Knieps, Günter; Weiß, Hans-Jörg

Working Paper

Regulatory agencies and regulatory risk

Diskussionsbeitrag, No. 118

Provided in Cooperation with:
Institute for Transport Economics and Regional Policy, University of Freiburg

Suggested Citation: Knieps, Günter; Weiß, Hans-Jörg (2007) : Regulatory agencies and regulatory risk, Diskussionsbeitrag, No. 118, Albert-Ludwigs-Universität Freiburg, Institut für Verkehrswissenschaft und Regionalpolitik, Freiburg i. Br.

This Version is available at:
https://hdl.handle.net/10419/32323

Regulatory Agencies and Regulatory Risk

by Günter Knieps and Hans-Jörg Weiß

Discussion Paper
Institut für Verkehrswissenschaft und Regionalpolitik
No. 118 – November 2007

Abstract:

The aim of this paper is to show that regulatory risk is due to the discretionary behaviour of regulatory agencies, caused by a too extensive regulatory mandate provided by the legislator. The normative point of reference and a behavioural model of regulatory agencies based on the positive theory of regulation are presented. Regulatory risk with regard to the future behaviour of regulatory agencies is modelled as the consequence of the ex ante uncertainty about the relative influence of interest groups in the regulatory process. The problem of regulatory risk is analysed separately in competitive network areas and in non-competitive network areas. For both cases a specific measure of regulatory risk is proposed. But measurement and compensation are different issues. The impossibility of compensating for regulatory risk is demonstrated. Finally, the disaggregated regulatory mandate is presented as an institutional reform approach.

Prof. Dr. Günter Knieps
Dr. Hans-Jörg Weiß
Institut für Verkehrswissenschaft und Regionalpolitik
Universität Freiburg
Platz der Alten Synagoge, 79085 Freiburg i. Br.
Phone: (+49) - (0)761 - 203 - 2370
Fax: (+49) - (0)761 - 203 - 2372
e-mail: guenter.knieps@vwl.uni-freiburg.de
hans-joerg.weiss@vwl.uni-freiburg.de

The electronic version of this paper is available under:
http://www.vwl.uni-freiburg.de/fakultaet/vw/publikationen/diskussionspapiere/Disk118.pdf

1. Introduction

In the current debate on regulatory reforms the issue of the costs of regulatory risk gains increasing importance. Several definitions of regulatory risk are known from the economic literature (cf. Pedell, 2006). In general, these definitions of regulatory risk do not differentiate systematically between, on the one hand, the impacts of a specific regulatory intervention on the risk of the regulated firms, or – more generally – on the social welfare (regulatory impact) and, on the other hand, uncertainties arising from the discretionary behavior of regulatory agencies.

Effective regulation changes the systematic risk of the regulated activities, thereby (ceteris paribus) leading to increasing or decreasing opportunity costs of the invested capital (cf. Gaggero, 2007). The impact of regulation on the entrepreneurial risk and therefore the cost of equity capital are neither a normative justification for regulatory interventions in competitive markets, nor are they an argument against necessary regulatory interventions to discipline market power. Instead they ought to be treated as positive or negative side effects of regulation. In competitive markets regulation should obviously never be introduced in order to mitigate the risk of the firms involved. Neither the risk of the unregulated monopolist nor the risk of the business under hypothetical conditions of competition should be considered as relevant reference points (see Myers, 1972, pp. 79-81; Buckland, Fraser, 2001, p. 879). In those parts of network industries where network-specific market power is still present, the risk of the business under regulated conditions has to be taken into account. From the perspective of regulatory reform to term regulatory impact regulatory risk is misleading and should therefore be avoided (cf. Knieps, Weiss, 2007, pp. 1-3).

In traditional regulatory economics, regulatory risk due to discretionary behaviour of regulatory agencies is analysed in the context of the implementation of a given regulatory instrument in a given regulatory framework. It is assumed that regulatory agencies do not pursue self interests and ultimately act in the public interest. Ahn, Thompson (1989), for example, analysed uncertainties surrounding the triggering of a rate case (triggering risk) and uncertainties surrounding

the setting of the allowed rate of return (setting risk) in the context of the implementation of rate-of-return regulation. In Ahn, Thompson the "error terms" surrounding the implementation of the regulatory instrument are distributed symmetrically, so there is no systematic bias in one direction. The central thesis of the contribution of Kolbe, Tye, Myers (1993) is that asymmetries caused by regulation are not represented sufficiently in the cost of capital as it is usually determined in regulatory practice, and that therefore an additional cost element is necessary to compensate for those risks. In all these contributions the active role of regulatory agencies in the regulatory process is disregarded.

