swiss economics

# A General Framework for Regulation and Liberalization in Network Industries

**Christian Jaag**
**Urs Trinkner**

**Swiss Economics Working Paper 0016**

**December 2009**

Published as:

"A General Framework for Regulation and Liberalization in Network Industries" (2011). In: International Handbook of Network Industries. Finger, M. and Künneke, R. (eds), 2011, pp. 26-53.

**Swiss Economics SE AG**
**Abeggweg 15**
**CH-8057 Zürich**

**T: +41 (0)44 500 56 20**
**F: +41 (0)44 500 56 21**

**office@swiss-economics.ch**
**www.swiss-economics.ch**

# A General Framework for Regulation and Liberalization in Network Industries [1]

**Christian Jaag**, Swiss Economics and University of St. Gallen
**Urs Trinkner**, Swiss Economics and University of Zurich[2]

## 1. Introduction

Traditionally, most network industries used to be dominated by state-owned regulated monopolies. During the past twenty years, governments in many parts of the world have started liberalizing their network industries, e.g., telecommunications, postal services, electricity, and transport. This liberalization process started in the United States in the late 1970s and in the United Kingdom in the early 1980s. Since then, sectors such as telecommunications and air transport have become fully liberalized in the European Union and are becoming increasingly competitive. The electricity sector, postal services, and railways are not yet fully liberalized.

In parallel with liberalization, sector-specific regulation in network industries has become a widely discussed topic among academics, policy makers, industry economists and regulators themselves. The issue of these debates has usually been on whether such regulation is necessary and if so what its optimal design should be. Some argue for complete deregulation (i.e., the complete abolishment of sector-specific regulations), whereas others propose re-regulations, that is the replacement of pre-existing (monopoly) regulations by new regulations aiming at safeguarding service levels and competition. The resulting compromise is often somewhere in between; the liberalization process usually entails the partial replacement and realignment of sector-specific regulatory intervention by the disciplining forces of competition protected by competition law. Consequently, competition law and sector-specific regulation play complementary roles.[3]

In this chapter, we present a general economic framework to assess regulatory remedies in network industries. Therein, liberalization, or more generally market access regulation, can be assessed as well. It provides a foundation and explanation of current sector-specific regulations in place. Our analytical starting point is the observation of industry-specific deviations from the concept of perfect markets. Where markets are perfect, efficient outcomes can be expected. In such a world, the only rationale for sector-specific regulation would be redistribution. This standard result of economic theory is based on quite rigid assumptions. In real markets, there are important deviations which give rise to market failures and inefficient market equilibria. We find that in the network industries, most regulatory interventions can be explained by market failures. In particular, natural market power, incomplete markets, and asymmetric information are sound rationales for sector-specific market interventions. However, political processes often fail to produce consistent regulatory models[4], and

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[1] For a detailed description of the framework and applications to the postal and telecommunications sector, see Trinkner (2009) and Swiss Economics (2009).

[2] Corresponding author; urs.trinkner@swiss-economics.ch.

[3] The terms "competition law" and "antitrust law" are used as synonyms. The former is the technical term in the EU, while the latter is used in the US.

[4] Politics can be interpreted as a rent seeking or capture process, see Stigler (1971). In this view, consistency would be a product of coincidence.

moreover, there are no benevolent regulatory authorities able to implement these models in practice perfectly.[5] Hence, there is the risk of potential regulatory failure too. Therefore, market failures are necessary but not sufficient pre-conditions for market interventions. In particular, market failure and regulatory failure must be balanced against each other. In the second part of the paper, we propose a framework on how to perform this assessment. Applying the framework to market power regulation, we find that pre-existing regulations should not be fully replaced by competition law in the presence of infrastructures or network layers which are monopolistic by nature.

Market failures as a starting point for regulations have been proposed by many authors. For example Baldwin and Cave (1999) provide rationales for regulation that are closely linked to deviations from perfect markets.[6] While others take a different starting point[7], our approach follows these lines. It is new to the extent that it provides a comprehensive framework for understanding and analyzing the need for sector-specific regulations in the network industries (including the role of market access and universal service obligations). Moreover, it allows to directly deriving an appropriate and consistent regulatory model to cope with prevalent or potentially harmful market failures.

The chapter proceeds as follows: Section 2 presents the analytical framework to assess the need for regulatory intervention. Section 3 applies this framework to bottleneck regulation in network industries. We conclude in Section 4.

## 2. Analytical Framework

### 2.1 Basic framework

~~Our theoretical framework starts from a free market primacy assumption: Markets, if they function properly, provide firms with the right incentives to enter markets, set prices, and invest in innovation at a socially optimal level.~~ Of course, there are a number of obstacles to markets functioning well in that sense. So called market failures give rise to potentially beneficial regulation – at the risk of these regulations failing as well~~. Generally, those market failures should be tackled by regulatory interventions that that result in a clear welfare improvement in light of possible regulatory failures.~~

Figure 1 illustrates the basic framework. Starting from a free market situation, if there is no market failure or no harmful potential market failure, there is no need to intervene. If the

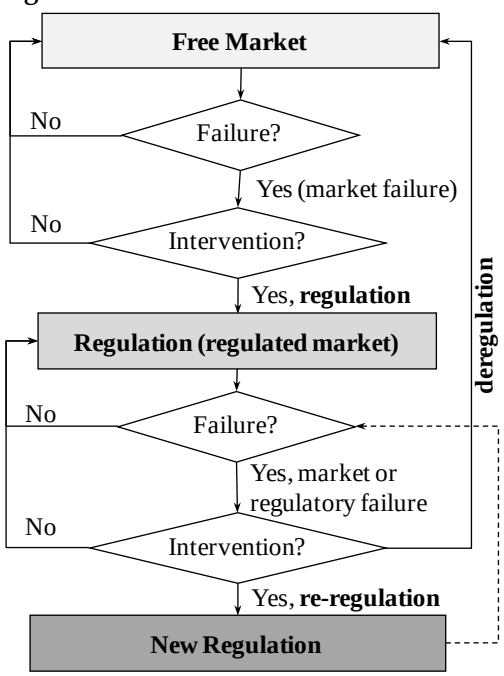
[5] Newbery (1999) describes normative and positive theories of regulation. He finds that "regulation … is inevitably inefficient because of problems of information and commitment and, more fundamentally, because of inefficient bargaining between interest groups over potential utility rents."

[6] They also summarize positive theories of regulation, including public interest theories, interest group theories, and private interest theories.

[7] For example, Spiller (2008) understands regulation as a public contract between the government and operators and develops a theory on liberalization depending on regulatory credibility and opportunism of all involved parties. While Spiller (as many others) treats regulators as opportunistic like any other agent in the economy, the Toulouse school usually assumes benevolent regulators in a world of asymmetric information and aims to provide the right incentives for the companies in the market. More explicitly, Armstrong and Sappington (2006) see the key question of whether to liberalize or not in an unavoidable trade-off between efficiency of operations and rent extraction by operators. They discuss various regulatory policies and identify which ones are suitable and which ones not.

~~market fails persistently and government chooses to intervene, it establishes regulations.[8] If the regulated situation still fails when confronted with the socially desirable outcome – either because the selected regulation is not appropriate to cope with the initial market failure or due to other political or social goals – there is scope for re-regulation. However, if regulation in general is deemed not appropriate or detrimental to attain social goals, this should result in de-regulation, i.e. a lighter regulatory framework leaving market players more leeway to act in the market.~~ The right side of Figure 1 summarizes the main criteria that should be considered when assessing the need for regulatory remedies. We will develop the rationale behind these criteria in the remainder of the paper.

**Figure 1: Illustration of General Framework**




**Criteria**

- Persistent or harmful potential market failure
- Precondition: Important deviation from perfect markets paradigm

- Qualitative Criteria: Proportionality, expedience, competitive neutrality , etc.
- Quantiative Criteria: Short and long term impact on overall welfare

- Persistent or harmful potential market and/or regulatory failure
- Precondition: Important deviation from perfect markets paradigm

- Qualitative Criteria: Proportionality, expedience, competitive neutrality , etc.
- Quantiative Criteria: Short and long term impact on overall welfare

Source: Authors' own

## 2.2 Economic foundations of sector-specific regulation

### 2.2.1 Welfare theorems

In perfectly competitive markets, the resulting competitive market equilibrium is Pareto optimal (first fundamental theorem of welfare economics)and there are no market failures. The market equilibrium is efficient in the sense that one cannot make anyone better off without making at least somebody else worse off. This rather descriptive welfare criterion is not very ambitious; depending on the initial endowment of the economy, a Pareto efficient equilibrium may constitute an uneven distribution of wealth among individuals.

The second theorem of welfare economics establishes that by use of appropriate lump sum transfers, one can achieve different Pareto efficient market equilibria with different wealth distributions. This second theorem gives rise to a first fundamental source of market interventions: Redistribution. For example, if a society agreed on a social goal like an even income distribution, it could do so by appropriately defining lump sum transfers.

