Principles of Economics

Chapter 4: Perfect Competition

Dr. Christian Feilcke

TUM School of Management

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Agenda

4. Perfect Competition
   - Equilibrium
   - Welfare

Reading:

- Mankiw/Taylor (2023), Chapters 3, 7, 8
- Varian (2014), Chapters 14, 16

Model

Perfect Competition: A market is perfectly competitive if all producers and all consumers are price takers.

Framework: Consider a perfectly competitive market where an ordinary good is supplied by $n \in \mathbb{N}$ identical profit-maximizing firms that produce at increasing marginal costs.

- No barriers to market entry or exit exist.
- Consumers consider every unit of the good as identical, i.e. they regard the products of different producers in the market as perfect substitutes.
- Producers and consumers are perfectly informed about prices in the market.

Market Demand and Market Supply

Competitive Equilibrium: The market is in equilibrium if for a given price p, market demand Q^D equals market supply Q^S so that the market is cleared.

- Let p^* denote the equilibrium price, also called the market clearing price, and let Q^* denote the equilibrium quantity, also called the market clearing quantity.
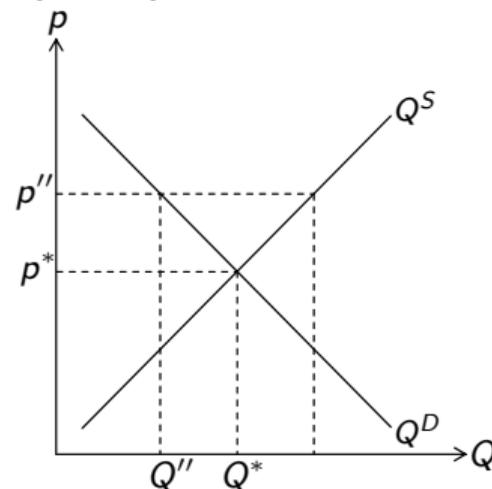
$$Q^D(p^*) = Q^S(p^*) = Q^*$$
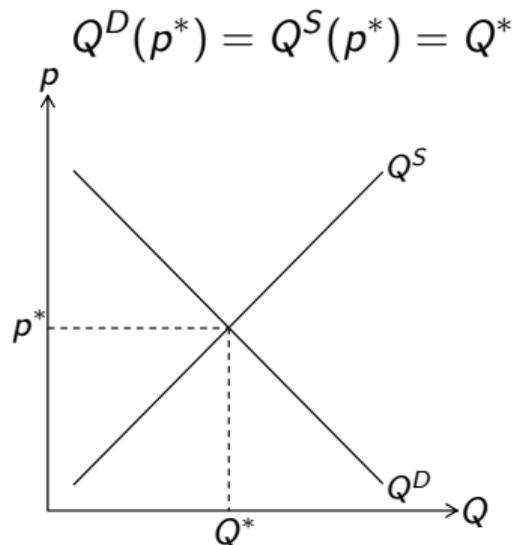
Market Demand and Market Supply

Market Imbalance: The market is imbalanced if for a given price p, market demand Q^D differs from market supply Q^S so that the market is not cleared.

- Excess Demand: If $p' < p^*$, then $Q^D > Q^S$ and $Q' < Q^*$.
- Excess Supply: If $p'' > p^*$, then $Q^D < Q^S$ and $Q'' < Q^*$.
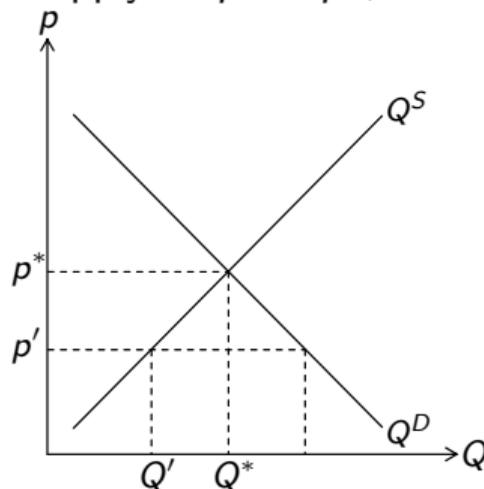
Excess Demand

Excess Supply

Number of Firms

Short Run: The number of firms in the market is fixed.

Long Run: The number of firms in the market may change because of entry and exit of firms.

