

**Public Affairs 856**  
**Trade, Competition, and**  
**Governance in a Global Economy**  
**Lecture 16**  
**3/13/2017**

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**UW Madison**  
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# Export Policies in Resource and High-Technology Industries

1. **Export Subsidies in a Large Home Country**
2. **Production Subsidies**
3. **Export Tariffs**
4. **Export Quotas**
5. **High-Technology Export Subsidies**

# Introduction

On July 21, 2008, representatives of the 152 countries belonging to the WTO met in Geneva, Switzerland to discuss reforms of the world trading system. Like earlier meetings it was marked by large-scale protests.

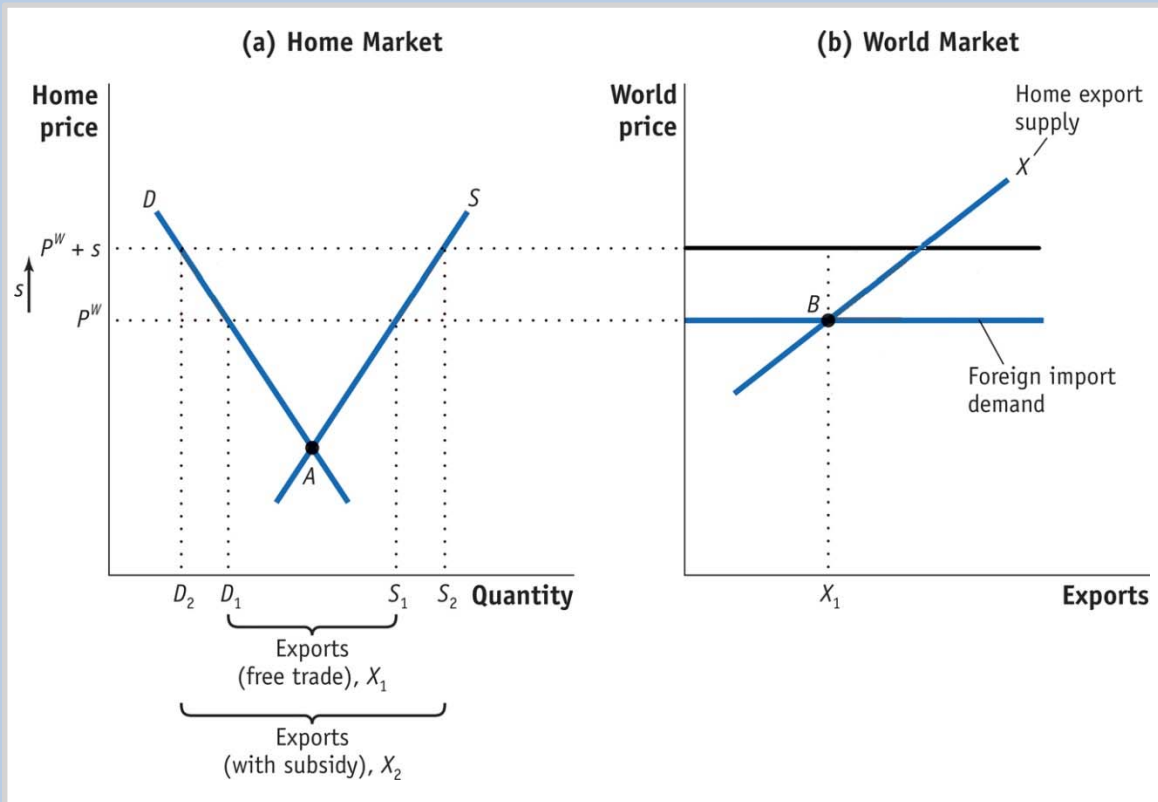


- The first goal of this chapter is to explain subsidy policies that effect resource-based industries and high-tech industries.
- The second goal of this chapter is to explain the effect of two policies, **export tariffs** and **export quotas**, on the countries that use them.
- The third goal of the chapter is to examine how export subsidies can be used strategically by governments to bolster domestic companies and industries.

## 2 Export Subsidies in a Small Home Country

### Impact of an Export Subsidy

FIGURE 10-1 (1 of 2) Export Subsidy for a Small Country



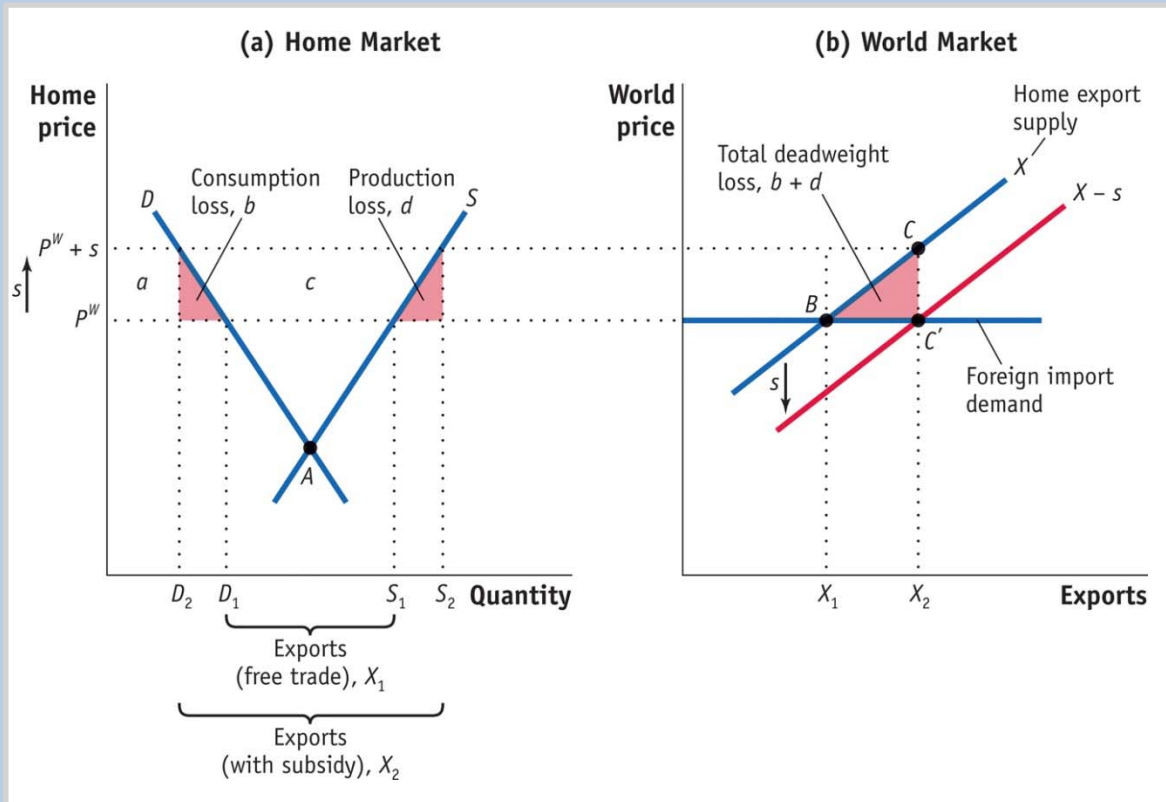
Applying a subsidy of  $s$  dollars per unit exported will increase the price that Home exporters receive from  $P^W$  to  $P^W + s$ .

As a result, the domestic price of the similar good will also rise by that amount. This price rise leads to an increase in Home quantity supplied from  $S_1$  to  $S_2$  and a decrease in Home quantity demanded from  $D_1$  to  $D_2$ , in panel (a).

## 2 Export Subsidies in a Small Home Country

### Impact of an Export Subsidy

FIGURE 10-1 (2 of 2) Export Subsidy for a Small Country (continued)



Exports rise as a result of the subsidy, from  $X_1$  to  $X_2$  in panel (b).

