LECTURE 8
TAXATION AND THE INCOME DISTRUBUTION

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You may want to review the following problems:
Finals
Winter 1995, Question 3
Spring 1995, Question 1
Fall 1995, Question 3
Winter 1996, Question 3
Spring 1996, Question 5
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I. INTRODUCTION

How do taxes affect the distribution of income? By using the term "distribution of income," we mean who wins and loses from a tax. Assessing this question is not as simple as asking who pays for the tax legally. If the government imposes tax on sellers of cigarettes, for example, but the tobacco firm raises prices, the firm does not "bear" the full burden of the tax. Instead, part of the tax is shifted onto the consumers of cigarettes.

Statutory incidence: who is legally responsible for the tax.

Economic incidence: who really pays for the tax. The economic incidence is the change in the distribution of income brought about by the tax. The economic incidence may differ from the statutory incidence because the tax might be "shifted."

One example might be helpful in thinking about these two concepts. If the government imposed a tax on all brands of cigarettes, and taxed the firms, it might be easy for the firms to pass this tax increase onto consumers because cigarettes are inelastically demanded -- it is unlikely that smokers will either quit or find a good substitute. In this case, the statutory incidence would be on the firms, but the consumers bear most of the tax. On the other hand, suppose the government imposed a tax on only one brand of cigarettes. Because the cross-price elasticity between cigarette brands is likely to be quite high, consumers can easily switch if the price for only one brand increased. Thus, the firm would have difficulty in raising its price, and the statutory incidence would be similar to the economic incidence.

II. TAX INCIDENCE: GENERAL REMARKS

A. Only people can bear taxes

- "Business paying its fair share" does not have much meaning in tax incidence. Taxes are borne by people: stockholders, workers, landlords, firms, and consumers.

B. Both sources and uses of income should be considered

- consumers, clearly, can be hurt through tax increase
- factors of production, such as laborers, might suffer as well.

We will usually focus on either input or output market, but this focus is only appropriate if there are not spillovers.

C. Incidence Depends on How Prices are Determined

Different models give different price changes to the same tax. For example, an anticipated tax on cigarettes gives a very different price path than an unanticipated tax increase. The competitiveness of the market matters, too. The tax incidence in a monopolistic setting differs from that of a competitive setting.

D. Incidence Depends on how the money is spent

- Balanced budget incidence: analyzes the combined effect of levying tax and spending the money. For example, taxing the poor and spending the money on public housing projects generates different incidence that spending the money on golf courses.
- Differential tax incidence: Ignores how the government spends the money, and simply examines how incidence of one tax differs from another.

III. PARTIAL EQUILIBRIUM MODELS

Partial equilibrium models of price determination: models that look only at the market in which the tax is imposed and ignore the ramifications in other markets.

A. Per-Unit tax

A per-unit tax is a fixed tax per unit of commodity sold. Key step: *in presence of a tax, the price paid by consumers and the price received by suppliers differ.*

Suppose that the statutory incidence is on the consumer. How does the tax affect the demand schedule? It shifts it downward, parallel to the old demand curve. Recall that the demand curve is the maximum willingness to pay for

the next unit of the good. But now producers do not receive the full amount, instead only the price minus the tax. *The shifted demand curve is the one that is now perceived by the suppliers.*

Example: suppose initially market for cigarettes is:

$$Q^D = 100 - 2P$$
$$Q^S = 20 + 2P$$

Initially equilibrium is at $P = 20, Q = 60$.

And now we slightly modify this framework ...

The government imposes a per unit tax of $8 per cigarette smokers. This tax creates a wedge between the price the smoker pays and the price the tobacco firm receives. We can rewrite the above demand and supply curves as:

$$Q^D = 100 - 2P^D$$
$$Q^S = 20 + 2P^S$$
$$P^D = P^S$$

Before the tax, $P^D = P^S$. In equilibrium,
$Q^D = Q^S \Rightarrow 100 - 2P^D = 20 + 2P^S \Rightarrow P = 20.$

After an $8 per unit tax is imposed on the smokers, the price the tobacco firm receives is 8 dollars less than the price the consumer pays. Thus,
$P^D - 8 = P^S \Rightarrow 100 - 2P^D = 20 + 2(P^D - 8) \Rightarrow P^D = 24, P^S = 16, Q = 52$

Graphically,

***** SEE FIGURE 8-1, 8-2, 8-3 8-4, 8-5, 8-6 *****

In this instance the tobacco firm absorbs half of the $8 tax: it used to receive $20, and now it receives $16. The price facing the smoker does not increase by the full $8; instead only $4. The tax raises $416 in revenue.

Is there deadweight loss from imposing this tax?

Exercise: what if the government imposed the tax of $8 per unit on the tobacco firm instead of the smoker? In this case, the "effective supply curve" shifts inward. Calculate the prices and quantities in this case.

Comment #1: the economic incidence of a per-unit tax is independent of whether it is levied on consumers or producers.

The same per unit tax above, levied on firms gives the exact same prices and quantity. The difference in prices paid and received is known as the "tax wedge."

More generally, a tax J levied on consumers shifts down the demand curve as perceived by the firm: $P^S = P^D - \tau$. The same tax J levied on firms shifts up the supply curve as perceived by the consumers: $P^D = P^S + \tau$. Clearly these two equations lead to the same answers.

Comment #2: the incidence of a tax depends on the elasticities of supply and demand.

Consider two sets of $8 per-unit taxes on the demanders, with the same demand curve, but let the slope of the supply curve vary: one supply curve is steeper (more inelastic) than the other. The share of the tax paid by consumers increases in the second case, with more elastic supply.

- Generally, the more elastic the demand curve, the less of the tax borne by consumers, ceteris paribus. The more elastic the supply curve, the less of the tax borne by producers, ceteris paribus. The intuition is that the elasticity represents a person's sensitivity to price. Sensitivity to price is a measure of the person's ability to escape the tax.

Comment #3: subsidies are simply "negative taxes."

Comment #4: With per-unit taxes and subsidies on demanders and suppliers, the relationship becomes

$$P^D - \tau^D + s^D = P^S + \tau^S - s^S$$

where P^D=price demanders pay, τ^D=per unit tax imposed on demanders, s^D=per unit subsidy imposed on demanders, P^S=price received by suppliers, τ^S=per unit tax imposed on suppliers, and s^S=per unit subsidy imposed on suppliers. Thus a per unit subsidy of $8 per unit on demanders, along with an $8 per unit tax imposed on suppliers yields identical answers to no taxes or subsidies at all.

