Regulation and deregulation
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Chapter 12

Regulation and Deregulation

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Chapter 12
Regulation and Deregulation

12.1. Introduction

Government interferes with markets in several ways. Competition policy and regulation are areas of government interference that are of special interest to industrial organization. *Competition laws* condemn certain actions taken by firms, which constitutes an ex post approach to business behavior. *Regulation* involves the intervention of government in markets in an ex ante fashion to repair market failure. Some sectors are singled out to require government regulation to function properly. Regulation is imposed on industries that cannot attain technical and/or allocative efficiency through market competition and is carried out by sector specific regulatory agencies. Regulation differs from industrial or technology policy, whereby government wants to support investments in sectors it deems to be of national importance.

Both private and state-owned firms can be regulated. Many European utility sectors like gas, water and electricity were state-owned, whereas private ownership of utilities prevailed in the US. Regulation of utility sectors is inspired by the natural monopoly character of these network industries. Government determines prices in these industries to prevent private appropriation of monopoly profits. Regulation also features markets that tend to be excessively competitive like the professions and the taxi branch. Regulation takes the form of price setting and restrictions on entry in these industries. People require a permit or license to enter a trade. Government intervention in agricultural product markets wants to raise price above market clearing levels to support farm incomes.

Government regulation can also occur in the form of the prohibition of certain activities as happened in banking, when investment and commercial bank activities were required to be separated entities under the Glass Steagall Act of 1929, which was repealed in 1999. The bail out and/or nationalization of banks that were on the verge of collapse in the banking crisis of the first decade of the new millennium also constituted sector specific interventions.

*Deregulation* involves the lifting of regulation. This can involve the abolition of price setting by regulatory agencies. Deregulation also involves the removal of entry requirements. Deregulation can also involve the annihilation of subsidies as in agriculture. Many industries have been deregulated since the 1980s and 90s. We can think of the airline industry, electricity, telecommunications, railroads and banking. Many deregulated industries involved network industries that exploited natural monopolies. Banking has been deregulated to stimulate
(international) competition. The World Trade Organization wants to reduce agricultural subsidies to stimulate international trade. Professional organizations like realtors, the medical profession and taxi driving have been deregulated in several nations by assuaging entry requirements. This chapter focuses on the regulation and deregulation of network industries like electricity, telephone, airlines and postal services. Deregulation of network industries often involved re-regulation to allow access at ‘reasonable’ prices. The chapter also discusses regulation and deregulation in the professions, banking and agriculture. We do not discuss regulation that is carried out for non-economic reasons, like the prohibition of selling alcohol to minors; restrictions of opening hours for shops and minimum age requirements for labor.

12.2. Motives for Regulation

12.2.1. Regulation to increase Consumer Welfare

Market regulation may be motivated by the view that regulation improves consumer welfare. Optimal market performance is achieved, when price equals long run average costs of the most efficient firm. Markets can fail to produce such outcomes, because fixed costs are of a magnitude that does not allow more than one efficient firm to operate in an industry. This is a market failure caused by natural monopoly in network industries such as gas, electricity, water, telecommunication and postal services. It is inefficient to operate more than one network. This applies particularly to connecting each and every home to a network. Railroad networks are also costly to replicate. The same applies to the network of mail receiver boxes and daily delivery systems of letter mail. Replication of these networks is costly. Local public transport networks of bus and metro lines can also not be easily replicated without incurring excessive costs. Another feature of these network industries is what is called universal service and universal access. Universal access applies to the installation of water, gas and electricity connections at identical prices in rural and urban areas irrespective of installation costs. Universal access is abandoned, when people pay cost based prices for the installation of utilities. Universal services imply that people pay identical prices for a service irrespective of costs. Delivering a letter to your neighbor or an acquaintance in a faraway rural area can be paid for with an identical stamp. Universal services obligations disappear, when services are provided at cost based prices

12.2.2. Regulation to Protect Incomes
Regulation can also stem from a desire to protect incomes of a certain group. This applies to farm subsidies. The initial motive for subsidizing agriculture was to guarantee farmers a certain income in the depression years of the 1930s, when agricultural prices lagged behind manufacturing prices.

Regulation of easy accessible industries like the taxi market wants to lift incomes and improve average quality. Too many taxi cabs would crowd the streets in the absence of regulation, which could reduce drivers’ incomes without lowering price or increasing quality. A-symmetric information would not allow passengers to distinguish between ‘good’ and ‘bad’ taxi drivers in the absence of regulation. Regulation of the professions is also motivated by the desire to improve performance by guaranteeing quality of professional services by limiting entry. Entry costs are either completely absent or of such a small magnitude that they do not deter people from entering in excessive numbers into these industries and professions.

12.2.3. Regulation to appropriate profits

Regulation can also be installed to maximize government revenues. Government could impose state monopolies in industries to extract monopoly profits that accrue to government. State monopolies have been imposed by some European countries in industries like alcoholic beverages and tobacco to appropriate profits from these trades. Governments also appropriate profits from natural resources like oil and gas. The Dutch government appropriates the larger part of revenues of local oil and gas production through profit sharing agreements with oil companies. Middle Eastern governments have nationalized oil and gas production to appropriate revenues stemming from these natural resources. The argument behind these appropriation policies is that revenues of natural resources should benefit the whole population and not private firms.

12.3. Regulation of a Natural Monopoly

Long term equilibrium can feature monopoly profits in industries wherein supply conditions make oligopoly inefficient. We call industries wherein one firm can operate at lower average costs than two firms natural monopolies. But, natural monopolies do not need to deter entry, if sunk costs are too low to blockade entry. We can recall here that a natural monopolist could deter entry while keeping price at the monopoly level, if sunk costs were at least \( \frac{\pi_m}{4} = \frac{(a - c)^2}{16} \), if the entrant expects the
monopolist to behave as a Stackelberg leader. The entrant would be indifferent between entering or not at this level of sunk costs, because the expected producer surplus equals sunk costs. Government regulation could reduce price below the monopoly level. We will illustrate this with the following numerical example:

\[ P = 250 - Q \]
\[ C(q) = 10Q + 3600 \]

Monopoly output and profits are as follows:

\[ Q_m = \frac{250 - 10}{2} = 120 \]
\[ P_m = 130 \]
\[ PS_m = 14400 \]

Monopoly price equals limit price in this numerical example. An entrant that behaves as a Stackelberg follower would supply 60 and make profits of 3600, which would just cover its fixed/sunk costs. Monopoly can thus be sustained by setting price an infinitely small amount below 130. This allows the monopolist to make excess profits of almost 14,400 – 3,600 = 10,800.

A regulator could set price at the level of average costs:
\[ P = ac \]
\[ 250 - Q = 10 + \frac{3600}{Q} \]
\[ 240Q - Q^2 - 3600 = 0 \]
\[ Q^2 - 240Q + 3600 = 0 \]
\[ Q = \frac{240 + \sqrt{240^2 - 4.3600}}{2} \]
\[ Q = \frac{240 + 207.846}{2} = 223.9 \]

Price would then be set at 26.1 and producer surplus would equal sunk costs. Regulation would thus improve consumer welfare by reducing price below the monopoly level.

Regulators need to have an idea of cost and demand conditions to be able to calculate competitive price. It can be difficult to obtain these data in the absence of price signals given by markets. Moreover, efficiency can be hampered, if monopoly firms are lackluster in adopting up to date technologies.
Government could open up network industries for entry competition, if sunk costs are not of a magnitude that prohibits entry. Hence, entry into the above market is not precluded, if sunk costs were below 3600. (The threat of) entry would make price drop and increase consumer welfare. Natural monopolies would feature Bertrand competition in the post entry situation, if one firm suffices to supply the market at competitive prices. Price would then drop to the level of marginal costs after entry. The appearance of an entrant with sufficient capacity to take over the whole market would make price drop till marginal costs of 10 and both firms would incur losses. Monopoly profits could be re-installed, if one of the two firms left the industry. The market would gyrate between perfect competition and monopoly outcomes under these conditions.

Entrants can successfully enter, if entrant costs are below that of an incumbent firm. An entrant can then undercut the incumbent monopolist and replace him. The new monopolist would keep price slightly below former monopoly costs and reap the price cost margin as profit. Natural monopolies could attract entry, if the industry shows rapid technological advance. But, excess capacities could emerge after entry, if each firm could supply the whole market. Excess capacity could remain in the industry, if bankrupt firms are acquired. The low price paid for a firm in bankruptcy may hamper the chances of survival of other firms. This happened to the cable industry after the burst of the internet boom that reduced the value of optic fiber networks to very low levels.

Deregulation could more easily achieve long run competitive equilibrium, if the industry operates under conditions of limited production capacity. Stackelberg and Cournot equilibrium configurations would emerge, if output is constrained by capacity. Deregulation could produce an efficient outcome, if capacity of equipment costing 3600 was limited to 60. Capacity constraints could then generate a long run Cournot equilibrium counting 3 one plant firms. Stackelberg equilibrium could have emerged, if the market leader operated two plants and an entrant one plant.

12.4. How to regulate price?

12.4.1. Introduction

We have explained above that welfare is maximized, if price equals average costs. However, it may be difficult to measure average costs of an efficient firm, if there are no competitors that can serve as benchmarks. The monopolist might use outdated equipment that is less efficient than state-of-the art technology, which unnecessarily raises costs. Moreover, the valuation of assets can be a hindrance in estimating the
fixed cost part of average costs. Assets of incumbent firms could lose all of their value upon entry. Assets could be valued at purchasing price, but the question arises in how much time these assets should be written off? Moreover, who should finance new investments of regulated industries? Should these sums be borrowed on financial markets or be provided by the state? Several methods have been developed to address these questions.