The discretionary behaviour of regulatory agencies has been in particular discussed in connection with missing investment incentives in regulated industries due to regulatory opportunism (e.g. Newbery, 2000; Gans, King, 2003). The focus of this literature is on the missing commitment ability of regulatory agencies vis-à-vis the regulated firms. Thus regulatory agencies cannot commit themselves to allow full cost recovery of the invested capital. As a consequence, incentives for underinvestment arise. The policy focus is on possible compensation mechanisms, especially so-called access holidays.

Regulatory agencies make use of their discretionary power in response to the relative influence of the interest groups involved (cf. e.g. Becker, 1983; Stigler, 1971; Peltzman, 1976). Therefore regulatory agencies cannot commit to welfare-maximising behaviour. The resulting underinvestment incentives are typically termed hold-up problem, commitment problem or problem of regulatory opportunism. The starting point of this paper is to question the general inability of regulatory agencies to commit themselves. They can only commit to regulatory actions which reflect the relative influence of the interest groups within their legally defined competencies (i.e. their regulatory mandate). The aim of the present paper is to show that regulatory risk is due to the discretionary behaviour of regulatory agencies caused by a too extensive regulatory mandate provided by the legislator.[1] Policy recommendations (e.g. access holidays) which neglect

[1] This problem has been mentioned – though not examined in detail – before: "[A] retroactive shift in the distribution of possible disallowances due to a change in regulatory oversight" (Kolbe, Tye, Myers, 1993, p. 38). "A common concern among

or try to bypass the influence of interest groups are not credible and therefore cannot compensate for regulatory risk. Instead it is necessary to constrain the discretionary power of regulatory agencies by way of a disaggregated regulatory mandate, thus reducing the expected welfare losses due to regulatory risk.

The paper is structured as follows: In section 2 the normative point of reference (2.1) and a behavioural model of regulatory agencies based on the positive theory of regulation are presented (2.2). Regulatory risk with regard to the future behaviour of regulatory agencies is modelled as the consequence of the ex ante uncertainty about the relative influence of interest groups in the regulatory process. In section 3 the problem of regulatory risk in competitive network areas is analysed. Section 4 deals with regulatory risk in non-competitive network areas. For both cases a specific measure of regulatory risk is proposed. But measurement and compensation are different issues. Section 5 demonstrates the impossibility of compensating for regulatory risk. Finally, section 6 presents the disaggregated regulatory mandate as an institutional reform approach.

2 Regulatory risk caused by an extensive regulatory mandate

2.1 The normative dimension: Regulatory needs due to monopolistic bottlenecks

From the normative point of view it is important to differentiate between those parts of a network industry which are competitive and those parts which are characterised by network-specific market power. Liberalisation of network industries does not mean that all sector-specific regulation becomes superfluous. In most network industries there remain some non-competitive network areas. The theory of monopolistic bottlenecks enables a localisation of the remaining network-specific market power in order to determine the minimal regulatory ba-

---

those involved in regulation is that the regulator can itself introduce risk, through unpredictable or unjustifiable regulatory intervention, so raising the regulated firm's cost of capital, and leading to inefficient investment" (Wright, Mason, Miles, 2003, p. 119).

sis.[2] Its objective is to derive, based on the principles of network economics, a regulatory basis consistent for all network sectors which justifies sector-specific regulatory inventions, irrespective of historical or institutional coincidence. All other network areas are subject to general competition law. The special focus of regulatory activity should be on the design of a symmetrical regulation of the access to monopolistic bottlenecks, combined with a regulation of access charges. The conditions for a monopolistic bottleneck are fulfilled:

(1) if a facility is necessary for reaching customers, i.e. if no second or third such facility exists, in other words if there is no active substitute. This is the case if there is a natural monopoly and a single provider is able to make the facility available more cheaply than several providers.

(2) if at the same time the facility cannot reasonably be duplicated as a way of disciplining the active provider, in other words, if there is no potential substitute. This is the case if the costs of the facility are irreversible.