Example 1

Suppose that the market for child immunizations is characterized by the following supply and demand curves:

$$Q^S = 12 + 2P$$
$$Q^D = 150 - P$$

a. Suppose that the government decides it wants parents to immunize their children, so imposes a per-unit subsidy of $15 on the demanders of immunizations. After the subsidy is imposed, what is:

- the price that consumers pay
- the price that producers receive
- the total expenditure by the government
- the equilibrium quantity

Note that before the subsidy, $P = 46, Q = 104$. Intuitively, a subsidy should increase demand for the good. The subsidy creates a wedge between the prices consumers pay and firms receive. The wedge is equal to: $P^S = P^D + 15$. That is, the demand curve (as perceived by the firm) is higher than before. First, substitute this equation into the supply curve: $Q^S = 12 + 2(P^D + 15) = 42 + 2P^D$. The set supply equal to demand: $42 + 2P^D = 150 - P^D$. This gives $P^D = 36, P^S = 51, Q = 114$. The government spends $sQ = 1710$.

Graphically,

***** SEE FIGURE 8-7, 8-8 *****

b. Calculate the deadweight loss from this subsidy.

Since there was no mention of externalities, we can assume that the quantity the private market provides is the socially optimal level. After the subsidy, there is "too much" of this good. $DWL = \frac{1}{2}(114 - 104)15 = 75$.

c. As an alternative to the proposal of the $15 subsidy for demanders, suppose that the government offered a per-unit subsidy of $5 to demanders and a per-unit subsidy of $10 to suppliers. Calculate the price that consumers pay, the price that producers receive, the total expenditure by the government, and the equilibrium quantity.

The numbers will be exactly the same as before -- on paper the subsidy appears to be different, but the economic incidence is the same.

d. (True or False, define the underlined term) While the statutory incidence of a $15 subsidy on the demanders *or* a $15 tax on the suppliers differs, the economic incidence is the same because both policies lead to identical equilibrium quantities, producer prices and consumer prices.

First, the statutory incidence is who legally bears the tax. But the statement is false, because a tax leads to different economic incidence than a subsidy. That is, a $15 subsidy on suppliers or demanders leads to the same conclusions, but this is not what the question asked. If the question had asked whether a $15 subsidy leads to the same conclusions as a $10 subsidy, the answer is clearly "no." A tax is simply a negative subsidy -- thus, does a $15 subsidy lead to the same conclusions as a -$15 subsidy? A tax would shift the demand or supply curve inward (and reduce Q), while a subsidy would shift the demand or supply curve outward (and increase Q).

B. Ad Valorem Taxes

In real-life, most taxes are not "per-unit" taxes (although taxes on cigarettes are per-unit taxes). Instead, most taxes are a fraction of the price, known as "ad-valorem" taxes. Sales taxes are a good example of this.

Now instead of moving the demand curve down by the same absolute amount for each quantity, the ad valorem tax lowers it in the same *proportion.* Graphically:

***** SEE FIGURE 8-9 *****

Unlike a per-unit tax, which shifts the demand curve downward by a fixed amount, with an ad-valorem tax it shifts by a proportional amount.

An ad-valorem tax J^D levied on consumers leads to the "effective" demand curve of: $P^S = (1 - \tau^D)P^D$. An ad-valorem tax J^S levied on firms shifts up the supply curve as perceived by the consumers: $P^D = (1 + \tau^S)P^S$. In this case, an equal ad-valorem tax on suppliers or demanders does not lead to the same answer -- if the tax on demanders was 25 %, the equivalent tax on suppliers would be 33%:

$$\tau^D = 0.25 \Rightarrow P^S = (1 - \tau^D)P^D = 0.75P^D \Rightarrow P^D = \left(\frac{1}{0.75}\right)P^S = (1 + .\overline{3})P^S \Rightarrow \tau^S \approx 0.33.$$

Example 2

Suppose the cigarette market is characterized by the following demand and supply curves:

$$Q^D = 200 - 4P$$
$$Q^S = 50 + P$$

a. Suppose the government imposes a $25 *per-unit* tax per on the smokers of cigarettes. What price does the cigarette smoker pay after the tax? How much money does the government raise?

The effective demand curve is shifted inward: $P^S = P^D - 25$. Thus, $200 - 4P^D = 50 + (P^D - 25) \Rightarrow P^D = 35, P^S = 10, Q = 60$. The revenue raised is $25*60=$1500.

b. What is the statutory incidence of the tax in part (a)? What is its economic incidence?

The statutory incidence falls 100% on the demanders. Since the original price was $P = 30 \Rightarrow \frac{(35-30)}{35} = 20\%$ of the economic incidence falls on the demanders.

c. Evaluate the following statement: "If the government imposed a $15 per unit tax on smokers and a $15 per unit tax on firms, this combination would produce exactly the same deadweight loss as the tax proposed in part (a)."

False. If the initial tax had been $30, the deadweight loss would be the same. The deadweight loss is smaller with the $25 tax than with the new scheme.

d. Instead, suppose the government imposes a 25% *ad-valorem* tax on the smokers of cigarettes. What price does the cigarette firm receive after this tax? What price does the consumer pay after this tax?

Now, $P^S = (1-0.25)P^D = 0.75P^D$. Thus $200 - 4P^D = 50 + (0.75P^D) \Rightarrow P^D \approx \$31.57$. The cigarette firm receives $P^S = (1-0.25)P^D \approx \$23.68$.

e. Suppose the government imposes a $25 *per-unit* tax on the suppliers of cigarettes. What price does the cigarette smoker pay after the tax? How much money does the government raise?

The economic incidence is the same as in part (a), where the per-unit tax was levied on smokers rather than the firms.

f. Evaluate the following statement: "If the government imposed a $15 per unit tax on smokers and a $10 per unit subsidy on firms, this combination would produce exactly the same deadweight loss as the tax proposed in part (a)."

False, this is equivalent to a $5 per unit tax, not a $25 per unit tax.

g. Does a 40 % *ad-valorem* tax on producers has the same economic incidence as a 40 % *ad-valorem* tax on consumers.

