Suggested Solutions for Problem Set #2

1. *You needed to upload the handwritten honor pledge. Without that, you get zero points on the entire problem set.*

2. *Suppose the marginal propensity to consume (mpc) depends upon the source of the change in disposable income. Let's use subscripts to indicate which mpc is which.*

- *The mpc if the change in YD is due to a change in Y is mpc_Y*
- *The mpc if the change in YD is due to a change in TR is mpc_{TR}*
- *The mpc if the change in YD is due to a change in TA is mpc_{TA}*

Suppose $mpc_{TR} > mpc_Y > mpc_{TA}$.

If the goal of policy is to increase consumption by as much as possible, how should the government prioritize spending on installing proper ventilation in government buildings versus cutting personal income taxes versus providing additional grants to college students? Discuss.

The primary challenge in this question was mapping the events to changes in Y, TR, or TA.

- The government installing proper ventilation in government buildings will generate income for the people who do the work, so this is a change in Y.
- Cutting personal income taxes is a change in TA.
- Providing additional grants to college students is a transfer payment, TR.

So if the goal of policy is to increase C by as much as possible, they should provide additional grants to college students, then spend money on purchasing goods & services (including, here, ventilation), and lastly, cut taxes.

The question doesn't ask, but what would a consumption function look like if the mpc varied depending on the source of the change in disposable income? The standard consumption function is $C = C_0 + C_y Y^D = C_0 + C_y(Y + TR - TA)$. Expanding all terms, we have in the standard function, $C = C_0 + C_y Y + C_y TR - C_y TA$. All we're doing here is assuming that the mpc C_y varies. So we would have instead (using the notation in the question)

$$C = C_0 + mpc_y Y + mpc_{TR} TR - mpc_{TA} TA$$

3. *Suppose the investment function is $I = I_0 + I_y Y - I_r r$. Suppose businesses interpret a rise in real GDP as indicating their sales will rise in future years. If real GDP rises, will the resulting increase in expected revenue cause I_0 to increase? Explain.*

An increase in real GDP does <u>not</u> increase I_0. The rise in real GDP is captured here as a change in Y. The equation tells us there's a relationship between Y & I. It doesn't state why. All the question is doing is filling in the story behind the equation. Providing the explanation for why there's a relationship between Y & I does not change how we use the equation. A change in Y leads to a change in I, with $\Delta I = I_y \Delta Y$. It doesn't matter why the change in Y leads to a change in I; its effect is captured by I_y.

4.

a. Why is the real exchange rate part of the equation for GX but not part of the equation for IM?

(See the video on bcourses if this is still unclear.)

First, why does $\Delta\varepsilon \rightarrow \Delta GX$? Because we respond to changes in prices. Unless we assume that demand is perfectly price inelastic, then an increase in the price of something will lead to a decrease in the quantity demanded of that thing. Here, we have to stand on our heads just a bit because the real exchange rate ε is the price of foreign goods (such as cars manufactured in Japan) relative to the price of domestic goods (such as cars manufactured in the US), but we are thinking about quantities demanded for domestically produced goods and services. That's because GX is gross exports, which are goods and services manufactured in the US (domestically-produced goods and services) and sold to people/ businesses/

government agencies from other countries. So when foreign-produced goods become more expensive relative to domestically-produced goods (↑ ε), people/businesses/government agencies in other countries will buy fewer foreign-produced goods and more domestically produced goods (↑ GX).

What about imports? Now we are thinking of the behavior of different people – now we are thinking about what people / businesses / government agencies in the US will do in response to a change in ε. When foreign goods become relatively more expensive (↑ ε), people / businesses / government agencies in the US will buy fewer foreign-produced goods. Quantity demanded will go down. But in the national income and product accounts, IM measures not the quantity of goods and services imported (1 car, 3 bottles of wine, etc) but the dollar value of goods and services imported ($30,000 worth of car, $45 worth of wine, etc). So what's recorded in IM reflects both the price of the foreign good or service and the quantity purchased.

