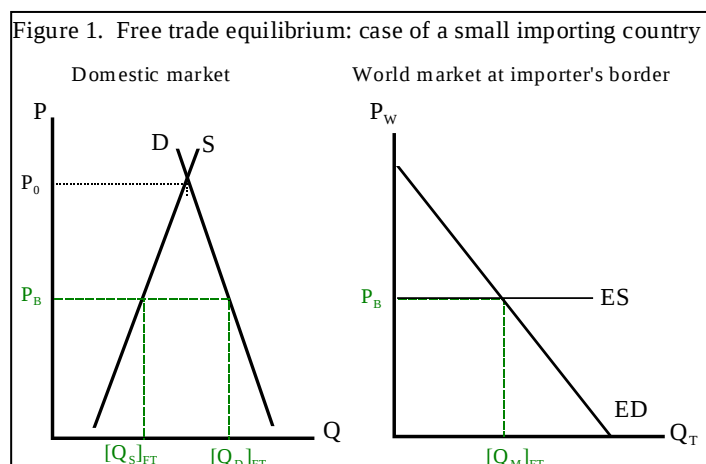


## Modeling tariffs and quotas for a small country

### 1. Free trade equilibrium

Suppose the domestic market of a small-country importer looks as presented in the left panel of figure 1. The internal market situation, i.e., supply (S) and demand (D) determine the closed market (autarky) equilibrium at  $P_0$ . The world price, indicated as  $P_B$  for the border price, is lower than  $P_0$ . That is, the imported good arrives at the border and clears customs costing  $P_B$ , suggests that the country has a cost disadvantage relative to the rest of the world, making it a net importer of the good.



On the right panel of figure 1 is the world market at the importing country's border. The excess demand curve (ED) shows how much the country would import at any price less than  $P_0$ . At  $P_0$ , the country's market is in equilibrium and there would be no need to import, but for any price less than  $P_0$ , the country would be in deficit as D is greater than S. The deficit would be made up by imports.

ES is shown as being horizontal (the case of a small country importer), suggesting that the country is a price taker and is unable to affect the world price. If there was a change in the domestic market (i.e., a change in D or S) causing a change in ED (a shift to the left or right), it would not cause a change in  $P_B$ .

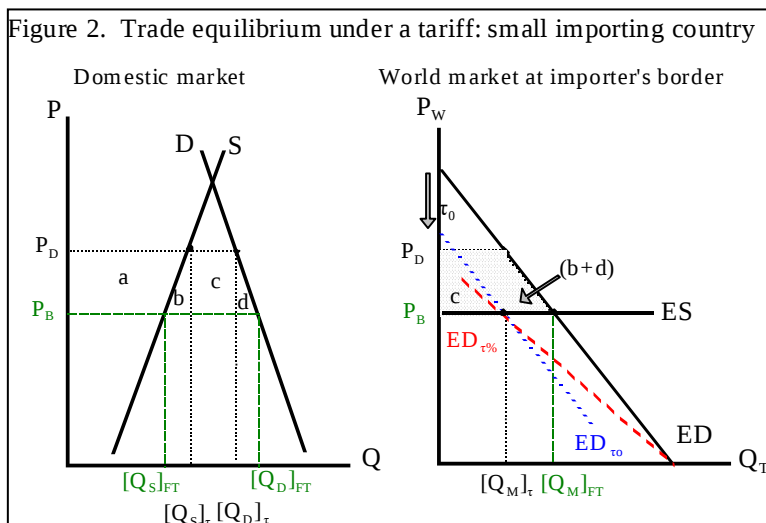
In equilibrium, where ES intersects ED,  $P_B$  shows how much the quantity imported ( $Q_M$ ) would be. In the absence of trade policy (or any violation of the underlying conditions supporting the law of one price),  $P_B$  determines the free trade import volume,  $[Q_M]_{FT}$ .  $P_B$  also determines the quantities demanded and supplied on the domestic market,  $[Q_D]_{FT}$  and  $[Q_S]_{FT}$ , respectively. The deficit on the domestic market, at that price, is the volume of imports, i.e.,  $[Q_D]_{FT} - [Q_S]_{FT} = [Q_M]_{FT}$ .

