Economics 285
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Help With Practice Problems 2

Chapter 6:

1. Questions For Review: 1,3,5. Please see text and notes.

2. Problems and Applications: 1a-d,2,4,10,11.

Recall that national saving S is defined as the excess of income over domestic spending by consumers and the government: $S = Y - C - G$. In the model of Chapter 3, we had assumed that there was no international trade: $NX = 0$. In that case, national saving was the amount of income available to finance investment I. When we include international trade, national saving is now the amount of income available to finance investment I and net exports NX. This can remembered easily by manipulating the National Income Accounting Identity:

$$Y = C + I + G + NX$$

Moving C and G to the left hand side, the left hand side becomes S:

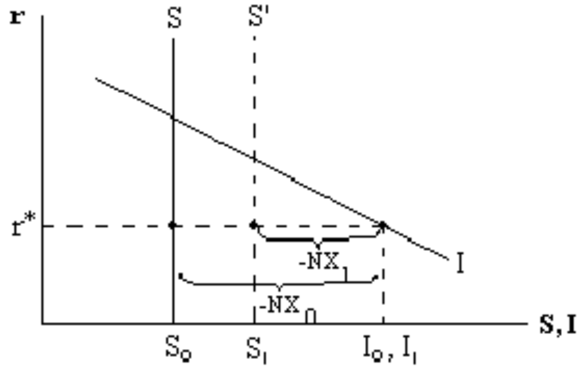
$$\begin{aligned} Y - C - G &= I + NX \\ S &= I + NX \end{aligned}$$

or again equivalently,

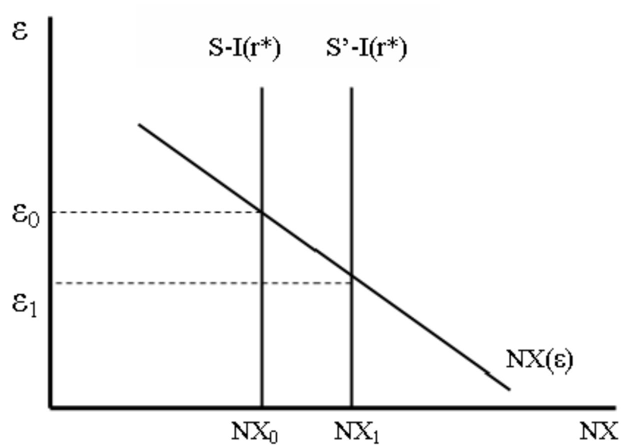
$$\begin{aligned} S - I &= NX \\ CF &= NX \end{aligned}$$

The excess of national saving over investment $(S - I)$, which is called "net capital outflow" or "net foreign investment" and labeled CF, is used to finance net exports. If domestic spending is less than domestic production, we must be selling the difference abroad and lending the income abroad to finance those purchases. Conversely, if we spend more than our current incomes (as the U.S. is currently doing), then we must be borrowing income from the rest of the world and importing their goods. Thus, net exports $(NX = EX - IM)$ can be interpreted as the trade surplus or as net foreign investment.

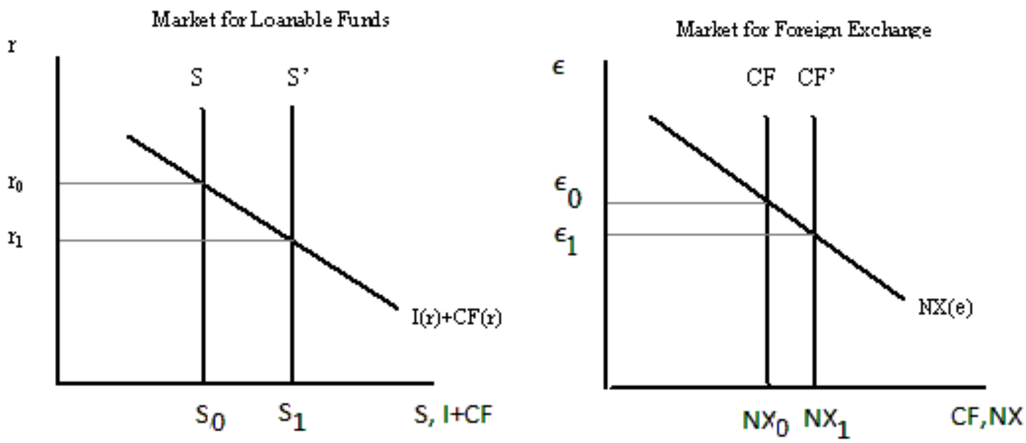
2.1a. The fall in consumption is an increase of national saving, which can be used to finance investment and or net exports. In the model in Chapter 3 (the closed economy model), the extra saving would drive real interest rates down, crowding in an equal amount of investment spending. In the model in the body of Chapter 6 (the small open economy model), the real interest rate for the economy is fixed at the world rate, and so investment does not change. The difference, therefore, must be lent abroad (or replace borrowing from abroad), and crowd in an equal amount of net exports. In the graph below I assume that the economy starts out running a trade deficit $(NX < 0)$. The increase in national saving then reduces the trade deficit.