Here's where we make the assumption of unitary price elasticity of demand. Remember back to Econ 1 and the total revenue application of price elasticity (if you had me for Econ 1, you're now seeing yet another reason that I said the Total Revenue effect was the most important thing to understand from the entire section on elasticity). Price elasticity of demand tells us how much the quantity demanded falls when price rises. When demand is price-inelastic, an increase in price (which of course triggers a decrease in quantity demanded) results in an increase in total revenue (p*q). When demand is price-elastic, an increase in price (which of course triggers a decrease in quantity demanded) results in a decrease in total revenue (p*q). But when demand is unitarily elastic, an increase in price (which of course triggers a decrease in quantity demanded, demand curves after all slope down) results in no change in total revenue (p*q).

So here we invoke the assumption of unitary elasticity of demand. When the price of foreign goods and services rises relative to the price of domestic goods and services, the movement down the demand curve for foreign goods and services is just the right amount so that total spending (p*q, the total revenue of the foreign firms) is unchanged. So with the assumption of unitary elasticity of demand, we can keep our math a tad simpler and have no role for ε in the IM equation.

A numerical example is in the video.

B. When things become uncertain in the world (such as when Covid began), many wealth holders around the globe move their wealth into U.S. financial assets, believing U.S. companies and U.S. government agencies that borrow to be a safer financial bet than companies and government agencies in other countries. What would be the effect on the real exchange rate of this fear-driven move? What would be the effect on gross exports? Explain.

Any event other than a change in domestic or foreign real interest rates that leads to a change in exchange rates is captured in ε_0. In this case, fear (perhaps driven by Covid) is an event other than a change in domestic or foreign real interest rates. The prompt tells us that the fear led to a shift of wealth into US financial assets. That means the supply of foreign currency offered in exchange for dollars (S_{FX}) has increased, and the demand for foreign currency by those currently holding dollars (D_{FX}) has decreased. ↑ S_{FX} and ↓ $D_{FX} \rightarrow \downarrow P_{FX}$.

So the nominal exchange rate (e) has decreased. The real exchange rate ε also decreases because $\varepsilon = \frac{\{e \cdot P^f\}}{\{P\}}$

And because this event wasn't triggered by a change in r or r^f, this decrease in ε is captured (shown by) a decrease in ε_0

The drop in the real exchange rate means the price of foreign-produced goods has fallen relative to the price of domestically-produced goods, which (see part A) leads to a decrease in foreign demand for domestically-produced goods and services, lowering our GX.

5. Suppose the economy can be defined by the following (all units are billions of $ per year)

C = 1,000 + 0.8Y^D
TA = 500 + 0.3Y
TR = 500 + 0.1Y
I = 2,000 - 10,000r
G = 3,000
GX = 4,000 - 20,000r
IM = 1,000 + 0.24Y
potential output Y = 14,000*

A. Using the Y=AD approach, solve for the equilibrium value of the real interest rate in the economy. In gradescope, you'll type in your starting equation, and your result. On your uploaded work, you'll show all the steps.

There are many ways to do the algebra, but they should all end at the same place, with r = 0.02. Here are two approaches. In the first approach, we don't substitute for Y until near the end. In the second approach, we substitute for Y at the very beginning. You might have used a third approach. That's cool, so long as you understood it and ended with r = 0.02. Common errors: mistakenly using Y rather than Y^D in the C function; mistakenly using Y^D rather than Y in the IM function; forgetting to distribute the minus sign through the IM function.