No, it does not. A 40 % ad-valorem tax on producers corresponds to a tax of roughly 29 % on consumers.

$$P^D = (1+0.40)P^S \Rightarrow P^S = \frac{1}{(1+0.40)}P^D \Rightarrow P^S \approx 0.71P^D = (1-0.29)P^D \ .$$

C. Taxes on factors of production: Labor and capital

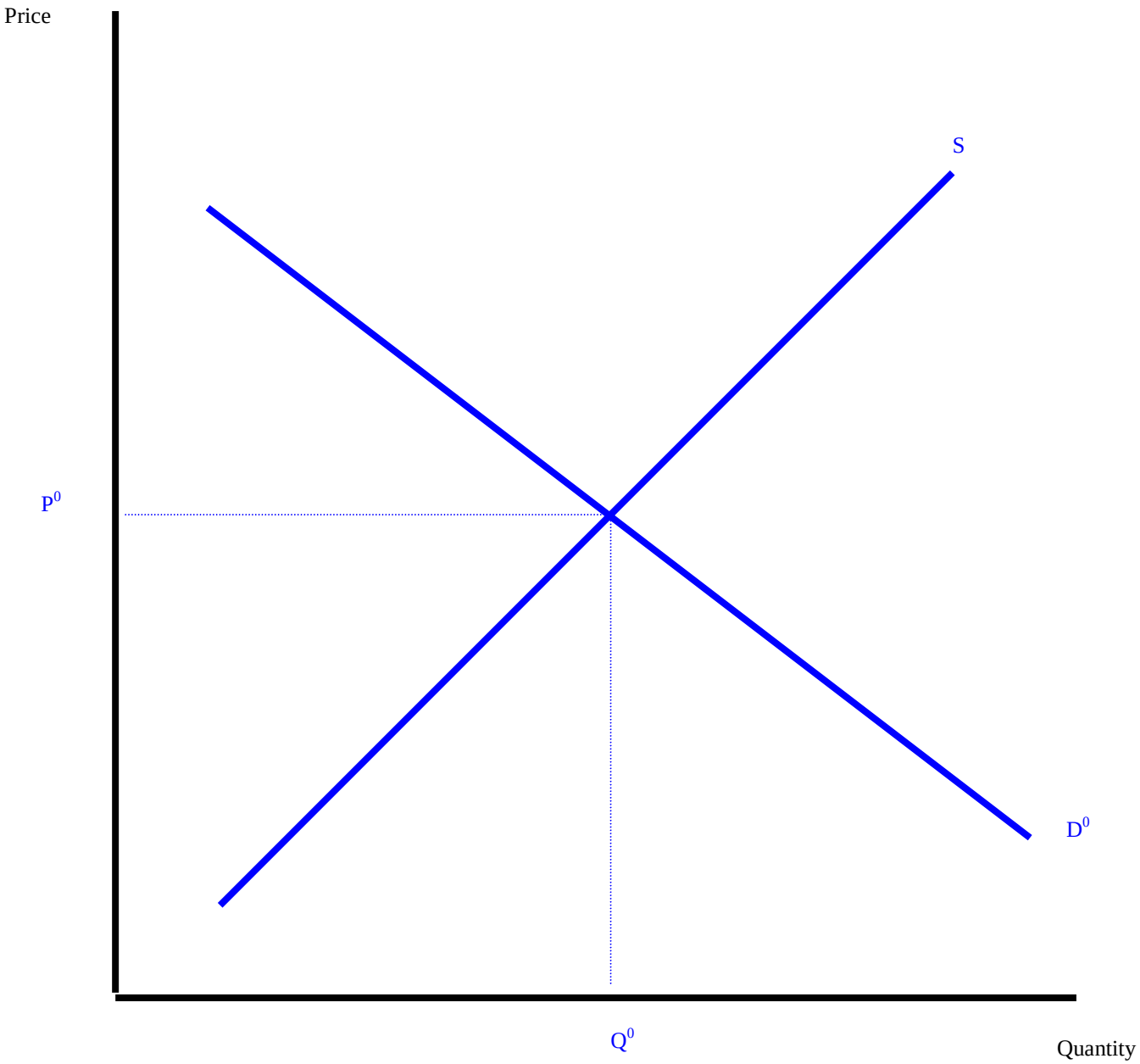
1. Labor

Instead of taxing output (say, cigarettes), we could instead tax the inputs (namely, labor and capital).

One important example of taxing inputs is the social security payroll tax. Together with Medicare, this tax totals 15.3 %, of which 7.65 % is legally paid by workers, the other half by firms. As with the previous taxes, the statutory distinction between workers and firms is irrelevant. The economic incidence of this tax is determined by the elasticities of labor supply and labor demand.