The Home export supply curve shifts down by exactly the amount of the subsidy since the marginal cost of a unit of exports decreases by exactly  $s$ .

As in the case of a tariff, the **deadweight loss** as a result of the subsidy is the triangle  $(b + d)$ , the sum of consumer loss  $b$  and producer loss  $d$ .

## 2 Export Subsidies in a Small Home Country

### Impact of an Export Subsidy

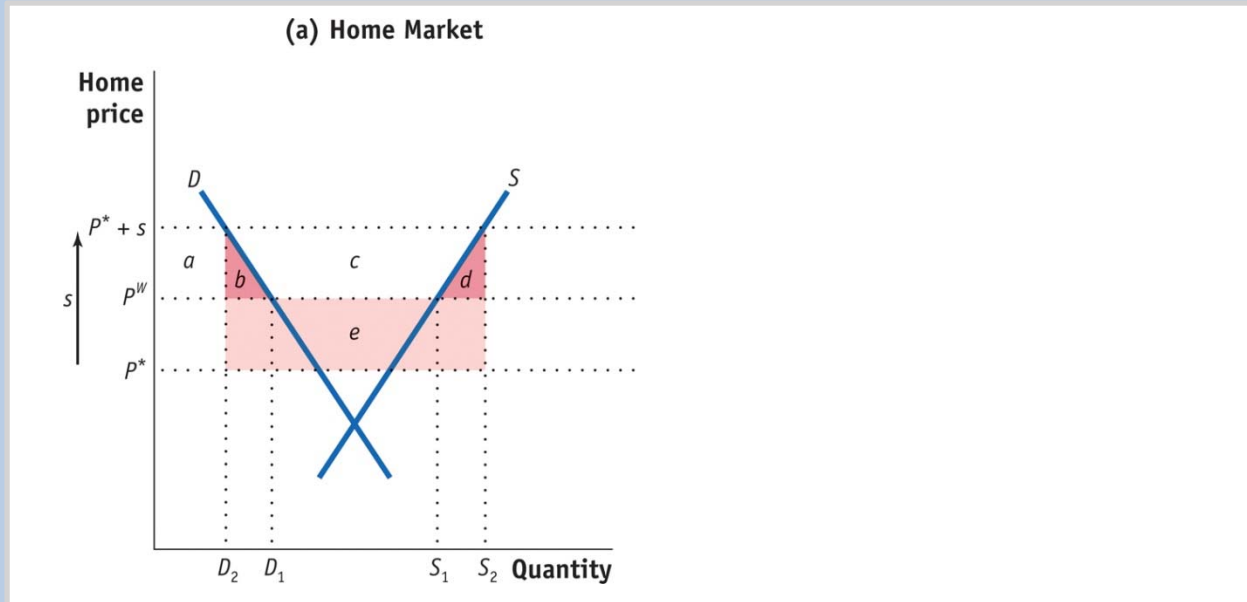
#### Impact of the Subsidy on Home Welfare

- The rise in Home price lowers consumer surplus by the amount  $(a + b)$ .
- The price increase raises producer surplus by the amount  $(a + b + c)$ .
- The export subsidy costs the government  $s$  per unit exported, shown by the area  $(b + c + d)$ .
- The triangle  $(b + d)$  is the net loss or deadweight loss due to the subsidy in a small country.

# 3 Export Subsidies in a Large Home Country

## Effect of the Subsidy

FIGURE 10-2 (1 of 2) Export Subsidy for a Large Country



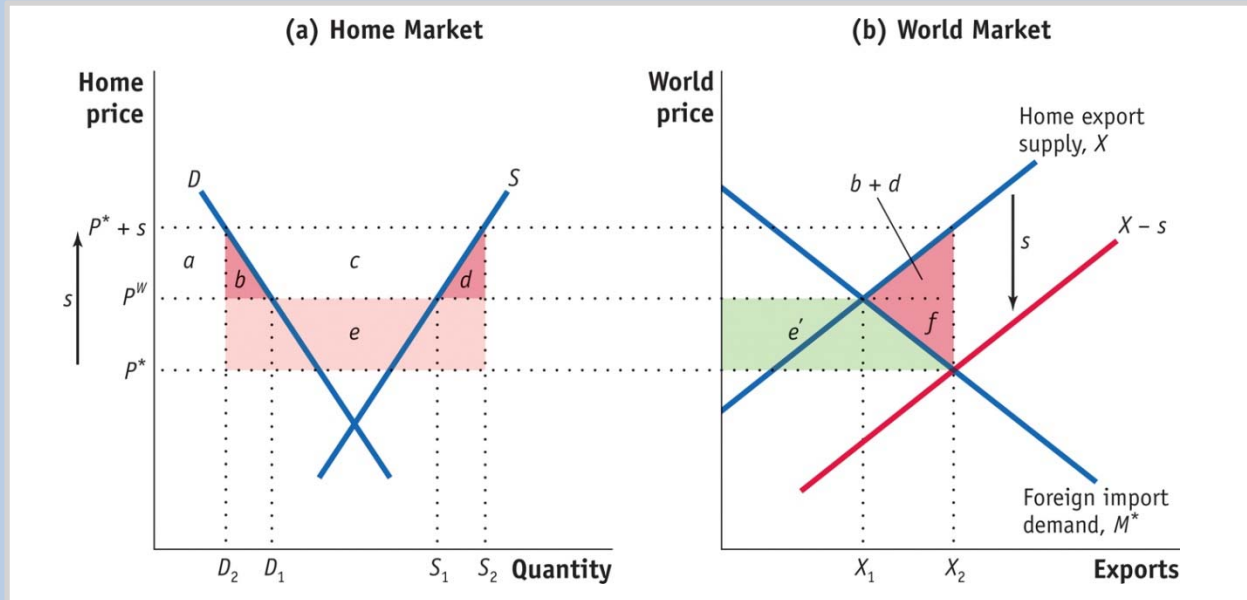
Panel (a) shows the effects of the subsidy at Home. The Home price increases from  $P^W$  to  $P^* + s$ , Home quantity demanded decreases from  $D_1$  to  $D_2$ , and Home quantity supplied increases from  $S_1$  to  $S_2$ .

The deadweight loss for Home is the area of triangle  $(b + d)$ , but Home also has a terms-of-trade loss of area  $e$ .

### 3 Export Subsidies in a Large Home Country

#### Effect of the Subsidy

FIGURE 10-2 (2 of 2) Export Subsidy for a Large Country (continued)



In the world market, the Home subsidy shifts out the export supply curve from  $X$  to  $X - s$ , reflecting the lower marginal cost of exports. As a result, the world price falls from  $P^W$  to  $P^*$ .

The Foreign country gains the consumer surplus area  $e'$ , so the world deadweight loss due to the subsidy is the area  $(b + d + f)$ . The extra deadweight loss  $f$  arises because only a portion of the Home terms-of-trade loss is a Foreign gain.



### 3 Export Subsidies in a Large Home Country

#### Effect of the Subsidy

#### Home Welfare

- The increase in the Home price from  $P^W$  to  $P^* + s$  reduces consumer surplus by the amount  $(a + b)$  and increases producer surplus by the amount  $(a + b + c)$ .
- Due to the terms-of-trade effect, the revenue cost of the subsidy to the government is the area  $(b + c + d + e)$ , which equals  $s \cdot X_2$ . The net effect on welfare is  $-(b + d + e)$ ,

#### Foreign and World Welfare

- While there is a terms-of-trade gain of  $e'$  for the foreign country there is still an overall deadweight loss for the world, measured by the area  $(b + d + f)$ .