### 2. Restricted trade equilibrium: case of a tariff

Now, suppose that the importing country's government intends to restrict trade through a tariff. The policymaker's decision is whether to apply a specific or an *ad valorem* tariff. A specific tariff is a per unit tax on imports, e.g., 20 kr/kg on chicken. The *ad valorem* tariff, by contrast, is a tax based on the price of the imported good, e.g., 20% on top of the price of chicken. The tax is applied as the good arrives at the customs point. An invoice will accompany the imported good specifying the product, the volume contained in the shipment, the price, origin of the good, etc. Thus, the customs authorities will be able to apply the appropriate tariff on the shipment.

An import tariff is essentially a choice by the government to affect the country's willingness to import. That is, the intention is to reduce the excess demand. The tax will cause the ED curve to shift to the left. At all import prices, the volume of import will decrease because a tax is being applied on the good at the border.

In figure 2, the cases of both the specific and *ad valorem* tariff are shown relative to the free trade equilibrium (as was presented in figure 1). Take the case of the specific tariff first. The ED curve shifts to the left by the vertical amount of the tax,  $\tau_0$ . It is a parallel shift because everywhere between ED and  $ED_{\tau_0}$  (in blue) the difference is the amount of  $\tau_0$ . The new equilibrium is the intersection of  $ED_{\tau_0}$  and ES. As the country is small, the change in ED has no effect on the world price, but the shift in ED to the left results in a smaller quantity imported,  $[Q_M]_{\tau}$ . The imported good arrives at the customs point at  $P_B$ . Upon arrival, the tax of  $\tau_0$  is applied and the good clears customs costing  $P_B + \tau_0 = P_D$ , the domestic price.



On the domestic market, the higher price reduces the quantity demanded to  $[Q_D]_{\tau}$ , but increases the quantity supplied domestically,  $[Q_S]_{\tau}$ . Thus, the deficit is smaller,  $[Q_D]_{\tau} - [Q_S]_{\tau} = [Q_M]_{\tau}$ .

The case of the *ad valorem* tariff shows an identical equilibrium as in the case of the specific tariff. This was intended for simplification. Had policymakers opted for an *ad valorem* tax, (say it is a rate of 20%, or  $\tau\% = 0,2$ ), then the ED curve would rotate leftwards starting from the point at the intersection of the quantity traded axis rather than as a shift of ED curve to the left. Everywhere between ED and  $ED_{\tau\%}$  (in red) the difference is 20%. As the price of the good increases, the tax magnifies the difference between ED and  $ED_{\tau\%}$ , making it look like a cone. Thus, the size of the opening of the cone increases.

The equilibrium is shown as the intersection of ES and  $ED_{\tau\%}$ . Again, the small country has no effect on the world price but the leftward rotation of the ED curve results in a reduction in imports (because of its higher price on the domestic market). The good arrives at the customs point where the authorities apply the tax. The good is priced at  $P_B$  and  $\tau\%$  is applied, i.e.,  $P_B \cdot (1 + \tau\%)$ . This makes the cost of the imported good  $P_B \cdot (1,2) = P_D$ , where  $P_D$  is 20% higher than when the good arrived at the port.

The *ad valorem* tariff rate chosen results in the same trade effect and economic effect. In both cases, the world price and domestic price are the same, resulting in the same quantity imported, and the same quantities demanded and supplied on the domestic market. The *ad valorem* tariff rate is said to have the equivalent effect of the specific tariff rate. In general, for every specific tariff there is an *ad valorem* tariff rate equivalent that produces the same equilibrium. In both cases, the difference between the domestic price and the world price is the same,  $(P_D - P_B)$ . In the case of the specific tariff the difference is  $\tau_0$ . In the case of the *ad valorem* tariff the difference is the rate  $\tau\%$ ,  $[(P_D - P_B)/P_B]$ .

Since both tariffs are equivalent, the welfare effects will also be the same. In the table below, the welfare effects of the tariffs are summarized. The welfare values correspond with the areas denoted in figure 2.

| Welfare analysis from the tariff |                            |
|----------------------------------|----------------------------|
|                                  | Areas representing welfare |
| $\Delta CS$                      | - (a+b+c+d)                |
| $\Delta PS$                      | + (a)                      |
| $\Delta G$                       | + (c)                      |
| $\Delta NSW$                     | - (b+d)                    |

The change in consumer surplus,  $\Delta CS$ , represents the value lost to consumers from the tax. That value is measured as the area under the demand curve associated with the change in price, the increase from  $P_B$  to  $P_D$ . The lost value equals the area  $(a+b+c+d)$ , indicating that consumers are made worse off by the policy. The tariff has the effect of a consumption tax (paid by consumers).

