

Cooleconomics.com**Macroeconomics****Investment and Savings in an Open Economy: A Long Run Model**

In prior notes we developed a model of a closed economy and how national savings and investment interact to determine the interest rate and other important things. In this set of notes we open our economy to foreign trade, and see how our long run closed economy model needs to be modified to represent an open economy.

First, we need to be able to keep track of international transactions. Let's take a look at how this is done in the real world; then we'll simplify reality to get a model of international transactions that we can use in our open economy models.

Balance of Payments Accounts

The **balance of payments accounts** keep track of a country's international transactions. There are three such accounts—the *current account*, the *capital account*, and the *official settlements balance*. Let's look at each one below (from the point of view of the U.S.):

The Current Account keeps track of three types of international transactions:

1. Flows of goods and services into and out of the U.S. (imports and exports)
2. Income earned by Americans on investments abroad, and income earned by foreigners from their investments in the U.S.
3. Transfers of income (gifts) by Americans to foreigners, and from foreigners to Americans.

For our purposes #2 is the same as net factor payments from abroad, NFP

The current account balance = exports - imports + investment receipts on investments abroad - investment payments on foreign investments in the U.S. + transfers of income from foreigners to Americans - transfers of income by Americans to foreigners.

The Capital Account keeps track of changes in American ownership of foreign assets and foreign ownership in U.S. assets

Types of assets include stocks, bonds, real estate, foreign currency, and corporations.

The capital account balance = foreign purchases of U.S. assets - American purchases of foreign assets

The Official Settlements Balance is a subset of the capital account, which keeps track of the change in the official reserve assets of the U.S. Central Bank—The Federal Reserve System. (Digression: for various reasons, from time to time the Federal Reserve System buys and sells *official reserve assets* such as foreign currency.)

the official settlements balance = net change in official reserve assets of the Federal Reserve System

Deficit or surplus? When one of the balance of payments accounts has a positive balance, it is said to have a *surplus*; when an account has a negative balance, it is said to have a *deficit*. Example: the U.S. in 2000 has a large current account deficit, mainly because imports are much larger than exports. Simultaneously, it has a large capital account surplus, since foreigners are buying lots more American assets than Americans are buying of foreign assets.

Now that we've discussed these balance of payments accounts, let's discuss an accounting fact: Barring any destroyed goods or services or assets, then the value of stuff that leaves a

country must equal the value of stuff that enters a country. This is true in any trade. It's true for individuals. For you, the value of your (private disposable) income must equal the value of what you do with that income (spend it, save it, give it away, or pay down debt), assuming that you don't lose or destroy any of your income.

This equal value principle is not a theory or hypothesis; it is a fact that must be true.

This equal value truth means that:

The current account balance + the capital account balance = 0

Equivalently and more specifically:

If there's a current account deficit then there must be an equal-sized capital account surplus.

current account deficit = capital account surplus or

If there's a current account surplus then there must be an equal-sized capital account deficit.

current account surplus = capital account deficit

Recall that we already have abbreviations to represent the current account balance and capital account balance: CA and KA. The equal value truth means that:

$CA + KA = 0$

or $CA = -KA$

Simplifying the balance of payments accounts for use in our models

To avoid unnecessary complexity, we shall assume for modeling purposes that the current account includes only exports and imports of goods and services:

Simplification for our models: $CA = \text{exports} - \text{imports}$

Equivalently: $CA = NX$

Here we simplify and assume that NFP is zero and so are international transfers (gifts)

Application of what we've learned so far:

We know from the media that the U.S. has a large current account deficit. You may also know that the U.S. has a large capital account surplus. Should we be surprised that we have a huge current account deficit and simultaneously foreigners are buying lots of our assets? No! The two MUST go together. If something happens to reduce our huge trade deficit, then the capital account surplus MUST also fall.

(By the way, you might be wondering: what *causes* these accounts to run deficits and surpluses? Stay tuned—later we shall see how economists try to explain these things.)

