taxes t_t are collected, an amount $\gamma(t_t) = bt_t^2$ of income is wasted, where b is a positive constant. We may think of this as collection costs or "deadweight losses." The marginal loss given by $\gamma'(t) = 2bt$ is increasing in t .

- (a) [3 points] Obtain the intertemporal budget constraint for the consumer.

Answer:

$$c_1 + \frac{c_2}{1+r} = y_1 - t_1 - \gamma(t_1) + \frac{y_2 - t_2 - \gamma(t_2)}{1+r}$$

- (b) [2 points] Obtain the intertemporal budget constraint for the government.

$$g_1 + \frac{g_2}{1+r} = t_1 + \frac{t_2}{1+r}$$

- (c) [5 points] Does the Ricardian equivalence still hold? Explain.

Answer:

$$c_1 + \frac{c_2}{1+r} = y_1 + \frac{y_2}{1+r} - \left[g_1 + \frac{g_2}{1+r} \right] - \left[\gamma(t_1) + \frac{\gamma(t_2)}{1+r} \right]$$

No, the timing of taxes does matter for consumption choices.

- (d) [4 points] Suppose that the consumer could choose the timing of taxes subject to the intertemporal budget constraint for the government. Recall that under the assumption $\beta(1+r) = 1$, $c_1 = c_2$. State the maximization problem to determine the optimal choice of t_1 and t_2 . No need to solve.

Answer: Given that $\beta(1+r) = 1$ optimal consumption path is constant $c_1^* = c_2^* = c^*$ given by

$$c^*(t_1, t_2) = \frac{1+r}{2+r} \left\{ const - \left[\gamma(t_1) + \frac{\gamma(t_2)}{1+r} \right] \right\}$$

A benevolent government would maximize $(1+\beta)u[c^*(t_1, t_2)]$, which is equivalent to maximizing $c^*(t_1, t_2)$.

The government maximizes utility for the consumer subject to the constraint that the net present value of the revenues has to be equal to the net present value of tax collection.

$$\begin{aligned} \min \quad & \gamma(t_1) + \frac{\gamma(t_2)}{1+r} \text{ s.t.} \\ g_1 + \frac{g_2}{1+r} = & t_1 + \frac{t_2}{1+r} \end{aligned}$$

(e) [2 points] Interpret the following two conditions that determine optimal tax collection.

$$\begin{aligned} 2bt_1^* &= 2bt_2^* \\ g_1 + \frac{g_2}{1+r} &= t_1^* + \frac{t_2^*}{1+r} \end{aligned}$$

Answer: The optimal pair must satisfy the budget constraint. Also, the marginal collection cost has to be the same in each period (independent of r , since the tax revenue and the collection cost arise at the same point in time).

(f) [4 points] Solve for the optimal tax path.

Answer: The condition $\gamma'(t_1^*) = \gamma'(t_2^*)$ together with the assumptions on γ imply that optimal taxes are constant in time $t_1^* = t_2^* = t^*$. Therefore,

$$\begin{aligned} g_1 + \frac{g_2}{1+r} &= t^* + \frac{t^*}{1+r} = \frac{2+r}{1+r}t^* \\ t^* &= \frac{1+r}{2+r} \left[g_1 + \frac{g_2}{1+r} \right] \end{aligned}$$

(g) [5 points] Use your results to justify how a government should finance a temporary increase in government expenditures (e.g. wartime).

Answer: The government should use debt to smooth the tax burden in time when there is a temporary increase in government expenditures.

3 Open Economy (35 points)

Consider a world economy with two countries. The home country is characterized by:

$$\begin{aligned} C &= c_0 + c_1Y \\ I &= c_2 \\ X &= \frac{d_1\tilde{Y}}{e} \\ \frac{M}{e} &= d_2Y \end{aligned}$$

where $C, Y, \tilde{Y}, I, M, X, e$ denote aggregate consumption, domestic output, foreign output, investment, imports, exports and the real exchange rate, respectively. Assume $c_0, c_2 > 0$, $0 \leq c_1 \leq 1$, $0 \leq d_1 \leq 1$, $1 - c_1 + m > 0$, $0 \leq d_2 \leq 1$.

