Tariffs are just taxes on trade.

Suppose that good $X$ is imported. Let $p$ denote domestic prices (producer and consumer prices), and let $p^*$ denote world prices.

\[
\frac{p_1}{p_2} = \frac{p_1^*(1 + t)}{p_2^*} \quad \Rightarrow \quad \frac{p_1}{p_2} > \frac{p_1^*}{p_2^*}
\] (18.1)

Bear in mind, however, that trade must balance at world prices. The balance-of-trade constraint, first introduced in Chapter 4, is given by

\[
p_1^*(D_1 - X_1) + p_2^*(D_2 - X_2) = 0 \quad p^* = \frac{(X_2 - D_2)}{(D_1 - X_1)} \quad p^* = \frac{p_1^*}{p_2^*}
\] (18.2)
Graphically, the production and consumption points must be connect by the world price ratio.

What does equilibrium look like? Figure 18.1

(1) The production and consumption points connected by the world price ratio.

(2) The slope of the production frontier and the indifference curve must equal the domestic price ratio.
What are the effects of a tariff in a “small” economy that faces fixed world prices?

Suppose it’s a Heckscher-Ohlin economy.

1. Overall welfare is reduced

2. Production shifts toward the import-competing good.

   By the Stolper-Samuelson theorem, this raises the real return to the factor used intensively in the importing sector, and lowers the real return to the factor used intensively in the export sector.

   Thus the tariff raises the real income of the scarce factor and lowers the real income of the abundant factor.
Two important equivalences

(A) an import tariff on $X_1$ has the same effect as an export tax on $X_2$.

\[
\frac{p_1}{p_2} = \frac{p_1^*}{p_2^*(1 - t)} \quad \frac{p_1}{p_2} > \frac{p_1^*}{p_2^*}
\]  

(B) $p_1 = q_1 = p_1^*(1 + t)$ \quad $p_1 = q_1 > p_1^*$

This point is often confused in policy discussions, where we sometimes hear the view that we should restrict imports and promote exports.

In fact, such a combination of policies cancels out!
Note that an import tariff:

Raises the price that domestic producers of $X_i$ can charge consumers. (producers are happy)

Raises the price that domestic consumers must pay for $X_i$ (consumers are unhappy)

Therefore, a tariff is equivalent to a combined policy of a production subsidy plus consumption tax

This is imported insofar as some anti-trade critics see tariffs as only hurting foreigners.

The same critics probably would not like the thought of a production subsidy. But in fact an import tariff is worse than just subsidizing production, since it also taxes consumption.
Export Subsidy

Suppose again that the country has a comparative advantage in Y and faces fixed world prices.

Well, under the view that exports are a “good thing”, maybe the country should subsidize exports?

Let $s$ be the subsidy rate, so that exporters of Y receive $p_y^*(1+s)$.

$$\frac{p_1}{p_2} = \frac{p_1^*}{p_2^*(1+s)} \quad \frac{p_1}{p_2} < \frac{p_1^*}{p_2^*}$$

(18.4)

The domestic price ratio is flatter than the world price ratio. The domestic production and consumption points must be connected by the world price ratio.

Figure 18.3
Figure 18.3
The subsidy is welfare reducing. It amounts to selling to foreigners below the cost of production.

Exports should not be confused with welfare.

Point of exporting is to allow us to import: buy things that are difficult and costly to produce at home.

18.4 Gains-from-trade with many goods, trade taxes, and subsidies

Let domestic prices be $p^d = p^*(1+t)$, where $p$ refers to any good, an import or export or even non-traded.

But whether or not a positive $t$ is a tax or subsidy, depends on whether the good is an export or an import.
(A) If $X_i$ is imported, $t_i > 0$ is an import tariff, $t_i < 0$ is an import subsidy. This is the case we consider in the first section above.

(B) If $X_i$ is exported, $t_i < 0$ is an export tax, $t_i > 0$ is an export subsidy.

Remember that an export tax lowers the domestic price below the world price, and thus $t_i < 0$ on an export good is a tax as in (18.3).