International Transactions in Our Model

Let's alter our closed economy model to accommodate international transactions. Here's what we must do:

1. Add net exports to aggregate demand.

Recall that in a closed economy we have the condition $AD = C + I + G$. In an open economy we write:

$$AD = C + I + G + NX$$

(We could also write this : $AD = C + I + G + CA$)

2. Alter our loanable funds market to accommodate international flows of loanable funds

Recall that in our closed economy model, in equilibrium national savings equals investment

$$\text{closed economy: } S = I$$

Well, in an open economy, our nation's savers can either lend out their saved money here (to be used for investment here), or they can buy foreign assets with it (which subtracts from the capital account):

$$S = I - KA$$

or, recalling that $CA = -KA$

$$S = I + CA$$

(We could also write this: $S = I + NX$)

Let's take a look at our new loanable funds market for an open economy.

Loanable Funds in an Open Economy: Some Important Issues

Issue A: Remember, in the open economy, not only do goods and services flow internationally, but loanable funds also flow internationally. This means that the interest rate that prevails in a country is influenced by stuff that takes place outside the country. This is because:

1. American savers have the option of lending their money abroad, rather than in the U.S.
2. Americans who do investing (I) have the option of getting the money from foreign, rather than domestic savers.

Issue B: Since loanable funds are allowed to flow freely among countries, we would expect that lenders would move their money around internationally seeking the highest possible return. If true, then there should be a "world" interest rate, r^w , that is equal across countries.

For simplicity, we ignore differences in risk of lending in different countries.

The free flow of loanable funds implies that interest rates should be equalized across countries

Issue C: The open economy loanable funds market depends on how large the economy is in the world market for loanable funds! We shall develop two distinct long run models, using a somewhat arbitrary distinction:

1. Small open economy: We shall define a small open economy as one so small that no action within this economy affects the world interest rate. Technically, this means that a small economy must be infinitesimally small, but this assumption is a reasonable approximation for very small economies (such as Haiti or Burkina Faso).

2. Large open economy. We shall define a large open economy as big enough that actions within the economy affect the world interest rate. This assumption is realistic for large developed economies such as the U.S., Japan, and France.

Let's build these two loanable funds models now.

The Loanable funds market in a **small** open economy

Here's the idea:

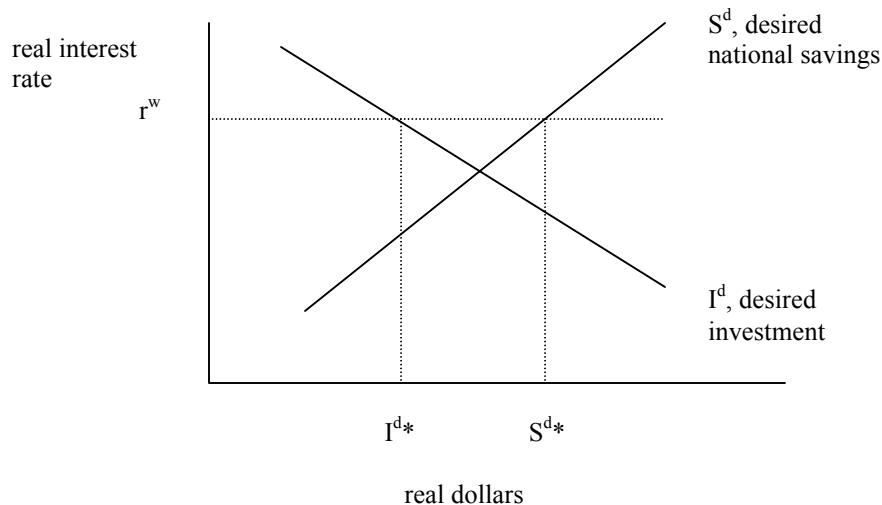
This economy takes the world interest rate as a given. There are two possible equilibrium conditions in the loanable funds market, depending upon the size of national savings relative to investment:

Possible equilibrium 1: If, at the world interest rate, there is more national savings than desired investment, then some of the nation's national savings will go to buy assets abroad—there will be a capital account deficit.

Possible equilibrium 2: If, on the other hand, at the world interest rate there is more desired investment than there is national savings, then some of that investment will be financed by foreign savings—there will be a capital account surplus.