12.4.2. Rate of Return Regulation (ROR)

Rate of return regulation gives public utilities a guaranteed rate of return on their investments that is tied to market rates. Rate of return regulation has been adopted by US public utilities, which are privately owned firms that provide public services with natural monopoly characteristics (Sherman 2008, 417). Investments of public utilities in the US were financed by issuing bonds. However, rate of return regulation had a few drawbacks. A first issue that arose in applying rate of return regulation involved the determination of asset value. Should asset value be determined at historical costs or at replacement costs? Different answers were given to this question at different times. A second issue involved the incentives that rate of return regulation provided. Rate of return regulation could induce firms to over-invest in order to boost revenues. Rates could be changed in rate hearings, wherein public utilities needed to present their case before a commission of the regulatory agency. Historically, asset values have been huge in many regulated US industries. They amounted to three times annual sales in the electricity industry, which pointed at over investing (Sherman, 2008, 417).

We can also wonder what objective function utilities want to maximize? Being a public utility keeps them from maximizing profits. Utilities could want to maximize sales, since this would maximize capital and management incomes. Another drawback involves that cost based prices undermine innovation. The incentives for innovation in ROR regulated utilities were found to be weak. Modifications of rate of return regulation were introduced to curb these adverse incentives of ROR.

12.4.3. Price cap regulation and other forms

*Price cap regulation* puts a ceiling on annual cost increases, which are only allowed to increase with a percentage equal to that of inflation minus a percentage determined by estimated technological progress. The latter element is called the X factor (Sherman, 2008, 418). Price cap regulation
wants to keep price low by stimulating technological advance. Efficient firms that reduce costs by a larger percentage could keep the difference. Both ROR and price cap regulation entailed a negotiation process between parties with different interests like investors and consumers, which was often settled in court. Price cap regulation became popular in the past decades and was used by many US states to regulate local telephone tariffs. However, price cap regulation can induce firms to save costs by lowering quality. Regulators, therefore, need to control quality, if price cap regulation is applied.

Yardstick regulation involves the determination of rates based on costs of rivals in similar conditions. Regulators need to build models to make cost structures of various firms comparable. Efficient firms can make a profit, if regulated price is set at a level above their average costs. Price cap and yardstick regulation are applied in the determination of access prices.

Peak load pricing is also used by utilities to increase cost efficiency.

12.5. Deregulation

12.5.1. Deregulation and Privatization

Deregulation and privatization are often used as synonyms. However, privatization can occur without deregulation and the opposite also applies. A state owned company can be subjected to entry competition, while remaining state owned. This would expose the state owned company to market competition and erode monopoly profits. On the other hand, privatization can occur without deregulation. This could mean that a state monopoly is replaced by a private monopoly. Such privatization would not improve consumer welfare. The state could appropriate future monopoly revenues by auctioning off the state monopoly. Government can also both privatize and deregulate a sector. However, the emergence of entry competition would depress the value of the former state owned company. Selling the company to a private party could then bring in fewer revenues than expected. Private investors in regulated utility companies can lose out on their investments, if the sector is opened up to entry.

12.5.2. Access Pricing

Opening a sector up for entry will not attract entry, if sunk costs are prohibitively high. This can prompt regulators to force monopolists to
give competitors access to their network at regulated prices. These network industries are considered essential facilities that possess market power and, therefore need to give access to competitors on their network at ‘reasonable’ prices. Entry competition can thus be introduced in natural monopoly markets by declaring it to be an essential facility. This applies to telecom landlines and to gas pipelines, whose use is required by telecom companies and gas distributors to reach consumers. But, monopoly firms could prevent entry to occur, if they charged access prices that would not allow competition to survive (foreclosure). Access prices to monopoly networks, therefore, need to be regulated to function well. Deregulation in these industries thus requires re-regulation.

The concept of essential or bottleneck facility has also been used in reciprocal situations. The concept originated in the 19th century US railroad industry, when the US Supreme Court ruled that railway companies were required to allow rival companies access to their tracks. Regulation due to bottleneck pricing in oligopoly may occur in telecommunication markets, where companies require access to a rival company’s network to terminate a call (Sherman, 2008, 395). The company of the customer that receives the call could then charge monopoly prices for the use of its network in the absence of regulation. Access to rival networks in oligopoly is - by definition - a reciprocal affair, since all firms need to use each others networks to terminate calls. Access price regulation figures most largely in long distance and international telecommunications. A foreign phone company needs access to a national network to complete an international (or in the US a long distance) call.

12.6. The Electricity Industry

12.6.1. Motives and problems in deregulating electricity

Electricity markets have special features. Electricity cannot be stored, which requires that capacity must be sufficient to meet demand at all times. A lack of capacity will result in a collapse of the system with grave economic consequences. The electricity industry counts 3 stages:

- generation
- transport
- retail sales

The transport stage uses large networks. We can distinguish between high voltage networks that constitute the backbone of the system and low voltage networks for local transmission and distribution. These transmission networks constitute (local) monopolies. Network capacity
should be large enough to meet demand and demand should be large enough to keep electricity flows running. The impossibility of storage and the requirement of sufficient electricity supply could cause Bertrand competition to emerge in deregulated electricity industries upon entry. Entrant firms that build their own networks would entail the creation of excess capacity and cutthroat price competition.

Electricity generation constituted a natural monopoly in former days, when one power plant possessed sufficient capacity to supply a community. As a consequence, all three functions were integrated in one (local) monopoly power company. Regulation of electricity prices was linked to costs and exercised on a state level in the US. However, electricity prices differed widely between states at the beginning of the 1990s. Price was 11,9$ cents per kWh in New Hampshire and 4$ cents in Idaho (Sherman, 2008, 617).

Electricity was largely a state owned sector in Europe, where electricity companies were owned by national or local government and operated as part of state or local bureaucracy.

But, economies of scale in electricity generation have declined in time, when new technologies replaced steam powered electricity production. This allowed possibilities for a more market driven electricity generation industry. The introduction of market incentives began in the US in 1992 and Europe has followed the US example. Deregulation of the electricity industry entailed the opening up of local electricity markets for imports from neighboring states and nations. Such trade liberalization would make prices converge. Consumers in cheap states would suffer from trade liberalization, whereas expensive states would benefit from it. However, such market price convergence required a reconfiguration of the electricity grid, since transmission networks were geared to serve local and national markets. Moreover, market convergence could devalue the assets of public utilities; a risk that was not known at the time US utility companies issued their bonds. Investors of US public utilities, therefore, needed to be compensated for value losses caused by deregulation.

Deregulation also entailed opening up the net to independent electricity generators. Access pricing was installed to allow such competition. Networks were divested from electricity generation and retail sales to achieve a level playing field for competition. ‘Green’ electricity produced by wind and solar energy had access to the transmission networks at regulated and sometimes subsidized rates.

The wider use of transmission networks that evolved from deregulation amplified the task of net coordinators that had to balance demand and supply at every moment in time to prevent collapse of power supply. An independent systems operator (ISO) has the authority to start up or shut down generators in order to keep the network in operation.
Insert

The California 1998 Power Crisis
The break up of monopolies could spur power generators to expand production and reduce price. However, more vigorous competition at the generation stage requires either the existence of excess capacity or capacity expansion. Limited capacity or output reduction after liberalization, by contrast, would drive up wholesale prices. This was what happened in the California electricity crisis of 2000, when supply was insufficient to meet demand. California had installed an open market for electricity generation in 1998. All electricity generated was supplied to a spot market; the California Power Exchange (CALPX), where suppliers and buyers met. California was a net importer of electricity at 25 percent of consumption when deregulation set in (Sherman, 2008, 631). Liberalization required former vertically integrated utilities to divest their generation facilities. Much of generation capacity was bought up by five power companies; AES, Duke, Dynegy, Mirant and Reliant. Retail prices were frozen at a level 10 percent below former regulated levels by authorities. The low price level did not entice entry, since entrant costs were above incumbent costs. As a consequence too little electricity was offered on CALPX and spot market prices on the wholesale market surged. Price increase was intensified by rising fuel prices. The big gap between retail and wholesale prices forced CALPX to shut down in January 2001. The former utilities that had to buy at high and sell at low prices had to file for bankruptcy.

We can ask the question whether deregulated electricity markets will create sufficient capacity to make prices fall? Private investments in electricity generation may be hampered by long pay back times and uncertainty about future regulation. This applies also to environmental policies that could make production facilities that do not meet environmental standards worthless.

12.6.2. EU Electricity Policy

The European Commission has issued directives on the internal electricity and gas market. The first and second (2003) packages wanted to liberalize electricity and gas sectors. State owned companies should be privatized and entry encouraged allowing market forces to operate. This, however, did not solve the natural monopoly problem of the transmission networks. The third energy market package that was proposed in September 2007 addressed this problem. The transmission networks should be divested from the vertically integrated companies and be regulated by national
electricity regulators. The third package suggested several methods to unbundle transmission from the production and distribution of energy.

1. separation of network ownership from ownership of generation and distribution company
2. appointment by the state of an independent transmission operator
3. independent transmission network operators using the network belonging to a power company (EU, 2008)

Transmission prices are regulated in all three cases. The first method involves the divestiture of the transport network from power generation and distribution. Vertically integrated electricity companies can divest their networks and give up ownership. They can maintain ownership of the network, if they opt for options 2 and 3. The latter two options would allow them to sell transmission capacity at regulated prices to either their own or third party companies. This possibility was introduced, because several EU member states opposed complete unbundling of power networks.

Unbundling posed specific questions, because vertically integrated electricity companies in the European Union were state owned. Ownership of a network can be rewarding, if regulated transmission price leaves sufficient margins. Moreover, the possession of a regulated network is a safe investment. Network companies can hardly fail, if regulated access price is based on costs. The transmission networks, therefore, constitute valuable assets that can be used as collateral to loans at favorable rates. Networks can be sold and leased back by their former owners.