From this viewpoint, rent seeking activities are compliant with the second fundamental welfare theorem – rent seekers try to establish a different Pareto equilibrium. In fact,

[8] There is a broad range of possible regulations including self-provision of certain goods or services by the government itself.

regulatory economists such as Crew and Kleindorfer (2002) conclude that in practice, liberalization of network industries might largely be motivated by redistributions of wealth (in particular from small customers to large customers): "Rent seekers will devote considerable resources to obtaining a share of the monopoly rents of which government now has taken control through the regulatory process "(p. 8), "Deregulation's likely primary driver is the division and redistribution of the monopoly rents. Large customers are attempting to gain at the expense of small customers" (p. 12).

Summarizing, the only market interventions that are economically justifiable in perfect markets are lump sum transfers aiming for redistribution. In practice however, markets are hardly ever perfect and redistribution is hardly ever lump sum.

### 2.2.2 Market imperfections

Attempts for redistribution are present in any industry and market. ~~Although redistribution is at the heart of any regulatory discussion and political process in network industries~~, the second theorem of welfare economics cannot explain why topics like access regulation or universal service obligations are specific to network industries.

In the remainder of the chapter we will present a theoretical framework that explains why sector-specific regulations implemented in network industries do and should differ both from other industries as well as among the various network industries.

Our analytical starting point are deviations of real markets from the above paradigm of "perfect markets" (or "perfectly competitive markets"). Recall that the perfect market assumption lies at the basis of the two welfare theorems. Important assumptions are:

- ~~A1:~~ ~~Any company or consumer in the economy acts as price taker, i.e. there is *no bargaining or market power;*~~
- ~~A2:~~ ~~Markets are complete, i.e. there exists a true price for any good – there are *no externalities* (or they are readily traded and thus internalized correctly);~~[9]
- ~~A3:~~ ~~Information is symmetrically distributed (*no asymmetric information*) and there are *no transaction costs*.~~

These assumptions are very rigid and are hardly ever met in practice. This gives room for market failures. Market failures are "situations in which some of the assumptions of the welfare theorems do not hold and in which, as a consequence, market equilibria cannot be relied on to yield Pareto optimal outcomes" (Mas-Colell et al., 1995, p. 350). As a consequence, sector-specific regulation tackling the relevant market imperfections can potentially lead to Pareto improvements (i.e. Pareto efficient equilibria).

However, many deviations from perfect markets can be observed in most if not all markets. It makes sense to tackle them uniformly and *equally among all sectors* of an economy. First of all, and in light of important information asymmetries, any society must find ways to allocate and enforce property rights, and to secure commercial freedom and the free movement of prices. Consequently, an important share of civil and commercial law deals with securing (intellectual) property rights and making contracts better enforceable in a world of incomplete contracts and asymmetric information. A further important source of general regulations are competition or antitrust laws aiming to limit harmful abuse of market power. .

In principle, the area of application of these laws and acts covers all markets of an economy. However, they may not be sufficient to cope with sector-specific market failures. Hence, potential sector-specific regulations must be assessed against these prevailing laws. Non-sector-specific market failures (or regulatory failures) should be dealt with in general laws to

[9] For the link between incomplete markets and externalities see Arrow (1969).

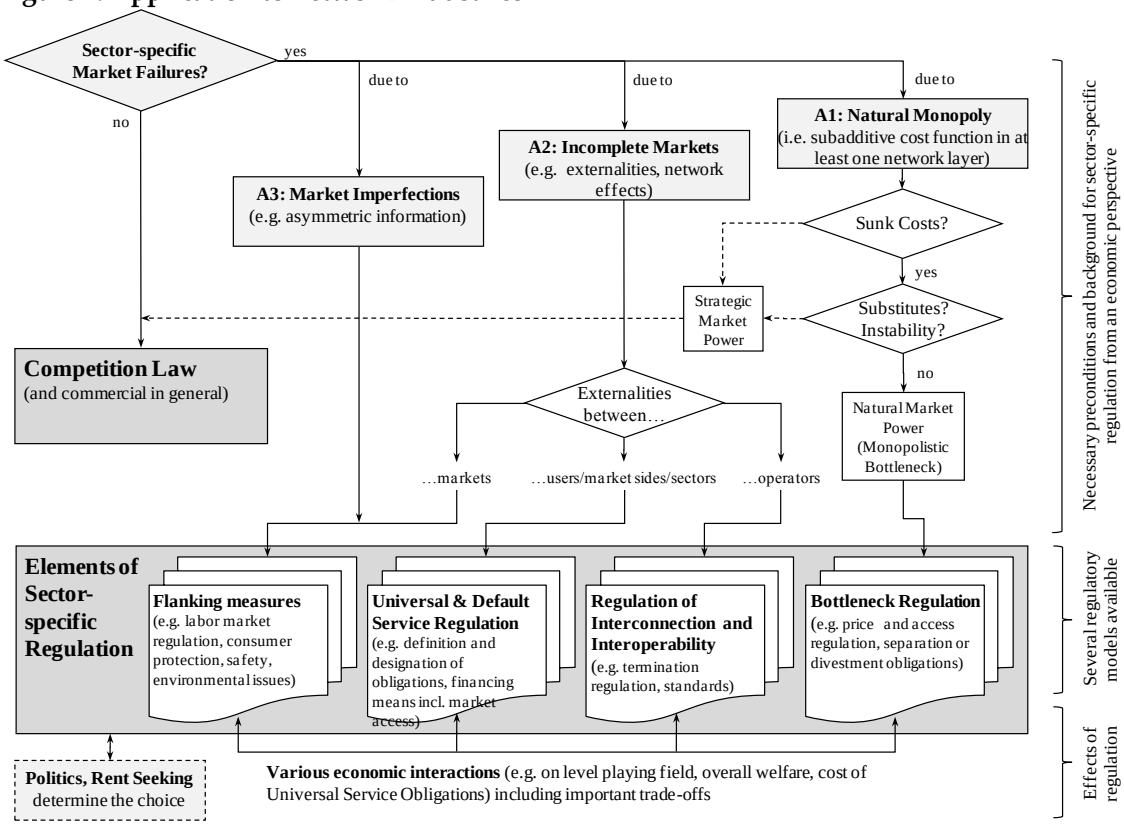
avoid uneven and inconsistent treatment of market players among various industries.[10] In network industries, the most important source of prevailing regulations is competition law.

We summarize as follows. (i) Any new sector-specific regulation in question should be based on deviations of the perfect markets assumptions leading to (potential) market failures with harmful effects on overall welfare. (ii) New regulation should be introduced only if these failures are not sufficiently tackled by general regulations or prevailing sector specific regulations. (iii) Moreover, the new regulations should clearly improve the situation with respect to potential regulatory failures.

### 2.3 Sources for sector-specific regulation in network industries

In most industries and in network industries in particular, there are important deviations from the perfect markets assumptions A1 to A3 that have been introduced above. On the grounds of these deviations we will be able to explain most elements of sector-specific regulations in network industries.[11] Figure 2 provides an overview of our approach and illustrates that monopolistic bottlenecks (A1), externalities (A2), and further market imperfections such as information asymmetries (A3) provide sound reasons for sector-specific regulations that typically are encountered in industrialized countries. We will now briefly discuss these three dimensions of potential market failures and their regulatory remedies.

**Figure 2: Application to network industries**




Source: Authors' own.

[10] For example, Panzar (2009) discusses the relationship of competition policy and (sector-specific) regulation in the newly liberalized postal sector.

[11] See Trinkner (2009) and Swiss Economics (2009) for applications to the postal and telecommunications sector.

## A1: Market power – Regulation of Bottlenecks

~~Economic agents do not act as price takers if they have persistent market power. In such a case they are able to profitably alter prices away from competitive levels without provoking new market entries or other counteractions that force prices back to efficient levels within a reasonable time limit. Because of the specific characteristics of network industries, market power is an important issue in these industries.~~

~~Our starting point for the localization of persistent market power is the concept of barriers to market entry dating back from Bain (1956) and Stigler (1968). Stigler defines barriers to entry as follows: "A barrier to entry may be defined as a cost of producing (at some or every rate of output) which must be borne by a firm which seeks to enter an industry but is not borne by firms already in the industry" (Stigler, 1968, p. 67). The more persistent such barriers to entry are the more likely harmful price setting by incumbent operators is.~~ However, barriers to entry are not per se a rationale for regulation. Virtually any industry exhibits some kind of barriers to entry and one can expect from new entrants that they overcome some barriers by other advantages such as new processes, technologies and innovation. Consequently, we must take a closer look at barriers to entry of which there are various classifications. For example, Church and Ware (1999) distinguish structural and strategic barriers. As De Bjil et al. (2006) and others, we differentiate between "legal barriers to entry", "strategic barriers to entry", and "natural barriers to entry".

