Large Open Economies

International Macroeconomics
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Introduction: In the previous chapters, we studied small open economies that take the world interest rate as given. This assumption greatly simplifies the analysis, but it fails to capture how the decisions of a large country — like the United States — can influence global financial conditions. In this chapter, we extend our model to analyze a world composed of two large regions: the United States (US) and the rest of the world (RW). In this setup, each region's saving and investment decisions affect the world interest rate. This framework allows us to analyze how economic shocks in one country can spill over to the rest of the world through changes in global interest rates and current account imbalances.

1. A Two-Country Economy

We now divide the world into two economies: the United States (US) and the Rest of the World (RW). Since every international transaction is a two-sided exchange, it follows that the global current account must always be balanced. Formally:

$$CA_{US} + CA_{RW} = 0 \tag{1}$$

That is, if the United States runs a current account deficit ($CA_{US} < 0$), the rest of the world must run an equally large current account surplus ($CA_{RW} > 0$), and vice versa.

As we have learned in earlier chapters, the current account of any country is an increasing function of the interest rate. This relationship arises because:

- A higher interest rate encourages households to save more, increasing the supply of loanable funds.
- At the same time, a higher interest rate discourages firms from borrowing to invest, decreasing the demand for funds.

These combined effects raise the country's net lending position and improve its current account balance.

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Therefore, both the United States and the rest of the world feature upward-sloping current account schedules in the (r, CA) space. The world equilibrium is determined by the intersection of these two schedules. At the equilibrium interest rate r^*, the current account balances of the two regions satisfy:

$$CA_{US}^* + CA_{RW}^* = 0 \tag{2}$$

Suppose now that in period 1, firms in the United States receive news that capital will be more productive in period 2. This can be interpreted as a positive expected productivity shock. In response:

- U.S. firms want to invest more at every interest rate, shifting the investment schedule up.
- U.S. households, anticipating higher future income, choose to save less today, shifting the saving schedule down.

The result is that the current account schedule of the U.S., given by the difference between savings and investment, shifts downward at every interest rate:

$$CA'_{US}(r_1) < CA_{US}(r_1) \tag{3}$$

The rest of the world is unaffected by this domestic U.S. shock, so its current account schedule remains unchanged. Graphically, this creates an excess demand for loanable funds at the original world interest rate r^*, as the U.S. now wants to borrow more but the rest of the world is not initially willing to lend more.

To restore equilibrium in global financial markets, the interest rate must rise to a new level $r_0^* > r^*$. This rise in the world interest rate has two effects:

- It moderates the U.S. demand for external funds by partially offsetting the initial increase in investment and drop in saving.
- It encourages higher savings (and/or lower investment) in the rest of the world.

In the new equilibrium:

$$CA_{US}^{*'} < CA_{US}^* \quad \text{(a larger deficit)} \tag{4}$$
$$CA_{RW}^{*'} = -CA_{US}^{*'} > -CA_{US}^* \quad \text{(a larger surplus)} \tag{5}$$

This illustrates a key result: because the U.S. is a large open economy, its shocks affect the global interest rate. The interest rate adjusts upward to balance the international market for loanable funds.

However, note the following:

- If the interest rate had remained fixed (as in a small open economy), the increase in the U.S. current account deficit would have been even larger.

- If the U.S. were a closed economy, the interest rate would have risen even more, since there would be no external savings to draw from. Thus, the increase in interest rates is *attenuated* by the ability to borrow from abroad.

This example demonstrates how shocks in large open economies influence global financial conditions and generate cross-border spillovers. It also highlights the balancing role played by the world interest rate in adjusting to saving-investment imbalances across countries.

2. Microfoundations of the Two-Country Model

Consider a two-period world economy composed of two countries: the United States (US) and the rest of the world (RW). Each country is populated by a representative household that derives utility from consuming a tradable, perishable good in each period. Preferences are identical across countries and given by:

$$\ln C_1 + \ln C_2$$

where C_t denotes consumption in period $t = 1, 2$.

Let the endowments of the representative household in the US be Q_1^{US} and Q_2^{US}, and similarly, for the rest of the world Q_1^{RW} and Q_2^{RW}. Households can borrow or lend at an interest rate r_1, which is common across countries due to free international capital mobility. All households start period 1 with no assets and must end period 2 with zero holdings of financial assets — a standard transversality condition. Formally:

$$B_0^{US} = B_0^{RW} = 0, \quad B_2^{US} = B_2^{RW} = 0$$

2.1. Household Optimization

The household in the United States faces the following budget constraints:

$$\begin{aligned} &\text{Period 1:} && C_1^{US} + B_1^{US} = Q_1^{US} \\ &\text{Period 2:} && C_2^{US} = Q_2^{US} + (1 + r_1)B_1^{US} \end{aligned}$$

Substituting the first equation into the second gives the household's present value budget constraint:

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

The household maximizes lifetime utility:

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

subject to the present value constraint above. Substituting for C_2^{US} and optimizing yields:

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

The optimal level of consumption in period 1 is simply the average of total lifetime resources, discounted appropriately. This reflects the desire to smooth consumption over time.

