Public Affairs 854
Spring 2021
University of Wisconsin-Madison

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Social Sciences 7418

Midterm 1 Answers

The total time for the exam is 75 minutes, although you are given 90 minutes to complete it. Points are allocated proportionally to the time allocations**.**

Hint: To ease entry of symbols, you can use tildes to denote overbars (i.e., $\bar{I}$ is written as *I*~), and use *d* as a change symbol (i.e., Δ is written as *d*), and $\bar{\alpha}$ as *alpha*~, and $\hat{\alpha}$ as *alpha*^.

1. Consider the Balance of Payments condition, CA + FA + ORT ≡ 0.
   1.1 (4 minutes) Suppose on net, foreigners (not including foreign central banks) are buying more US bonds and stocks than US residents are buying of foreign bonds and stocks, and in addition, the US central bank is not adding or subtracting from its foreign exchange reserves. Is the current account in surplus or deficit, or are we unable to tell? Show your work, in addition to explaining in words.

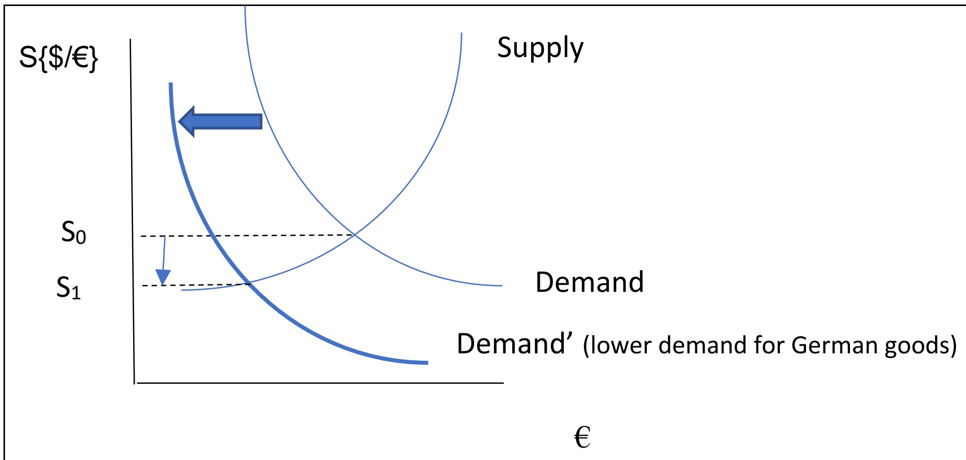
If on net foreigners are purchasing US assets, then foreigners are lending to the US, i.e., FA > 0. US central bank is not adding/subtracting from reserves implies ORT=0. Since CA ≡ -FA-ORT, then CA < 0 *[corrected 3/10].*

   1.2 (4 minutes) Suppose CA + FA is continuously negative. Can this situation go on forever? Why or why not?

CA+FA is the economic concept of the “balance of payments”. If CA+FA < 0, then it must be by accounting ORT > 0, which means you eventually run out of foreign exchange reserves.

2. Suppose today, the exchange rate (from the American perspective) is 1.20 $/€.

2.1 (4 minutes) Using a diagram of the foreign currency market, show what happens when demand for German goods decreases.



When the demand for German goods falls, demand for euros necessary to buy German goods falls. This shifts in the Demand curve for euros, leading to a fall of the $/€ rate from S_0 to S_1 (i.e., an appreciation of the US dollar against the euro).

2.2 (4 minutes) Suppose a year ago, it took 1 $ to buy a single €. Has the dollar appreciated or depreciated over the past year? What is the percentage change in the dollar's value over that year (from an American perspective)? Show your work!