***Legal barriers*** prohibit new entrants to access markets ("market access regulations"). Usually, some kind of exclusive rights are granted to a governmental or private undertaking. If such legal barriers to entry are politically desired (e.g. a state monopoly on military forces, the U.S. monopoly for selected postal services), there is no reason to grant access to new entrants. However, safeguards should be established that limit the abuse of market power based on the granted exclusive rights. Very popular are price regulations and measures to avoid cross-subsidization into adjacent and other markets. The according regulations are sector-specific by nature. For selected economic reasons for market access regulations (i.e. legal barriers to entry), cf. Section 2.4

***Strategic barriers*** to entry arise by *conduct*. The behavior of one or several market players, for example a cartel, can lead to market power that in turn can be used for anti-competitive and welfare-decreasing practices. Such harmful conduct is usually tackled by competition law and should therefore not be duplicated by sector-specific regulations.[12]

***Natural barriers*** *(also called structural barriers)* arise where the *cost structure* of an industry leads to stable market power ("natural market power"). Recall that the concept of perfect markets assumes constant returns to scale. Increasing returns to scale – which are usually present in network industries – might give rise for regulation form an economic point of view. However, neither scale economies nor a natural monopoly (defined as a subadditive cost structure[13]) are a sufficient condition for regulation as shown by the theory of contestable markets. The theory has its origins in the work of Baumol, Panzar and Willig (1982) and essentially extends the economic efficiency properties of perfect markets to all markets which are contestable, i.e. markets without relevant sunk and transaction costs.[14] If such sunk costs are present together with a natural monopoly (cost subadditivity), we speak of a "monopolistic bottleneck". If this

[12] Among others, see De Bijl et al. (2006).

[13] Subadditivity implies that the cost of producing a set of outputs as a whole are less than the costs of producing the same output subdivided in any combination of subsets. See Baumol (1977) for a precise definition.

[14] Postal markets provide empirical support for the theory: despite substantial economies of scale and scope, new entrants have succeed to enter newly liberalized markets (among others, see De Bijl et al. 2006).

bottleneck cannot be duplicated nor substituted by other means, it is called a "stable monopolistic bottleneck"[15] (in US antitrust law this is referred to as an "essential facility"). Such infrastructures give the owner natural market power and potential entrants will not be able to enter the market, even if the incumbent charged excess prices. Therefore, it will be crucial to ensure in liberalized markets that new market players get timely access to bottleneck facilities at reasonable terms and conditions that prevent the abuse of market power. On the other hand, any sector-specific access regulation is to be seen as a massive intervention into the bottleneck owner's property rights. Recall that securing property rights stays at the heart of making markets functioning and plays a major role for providing appropriate innovation and investment incentives.

In line with Knieps (2000a) and others we conclude that the goal of any regulation of a stable monopolistic bottleneck is to *enable non-discriminatory access to these bottlenecks at reasonable conditions while minimizing the infringement of property rights on the bottleneck resource.*

In practice, competition law is often not sufficient to tackle harmful behavior of companies with natural market power. In the network industries, one network layer often has the property of a stable monopolistic bottleneck. Moreover, the issues are quite technical and sector-specific knowledge is needed. Hence, sector-specific regulation dealing with natural market power might be particularly appropriate in network industries.

Section 4 explores the issue in more detail and provides a framework to select the appropriate regulatory intervention to cope with monopolistic bottlenecks.

### A2: Externalities – Universal and Default Service Regulations, Interconnection and interoperability regulations, flanking measures

External effects are present when one economic agent's actions affect the actions of other agents in the economy. One agent's action can have positive or negative externalities on other agents. The classical case for a negative externality is a chemical plant which pollutes a river, thereby reducing the prospects of the fishery located downstream the river. Analytically, externalities are closely linked with incomplete markets; when an economic agent's own action has a positive effect on others but is not rewarded in return, there exists no market for this external effect. In general, when external effects are present, market equilibria are not efficient, as these effects are not taken into account in individual decisions. However, potentially, they can be "internalized", e.g. by public obligations, taxes, quotas or the allocation of property rights (where these are in fact enforceable).[16]

In the network industries, manifold important externalities exist and thus there is a potential for market failure. The following types of externalities are present which give room for universal service or default obligations, regulations of interconnection and interoperability, market access regulations, or flanking measures.

***Network externalities among users:*** The utility of a user increases with the number of users connected to the network. For example, a phone subscription is much more valuable if others are connected to the network too.[17] Similarly, letters as a media are much more attractive if one can reach anyone. Positive network externalities give rise to universal service regulations that aim at connecting everyone to the telecommunications or postal network. Such obligations can be found in virtually any industrialized communications and postal market.

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[15] See Knieps (2000a).

[16] See Mas-Colell (1995).

[17] See Economides (1996) and Farrell and Klemperer (2007).

***Externalities between market sides:*** Closely linked to network externalities are externalities between different market sides of a platform. Where lump sum price redistributions between market sides affect overall demand, markets are said to be two- or multi-sided.[18] Many network industries, such as telecommunication, postal, or cable networks can be understood as being such platforms. These platforms link senders and receivers, as well as sellers and buyers. An example for a positive externality would be the mere existence of a broad installed base, which makes entering a market attractive if interconnection is available. Negative externalities usually arise in the context of advertisement. Platforms are convenient means to reach people. Their operators have incentives to sell as much direct mail, telemarketing, and TV-ads as possible. The receiver's perceive these as "bads", and it is crucial to find the right balance between content (good) and advertisement (bad). If platforms fail to tackle these issues, regulatory answers are Robinson's lists or the acceptance of "no advertisement" stickers on mailboxes.[19]

***Network externalities between various operators:*** By analogy to network externalities, demand in a given mobile network is higher if the network is interconnected with other competing networks (a subscriber's network is extended to a much larger subscriber base). Termination issues in telecommunications should primarily be decided against this background (and only secondary against market power[20]). Similarly, in liberalized postal markets, P.O. Box access is essentially a termination issue.[21] In the railways industry, integrated and interconnected systems provide the passengers much more utility than isolated solutions. Hence, from a user's perspective, it makes sense to interconnect competing networks. Often, an industry-specific self-regulation arises. Some of the oldest international organizations deal with interconnection issues. Examples are the Universal Postal Union (UPU) or the International Telecommunications Union (ITU). However, under some circumstances, negotiations might fail in light of the commercial interests of the involved operators. Again, regulation can be a reasonable means to internalize these positive externalities.

The issue of interconnection is closely linked with interoperability. In most technical systems, interoperability is a precondition for interconnection. Consequently, sector-specific regulation in the network industries usually includes interoperability ( e.g. in railways, telecommunications or electricity markets). Industry standards generally can be seen as platforms.[22] Where self-regulation fails, government intervention might be reasonable from an economic perspective.

***Externalities onto other sectors of the economy*:** Network industries usually provide an economy nationwide with essential services such as water, power, communications, transport,

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[18] See Rochet and Tirole (2006) for a formal definition.

[19] See Tempest (2007) for a discussion of Robinson lists. Uniform pricing constraints can also be explained partly by two-sided markets. In the two-sided postal market for example, postage is usually charged to the senders. However, the charges are often passed on to the receivers, e.g. by banks or distance mail order companies. Thereby, normally single piece prices are charged instead of the effective wholesale prices. Some mail order companies make to bulk of their profits out of this difference. Such behavior has a negative impact on overall mail volume development as the average price signal is higher than the one actually charged by the platform. Under uniform pricing, the difference is smaller.

[20] Market power can play an important a role in private termination negotiations. In such cases, termination regulations should cope with the respective side effects.

[21] In particular, P.O. boxes are not monopolistic bottlenecks. For a discussion of P.O. Box provision in two-sided postal markets cf. Jaag and Trinkner (2008)

[22] The issue is closely linked with compatibility. Among others, Katz and Shapiro (1985) analyze the conditions under which an industry achieves compatibility by self-regulation. See Economides (1996) for a summary. Essentially, compatibility is a strategic issue from an operator's perspective.

and delivery. A new train service will boost a region's economic activity in many aspects and attract new businesses and residents. Among others, beneficiaries include people who will not use the train connections (for example property owners). Hence, the passengers' willingness to pay for the future service is too low. As a consequence, such projects often need government support. Similarly, postal services can be seen as "economic enablers"; the interplay between letters, parcels, and payment services is manifold and various external effects are present. Universal service regulations might be needed to ensure the necessary minimal standards. In the electricity industry, blackouts cause serious harm (large negative externalities on other suppliers as well as customers). However, the market will fail to provide the necessary overcapacities and quality standards, as these extra costs are not compensated in the market place. Default service regulations might be the only solution to mitigate the problem. Other negative externalities include pollution. For example, full market opening in postal markets will lead to overlapping and parallel networks, thereby potentially increasing pollution (i.e., a negative externality). Hence, one might think of flanking measures to internalize these effects (if not already accounted for in road traffic regulations).

### A3: Other important imperfections – Other flanking measures

The perfect market hypothesis assumes symmetric information, i.e., everybody knows about everything at every point in time. This is hardly ever the case. However, many information asymmetries have found market solutions over time (e.g., private certification bodies) or are dealt with in general law.[23] Still, there might be sector-specific failures caused by asymmetric information.