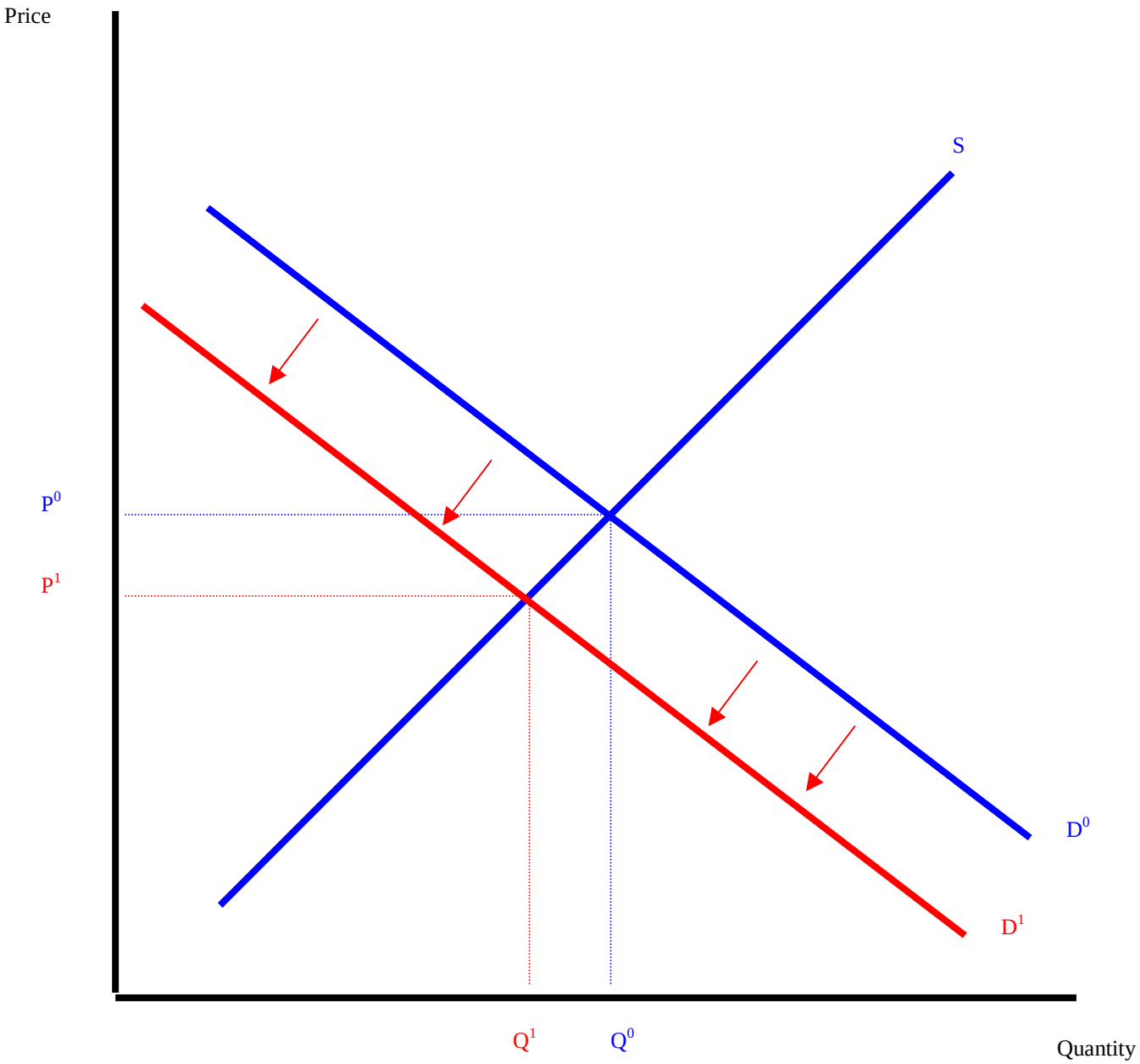
Suppose the supply of labor was perfectly inelastic (which is close to true for adults between the ages of 25 and 54), and this ad-valorem tax was imposed. With perfectly inelastic labor supply, the tax is fully passed to the worker in lower wages.

Figure 8-1 – Initial supply and demand curves before a tax



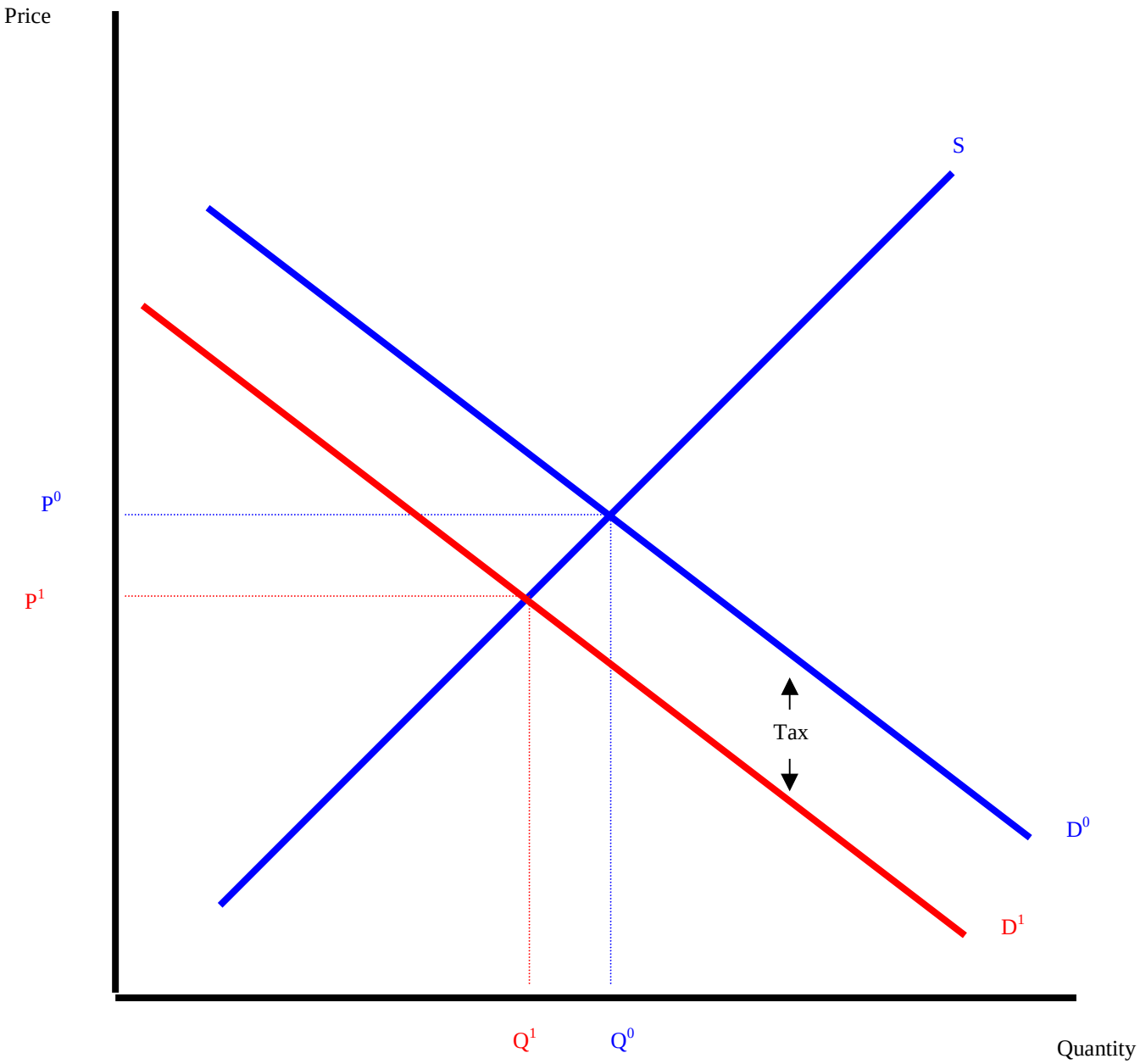
Initial price and quantity labeled Q^0 and P^0.