## Slide 9

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**J.Baker4** The Notes under this slide are the same as the notes under slide 9. Accurate?  
JNB, 7/17/2014

## 4 Production Subsidies

Suppose the government provides a subsidy of  $s$  dollars for *every unit* that a Home firm produces. This is a **production subsidy** because it is a subsidy to every unit produced and not just to units that are exported.

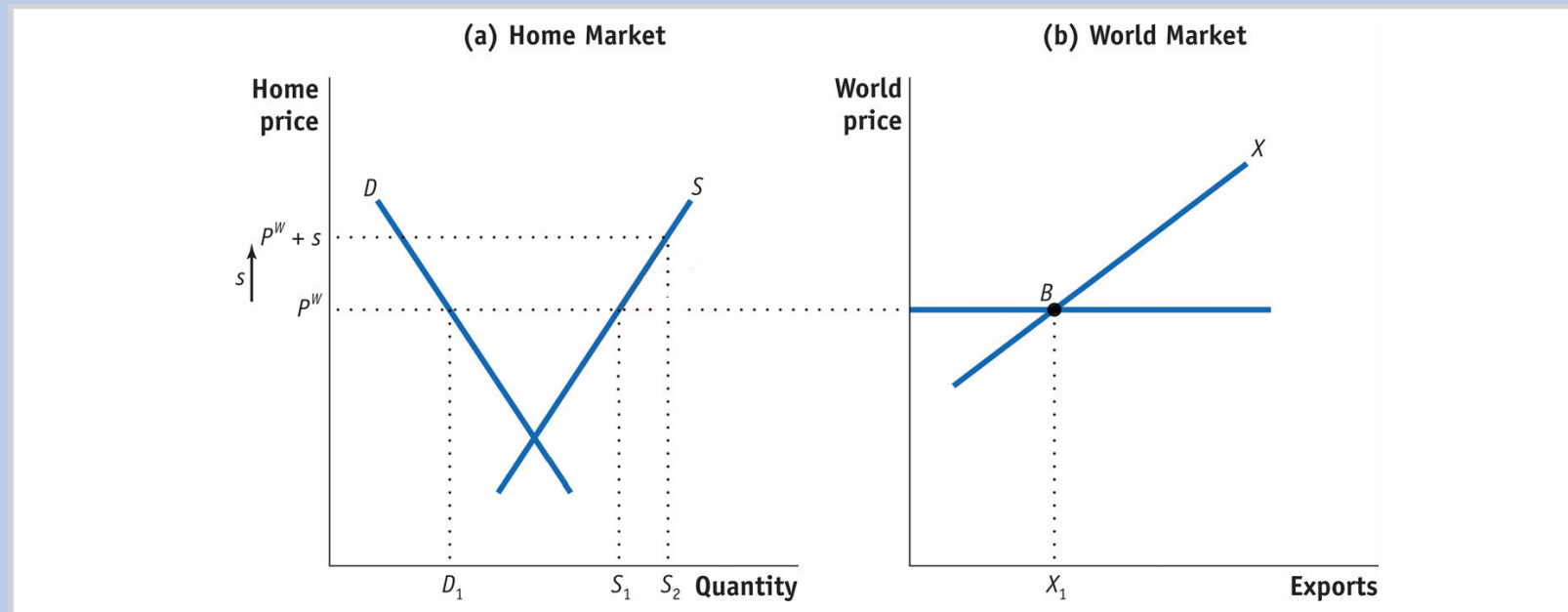
There are several ways that a government can implement such a subsidy.

- The government might guarantee a minimum price to the farmer, and make up the difference between the minimum price and any lower price for which the farmer sells.
- Alternatively, it might provide subsidies to users of the crop to purchase it, thus increasing demand and raising market prices; this would act like a subsidy to every unit produced.

## 4 Production Subsidies

### Effect of a Production Subsidy in a Small Home Country

FIGURE 10-4 (1 of 2) Production Subsidy for a Small Country

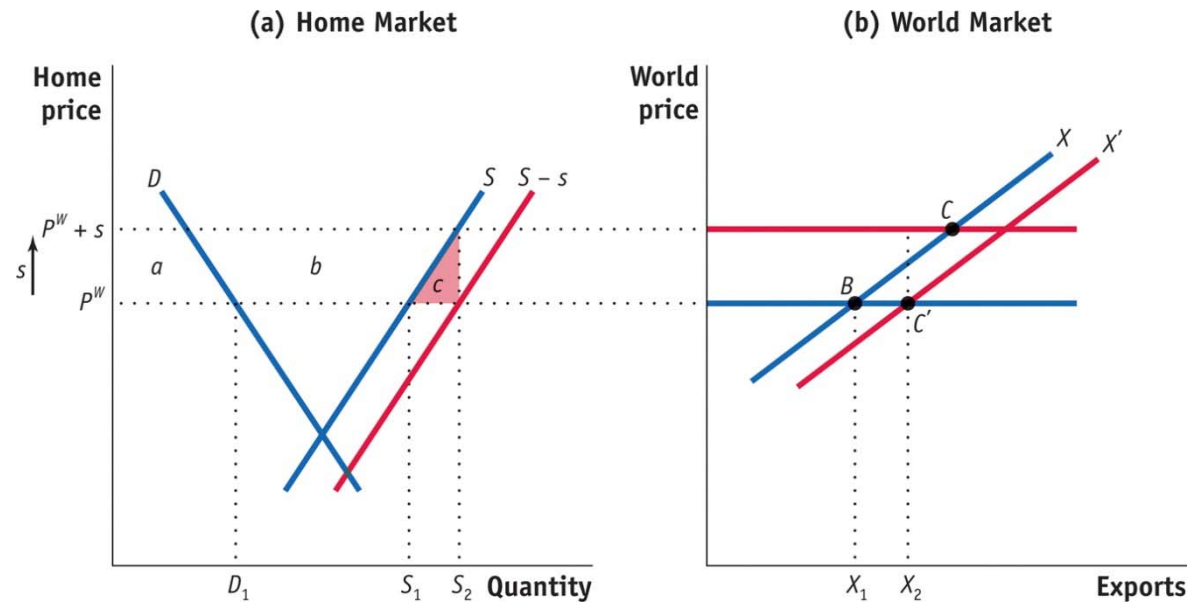


In panel (a), applying a production subsidy of  $s$  dollars per unit produced will increase the price that Home firms receive from  $P^W$  to  $P^W + s$ . This price rise leads to an increase in Home quantity supplied from  $S_1$  to  $S_2$ . The consumer price at Home is not affected because the production subsidy does not distinguish between items sold at Home or exported (firms therefore continue to charge the world price at Home), so the quantity demanded stays at  $D_1$ .

# 4 Production Subsidies

## Effect of a Production Subsidy in a Small Home Country

FIGURE 10-4 (2 of 2) Production Subsidy for a Small Country (continued)



The deadweight loss of the subsidy for a small country is the area  $c$ . In panel (b), exports rise as a result of the production subsidy, from  $X_1$  to  $X_2$ , though the increase in exports is less than for the export subsidy because, for the production subsidy, quantity demanded does not change at Home.

## 4 Production Subsidies

### Effect of a Production Subsidy in a Small Home Country

#### Targeting Principle

Our finding that the deadweight loss is lower for the production subsidy makes it a better policy than the export subsidy to increase Home supply. This finding is an example of the **targeting principle**: *to achieve some objective, it is best to use the policy instrument that achieves the objective most directly.*

There are many examples of using a targeting principle in economics:

- Taxes on cigarettes and gasoline.
- To use an example from this book, it is better to provide trade adjustment assistance directly to those affected, than to impose a tariff or quota.

