Slides for Chapter 7:

Large Open Economies

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These are the slides for the textbook, "International Macroeconomics: A Modern Approach," by Stephanie Schmitt-Grohé, Martín Uribe, and Michael Woodford, Princeton University Press, 2022, ISBN: 9780691170640.

Motivation

• Thus far, we have analyzed the determination of the current account in a small open economy.

• A defining feature of a small open economy is that even if the country borrows or lends a large sum relative to its output in international financial markets, it will not affect the world interest rate.

• By contrast, when a large economy, like the United States, increases borrowing or lending, even if the change is not too large relative to its GDP, it can cause significant changes in the global supply or demand for funds thereby changing the world interest rate.

• In this chapter, we present a framework suitable for analyzing the determination of the current account, the world interest rate, and other macroeconomic indicators in large open economies.

A Two-Country Economy

• Let's divide the world into two regions, the United States (US) and the rest of the world (RW).

• Because a U.S. current account deficit represents the current account surplus of the rest of the world and vice versa, we have that

$$CA^{US} + CA^{RW} = 0,$$

where CA^{US} and CA^{RW} denote the current account balances of the United States and the rest of the world.

The Current Account Schedules of US and RW

As we saw earlier, the current account schedule of a country is an increasing function of the interest rate and other variables. So we can write

$$CA_1^{US} = \underset{+}{CA^{US}}(r_1),$$

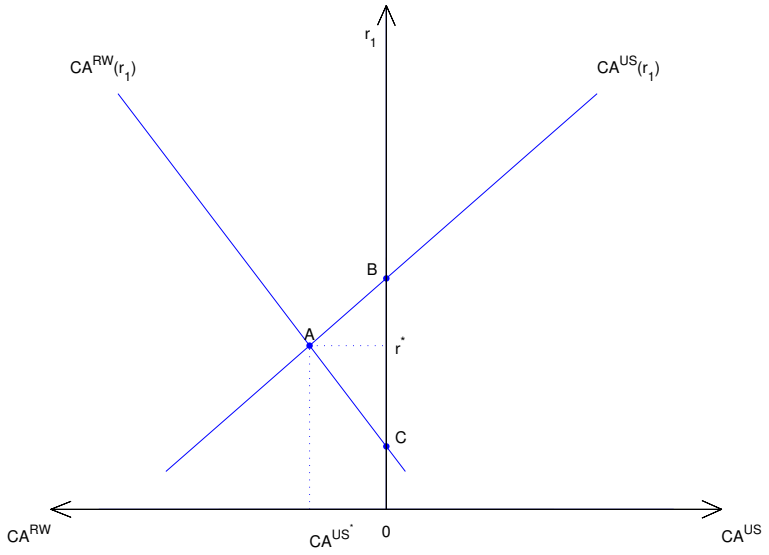
and

$$CA_1^{RW} = \underset{+}{CA^{RW}}(r_1).$$

Intuitively, an increase in the interest rate induces households in the United States and the rest of the world to increase saving in period 1. Also it induces U.S. and RW firms to cut investment in the same period.

The next slide plots the two current account schedules in the space (CA, r).