Producers, on the other hand, are made better off because the protection offers them a price support and raises their incomes. The value to producers, the change in producer surplus,  $\Delta PS$ , represents the

value gained by producers from the policy. This amounts to the area (a). This area is associated with the increased production from the increase in price from  $P_B$  to  $P_D$ . Producers earn more revenue which is greater than the additional cost of producing the increased output, the change from  $[Q_S]_{FT}$  to  $[Q_S]_T$ .

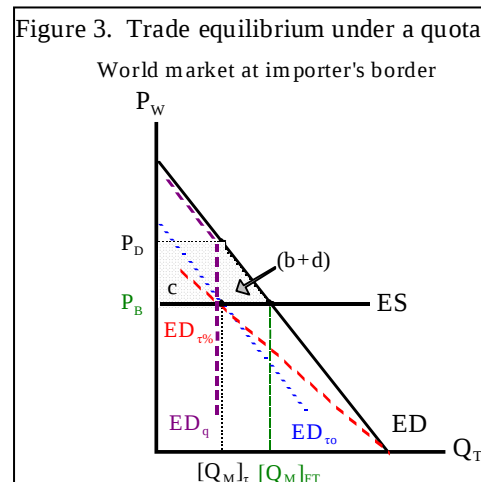
The area (a) is lost by consumers and gained by producers, amounting to an income transfer from consumers to producers. It must have been part of the intention of the policy.

Because the tariff is a tax on imports, it is the government that collects tax revenue. If the tax is specific, then for each unit imported,  $[Q_M]_T$ , a per unit tax is applied ( $\tau_0$ ). The total revenue collected by the government amounts to  $(P_D - P_B) \cdot [Q_M]_T$ , or  $\tau_0 \cdot [Q_M]_T$ . This value is equal to the area (c). If instead the tax was *ad valorem*, the value would be the same. It is calculated as  $P_B \cdot (1 + \tau\%) \cdot [Q_M]_T$ . Since consumers lose the value of area (c) and the government gains this value, this is interpreted as an income transfer from consumers to government. It is the tax on consumption that is collected by the government. This was definitely an intention.

On net, the change in social welfare,  $\Delta NSW$  is negative and equal to the area (b+d) because there is a part of the CS loss that is not transferred to anyone in society. This is referred to as dead-weight losses (DWL). The area (b) is a loss to society for encouraging inefficient production of a good in which the country has a cost disadvantage. Area (d) is related to inefficiency in consumption from the tax.

### 3. Restricted trade equilibrium: case of a quota

The case of a quota, a quantitative restriction on the volume of imports, is presented in figure 3. The right-hand-side panel of figure 2 is modified to include the import quota. The policy decision here is to specify the desired quantity of imports that can enter the country legally. Suppose that the policymaker chooses the import volume  $[Q_M]_T$ . This allows a direct comparison of the resulting equilibrium to that of the tariffs.



The legally binding import volume implies that the government is reducing the country's willingness to

import. The ED curve under a quota,  $ED_q$ , is kinked. It is vertical at the specified quantity of imports,  $[Q_M]_t$ , and continues up until it hits ED. It can follow along the ED curve because the government could be satisfied with a volume of imports that is less than  $[Q_M]_t$ . If imports are less than  $[Q_M]_t$ , then the quota would not be binding (and we would need an explanation for why the quota is not filled). Here, the intention of the policy is to restrict imports to  $[Q_M]_t$ , which is a binding constraint.

Because the quota is binding at  $[Q_M]_t$ , the import volume under the quota is the same as the tariff, so that we can show equivalence between a tariff and a quota. The world price would remain  $P_B$  and the price on the domestic market would increase to  $P_D$  as it does under the tariffs. Thus, the quota has the same trade, economic and welfare effect as the tariffs.

The domestic market is not shown because the domestic price is  $P_D$ , the same as under the tariffs. Thus, the trade, economic and welfare effects are all the same. Only the area (c) has a different interpretation. As this is a quota, it represents quota rents rather than tariff revenue. Depending on how the quota is administered, the quota rents can be earned by the government as a fee sold to traders for the right to import (or licenses that are sold by auction), and/or can be rents that are shared with importers or exporters.