- Additional firms enter the market if this yields non-negative profits.
- Incumbent firms exit the market if they make losses.
- In equilibrium, the number of firms in the market is the maximum number of firms that can make non-negative profits.
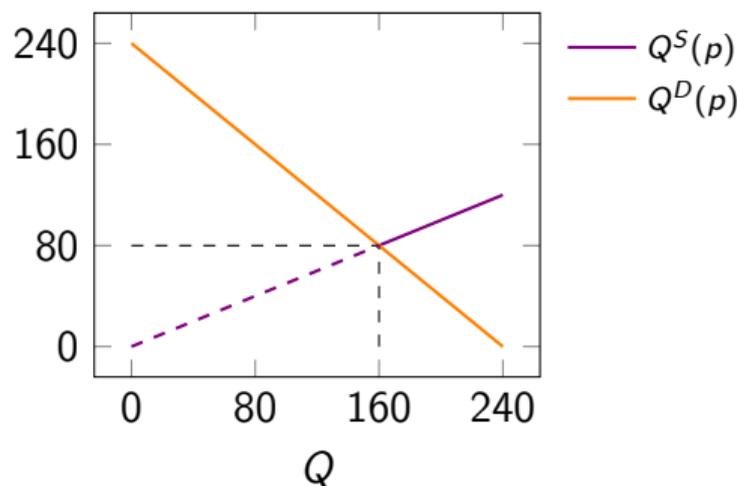
Equilibrium in the Long Run

Example: Consider a perfectly competitive market with market demand $Q^D(p) = 240 - p$
served by $n \in \mathbb{N}$ identical firms. Each firm has total costs of $C(q) = 3{,}200 + \frac{1}{2}q^2$.

- In the long run, market supply is

$$Q^S(p) = \begin{cases} np, & p \geq 80 \\ 0, & p < 80. \end{cases}$$

Reservation Prices

Marginal Willingness to Pay: At any quantity Q, inverse market demand $p(Q)$ measures the maximum price that consumers are willing to pay for an additional (marginal) unit of the good.

- Utility maximization implies that consumers buy a quantity for which inverse market demand equals the market price.

$$p(Q) = p$$

Marginal Willingness to Accept: At any quantity Q, marginal costs $MC(Q)$ measure the minimum price that producers are willing to accept for an additional (marginal) unit of the good.
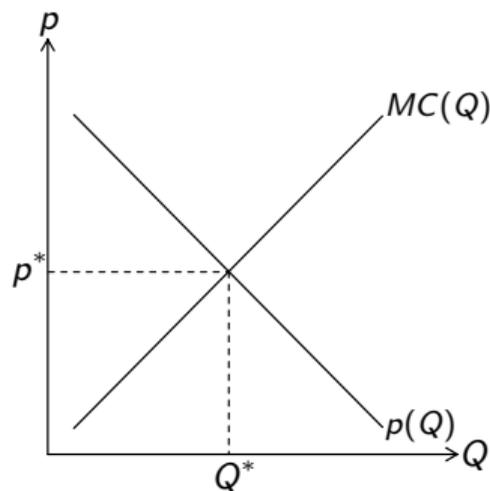
- Profit maximization implies that firms produce a quantity for which marginal costs equal the market price.

$$MC(Q) = p$$

Reservation Prices

Competitive Equilibrium: If consumers and producers face the same market price, then inverse market demand equals marginal costs in equilibrium, i.e. at the market clearing quantity Q^*.

$$p(Q^*) = MC(Q^*) = p^*$$

Gains from Trade

Consumer Surplus: Aggregated differences between inverse market demand and the market price

$$CS = \int_0^{Q(\tilde{p})} (p(Q) - \tilde{p}) \, dQ$$

Producer Surplus: Aggregated differences between the market price and marginal costs
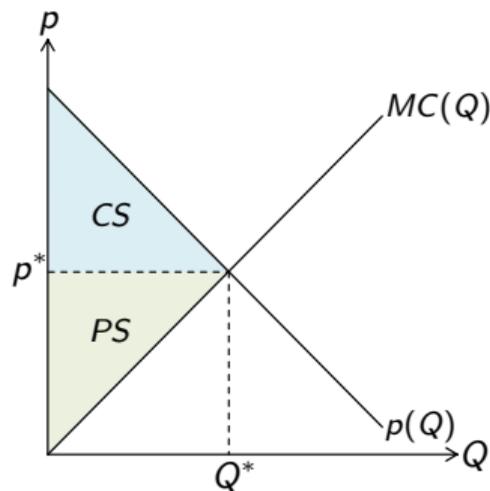
$$PS = \int_0^{Q(\tilde{p})} (\tilde{p} - MC(Q)) \, dQ$$

Total Surplus: Sum of consumer and producer surplus

$$TS = CS + PS$$

Gains from Trade

Welfare Maximum: If at the traded quantity inverse market demand equals marginal costs, total surplus is maximized.

- At market clearing quantity Q^*, all potential gains from trade are realized.

Welfare Loss: If at the traded quantity inverse market demand exceeds marginal costs, not all potential gains from trade are realized and a welfare loss *WL* occurs.