Current account determination in a large open economy

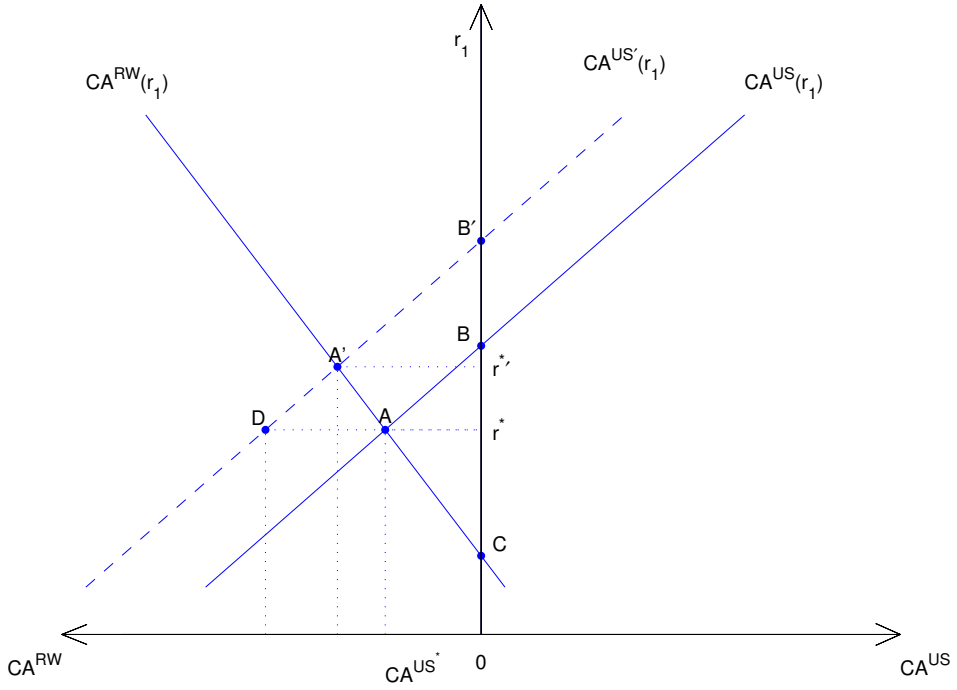


• The horizontal axis measures from left to right the current account balance of the United States and from right to left the current account balance of the rest of the world.
• Equilibrium occurs at the intersection of the current account schedules of the United States and the rest of the world (point A).
• In this example, in equilibrium, the United States runs a current account deficit and the rest of the world a current account surplus.
• The equilibrium value of the world interest rate is r^*.
• If the two economies were closed, the equilibrium would be at point B in the United States and at point C in the rest of the world.

An Investment Surge in the United States

• Suppose that in period 1 firms in the United States learn that their capital will be more productive in period 2.
• Example: a technological improvement, such as fracking, discovered in period 1 that is expected to be in place in period 2.
• This causes the U.S. investment schedule to shift up and to the right.
• Also, U.S. households, in anticipation of higher future incomes generated by the investment boom, reduce current savings at any given interest rate, so that the U.S. saving schedule shifts up and to the left.
• Thus the current account schedule of the United States (difference between the saving and investment schedules) shifts up and to the left.
The figure on the next slide shows how this affects the equilibrium in the world economy.

Current Account Adjustment to an Investment Surge in the United States



• The investment surge shifts the current account schedule of the United States up and to the left as shown with the broken line.
• The equilibrium before the investment surge is at point A, and after the investment surge it is at point A′, where the world interest rate is higher, the current account deficit of the United States is larger, and the current account surplus of the rest of the world is higher.
• In a closed world economy, the interest rate would have increased in the US (from B to B'), and would have remained unchanged in the RW (point C).

Microfoundations of the Two-Country Model

• In the previous two sections, the starting point of the analysis was the current account schedule of each country.

• In this section, we dig deeper and derive the equilibrium levels of the current account and the world interest rate starting from the decisions of individual households.

• To simplify the analysis, we will study an endowment economy (no investment in physical capital).

Preferences

Suppose that preferences of households in the United States and the rest of the world are identical and described by the utility functions

$$\ln C_1^{US} + \ln C_2^{US} \tag{1}$$

and

$$\ln C_1^{RW} + \ln C_2^{RW},$$

where C_t^{US} and C_t^{RW}, for $t = 1, 2$ denote consumption in period $t = 1, 2$ in the United States and the rest of the world.

Budget Constraints

Assume that households in the United States start period 1 with no initial assets or debts ($B_0^{US} = 0$). Then their budget constraint in period 1 is

$$C_1^{US} + B_1^{US} = Q_1^{US}, \tag{2}$$

where B_1^{US} denotes bonds acquired in period 1 and Q_1^{US} denotes the period-1 endowment of goods. In period 2, the budget constraint is

$$C_2^{US} = Q_2^{US} + (1 + r_1)B_1^{US}, \tag{3}$$

(Recall that $B_2^{US} = 0$ by the transversality condition.) Combining (2) and (3) to eliminate B_1^{US} yields the intertemporal budget constraint of the U.S. household

$$C_1^{US} + \frac{C_2^{US}}{1 + r_1} = Q_1^{US} + \frac{Q_2^{US}}{1 + r_1}. \tag{4}$$

Optimal Consumption Choice

Solving the intertemporal budget constraint (4) for C_2^{US} to eliminate C_2^{US} from the utility function (1), the problem of the U.S. household reduces to maximizing

$$\ln C_1^{US} + \ln \left[(1 + r_1)(Q_1^{US} - C_1^{US}) + Q_2^{US} \right].$$

Optimality Condition: Take the derivative with respect to C_1^{US}, equate it to 0, and rearrange terms to get the U.S. household's optimal consumption in period 1,

$$C_1^{US} = \frac{1}{2} \left(Q_1^{US} + \frac{Q_2^{US}}{1 + r_1} \right). \tag{5}$$

Consumption in period 1 is increasing in both endowments as both make the household richer. Also, an increase in the interest rate makes saving more attractive and discourages present consumption.