# 4 Production Subsidies

## Effect of a Production Subsidy in a Large Home Country

Figure 10-1 (b) World Market

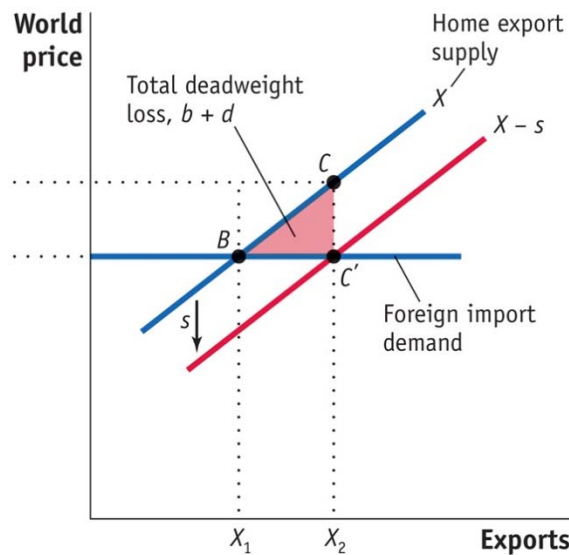
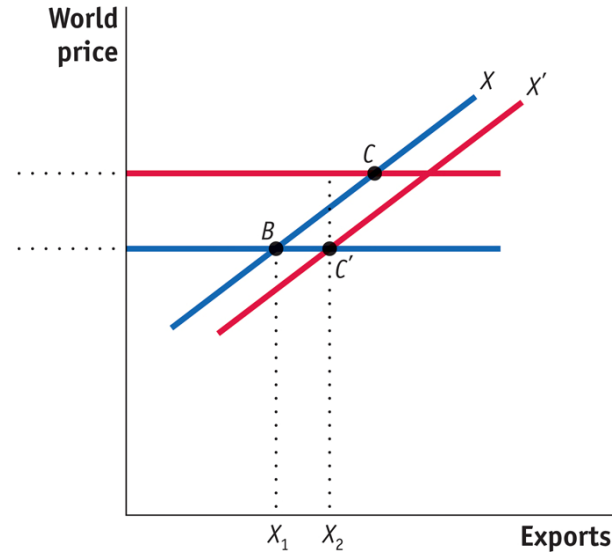


Figure 10-4 (b) World Market



- Notice that the rise in the quantity of exports due to the production subsidy, from point  $B$  to  $C'$  in Figure 10-4, is *less than* the increase in the quantity of exports for the export subsidy, from point  $B$  to  $C'$  shown in Figure 10-1.
- With the export subsidy, the price for Home producers *and* consumers rose to  $P^W + s$ , so exports increased because of both the rise in quantity supplied and the drop in quantity demanded.

# 4 Production Subsidies

## Effect of a Production Subsidy in a Large Home Country

Figure 10-1 (b) World Market

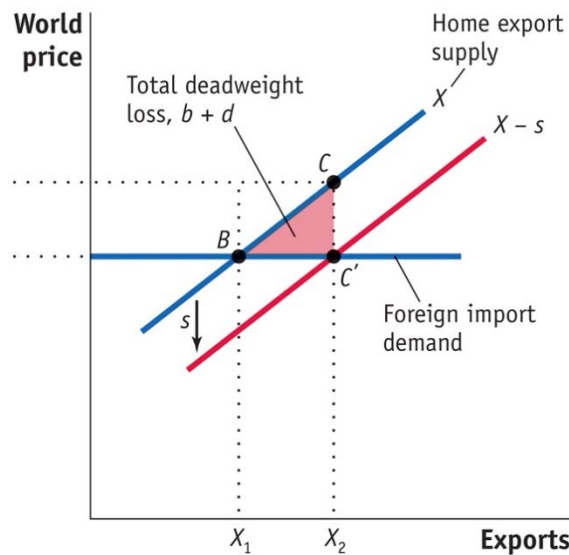
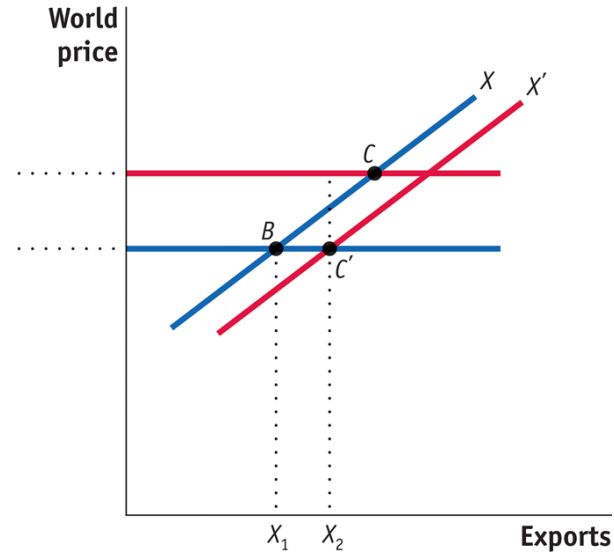


Figure 10-4 (b) World Market



- As a result, the export subsidy shifted the Home export supply curve down by exactly the amount  $s$  in Figure 10-1.
- In contrast, with a production subsidy, exports rise only because Home quantity supplied increases so that export supply shifts down by an amount less than  $s$  in Figure 10-4.



## 4 Production Subsidies

### Effect of a Production Subsidy in a Large Home Country

Figure 10-1 (b) World Market

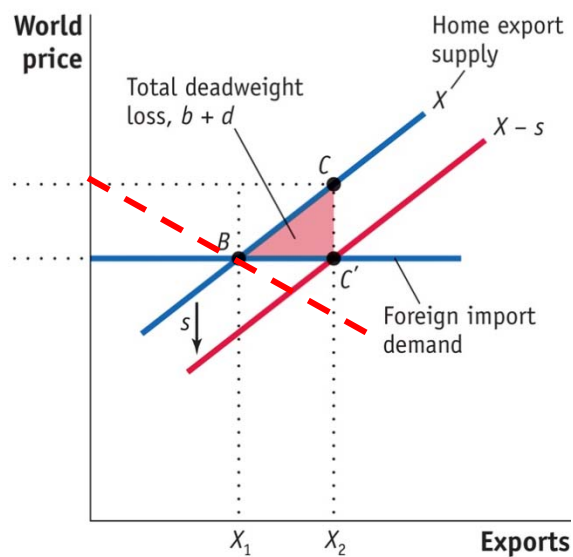
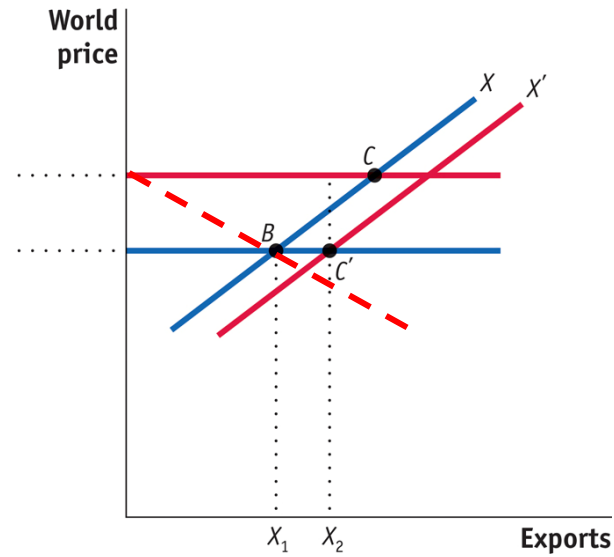


Figure 10-4 (b) World Market



- If we drew a downward-sloping Foreign import demand curve in panel (b), then the increase in supply as a result of the production subsidy would lower the world price.
- But that drop in world price would be *less than* the drop that occurred with the export subsidy because the increase in exports under the production subsidy is less.