The proposed EU electricity regulation allows power companies to remain in possession of the transmission networks. However, electricity companies that divest their networks can appropriate the market value of these assets. Deregulation of electricity companies in the 1990s allowed local governments to cash in on the value of the electricity networks. Dutch vertically integrated power companies that were owned by local and regional governments were privatized in 1998. The sales of high voltage networks brought revenues to local governments. However, new insights and amendments to EU regulations prompted the Dutch central government to take repossession of the high voltage network. The network company Tennet was repurchased by the Dutch state in October 2001 at a price of 1,16 billion Euros. Tennet also intends to become the owner of all low voltage networks. Dutch local governments benefited from these deals, but central government had to pay the bill.

12.7. Deregulation of Telecommunications
12.7.1. Introduction

Telecommunications is also a network industry. Network economies operate both at the supply and the demand side of the telecom industry. Telecom uses big networks that connect all subscribers. More subscribers in a certain area reduce the costs of installation. Moreover, more subscribers make the service more valuable, because more people can be reached using the network. A higher number of subscribers thus both raises consumer value and decreases costs of telecom networks. Telecom networks differ from electricity networks because of these demand externalities. Telecom networks also differ, because they have been subject to massive technological change, which allowed the appearance of alternative networks in the past decades. Regulatory responses to these technological developments have largely shaped the industry.

12.7.2. Evolution of the US Telecom Industry

Telecom industries emerged as public monopolies in the 20th century. These were either private monopolies as was the case in the US, where ATT had a private monopoly that was regulated. European nations had state-owned telephone companies that were also regulated. Microwave transmission that appeared in the 1950s offered an alternative to private line connections at lower costs. The US regulatory agency the Federal Communications Commission (FCC) had to decide whether it wanted to grant radio frequencies above 890 megahertz to private microwave transmissions (Sherman, 2008, 480). The FCC decided in 1959 to grant permission to companies like Motorola to build networks and operate the new service. This constituted a competitive threat to ATT. The private lines were interconnected to the ATT network, which raised questions of access pricing. Interconnection proved to be the Achilles heel of ATT. New companies like MCI (Microwave Communications Inc.) sprung up in the early 1960s and wanted to build a network and provide telecom services between two large cities (Chicago and St Louis). The capacity installed, however, was too big for MCI alone and it, therefore, wanted to rent capacity to other firms. The FCC allowed MCI to sell capacity on its long distance services and to connect its lines to the ATT network. ATT had argued that this hurt ATT, because it had to maintain lines on a national scale as a universal access and service provider. Newcomers, by contrast, were not subjected to universal service obligations. Access to the ATT network allowed the new competition to provide nationwide services in the most attractive regions. Many disputes arose about access to the ATT network. An antitrust complaint was filed
against ATT in 1974, claiming that ATT wanted to monopolize telecommunications markets by excluding others from its network (Sherman, 2008, 483). As a consequence of the anti trust suit ATT was broken up in a 1984 decision. The long distance service (Ma Bell) was separated from the local services (Baby Bells). US long distance rates declined considerably after MCI, Sprint and other firms had entered this market. Long distance services became competitive, but local services remained monopolistic and were still regulated. Price cap regulation came to replace rate of return regulation in local markets.

The 1996 US Telecommunications Act opened local services to competition. Deregulation was prompted by technological developments. Entrant firms built local networks for businesses that had always paid high rates under the ATT regime. Mobile and wireless technologies appeared that competed with land lines. The 1996 Act wanted to promote the ascent of these new technologies by stimulating investment in telecom networks. The Act posed intricate questions of fixed network access pricing by companies building their own networks or companies that only built networks in large cities. These entailed many court disputes. The FCC decided in 2003 that local exchange carriers (LECs) companies were freed from leasing the broadband part of their networks to entrants at regulated prices. This was done to stimulate investments in these networks (Sherman, 2008, 490). Cable companies posed a new competitive threat to the LECs. The cable network that was originally built to transmit television signals could provide telephone and internet services due to technological progress. These cable companies were not subject to regulated access pricing.

New competition from rival networks caused financial trouble for the providers of long distance communications, where competition was most fierce. A race to invest in new broadband networks spurred investments, which reached a peak in 1999 just before the collapse of the internet boom. Investments in mobile services also peaked at this point in time. Profit expectations that drove these network investments were deflated when the internet bubble burst and many firms filed for bankruptcy.

12.7.3. European Union/ Mobile telecom

The EU has acted as a federal agency for deregulation in telecom. The Commission has issued white papers that set the dates for the implementation of several rounds of deregulation. The EU set public standards for mobile telecom like GSM (2nd generation), GPRS and UMTS (3d generation). These public standards homogenized competition between mobile suppliers. Public setting of standards in Europe differed
from procedures in the US, where several private standards competed for hegemony. The EU initiated deregulation of telecommunications in the late 1980s. Deregulation of EU telecommunications was scheduled to be completed by 1998. The 1994 EU Green paper formulated a regulatory framework for the introduction of 2nd generation mobile telephony (GSM). EU 2nd generation regulation took action against member states that had maintained monopoly provision of GSM markets. Member states were required to allocate at least two GSM licenses. The market for mobile telecom was thereby opened for entry. All entrants had to roll out a network within a certain time limit. Mobile operators required access to fixed networks to terminate calls to fixed network users. The EU wanted to regulate access to fixed networks by mobile phone companies. Moreover, access to fixed networks was also opened for companies without (mobile) networks at regulated rates.

Several companies wanted to build mobile networks. But, entry into mobile telecom is limited by the scarcity of radio spectrum that mobile phone companies use. Mobile operators, therefore, require a license to build and operate a network. Several allocation mechanisms have been applied to allocate scarce radio spectrum licenses. First and second generation radio spectrum were allocated to incumbent monopolists; the state-owned PTTs. Other carriers could obtain a license on remaining 2G spectrum space, when the EU had ruled that member states had to issue at least two 2G licenses. Additional licenses were allocated either by beauty contests or through auctions. Beauty contests are comparative tests that grant licenses to the ‘best’ candidate. However, these contests can be manipulated for political reasons. Auctions are, therefore, considered to be a more objective way to allocate scarce frequencies. Auctions let prospective buyers bid for a license. The company that values the license most will obtain it.

12.7.4. The Value of (Mobile) Licenses

Sequential Entry
The Dutch government allocated 2G mobile licenses to entrants via beauty contests. This seemed a fair method, because KPN, the incumbent monopolist, had also obtained a license for free. However, rejected parties protested against such allocation. Entry into GSM markets was not simultaneous but sequential due to the EU order. The former monopolist remained dominant in mobile telephony in the Netherlands and other EU countries in 2G mobile telephony. We can explain their behavior as that of a Stackelberg leader.
that is confronted with sequential entry. The first follower would supply half of monopoly output. The second follower would supply a quart of monopoly output and so on.

\[ q_2 = \frac{a-c}{2^2} \]
\[ q_3 = \frac{a-c}{2^3} \]
\[ q_n = \frac{a-c}{2^n} \]

\[ Q = (a-c - \frac{a-c}{2^n}) \]
\[ P - c = \frac{a-c}{2^n} \]
\[ \pi_{leader} = \frac{(a-c)^2}{2^{n+1}} \]
\[ \pi_{follower} = \frac{(a-c)^2}{(2^n)^2} \]

A first follower would increase n to two and the follower would make profits of 1/16 \((a-c)^2\). A second follower expects to reap profits of 1/64 \((a-c)^2\) and so on. A first follower would make incumbent profits drop from monopoly of \(1/4 (a-c)^2\) till 1/8 \((a-c)^2\). A second follower would cut the former monopolist’s profits again in half till 1/16 \((a-c)^2\) and so on.

A former incumbent monopolist can also choose to collude with entrants: Its profits are then:

\[ \pi_{coll} = \frac{\pi_m}{n} = \frac{(a-c)^2}{4n} \]

The former monopolist would be indifferent between dominance and collusion, if one entrant arrived on the scene \((n=2)\).

\[ \pi_{stick} = \pi_{collusion} \]
\[ \frac{(a-c)^2}{2^3} = \frac{(a-c)^2}{8} \]

But, the incumbent would prefer collusion to dominance, if two or more sequential entrants arrived.
Simultaneous Entry

The leader’s expected profits for a number of n-1 simultaneous followers can be depicted in the following way:

\[ \pi_f = [(a - c - Q_f - (n_f - 1)q - q_f)]q_f \]

\[ \frac{\partial \pi_f}{\partial q_f} = a - c - Q_f - (n_f - 1)q - 2q_f = 0 \]

\[ q_f = \frac{a - c - Q_f}{n_f + 1} \]

\[ Q_{leader} = \frac{a - c}{2} \]

\[ q_f = \frac{a - c}{2(n_f + 1)} \]

\[ Q = \frac{a - c}{2} + \frac{n_f[(a - c)]}{2(n_f + 1)} \]

\[ P - c = \frac{a - c}{2(n_f + 1)} \]

\[ \pi_{leader} = \frac{(a - c)^2}{4(n_f + 1)} \]

\[ \pi_{follower} = (P - c)q_f = \frac{(a - c)^2}{4(n_f + 1)^2} \]

Assuming leadership becomes less attractive, if the number of simultaneous followers increases. One follower would cut monopoly profits in half. Two followers would reduce it to one third etc.