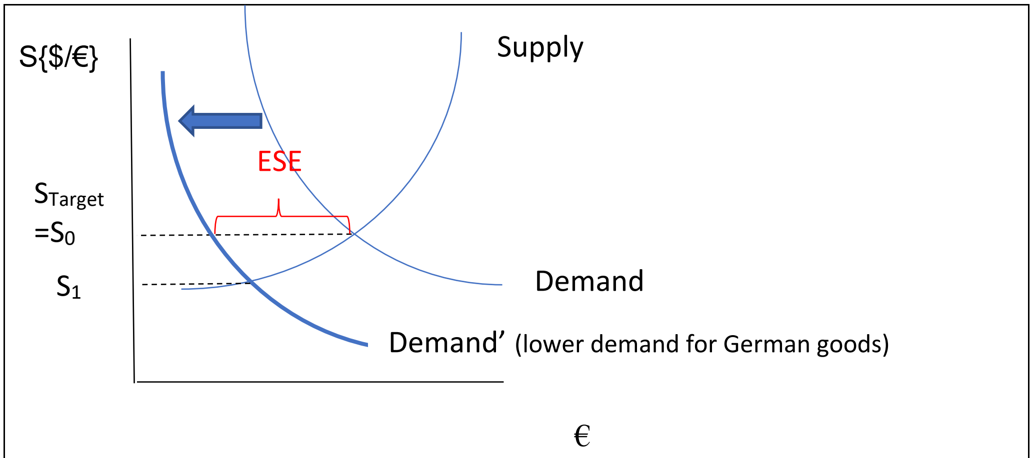
Using the standard approach for calculating the exchange rate depreciation from the American perspective ($/€):

$(S_{2021}-S_{2020})/S_{2020}$ = (1.2 – 1)/1 = 0.20, or 20%

[The alternative approach is to use natural logs, so

Ln(1.2/1) = 0.182 or 18.2%]

2.3 (4 minutes) Suppose a year ago, the American government had decided it wanted to keep the exchange rate constant at 1 $/€. Redraw the answer to 2.1, and explain what the American government would need to do in order to achieve its goal?



If the US government wants to target the exchange rate at S_{2020}, in the face of declining demand for German goods and hence declining demand for euros, then it will have to purchase the excess supply of euros ESE.

3. Consider the following economy:

Eq.No.	Equation	Description
(1)	$Y = AD$	Output equals aggregate demand, an equilibrium condition
(2)	$AD \equiv C + I + G + X - IM$	Definition of aggregate demand
(3)	$C = \bar{C} + c(Y - T + Tr)$	Consumption function, *c* is the MPC
(4)	$T = \bar{T} + tY$	Tax function; *t* is tax rate.
(5)	$Tr = \overline{Tr}$	Fiscal transfers function (e.g., social security payments)
(6)	$I = \bar{I}$	Investment function
(7)	$G = \bar{G}$	Government spending on goods and services
(9)	$X = \bar{X} + n\bar{q}$	Export spending
(10)	$IM = \overline{IM} + mY - v\bar{q}$	Import spending

Assume the real exchange rate is constant.

3.1 (5 minutes) Solve for *Y*. Show your work.

Solve for *Y*, setting $\bar{A} \equiv \bar{C} + \bar{I} + \bar{G}$

$$Y = AD = \bar{C} - c\bar{T} + c\overline{Tr} + c(1-t)Y + \bar{I} + \bar{G} + \bar{X} + n\bar{q} - \overline{IM} - mY + v\bar{q}$$

Collect up terms:

$$Y = \bar{A} - c\bar{T} + c(1-t)Y - mY + \bar{X} - \overline{IM} + (n+v)\bar{q} \quad \text{where} \quad \bar{A} \equiv \bar{C} + c\overline{Tr} + \bar{I} + \bar{G}$$

Shift "*Y*" terms to the left hand side:

$Y - c(1-t)Y + mY = \bar{A} - c\bar{T} + \bar{X} - \overline{IM} + (n+v)\bar{q}$ where $\bar{A} \equiv \bar{C} + c\overline{Tr} + \bar{I} + \bar{G}$

So:

$Y[1 - c(1-t) + mY] = \bar{A} - c\bar{T} + \bar{X} - \overline{IM} + (n+v)\bar{q}$

Divide both sides by the term in the square bracket to obtain equilibrium income, Y_0:

$Y_0 = \bar{\alpha}[\bar{A} - c\bar{T} + \bar{X} - \overline{IM} + (n+v)\bar{q}]$ where $\bar{\alpha} \equiv \left(\frac{1}{1-c(1-t)+m}\right)$

3.2 (5 minutes) Calculate the change in income for a change in lump sum taxes. Show your work!