## **5 Export Tariffs**

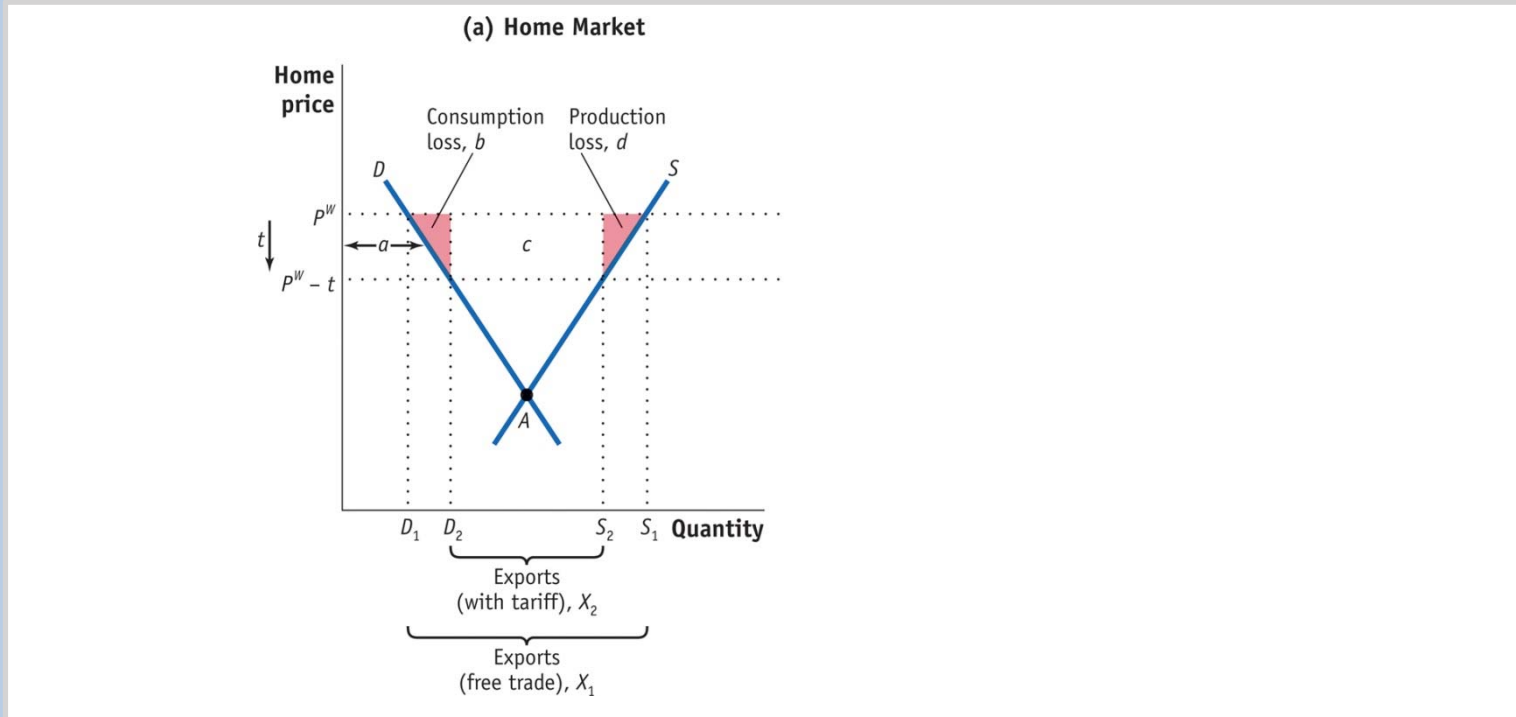
Export and production subsidies are not the only policies that countries use to influence trade in certain products. Some countries apply export tariffs—which are taxes applied by the exporting country when a good leaves the country.

- We will look at how export tariffs affect the overall welfare of the exporting country, taking into account the effects on consumers, producers, and government revenue.
- We start with the case of a small exporting country, facing fixed world prices.
- Following that, we look at how the outcome differs when the country is large enough to affect world prices.

# 5 Export Tariffs

## Impact of an Export Tariff in a Small Country

FIGURE 10-5 (1 of 2) Export Tariff for a Small Country

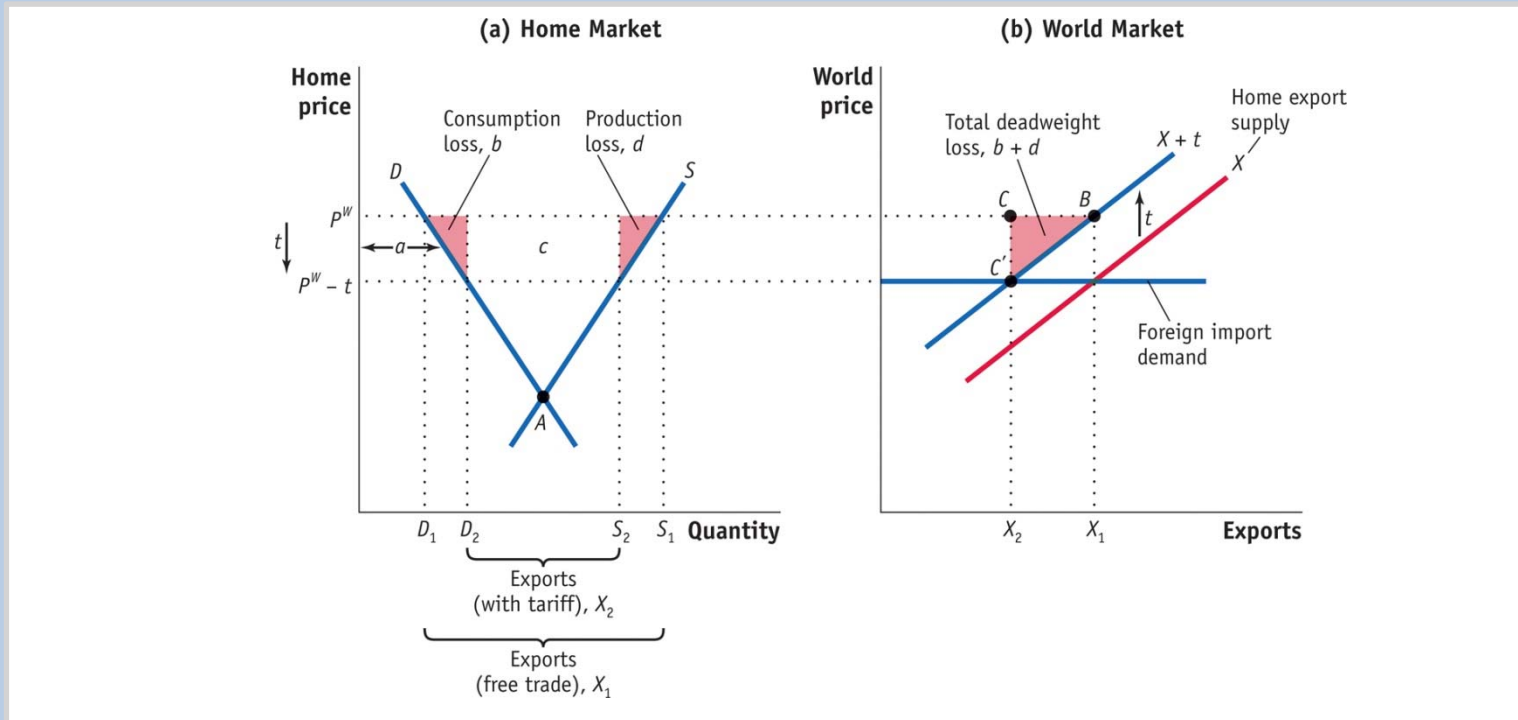


Panel (a): Applying an export tariff of  $t$  pesos per unit exported decreases the price that Home exporters receive from  $P^W$  to  $P^W - t$ . As a result, the domestic price of the similar good also falls by that amount. This price fall leads to a decrease in Home quantity supplied from  $S_1$  to  $S_2$ , and an increase in Home quantity demanded from  $D_1$  to  $D_2$ , in panel (a).