We can assume that the total number of firms in equilibrium with simultaneous entry of n-1 followers equals the number of firms in collusive equilibrium. This would make us conclude that a dominant firm is indifferent between maintaining output at the monopoly level in simultaneous entry and colluding with entrants. We can assume n to be fixed by licensing policies of governments.

\[ \frac{(a - c)^2}{4(n_f + 1)} = \frac{(a - c)^2}{4n} \]

However, entrants would obviously prefer the collusive outcome.
Former monopolists can either stick to monopoly output or accommodate. Sequential entry favors dominance. Dominant behavior would keep the former monopolist’s market share above 50 percent. Former state owned monopolists remained dominant in many second generation mobile (GSM) markets, wherein sequential entry prevailed. This applied to Italy, Austria, the Netherlands, France, Belgium, Portugal, Sweden, Spain, Finland, Norway, Switzerland and Ireland. Dominance had disappeared in the UK and Germany, where former monopolists had a market share below fifty percent. British Telecom had a market share of 30 percent and Deutsche Telekom of 40 percent before the UMTS auctions of 2000.

Another possible scenario involves Bertrand competition after entry, which could be triggered by the presence of large excess capacities in the industry. Bertrand competition can be curbed by pursuing product differentiation strategies. Entry is thus considered most attractive, if newcomers expect collusion to prevail after entry and least attractive, if Bertrand or dominance is expected to prevail.

12.7.5. The UMTS auctions

Third generation mobile licenses were allocated by auctions and beauty contests that took place all over Europe in 2000 and 2001. UMTS licenses for each nation were—in contrast to GSM licenses—allocated simultaneously. All second and third generation mobile suppliers were required to roll out a network that covered national markets almost completely.

Both beauty contests and auctions can fail to reach the attained goal, if an insufficient number of candidates for licenses appear. We can say that beauty contests fail, if the number of candidates is less than the number of licenses. However, an auction fails, if the number of candidates equals the number of licenses. Firms then do not need to bid above the minimum price. It was demonstrated above that expectations of dominant behavior by the former monopolist or Bertrand competition could deter all entry, so that auctions/beauty contests would fail. However, the fact that auctions and beauty contests constitute a one and only opportunity to enter a market for a lengthy period of time, will encourage entry. This is the case, if remaining licenses are not kept in reserve.

A difficult question arose at the start of the 3G UMTS auctions that were scheduled for 2000 and 2001. The number of licenses had to be at least equal to the number of incumbent GSM suppliers. That seemed fair, because GSM networks could be used in UMTS services. However, this circumstance put entrants lacking a network at a competitive
disadvantage. This impediment to entry was partly eroded by offering entrants connection rights to existing GSM networks at retail prices, as happened in the UK. Other European countries were less specific with regard to such access rights. The decision to issue a number of 3G licenses that allowed all 2nd G suppliers to obtain a license implied that the number of licenses issued equaled the number of incumbents. However, this entailed that at least one entrant had to bid to make the auction successful. But, entrants could have a competitive disadvantage vis-à-vis network holding incumbents, which would keep them from bidding. Some governments felt compelled to increase the number of licenses above the number of incumbents to entice entry. This required at least two entrants to make the auction a success. Success of the auctions thus depended largely on the arrival of entrants to the auction in such numbers that the number of bidders exceeded the number of licenses.

The UK, Germany, the Netherlands, Italy, Austria, Switzerland, Belgium and Denmark organized UMTS auctions in 2000 and 2001. The first auctions organized by the UK and Germany were big successes; raising enormous revenues. However, subsequent auctions were much less successful and even failed completely. We could argue that both German and UK incumbent monopolists had renounced dominance in GSM markets before the auction and, therefore, signaled to potential bidders that collusive or Cournot outcomes were likely.

Table 12.1. 
Average per capita revenues of EU UMTS auctions

<table>
<thead>
<tr>
<th>Year 200</th>
<th>Year 2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK</td>
<td>650 Euro</td>
</tr>
<tr>
<td>615 Euro</td>
<td></td>
</tr>
<tr>
<td>Netherlands</td>
<td>170 Euro</td>
</tr>
<tr>
<td>Denmark</td>
<td>45 Euro</td>
</tr>
<tr>
<td>Germany</td>
<td>240 Euro</td>
</tr>
<tr>
<td>Italy</td>
<td>100 Euro</td>
</tr>
<tr>
<td>Austria</td>
<td>20 Euro</td>
</tr>
<tr>
<td>Switzerland</td>
<td>45 Euro</td>
</tr>
</tbody>
</table>

Source: Binmore & Klemperer, 2001

Table 12.1. shows that the UK and Germany obtained much higher per capita prices at their auctions than other EU countries. Both the UK and Germany attracted more newcomers to the auction than other countries. The Swiss (and also the Belgian and Greek) auction failed, because the number of bidders equaled the number of licenses or was even below that as was the case in Belgium. Some beauty contests like that of France
failed, because the number of candidates fell short of the number of licenses.

We can argue that 3G mobile telecom auctions were private value auctions; each bidder valued a license differently. This sprang from the fact that incumbents were advantaged above entrants due the 2G network they had already rolled out. Moreover, licenses were more valuable to dominant firms that intended to maintain dominance than to fringe 2G competitors that expected to play a subordinate role. Different valuations would impede bidding, because some firms that had low valuations would leave the auction early. The expectation of post auction collusion, by contrast, would make the auction more a common value auction and, therefore, increase auction revenues.

After the Auction

A tendency towards equalization of market shares emerged after the UMTS licenses were allocated. The dominance of Italia Telecom was reduced; the same applied to former Dutch monopolist KPN. But, profit expectations of mobile phone companies were severely reduced after the burst of the dotcom bubble. Some companies delayed rolling out a UMTS network and even filed for bankruptcy or were acquired by rivals. This raised the question, whether firms could hand their license back to government? A related question involves whether an acquired company still needed to roll out a network as described in the license. Five UMTS licenses were obtained at the 2000 Dutch auction; by KPN, Vodafone, Orange (France Telecom), Telfort (British Telecom) and Ben. Ben was acquired by Deutsche Telecom shortly after the auction. Telfort was acquired by KPN in 2005. Orange was acquired by T-mobile (Deutsche Telecom) in 2007. That only left KPN, T-Mobile and Vodafone in the mobile market.

The Dutch telecom regulatory authority ruled in a May 2009 decision that Telfort needed to complete a UMTS network as described by the license after being acquired by KPN. The company was fined 5 million euro for not complying with the license conditions. KPN returned the license to the state to escape further fines. T-Mobile was ordered in November 2009 to complete the Orange network and received a 5 million fine for non compliance. The Orange network was tested on 300 points, but was found lacking on all points.

All licensees had to roll out a network in seven years after obtaining the license, which covered at least all towns above 25,000 inhabitants, airports and important highways. However, both KPN and T-Mobile did not need Telfort and Orange networks to provide services to their
customers. This indicates that fewer than five licenses sufficed to cover the Dutch market and that entry had been excessive. Mobile telecom thus has features of a natural monopoly. Excess capacity allows network operators to grant access to operators without a network (mobile virtual network operators). Such operators in fact appeared on UMTS networks. Access prices paid by virtual network operators are not regulated in most EU countries.

Insert

**Auction Types**

Auctions are organized to sell a variety of objects. Auctions for antiques and art are well known. The government can organize auctions to sell the rights to some scarce commodities, like spectrum frequencies for radio broadcasting or telecom; drilling rights for oil and gas and other scarce resources. Governments do not sell property rights, but auction licenses for a fixed period of time. This was 20 years in the case of 3G telecom licenses. Drilling rights on off shore tracks are licensed by the US government for a period of 5 years.

Auctions can be organized at one shot as in *sealed bid auctions*. Each bidder puts a price in a sealed envelope, which are opened at a public meeting. We can distinguish between first price and second price sealed bid auctions. The highest bidder pays his stated price in a first price auction. He pays the price of the second highest bidder in a second price auction.

*Ascending and descending auctions* can proceed in several rounds. The auction stops, if only one bidder is left (ascending auction), or when one firm accepts the bid price (descending auction). Ascending auctions resemble second price auctions, because the winner pays the price of the previous bidder plus the bid increment.

Auctions can be *common value* or *private value* auctions. A common value auction exists, when an object is equally valuable to all bidders. Bidders in an auction for drilling rights for oil and gas can attach equal values to a track, which would make it a common value auction. However, if different firms attach different values to a track it is a private value auction. Different valuations can stem from different estimates of future revenues. Firms undertake seismic research before they make a bid. The data this provides can be interpreted in different ways. Some tracks are more attractive to some firms than to others, if they are located in the neighborhood of other fields already licensed to a firm.

Insert

**Termination charges and Market Power**
Mobile operators had monopoly rights to the termination of a call on their network. This monopoly was most pronounced in fixed to mobile calls. Reciprocity in this market was absent due to the regulation of tariffs on fixed (landline) networks. Fixed-to-mobile termination charges were a tenfold of fixed–to-fixed charges in the EU (European Commission, 2001, 16). Fixed line prices were regulated due to their dominance in the landline markets. Mobile operators were granted access to their networks at regulated prices. Prices of mobile network access, however, were not regulated. The British regulator Oftel, however, argued that all mobile operators had a monopoly position on their termination market and that termination charges, therefore, needed to be regulated (Oftel, 2001). International connection (roaming) was not regulated on EU markets until 2008. This entailed sky high tariffs on international calls, which were terminated by foreign companies. This prompted the European Commission to regulate these roaming tariffs.