Take the total differential of the answer to question 3.1.

$\Delta Y = \bar{\alpha}[\Delta A - c\Delta T + \Delta X - \Delta IM + (n+v)\Delta q]$ where $\bar{\alpha} \equiv \left(\frac{1}{1-c(1-t)+m}\right)$

Set $\Delta A = 0 = \Delta X = \Delta IM = \Delta q$

$\Delta Y = -\bar{\alpha}c\Delta T$

3.3 (5 minutes) Calculate the change in income for a change in the real exchange rate. Show your work! (Remember, when q rises, that's a weakening of the home currency in real terms).

Take the total differential of the answer to question 3.1.

$\Delta Y = \bar{\alpha}[\Delta A - c\Delta T + \Delta X - \Delta IM + (n+v)\Delta q]$ where $\bar{\alpha} \equiv \left(\frac{1}{1-c(1-t)+m}\right)$

Set $\Delta A = 0 = \Delta X = \Delta IM = \Delta T$

$\Delta Y = \bar{\alpha}(n+v)\Delta q$

3.4 (5 minutes) Calculate the change in the trade balance for a given change in lump sum taxes. Hint: $TB \equiv X - IM$. Show your work!

$TB \equiv X - IM$, so $TB = (X + n\bar{q}) - (IM + m\Delta Y - v\bar{q})$

$$\Delta TB = (\Delta X + n\Delta q) - (\Delta IM + m\Delta Y - v\Delta q)$$

Set $\Delta A = 0 = \Delta X = \Delta IM = \Delta q$

$$\Delta TB = -(m\Delta Y)$$

Substitute in for change in income from 3.2:

$$\Delta TB = -(m(-\bar{\alpha}c\Delta T))$$

$$\Delta TB = (m\bar{\alpha}c\Delta T)$$

3.5 (5 minutes) Calculate the change in the trade balance for a given change in the real exchange rate. Hint: $TB \equiv X - IM$. Show your work!

$$\Delta TB = (\Delta X + n\Delta q) - (\Delta IM + m\Delta Y - v\Delta q)$$

Set $\Delta A = 0 = \Delta X = \Delta IM = \Delta T$

$$\Delta TB = -(m\Delta Y) + (n + v)\Delta q$$

But recall the change in income depends on the change in income, from your answer to 3.3:

$$\Delta TB = -(m\bar{\alpha}(n + v)\Delta q) + (n + v)\Delta q$$

Factoring:

$$\Delta TB = (1 - m\bar{\alpha})(n + v)\Delta q$$

3.6 (5 minutes) If one wanted to increase GDP while improving the trade balance, what would be the preferred policy? Explain the economics of your answer.

An increase in lump sum taxes improves the trade balance but decreases output. The decrease in output reduces imports which is why the trade balance improves.

A depreciation in the real exchange rate (q rises) improves the trade balance and hence improves income. There is some slight offsetting decrease in the trade balance because the increase in income increases imports.

4. Consider an IS-LM model, where all equations are the same as (1-10), but (6) now looks like:

(6) $I = \bar{I} - bi$

4.1 (5 minutes) Solve for the IS curve (Y on the left hand side).