The U.S. Current Account Schedule

The current account of the United States in period 1 is given by

$$CA_1^{US} = B_1^{US} - B_0^{US}.$$

Recalling that $B_0^{US} = 0$, we have that

$$CA_1^{US} = B_1^{US}. \tag{6}$$

Using the period-1 budget constraint (2) to replace B_1^{US} yields

$$CA_1^{US} = Q_1^{US} - C_1^{US}.$$

Finally, use equation (5) to eliminate C_1^{US} to obtain

$$CA^{US}(r_1) = \frac{1}{2}Q_1^{US} - \frac{1}{21+r_1}Q_2^{US}. \tag{7}$$

This is the current account schedule of the United States. It is:

• increasing in the interest rate r_1, because, as the interest rate increases households become more attracted to saving.

• increasing in the current endowment, Q_1^{US}, and decreasing in the future endowment, Q_2^{US}, because households like to smooth consumption over time.

The Current Account Schedule of the Rest of the World

Households in the rest of the world are identical to U.S. households except for their endowments. So their optimal consumption in period 1 is

$$C_1^{RW} = \frac{1}{2}\left(Q_1^{RW} + \frac{Q_2^{RW}}{1+r_1}\right). \tag{8}$$

And the current account schedule of the rest of the world is

$$CA^{RW}(r_1) = \frac{1}{2}Q_1^{RW} - \frac{1}{2}\frac{Q_2^{RW}}{1+r_1}. \tag{9}$$

Like the current account schedule of the United States, the current account schedule of the rest of the world is increasing in the interest rate and in the period-1 endowment and decreasing in the period-2 endowment.

The Equilibrium World Interest Rate

The equilibrium world interest rate, r^*, is the interest rate that guarantees that the world current account is zero, that is,

$$CA^{US}(r^*) + CA^{RW}(r^*) = 0. \tag{10}$$

Using equations (7) and (9) to replace $CA^{US}(r^*)$ and $CA^{RW}(r^*)$ in (10) and rearranging yields

$$r^* = \frac{Q_2^{US} + Q_2^{RW}}{Q_1^{US} + Q_1^{RW}} - 1. \tag{11}$$

- r^* is increasing in the growth rate of the world endowment.
- **Intuition:** if the world endowment in period 2, $Q_2^{US} + Q_2^{RW}$, increases relative to the world endowment in period 1, $Q_1^{US} + Q_1^{RW}$, on average, households would like to borrow against future income, to smooth consumption over time. But this is impossible: the world as a whole cannot borrow. So the interest rate must go up to ensure zero worldwide borrowing.
- In this economy, the world interest rate, r^*, depends upon world endowments, and not upon the distribution of endowments across countries.

The Equilibrium Current Account

To obtain the equilibrium CA of the United States, use equation (11) and use $r_1 = r^*$ to eliminate r_1 from equation (7),

$$CA_1^{US} = \frac{1}{2}\frac{Q_1^{RW}Q_2^{RW}}{Q_2^{US}+Q_2^{RW}}\left(\frac{Q_1^{US}}{Q_1^{RW}} - \frac{Q_2^{US}}{Q_2^{RW}}\right)$$

• The important part of this expression is the object in parenthesis. It says that the United States will run a current account surplus when its endowment is relatively more abundant than that of the rest of the world in period 1 relative to period 2, $\frac{Q_1^{US}}{Q_1^{RW}} > \frac{Q_2^{US}}{Q_2^{RW}}$.

• Intuition: If the U.S. endowment in period 1 is large relative to that of the rest of the world compared to the relative endowments in period 2, U.S. households end up sharing part of their relatively abundant period-1 endowment with the rest of the world.

• This is a relative-relative type condition. What matters is the joint relative endowments of the two countries across space and time (the United States relative to the rest of the world, and period 1 relative to period 2).

International Transmission of Country-Specific Shocks

Increases in the period-1 endowment, Q_1^{US}, and in the future endowment, Q_2^{US}, have similar effects on U.S. consumption, but different effects on foreign consumption and the world interest rate:

• By equation (5), we see that C_1^{US} increases when either Q_1^{US} or Q_2^{US} increase.