12.8. Postal Services

12.8.1 Introduction
Postal services have been state and federal government monopolies for long and typically were government owned enterprises. Postal services are varied and encompass parcel post, magazines, bulk letter mail from banks and other firms and letter mail. The latter category is called first class mail in the US. Postal services were mostly government owned in both the US and Europe. The government owned enterprise has no clear motivation like profit maximization to guide its behavior and curb costs. It might be motivated to maximize budgets and revenues and thereby harm social welfare. Thus applies with the greatest force, if entry into these markets is prohibited by law. Deregulation could thus improve efficiency, if monopoly is broken up. Deregulation of postal services involves primarily the opening up of monopoly markets to entry. Privatization involves turning state owned into privately owned companies. Deregulation enabled the rise of private postal express companies like Federal Express and UPS. Deregulation has occurred in both the US and Europe for most categories of mail apart from letter mail that is collected via mailboxes and delivered six days a week. Economies of scale and universal service conditions postponed liberalization of letter mail. But, the EU has outpaced the US on deregulation of postal services and intends to open up the letter mail market to entry in 2011. The EU has also set larger steps on the postal privatization front than the US.
12.8.2 Postal Services as a Network Industry

Postal services consist of the following activities: Collection, Transport, Sorting and Delivery

Economies of scale are present in all four these activities. However, collection and delivery constitute natural monopolies for light weight letter mail, because the operation of collection and delivery systems for this type of mail cannot be replicated without raising costs. Moreover, both letter collection and delivery is subject to universal access and universal service obligations that increase costs. Letter collection boxes need to be present in large enough quantities to satisfy consumer comfort. Within the Netherlands TNT Post exploits 20,000 letter collection boxes, which are emptied six days a week. The letters are delivered six days a week and 98 percent of domestic mail is delivered within 24 hours. Universal service requirements can make entry by private firms, which are not bound to universal service requirements, attractive. This market segment thus poses difficult questions of deregulation.

12.8.3. Deregulation of US postal services

US Mail is a budget constrained government owned organization. Budget constrained means that it is expected to raise enough revenues to cover its costs (Sherman, 2008, 440). The US Postal Act of 1845 forbade private letter services in lucrative metropolitan areas in order to preserve universal services all over the country. Congress imposed universal service on US mail, implying that First Class mail service be offered to every destination in the nation for the same price for all mail weighing one ounce or less. The US Postal services were created in 1970, which made US Mail a public enterprise. This differed from the previous organizational form under which it was part of government bureaucracy. Rates are set by a Postal Rate Commission.

The 1970s also witnessed the first step on the road to deregulation. Several parts of US postal services have been unbundled in recent decades. Another part of the postal market that has been set apart involves bulk mail. Firms that deliver mail in bulk can take over some of the services rendered by US mail like putting on bar codes, which facilitates sorting, which entitles them to a rate reduction.

12.8.4 Deregulation of EU postal services

The EU started a debate on the deregulation of postal services in the 1980s. A first directive was issued in 1997, which foresaw the complete liberalization of EU postal markets in 2008. EU deregulation of postal
services goes beyond that of the US, which has not considered deregulation of letter mail yet. However, the 2008 date was postponed several times with regard to letter mail below 50 grams. The first directive was amended in 2002 and January 1st of 2009 was set as the date for complete liberalization of the EU postal markets. However, a 2008 amendment to the directive postponed the completion date to 2011 for old EU member states and to 2013 for new members. A reciprocity clause allows states to deny entry to their markets to companies that have their origin in non-deregulated member states. The EU directives involve the termination of monopoly protection by allowing entry. Privatization of PTT’s was not required. Germany and the Netherlands have privatized their postal services, but the UK and France have not.

Insert

Postal Deregulation in the Netherlands

Deregulation of the Dutch postal markets involved the incorporation of PTT Post as an independent organization instead of being part of a government departmental bureaucracy. The Dutch PTT was incorporated in 1989 as KPN and was privatized by selling subsequent tranches of KPN shares on the stock market. The postal services were divested from KPN telecom in 1996. The postal division acquired Australian TNT in 1996 and continued existence as TNT Post. The company counts several divisions; one involving collection and delivery of letter mail below 50 grams. This division continued to operate as a universal service provider under monopoly conditions, while other postal markets had been opened for entry competition by 2006. April 1st 2009 was set as the date for the complete liberalization of Dutch postal services, including the universal services part. But, entry into the letter market without a universal service requirement imposed on entrants would allow entrants to underbid TNT Post in metropolitan markets and increase costs for the remainder of the network. The universal service provider could then be squeezed out of the market. Liberalization of the postal market raised the question, whether TNT Post should be forced to allow access to its collection and delivery networks at regulated rates? Hence, could this network be considered to constitute an essential facility? TNT is indeed obliged to accept and deliver mail below a weight of 2 kilograms and parcels below 10 kilograms. Access to the TNT network is regulated by OPTA; the Dutch regulatory agency of Post and Telecommunications. The universal service part of the market is subject to price cap regulation.
Sandd entered the Dutch postal market in 2001. Sandd only accepts bulk mail with a minimum of 1500 pieces. Delivery is twice a week. Select Mail is a subsidiary of Deutsche Post and operates in the same markets as Sandd. Sandd and Direct Mail use the TNT delivery network to deliver mail at remote locations. TNT Post has also entered bulk markets with new services like TNT-Budgetmail and VSP Netwerk. Price wars were fought on these markets.

Another issue after deregulation involved the status of KPN employees that were former public servants. Entrants like Sandd and Select Mail do not employ unionized full time employees, but hire part time workers at reduced hourly rates. TNT dropped employee privileges in order to compete on equal terms with the entrants.

12.9. Airline Deregulation

12.9.1 The Economics of Airline Deregulation

Airlines were regulated from the beginning of the industry comprising both safety and economic regulation. Economic regulation encompassed tariff setting and the regulation of entry into the industry. Airline deregulation has been advocated by economists, who argued that air traffic constituted a contestable market. Each aircraft can be easily moved between routes. Investments in aircraft are, therefore, not sunk. Consequently, free entry into route markets would drive price down till average costs and regulation could be terminated.

12.9.2. Airline deregulation in the US

US airline regulation began in the 1930s with the advent of commercial air travel. The first impulse was to strengthen the emerging industry. However, regulatory control over pricing and entry limited the number of carriers on each route after the Civil Aeronautics Act was passed in 1938 (Sherman 2008, 559). Regulation was carried out by the Civil and Aeronautics Board (CAB). Regulation forbade companies to compete on price, which was set by the CAB. Entry was in fact prohibited for the next 40 years due to the heavy entry requirements and opposition from incumbent airlines to new entry. Airlines competed on non price features under regulation such as food and drinks and other services that are provided on board.

The call for airline deregulation became ever stronger in the 1970s. As a consequence, routes were opened for new entry. The Airline Deregulation Act of 1978 ended the CABs control of US routes, entry and air fares. New business models sprang up like the budget airlines. Airfares
decreased after deregulation. However, this applied especially to heavily flown routes, while competition was less intense on less densely traveled routes. US air fares decreased at an average of 25 percent in the 1990s (Morrison & Winston, 2000).

12.9.3. Airline Deregulation in Europe

The US pioneered airline deregulation. Deregulation spread to Europe after its successes had become visible. The European Union started airline deregulation in 1987 with the acceptance of the Single European Act (SEA), whose goal was to create a common market across the European Community by lifting all trade barriers across the Member States. The 1957 Treaty of Rome was amended in 1992 to strengthen the Commission’s authority to direct common policies, including a common transport policy. EU airline deregulation began in 1993, when the amendment came into effect and remaining barriers to a free aviation market were removed. The last barriers to competition on European routes were removed in 1997, when national markets were opened up to carriers from other member states.

12.9.4 Open Skies Agreements

Regulation was primarily directed towards national aviation routes. Regulation of international routes was conducted by IATA. Regulatory authorities like CAB could accept or reject air fares set by IATA on international routes. Open skies agreements are concluded between two nations that want to allow planes to land on each other’s soil and remove barriers to competition. The US has open skies agreements with more than 80 countries including all 27 EU countries. The US had concluded open skies agreements on a bilateral basis with EU member states before an EU agreement was reached. The Netherlands was the first open skies partner of the US. However, open skies agreements do not permit foreign carriers to enter routes that are outside their national or EU territory. A US airline can thus not enter services on a European route. The same applies to EU airlines that want to enter a US domestic route. The Civil aeronautics Act of 1938 required that US citizens own or control at least 75 percent of the voting interests of US airlines. This requirement has not been removed (yet). The EU also allows only European carriers to fly on routes within the European Union. A European carrier has to have at least 51 percent of voting stock in European hands. The European Union concluded an agreement with the US in 2007 that opened up their skies. The new agreement went into effect on March 30
2008. It extends open skies agreements to 11 EU countries with which the US had restrictive agreements before. These countries include Greece, Ireland, Spain and the UK.

12.9.5. The Hub and Spoke Model

The relevant market in the airline industry is the route; a connection between two cities. Deregulation of airlines occurred, when the industry was opened up for entry. Some routes attracted a lot of entry after deregulation; others less. Some airlines established a hub and spoke network. The hub and spoke network brings passengers from various points to the central airport; the hub; where passengers board to complete their flight. The hub and spoke network was developed by Federal Express and other parcel express firms and constituted an efficient way to deliver mail and packages rapidly as it saved on planes and miles flown.

Direct flights between 4 cities require 12 flights to connect these four cities in a point to point network; constituting 6 routes. A hub and spoke network, by contrast, would require 6 flights on 3 routes. We elucidate the situation for flights between four cities in the following figure.

Figure 12.1 Point to point and a hub and spoke network between 4 cities

We can generalize these results for n cities:

**Point to Point Network**

Direct Flights is \( n \times (n-1) \) flights

Routes is \( \frac{1}{2} n \times (n-1) \)
**Hub & Spoke Network**

*Flights is* $2 (n-1)$

*Routes is* $n -1$

*Connections is* $n(n-1)$

The number of city to city connections in the hub & spoke network is thus equal to the number of flights in the point to point network. That is because the same number of cities is reached from each point of departure.

The consequence of operating a hub & spoke network is that many passengers have to board another plane to reach their destination. Hub & spoke networks carry more passengers per flight than point to point networks. We assume that an equal number of passengers want to fly from one city to another. If 100 people want to fly from each city to each other city 300 passengers want to fly to 3 different destinations in a 4 city network. Hence, the number of passengers per flight from the non hub cities is $(n-1).100 = 300$.