A first issue related with asymmetric information is safeguarding demand. The issue is closely linked with customer protection measures (protecting against asymmetric information). In postal markets, operators must comply with a number of obligations which aim at ensuring the integrity of mail (e.g., the postal secrecy). Similarly, operators are obliged to publish figures on their quality of service which is not observable by individuals. With regards to safety, airlines or railways must ensure that their employees meet certain professional standards. Such "flanking measures" are usually implemented by application of individual or general authorization procedures (the former needing *ex ante* approval by the regulatory authority before being active in the market, the latter – if at all – *ex post* approvals, subject to a declaration of fulfilling the respective obligations).

Further flanking measures might relate to working conditions. Examples can be found in the railways, telecommunications, and postal industry. These might be motivated mainly by redistributive (social) goals. In industrial countries, the following sector-specific issues are relevant. First, in light of the establishment of a level playing field, the regulation of labor regulations (e.g. minimal wages) might assure even conditions for old and new operators where historically grown labor costs are rigid (the issue is comparable with stranded costs in the electricity industry). Note that high minimal standards might raise important barriers to entry. Second, once parallel networks (and overcapacities) evolve, operators tend towards marginal cost pricing. This is not sustainable given the decreasing average costs in network industries and leads to underinvestment or downward pressure on labor conditions (e.g. in the postal industry, where an important fraction of total cost is labor cost). From an economic point of view, this would be a concern if it had negative consequences on service quality (and the externalities provided to other industries). As a consequence, governments might impose flanking measures to guide market forces away from harmful "price competition" towards "quality competition", where operators shall, given common lower boundaries for working conditions, compete for quality and innovation.

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[23] Moral, ethical and religious standards are of importance too. For example, most social standards condemn the breach of contracts.

Finally, sector-specific regulations need to be implemented in the market. In a world of asymmetric information, the law alone will not be sufficient. Where necessary, independent bodies must be established and empowered to enforce compliance with the rules. Consequently, sector-specific acts usually contain provisions that deal with the establishment of regulatory bodies and their powers, with processes and with information and accounting requirements of market participants. Thereby, it is a challenge to establish "independence ", that is the compliance of the competent authorities themselves (ministries, regulatory authorities, others).[24] A second challenge is the establishment of appropriate processes that empower the authorities to ensure compliance while protecting market actors from regulatory arbitrariness.

### 2.4 The role of Liberalization in the framework

In the previous section we discussed various sources of market failures and their potential regulatory remedies. What is the role of liberalization herein?

In essence, liberalization is a change of market access regulations towards a more entry-friendly regime. Note that for the discussed three sources of market failures, limiting market access / restricting competition (i.e. the contrary of liberalization) is a potential regulatory remedy. Consequently, we understand market access regulations in general (and liberalization in particular) as ordinary regulatory remedies to deal with market imperfections.

Thereby, establishing a legal monopoly would be the most rigid form of (market access) regulation; it precludes competitive forces to a large extent.[25] In our framework which starts from the "free market primacy", a monopoly should be introduced as a "remedy of last resort" only. Recall that monopolizing a market will usually not provide the right signals for pricing, efficiency, innovation, and customer friendliness. A priori, regulations preventing market access are harmful. In any case, they should be combined with appropriate regulations that prevent the exploitation of market power and that aim at giving the right incentives for efficiency and innovation. This is a difficult task and involves many fundamental trade-offs which are increasingly complex to resolve with the degree of asymmetric information.[26]

Initially, most network industries were fully opened and free markets. Over time, virtually all of them got monopolized. Only recently, important sectors like telecommunications, railways, electricity, and posts have been opened up to competition again.[27] Hence, liberalization is a quite new policy where the starting point are pre-existing sector-specific regulations preventing market entry ("legal barriers to entry") combined with safeguards to prevent the abuse of market power by the legal monopolist. Examples are "reserved areas" or exclusive concessions granted to state-owned enterprises coupled with price regulations and anti cross-subsidizations measures.

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[24] In practice, there is no benevolent authority. The institutional design should minimize regulatory capture (from incumbents, new entrants, unions, etc.) and deal with persistent information asymmetries.

[25] Unless there is platform competition (facilities-based competition). Similarly, modern incentive regulation has some potential for fostering efficiency.

[26] Note that in a world of perfect markets, a benevolent regulator/dictator could also achieve any Pareto optimal market solution. However, if these assumptions do not hold true, both markets as well as regulators are increasingly likely to fail.

[27] Besides the above mentioned reasons (innovations, etc.), a particular reason with regards to efficiency of operations might refer to market power of labor unions in public undertakings. Over time, unions have succeeded in extracting a large part of the incumbents' monopoly rents. Hence, liberalization might be a means to break the unions' bargaining power and to enforce the necessary adjustments on the salary side.

In the past, limiting market access have been a popular regulatory remedy for the following reasons.

- Investments in network industries are high and have a long-term time horizon. In particular, large sunk cost must be spent in advance. This comes along with investment risks which are higher in fully competitive markets where other market players increase uncertainty and limit pricing flexibility. Moreover, the risks are usually higher for private companies than for public companies as they must be aware of government opportunism, cf. Spiller (2009). At the same time, private investors usually demand higher risk premia and expect a shorter payback period.[28] Hence, public monopolists might have the best capabilities to undertake the large investments needed to succeed in network industries.
- Related to the point above, monopolies might be a means for financing public obligations (e.g. universal service obligations). Compared to competitive markets, pricing must not necessarily be fully cost based (there are no market forces that would driving prices back to costs). This allows for (1) mark-ups over competitive price levels to finance extra obligations, and (2) for redistributions between customer segments (e.g. from densely populated low-cost regions to rural high-cost ones). In competitive markets, such pricing policies would cause selective market entries (cherry picking) and would not be sustainable. Thirdly, monopolies prevent inefficient duplication of networks and hence ensure optimal utilization of costly infrastructures.
- Where the industry characteristics inevitably lead to market power (e.g. where monopolistic bottlenecks are present), a public monopoly might be superior to a private one.[29] Still today, most bottlenecks remain state-owned or state-dominated (airports and train stations, roads, bridges and tracks, electricity grids, last mile infrastructures in telecommunications).

We conclude as follows. The world we live in is far away from the perfect markets paradigm; Asymmetric information is the norm. Consequently, there will be both market failures in fully opened markets and regulatory failures in regulated monopolies. The key question regarding market access and liberalization is whether a free market would lead to an outcome *less inefficient* than a regulated monopoly. In free markets, decision making is delegated to the various market players and organized by the pricing mechanism (the "invisible hand"). The more market players there are, the better is the outcome of the decision making process. Finally, the various market players are much better informed than centralized regulators (or managers). Consequently, economists expect better decisions from free markets under normal circumstances. However, network industries exhibit characteristics where competitive forces might fail (or are not present). Hence, depending on the very situations in individual economies, the optimal answer on how to regulate market access will vary not only from sector to sector but also from country to country.

## 3. Normative criteria to assess regulatory remedies

In Chapter 2 we have introduced our general framework. The framework allows for a broad range of sector-specific regulations and covers most regulations that are encountered in practice (cf. Section 2.3). Summarizing, we have developed *three economic preconditions* that should be met when thinking on new sector-specific regulations in network industries. First,

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[28] In investments with time horizons of e.g. 30 years, a private investor's depreciation rate makes cash flows in the second half of the project almost worthless.

[29] In case monopoly rents occur, these remain public. Moreover, pay-offs are symmetric in case of public ownership whereas with private ownership, eventual losses exceeding private equity at stake must be borne by the public.

one should observe important deviations from the perfect markets paradigm. In network industries, this is certainly the case. Second, there should be none or poor prevailing regulations dealing with these market failures. Third, harmful market or regulatory failures should be prevalent or imminent.

If these preconditions are met, various regulatory remedies are at disposal to deal with the detected failures. The crucial normative question is which regulations should be chosen, and which ones not. We will now briefly outline our approach. The details are provided in Section 4.

For any problem set, there are various *regulatory instruments* available. These may vary in scope and nature. For example, when dealing with monopolistic bottlenecks, there are ex post and ex ante variations of prices and/or access regulation as well as separation of accounts, functions, structures, and/or ownership.