Solve for Y, setting $\bar{A} \equiv \bar{C} + \bar{I} + \bar{G}$

$$Y = AD = \bar{C} - c\bar{T} + c\overline{Tr} + c(1-t)Y + \bar{I} - bi + \bar{G} + \bar{X} + n\bar{q} - \overline{IM} - mY + v\bar{q}$$

Collect up terms:

$Y = \bar{A} - c\bar{T} + c(1-t)Y - mY + \bar{X} - \overline{IM} + (n+v)\bar{q} - bi$ where $\bar{A} \equiv \bar{C} + c\overline{Tr} + \bar{I} + \bar{G}$

Shift "*Y*" terms to the left hand side:

$Y - c(1-t)Y + mY = \bar{A} - c\bar{T} + \bar{X} - \overline{IM} + (n+v)\bar{q} - bi$ where $\bar{A} \equiv \bar{C} + + c\overline{Tr} + \bar{I} + \bar{G}$

So:

$$Y[1 - c(1-t) + mY] = \bar{A} - c\bar{T} + \bar{X} - \overline{IM} + (n+v)\bar{q} - bi$$

Divide both sides by the term in the square bracket to obtain equilibrium income, Y_0:

$Y = \bar{\alpha}[\bar{A} - c\bar{T} + \bar{X} - \overline{IM} + (n+v)\bar{q} - bi]$ where $\bar{\alpha} \equiv \left(\frac{1}{1-c(1-t)+m}\right)$

4.2 (5 minutes) The LM curve is:

$$i = -\frac{1}{h}\left(\frac{\bar{M}}{\bar{P}}\right) + \frac{k}{h}Y$$

Solve for equilibrium income. Show your work!

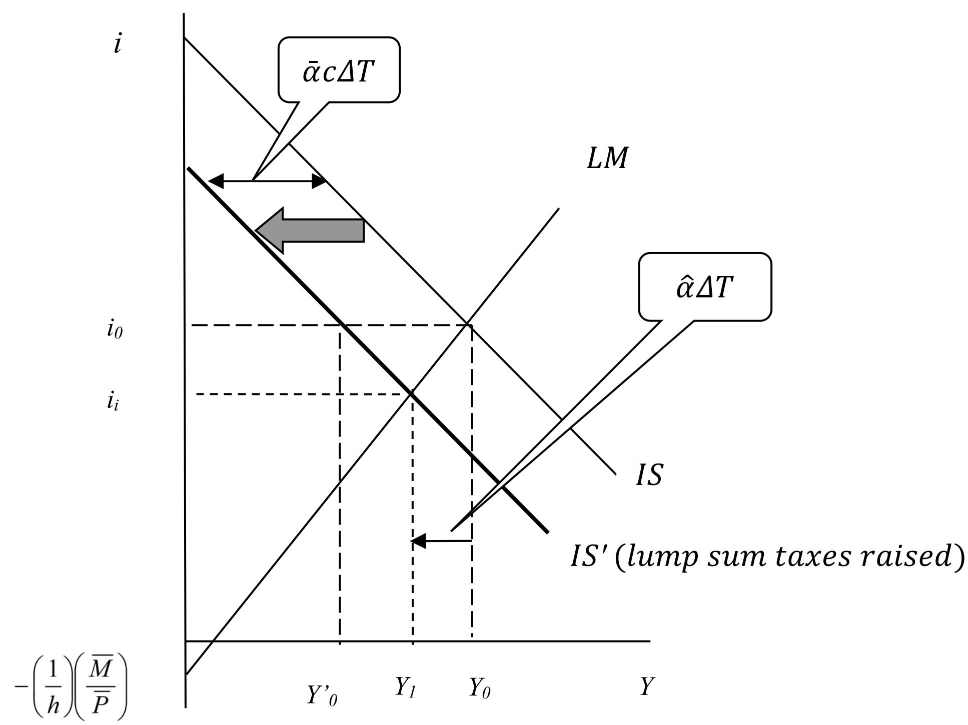
$Y = \bar{\alpha}[\bar{A} - c\bar{T} + \bar{X} - \overline{IM} + (n+v)\bar{q} - b\left(-\frac{1}{h}\left(\frac{\bar{M}}{\bar{P}}\right) + \frac{k}{h}Y\right)]$ where $\bar{\alpha} \equiv \left(\frac{1}{1-c(1-t)+m}\right)$