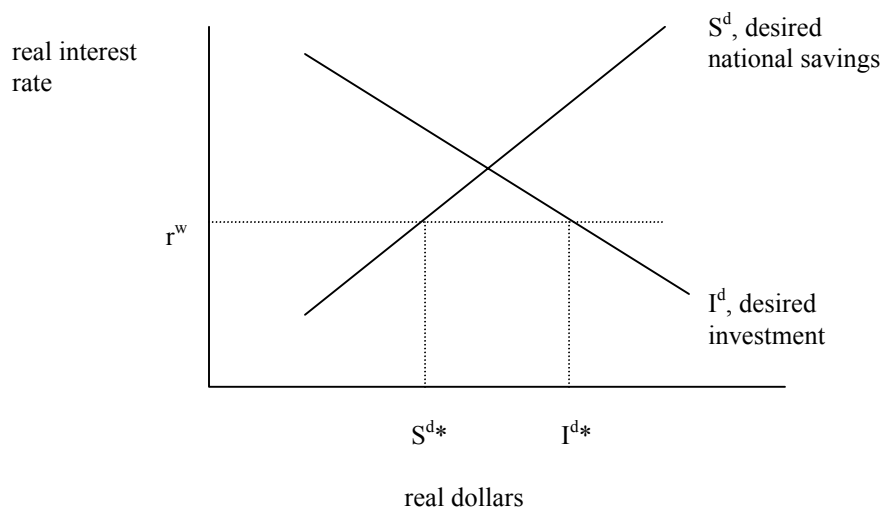
Here are the graphs of equilibrium, along with some analysis:

Graph of possible equilibrium 1 in a small open economy:



Analysis of possible equilibrium 1: In the above graph, equilibrium desired savings, S^{d*} , exceeds equilibrium desired investment, I^{d*} , at the world interest rate. Hence there will be a capital account deficit equal to the distance between I^{d*} and S^{d*} . BONUS: remember that in order for international payments to balance, the capital account deficit always equals the current account surplus. So this country has a current account surplus (exports of goods and services exceed imports of goods and services) equal to the distance between I^{d*} and S^{d*} .

Graph of possible equilibrium 2 in a small open economy:



Analysis of possible equilibrium 2: In the above graph, equilibrium desired savings, S^{d*} , is less than equilibrium desired investment, I^{d*} , at the world interest rate. Hence there will be a capital account surplus equal to the distance between I^{d*} and S^{d*} . BONUS: remember that in order for international payments to balance, the capital account surplus always equals the current account deficit. So this country has a current account deficit (exports of goods and services are less than imports of goods and services) equal to the distance between I^{d*} and S^{d*} .

Policy implications of possible equilibrium 2: Suppose a country with equilibrium 2 wants to reduce its current account deficit (or equivalently, to reduce its capital account surplus). Well, the country must reduce the distance between S^{d*} and I^{d*} . The best way to do this is to increase national savings, S^d . This can be achieved by either increasing government savings (by increasing taxes or cutting government spending) or by increasing private savings (by reducing the portion of national income that is spent on consumption).

NOTICE THAT BARRIERS TO IMPORTS, SUCH AS TARIFFS OR QUOTAS, WILL NOT REDUCE THE CURRENT ACCOUNT DEFICIT, unless they somehow result in increased national savings.

Now here's the algebra of equilibrium in a small open economy. (This is a long run model.)

Example:

A hypothetical small open economy is characterized as follows:

full employment real national income = 8000

$$C = 1000 + .8(Y-T) - 50r^w$$

$$I = 2000 - 20r^w$$

$$G = 1000$$

$$T = .25Y$$

$$r^w = 20$$

Calculate equilibrium values for C, S, I, NX, CA, and KA:

$$C = 1000 + .8(8000 - .25(8000)) - 50(20) = 4800$$

$$I = 2000 - 20(20) = 1600$$

$$NX = Y - C - I - G = 8000 - 4800 - 1600 - 1000 = 600$$

$$CA = NX \rightarrow CA = 600$$

$$KA = -CA \rightarrow KA = -600$$

This economy has a current account surplus and a capital account deficit, and hence is in equilibrium under possibility 1.

$$S = S_{pvt} + S_{govt}$$

$$S_{govt} = T - G = .25(8000) - 1000 = 1000$$

$$S_{pvt} = Y - T - C = 8000 - .25(8000) - 4800 = 1200$$

$$\text{So } S = 1000 + 1200 = 2200$$

Check: $S = I + CA?$ $2200 = 1600 + 600$. Yes!