# 5 Export Tariffs

## Impact of an Export Tariff in a Small Country

FIGURE 10-5 (2 of 2) Export Tariff for a Small Country (continued)



Panel (b): The Home export supply curve shifts up by the amount of the tariff because the marginal cost of a unit of exports increases by exactly  $t$ . The deadweight loss due to the subsidy is the triangle  $(b + d)$ , the sum of the **consumption loss  $b$**  and **production loss  $d$** .

## 5 Export Tariffs

### Impact of an Export Tariff in a Small Country

#### Impact of the Export Tariff on Small Country Welfare

- Since the Home price falls because of the export tariff, consumers benefit. The rise in consumer surplus is shown by area  $a$ .
- Producers are worse off, however, and the fall in producer surplus is shown by the amount  $(a + b + c + d)$ .
- The government collects revenue from the export tariff, and the amount of revenue equals the amount of the tariff  $t$  times exports of  $X_2$ , area  $c$ .

Rise in consumer surplus:  $+ a$

Fall in producer surplus:  $- (a + b + c + d)$

Rise in government revenue:  $+ c$

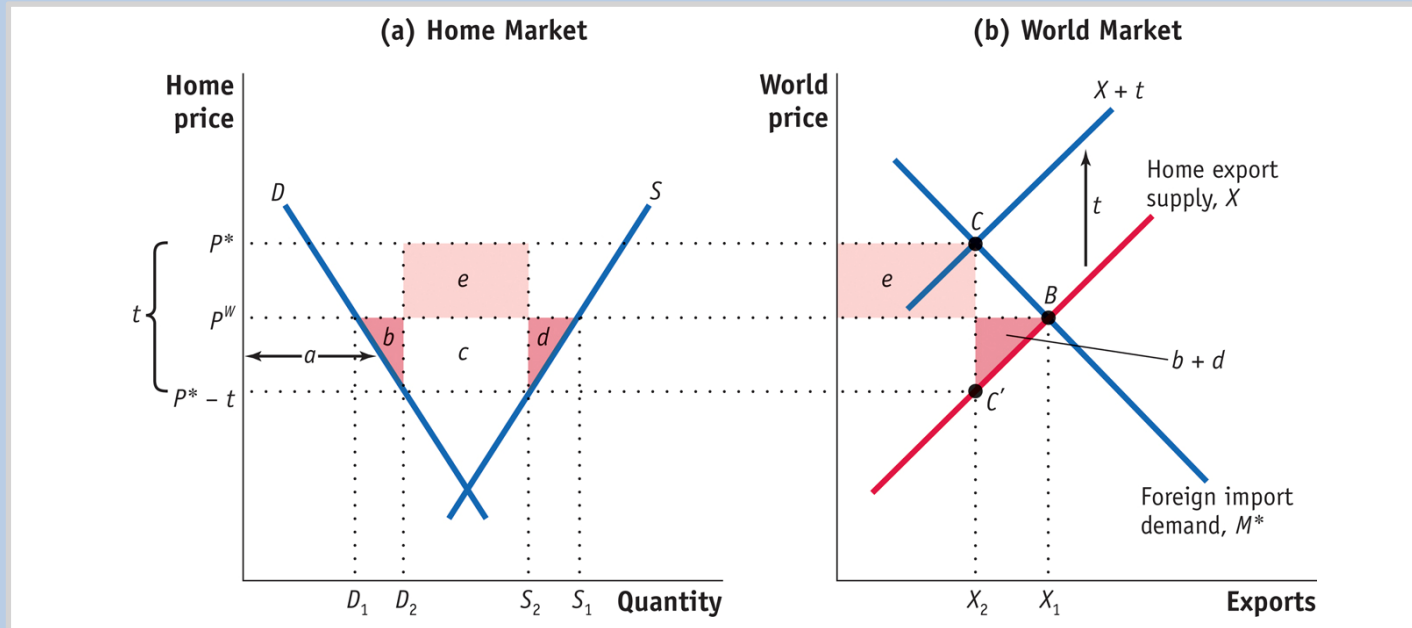
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**Net effect on Home welfare:  $- (b + d)$**

# 5 Export Tariffs

## Impact of an Export Tariff in a Large Country

FIGURE 10-6



**Export Tariff for a Large Country** The tariff shifts up the export supply curve from  $X$  to  $X + t$ , in panel (b). As a result, the world price increases from  $P^W$  to  $P^*$ . This increase in the world price is less than the upward shift in export supply of  $t$ . The Home price decreases from  $P^W$  to  $P^* - t$ , in panel (a). Home quantity demanded increases from  $D_1$  to  $D_2$ , and Home quantity supplied decreases from  $S_1$  to  $S_2$ . The deadweight loss for Home is the area of triangle  $(b + d)$ . Because world price rises from  $P^W$  to  $P^*$ , Home also has a terms-of-trade gain of area  $e$ .

## 5 Export Tariffs

### Impact of an Export Tariff in a Large Country

#### Impact of the Export Tariff on Large Country Welfare

- Since the Home price falls because of the export tariff, consumers benefit. The rise in consumer surplus is shown by area  $a$ .
- Producers are once again worse off, and the fall in producer surplus is shown by the amount  $(a + b + c + d)$ .
- The revenue the government collects from the export tariff equals the amount of the tariff  $t$  times exports of  $X_2$ , by area  $(c + e)$ .

Rise in consumer surplus:  $+ a$

Fall in producer surplus:  $- (a + b + c + d)$

Rise in government revenue:  $+ (c + e)$

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**Net effect on Home welfare:  $e - (b + d)$**