Stars * denote world prices and superscript ‘a’ denotes autarky. Producers respond to domestic prices, not world prices, so the value of output with trade is maximized at domestic producer prices.

$$\sum_i p_i^*(1 + t_i)X_i^* \geq \sum_i p_i^*(1 + t_i)X_i^a$$  \hspace{1cm} (18.5)
Autarky market clearing and trade balance conditions are the usual

\[ X_i^a = D_i^a \quad \sum_i p_i^* X_i^* = \sum_i p_i^* D_i^* \]  

(18.6)

First, use the first equation in (18.6) to substitute autarky consumption for production on the right-hand side of (18.5).

Second, move the left-hand side of (18.5) over to the right, entering it with a minus sign. Third, add the following to both sides of (1)

\[ \sum_i p_i^* (1 + t_i) D_i^* \]

Inequality (18.5) then becomes
Apply the balance-of-trade constraint in (18.6) to the right-hand term in (18.7) which allows this to be simplified.

Then use the definition of domestic prices to replace the \( p^*(1 + t) \) terms with \( p^d \).

\[
\sum_i p^*_i (1 + t_i) D_i^* \geq \sum_i p^*_i (1 + t_i) D_i^a + \sum_i p^*_i (1 + t_i) (D_i^* - X_i^*) \tag{18.7}
\]

The term on the far right of (18.8) is just total trade tax revenue: taxes minus subsidies. If a good is imported \((D - X) > 0\), then a \( t > 0 \) is a tax. If \( t < 0 \) then it is an import subsidy. Similarly, if the good is exported \((D - X) < 0\), then a \( t < 0 \) is a tax and so forth.

\[
\sum_i p^d_i D^f_i \geq \sum_i p^d_i D^a_i + \sum_i p^*_i t_i (D_i^* - X_i^*) \tag{18.8}
\]
Monopoly power in trade

If a country is large in the market for a good, changes in its imports or exports will change world prices.

This puts the country as a whole (as opposed to individual small firms) in the position of having market power.

This in turn means that the country can improve its welfare by restricting trade which moves prices in its favor.

Country large implies Market power implies Trade restrictions improve its terms of trade

Figure 18.1 (refer back) Figure 18.4 Figure 18.5

OPEC, marketing boards
$M_i$ is the excess demand for good $i$: $M_i > 0$ for an import and we assume that this country imports good 1.

The domestic imports of good 1 are foreign exports, denoted $E_1^*$. We assume that $E_1^*$ is an increasing function of the world price ratio $p^*$.

Let $G(p^*)$ be referred to as the foreign excess supply function (foreign exports of $X_1$ are our imports).

$$M_1 = E_1^* = G(p^*) \quad G' \geq 0 \quad (18.17)$$

Algebra will show that welfare change is given by:

$$dW = (p^* t G' - E_1^*) dp^* \quad (18.27)$$
A tariff forces down the price of the import good, so $dp^* < 0$. Recall also that $E_1^* > 0$ and $G' > 0$.

The first term in (18.27) is called the volume-of-trade effect and contributes negatively to welfare following a tariff increase.

The second term in (18.27) is called the terms-of-trade effect and contributes positively to welfare following a tariff increase.

Figure 18.6

Optimizing with respect to the world price ratio by setting this to zero gives the optimal tariff.

\[
  t^o = \frac{E_1^*}{p^* G'} = \frac{1}{\eta_s^*} \quad \eta_s^* = \frac{p^*}{E_1^*} \frac{dE_1^*}{dp^*} \quad \text{since} \quad G' = \frac{dE_1^*}{dp^*}
\]
Existing Distortion and the theory of the second best

Suppose that there is a positive production externality in the $X_i$ sector. Each firm confirms positive benefits on other firms, benefits than the firm cannot charge for.

The theory of the second-best:

Second best 1: in the present of one (or more) distortions, adding a further distortion that acts to offset the first one can improve welfare.

Second best 2: in the present of more than one distortion, removing one of the distortions can make the country worse off.
The free trade equilibrium is not optimal, and too little $X_1$ is produced. Let $p^*$ denote the (fixed) world price ratio.