• By equation (8), we see that C_1^{RW} increases when Q_1^{US} increases, but falls when Q_2^{US} increases.

• By equation (11), we see that the world interest rate, r^* falls when Q_1^{US} increases, but increases when Q_2^{US} increases.

Country Size and the International Transmission Mechanism

• How would the determination of the world interest rate change if countries had different population sizes?

• How would the international transmission of domestic shocks be affected by the size of the country?

• To address these questions, let's assume that the United States is populated by N^{US} identical households and the rest of the world by N^{RW} identical households.

Country Size and the Current Account of the United States

The U.S. current account is then given by

$$CA_1^{US} = N^{US} B_1^{US},$$

where B_1^{US} is bond holdings of the individual household. This is a generalization of equation (6) when the country is populated by N^{US} identical households.

Combine this expression with equation (2) to eliminate B_1^{US}.

$$CA_1^{US} = N^{US}(Q_1^{US} - C_1^{US}).$$

Now use (5) to eliminate C_1^{US}

$$CA^{US}(r_1) = \frac{N^{US}}{2}\left(Q_1^{US} - \frac{Q_2^{US}}{1+r_1}\right). \tag{12}$$

Country Size and the World Interest Rate

The current account of the rest of the world takes a form similar to (12),

$$CA^{RW}(r_1) = \frac{N^{RW}}{2}\left(Q_1^{RW} - \frac{Q_2^{RW}}{1+r_1}\right). \tag{13}$$

Combine (12) and (13) with the market clearing condition in the world financial market, given by equation (10), to eliminate CA_1^{US} and CA_1^{RW} and solve for the interest rate to get

$$r^* = \frac{N^{US}Q_2^{US} + N^{RW}Q_2^{RW}}{N^{US}Q_1^{US} + N^{RW}Q_1^{RW}} - 1.$$

Country Size and the World Interest Rate (cont.)

Let $\alpha \equiv N^{US}/(N^{US}+N^{RW})$ denote the share of the U.S. population in the world population. Then we can write r^* as

$$r^* = \frac{\alpha Q_2^{US} + (1-\alpha) Q_2^{RW}}{\alpha Q_1^{US} + (1-\alpha) Q_1^{RW}} - 1. \tag{14}$$

• This expression shows that the larger the U.S. economy (the larger is α) is, the more important U.S. endowment shocks will be for the determination of the world interest rate.

How Large Economies Affect Small Economies

Suppose the rest of the world is a small economy, that is, consider the limiting case in which $1-\alpha$ is infinitesimally small. Then (14) collapses to

$$r^* = \frac{Q_2^{US}}{Q_1^{US}} - 1.$$

• The world interest rate is exclusively determined in the large economy. This justifies our assumption in Chapter 3 (and others) that the small economy takes the world interest rate, r^*, as given.

• Large countries affect small countries through the interest rate: Changes in the U.S. endowments affect the world interest rate, which in turn affects the small economy (in this case the rest of the world).

Explaining the U.S. Current Account Deficit: The Global Saving Glut Hypothesis*

• Between 1996 and 2006, the U.S. current account deficit increased from 1.5% of GDP to about 6% (from $200bn to $800bn, see the right panel of the figure on the next slide).