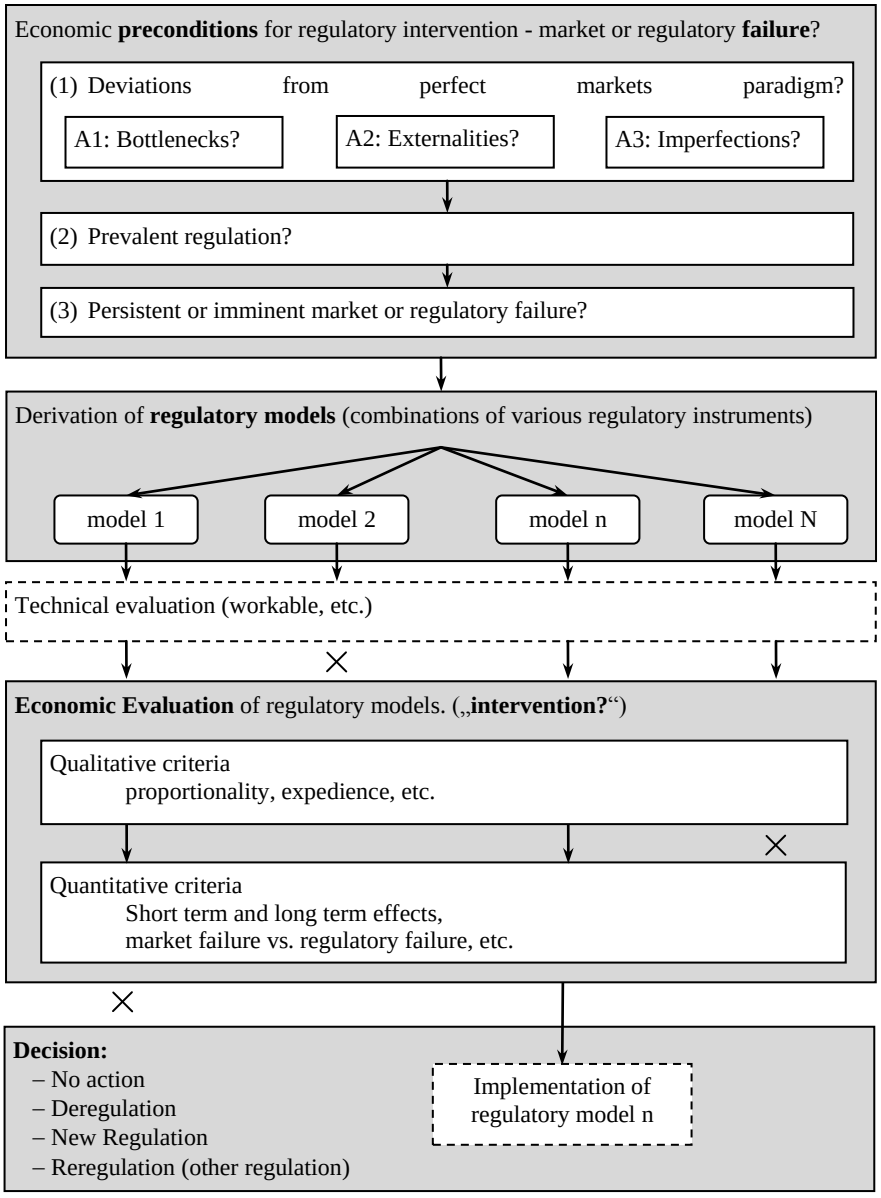
Combinations of such regulatory instruments can be bundled into specific *regulatory models* that one can apply in practice. Of course, these models must be technically and commercially feasible.

From an economic point of view, any such regulatory model must bear up against a thorough *economic analysis and comparison* according to a number of qualitative and quantitative criteria. These are partly contradictory, which mirrors different interests of the various stakeholders in the marketplace: Incumbent operators and their residual claimants, new operators, employees, business customers, private customers, and tax payers. The *qualitative criteria* include proportionality, expedience, competitive neutrality (including lightness, symmetry), incentive neutrality, subsidiary, simplicity, transparency, and temporality. While these criteria are of qualitative nature and mostly have an indirect impact on welfare, *quantitative criteria* should be included too to compare the economic effects of any model compared to the (non)regulation in place in the short- medium- and long run (market failure vs. regulatory failure). Thereby, static effects like benefits from regulation, productive efficiency, and direct costs of regulation should be considered as well as dynamic aspects such as efficiency incentives, innovation- and investment incentives, risks, and the effects of regulatory and organizational dynamics.

The regulatory model with the least net economic cost is then the one which should be chosen – if it sufficiently conforms to the qualitative criteria. Of course, welfare effects are hard to quantify as they often take effect in the long-run (e.g. innovation incentives) and would therefore have to be explicitly considered in a dynamic setting.

Figure 3 summarizes our approach. Section 4 provides the details by way of application to the most prominent example in network industries, namely the regulation of monopolistic bottlenecks.

**Figure 3: Summary of regulatory assessment framework**




Source: Swiss Economics (2009)

## 4. Application to Bottleneck Regulation in Network Industries

As described in Secion 2.3, the existence of a persistent monopolistic bottleneck is an important rationale for regulation. Recall that monopolistic bottlenecks are present if an industry, network layer or value chain element exhibits the properties of (i) natural monopoly (subadditive cost function), (ii) considerable sunk costs, and (iii) no substitutes (i.e. no economic possibilities for bypass). Such bottlenecks are present in most network industries and raise the issue of natural market power being capable to distort competition in a harmful way.

The presence of a bottleneck does not directly imply the optimal choice of regulatory intervention. To this end, it is important to first exactly locate the source of monopolistic market power (section 4.1). Only then, it is possible to identify possible regulatory instruments (section 4.2) which can be combined to consistent regulatory models (section 4.3). In order to make sure that the implementation of regulatory models really improves the market outcome it needs to be assessed against various criteria, which are not only economic, but which may encompass broader goals of market intervention (sections 4.4 and 4.5).

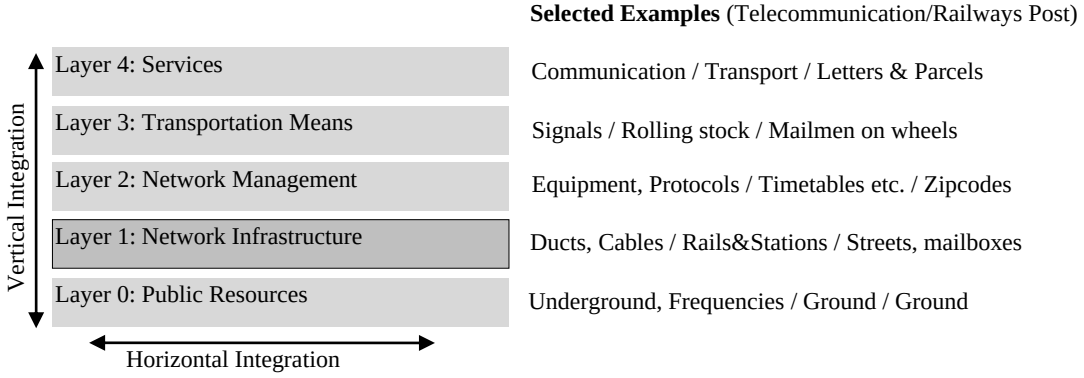
### 4.1 A disaggregated approach to bottleneck regulation in network industries

A common characteristic of all network industries is that they form a coherent and interrelated system. The central aspect of networks is their ability to transport goods or information between two geographically diverse locations. At the nodes in the network (which are connected by transportation means), the routing follows specific rules. Networks can be either one- or two-sided. A typical one-sided network is the grid in the electricity sector which is essentially a distribution channel with one side selling electricity to the other.[30] In the telecommunication sector, however, households and businesses are on the originating and terminating side of the network at the same time and their utility increases in the number of people connected to the network. Generally, two-sided markets increase complexity and call for adaptations of the traditional regulatory recipes (Wright, 2004).

The concept of monopolistic bottlenecks allows for the localization of market power in a disaggregate manner. Among others, Knieps (2000) proposes to subdivide networks into various network layers. Figure 4 illustrates the relevant network layers within our framework. Such a subdivision is applicable both in one- and two-sided network markets. Each layer of a specific network has a specific function in the network. Therefore, some layers may be fully competitive while others constitute persistent monopolistic bottlenecks. The starting point of the disaggregate approach is the differentiation between those network layers or segments in which workable (actual and potential) competition is warranted and those in which there is stable market power. The latter must be expected only in those layers or segments, which are characterized by a subadditive cost function in combination with irreversible costs and the absence of close substitutes. Hence, regulation based on the essential-facilities-doctrine should be focused on certain network elements and not the entire network.

This implies that various network layers can and should be analyzed separately – notwithstanding the strong connections among the layers. An aggregate analysis would come to the imprecise conclusion that competition is not workable in an entire industry as long as there is at least one bottleneck layer. One single non-competitive layer would bias the entire analysis.

**Figure 4: Network Layers**




Source: Swiss Economics (2009)

Often, monopolistic bottlenecks are located on layer 1, as shown in Figure 4. This layer contains the physical network infrastructure, the establishment of which entails considerable

[30] The tendency towards smart grids might increase the fraction of households consuming and producing electricity at the same time. However, the utility of a subscriber depends on the electricity delivered and not on the fraction of consumers connected to the network.

sunk costs. In the process of liberalization, competition will first set in on the higher layers if access to the infrastructure is available at reasonable terms. Hence, regulatory intervention should focus primarily on layer 1 in network industries.