The owner of such a monopolistic bottleneck has stable market power, even if all players have perfect information and a complete willingness to switch so that even small changes in prices result in a migration of demand. Irreversible costs are no longer decision-relevant for the established firm – in contrast to the potential competitor, who is faced with the decision whether to invest in a given market or not. Thus the incumbent has lower decision-relevant costs than the potential competitors. This leads to scope for strategic behaviour, so that inefficient production or surplus profits no longer necessarily result in newcomers entering the market.

Within a given network the entire value chain has to be examined in a disaggregated manner, that is it has to be differentiated into those network areas that do have bottleneck characteristics and the other areas that are characterised by effective competition. The latter is by no means confined to potential competition. Both active and potential competition with and without technological differen-

[2] Cf. Knieps (1997), pp. 362 ff.; Knieps (2006), pp. 53 ff.; Laffont/Tirole (2000), p. 98.

tiation as well as product differentiation and innovation (of both products and processes) constitute potential parameters of effective competition. Due to the absence of irreversible costs service networks unquestionably have a non-bottleneck character; they may or may not possess the characteristics of a natural monopoly.

2.2 The positive dimension: Regulatory agencies influenced by interest groups

The basic hypothesis of the positive theory of regulation is that the influence of interest groups is the central explanatory variable in the behaviour of a regulatory agency. Trying to influence the decisions of the regulatory agency in a favourable direction is in the interest of the participants in the regulatory process. Thus, a behavioural model is needed to explain how regulatory agencies make use of their discretionary power in response to the relative influence of the interest groups involved (cf. e.g. Becker, 1983; Stigler, 1971; Peltzman, 1976).

Already in a simple model context with a homogeneous group of consumer interests and a homogeneous group of producer interests, we can define a function M representing the influences on regulatory agencies. For reasons of simplification the following Cobb-Douglas function is assumed to represent the concurring influences of the interest groups (cf. Spulber, 1989, pp. 94 ff.; Besanko, Spulber, 1992, p. 156):

$$M = M(\Omega, \pi) = \Omega^{1-\alpha} \cdot \pi^{\alpha}$$

The variables Ω and π denote consumer surplus and producer surplus (profit), respectively. α is a parameter representing the relative weights of the two interest groups. α can have values in between zero and one. In case of the corner solution $\alpha = 0$ the regulatory agency acts solely in the interest of consumers (consumer protection hypothesis). In the other extreme, i.e. $\alpha = 1$, the regulatory agency acts solely in the interest of producers (capture hypothesis). In case of $0 < \alpha < 1$ the regulatory agency prefers a weighted average. Given α, the relative

influence of producers versus the relative influence of consumers can be expressed by the marginal rate of substitution (*MRS*).

$$MRS = -\frac{\partial M / \partial \pi}{\partial M / \partial \Omega} = -\frac{\alpha}{1-\alpha} \cdot \frac{\Omega}{\pi}$$

In the traditional positive theory of regulation it is usually assumed that the relative influence of interest groups is exogenously given. Regarding the presumed Cobb-Douglas function this corresponds to the assumption that α is a given parameter. Peltzman considers the extreme case of unlimited discretion on the part of the regulator which is not bound by a regulatory mandate. It is assumend that the regulator can observe the relative strength of the interest groups and implements price and entry regulations accordingly (cf. Peltzman, 1976, pp. 222 ff.).[3]