Figure 8-2 – Per unit tax on demanders shifts demand inward



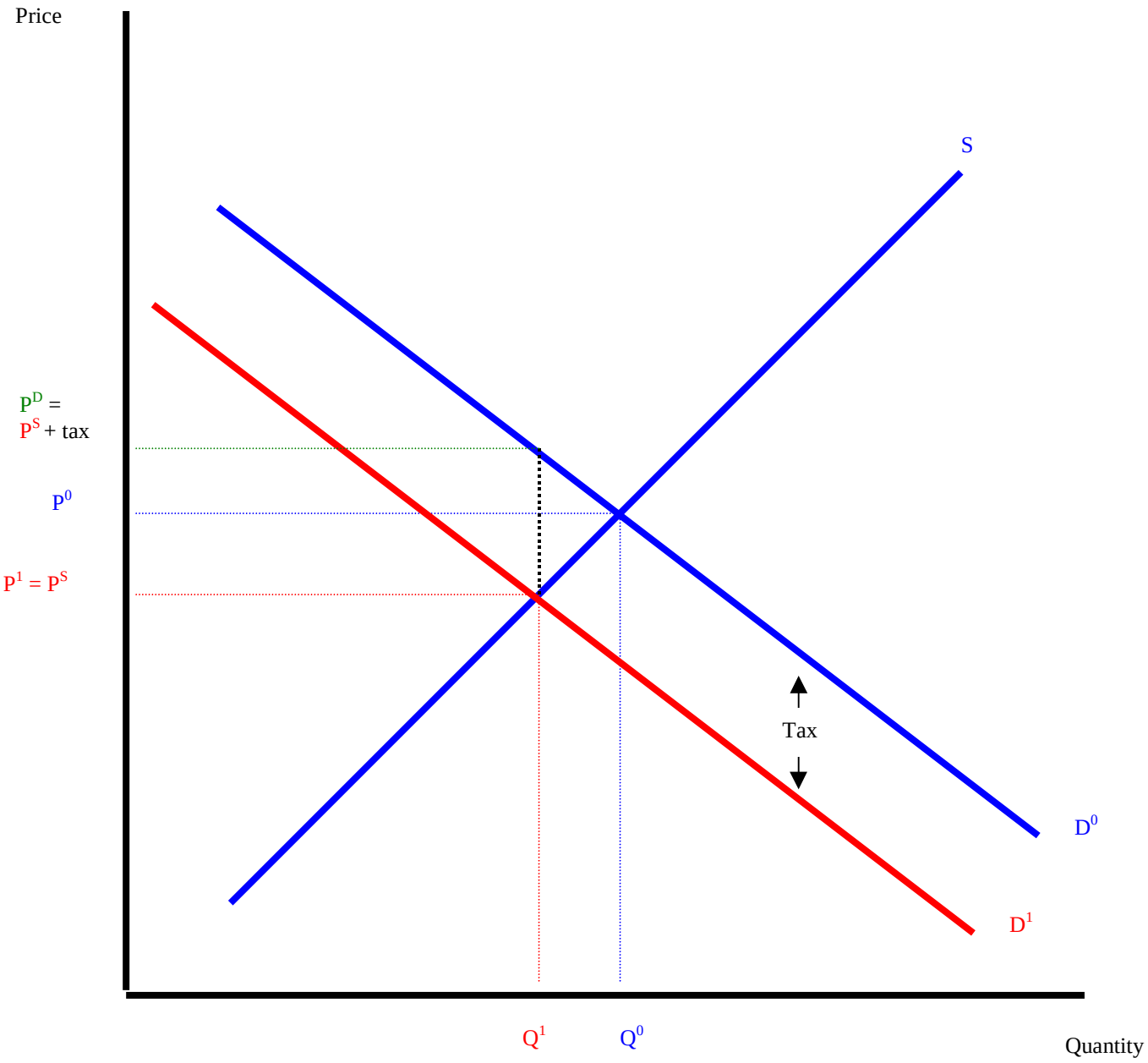
P^1 is the price paid by demanders.
The new quantity is Q^1.

Figure 8-3 – Vertical distance between D^0 and D^1 is tax.