### 4.2 Instruments for Bottleneck Regulation

The goal of any regulation of a stable monopolistic bottleneck is to enable non-discriminatory access to these bottlenecks at reasonable conditions while minimizing the infringement of property rights on the bottleneck resource. There are a number of potential regulatory measures to tackle the issue. Figure 5 provides an overview. We distinguish the dimensions ex post/ex ante, general competition law vs. sector-specific regulation, and regulatory instruments (price regulation etc.).[31]

**Figure 5: Overview Regulatory Instruments for Bottleneck Regulation**

| | *ex post* | | *ex ante* |
|---|---|---|---|
| **Competition law** | **X** | | |
| – Price regulation in case of market power | (X) | | |
| – Access based on non-discrimination | X | | |
| – (Merger control) | | | X |
| **Sector specific regulation** | **X** | **or** | **X** |
| – Price regulation | X | or | X |
| – Access regulation | X | or | X |
| – Accounting / functional / structural Separation | | | X |
| – Ownership Regulation | | | X |

Source: Authors' own.

***Ex post* vs. *ex ante* regulation:** Governmental market interventions can either be effective *ex post* or *ex ante*. In the case of *ex post* regulation, the regulatory authority has the right (and often also the duty) to take action only if market participants have not been able or willing to settle access or interconnection disputes by means of self-regulation. This implies that the authority has the competence to correct errors of the second kind which means that it can alter an unexpectedly adverse market outcome.[32] In an *ex ante* regulatory environment, the authority can – based on its legal competences – act directly, without awaiting the outcome of the operators' self-regulation. Hence, this potentially accelerates the regulatory process. Moreover, if the regulator is able to commit to its rulings, it is in principle able to impart proper efficiency incentives as the regulated operators (or their owners) remain the residual claimants of increased profits. The downside of ex ante regulations is the creation of errors of the first kind which results in unnecessary regulation with potentially adverse effects on competition.

**Competiton law vs. Sector-specific regulation:** Competition law and sector-specific regulation differ in several fundamental aspects. Competition law typically contains guidelines that describe acceptable behavior in broad terms, while regulatory policy specifies detailed rules

[31] Note that some authors do not distinguish between ex post vs. ex ante and competition law vs. sector-specific regulation as competition law usually applies ex post while regulation applies ex ante.

[32] Glazer and McMillan (1992) argue that in the liberalization process, regulatory control may sometimes be replaced by the specter of regulation. A similar effect is at work in cases where self-regulation is used to avert explicit regulation. An example for the latter is Deutsche Post that provides universal postal services with neither being explicitly mandated nor any form of compensation.

which often apply to particular firms. Competition law focuses on non-discrimination between comparable customers, with ex ante guidelines which are enforced ex post. In contrast, sector-specific regulation couples ex ante rules with permanent industry control and rule refinement. Moreover, competition law relies on commands to discontinue anticompetitive behavior, while regulation proscribes certain types of conduct with associated incentives and ongoing intervention.[33]

**Elements of competition law to deal with bottlenecks:**

Banning abusive behavior by a firm dominating a market, or anti-competitive practices that lead to such a dominant position is one of the three main elements of competition law.[34] Practices controlled in this way include predatory pricing, tying, price gouging, refusal to deal, among others.

**Elements of sector-specific regulation to deal with bottlenecks:**

Regulation potentially has a much broader range of instruments that competition law:

- **Price regulation** confers the price setting competence to the sector-specific regulatory authority. Such regulation can be applied to retail and/or access prices by means of a price-cap or a cost-plus mechanism (the latter is basically equivalent with a rate of return regulation). In a cost-plus regime, the regulated rate is based on (an estimation) of the regulated firms' costs. This entails serious incentive problems as the regulated operator is no longer the residual claimant of efficiency improvements. This problem is temporarily solved with a price cap regulation, which adjusts the operator's prices according to the price cap index that reflects the overall rate of inflation in the economy, the ability of the operator to gain efficiencies (not actual gains in efficiency), and the inflation in the operator's input prices. As long as all these factors influencing the evolution of the price cap are exogenous to the regulated operator, they do not distort his incentives to innovate. However, in practice, both price setting rules often converge to a rate of return regulation due to the need to re-set the conditions of regulation as the regulator is not able to commit to terms allowing the operator excessively high or low profits.
- **Access regulation** concerns non-discriminatory prices and conditions of access to a monopolistic bottleneck. This also comprises non-tariff access barriers. Such regulation may either be ex post or ex ante and based on several possible calculation methods. Among the most prominent methods are the efficient component pricing rule (ECPR, cf. Willig, 1979 and Baumol and Sidak, 1994), LRIC (including variants), Ramsey Pricing, or a global price cap (cf. Crew and Kleindorfer, 1994 and Laffont and Tirole, 1993, 1996) including access or wholesale prices). The very details are fairly important but their discussion would be beyond the scope of this chapter.
- **Separation** of the bottleneck resource from the rest of a vertically integrated operator is an important means to regulate bottleneck resources. Its effect is in principle ex ante. Cave (2006) differentiates between eight levels of separation, while other authors define three degrees of separation. There seems to be no consensus in the literature about the demarcation between different types of separation. In the following, we follow the terminology used by the European Group of Regulators (ERG, 2007):
  - **Accounting Separation** is the least intrusive form of separation. It is a requirement that forces greater transparency in accounts to disclose the real costs involved in the

[33] See Viscusi et al. (2005) and Carlton and Picker (2007). On the relationship between competition law and regulation see for example Bourreau and Dogan (2001), Cave (2004), and Geradin and Sidak (2005).

[34] The other two are merger control and prohibiting agreements or practices that restrict free trading and competition between firms. In particular this includes the repression of cartels.

production of regulated bottleneck resources in order to avoid cross-subsidization, margin squeeze or to enable cost-oriented pricing.

  - **Functional Separation** requires the creation of separate divisions within vertically integrated operators. It does not change ownership of bottleneck resources, however. Nevertheless, it requires operations and management separation and decisions to be made independently by the separated business unit and the rest of the company. While the exact location of separation may be variable, it typically includes a separation of functions, employees, and information (systems).
  - **Structural Separation** implies that the vertically integrated operator is forced by regulation to dissolve the bottleneck away from the rest of the company. The independent unit may still be owned by the incumbent company, be sold to a third party or even be nationalized.

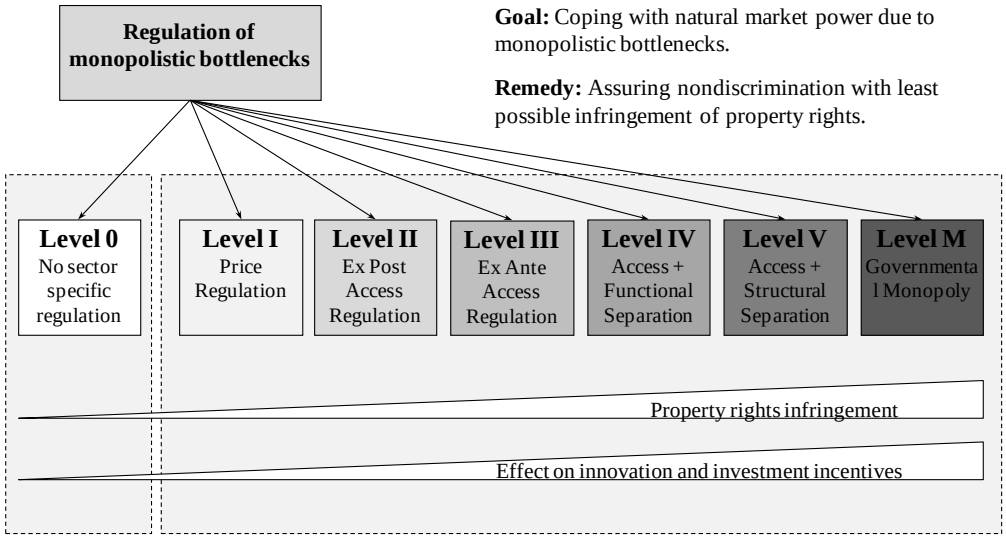
- **Ownership regulation** of the monopolistic bottleneck. Forced sale to an independent owner or to government are probably the most intrusive regulatory measures to assure non-discriminatory access conditions.

Sector-specific regulation disposes of a much broader spectrum of remedies to bottlenecks than competition law. This difference is due to the latter's generality which does not allow for sector-specificity and is the very reason for the co-existence of competition law and sector-specific regulation.[35]

### 4.3 Models for Bottleck Regulation

The specification of the various dimensions of regulation results in concrete regulatory models which are employed in practice. The models on all regulatory levels must be technically and commercially feasible. Figure 3 shows the range of possible regulatory levels in terms of bottleneck regulation. In increasing order, they become more intense and intrusive with respect to property rights infringement.

**Figure 6: Regulatory Models for bottleneck regulation**




Source: Swiss Economics (2009)

[35] See for example Shelanski (2002) for a discussion of the relationship between sector-specific regulation and competition law in the telecommunications sector.

The different levels of regulation can be characterized as follows:

***Level 0**:* No regulation. This is usually the case if there is no stable monopolistic bottleneck or if there is no (expected) misused market dominance.