Well, we've looked at equilibrium in a small open economy. Let's turn to equilibrium in a large open economy! Oh, the joys of life!

Dr. Joyce
Brothers says that
to increase the
joy in your life,
put your gripes
away in a box.
Where can I find
the box, Dr.
Brothers?

The Loanable funds market in a **large open economy (a long run model)**

As in the case of a small open economy in the long run, there are two possible equilibrium scenarios in a large open economy in the long run:

Possible equilibrium 1: If, at the world interest rate, there is more national savings than desired investment, then some of the nation's national savings will go to buy assets abroad—there will be a capital account deficit.

Possible equilibrium 2: If, on the other hand, at the world interest rate there is more desired investment than there is national savings, then some of that investment will be financed by foreign savings—there will be a capital account surplus.

Let's look first at possibility 1. I shall use Japan as an example of a large open economy that fits equilibrium 1 conditions.

Equilibrium possibility 1 explained:

Here's the idea: Japan is large, so actions within it can affect the world real interest rate.

Background: The world real interest rate is the price that one must pay to borrow money in the world. Its level depends on

- the demand for loanable funds in the world—total desired world investment
- the supply of loanable funds in the world—total world savings

In equilibrium:

total world investment = total world savings

or

Japan investment + rest of world investment = Japan savings + rest of world savings

Let's rewrite the above equation:

Japan savings = Japan investment + (rest of world investment – rest of world savings)

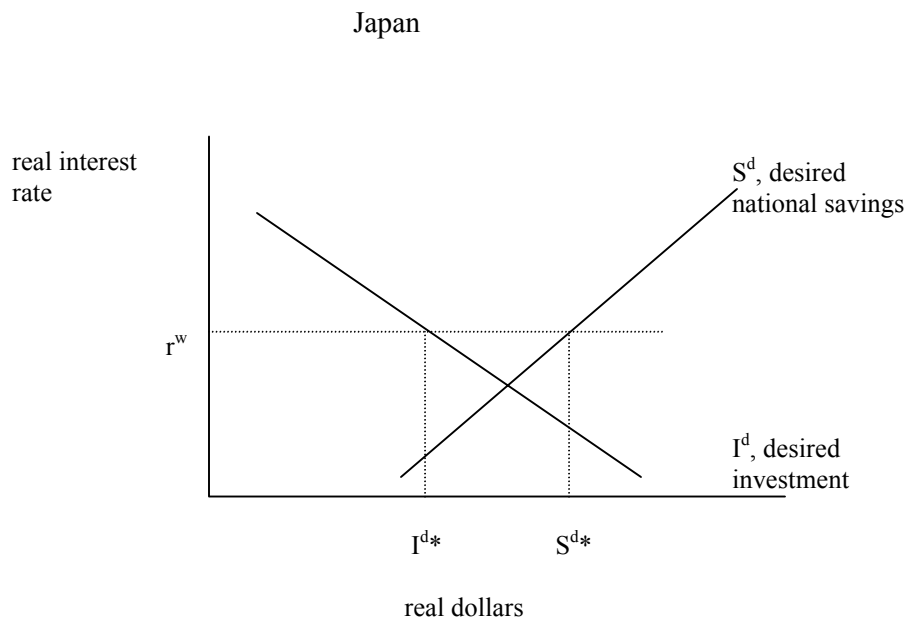
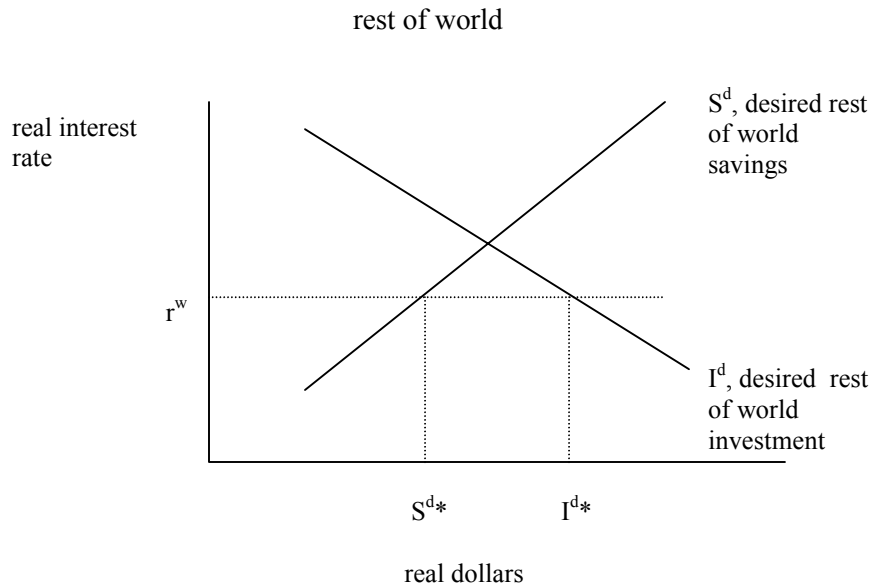
Aha! There is more Japanese savings than the country can use for investment; call this a surplus of Japanese savings. At the same time, the rest of the world does not have enough savings to fund its investment; call this a shortage of savings. There is an equilibrium in the world when the surplus of savings in Japan is exactly equal to the shortage of savings in the rest of the world.