APPROACH 1

$$
\begin{aligned}
Y &= AD \\
Y &= C + I + G + GX - IM \\
Y &= (1{,}000 + 0.8[Y + (500 + 0.1Y) - (500 + 0.3Y)]) + (2{,}000 - 10{,}000r) + 3{,}000 \\
&\quad + (4{,}000 - 20{,}000r) - (1{,}000 + 0.24Y) \\
Y &= \big(1{,}000 + 0.8(Y - 0.2Y)\big) + 2{,}000 - 10{,}000r + 3{,}000 + 4{,}000 - 20{,}000r - 1{,}000 - 0.24Y \\
Y &= \big(1{,}000 + 0.8(0.8Y)\big) + 2{,}000 - 10{,}000r + 3{,}000 + 4{,}000 - 20{,}000r - 1{,}000 - 0.24Y \\
Y &= 9{,}000 + 0.64Y - 30{,}000r - 0.24Y \\
Y &= 9{,}000 + 0.4Y - 30{,}000r \\
0.6Y - 9{,}000 &= -30{,}000r \\
0.6(14{,}000) - 9{,}000 &= -30{,}000r \\
8{,}400 - 9{,}000 &= -30{,}000r \\
-600 &= -30{,}000r \\
\frac{-600}{-30{,}000} &= r \\
r &= 0.02
\end{aligned}
$$

APPROACH 2: Let's solve first for Y^D so that we're less likely to make a copying error.

$$
\begin{aligned}
Y^D &= Y + TR - TA \\
Y^D &= 14{,}000 + \big(500 + 0.1(14{,}000)\big) - \big(500 + 0.3(14{,}000)\big) \\
Y^D &= 14{,}000 + 1{,}900 - 4{,}700 \\
Y^D &= 11{,}200
\end{aligned}
$$

Now I can use that value of Y^D in the consumption equation.

$$
\begin{aligned}
Y &= AD \\
Y &= C + I + G + GX - IM \\
14{,}000 &= (1{,}000 + 0.8(11{,}200)) + (2{,}000 - 10{,}000r) + 3{,}000 + (4{,}000 - 20{,}000r) - (1{,}000 + 0.24(14{,}000)) \\
14{,}000 &= 9{,}960 + 2{,}000 - 10{,}000r + 3{,}000 + 4{,}000 - 20{,}000r - 1{,}000 - 3{,}360 \\
14{,}000 &= 14{,}600 - 30{,}000r \\
-600 &= -30{,}000r \\
\frac{-600}{-30{,}000} &= r \\
r &= 0.02
\end{aligned}
$$

B. Now, use those same equations to derive equations for saving and for investment. Use those saving and investment equations to solve for the equilibrium value of the real interest rate. In gradescope, you'll type in the equations for household saving, government saving, and foreign saving, and your result. On your uploaded work, you'll show all the steps.

Common errors: Forgetting to substitute in the known value of Y; mistakenly using Y rather than Y^D in the consumption function and/or in the S^H equation; forgetting to distribute the minus sign (multiple opportunities to mess that up); messing up the S^G equation (usually, flipping TR and TA); forgetting that the negative of a negative is a positive in the S^F equation.

$$S^H = Y^D - C$$
$$S^H = (14{,}000 + \big(500 + 0.1(14{,}000)\big) - \big(500 + 0.3(14{,}000)\big) - C$$
$$S^H = 11{,}200 - \big(1{,}000 + 0.8(11{,}200)\big)$$
$$S^H = 11{,}200 - (1{,}000 + 8{,}960)$$
$$S^H = 11{,}200 - 9{,}960$$
$$S^H = 1{,}240$$