***Level I:*** Price-Cap Regulation of existing access prices to a bottleneck resource on the basis of separated accounts.

***Level II:*** Ex post access regulation to a bottleneck resource based on separated accounts. This implies a subsidiary competence of the regulator to enact regulations if competing operators cannot agree on access conditions (primacy of self-regulation).

***Level III:*** Ex ante access regulation to a bottleneck resource by a regulator based on separated accounts. The results of such a regulation are the more incisive the larger the regulator's discretion in defining the scope of its regulation. Generally, such competences should not exceed the scope of the regulated stable bottleneck resource.

***Level IV:*** Functional separation of the bottleneck resource from the rest of the operator. The separated business unit operating the bottleneck is obligated to grant non-discriminatory access conditions to all operators.

***Level V:*** Structural separation by creating an independent legal entity for the operation of the bottleneck resource. The commercial freedom of this operator has to be defined in detail, e.g. whether it is allowed to offer own services based on its infrastructure.

***Level M:*** Nationalization of the bottleneck resource by expropriation of the original owner. This results in a governmental monopoly.

The stronger the property rights of one or all operators are confined, the stronger this will affect investment and innovation incentives in the long-run. E.g. the abandonment of regulation (Level 0) results in strong incentives to the bottleneck owner to develop it further, as it is the residual claimant of all profits resulting from is development. At the same time, all operators without access to the bottleneck have strong incentives to search for alternative technologies in order to bypass the bottleneck and offer substitute services.

A structural separation of the bottleneck resource (Level V) adds to its stability and therefore creates the need for continuing (follow-up) regulation. If access is granted on a cost basis, the owner's incentives are low to invest in its development as cost savings are automatically passed down to competitors.[36] If there is an (unregulated) bypass opportunity, the bottleneck operator will rather invest there in order to bypass regulation.[37]

### 4.4 Qualitative Criteria to Assess Bottleneck Regulation

When choosing the optimum level of regulation in case of an abuse of a stable monopolistic bottleneck, from an economic point of view the following criteria should be considered.[38] They are partly contradictory and imply trade-offs which mirrors different interests of the various stakeholders: Incumbent operators, new operators, business customers, private customers, tax payers, and employees among others.

- **Proportionality:** The impact of regulation should be commensurate with the market failure that is to be corrected. Indirect and second-order effects should be taken into account, e.g. the long-term influence on industry development. An important prerequisite is a clear understanding of the purpose and the scope of regulation.

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[36] Price-cap regulations tend to converge to rate-of-return regulations in the long-run, as regulators are not able to politically maintain a situation in which the regulated operator generates above-normal profits. Hence, if the regulated firm under a price-cap – due to good incentives to increase efficiency – is successful in outperforming, future price-caps will be renegotiated.

[37] For a detailed discussion of the various economic effects of a structural separation in telecommunications see for example Crandall and Sidak (2002).

[38] Many of these criteria also serve to assess other regulatory remedies apart from bottleneck regulation.

- **Expedience:** Any regulation should be aimed at mitigating the effects of market failure without compromising the achievement of other objectives. Trade-offs between conflicting goals must be solved in a transparent manner.
- **Competitive neutrality:** Regulation should have the least possible impact on working competition and not distort the operators' market behavior in non-monopolistic market segments/layers. The following two aspects are of greatest importance:
  - **Lightness:** Regulation should be as weak as possible in order to not create inefficient barriers to entry („light is right").[39]
  - **Symmetry**: If possible, obligations and regulations should be the same for all operators in order to create a playing field as level as possible. Asymmetric regulations induce market distortions which are hard to neutralize (second-order effects of regulation). Exempt are universal service obligations that are otherwise not provided in an unregulated market. In such situations, designating the obligations to just one operator is probably more efficient (and light) than obliging any market player with the same obligations.
- **Incentive neutrality**:
  - Any regulation should have the least possible effect on investment and innovation incentives.
  - At the same time, a risk transfer from corporations to government should be avoided: Regulations should not result in crowding out the operators' direct responsibility, e.g. in pricing matters.
- **Subsidiarity:** Regulation should come into action rather ex post than ex ante. While ex ante regulation allows a regulator to commit to its regime and set long-term incentives right, ex post regulation gives market participants a real chance to organize themselves. This reduces the risk of regulatory failure and the cost of regulation. It is important, however, to design ex post regulation such that negotiations between operators are not affected by the expectation of future regulation.
- **Simplicity:** The simpler regulations are and the lower the regulator's information needs are, the easier is the implementation and control of regulation and therefore the lower its direct cost.
- **Transparency:** Transparency enables fair processes and strengthens the regulator's and the regulatory system's credibility in the public. Moreover, it also allows competing operators and consumers to indirectly "regulate" through their informed decisions.
- **Temporality**: Technological progress and changing consumer needs put regulation at risk of becoming irrelevant and lapsed.[40] It is therefore important to design regulation as flexible as possible in order to adjust it to a changing environment. Moreover, there should be a sunset clause allowing a regulation to be withdrawn once it becomes obsolete. Temporality is not possible as far as irreversible regulations are concerned and with dynamic developments in which the development of markets and regulation strongly affect each other.

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[39] Cf. e,g. de Bijl, van Damme and Larouche (2005) for an application to the postal sector.

[40] Note that only persistent monopolistic bottlenecks without substitutes necessitate the regulation of access conditions. These conditions vary over time.

### 4.5 Quantitative Criteria to Assess Bottleneck Regulation

The above criteria for choosing optimum regulation are of qualitative nature. In the following, we discuss the direct and indirect economic impact of regulation in the short- medium- and long run. The instrument with the least net economic cost is then the one which should be chosen – if it sufficiently conforms to the qualitative criteria. However, it must be noted that the welfare effects depend very much on consumer preferences and the operators' cost structure. They are therefore hard to quantify. Moreover, they often take effect in the long-run (e.g. innovation incentives) and therefore need to be explicitly modeled in a dynamic setting.

#### 4.5.1 Static Aspects

- **Benefits from Regulation:** What is the direct impact of regulation with respect to consumer prices? Will they decrease due to increased inter-layer competition? Or will they increase because of double marginalization problems in case of a vertical separation? The answers to these questions will strongly affect the overall welfare impact of regulation. Redistribution of profits among operators, however, is welfare-neutral in principle, as they have a distributional effect only.
- **Productive Efficiency**: Will regulation result in (static) cost savings on the operators' side? In the case of sub-additive cost functions – which are prevalent in certain infrastructure layers in network industries – a division of volumes among several operators increases costs per piece. Additionally, will some of the pre-existing vertical synergies be destroyed through the duplication of overhead activities and additional need for coordination?
- **Direct Costs of Regulation:** Regulation does not come for free. Regulatory authorities need to be installed and be equipped with resources. Legal disputes resulting from more complex interactions between operators tie up management attention and delay the market development.

#### 4.5.2 Dynamic Aspects

- **Efficiency Incentives:** Strong competition results in a strong pressure to save on costs in order to stay competitive; benchmarking among competing operators allows for mutual learning and further efficiency gains.
- **Innovation- and Investment Incentives:** Who is the residual claimant of profits resulting from increased efficiency? Are the operators' innovation incentives protected from regulatory appropriation (e.g. through patent protection or "regulatory holidays")? E.g. the regulation of access conditions to a monopolistic bottleneck yields to constant downward pressure on prices on the part of those operators that seek access while access providers tend to try to increase prices, of course. In any case, the incentives to invest and innovate are fundamentally distorted as the owner of a bottleneck resource has little incentives to develop it further and competing operators do not invest in substitutes as long as they have cheap access to existing infrastructures. Abandoning such regulation may therefore yield better dynamic effects (at cost of static inefficiencies).
- **Risks:** Does regulatory discretion directly increase business risk? Does regulation indirectly alter the risk structure in the entire industry? Does it change incentives to deal with such risks? Are there implicit government guarantees?
- **Regulatory Dynamics**: What are the costs of a potential regulatory „encrustation", if new entrants base their business cases on regulatory arbitrage? In such cases, the abandonment of lapsed regulation (due to emerging substitutes) may be delayed. The dynamics of the regulatory framework is also driven by the regulators' (often successful) quest for increased influence on markets to justify their budgets. This results in a dynamic regulatory spiral.

Moreover, there is the risk of regulatory capture if lobbyists become increasingly strong over time.

