Terms of Trade, Tariffs, and the Current Account

International Macroeconomics
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Introduction: In the previous lecture, we built an intertemporal framework to understand how a small open economy chooses consumption and savings over time, and how these decisions translate into movements in the trade balance and the current account. However, that model assumed a one-good world, where the good that households are endowed with is the same as the one they consume. In this lecture, we enrich the model by introducing relative prices between goods—the *terms of trade*—and explore their effects on macroeconomic aggregates. We will also study how changes in the imposition of tariffs influence the current account dynamics of a small open economy.

1. Terms-of-Trade Shocks

The one-good assumption abstracts from a fundamental feature of open economies: countries typically produce different goods from those they consume. In reality, households consume imported goods, while the economy exports domestic endowments in exchange for them. To account for this, we now distinguish between the price of imports P_t^M and the price of exports P_t^X. The *terms of trade* (TT) at time t are defined as:

$$TT_t \equiv \frac{P_t^X}{P_t^M}$$

which reflects how many units of the import good the country can obtain per unit of its export good. A higher TT_t indicates an improvement in the terms of trade, meaning exports command more consumption goods.

In this context, endowments Q_1, Q_2 are expressed in export goods, while consumption C_1, C_2 is in import goods. The value of the endowment in units of the consumption good is then $TT_1 Q_1$ and $TT_2 Q_2$, respectively. The period budget constraints become:

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$$C_1 + B_1 - B_0 = TT_1Q_1 + r_0B_0$$
$$C_2 + B_2 - B_1 = TT_2Q_2 + r_1B_1$$

Applying the transversality condition $B_2 = 0$ and combining both constraints, we obtain the intertemporal budget constraint of the household in this two-good setting:

$$C_1 + \frac{C_2}{1+r_1} = (1+r_0)B_0 + TT_1Q_1 + \frac{TT_2Q_2}{1+r_1}$$

This equation shows that what matters for lifetime income is the present discounted value of export income, evaluated in terms of the consumption good. Thus, from the point of view of the consumer, changes in the terms of trade are analytically equivalent to changes in the endowment. The model's predictions follow directly from this insight.

Consider a temporary deterioration in the terms of trade, i.e., a fall in TT_1 while TT_2, Q_1, Q_2 remain unchanged. This reduces the value of the current endowment but leaves future income unchanged. As in the case of a temporary negative income shock, the economy smooths consumption by borrowing from abroad. As a result:

- $C_1 \downarrow$, but by less than the fall in TT_1Q_1
- $B_1 < B_0$, implying net borrowing
- $TB_1 = TT_1Q_1 \downarrow - C_1 \downarrow$, $TB_1^* \downarrow$: the trade balance worsens
- $CA_1 = r_0B_0 + TB_1 \downarrow$: the current account also deteriorates

Now consider a permanent deterioration, i.e., $TT_1 \downarrow$ and $TT_2 \downarrow$. Lifetime income falls, and so the household adjusts consumption in both periods accordingly:

- $C_1 \downarrow$, $C_2 \downarrow$
- B_1 adjusts slightly or not at all
- TB_1 and CA_1 exhibit little movement, as the adjustment occurs primarily via consumption

Conclusion: Just like with endowment shocks, temporary changes in the terms of trade generate smoothing behavior and adjustments in the current account, while permanent changes are absorbed mostly through consumption changes. This result highlights the role of the current account as a buffer to temporary fluctuations in national income, regardless of whether these arise from quantity (endowment) or price (terms-of-trade) shocks.

2. Import Tariffs

We now introduce tariffs to our basic model. We won't analyze the optimality of the import tariffs policy as that is a international trade policy, we simply present a way to include tariffs in our open economy model. In this setting, consumers purchase foreign consumption goods using income earned from exporting domestic goods.

Let $\tau_1 \geq 0$ and $\tau_2 \geq 0$ denote the ad-valorem tariff rates on imports in periods 1 and 2, respectively. Then, households must pay $1+\tau_1$ units of domestic currency for each unit of imported consumption good in period 1, and $1+\tau_2$ in period 2. In turn, the government collects tariff revenues and redistributes them as lump-sum transfers, denoted by L_1 and L_2. The household's period-by-period budget constraints become:

$$\begin{aligned}(1+\tau_1)C_1 + B_1 &= TT_1Q_1 + L_1 + (1+r_0)B_0 \\ (1+\tau_2)C_2 &= TT_2Q_2 + L_2 + (1+r_1)B_1\end{aligned}$$

The intertemporal budget constraint is then:

$$(1+\tau_1)C_1 + \frac{(1+\tau_2)C_2}{1+r_1} = (1+r_0)B_0 + TT_1Q_1 + \frac{TT_2Q_2}{1+r_1} + L_1 + \frac{L_2}{1+r_1}$$