$X^*, D^*$ - free trade production and consumption points

$X^t, D^t$ - production and consumption with a tariff on $X_1$

Figure 18.7

But note that a tariff is not the best instrument to use because it introduces a consumption distortion.

A tariff is “third best”; a production subsidy to $X_1$ would be better.
Help out an industry initially, and it will be profitable in the long run.

This is generally wrong. The “social cost” of capital is the same as the private cost in well-functioning markets.

Thus if an investment is privately unprofitable, then it is socially unprofitable as well.

Possible Exceptions

1. positive production externalities
2. coordination failures
3. capital market imperfections

But a production subsidy is generally preferred to an import tariff.
Effective protection

The “standard” tariffs we have been dealing with are now referred to as *nominal protection*: \( t^n \) is the protection offered to the output price.

\[
p = p^* (1 + t^n) \quad t^n = \frac{p - p^*}{p^*}
\]  

(18.29)

Effective protection and specifically the effective tariff \( t^e \) is defined as the protection offered to value added. Consider industry \( i \) and assume that value added is just payments to labor.

Value added is then output price minus the value of purchased inputs of other goods \( X_j \). \( a_{il} \) is the amount of labor needed to produce one unit of \( X_i \) and \( w \) is the wage rate, and \( p^* \)'s give world goods prices.

\[
v_i^* = a_{il} w = p_i^* - \sum_j a_{ij} p_j^*
\]  

(18.30)
Now consider all tariffs on all good, and replace the world prices in (18.30) with tariff-distorted domestic prices.

\[ v_i = a_i^*w = p_i^*(1 + t_i^n) - \sum_j a_{ij}p_j^*(1 + t_j^n) \]  \tag{18.31}

The effective tariff is defined as:

\[ t_i^e = \frac{v_i - v_i^*}{v_i^*} = \frac{p_i^*(1 + t_i^n) - \sum_j a_{ij}p_j^*(1 + t_j^n) - p_i^* + \sum a_{ij}p_j^*}{p_i^* - \sum_j a_{ij}p_j^*} \]  \tag{18.32}

Divide through the numerator and denominator on the right by \( p_i^* \), and use the notation
\[ \frac{a_{ij}p_j^*}{p_i^*} = \sigma_{ij} = \text{share of input } j \text{ in the value of } i \]

The effective tariff rate is then given by

\[ t_i^e = \frac{v_i - v_i^*}{v_i^*} = \frac{(1 + t_i^n) - \sum_j \sigma_{ij}(1 + t_j^n) - 1 + \sum_j \sigma_{ij}}{1 - \sum_j \sigma_{ij}} \quad (18.33) \]

which simplifies to

\[ t_i^e = \frac{v_i - v_i^*}{v_i^*} = \frac{t_i^n - \sum_j \sigma_{ij}t_j^n}{1 - \sum_j \sigma_{ij}} \quad (18.34) \]
First suppose that there is a tariff protecting industry i and all other tariffs are zero. Then the effective tariff exceeds the nominal tariff: $t_i^e > t_i^n$. The protection to value added exceeds the nominal tariff.

Second, assume that all tariffs on all goods are the same $t_i^n = t_j^n \forall j$. In this case, the common tariff rate factors out of (18.34) and the remaining terms in the numerator cancel with the denominator: the effective and nominal rates are equal: $t_i^e = t_i^n$.

Finally, assume that there is no tariff protecting the $X_i$ industry, but that at least one input tariff is positive. In this case, the effective tariff for industry i is *negative*.

Export industries, for example, are (correctly) classified as losing from the tariff system as a whole.
Tariffs versus transport and transactions costs, red tape

Balance of trade

\[ \sum_i p_i^* X_i = \sum_i p_i^* D_i \]  \hspace{1cm} (18.35)

Adding and subtracting terms for tariff revenue, this can be written as

\[ \sum_i p_i^* (1 + t_i)D_i = \sum_i p_i^* (1 + t_i)X_i \hspace{0.5cm} + \hspace{0.5cm} \sum_i p_i^* t_i (D_i - X_i) \]  \hspace{1cm} (18.36)

The tariff-distorted prices \( p^*(1+t) \) are domestic prices, which we can denote by \( p' \), and the last term on the right-hand side of (18.36) is tariff revenue: price times the tax rate times the net import volume.

\[ \sum_i p_i' D_i = \sum_i p_i' X_i \hspace{0.5cm} + \hspace{0.5cm} \text{[tariff revenue]} \]  \hspace{1cm} (18.37)
Suppose instead that there are trade costs. Alternatively, customs’ officials have to be withdrawn from the labor force, and their salaries just exactly exhaust tariff revenues. Tariff revenues = forgone production.