The number of passengers that make a stop-over is $\frac{n-2}{n-1}(n-1).100 = 200$ per flight from the non hub city. In our example, where $n = 4$ only one third of passengers from non hub cities would fly directly and two third of passengers have to make a stop over at the hub airport.

Direct connections is $1/(n-1)$ and indirect connections are $1 - 1/(n-1) = (n-2)/(n-1)$ of non hub city departures.

All passengers living in the hub city would fly directly. The non hub cities constitute $(n-1)/n$ of all cities in the network. One third of all passengers on flights that originate from the hub airport fly directly. Three flights depart from the hub city, carrying 300 passengers; 100 from the hub city and 200 stopovers.

The number of passengers transported in the H&S exceeds that of passengers transported in the P to P network due to stopovers:

$$\Delta H & S = PtoP[\frac{n-2}{n-1}.\frac{n-1}{n}] = PtoP[\frac{n-2}{n}]$$

$$H & S = PtoP[1 + \frac{n-2}{n}] = n(n-1)[\frac{2(n-1)}{n}] = 2(n-1)^2$$

The number of additional passengers is $\frac{1}{2}$ that of passengers in the PtoP network in our example $(1/2 \times 1200 = 600)$. The total number of passengers is 1800.
Number of passengers per flight is:
\[
\frac{2(n-1)^2}{2(n-1)} = (n-1).100
\]
Total number of stopovers at the hub is \((n-2). (n-1). 100\) is 600 passengers in a 4 city network. This makes a total of 900 passengers that board in the hub city; 600 transits and 300 that originate in the hub city. Hence, each flight from the hub carries 100 passengers originating from the hub city and \((n-2). 100 = 200\) stopovers. Each plane that leaves the hub city also carries 300 passengers; 3 times as much as in a point to point network between 4 cities.

Total revenues in a city hub & spoke network are
\[
R = P.(n-1).n.100
\]
Cost per flight consist of fixed costs \(F\) and variable costs \(c\) that are related to the number of passengers on a plane.
Costs per flight are:
\[
C_{flight} = (n-1).100. c + F
\]
Total costs in a H&S network are
\[
2(n-1)^2 100.c + 2(n-1).F
\]
Profits are
\[
\pi_{HS} = P(n-1).n.100 - 2(n-1)^2 100.C - 2(n-1).F
\]
Hub and spoke networks are especially suited to transport freight, but less to transporting passengers, who prefer direct to stop-over flights. Hub and spoke networks that connect many cities are vulnerable to delays, since the plane can only leave the hub, if the last ‘feeder’ plane has arrived on the hub airport. Hub and spoke networks are employed for passenger transport on international routes. But, new budget airlines that offered direct flights between big cities on regional routes entered after deregulation. These airlines fly with a high frequency, which saves on costs, because the same aircraft and crew could carry out more flights in a day. Moreover, they depart from secondary airports that charge lower fees. The liberalization of airlines caused air traffic to increase rapidly. Consequently, airport capacity became a scarce commodity, which increased slot prices. Opening up former military and other less used
airports attenuated the scarcity of slots (time segments for take-off and landing). A new airline business model thus emerged that differed from the hub and spoke network. This model had direct flights between cities; high frequencies and flew to secondary airports. The new model had an optimal utilization of aircraft and crew due to short turn over times. This model was applied by Southwest Airlines in the US and by several budget airlines like Ryan Air and Easy Jet in Europe.

12.10. Market Regulation to Curb Competition

12.10.1. Introduction

Regulation can compensate for the effects of natural monopoly by setting price and output at cost levels. But, regulation can also ease competition in industries where competition is particularly intense due to the absence of sunk costs. The professions come to mind as examples of industries that are regulated to increase price above levels that would emerge from unrestricted competition. These regulations mainly involve entry requirements into professions like realtors, medicine, lawyers, taxicab drivers and so on. Entry requirements make professionals scarce, which increases their price. This implies particularly to professions with inelastic supply due to large training periods such as the medical professions, lawyers and pharmacists. Price and quantity in these industries are determined by the number of professionals that has entered these studies several years before. Scarcity could be attenuated by allowing foreign professionals into the country. Increasing numbers of professionals will drop their incomes. We can imagine that lawyers’ incomes will drop substantially, if their number doubles. Reduced income can either stem from partial unemployment due to a decrease of billable hours or from reduced hourly rates. Market regulation to curb competition is often justified by arguments of quality control. Medicine should be practiced by licensed doctors; taxis should be driven by drivers that know the town; lawyers should be knowledgeable about the law. Entry requirements into the professions are often designed and enforced by branch organizations. We call this self regulation. Requirements can also be set by local or central governments as is the case, if municipal authorities regulate entry into the taxi business. Governments can deregulate professional markets by easing entry requirements.

Entry regulation allows professionals to appropriate quasi rents springing from scarcity. Easing entry requirements can diminish these quasi rents.

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Deregulation of Dutch real estate agencies
Deregulation occurred in the Dutch real estate agents’ market in the 1990s. The official real estate association could no longer regulate entry through exams (self regulation). Brokerage fees declined after the market was opened to new entry. The market was further restructured by the advent of internet sites for home sales. Such internet sites can erect barriers to entry, if newcomers can be precluded from using the site. Deregulation may break up the power of official industry associations that can no longer refuse entrants. However, new voluntary associations might emerge that do not accept everyone as a member. This has happened in the Dutch realtor business.

12.10.2. Regulation in Agriculture

Prices of agricultural products are regulated in many countries. The regulation of US agriculture took off at the onset of the Depression in 1929, when the Federal Farm Board was established. Farmer’s incomes dropped rapidly, when prices of agricultural goods like wheat and cotton declined at the onset of the depression. The Roosevelt government wanted to intervene to protect farmers’ income and safeguard agricultural production. It, therefore, developed a scheme to support prices. Prices of agricultural products were not supposed to fall more than in manufacturing. Price supports involved government buying of agricultural products at an intervention price. The intervention price was above market price, if harvests were abundant and market price dropped. The bought up crops were hoarded to be sold at the moment when market price would exceed the intervention price. Surpluses and shortages were expected to even out over time. However, intervention prices were above long run market prices, which caused the accumulation of large stockpiles of wheat and other agricultural products. These surpluses entailed the launch of production restriction programs such as quota and premiums for not planting. Agricultural price policies made domestic prices diverge from world market prices. This forced governments to raise tariff and other trade barriers to protect their domestic agricultural markets.

The operation of a price support scheme is demonstrated in figure 12.2. Market price and quantity are determined by the intersection of the demand and supply curves at $P_{ma}$. We assume that supply is perfectly inelastic after the harvest. Supply may fluctuate from year to year due to weather conditions and planting plans. We assume that the intervention price $P_r$ is set above market price $P_{ma}$ at $P_r$. As a consequence, quantity demanded by consumers will drop from $Q_{ma}$ till $Q_r$. Consumers pay $P_r Q_r$ and government pays $P_r (Q_{ma} – Q_r)$. 

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Farmers’ incomes increase by $A + B + C$ in figure 12.2 compared to a situation without price supports. Consumers lose consumer surplus of $A + B$. Governments pay $B + C + D$.

Figure 12.2
*Price supports*

Total welfare effects are:
Consumers $-$ $(A + B)$
Producers $+$ $(A + B + C)$
Government $-$ $(B + C + D)$
Net effect on welfare $-$ $(B + D)$

Subsidies can be curtailed, if production quotas are imposed. No subsidies are required, if production is restricted to $Q_r$. However, this would reduce farmers’ incomes by $B + C + D$ in comparison to the price support scheme and could even let their incomes fall below market revenues. Farmers are, therefore, compensated for fields that lay fallow and for reduced output. That led to newspaper articles, wherein farmers report that they earned more for not producing than for producing, arousing indignation among the public.

The US agricultural policy example was followed by most developed nations after World War II. The EU installed price support programs for grains, diary, livestock and sugar. Among OECD nations Switzerland spends most on agricultural subsidies, which are at 69 percent of production values. This amounted to 650$ a

**Insert**

**US Agricultural Subsidies**

Agricultural subsidies mostly involve staple goods. The US subsidizes corn, cotton, wheat, rice, soy beans, dairy products, peanuts and sugar. The US is a large net exporter of wheat cotton and corn. Intervention prices that rise domestic prices above market levels would cause problems in international trade. The US should set import tariffs equal to the price differential to keep imports out. New subsidy schemes do not raise domestic price above market price, but give income support to farmers, if price drops below a certain level. Some of these schemes are related to prices and output like the Marketing Assistance Loan Program; others like the Direct Payments Program are not. The Counter Cyclical Program evens out farmers’ income over the seasons and is paid based on historical production. US cotton subsidies averaged 0,21 $ per pound from crop year 1991 till 2003. The average market price of cotton from 1991 through 2003 was 0,56$ per pound. The subsidies thus added 37,5 percent to farmers’ revenues.

**12.11. Regulation and Deregulation in Banking**

**12.11.1 Introduction**

The banking sector is regulated, because bank failures can have grave consequences for the whole economic system. Shareholders and creditors are badly affected by bankruptcy of companies. However, these are calculated risks made by investors in those companies. Bank failures differ from other bankruptcies, because people lose their deposits, if a bank collapses. They would not have put their money in the bank, if they expected it to fail. Particularly, the effect of default on depositors has triggered bank regulation. Central banks that appeared in the 20th century acted as lenders of last resort and could bail out collapsing banks.

**12.11.2 US Bank Regulation**

US bank regulation distinguishes between state chartered and federal chartered banks. The latter are called national banks. US bank regulation started in the 1860s and involves requirements with respect to the equity cushions banks should hold and the reserve fractions they keep. National
banks needed to comply with larger capital requirements than state banks (Sherman, 2008, 805). Fractional reserves point at the share of deposits banks need to keep in reserve. A reserve fraction of 10 percent is common.