Note also that the Japanese are net buyers of foreign assets--Japan has a capital account deficit. (And, since international payments must balance, Japan also has a current account surplus.)

“Rest of world”
in this case
means all
countries except
for Japan.

Equilibrium possibility 1 graphed:

We need two graphs to illustrate equilibrium—one representing savings and investment in Japan, and the other representing savings in investment in the rest of the world. Equilibrium occurs when the surplus of savings in Japan is exactly enough to fund the shortage of savings in the rest of the world.



Notice in the above graphs that in Japan, S^{d*} exceeds I^{d*} ; this is their surplus of savings. Meanwhile, in the rest of the world, I^{d*} exceeds S^{d*} ; this is their shortage of savings. In equilibrium, r^w is reached where the surplus equals the shortage, ensuring that world savings equals world investment.

Now let's discuss

Equilibrium possibility 2 in the large open economy.

We shall use the U.S. as a large open economy satisfying equilibrium possibility 2 conditions.

Here's the idea:

In equilibrium:

total world investment = total world savings

or

U.S. investment + investment in the rest of the world = U.S. savings + rest of world savings

Let's rewrite the above equation:

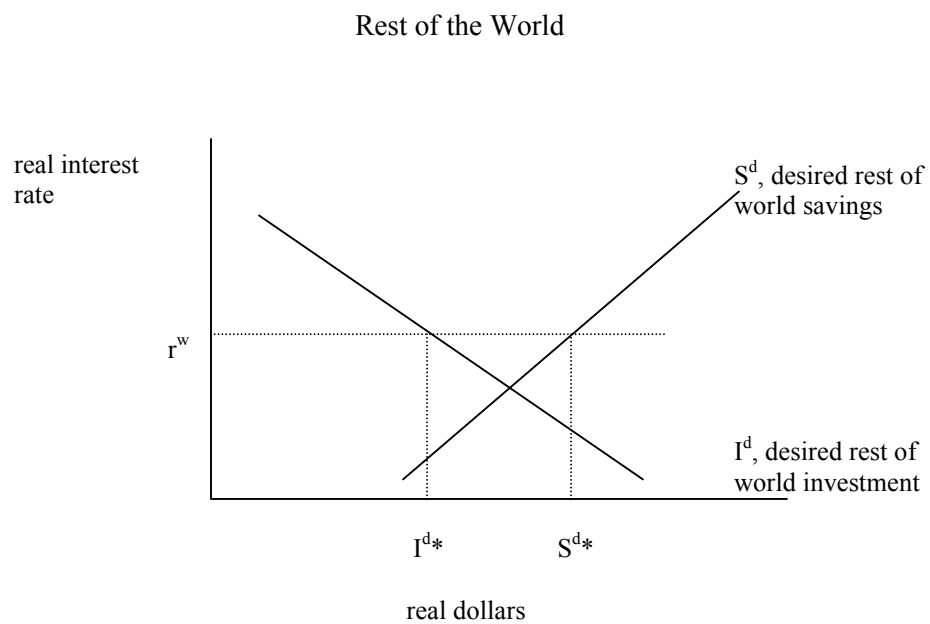
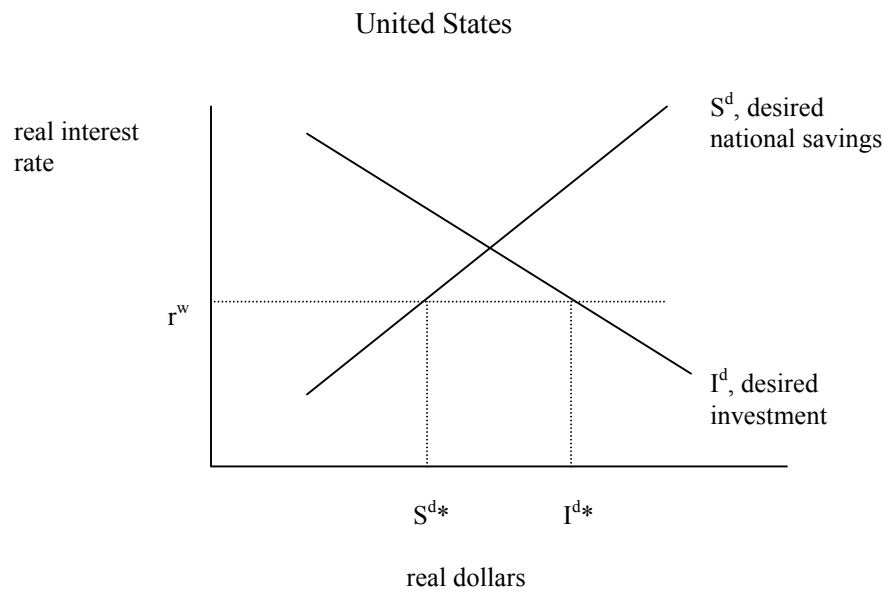
U.S. investment = U.S. savings + (rest of world savings – rest of world investment)

Aha! There is less U.S. savings than the country needs for investment; call this a shortage of U.S. savings. At the same time, the rest of the world has more than enough savings to fund its investment; call this a surplus of savings. There is an equilibrium in the world when the surplus of savings in the rest of the world is exactly equal to the shortage of savings in the U.S..