Now let the t’s be transport costs so that consumers must pay the world price plus t for imports (assume exporters earn the world price).

\[ \sum_i p_i^* (1 + t_i) (D_i - X_i) = 0 \quad t_i > 0 \quad \Leftrightarrow \quad (D_i - X_i) > 0 \quad (18.35') \]

\[ \sum_i p_i^* (1 + t_i) D_i = \sum_i p_i^* (1 + t_i) X_i \quad (18.36') \]

\[ \sum_i p_i^t D_i = \sum_i p_i^t X_i \quad (18.37') \]

Figure 18.8
Figure 18.8
1. A trade barrier necessarily reduces national income for a small economy.

2. But some groups generally gain; e.g., owners of factors used intensively in the import-competing sector. This helps explain the politics of protection.

3. An import tariff is equivalent to an export tax, not to an export subsidy.

4. A tariff is equal to a combined policy of a production subsidy and a consumption tax.

5. An export subsidy increases exports, but it is always welfare worsening (in the absence of other distortions).

   An export subsidy involves selling to foreigners for less than the cost of production.
6. Monopoly power in trade by big countries is another possible case for trade restrictions: getting many small producers to act like a single monopoly seller or buyer.

   But this argument is weakened by the likelihood of retaliation by other countries.

7. A tariff may be justified as an additional distortion introduced to counteract an existing distortion. The infant-industry argument may be conceivably be valid in some cases.

   But even then, subsidies are preferred to tariffs, and efforts might be better directed at export industries.

8. The "effective protection" argument is a type of leverage effect on the incomes of specific factor owners, and illustrates why some groups are willing to fight so hard over trade policy.
9. The standard analysis of tariffs assumes that they are costless to collect and that the revenue is costless to redistribute.

If instead the trade cost is a transport cost, or all revenues are needed to pay the wages of tax collectors (who forego productive activity), then the welfare loss is much worse.
TABLE 15.1
Nominal and effective rates of protection in selected industries, United States, Japan, and Republic of Korea

<table>
<thead>
<tr>
<th>Industry</th>
<th>United States</th>
<th>Japan</th>
<th>Republic of Korea</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NRP (%)</td>
<td>ERP (%)</td>
<td>NRP (%)</td>
</tr>
<tr>
<td>Agriculture</td>
<td>1.80</td>
<td>1.91</td>
<td>18.40</td>
</tr>
<tr>
<td>Food products</td>
<td>4.70</td>
<td>10.18</td>
<td>25.40</td>
</tr>
<tr>
<td>Wearing apparel</td>
<td>23.70</td>
<td>43.30</td>
<td>13.80</td>
</tr>
<tr>
<td>Wood products</td>
<td>1.70</td>
<td>1.72</td>
<td>0.30</td>
</tr>
<tr>
<td>Chemicals</td>
<td>2.40</td>
<td>3.66</td>
<td>4.80</td>
</tr>
<tr>
<td>Iron and steel</td>
<td>3.60</td>
<td>6.18</td>
<td>2.80</td>
</tr>
<tr>
<td>Electrical machinery</td>
<td>4.40</td>
<td>6.34</td>
<td>4.30</td>
</tr>
<tr>
<td>Transport equipment</td>
<td>2.50</td>
<td>1.94</td>
<td>1.50</td>
</tr>
</tbody>
</table>