Bank charters were provided on a large scale in the 19th century. The number of banks grew from 4338 in 1886 till 29151 in 1910. Many state chartered banks operated in local financial markets and were, therefore, not diversified. They ran a higher risk of default as a consequence of this. Moreover, there was no federal reserve system in the 19th century and, therefore, no lender of last resort. The Federal Reserve Act of 1913 created the Federal Reserve System that intended to give stability to the banking system. The system implied the founding of a central bank; the Federal Reserve or Fed. The Fed pursued monetary policy and could lend to banks that had joined the federal reserve system. National banks were obliged to join the federal reserve, whereas state banks were free to choose between state or federal reserve regulation. Most state banks preferred state to federal regulation.

The Federal Reserve Act of 1913 limited national banks to operations at only one location (Sherman, 2008, 806). Some states had the same restrictions. The 1930s saw a further restriction on branching, which was prohibited in half the states by 1930 and limited by others (Adams, 1977, 342). California was the only state that allowed branch banking throughout the state at the time. The limitations on branch banking were imposed to curb bank competition. The prohibition of branch banking was only released gradually. Interstate banking only became possible in the US in the 1990s (Sherman, 2008, 806).

Territorial restrictions made banks less diversified, which could hasten their collapse. However, one bank could not infect other banks under this regime and failures could remain local. Local banks were also assumed to assess the risk of loans to local businesses better than faraway banks. Banks that make an estimate of a loan’s risk based on personal information are engaged in relationship banking. However, no close surveillance of a person’s status can prevent a loan to default. Interest rates on loans, therefore, carry a risk premium to pay for defaults.

A bank can fail, if it underestimated risk on its investments. Moreover, rumors about an imminent bank failure can bring it to happen, if people run on a bank to recollect their deposits. A bank run would inevitably cause the collapse of a bank, because banks only hold a fraction of deposits in reserve.

Banking regulation intended to prevent bank failures. However, the crisis of the 1930s brought many bank failures in its wake. The Fed did not stop bank failures and more than 9000 US banks failed at the time. US Congress passed a Banking Act in 1933 to curb competition in banking:
- Banks were prevented from paying interest on checking account deposits
- A maximum interest rate was set to be paid on saving deposits
- Commercial banking was separated from investment banking. This part of the bill is called the Glass Steagall Act.
- The federal deposit insurance system was installed, which was to be enforced by the federal deposit insurance corporation (FDIC). The secured amount rose from 2500$ in 1933 till 250000$ for the years 2009 till 2013.

The central bank wanted to prevent bank failures by acting as lender of last resort and by insuring deposits. The insurance system was funded by levying a charge on the annual deposits of banks covered by the insurance (Sherman 2008, 807). State regulated banks had deposit insurance schemes of their own. Competition in banking was considered to be the root cause of the collapse of so many banks in the 1930s. Assuaging competition and separating investment from commercial banks should prevent future bank failures. Deposit insurance should prevent bank runs.

*The Regulation of Thrifts and mutual funds*

Thriffs are bank institutions that have specialized functions such as mortgage lending. Savings and loan banks and credit unions also belong to this category. These institutions got their own deposit insurance system and regulatory institution the Federal Savings and Loan Insurance Corporation (FSLIC) that was established in 1934. The thriffs borrowed short and lent long at fixed interest rates, which made their activities hazardous, if interest rates on loans are fixed for a long time, while short term rates fluctuate wildly. Thriffs were not subject to interest rate limits as were commercial banks. But, their rates were regulated in 1966 by the Interest Control Act, which gave them the authority to set ceilings on the interest rates thriffs had to pay, which were somewhat above the ceilings set by commercial banks (Sherman 2008, 808). However, banks and thriffs still competed for deposits, which took the form of non price competition like offering consumers toasters or other prizes, if they opened an account. Banks also increased service levels to compete. Regulation spread from commercial banks to thriffs.

New institutions appeared in the 1970s; the money market mutual funds. They escaped interest rate regulation, because they were neither commercial banks nor thriffs. Both money market funds and state chartered savings banks introduced interest bearing checking accounts,
which also escaped regulation. Banks and thrifts lost out to the new institutions in the inflationary seventies that paid higher interest rates on accounts (Sherman, 2008, 809). Government had widened the regulatory net when it regulated the thrifts. Now, it wanted to lift regulatory impediments on interest rates to allow banks and thrifts to compete with the new unregulated institutions. The thrifts were deregulated in 1980 in order to allow them to compete. Further deregulation terminated interest rate regulation (known as Regulation Q) for banks in 1986. Thrifts were no longer restricted to mortgage loans, but could also enter markets for credit card loans, consumer loans, commercial loans and equity investments. States followed suit. But, deregulation coupled to extended deposit insurance soon proved to be a recipe for disaster. Savings and loans came to carry out risky investments; as a consequence of which many failed in the savings and loan crisis of the 1980s. Deposit insurance funds proved to be insufficient to pay for deposits of failed banks up to an amount of 100,000$. The Fed, therefore, had to step in to pay for deposit insurance. The Savings and Loan crisis cost US tax payers 150 to 200$ billion (Sherman 2008, 811). About 400$ million was recovered through asset sales and lawsuits against S&L directors.

Further deregulation emerged in 1999, when the Glass Steagall Act was repealed. Moreover, the walls between insurance companies and banks were also removed in 1999. Commercial banks that also engage in investment banking and insurance are called universal banks. Such diversification was assumed to reduce risk.

12.11.3. Bank Regulation in the EU

The establishment of the European Community in 1958 did not imply a monetary union. The European Monetary Union (EMU) began in 1999, when several European countries adopted the euro as a common currency. A European central bank (ECB) was established in Frankfurt. The ECB carries out monetary policy, whereas bank regulation is carried out by the various national central banks. Each national central bank has its own policies with regard to bank entry, merger and deposit insurance. These policies are coordinated by the European Commission. The EU Directive on deposit guarantee schemes of 1994 requires all member states to have a deposit guarantee scheme for at least 90 percent of a deposited amount of at least 20,000 euros per person. This was increased till a minimum amount of 50,000 euros in October 2008 after Ireland had increased its guarantees till an unlimited amount (Wikipedia, Deposit Insurance).
National central banks also need to provide the funds to bail out banks that are on the verge of collapse. National central banks are also responsible for deposit insurance schemes of banks located in their territory.

12.11.4. Financial Crises after Word War II

Financial systems are subject to asset price bubbles that cause a crisis, if they burst. The post World War II world has not shown deep depressions in the western world, but featured several recessions until 2007-2009. The US Savings and Loan crisis of the 1980s and 90s emerged, after these institutions were deregulated. More than 1600 insured S&L’s failed between 1986 and 1995. The collapse was triggered by declining home prices that were used as collateral to the mortgage loans issued by these institutions. New home constructions fell by more than 40 percent between 1986 and 1991 (Wikipedia, Savings and Loan Crisis). US government had to bail out S&L’s to a value of 3.2 percent of GDP.

The dotcom crisis of 2001 was merely an equity asset bubble and hardly affected the real economy. Five $ trillion of asset value was wiped out by the dotcom crisis. These losses were taken by private investors.

The credit crisis that started in 2007 as a US sub-prime mortgage loan crisis had spread into other financial and regional markets by 2009. The credit crisis was spurred by financial innovations like collateralized debt obligations (CDOs) and credit default swaps (CDSs), whose risk was underestimated. CDOs contained tranches of sub prime mortgage loans; the first losses were borne by the original issuing institutions, which reduced the risk profile of these securities. Moreover, the sub prime loans were pooled with other securities and obtained AAA status from the rating agencies. The idea was that diversification would reduce risk. However, risk was systematically underestimated. This applied specifically to tail risk; the risk of infrequent events like defaults, which are hard to quantify (Diamond & Rajan, 2009). Banks increased leverage due to alleged risk reduction through securitization. But banks effectively maintained credit risk (Acharya & Schnabl, 2009). Moreover, these new securities were financed with short term debt, which made them vulnerable to becoming illiquid or even insolvent, when asset values dropped below liabilities.

The financial products based on US mortgages lost most of their value, when risk became apparent due to dropping home prices and foreclosures. The new securities had been sold to domestic and foreign banks that had to depreciate their balance sheets, when the losses appeared. The credit crisis spread to all asset backed securities; high yield bonds; commercial paper; money market funds and the real economy. The crisis brought
many banks on the verge of collapse due to huge write downs. Failures could only be prevented by huge government bail-outs. The Fed injected billions into the financial system and the Treasury department propped up banks’ balance sheets by massive loans and/or equity injections. Interest rates were cut to historically low levels. The ECB injected billions of euro into the market; 250 billion in September 2007 alone and also reduced interest rates.

However, these policies could not prevent the (near) collapse of banks in the US and Europe. Bear Stearns was rescued by the US Treasury and acquired by JP Morgan in March 2008. Lehman Brothers filed for bankruptcy in September 2008. Merrill Lynch was acquired by Bank of America in the same month. AIG the big US insurance company got a 85$ billion bail out in September 2008, while the US government obtained 85 percent of its stock. Fannie May and Freddy Mac; two big mortgage finance insurance companies were rescued and nationalized in September 2008. Creditors were protected, but shareholders were not in these operations.

Deregulation had blurred the boundaries between commercial and investment banking in the US. The credit crisis meant the end of investment banking in the US as we knew it. Investment banks like Bear Stearns, Lehman and Merrill Lynch disappeared either through bankruptcy or were acquired by a commercial bank. Morgan Stanley and Goldman Sachs switched status to become bank holding companies, which allowed them to take retail deposits. Hence, investment banks disappeared and were amalgamated into commercial banks. The obligations of the FDIC increased as a consequence of these moves. The combination of deregulation and an extending safety net of deposit insurance turned out to be a lethal mixture.