The current account of the United States in period 1 equals the net acquisition of foreign assets:

$$CA_1^{US} = B_1^{US} = Q_1^{US} - C_1^{US}$$

Substituting the optimal consumption value gives the U.S. current account schedule:

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

The intuition is the usual and straightforward:

- A higher interest rate makes future consumption more attractive, so households save more, increasing the current account.
- A higher current endowment Q_1^{US} increases savings, also improving the current account.
- A higher future endowment Q_2^{US} induces households to borrow, reducing the current account.

Households in the rest of the world face the same preferences, budget constraints, and interest rate. Thus, their optimal consumption in period 1 is:

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

Their current account schedule is therefore:

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

2.2. Equilibrium in World Capital Markets

In equilibrium, the global current account must be zero:

$$CA^{US}(r^*) + CA^{RW}(r^*) = 0$$

Substituting both current account schedules and solving for the equilibrium interest rate r^*, we obtain:

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

The interpretation is clear: the equilibrium interest rate depends on the growth rate of the world endowment. If the world has more resources in the future relative to the present, the interest rate must rise to prevent global overborrowing, ensuring intertemporal equilibrium.

2.3. Equilibrium Current Account of the United States

To obtain the U.S. current account in equilibrium, substitute r^* into the expression for $CA^{US}(r_1)$, yielding:

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

The sign of the U.S. current account depends on the term in parentheses:

$$\frac{Q_1^{US}}{Q_1^{RW}} - \frac{Q_2^{US}}{Q_2^{RW}}$$

This condition compares the relative abundance of U.S. endowment in period 1 versus period 2 with respect to the rest of the world. When the U.S. is relatively richer in period 1, it runs a surplus, sharing current resources in exchange for future returns. Conversely, if the U.S. expects to be relatively richer in the future, it runs a deficit today and repays it tomorrow.

This final expression emphasizes that current account imbalances are not driven by absolute endowment levels, but by *relative abundance across countries and time.*

3. Transmission of Country-Specific Shocks

A key distinction between small and large open economies lies in how country-specific shocks transmit internationally. In small open economies, domestic shocks do not affect international prices like the world interest rate. In contrast, large economies influence the rest of the world through such prices. This section explores the international effects of aggregate shocks in a large open economy setup.

Consider a positive shock to the period-1 endowment of the United States, Q_1^{US}. U.S. households, wishing to smooth consumption over time, attempt to save part of their temporarily high income, increasing the global supply of funds. By the equilibrium condition in the world capital market, this excess supply pushes down the world interest rate.

The fall in the interest rate stimulates current consumption in both countries. In the U.S., the effect is amplified: households consume more in period 1 due to both higher income and cheaper borrowing. In the rest of the world, although there is no change in endowment, lower borrowing costs also lead to increased current consumption. As a result, a current-endowment shock in the U.S. generates positive comovement in current consumption across countries.

Now consider an anticipated increase in the future U.S. endowment, Q_2^{US}. U.S. households attempt to borrow against this higher future income, raising the global demand for funds. As a result, the world interest rate rises. This has opposite effects across countries: in the U.S., households raise period-1 consumption via borrowing; in the rest of the world, the higher interest rate makes borrowing more expensive, discouraging current consumption. Thus, a future-endowment shock causes divergent consumption movements across countries in the current period.

3.1. Heterogeneous Country Size

The previous analysis implicitly assumed that the U.S. and the rest of the world have the same population size. This is reflected in our notation: B_1^{US} was both the individual and aggregate bond holdings in the U.S., implying that the representative household stood for the entire economy. We now relax this assumption and analyze how country size affects global outcomes.

Let the United States be populated by N_{US} identical households and the rest of the world by N_{RW} households. The U.S. current account is now:

$$CA_1^{US} = N_{US} \cdot B_1^{US} = N_{US} \left(Q_1^{US} - C_1^{US} \right)$$

Substituting in the optimal consumption rule:

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

we obtain the current account schedule for the U.S.:

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

Analogously, for the rest of the world:

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

World financial market equilibrium requires:

$$CA^{US}(r^*) + CA^{RW}(r^*) = 0$$

Substituting both expressions:

$$\frac{N_{US}}{2} \left(Q_1^{US} - \frac{Q_2^{US}}{1 + r^*} \right) + \frac{N_{RW}}{2} \left(Q_1^{RW} - \frac{Q_2^{RW}}{1 + r^*} \right) = 0$$

Multiplying through by 2 and solving for r^*, we find:

$$1 + r^* = \frac{N_{US} Q_2^{US} + N_{RW} Q_2^{RW}}{N_{US} Q_1^{US} + N_{RW} Q_1^{RW}}$$

Let $\alpha = \frac{N_{US}}{N_{US}+N_{RW}}$ be the U.S. share of the world population. Then:

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

This expression shows how the world interest rate depends on the relative size and intertemporal distribution of endowments across countries. The larger α, the greater the influence of U.S. shocks on the global interest rate. In the limiting case where $\alpha = 1$, the U.S. determines the world interest rate entirely. Conversely, if $\alpha = 0$, the rest of the world does.

In sum, in a world of integrated financial markets, shocks in large economies transmit internationally through changes in the world interest rate. Whether these shocks lead to global comovement or divergence depends on whether the shock affects current or future resources. Moreover, the larger the country, the more weight its economic conditions carry in determining global outcomes.