A second observation is that many developing countries have arranged their protective structures so that effective tariffs are far higher than published tariffs. In part, this is an attempt to foster growth in domestic manufacturing through a regime of import-substituting industrialization. Again, the goal is to promote domestic output of final goods by escalating tariffs on the inputs. This policy is often accompanied by a deliberate overvaluation of the domestic currency, done in part to discourage exports of primary products in favor of keeping primary goods at home for use in manufacturing import-competing goods. On occasion, these protection levels can be extraordinary. For example, it was estimated that in 1969, Argentina had nominal tariff rates of 63 percent on finished textiles and 76 percent on woodworking industries. However, the associated effective rates of protection, accounting for trade barriers, taxes, and the exchange-rate regime, amounted to 832 percent and 1,308 percent, respectively.11

To provide further perspective, Table 15.1 presents recent nominal tariff rates and estimates of effective protection rates in the United States, Japan, and the Republic of Korea. It can be seen that all countries heavily protect wearing apparel, while Japan and Korea strongly protect their agricultural sectors. Indeed, the costs of agricultural protection in Korea are so high that the food products industry is effectively taxed, despite an 11.7 percent nominal tariff.

15.7 GAINS FROM TRADE WITH MANY GOODS, TRADE TAXES, AND SUBSIDIES

Up to this point, we have focused mainly on a simple model in which there are only two goods. Results of the analysis suggest that an import tariff reduces welfare relative to free trade but still leaves welfare greater than or equal to the autarky level. An import or export subsidy, however, has the potential of making the country worse off relative to autarky.

Can we say anything about a country that trades many goods, some of which are taxed and some of which are subsidized? It turns out that there is in fact a very simple condition for gains from trade: if net trade tax revenue (the sum of all import and export tax revenues minus trade subsidy payments) is positive, then the country is better off than in autarky. Another way of saying this is that if trade is, on average, taxed more than it is subsidized, then there are still gains from trade.

Suppose that there are n goods, \((X_1, \ldots, X_n)\), with fixed world prices \((p_1, \ldots, p_n)\) (although the argument easily generalizes to a large economy) and corresponding domestic prices \((p_1, \ldots, p_n)\). Domestic and world prices are related by \(p_i = p_i^a(1 + t_i)\). If good i is imported, then a positive \(t_i\) is an import tariff and a negative \(t_i\) is an import subsidy. If good i is exported, then a positive \(t_i\) is an export subsidy and a negative \(t_i\) is an export tax (e.g., if the world price is higher than the domestic price \((t_i < 0)\), then \(t_i\) is a export tax).

Domestic producers optimize with respect to domestic prices. In a competitive economy, this means that the value of production at domestic prices in (distorted) trade is greater than or equal to the value of autarky production at these same prices. Let superscript \(d\) denote quantities in tax/subsidy distorted trade and superscript \(a\) denote autarky quantities. Subscripts \(p\) and \(c\) denote production and consumption quantities as before. Competitive equilibrium is characterized by

\[
\sum_{i=1}^{n} p_i^a(1 + t_i)X_i^p = \sum_{i=1}^{n} p_i^d(1 + t_i)X_i^d
\]

Equation (15.10) can be rearranged as

\[
\sum_{i=1}^{n} p_i^dX_i^p = \sum_{i=1}^{n} p_i^aX_i^p + \sum_{i=1}^{n} p_i^a t_i (X_i^p - X_i^d)
\]

The balance-of-trade condition and the autarky market-clearing condition are given by

\[
\sum_{i=1}^{n} p_i^dX_i^c = \sum_{i=1}^{n} p_i^aX_i^c = X_i^a
\]

Substituting Eq. (15.12) into Eq. (15.11), the latter becomes

\[
\sum_{i=1}^{n} p_i^dX_i^c = \sum_{i=1}^{n} p_i^aX_i^c + \sum_{i=1}^{n} p_i^a t_i (X_i^p - X_i^d)
\]

A welfare comparison of distorted-trade versus autarky consumption must, however, be done at domestic prices. By adding and subtracting several terms to both sides of the equation, Eq. (15.13) becomes

\[
\sum_{i=1}^{n} p_i^d(1 + t_i)X_i^c = \sum_{i=1}^{n} p_i^a(1 + t_i)X_i^c + \sum_{i=1}^{n} p_i^a t_i [(X_i^c - X_i^d) - (X_i^a - X_i^c)]
\]

(15.14)