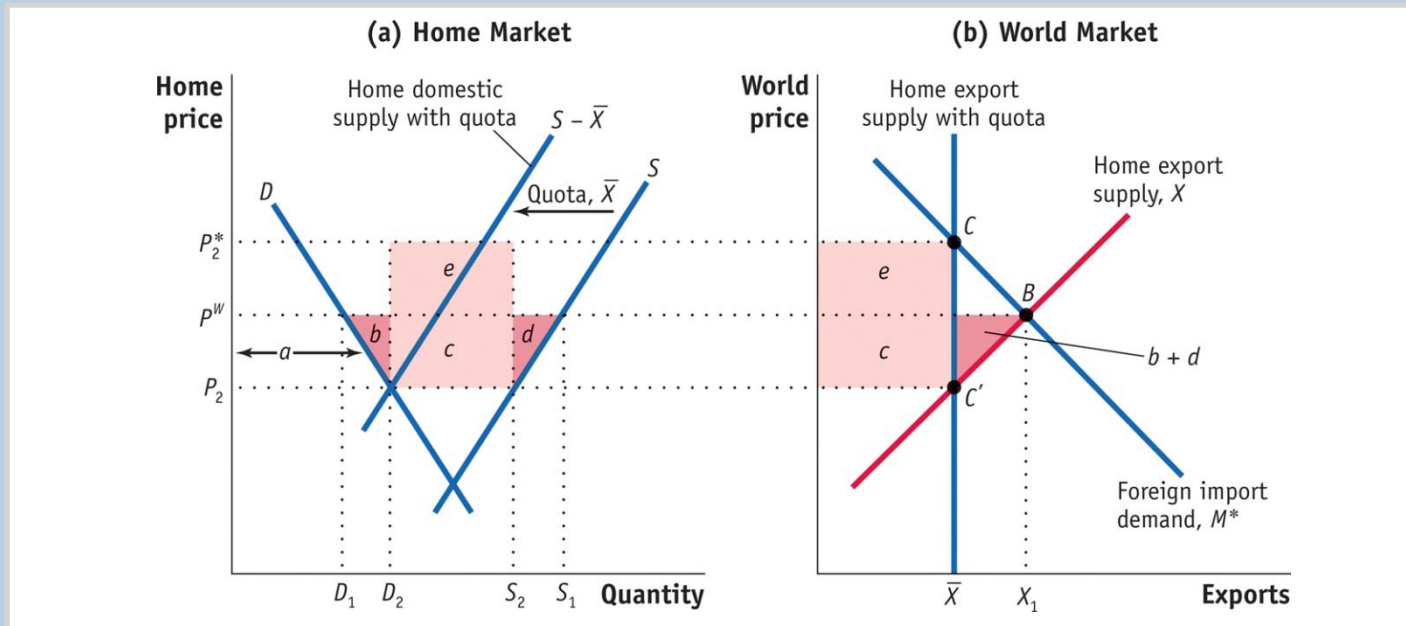
## 6 Export Quotas

- There is one other export policy that also benefits the large country applying it: an export quota, which is a limit on the amount that firms are allowed to export.
- The most well-known system of export quotas in the world today is the system used by the Organization of Petroleum Exporting Countries (OPEC).
- OPEC sets limits on the amount of oil that can be exported by each country, and by limiting oil exports in this way, it keeps world petroleum prices high.
- Those high prices benefit not only OPEC's member countries, but also other oil-exporting countries that do not belong to OPEC.



# 6 Export Quotas

FIGURE 10-7



**Export Quota for a Large Country** The export quota leads to a vertical export supply curve above the quantity  $\bar{X}$  in panel (b). The world price increases from  $P^W$  to  $P_2^*$ . Because Home firms can export only the amount  $\bar{X}$ , the remaining home supply curve shifts left by that amount, as shown by  $S - \bar{X}$ . This remaining Home supply intersects Home demand at the price  $P_2$  in panel (a), which is lower than the initial world price of  $P^W$ . This increase in the world price is less than the upward shift in export supply of  $t$ . The deadweight loss for Home is the area of triangle  $(b + d)$ , while Home firms earn the quota rents of area  $(c + e)$ .

## 6 Export Quotas

Let's compare the welfare effects of the export quota with those of the export tariff.

- Home consumers gain the same amount of consumer surplus  $a$  due to lower domestic prices.
- If producers earned the lower price of  $P_2$  on *all* their quantity sold, as with the export tariff, then they would lose  $(a + b + c + d)$  in producer surplus.
- Under the export quota they also earn rents of  $(c + e)$  on exports, which offsets the loss in producer surplus. These rents equal the difference in prices,  $P_2^* - P_2$ , times the amount exported  $\bar{X}$ .
- The overall effect of the export quota on the Home welfare is the same as the export tariff, with a net effect on welfare of  $e - (b + d)$ .

## APPLICATION

### Chinese Export Policies in Mineral Products

China uses a wide variety of export policies, including tariffs and quotas to its exports of mineral products.

- In 2009, the United States and other countries filed a case against China at the WTO, charging that the export tariffs and quotas that China applied on many industrial minerals distorted the pattern of international trade.
- While export restrictions of this type are banned under Article XI of the GATT, there is an exception stating that this rule does not apply to “*export prohibitions or restrictions temporarily applied to prevent or relieve critical shortages of foodstuffs or other products essential to the exporting contracting party.*”

## **7 High-Technology Export Subsidies**

Governments subsidize high-technology industries because they may create benefits that spill over to other firms in the economy.

That is, governments believe that high-tech industry produces a positive **externality**.

This argument for a subsidy is similar to the infant industry argument used to justify protective tariffs.

## 7 High-Technology Export Subsidies

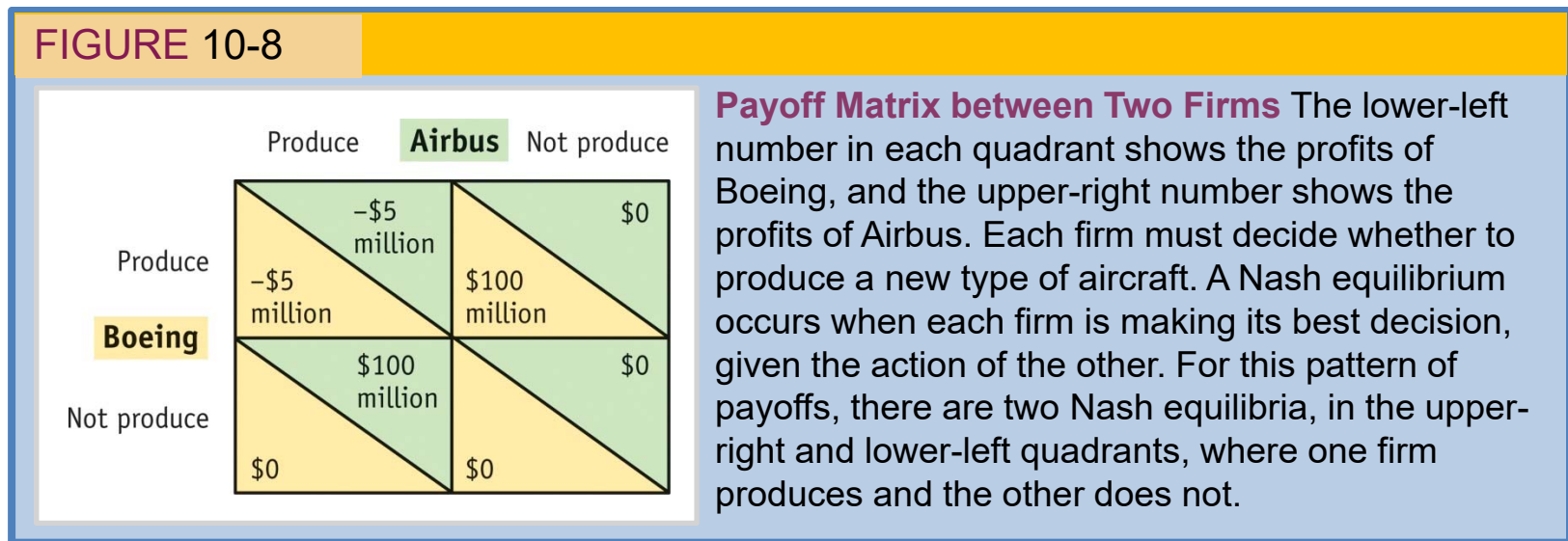
### “Strategic” Use of High-Tech Export Subsidies

- In addition to the spillover argument, governments and industries also argue that export subsidies might give a **strategic advantage** to export firms that are competing with a small number of rivals in international markets.
- To examine whether countries can use their subsidies strategically, we use the assumption of **imperfect competition**.
- Now we allow for two firms in the market, which is called a **duopoly**.
- To capture the strategic decision making of two firms, we use **game theory**, the modeling of strategic interactions (games) between firms as they choose actions that will maximize their returns.

## 7 High-Technology Export Subsidies

### “Strategic” Use of High-Tech Export Subsidies

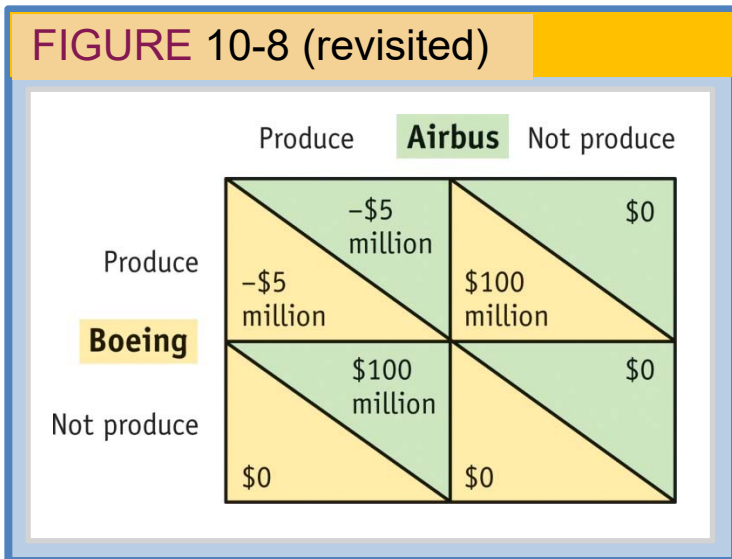
**Payoff Matrix** In Figure 10-8, we show a **payoff matrix** for Boeing and Airbus, each of which has to decide whether to produce the new aircraft.