The details of the story are as follows. The U.S. has additional saving, which it lends abroad (or uses to replace borrowing from abroad) – i.e., CF increases. This capital flow out of the U.S. drives down the exchange rate (the value of the dollar), since it represents an increase in the supply of dollars (and equivalently, an increase in the demand for foreign currency) in international currency markets (often referred to as foreign exchange, or Forex, or FX markets) on the part of U.S. investors who wish to buy foreign assets. The value of the dollar falls until net exports increase by exactly the increase in CF (which is exactly the increase in S), at which point the demand and supply of dollars in international currency markets are equal. Thus, in the National Income Accounting Identity, we have a fall in C which crowds in an equal amount of NX.



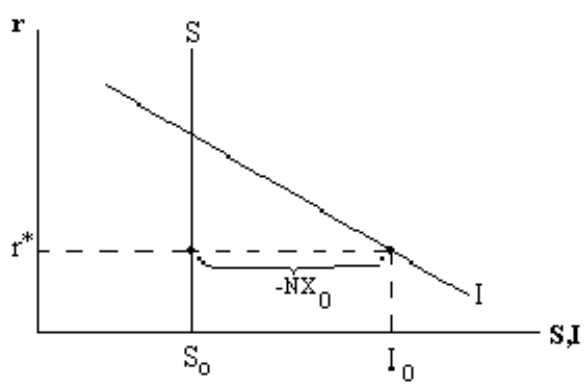
We should note that the model is somewhat unrealistic, since it assumes that the domestic interest rate does not change at all — i.e., is fixed at a constant world rate. This is based on the assumptions of perfect international capital mobility and small country size. Since, in practice, there is imperfect capital mobility between the U.S. and the rest of the world (and the U.S. is not small), the actual long run outcome of an increase in national saving will probably be some combination of the predictions of the closed economy model of Chapter 3 and the small open economy models of Chapter 6. Some of the extra saving will probably stay in the U.S., and so domestic interest rates *will* probably fall somewhat, crowding in some investment spending. But the extra saving that does flow out of the U.S. economy will crowd in net exports. So in the real world we should end up somewhere in between, with the fall in C crowding in a combination of I and NX. This more realistic story is fleshed out in the model in the Appendix to Ch. 6 (the large open economy model with imperfect capital mobility). There, a fall in C (increase in S) would lower domestic interest rates somewhat, which would both cause I to rise and cause a capital outflow to the rest of the world (where interest rates have not fallen). This increase in CF in turn would drive down the value of the dollar, stimulating NX. So a combination of I and NX would be crowded in by the fall in C. Here are the model diagrams for the large open economy:



2.1b. This increase in investment spending I is a shift upward in the entire investment function $I(r)$. The increase in I lowers $(S - I)$ (i.e., lowers CF), which causes the real exchange rate ε to rise, which in turn causes NX to fall.

2.1.c. Suppose that consumers reduce their purchases of domestically produced cars and increase their purchases of foreign produced cars by equal dollar amounts. Then C is unchanged. However $NX = EX - IM$ has fallen (at least momentarily), since IM has risen.