Note also that foreigners are net buyers of U.S. assets; the U.S. has a capital account surplus. (And, since international payments must balance, the U.S. also has a current account deficit.)

Equilibrium possibility 2 graphed:

We need two graphs to illustrate equilibrium—one representing savings and investment in the U.S., and the other representing savings in investment in the rest of the world. Equilibrium occurs when the surplus of savings in the rest of the world is exactly enough to fund the shortage of savings in the U.S.



Notice in the above graphs that in the rest of the world, S^{d*} exceeds I^{d*} ; this is their surplus of savings. Meanwhile, in the United States, I^{d*} exceeds S^{d*} ; this is their shortage of savings. In equilibrium, r^w is reached where the surplus equals the shortage, ensuring that world savings equals world investment.

Policy implications of possible equilibrium 2: Suppose the U.S. wants to reduce its current account deficit (or equivalently, to reduce its capital account surplus). Well, the country must reduce the distance between S^{d*} and I^{d*} . The best way to do this in the U.S. is to increase national savings, S^d . This can be achieved by either increasing government savings (by increasing taxes or cutting government spending) or by increasing private savings (by reducing the portion of national income that is spent on consumption).

NOTICE THAT BARRIERS TO IMPORTS, SUCH AS TARIFFS OR QUOTAS, WILL NOT REDUCE THE CURRENT ACCOUNT DEFICIT, unless they somehow result in increased national savings.