**Nash Equilibrium** The idea of a **Nash equilibrium** is that each firm must make its own best decision, taking as given each possible action of the rival firm. When each firm is acting that way, the outcome of the game is a Nash equilibrium. The action of each player is the best possible response to the action of the other player.

# 7 High-Technology Export Subsidies

## “Strategic” Use of High-Tech Export Subsidies

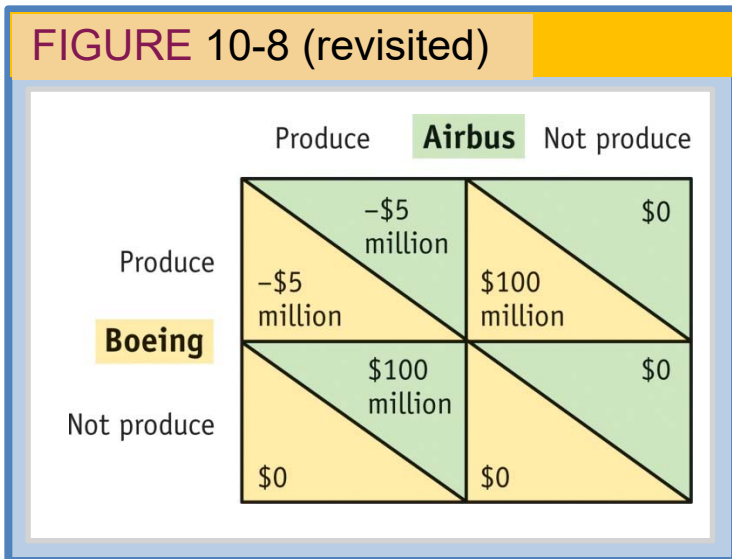


**Best Strategy for Boeing** If Airbus produces, then Boeing is better off *not* producing. This finding proves that having both firms produce is not a Nash equilibrium. Boeing would never stay in production, since it prefers to drop out of the market whenever Airbus produces.

**Best Strategy for Airbus** The decision illustrated in the lower-left quadrant, with Airbus producing and Boeing not producing, is a Nash equilibrium because each firm is making its best decision given what the other is doing.

# 7 High-Technology Export Subsidies

## “Strategic” Use of High-Tech Export Subsidies



**Multiple Equilibria** The upper-right quadrant, with Boeing producing and Airbus not producing, is *also* a Nash equilibrium. When Boeing produces, then Airbus’s best response is to not produce, and when Airbus does not produce, then Boeing’s best response is to produce.

When there are two Nash equilibria, there must be some force from outside the model that determines in which equilibrium we are. An example of one such force is the **first mover advantage**, which means that one firm is able to decide whether or not to produce before the other firm.



# 7 High-Technology Export Subsidies

## Effect of a Subsidy to Airbus

FIGURE 10-9

		Airbus	
		Produce	Not produce
Boeing	Produce	-\$5 million / \$20 million (Boeing profit / Airbus profit)	\$100 million / \$0 (Boeing profit / Airbus profit)
	Not produce	\$0 / \$125 million (Boeing profit / Airbus profit)	\$0 / \$0 (Boeing profit / Airbus profit)

**Payoff Matrix with Foreign Subsidy** When the European governments provide a subsidy of \$25 million to Airbus, its profits increase by that much when it produces a new aircraft. Now there is only one Nash equilibrium, in the lower-left quadrant, with Airbus producing but Boeing not producing. The profits for Airbus have increased from 0 to \$125 million, while the subsidy cost only \$25 million, so there is a net gain of \$100 million in European welfare.

**Best Strategy for Airbus** With the subsidy, Airbus now earns \$20 million by producing instead of losing \$5 million.

**Best Strategy for Boeing** Boeing will want to drop out of the market. Once Boeing makes the decision not to produce, Airbus's decision doesn't change.

# 7 High-Technology Export Subsidies

## Effect of a Subsidy to Airbus

FIGURE 10-9 (revisited)

		Airbus	
		Produce	Not produce
Boeing	Produce	-\$5 million / \$20 million (Boeing profit / Airbus profit)	\$100 million / \$0 (Boeing profit / Airbus profit)
	Not produce	\$0 / \$125 million (Boeing profit / Airbus profit)	\$0 / \$0 (Boeing profit / Airbus profit)

**Payoff Matrix with Foreign Subsidy** When the European governments provide a subsidy of \$25 million to Airbus, its profits increase by that much when it produces a new aircraft. Now there is only one Nash equilibrium, in the lower-left quadrant, with Airbus producing but Boeing not producing. The profits for Airbus have increased from 0 to \$125 million, while the subsidy cost only \$25 million, so there is a net gain of \$100 million in European welfare.

**Nash Equilibrium** The lower-left quadrant is a unique Nash equilibrium: each firm is making its best decision, given the action of the other. It is the only Nash equilibrium.

**European Welfare**

Rise in producer surplus:	+ 125
Fall in government revenue:	- 25
<hr/>	
<b>Net effect on European welfare:</b>	<b>+ 100</b>

# 7 High-Technology Export Subsidies

## Subsidy with Cost Advantage for Boeing

FIGURE 10-10 Another Payoff Matrix, with Boeing Cost Advantage

		Airbus	
		Produce	Not produce
Boeing	Produce	\$5 million, -\$5 million	\$125 million, \$0
	Not produce	\$0, \$100 million	\$0, \$0

If Boeing has a cost advantage in the production of aircraft, the payoffs are as shown here. Boeing earns profits of \$5 million when both firms are producing and profits of \$125 million when Airbus does not produce. Now there is only one Nash equilibrium, in the upper-right quadrant, where Boeing produces and Airbus does not.

# 7 High-Technology Export Subsidies

## Subsidy with Cost Advantage for Boeing

**FIGURE 10-11** Another Payoff Matrix with Foreign Subsidy

		<b>Airbus</b>	
		Produce	Not produce
<b>Boeing</b>	Produce	\$20 million \$5 million	\$0 \$125 million
	Not produce	\$125 million \$0	\$0 \$0

When the European governments provide a subsidy of \$25 million to Airbus, its profits increase by that much when it produces. Now the only Nash equilibrium is in the upper-left quadrant, where both firms produce.

The profits for Airbus have increased from 0 to \$20 million, but the subsidy costs \$25 million, so there is a net loss of \$5 million in European welfare

**Slide 35**

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**J.Baker5** Notes for this slide are the same as the notes for the previous one. Retain?  
JNB, 7/17/2014

## APPLICATION

### **Subsidies to Commercial Aircraft**

Subsidies for the large commercial aircraft industry include:

1. indirect subsidies that arise in the production of civilian and military aircraft; direct subsidies for R&D,
2. and subsidies of the interest rates that aircraft buyers pay when they borrow money to purchase aircraft.

If both firms stay in the market and are subsidized by their governments, then it is unlikely that the subsidies are in the national interest of either the United States or the European Union; instead, the countries purchasing the aircraft gain because of the lower price, while the United States and Europe lose as a result of the costs of the subsidies.