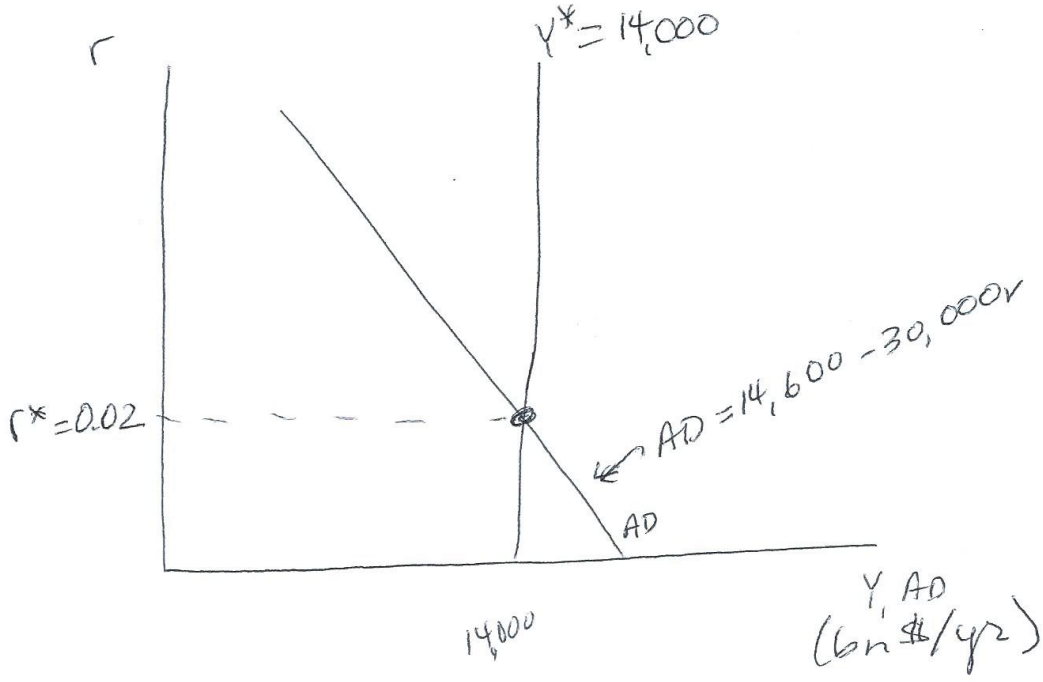
$$S^G = TA - TR - G$$
$$S^G = (500 + 0.3Y) - (500 + 0.1Y) - 3{,}000$$
$$S^G = \big(500 + 0.3(14{,}000)\big) - \big(500 + 0.1(14{,}000)\big) - 3{,}000$$
$$S^G = 4{,}700 - 1{,}900 - 3{,}000$$
$$S^G = -200$$

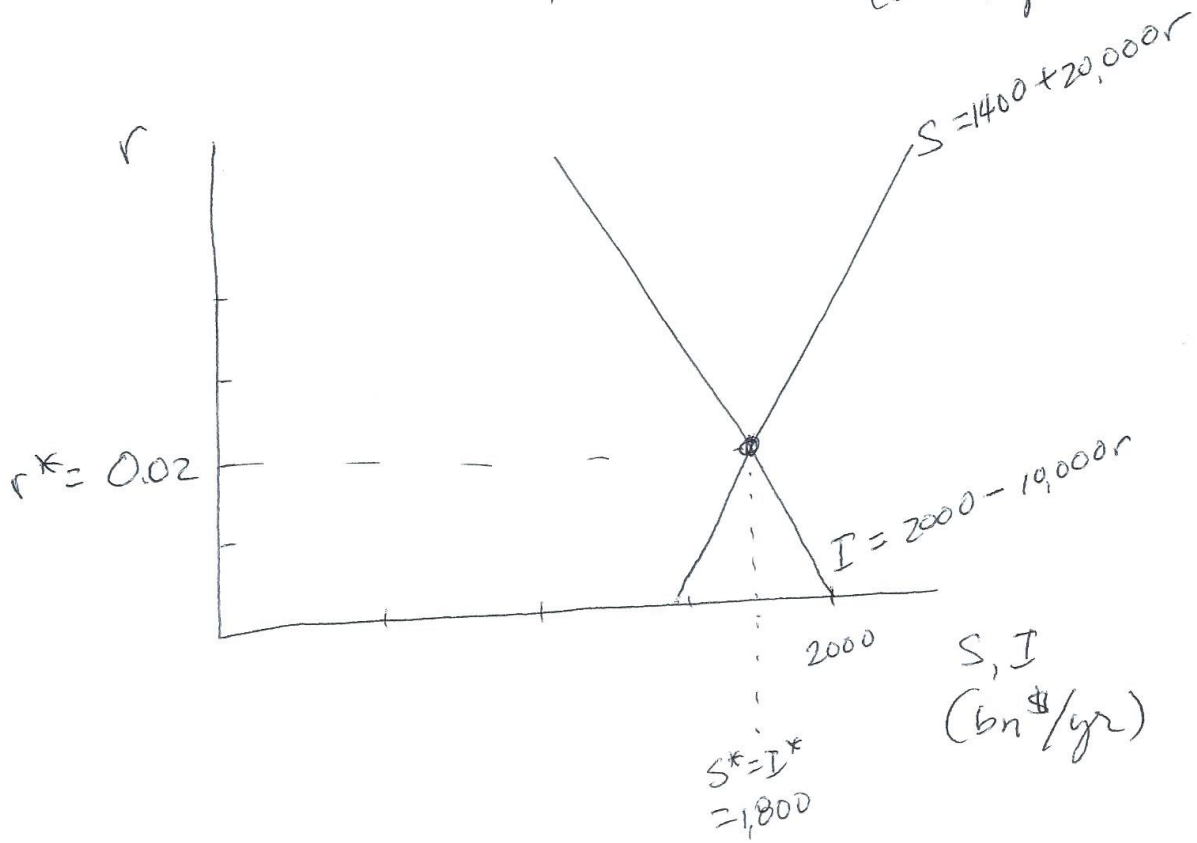
$$S^F = IM - GX$$
$$S^F = \big(1{,}000 + 0.24(14{,}000)\big) - (4{,}000 - 20{,}000r)$$
$$S^F = 4{,}360 - 4{,}000 + 20{,}000r$$
$$S^F = 360 + 20{,}000r$$