European banks like Northern Rock, Royal Bank of Scotland and ABN/AMRO-Fortis were also nationalized in 2008. The financial crisis prompted governments at both sides of the Atlantic to bail out banks. They do not want system banks to fail, because this would weaken the economy. Moreover, deposit insurance makes bank failure costly to the government, if insurance premiums are insufficient to cover the losses. The FDIC and other deposit guarantee institutions in the US and Europe proved to have insufficient means in times of financial crisis to insure deposits. Governments, therefore, stepped in to mop up the losses. This happened during the S&L crisis and the Scandinavian banking crises of the 1990s. Bail outs in 2008 and 2009 served the same goal. Governments had to choose between the Scylla of paying deposit holders in bankruptcy and the Charybdis of capital injections to prop up bank balance sheets to prevent bankruptcy. The deposit insurance schemes created a moral hazard problem, as they forced government to come to the rescue of
failing banks that posed a systemic risk. Banks that know to be bailed out may be prone to take excessive risks. This applies the more so, if bank directors and money managers benefit from profits through performance pay schemes. Bank officials thus receive on the upside, while tax payers pay for the downside.

Banks pursued identical policies that were based on faulty risk estimates. Banks no longer made risk estimates based on individual valuation of a person’s credit worth, but applied identical mathematical formulae to measure risk. Diversification does not work, if everybody keeps the same portfolio.

12.12 Summary

Market regulation has been induced by market failures such as natural monopoly and a-symmetric information. It has also been motivated by considerations to provide universal access and services to remote regions and to sustain farmers’ incomes. The wave of deregulations that characterized the 1980s and 90s sprang from technological developments and from economic theory i.e. contestable market theory. Deregulation has been most successful in industries where competition increased by the arrival of rival networks due to technological advance as was the case in telecommunications. Deregulation of airlines was also successful as it shattered an artificial monopoly that repressed competition unnecessarily. Deregulation in banking has been less successful, because it removed the brakes on risky loans, while losses were moved over to the government. The effects of deregulation in public utility sectors like electricity and railroads have also been doubtful.

Questions for Discussion

1. Compare the expected effects of deregulation in telecommunications, railways and taxicabs.
2. What will happen, if universal service breaks down in railways; in postal services?
3. Rate of return regulation had some drawbacks. What are the disadvantages of price cap regulation, in your view? What of yardstick regulation?
4. Voluntary associations sprang up among Dutch realtors after entry requirements were lifted by the government as part of a deregulation program. The new organization ran its own web site. Non member realtors demanded access to this web site. Should such access be mandatory?
5. Dutch postal workers agreed to a salary cut in a central wage contract that was concluded in 2008 to come on a par with entrants to the postal services market. Is such a cut, in your view, justified for the part of the market that is covered by universal service?

*Exercises*

1. A monopoly has the following demand and cost functions:

   \[ P = 130 - Q \]
   \[ C = 10Q + 900 \]

   a. What is monopoly price and output?
   b. What are monopoly profits?
   c. What should regulated price be, if price equals average costs?

2. The monopoly market is opened up for entry.
   a. One entrant appears that behaves as a Stackelberg follower.
      What is price; what is quantity now?
      a. What profits does the entrant expect to make?
      b. What is long run equilibrium market structure in Cournot equilibrium. What is price?
      c. What will price and quantity be in Bertrand competition?

3. The monopolist needs to operate two plants to satisfy monopoly output.
   a. What will Stackelberg equilibrium be?
   b. What will Cournot equilibrium be?

4. Capacity at sunk costs of 900 suffices to cover the whole market at competitive prices. An entrant has a new technology with the following cost function. His installed capacity is also sufficient to cover the whole market.

   \[ C = 5q + 400. \]

   a. What is post entry price and quantity?
   b. What are profits?
   c. What price should a regulator set?

5. A natural monopoly has the following demand and cost functions:

   \[ P = 90 - Q \]
\[ C = 30 \, Q + 400 \]
Capacity of one network suffices to cover the whole market.

a. What is monopoly price and output?
b. What is regulated price and output, if price equals average costs.
c. The sector is deregulated. Government opens up the industry for entrants without a network of their own. What should regulated access price be, if virtual entrants have marginal costs of 30? What if they have marginal costs of 20?

6. The natural monopoly of exercise 5 is state owned and regulated at a price of 40. The state wants to privatize the network.
   a. What is the value of the network, if it has an expected length of life of 30 years and the discount rate is 5 percent? What is the value of the network, if it is assumed to live forever?
   b. What is the value of the network, if it is opened for virtual entry, and access price is set at 10 per unit? Entrants have marginal costs of 20. For a length of life of 30 years, forever?

7. A fixed telecommunications network company that is a monopoly has the following demand and cost functions:

\[ P = 25 - Q \]
\[ C = 5Q + 50 \]

a. A cable company develops a technology, whereby its network can also be used for telephony: the fixed costs of the network are recovered by television subscriptions. Its marginal costs are 10 per unit.
   What price will the fixed monopolist set? What are its profits?
   b. The fixed network can be used for internet transmission, which has the following demand function:

\[ P = 50 - Q \]

What unit price will the fixed network monopolist demand, if it is the only internet provider? What are its additions to profits, if no additional investments are required to offer internet services and marginal costs per unit are 5?
c. Both cable and telephone company can offer internet services without additional investments, What are additional profits of the telephone and the cable company?

8. A mobile phone company has a monopoly on these services. Demand and cost functions are as follows:

\[ P = 30 - Q \]
\[ C = 4Q + 25 \]

a. What are monopoly profits?
b. The government puts 5 licenses up for auction. How many entrants will appear, if both incumbents and entrant firms need to spend 25 to roll out a network and the incumbent monopolist is expected to remain dominant?
c. How many firms will appear at the auction, if collusion is expected?
d. How many firms will appear at the auction, if Cournot behavior is expected in the post entry market?

9. A state postal services company has a monopoly. It has universal access and universal service obligations. We can distinguish metropolitan and rural markets with different cost functions.

**Metropolitan markets:**

\[ P = 50 - Q \]
\[ C = 15Q + 50 \]

**Rural Markets:**

\[ P = 50 - Q \]
\[ C = 25Q + 100 \]

a. What are regulated prices in each market, if price equals average costs?
b. What is regulated price under universal access and universal service obligations?
c. The markets are opened up for entry and price regulation stops.
How will this affect profits of the former monopolist, if it is still held to provide universal access and universal service while the entrants are not?

10. An airline has a point to point network connecting 10 cities with daily flights.
   c. How many flights are there per day?
   d. How many passengers are transported, if each plane carries 100 passengers?
   e. How many flights are carried out in a H&S network?
   f. How many passengers would fly directly?
   g. How many passengers would be on each plane?

11. An airline has a hub & spoke network that connects 3 cities by daily flights. 100 passengers want to transfer from one city to each other city daily. Price fore each city to city transfer is 100.
Costs per flight are

\[ C = 10Q + 2500 \]

a. How many flights are there per day. How many city to city transfers?
   b. How many passengers are on each flight?
   c. What are daily profits?
   d. What would profits be in a point to point network?

12. An airline has a hub and spoke network that connects 3 cities with one flight a day. Demand on all city to city transfers has the same demand function:

\[ P = 155 - Q \]

Each flight has the same cost function:

\[ C = 15Q + 2500 \]

a. What is the monopoly price for each city to city transfer
   What are profits?
   d. Passengers on indirect flights want a price reduction of 20. What are profits now?
13. An airline connecting 4 cities in a H&S network decides to break up the hub & spoke network and wants to install a point to point network. It buys smaller planes with a capacity of 100.

The demand function for each transfer is:

\[ P = 155 - Q \]

The new cost function for each flight is:

\[ C = 10Q + 1600 \]

a. How many flights are made?
b. What is price, if planes are filled up to capacity?
c. What are profits?

14. A government decides to impose a price support system for agriculture: Domestic demand for cotton is:

\[ P = 100 - Q \]

The intervention price is set at 40. The wheat harvest in a certain year is 80 (million) tons.

a. How much do producers gain from the intervention system?
b. How much do consumers lose?
c. What are costs to government?
d. What is the net welfare effect?
e. Government decides to donate 20 million tons of food aid each year. How much does this cost her with a price support scheme; without a price support scheme?

15. World demand for cotton is:

\[ P = 500 - Q \]

World production outside the US is 400. US production is 80 under an intervention scheme that pays a price of 40 for each ton of cotton. Domestic US demand is

\[ P = 100 - Q \]
a. What is the effect of the US price scheme on world market price, if the US keeps no stock piles?
b. Brazil, which is a net exporter of cotton, complains that the farmers’ assistance programs affect her income from cotton production. How much do Brazilian producers lose, if they produce 50 million tons of cotton?

16. The US installs an income support scheme, which pays small farmers that produce at high unit costs the difference between their costs and world market price of 30. One fourth of US production of 80 occurs at average costs of 40 and 3 fourths at costs of 20 or lower.
   a. What are the costs of this support scheme for US government?
   b. What are US imports, what exports?
   c. What is the effect on world market price?

17. The daily demand for taxi kilometers in a town is:

\[ P = 10 - 0.01 Q \]
The maximum number of kilometers a taxi can drive per day is 100.

   a. How many taxi licenses should be issued, if price is regulated at 1 per kilometer?
   b. Costs per kilometer are 0.50. What is the annual value of a taxi license, if each taxi operates 300 days a year?
   c. The number of taxis doubles after deregulation, but price remains at 1 per kilometer. How does this affect revenues per taxi, if fixed costs per day are 25 and variable costs are 0.25 per kilometer?

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