Tariff Analysis in General Equilibrium

Chapter 9 in *International Economics* and *International Trade* takes a partial equilibrium approach to the analysis of trade policy. That is, it focuses on the effects of tariffs, quotas, and other policies in a single market without explicitly considering the consequences for other markets. This partial equilibrium approach usually is adequate, and it is much simpler than a full general equilibrium treatment that takes cross-market effects into account. Nonetheless, it is sometimes important to do the general equilibrium analysis. In Chapter 6 of *International Economics* and *International Trade*, we presented a brief discussion of the effects of tariffs in general equilibrium. This appendix presents a more detailed analysis.

The analysis proceeds in two stages. First, we analyze the effects of a tariff in a small country, one that cannot affect its terms of trade; then we analyze the case of a large country.

**A Tariff in a Small Country**

Imagine a country that produces and consumes two goods, manufactures and food. The country is small, unable to affect its terms of trade; we will assume that it exports manufactures and imports food. Thus the country sells its manufactures to the world market at a given world price $P_M^*$ and buys food at a given world price $P_F^*$.

Figure 1 illustrates the position of this country in the absence of a tariff. The economy produces at the point on its production possibility frontier that is tangent to a line with slope $-P_M^*/P_F^*$, indicated by $Q^1$. This line also defines the economy’s budget constraint, that is, all the consumption points it can afford. The economy chooses the point on the budget constraint that is tangent to the highest possible indifference curve; this point is shown as $D^1$.

**Figure 1**

*Free Trade Equilibrium for a Small Country*

The country produces at the point on its production frontier that is tangent to a line whose slope equals relative prices, and it consumes at the point on the budget line tangent to the highest possible indifference curve.
Now suppose that the government imposes an ad valorem tariff at a rate $t$. Then the price of food facing both consumers and domestic producers rises to $P_F^*(1 + t)$, and the relative price line therefore gets flatter, with a slope $-P_M^*/[P_F^*(1 + t)]$.

The effect of this fall in the relative price of manufactures on production is straightforward: Output of manufactures falls, while output of food rises. In Figure 2, this shift in production is shown by the movement of the production point from $Q^1$, shown in Figure 1, to $Q^2$.

The effect on consumption is more complicated; the tariff generates revenue, which must be spent somehow. In general, the precise effect of a tariff depends on exactly how the government spends the tariff revenue. Consider the case in which the government returns any tariff revenue to consumers. In this case the budget constraint of consumers is not the line with slope $-P_M^*/[P_F^*(1 + t)]$ that passes through the production point $Q^2$; consumers can spend more than this, because in addition to the income they generate by producing goods, they receive the tariff revenue collected by the government.

How do we find the true budget constraint? Notice that trade must still be balanced at world prices. That is,

$$P_M^* \times (Q_M - D_M) = P_M^* \times (D_F - Q_F),$$

where $Q$ refers to output and $D$ to consumption of manufactures and food. The left-hand side of this expression therefore represents the value of exports at world prices, while the right-hand side represents the value of imports. This expression may be rearranged to show that the value of consumption equals the value of production at world prices:

$$P_M^* \times Q_M + P_F^* \times Q_F = P_M^* \times D_M + P_F^* \times D_F.$$

This defines a budget constraint that passes through the production point $Q^2$, with a slope of $-P_M^*/P_F^*$. The consumption point must lie on this new budget constraint.
Consumers will not, however, choose the point on the new budget constraint at which this constraint is tangent to an indifference curve. Instead, the tariff causes them to consume less food and more manufactures. In Figure 2 the consumption point after the tariff is shown as $D^2$. It lies on the new budget constraint, but on an indifference curve that is tangent to a line with slope $-P_M^*/[P_F^*(1 + t)]$. This line lies above the line with the same slope that passes through the production point $Q^2$; the difference is the tariff revenue redistributed to consumers.

By examining Figure 2 and comparing it with Figure 1, we can see three important points:

1. Welfare is less with a tariff than under free trade. That is, $D^2$ lies on a lower indifference curve than $D^1$.
2. The reduction in welfare comes from two effects. (a) The economy no longer produces at a point that maximizes the value of income at world prices. The budget constraint that passes through $Q^2$ lies inside the constraint passing through $Q^1$. (b) Consumers do not choose the welfare-maximizing point on the budget constraint; thus they do not move up to an indifference curve that is tangent to the economy’s true budget constraint. Both (a) and (b) result from the fact that domestic consumers and producers face prices that are different from world prices. The loss in welfare due to inefficient production (a) is the general equilibrium counterpart of the production distortion loss we described in the partial equilibrium approach in this chapter, and the loss in welfare due to inefficient consumption (b) is the counterpart of the consumption distortion loss.
3. Trade is reduced by the tariff. Exports and imports are both less after the tariff is imposed than before.

These are the effects of a tariff imposed by a small country. We next turn to the effects of a tariff imposed by a large country.

**A Tariff in a Large Country**

To address the large country case, we use the offer curve technique developed in the Online Appendix B to Chapter 6 of *International Economics* and *International Trade*. We consider two countries: Home, which exports manufactures and imports food, and its trading partner, Foreign. In Figure 3, Foreign’s offer curve is represented by $OF$. Home’s offer curve in the absence of a tariff is represented by $OM^1$. The free trade equilibrium is determined by the intersection of $OF$ and $OM^1$, at point 1, with a relative price of manufactures on the world market $(P_M^*/P_F^*)^1$.

Now suppose that Home imposes a tariff. We first ask, how would its trade change if there were no change in its terms of trade? We already know the answer from the small country analysis: For a given world price, a tariff reduces both exports and imports. Thus if the world relative price of manufactures remained at $(P_M^*/P_F^*)^1$, Home’s offer would shift in from point 1 to point 2. More generally, if Home imposes a tariff, its overall offer curve will shrink in toward a curve like $OM^2$, passing through point 2.

But this shift in Home’s offer curve will change the equilibrium terms of trade. In Figure 3, the new equilibrium is at point 3, with a relative price of manufactures $(P_M^*/P_F^*)^2 > (P_M^*/P_F^*)^1$. That is, the tariff improves Home’s terms of trade.
The effects of the tariff on Home’s welfare are ambiguous. On one side, if the terms of trade did not improve, we have just seen from the small country analysis that the tariff would reduce welfare. On the other side, the improvement in Home’s terms of trade tends to increase welfare. So the welfare effect can go either way, just as in the partial equilibrium analysis.

**Figure 3**

*Effect of a Tariff on the Terms of Trade*

The tariff causes the country to trade less at any given terms of trade; thus its offer curve shifts in. This implies, however, that the terms of trade must improve. The gain from improved terms of trade may offset the losses from the distortion of production and consumption, which reduces welfare at any given terms of trade.