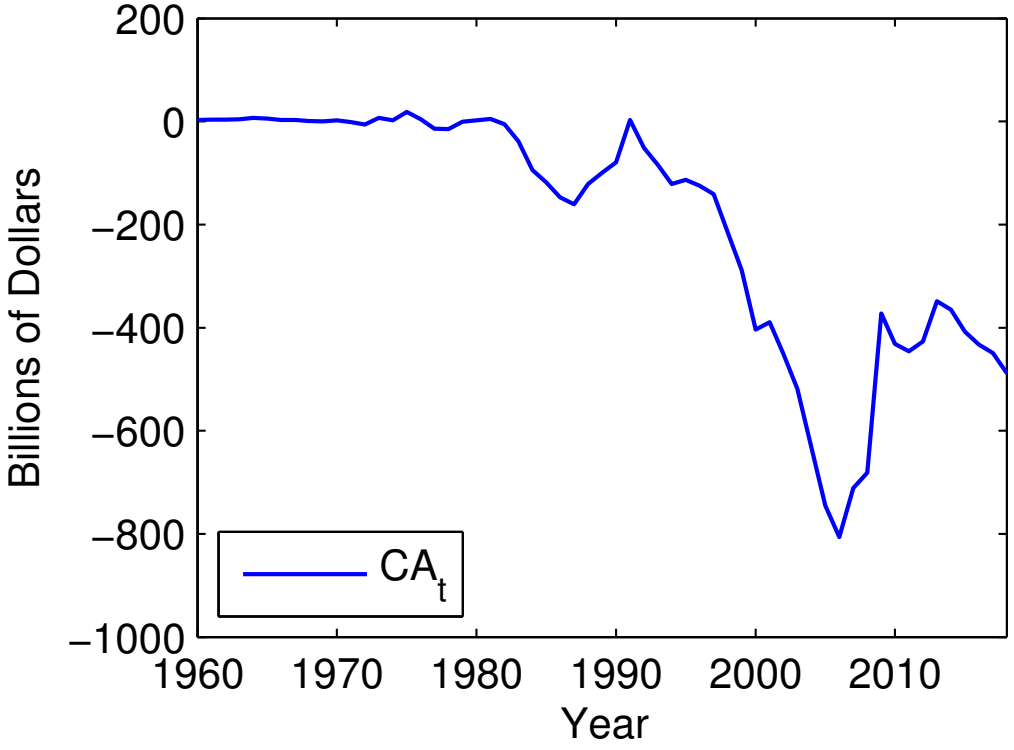
• The onset of the great recession of 2007 brought the ballooning of the current account deficit to an abrupt stop, with the deficit shrinking to 3% of GDP by 2009.

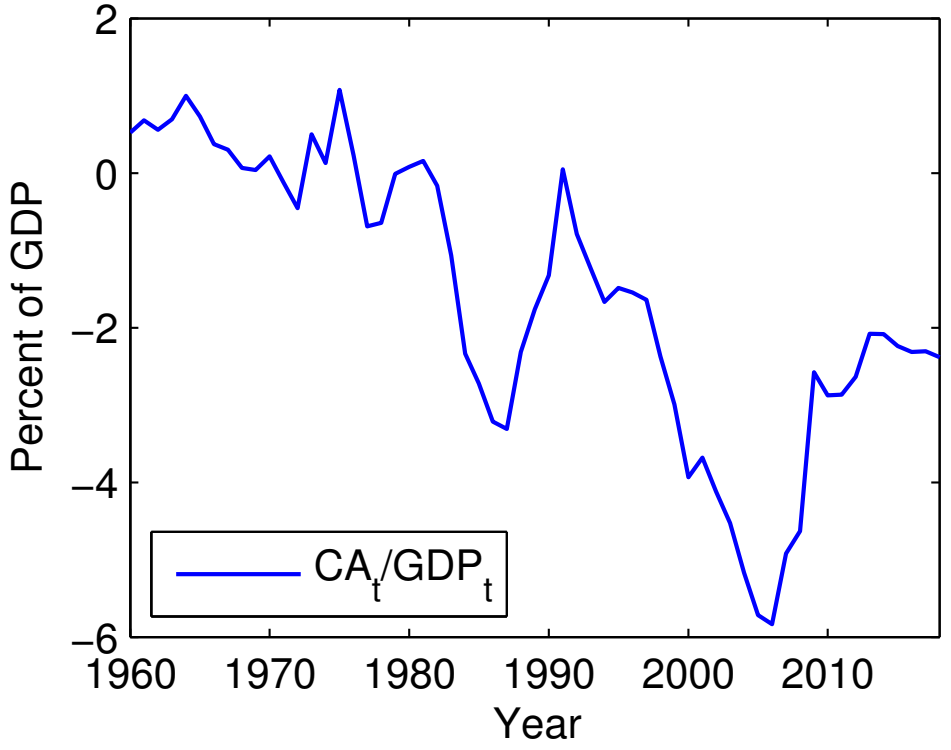
• Was this large rise and fall in the current account deficit primarily driven by domestic or external factors?

• Two competing explanations have been proposed:
— The global saving glut hypothesis.
— The Made in the USA hypothesis.

*See, Ben S. Bernanke, "The Global Saving Glut and the U.S. Current Account Deficit," Homer Jones Lecture, St. Louis, Missouri, April 14, 2005.