Total saving = investment

$$S = I$$
$$S^H + S^G + S^F = I$$
$$1{,}240 + (-200) + (360 + 20{,}000r) = 2{,}000 - 10{,}000r$$
$$1{,}400 + 20{,}000r = 2{,}000 - 10{,}000r$$
$$30{,}000r = 600$$
$$r = \frac{600}{30{,}000}$$
$$r = 0.02$$

Graphs are on next page


r
$Y^* = 14,000$
$r^* = 0.02$
AD = 14,600 - 30,000r
AD
14,000
Y, AD
(bn $/yr)


r
S = 1400 + 20,000r
$r^* = 0.02$
I = 2000 - 10,000r
2000
S, I
(bn $/yr)
$S^* = I^*$
= 1,800

Question 6: The Essay (3 points total)

Consider this argument: "An increase in the government's budget deficit will cause interest rates to rise, lowering investment spending."

Follow steps 1, 2*, 3, and 4 of "The Olney Method" (the 5-step method Prof. Olney presented on 1/21 for critiquing arguments) and write a 1-page essay in which you critique the argument above. Your essay should reflect your understanding of how to critique an argument and your understanding of the long-run growth model.

**You need not identify <u>all</u> assumptions in the argument, but do need to at a minimum identify the assumption that you change in step 3.*

There are lots of approaches to take here, so we can't provide you with "this is what you should have written." For one set of ideas, see lecture from 3/11/2021.

You needed to follow the specs: 400 words and 1 page max, double spaced, 10-11-12 pt font, 1" margins on all sideds, your name, date, and word count in top right corner. If you didn't follow the specs, you were penalized a point so the most you got was 2 points

You needed to also submit the essay on bcourses so that bcourses could do the plagiarism check. If you didn't submit on bcourses, you got a 0 for the essay.

Beyond that you were demonstrating two things: [1] that you understand how to critique an argument, and [2] that you understand the implications of the long-run flexible-price model. For one set of ideas, see lecture from 3/11/2021.

An excellent or very good job on both got you full credit for the content
An excellent or very good job on one and a not good job on the other cost you 30 – 50% of the credit for the content
A not good job on both cost you 60-80% of the credit for the content.
A clueless job cost you 100% of the credit