# 6   Market equilibrium, Algebraic solution, Changes of equilibrium
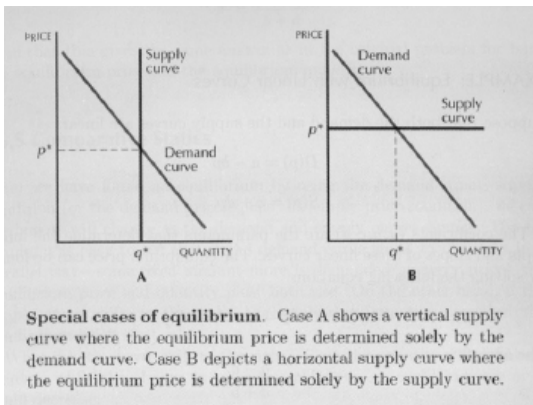
Demand curve/function - for each price p we determine how much of a good will be demanded $D(p)$. **Supply curve/function** - for each price p we determine how much of a good will be supplied $S(p)$. Given individual demand curves we can add them up to get a market demand curve. Similarly, if we have a number of independent supply curves to get the market supply curve. Individual demanders and suppliers are assumed to take prices as given (feature of a competitive market). **The equilibrium price** of a good is that price where the supply of the good equals the demand, i.e. the price where the demand and supply curves cross.
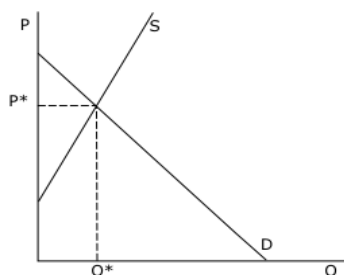

If $p < p^*$ the demand is greater than the supply. Then some product could be sold for higher price and hence the price is pushed up. If, on the other hand, $p > p^*$ demand is less than supply and some supplier will not sell what they would like to unless they lower the price. The equilibrium price and quantity is determined by both supply and demand. There are two special cases:

1. Vertical supply curve (perfectly inelastic supply). The amount supplied is fixed and independent of price. In this case the equilibrium quantity is determined entirely by the supply and the equilibrium price is determined entirely by demand conditions. When supply is perfectly inelastic, a shift in the demand curve has no effect on the equilibrium quantity supplied onto the market. Examples include the supply of tickets for sports or musical venues, and the short run supply of agricultural products (where the yield is fixed at harvest time) the elasticity of supply = zero when the supply curve is vertical.

2. Horizontal supply curve (perfectly elastic supply). The industry will supply any amount of a good at a constant price. In this case the equilibrium price is determined entirely by the supply and the equilibrium quantity is determined entirely by demand curve. When supply is perfectly elastic a firm can supply any amount at the same price. This occurs when the firm can supply at a constant cost per unit and has no capacity limits to its production. A change in demand alters the equilibrium quantity but not the market clearing price.

When supply is relatively inelastic a change in demand affects the price more than the quantity supplied. The reverse is the case when supply is relatively elastic. A change in demand can be met without a change in market price.

Special cases of equilibrium. Case A shows a vertical supply curve where the equilibrium price is determined solely by the demand curve. Case B depicts a horizontal supply curve where the equilibrium price is determined solely by the supply curve.

The consumer surplus is the amount that consumers benefit by being able to purchase a product for a price that is less than they would be willing to pay. **The producer surplus** is the amount that producers benefit by selling at a market price that is higher than they would be willing to sell for.
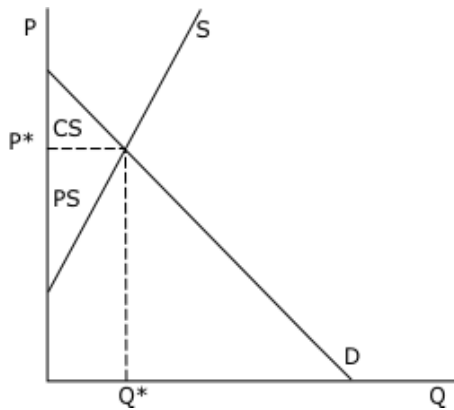

Changes in Equilibrium

Example: Imagine a company selling wheat. One year weather conditions, demand, and supply are such that the equilibrium price is P^* and equilibrium quantity is Q^*. The next year the company has a very large harvest. So the supply curve shifts to the right. As a result the equilibrium price decreases and equilibrium quantity increases. If, on the other hand, the harvest is very bad the whole supply curve shifts to the left. As a result the equilibrium price increases and equilibrium quantity decreases.
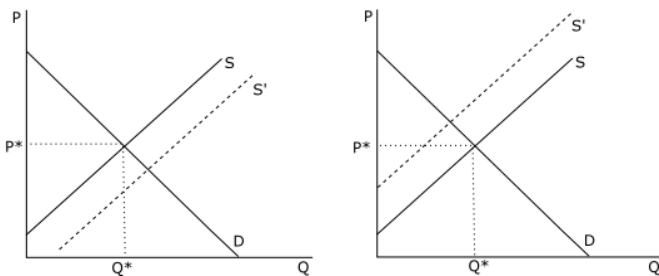
Example: Let's analyze the demand for ice cream. One summer the temperature is moderate and market demand and supply are such that the equilibrium price is P^* and equilibrium quantity is Q^*. The next summer is very hot, i.e. the whole demand curve shifts to the right and as a result both the equilibrium price and equilibrium quantity increase. If on the other hand summer is very