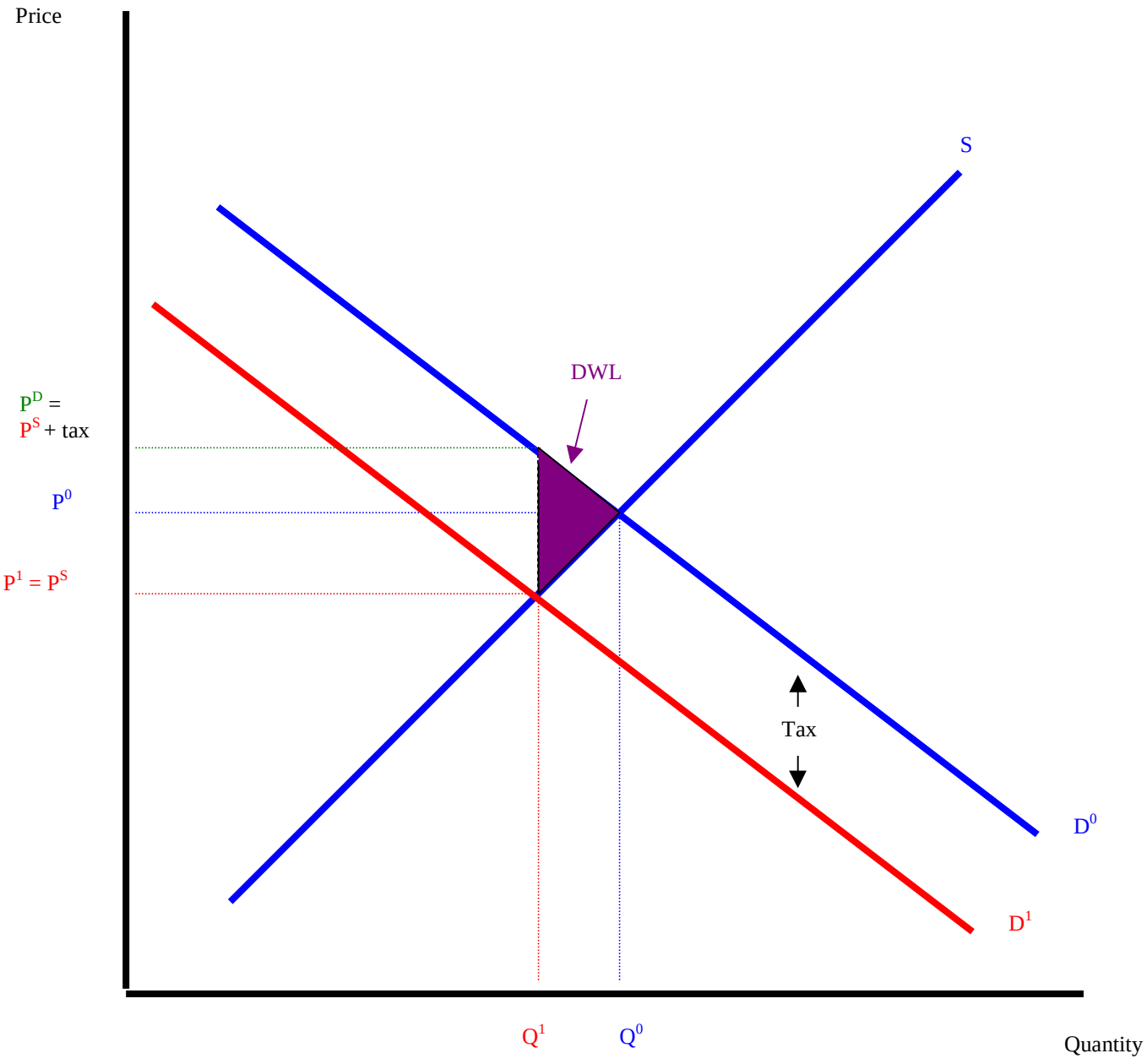
The tax creates a wedge between the price suppliers receive and demanders pay.
$P^D = P^S + Tax$

Figure 8-4 – Finding P^S and P^D after the tax.



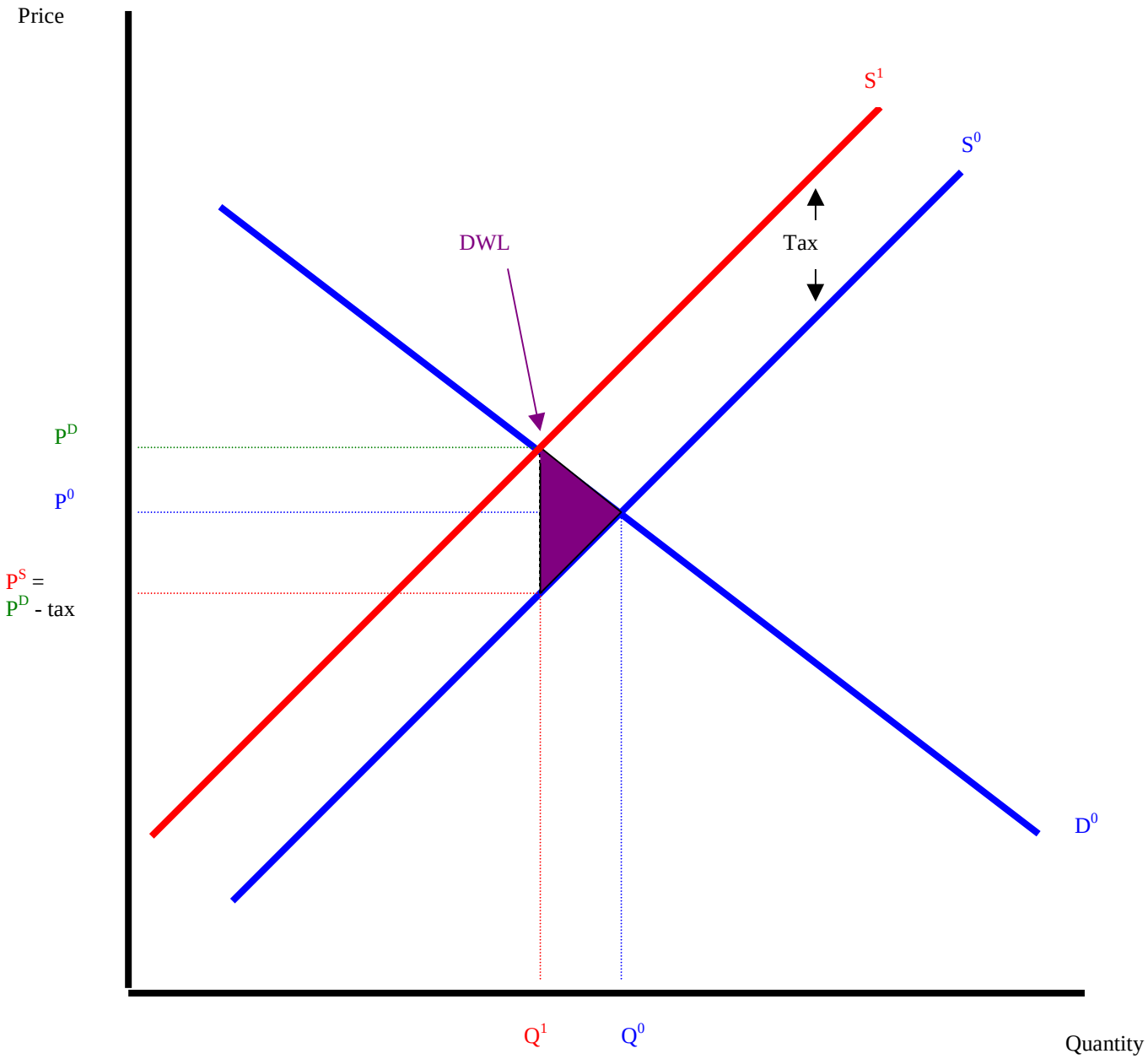
Demanders pay more than suppliers receive. The government gets the rest.
$P^D = P^S + Tax$