The U.S. Current Account Balance: 1960-2018





The Global Saving Glut Hypothesis

• It maintains that the deterioration in the U.S. current account deficit was caused by external factors:

• Between 1996 and 2006 the rest of the world experienced a heightened desire to save.

— Emerging countries increased foreign reserve accumulation to avoid or be better prepared to face future external crises.

— Government induced foreign currency depreciation aimed at promoting export-led growth (e.g., China).

— Some developed countries increased saving rates in preparation for an aging population.

The Made in the USA Hypothesis

• It maintains that the large U.S. current account deficits were due to economic developments inside the United States.

— Financial innovation in the United States (subprime mortgages, mortgage-back securities, etc.) induced low private savings rates and over-investment in residential housing.

Which View Is Right?

• Look at the left panel of the figure on the next slide. An increase in desired saving in the RW shifts the CA schedule of the RW down and to the left.

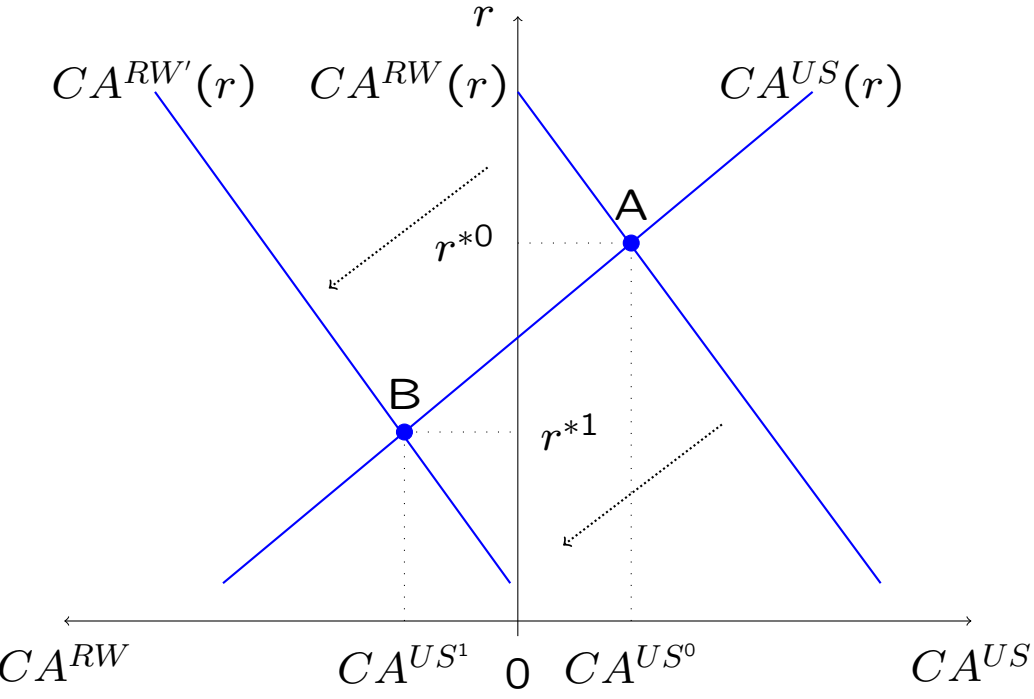
• The U.S. CA schedule doesn't move.

• The new equilibrium, point B, features a deterioration in the current account of the United States from CA^{US^0} to CA^{US^1} and a fall in the world interest rate from ${r^*}^0$ to ${r^*}^1$.