Notice also that increased U.S. savings will drive down the world interest rate, and not only reduce the capital account surplus in the U.S. but also reduce the capital account deficit in the rest of the world.

The Algebra of Equilibrium in a Large Open Economy (A Long Run Model)

In a hypothetical world there are only two open economies—X and Z

Suppose the following equations describe country X:

full employment real national income, $Y^x = 8000$

$$C^x = 1000 + .8(Y^x - T^x) - 50r^w$$

$$I^x = 2000 - 20r^w$$

$$G^x = 1000$$

$$T^x = .25Y^x$$

The superscript x applies to country X, and the superscript z applies to country z.

And these equations describe country Z:

full employment real national income, $Y^z = 8000$

$$C^z = 1000 + .8(Y^z - T^z) - 50r^w$$

$$I^z = 3200 - 20r^w$$

$$G^z = 1000$$

$$T^z = .25Y^z$$

Calculate equilibrium values for r^w , and a bunch of other stuff

To calculate r^w , let's set world savings equal to world investment:

$$S^x + S^z = I^x + I^z$$

$$S^x + S^z = (2000 - 20r^w) + (3200 - 20r^w)$$

$$S^x + S^z = 5200 - 40r^w$$

But wait! What are S^x and S^z ?

$$\begin{aligned} S^x &= (Y^x - C^x - G^x) \\ &= 8000 - [1000 + .8(8000 - .25(8000)) - 50r^w] - 1000 \\ &= 8000 - 1000 - 4800 + 50r^w - 1000 \end{aligned}$$

$$\begin{aligned}
 S^x &= 1200 + 50r^w \\
 S^z &= (Y^z - C^z - G^z) \\
 &= 8000 - [1000 + .8(8000 - .25(8000)) - 50r^w] - 1000 \\
 &= 8000 - 1000 - 4800 + 50r^w - 1000 \\
 S^z &= 1200 + 50r^w
 \end{aligned}$$

Now substitute these values into our world savings = world investment equation

$$(1200 + 50r^w) + (1200 + 50r^w) = 5200 - 40r^w$$

$$2400 + 100r^w = 5200 - 40r^w$$

$$140r^w = 2800$$

$$r^w = 20$$

So the equilibrium world interest rate is 20.

Now let's use the $r^w=20$ to calculate equilibrium values for C^x , S^x , I^x , NX^x , CA^x , and KA^x :

$$C^x = 1000 + .8(8000 - .25(8000)) - 50(20) = 4800$$

$$I^x = 2000 - 20(20) = 1600$$

$$NX^x = Y^x - C^x - I^x - G^x = 8000 - 4800 - 1600 - 1000 = 600$$

$$CA^x = NX^x \rightarrow CA^x = 600$$

$$KA^x = -CA^x \rightarrow KA^x = -600$$

This economy has a current account surplus and a capital account deficit, and hence is in equilibrium under possibility 1.

$$S^x = 1200 + 50r^w = 1200 + 50(20) = 2200$$

$$\text{Check: } S^x = I^x + CA^x? \quad 2200 = 1600 + 600. \text{ Yes!}$$

Nezt let's use the $r^w=20$ to calculate equilibrium values for C^z , S^z , I^z , NZ^z , CA^z , and KA^z :

$$C^z = 1000 + .8(8000 - .25(8000)) - 50(20) = 4800$$

$$I^z = 3200 - 20(20) = 2800$$

$$NZ^z = Y^z - C^z - I^z - G^z = 8000 - 4800 - 2800 - 1000 = -600$$

$$CA^z = NZ^z \rightarrow CA^z = -600$$

$$KA^z = -CA^z \rightarrow KA^z = 600$$

Country Z has a current account deficit and a capital account surplus, and hence is in equilibrium under possibility 2.

$$S^z = 1200 + 50r^w = 1200 + 50(20) = 2200$$

Check: $S^z = I^z + CA^z?$ $2200 = 2800 + (-600)$. Yes!

Analysis of the above algebraic example

Country X has a 600 surplus of savings, while country Z has a 600 shortage of savings; country X lends 600 to country Z. (Country X is similar to Japan in the real world, while country Z is similar to the U.S.)