The household chooses (C_1, C_2) to maximize its lifetime utility function:

$$\text{máx } U(C_1) + \beta U(C_2)$$

subject to the intertemporal constraint above. Substituting from the budget constraint, the problem becomes:

$$\begin{aligned}\mathcal{L} = {} & U(C_1) + \beta U(C_2) \\ & + \lambda \left[(1+r_0)B_0 + TT_1Q_1 + \frac{TT_2Q_2}{1+r_1} + L_1 + \frac{L_2}{1+r_1} - (1+\tau_1)C_1 - \frac{(1+\tau_2)C_2}{1+r_1} \right]\end{aligned}$$

The first-order condition yields the modified Euler equation:

$$U'(C_1) = \frac{1+\tau_1}{1+\tau_2} \cdot \beta(1+r_1)U'(C_2) \tag{1}$$

This equation illustrates that import tariffs distort the intertemporal consumption decision unless $\tau_1 = \tau_2$. If both tariffs are equal, then the relative price of consumption across periods remains unchanged, and the Euler equation is unaffected. However, if $\tau_1 > \tau_2$, then current consumption becomes relatively more expensive, and the household shifts consumption toward the future. That is, $C_1 \downarrow$ and $C_2 \uparrow$.

The intuition is clear: when consumption in period 1 is taxed more heavily than in period 2, consumers are incentivized to defer consumption to take advantage of the lower future tax. This intertemporal substitution effect directly affects saving behavior and therefore the trade balance and current account.

Nonetheless, on the fiscal side, if we assume that the government fully rebates tariff revenues to the households in that same period that it collects these taxes, then consumption allocation remains unchanged once again:

$$\tau_1 C_1 = L_1$$
$$\tau_2 C_2 = L_2$$

These transfers are taken as given by households and incorporated into their income stream. In this case, the maximization problem with these two additional constraints would equal our basic scenario:

$$\mathcal{L} = U(C_1) + \beta U(C_2) + \lambda \left[(1+r_0)B_0 + TT_1Q_1 + \frac{TT_2Q_2}{1+r_1} + \tau_1 C_1 + \frac{\tau_2 C_2}{1+r_1} - (1+\tau_1)C_1 - \frac{(1+\tau_2)C_2}{1+r_1} \right]$$

Or simply:

$$\mathcal{L} = U(C_1) + \beta U(C_2) + \lambda \left[(1+r_0)B_0 + TT_1Q_1 + \frac{TT_2Q_2}{1+r_1} - C_1 - \frac{C_2}{1+r_1} \right]$$

This results is trivial, as returning back to the households the taxes collected, the same period they are collected, is essentially the same as not taxing them at all. If they weren't return on the same period they are collected, would it make a difference? (This question is for you to think)

For the next subsections, we only consider the tariffs on imports and ignore the transfers. That is, the government collects tariff on imports and doesn't return them to the household in any way.

2.1. Temporary Increase in Import Tariffs

Suppose the economy initially has no tariffs, i.e., $\tau_1 = \tau_2 = 0$. Now consider a policy shock in which the government imposes a tariff only in the first period, so that $\tau_1 > 0$ and $\tau_2 = 0$. This change affects the household's intertemporal optimization problem as it raises the effective price of current-period consumption relative to future-period consumption.

The Euler equation becomes:

$$U'(C_1) = (1 + \tau_1)\beta(1 + r_1)U'(C_2) \tag{2}$$

Since $\tau_1 > 0$, the marginal utility cost of consuming today is now higher. To restore the optimality condition, the household reduces C_1 and increases C_2. Thus, the temporary import tariff creates an intertemporal substitution effect: the household defers consumption to period 2. Since the household reduces C_1, it ends up saving more, increasing the trade balance and the current account in the first period. In the second period, the household consumes the additional savings plus returns, reducing the trade balance and the current account in the second period. Therefore, a temporary tariff improves the current account in the first period and worsens it in the second. However, this improvement is not due to a reduction in imports per se, but rather due to intertemporal substitution of consumption induced by the distortion in relative prices. Still, in aggregate, consumption may fall a little bit as the tariff in the first period will diminish the frontier of possibilities of consumption of the household.

2.2. Permanent Increase in Import Tariffs

Now consider a permanent increase in import tariffs such that $\tau_1 = \tau_2 > 0$. In this case, consumption in both periods is taxed equally, and the intertemporal relative price of consumption is unaffected. The Euler equation simplifies to:

$$U'(C_1) = \beta(1 + r_1)U'(C_2) \tag{3}$$

which is identical to the Euler equation in the model without tariffs. Therefore, the household maintains the same consumption ratio across periods as before, even though the level of consumption is now lower in both periods because the effective price of consumption is higher.

Given the reduction in consumption in both periods, the trade balance and the current account of both periods increase.

In sum, a permanent tariff reduces overall consumption but has no effect on intertemporal allocation. The key reason is that the Euler equation is only altered under asymmetric taxation across periods, not under uniform increases in prices.

In this lecture note, we introduced two new key concepts in the analysis of open economies: the *terms of trade* and *import tariffs*. We delved into how to introduce them to our open economy model, and examined their main dynamics. In the next lecture, we expand the model by introducing a production sector. This will allow us to analyze how countries allocate not only consumption but also labor and capital over time and across borders, enriching our understanding of current account dynamics and international borrowing and lending decisions.