cold, the demand curve shifts to the left and as a result both the equilibrium price and equilibrium quantity decrease.
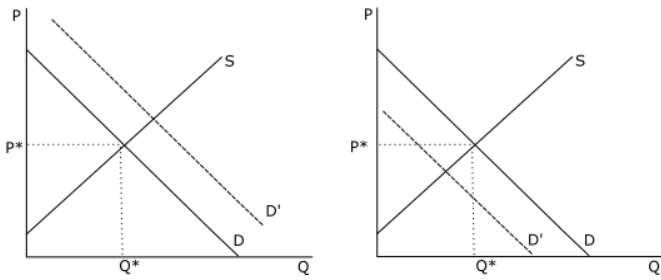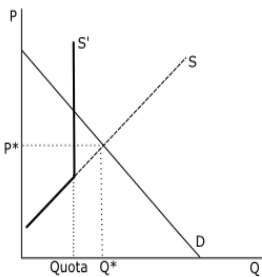

6.1   Price Caps and Quotas

Up to this point we analyzed situations where the equilibrium price and quantity where results of supply and demand curve only. Now we will look at what happens if government/local authority imposes some restrictions on price (price cap) or quantity (quota).

- Minimum price - if the minimum price is below $P*$ there is no change on the market. But if the minimum price is larger than $P*$ the result is that at this price supply exceeds demand (excess supply). There is a market inefficiency under such restriction. (left picture below)

- Maximum price - if the maximum price is above $P*$ there is no change on the market. But if the maximum price is lower than $P*$ the result is that at this price demand exceeds supply (excess demand). There is a market inefficiency under such restriction. (right picture below)
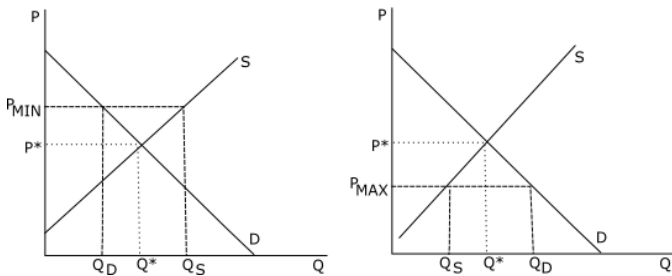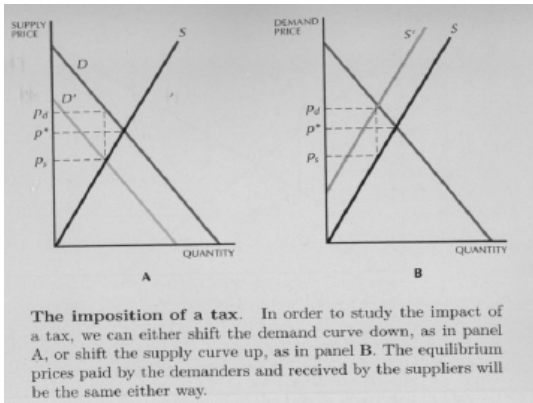

- Quota - if the quota imposed on production is larger than $Q*$ there is no change on the market. But if the quota is smaller than $Q*$ the result is that the equilibrium price increases and quantity sold decreases.

6.2   Taxes and Subventions

Unlike price caps and quotas taxes and subventions do not create inefficiencies in sense of excess demand or excess supply. In presence of taxes the price the demander pays and the price the supplier gets differ by he amount of the tax. If the tax is imposed on the suppliers, then the supply price plus the amount of the tax must equal the demand price: $P_D = P_S + t$ where t is quantity tax. If, on the other hand, the tax is imposed on the demanders, then $P_D - t = P_S$. These are the same equations which means that equilibrium price and quantity is the same in those two cases. Graphically, we either find the point where the curve $P_D - t$ crosses P_S or the point where the curve P_D crosses $P_S + t$.

The imposition of a tax. In order to study the impact of a tax, we can either shift the demand curve down, as in panel A, or shift the supply curve up, as in panel B. The equilibrium prices paid by the demanders and received by the suppliers will be the same either way.