The foreign country is characterized by

$$\begin{aligned} \tilde{C} &= \tilde{c}_0 + \tilde{c}_1\tilde{Y} \\ \tilde{I} &= \tilde{c}_2 \\ \frac{\tilde{M}}{\tilde{e}} &= d_1\tilde{Y} \\ \tilde{X} &= \frac{d_2\tilde{Y}}{\tilde{e}} \end{aligned}$$

Assume that parameters in the foreign economy satisfy assumptions analogous to the ones for the domestic economy.

We will assume throughout the question that the real exchange rate (e) is exogenously given.

- [5 points] Find the equilibrium level of output in the domestic goods market as a function of e, G, \tilde{Y} and parameters. Find the multiplier. Find equilibrium in foreign goods market as a function of \tilde{e}, \tilde{G}, Y and parameters.

Answer:

$$\begin{aligned} Y &= c_0 + c_1 Y + c_2 + G + d_1 \tilde{Y}/e - d_2 Y \\ Y &= \frac{1}{1 - c_1 + d_2} [c_0 + c_2 + d_1 \tilde{Y}/e + G] \\ &= m [c_0 + c_2 + d_1 \tilde{Y}/e + G] \end{aligned}$$

where M is the multiplier. Similarly,

$$\begin{aligned} \tilde{Y} &= \frac{1}{1 - \tilde{c}_1 + d_1} [\tilde{c}_0 + \tilde{c}_2 + d_2 Y/\tilde{e} + \tilde{G}] \\ &= \tilde{m} [\tilde{c}_0 + \tilde{c}_2 + d_2 Y/\tilde{e} + \tilde{G}] \end{aligned}$$

- [3 points] How do net exports depend on the real exchange rate in this model?

Answer: net exports are decreasing in the real exchange rate e :

$$NX = \frac{d_1 \tilde{Y}}{e} - d_2 Y$$

- [3 points] State a condition relating e and \tilde{e} .

Answer:

$$e = \frac{1}{\tilde{e}}$$

- [6 points] Solve for domestic output as a function of e, G, \tilde{G} and parameters.

Answer:

$$\begin{aligned} Y &= m [c_0 + c_2 + d_1 \tilde{Y}/e + G] \\ &= m \left[c_0 + c_2 + G + d_1 \tilde{m} \frac{\tilde{c}_0 + \tilde{c}_2 + d_2 Y e + \tilde{G}}{e} \right] \\ &= m \left[c_0 + c_2 + G + d_1 \tilde{m} \frac{\tilde{c}_0 + \tilde{c}_2 + \tilde{G}}{e} + d_1 d_2 \tilde{m} Y \right] \end{aligned}$$

$$Y = \frac{m}{1 - d_1 d_2 m \tilde{m}} \left[c_0 + c_2 + G + d_1 \tilde{m} \frac{\tilde{c}_0 + \tilde{c}_2 + \tilde{G}}{e} \right]$$

5. [6 points] How is domestic output affected by a real depreciation of the home goods relative to the foreign goods? What about foreign output? Explain.

Answer: Domestic increases following a real depreciation. Instead, foreign output decreases.

6. [6 points] Suppose that each country may either "not act" or "attempt to depreciate." If a country attempts to depreciate and the other country does not act, then the depreciation is achieved. However, if both countries attempt to depreciate, there is no change in the real exchange rate. Show that each country will choose to "attempt to depreciate".

Answer: based on the results in part 5, attempt to depreciate is a dominant strategy for each country.

7. [6 points] In light of the previous result, interpret the following paragraph of the article "Currency war fears after Swiss devaluation" (12th March 2009)

Analysts have warned of the emerging threat of currency wars following a Swiss market intervention. The Swiss franc fell by as much as 3.2 per cent against the euro to 1.53 - the biggest decline since 1999 - after the country's central bank said it was taking deliberate measures to weaken its currency. The move raises fears of retaliatory measures by other countries seeking to give their exporters a competitive edge.

[Hint: if prices are sticky, the real and nominal exchange rates move together]