$$Y(1-c(1-t)+m) = [\bar{A} - c\bar{T} + \bar{X} - \overline{IM} + (n+v)\bar{q} + \frac{b}{h}\left(\frac{\bar{M}}{\bar{P}}\right) - \frac{bk}{h}Y]$$

$$Y(1-c(1-t)+m+\frac{bk}{h}) = [\bar{A} - c\bar{T} + \bar{X} - \overline{IM} + (n+v)\bar{q} + \frac{b}{h}\left(\frac{\bar{M}}{\bar{P}}\right)]$$

$$Y_0 = \hat{\alpha}[\bar{A} - c\bar{T} + \bar{X} - \overline{IM} + (n+v)\bar{q} + \frac{b}{h}\left(\frac{\bar{M}}{\bar{P}}\right)] \quad \text{where } \hat{\alpha} \equiv \frac{1}{1-c(1-t)+m+\frac{bk}{h}}$$

4.3. (5 minutes) Draw the economy corresponding to the model (you can assume the IS curve is downward sloping, the LM is upward sloping). Show what happens when lump sum taxes are increased.



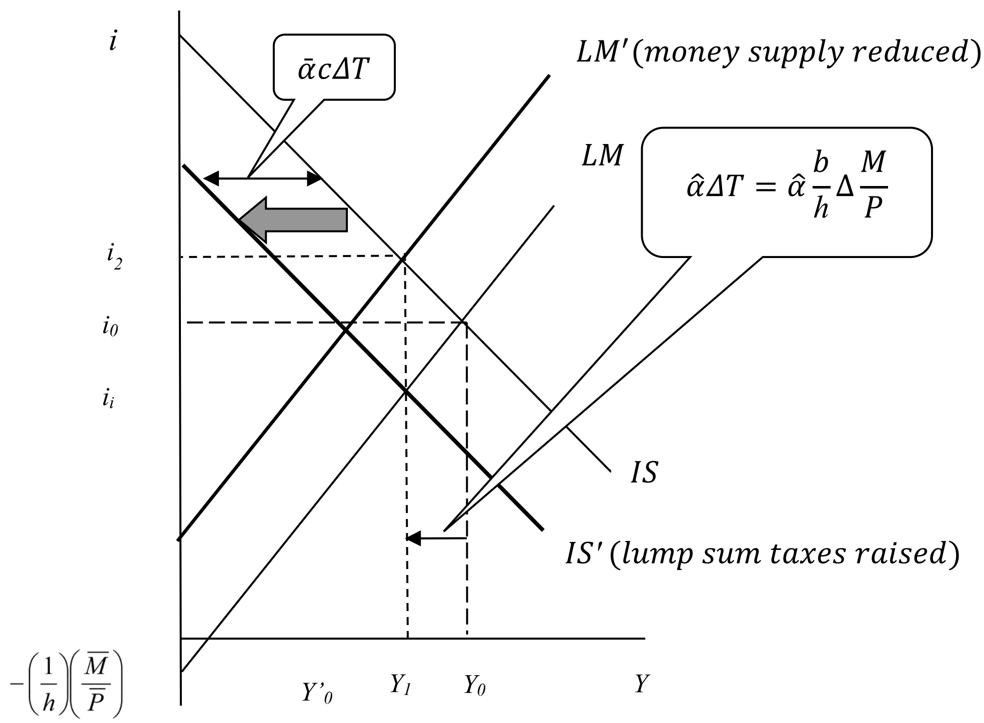
Income falls from Y_0 to Y_1.

4.4 (5 minutes) Using a graph, compare the impact of an increase in lump sum taxes and a decrease in money supply on output.

Suppose we wanted to decrease income the same amount, viz.,

$$\hat{\alpha}c\Delta T = -\frac{b}{h}\Delta\left(\frac{M}{P}\right)]$$

Then:



4.5 (5 minutes) In which case will investment increase, in which case will it decrease?

Since interest rates are higher (i2) with a reduction in money supply versus an increase in lump sum taxes (i1), then investment will be decreasing in the money supply case, given the investment function:

$$I = \bar{I} - bi$$