Figure 8-5 – The tax creates a deadweight loss



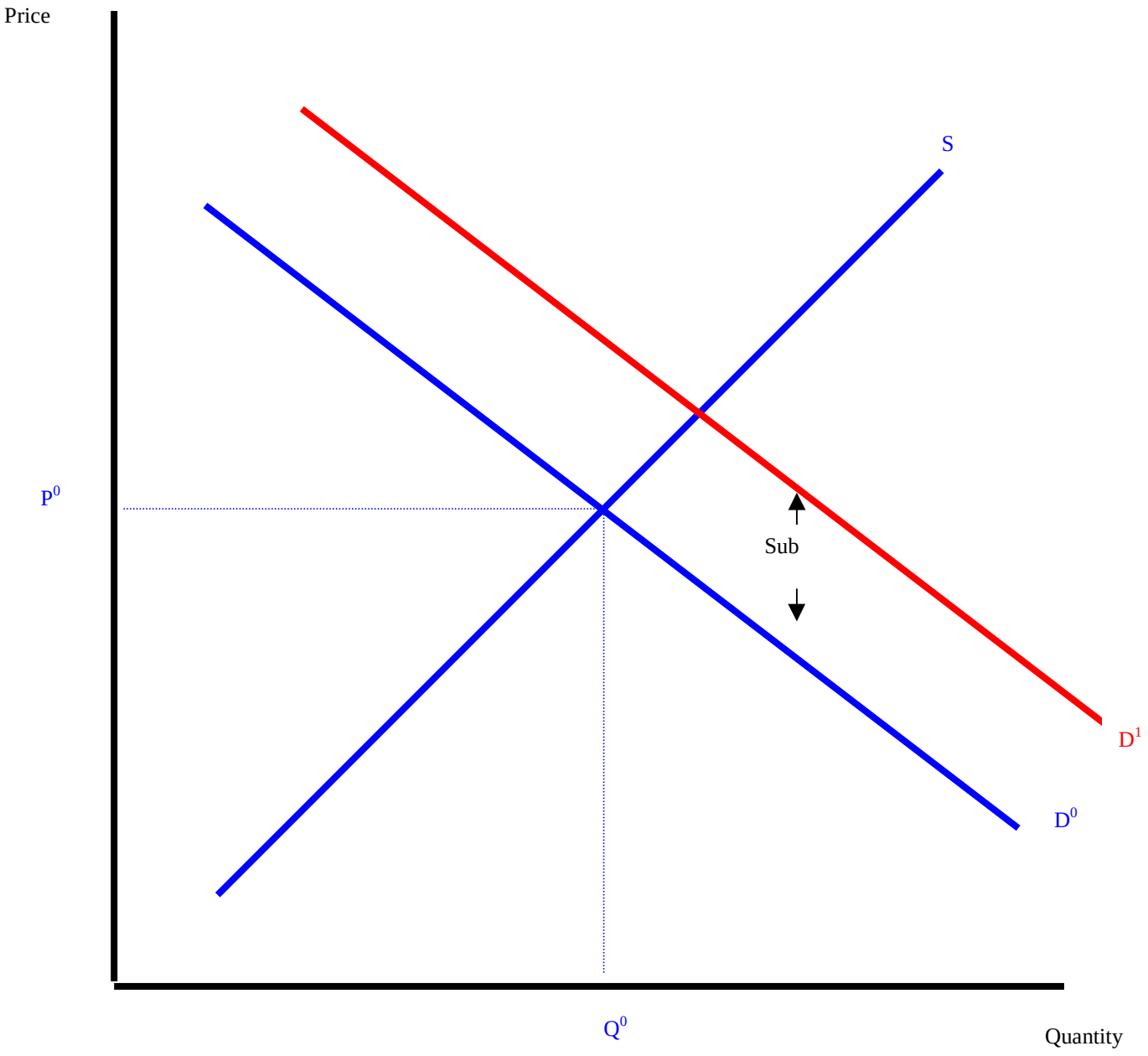
Since there are no preexisting distortions, Q^0 is the socially optimal quantity. The purple triangle is the deadweight loss.

Figure 8-6 – An equal per-unit tax on suppliers



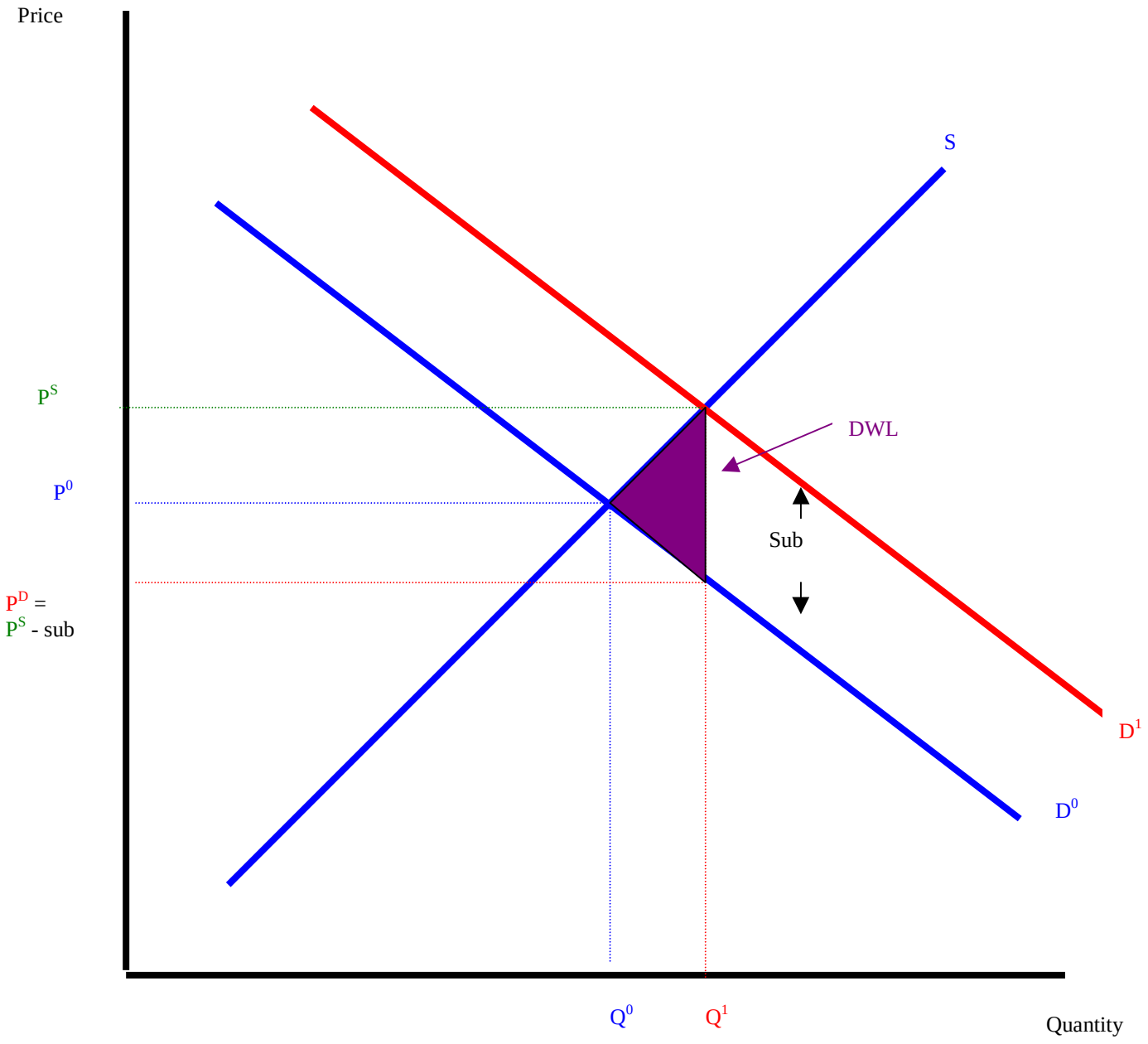
An equal per unit tax on supplier leads to same prices, quantity, and DWL.