Short-Run Welfare Effects of Price Controls

**Price Control:** An upper (lower) limit on the market price is called price ceiling (floor).

- A price ceiling at $p' < p^*$ implies $Q' < Q^*$ and $p(Q') > MC(Q')$.
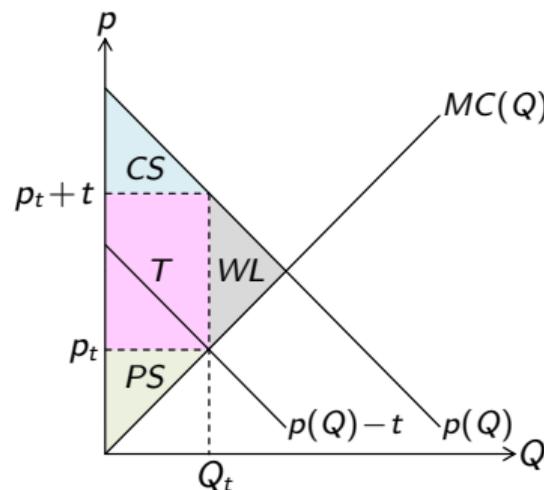- A price floor at $p'' > p^*$ implies $Q'' < Q^*$ and $p(Q'') > MC(Q'')$.

Price Ceiling

Price Floor
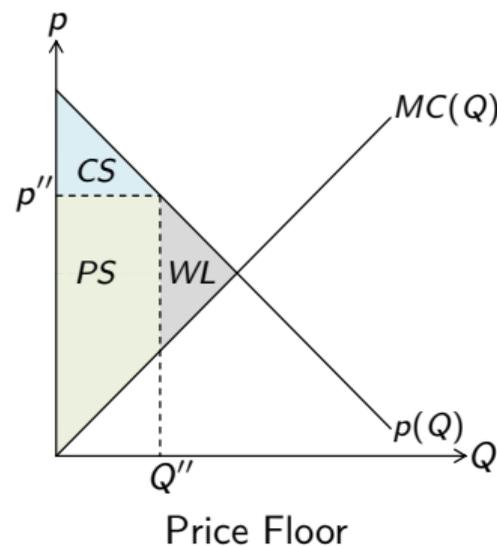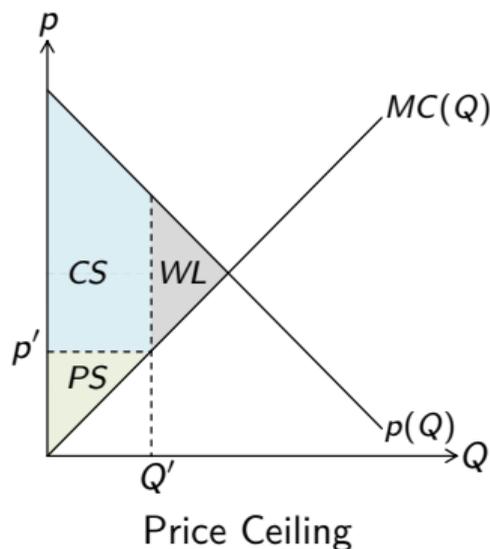
Short-Run Welfare Effects of Taxation

Taxation: Consider a tax on output at the rate $t > 0$, where $T = tQ$ is tax revenue. The welfare effects of the tax are independent of whether it is levied on producers or consumers.

- The tax drives a wedge between inverse market demand and marginal costs in equilibrium; $t = p(Q_t) - MC(Q_t)$.
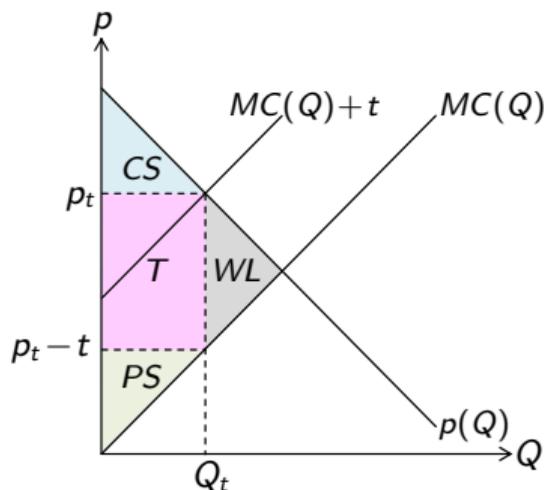
Tax Levied on Producers   Tax Levied on Consumers

Short-Run Welfare Effects of Taxation

Change in Tax Rate: If an increase in the tax rate decreases the traded quantity, i.e. the tax base, it will result in

- an increase (decrease) in tax revenue if the tax rate is sufficiently small (large),
- a higher welfare loss of taxation.

Tax Revenue

Welfare Loss