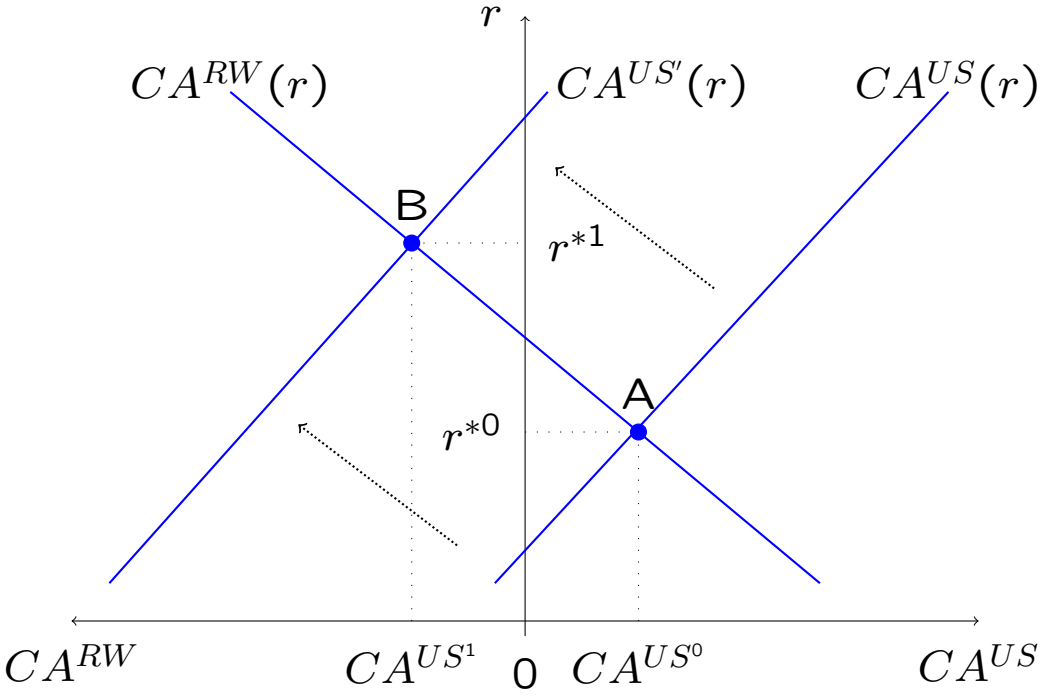
• Intuition: the United States will borrow more from the rest of the world only if it becomes cheaper to do so (only if the interest rate falls).

U.S. Current Account Deterioration: Global Saving Glut or "Made in the USA"?

Global Saving Glut Hypothesis



"Made in the U.S.A." Hypothesis



Which View Is Right? (cont.)

• The made in the USA hypothesis is illustrated in the right hand panel of the figure in the previous slide.

• Under this view, the current account schedule of the United States shifts up and to the left

• The current account schedule of the rest of the world is unchanged.

The new equilibrium, point B, features a deterioration in the current account of the United States and a rise in the world interest rate.

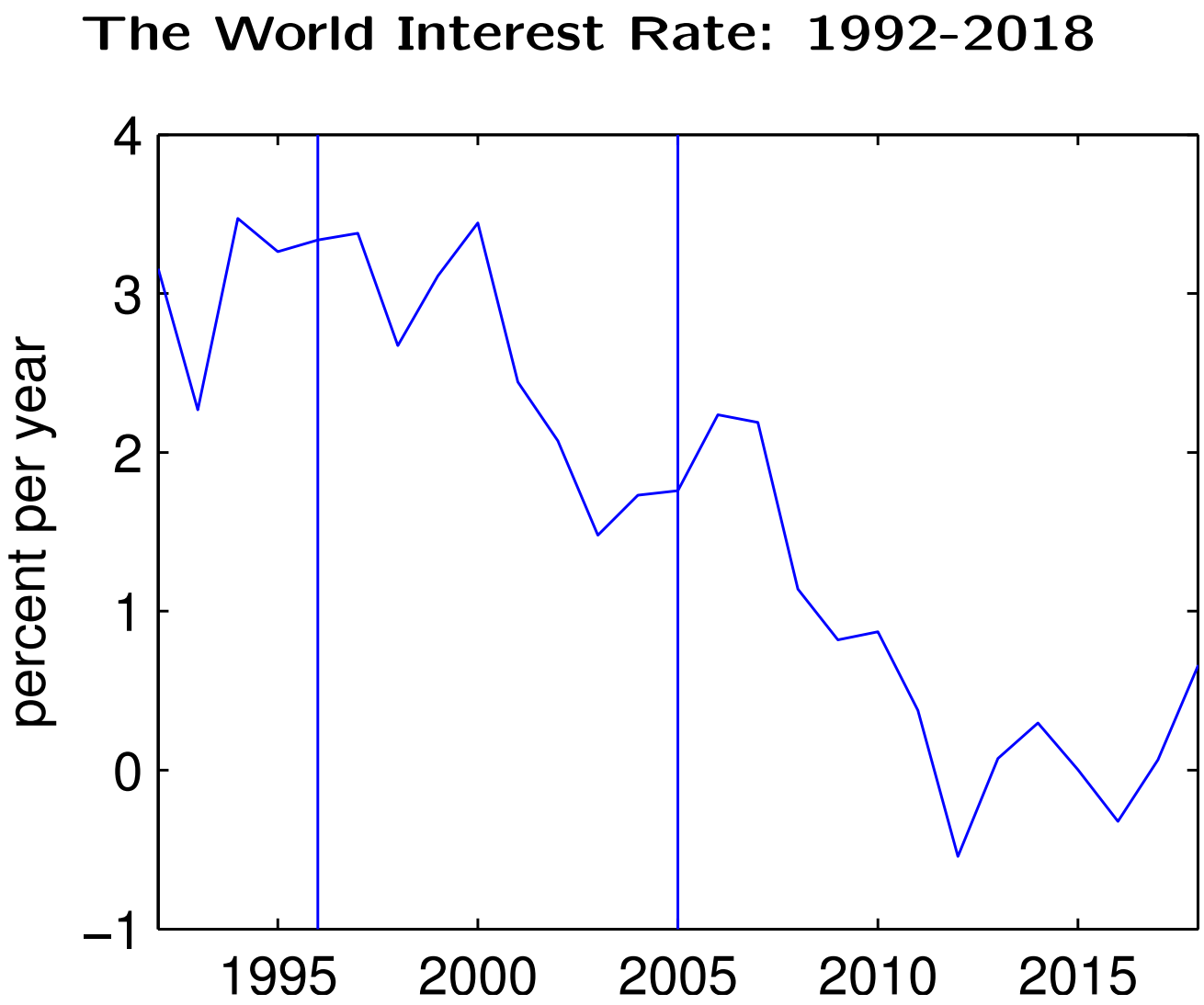
And the Winner Is . . .