Now here's the tricky part. According to the model that we are using, there is no change in the gap between national saving S and investment I, and so there can be no effect on NX in equilibrium. In the graph below, I again assume that the economy starts with a trade deficit. The change in car purchases has no effect on anything in the diagram.



To see this, we need to figure out what is going on with S and I. First look at $S = Y - C - G$. In the long run model that we are using, U.S. production is independent of people's desired spending habits, since it is fixed by the amount of resources in the economy. Thus, the drop off in spending on domestic autos does not cause U.S. production to fall in the long run (i.e., it must lead to an offsetting increase in spending). Thus S is unchanged. Similarly, since the interest rate is fixed in the (small open economy) Chapter 6 model at the world interest rate (by the assumption of perfect capital mobility), I is unchanged.

Then what has happened? The rise in U.S. imports creates an excess supply of dollars in international currency markets, driving down the real exchange rate ε (the real value of the dollar). Since there are no changes in international capital flows, the value of the dollar must fall until exports increase and imports decrease enough to bring NX back up to its original level (at which point international currency markets are back in equilibrium). NX is unchanged in equilibrium; the fall in purchases of domestic autos is offset by increases in domestic and international purchases of other U.S. products due to the depreciation of the dollar relative to other currencies.

To see this (in reverse) on a diagram with NX and ε, see Figure 6-12 on p. 158 of Mankiw. Similarly, for the large economy model in the appendix, the corresponding diagram is Figure 6-22 on page 176.

2.1.d. An increase in the supply of money in the U.S. should cause domestic prices to increase. However, since neither the increase in M or P has a direct effect on S, I, or the $NX(\varepsilon)$ function, it will not affect the equilibrium real exchange rate ε. So, given that $\varepsilon = e \cdot P/P^*$, it must be that the nominal exchange rate e falls to preserve the equilibrium real exchange rate.

So how does this happen? Given the current level of e, the increase in the domestic price level increases ε, which would cause U.S. imports to rise and U.S. exports to fall if it were to stay this higher value. But because there has been no change in capital flows, the change in trade creates an excess supply of $s in international currency markets, which drives down the price e of the dollar in those markets, returning ε to its original equilibrium value. This in turn returns trade to its original levels. So there is no effect on either ε or NX in equilibrium.

2.2.a. This is the similar to problem #10 in Ch. 3. However, now the interest rate is fixed at the world interest rate r^*, and there is international trade. You should find that the equilibrium real exchange rate $\varepsilon = 4$. This is the level that equates $Y = C + I + G + NX$, or equivalently, $S - I = NX$. You should also find that national saving (S) is 1000, private saving (S_p) is 1500, public saving (S_g) is -500 (the government is running a budget deficit), investment spending (I) is 500 and the trade balance (NX) is 500 (a trade surplus).

2.2.b. The fall in G by 500 is an increase in S by 500. Since r is unchanged at the world interest rate $r^* = 8$, I will be unchanged. Rather the fall in G will crowd in NX one for one. Again, you can verify this by solving for the level of ε that equates $Y = C + I + G + NX$, which is now $\varepsilon = 2$, which in turn implies $NX = 1000$. We are now running a larger trade surplus.

Intuitively, the decrease in government spending frees up income that the government was borrowing which can now be lent to the rest of the world (rather than to the government). This increase in net capital outflow (CF) drives down the value of the dollar ε and thus drives up NX (increases the trade surplus from 500 to 1000). Once NX has increased by 500, the reduced domestic spending on goods and services from the fall in G is replaced one for one by additional net exports, financed by the new additional lending to the rest of the world (CF). Note that the total domestic production of goods and services is still fixed at $Y = \bar{Y}$, and so is unchanged.

2.2.c. The decrease in the world interest rate r^* causes domestic investment spending I to increase (by 250). This decreases net capital outflow $S - I$, which drives up the value of the dollar (to $\varepsilon = 5$), which in turn drives down net exports NX (from its initial value of 500 to it's new value of 250). 6-10 on p. 156 of Mankiw shows this on a model diagram, but for an increase in r^*, rather than a decrease.