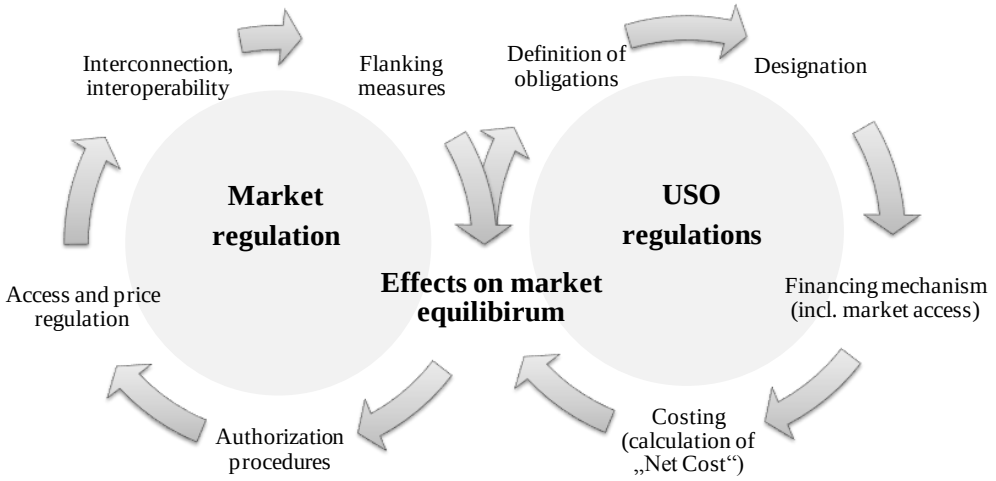
- **Organizational Dynamics:** Operators which are not regularly re-organized tend to encrustations, just as regulatory systems. If regulations slow down the evolution of entire industries, they curb the elimination of internal inefficiencies.

One fundamental trade-off between static market efficiency and dynamic efficiency incentives is the Williamson trade-off in the context of merger control in antitrust which weighs an increase in market power against cost efficiency.[41] Of course, there are other trade-offs between assessment criteria: E.g. high regulatory discretion to cope with time- or firm- specific issues comes at the cost of long-term regulatory dynamics.

### 4.5.3 Interactions

In addition to static and dynamic effects, the assessment of regulatory remedies needs to take into account their interaction with other elements of sector-specific regulation (cf. Figure 1 and 7). Often important trade-offs are present. For example, access regulations have an impact on the financing needs of public obligations that are delegated to the market. Similarly, many measures related to universal service obligations (USO) and its costing and financing have an impact on the levelness of the market playing field. Hence, an isolated first-best access solution might have unwanted negative effects on conflicting aims such as investment incentives or universal service provision. Hence, a second-best solution might still proof optimal when tackling the problem more globally. Generally, various elements of market regulations and universal service regulations should not be viewed independently of each other.

**Figure 7: Illustration of interactions**




Source: Authors' own

### 4.5.4 Further criteria

The appropriate choice among the various regulatory models ranging from unregulated competition to a government monopoly varies not only with the relevant technological and demand conditions. Also, a regulator's skills and resources, the degree of corruption in a society, the efficiency of the tax system and capital markets, and pre-existing institutions determine what regulatory model might be optimal.

[41] Cf. Williamson (1968).

### 4.6 Illustration

In the following, we shortly discuss the above considerations applied to a selection of regulated network industries (cf. Swiss Economics 2009 for a detailed analysis).

**Postal Services:** The postal sector is one of the oldest if not the oldest network industry. It is usually not analyzed along the layer framework as in the other industries. If so, the only layer exhibiting subadditive costs as well as sunk costs would the road system positioned on layer 1. It is public and open to anyone on nondiscriminatory terms. Rather, a disaggregate analysis focuses on the various parts of the value chain which consist of collection, sorting, transport and delivery of mail and parcel items. Collection and delivery exhibit subadditivity and hence the characteristics of a natural monopoly. As there are no significant sunk costs, there is no bottleneck facility which would justify access regulation or even mandated separation in general. Hence competition law (level 0) should be sufficient. Nevertheless, access to post office boxes or information on change of addresses is often regulated in liberalized markets. Note that these are no monopolistic bottlenecks. In our general framework, regulation can still be justified on the basis of market failures arising from network externalities (between operators, in analogy to termination issue in mobile telecommunication). In such cases, ex-post access regulation might be justified.

**Telecommunication:** In the (wire-bound) telecommunications sector, the relevant network layers are the wide-area and last-mile passive infrastructures (ducts, cables), active infrastructures (electronic equipment) and services. While all last-mile infrastructures can be considered a natural monopoly due to subadditive costs, only the last-mile ducts and cables are a monopolistic bottleneck which cannot (sensibly) be duplicated. However, as there is increasing inter-modal competition (for example, by wireless communication, in many developed countries also by local loops established by electricity and cable companies) and fast technological progress (fiber optics), the traditional cooper bottleneck in the last mile becomes increasingly contested. Hence, from an economics perspective, access regulation—which can be phased out eventually—to these temporary (copper-based) bottlenecks is more appropriate than a persistent functional or structural separation since the latter are often considered to be irreversible.[42] Once new fiber optics are in place however, the fiber local loop might be a stable bottleneck in case consumers were to demand capacities that can be delivered by fiber-to-the-home infrastructures only.

**Railways:** Railways in Europe carry both passenger and freight traffic. Despite high subsidies[43] and their vital economic and social links within countries and across Europe, they have steadily lost market shares to other modes of transportation over the last decades. In the railways sector, the relevant network layers are tracks and railway stations, network management (slot allocation, safety measures), rolling stock, and services. The tracks and railway stations can be considered a monopolistic bottleneck due to subadditivity and significant sunk costs; hence, there is a potential for regulation. There is only little technological progress on that layer, meaning that the bottleneck will likely be persistent. However, railways find themselves in intermodal competition against transportation means on roads, water, and air. Rail market shares exceed rarely more than 20 percent in the modal split. Depending of the effectiveness of this intermodal competition, two main scenarios are thinkable. Either price regulation of existing incumbents might be appropriate, or an intense regulation of the monopolistic bottlenecks to enforce competition on the service level. The latter necessitates strong regulatory interventions, such as access regulation combined with functional or structural separation of infrastructures (tracks, train stations) and passenger

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[42] See for example OECD (2003).

[43] Less than half of the total costs of rail transport in Europe are borne directly by passenger and freight customers.

services in order to assure non-discriminatory access conditions. Thereby, the decision on the intensity of the separation depends on the existing synergies between the various network layers. Caution might be indicated in well developed railway systems exhibiting tight synchronized schedules and scarce capacities on rail tracks and train stations.

## 5. Conclusions

Sector-specific regulation in network industries has become a widely discussed topic among academics, policy makers, industry economists and regulators themselves. The issue of these debates has usually been on whether such regulation is necessary and if so what its optimal design should be.

In this chapter we have presented a general economic framework to assess regulatory remedies and have applied it to network industries. It starts from a free market primacy assumption: Markets, if they function properly, provide firms with the right incentives to enter markets, set prices, and invest in innovation at a socially optimal level. Of course, there are a number of obstacles to markets functioning well in that sense. Such market failures give rise to potentially beneficial regulation – at the risk of these regulations failing as well.

There are *three economic preconditions* that should be met when thinking on new sector-specific regulations in a network industry. First, there need to be significant deviations from the perfect markets paradigm. In network industries, this is certainly the case; often, there are monopolistic cost structures, important externalities, and asymmetric information. Second, there should be none or poor prevailing general or sector-specific regulations dealing with these market failures. Third, harmful market or regulatory failures should be prevalent or imminent.

If these preconditions are met, there are various *regulatory instruments* available to deal with the detected failures. These may vary in scope and nature. For example, when dealing with monopolistic bottlenecks, there are ex post and ex ante variations of price and/or access regulation as well as separation of accounts, functions, structures, and/or ownership. Combinations of such regulatory instruments can be bundled into specific *regulatory models* that one can apply in practice. Of course, these models must be technically and commercially feasible.

From an economic point of view, any such regulatory model must bear up against a thorough *economic analysis and comparison* according to a number of qualitative and quantitative criteria. The *qualitative criteria* include proportionality, expedience, competitive neutrality (including lightness, symmetry), incentive neutrality, subsidiary, simplicity, transparency, and temporality. While these criteria are of qualitative nature and have an indirect impact on welfare, *quantitative criteria* should be included too to compare the economic effects of any model compared to the regulation in place (market failure vs. regulatory failure). Thereby, static effects like benefits from regulation, productive efficiency, and direct costs of regulation should be considered as well as dynamic aspects such as efficiency incentives, innovation- and investment incentives, risks, and the effects of regulatory and organizational dynamics. The regulatory model with the least net economic cost is then the one which should be chosen – if it sufficiently conforms to the qualitative criteria.

Within this framework, the question of *liberalization in network industries* is essentially a decision on market access towards a more liberal regime; new competitors willing to enter a market obtain the right to do so (or fewer duties). In practice, there will be both market failures in fully opened markets and regulatory failures in regulated monopolies. Hence, the key question regarding market access is whether a free market would lead to an outcome *less inefficient* than a regulated monopoly. We have pointed out that sector-specific market access

regulations play various roles. One the one hand, monopolies usually impair innovation, cost awareness, and customer friendliness. On the other hand, monopolies can provide important investment incentives, are a financing means for policies such as universal service obligations, and might be straightforward where the natural market characteristics tend to monopolize the market. Hence the optimal answer on how to regulate market access will vary not only from sector to sector but also from country to country.

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