• Both hypotheses can explain a deterioration in the U.S. current account.

• However, the global saving glut hypothesis implies a decline in world interest rates, whereas the Made in the USA hypothesis implies that world interest rates should have gone up.

• Hence we can use data on the interest rates to find out which hypothesis is right.

• The next figure shows that the large current account deterioration in the United States was associated with a significant fall in the interest rate, giving credence to the global saving glut hypothesis.



Notes. The world interest rate is measured as the difference between the rate on 10-year U.S. Treasury securities and expected inflation. Expected inflation in turn is measured as the median CPI inflation forecast over the next 10 years and is taken from the Survey of Professional Forecasters.

The Made in the USA Hypothesis Strikes Back

• With the onset of the global financial crisis in 2007, the U.S. CA had a sharp reversal: the deficit shrunk from 6% of GDP in 2006 to less than 3% in 2009.

• Can the global saving glut hypothesis also explain this development?

• Under this view, the reversal in the CA deficit would be due to a decline in desired savings in the rest of the world.

• Look again at the left panel of figure on slide 27. Assume that right before the beginning of the financial crisis the economy is at point B. A decline in desired savings in the rest of the world shifts the current account schedule of the rest of the world up and to the right.

• The new equilibrium is point A. The U.S. current account improves, and the interest rate rises.

The Made in the USA Hypothesis Strikes Back (cont.)

• Thus, under the global saving glut hypothesis, the V-shaped U.S. current account dynamics observed around the global financial crisis should have been accompanied by a V-shaped pattern of the interest rate.

• However, the figure shows that the interest rate does not display such a pattern—in fact it keeps falling—rejecting the possibility that the CA improvement was driven by external factors.

So what drove the improvement in the U.S. CA during the global financial crisis?

Observers have argued that the bursting of a bubble in the U.S. housing market led to an increase in saving and a fall in investment. That is, the US CA schedule shifted down and to the right. This caused an improvement in the CA and a fall in the interest rate. This suggests that domestic factors might have played a dominant role in explaining the U.S. current account dynamics during the global financial crisis.

Summing Up

• We analyzed the determination of the current account in a world with large open economies.

• The world interest rate responds to factors affecting savings and investment in large economies.

• A temporary output increase (Q_1) in a large country depresses the world interest rate.

• An expected future increase in output (Q_2) in a large economy drives the world interest rate up.

• The world interest rate is determined by the growth rate of global output. The larger the expected growth in global output is, the higher the world interest rate will be.

• Jointly theory and data suggest that the large increase in U.S. CA deficits 1996 was predominantly driven by an increase in the global supply of savings—the 'global savings glut.'

• But the sharp reduction of U.S. CA deficits in the aftermath of the GFC was most likely caused by an increase in U.S. savings and a reduction in U.S. investment after the bursting of the housing bubble—the made in the USA hypothesis