In case of taxes the consumer and producer surplus is illustrated on the picture below. The rectangle denoted GR represent's government revenue from taxes and the triangle area DWL denotes the deadweight loss - the economic inefficiency caused by taxation. The taxing a good will typically increase the price paid by the demanders and decrease the price received by the suppliers. This certainly represents a cost to the demanders and suppliers, but from the economist's viewpoint, the real cost of the tax is that the output has been reduced.
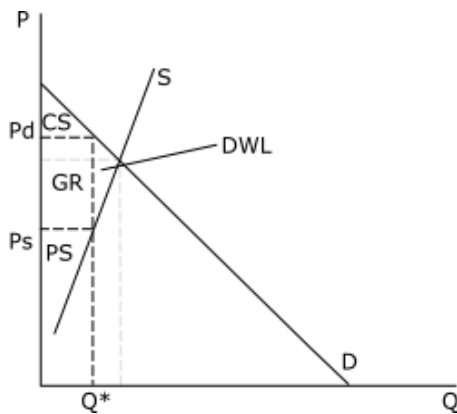
In general, a tax will both raise the price paid by consumers and lower the price received by firms. How much of a tax gets passed along will depend on the characteristics of demand and supply. To illustrate this we use two special cases of perfectly elastic (horizontal) and perfectly inelastic (vertical) supply.

In the case of a perfectly elastic supply curve the price to the consumers goes up by exactly the amount of the tax. The supply price is exactly the same as it was before the tax, and the demanders end up paying the entire tax. The horizontal supply curve means that the industry is willing to supply any amount of the good at some particular price, p', and zero amount at any lower price.

Thus, if any amount of the good is going to be sold at all in equilibrium, the suppliers must receive p^* for selling it. This effectively determines the equilibrium supply price, and the demand price is $p^* + t$. The entire tax is paid be demanders.
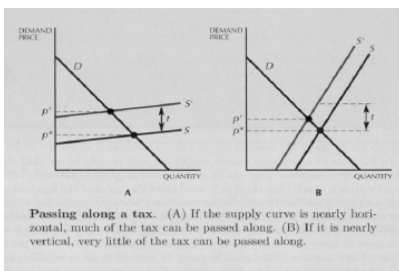
If the supply curve is vertical and we "shift the supply curve up," we don't change anything in the diagram. The supply curve just slides along itself, and we still have the same amount of the good supplied, with or without the tax. In this case, the demanders determine the equilibrium price of the good, and they are willing to pay a certain amount, p^*, for the supply of the good that is available, tax or no tax. Thus they end up paying p^*, and the suppliers end up receiving $p^* - t$. The entire amount of the tax is paid by the suppliers.

Special cases of taxation. (A) In the case of a perfectly elastic supply curve the tax gets completely passed along to the consumers. (B) In the case of a perfectly inelastic supply none of the tax gets passed along.
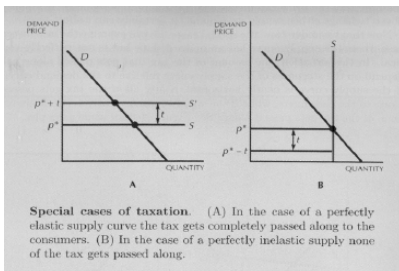
If the supply is not perfectly elastic or perfectly inelastic, the tax is paid by both supplier and demanders. The less elastic the supply curve the higher proportion of the tax is paid by suppliers.

Passing along a tax. (A) If the supply curve is nearly horizontal, much of the tax can be passed along. (B) If it is nearly vertical, very little of the tax can be passed along.

Subventions: Similarly as in case of taxes - irrespective of who gets subvention (buyers or sellers) the new equilibrium price and quantity is the same. The case where sellers or buyers get subvention is depicted on left side of the picture below. Picture on the right hand side illustrates how buyers and sellers share subventions depending on the slope of demand and supply curves.

Obr. 12 – 8 Subvence prodávajícím – Původní rovnováha trhu byla v bodě E. Subvence prodávajícím ve výši 8 000 Kč/m² posune nabídkovou křivku vertikálně dolů o velikost subvence a nová rovnováha trhu je v bodě F. Prodávající docílí cenu 23 000 Kč/m² a kupující platí cenu 15 000 Kč/m².

Obr. 12 – 9 Subvence kupujícím – Původní rovnováha trhu byla v bodě E. Subvence kupujícím ve výši 8 000 Kč/m² posune poptávkovou křivku vertikálně nahoru o výši subvence, nová rovnováha je v bodě G. Prodávající docílí cenu 23 000 Kč/m² a kupující platí cenu 15 000 Kč/m².

Obr. 12 – 10 Strmá poptávka a málo strmá nabídka způsobují, že kupující mají větší prospěch ze subvence než prodávající.

Obr. 12 – 11 Strmá nabídka a málo strmá poptávka způsobují, že prodávající mají větší prospěch ze subvence než kupující.