2.4. If U.S. government purchases G increase and taxes are unchanged, this is a decrease in national saving S. According to the long run model with perfect international capital mobility (Chapter 6), the fall in saving causes an equal fall in net exports. The details of the story are that the fall in national saving causes a fall in net capital outflow, which drives the real value of the dollar up, which in turn drives net exports down. The extra government spending is thus made possible, without reductions in spending by consumers and businesses, by increased net imports.

$$\begin{array}{ccccccccc} - & & - & & - & & \uparrow & & \downarrow \\ \mathrm{Y} & = & \mathrm{C} & + & \mathrm{I} & + & \mathrm{G} & + & \mathrm{NX} \end{array}$$

If many countries join the war and all are increasing their government purchases, world interest rates would be driven upward (by the reduction in world saving). Consequently, part of the increase in G in each country would be offset by a reduction in net exports, and the rest would be offset by a reduction in investment spending.

$$\begin{array}{ccccccccc} - & & - & & \downarrow & & \uparrow & & \downarrow \\ \mathrm{Y} & = & \mathrm{C} & + & \mathrm{I} & + & \mathrm{G} & + & \mathrm{NX} \end{array}$$

You should be able to show this on a model diagram.

If the war was truly global, then (at least for the average country) all of the impact of the increased government spending will fall on investment spending (note that all countries' trade balances can't fall together).

2.10. The real exchange rate ε between the U.S. and Mexico (the "real" value of the dollar) is the rate at which the same goods can be traded between the two countries – i.e., the number of Mexican goods that can be exchanged for one unit of U.S. goods. This in turn is the nominal exchange rate e (expressed in pesos per dollar: how many pesos does it take to buy a dollar) times the ratio of the general price level in the U.S. to that in Mexico:

$$\varepsilon = e \cdot \frac{P_{\text{US}}}{P_{\text{Mexico}}}$$

In the question, domestic prices in Mexico have risen faster than domestic prices in the U.S., while the dollar has appreciated (risen in value) against the peso. These effects work against each other. To see which effect dominates, take percent changes:[1]

$$\begin{aligned} \%\Delta\varepsilon &= \%\Delta e + \%\Delta P_{\text{US}} - \%\Delta P_{\text{Mexico}} \\ &= 50\% + 25\% - 100\% \\ &= -25\% \end{aligned}$$

According to these numbers, a unit of U.S. goods can be traded for a fewer number of units of Mexican goods than was the case before (approximately 25% less), and so it has gotten relatively *more* expensive to travel in Mexico.

We could make up numbers for a light lunch. Suppose that a hot dog cost one dollar in the U.S. and a taco cost 10 pesos in Mexico in 2010. Then with a nominal exchange rate e of 10 pesos

[1] We make use of the following approximation at various times in the course: if $z = x \times y$, then $\%\Delta z \approx \%\Delta x + \%\Delta y$. Notice that, technically, this is an approximation (unless the changes are infinitesimal). I will follow the text here in using $=$ rather than $\approx$, since this is a good, even if not numerically perfect, approximation as long as the individual growth rates are not very large.

per dollar, the dollar cost of a taco in Mexico was one dollar (P_{Mexico}/e). Suppose that now, in 2020, the same hot dog and taco cost \$1.25 in the U.S. and 20 pesos in Mexico. With a nominal exchange rate of 15 pesos per dollar, the dollar cost of the taco in Mexico is \$1.33, which is greater than the \$1.25 dollar cost of a hot dog in the States.

In terms of the real exchange rate, with the numbers in our example, the real value of the dollar (ε) is 1 in 2010 and 0.9375 in 2020. I.e., the real value of the dollar has fallen by 6.25%.[2]

2.11a. Expected inflation in Canada is 4 percentage points higher than in the U.S.

2.11b. The ratio (P_{US}/P_{CA}) is expected to fall by 4% per year, so if the equilibrium real exchange rate (ε) is not changing, then the nominal exchange rate e (nominal value of the dollar) should be expected to rise by 4% per year.

2.11c. If you convert the proceeds of your investment back to dollars, the excess interest you get in Canada will be wiped out by rise in the nominal exchange rate.