Figure 8-7 – A per-unit subsidy on demanders.



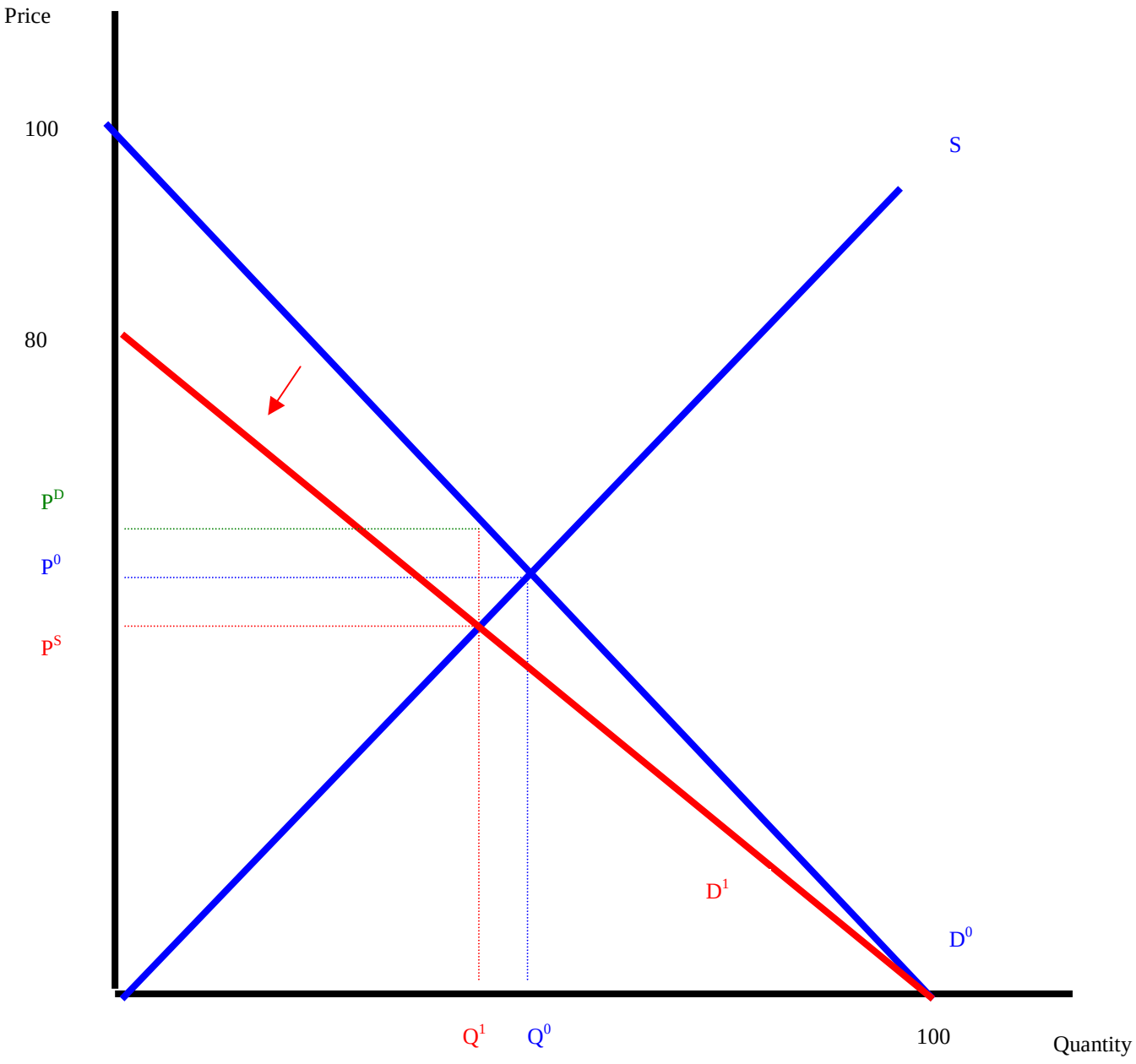
Find the equilibrium quantities, prices, and DWL after the subsidy is implemented.

Figure 8-8 – Outcome of a per-unit subsidy on demanders.



Make sure to understand the DWL triangle. Demanders now pay less than suppliers receive.

Figure 8-9 – An ad-valorem tax of 20%.



Initial price and quantity labeled Q^0 and P^0. Demand rotates inward.