Chapter 4:

3.

a. Here, $m = \frac{cr+1}{cr+rr} = \frac{cr+1}{cr+1} = 1$. with $rr = 1$ banks don't lend out any of their deposits. If the Fed increases B by \$1, it will be divided by the public between C and D according to the value of cr, but banks will hold all of the increased D as R, so there will be no further expansion of deposits through bank loans. The money supply rises by \$1.

b. cr is ∞ so $m = 1$. If the Fed increases B by \$1, the public holds it all as currency, so deposits do not rise, and banks have no new deposits to lend out. Money supply rises by \$1.

c. $m = \frac{cr+1}{cr+rr} = 1.\overline{66}$, so $M = 166,666$. If rr rises to 0.25, m falls to 1.6, so that M falls to 160,000. Banks hold deposits as reserves, bank loans, and other assets such as bonds. To increase the ratio of reserves to deposits, they must call in bank loans (or sell some of their bond holdings) and convert these to reserves. This causes deposit withdrawals from other banks and a subsequent chain of deposit destruction.

Chapter 5:

4. The Quantity Equation is

$$M \times V = P \times Y$$

This also implies the following (approximately) about growth rates of these variables:

$$\%\Delta M + \%\Delta V = \%\Delta P + \%\Delta Y$$

4a. Plugging in the growth rates,

$$5 + 0 = \%\Delta P + 2$$

we see that the inflation rate ($\%\Delta P$) must be (approximately) 3 percent per year on average.

If $\%\Delta M$ was 0, then the inflation rate would be (approximately) negative 2 percent. Velocity tells us how much nominal spending ($P \times Y$) per year is done with each dollar of money supply. If the money supply is constant, and velocity is constant, then nominal spending must be constant.

[2] You may notice that, using the concrete example, we get a substantially smaller reduction in the real exchange rate than the 25% reduction predicted above.This is because, the equation relating percent changes above is (again) just an approximation. While the approximation is not very tight in this case (because the individual growth rates are quite large), it does still give us the correct direction of the change.

In that case, any increase in the amount of goods (Y) purchased, must be matched by a decrease in the general price level (P).

4b. Notice that the Quantity Equation implies:

$$\%\Delta M + \%\Delta V = \%\Delta(P \times Y)$$

If $\%\Delta M$ is constant, a fall in $\%\Delta V$ implies a reduction in the rate of growth of nominal GDP, $(P \times Y)$. This could take the form of a slowdown in output growth, a fall in the inflation rate, or both.

6. The ex ante real interest rate r is defined as the nominal interest rate minus the expected rate of inflation: $r = i - \mathrm{E}\pi$. Thus, the Fisher Equation

$$i = r + \mathrm{E}\pi$$

is an identity which must hold at all times. The Fisher Effect is the theory that r is independent of $\mathrm{E}\pi$, and so i moves one for one with $\mathrm{E}\pi$.

In the problem, I note that in the late 1970s and early 1980s, nominal interest rates moved less than one for one with the actual inflation rate, and so ex post real interest rates fell as inflation rose (in the late 70s) and rose as inflation fell (in the early 80s). This *could* be consistent with the Fisher Effect if the changes in the inflation rate were partly *unexpected*.

In the example given in this problem, the ex post real interest rate in 1978 was zero percent.[3] In 1979, inflation increased by 4 percentage points, but the nominal interest rate rose by only 2 1/2 percentage points, so that the ex post real interest rate fell by 1 1/2 percentage points (from zero, to negative 1 1/2 percent).

Whether the Fisher effect works here, however, depends on what was happening to *expected* inflation and the equilibrium ex ante real interest rate at this time. If *expected* inflation rose by only 2 1/2 percentage points between 1978 and 1979, then the 2 1/2 percentage point increase in the nominal interest rate would leave the real ex ante interest rate unchanged and thus be consistent with the Fisher effect.[4]

[3] If you lent money to the government (bought Treasury bonds) in 1978, the nominal interest rate of 7 1/2 percent was just enough to cover the rate of erosion of the purchasing power of your principal due to inflation.

[4] We don't have precise measures of inflationary expectations, but survey data suggests that the average consumer's expectation of inflation was about 7% in 1978 and 9.5 % in 1979.