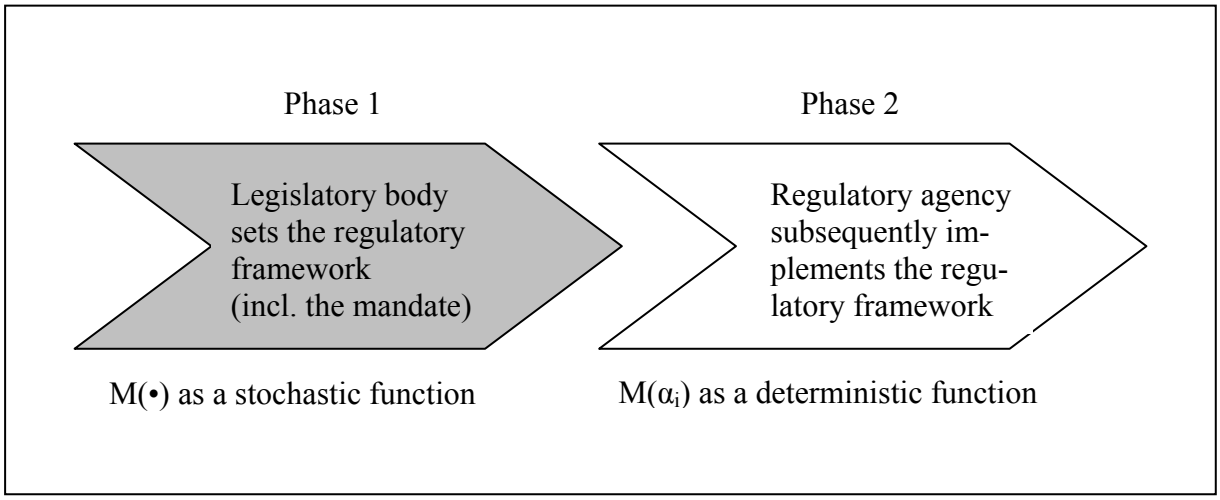
The basic contribution of the Stigler-Peltzman Model is the analysis of the role of interest groups in the process of regulation. However, a differentiation between legislator and regulatory agency is lacking (cf. Weingast, Moran, 1983, p. 768). The implementation of sector-specific regulatory laws is typically delegated to specialised agencies by the legislator in the context of a regulatory mandate. The necessity of a division of labour between legislative bodies and executive agencies has already been pointed out by Posner (1974). Regulatory agencies have more or less scope for discretionary activities, depending on the character and the extent of the competencies delegated by the legislator to the regulatory agency as specified in the regulatory mandate (cf. Spulber, Besanko, 1992).

It is important to differentiate between the time phase when a regulatory law (including a regulatory mandate) is debated and ultimately passed by the legislator (phase 1) and the subsequent implementation by a regulatory agency (phase 2). For a given regulatory mandate the legislator can foresee that interest groups will be a major determinant of the behaviour of the regulatory agency and the resulting regulatory outcome in phase 2. But it would be illusionary to assume

[3] Spulber (1989), Besanko, Spulber (1992) and Newbery (2000, Chap. 2) also assume that the relative strength of the interest groups is observable and exogenously given.

that the legislator is also able to predict the relative strength of the interest groups, i.e. the value of parameter α, with certainty. From the perspective of the legislator in phase 1 it is therefore necessary to treat parameter α and the implied influence function M(α) as uncertain. At best the legislator can form rational expectations about a probability distribution θ of the possible realisations of the uncertain parameter α in phase 2 (see Fig. 1).

Figure 1: The two-phases approach to analysing regulatory risk



The stochastic influence function does not only substantiate regulatory risk, but can also serve as a definite starting point for its measurement. In the following, a discrete characterisation of regulatory risk is chosen. $M(\alpha_i)$ denotes the influence function when parameter α_i is realised as indicator of relative interest group influences. Then we have

$$M(\alpha_i) = M(\Omega, \pi; \alpha_i) = \Omega^{1-\alpha_i} \cdot \pi^{\alpha_i}$$

If for future influence parameters $\alpha = (\alpha_{1, \ldots,} \alpha_n)$ an associated probability distribution $\theta = (\theta_1, \ldots, \theta_n)$ is known, then a measure of regulatory risk can be developed which is not restricted unilaterally to producer effects (cost of capital).[4] Only one-sided risk measures are of interest, because from the point of view of normative theory the influence of interest groups on the regulatory process always leads to welfare losses. Based on Stone (1973) and his general characteri-

[4] Models in the tradition of the Capital Asset Pricing Model (CAPM), which are usually used to analyse the impact of regulation on the cost of capital of firms, are not able to represent the impact on consumer interests.

sation of risk measures in the following a one-sided risk measure in the sense of an expected deviation from a target value is used (cf. Ebert, 2005, pp. 20 ff.). Concerning the problem of the measurement of regulatory risk, it follows that any $M(\alpha_i)$ gives rise to a regulatory outcome $W(\alpha_i)$, associated with consumer surplus $\Omega(\alpha_i)$ and producer surplus $\pi(\alpha_i)$. Due to the influence of interest groups it follows that the regulatory outcome deviates from the welfare maximum W^{Max}. In this paper we propose to measure regulatory risk by the following one-sided risk measure.[5]

$$\rho = W^{Max} - \sum_i \theta_i \cdot W(\alpha_i)$$

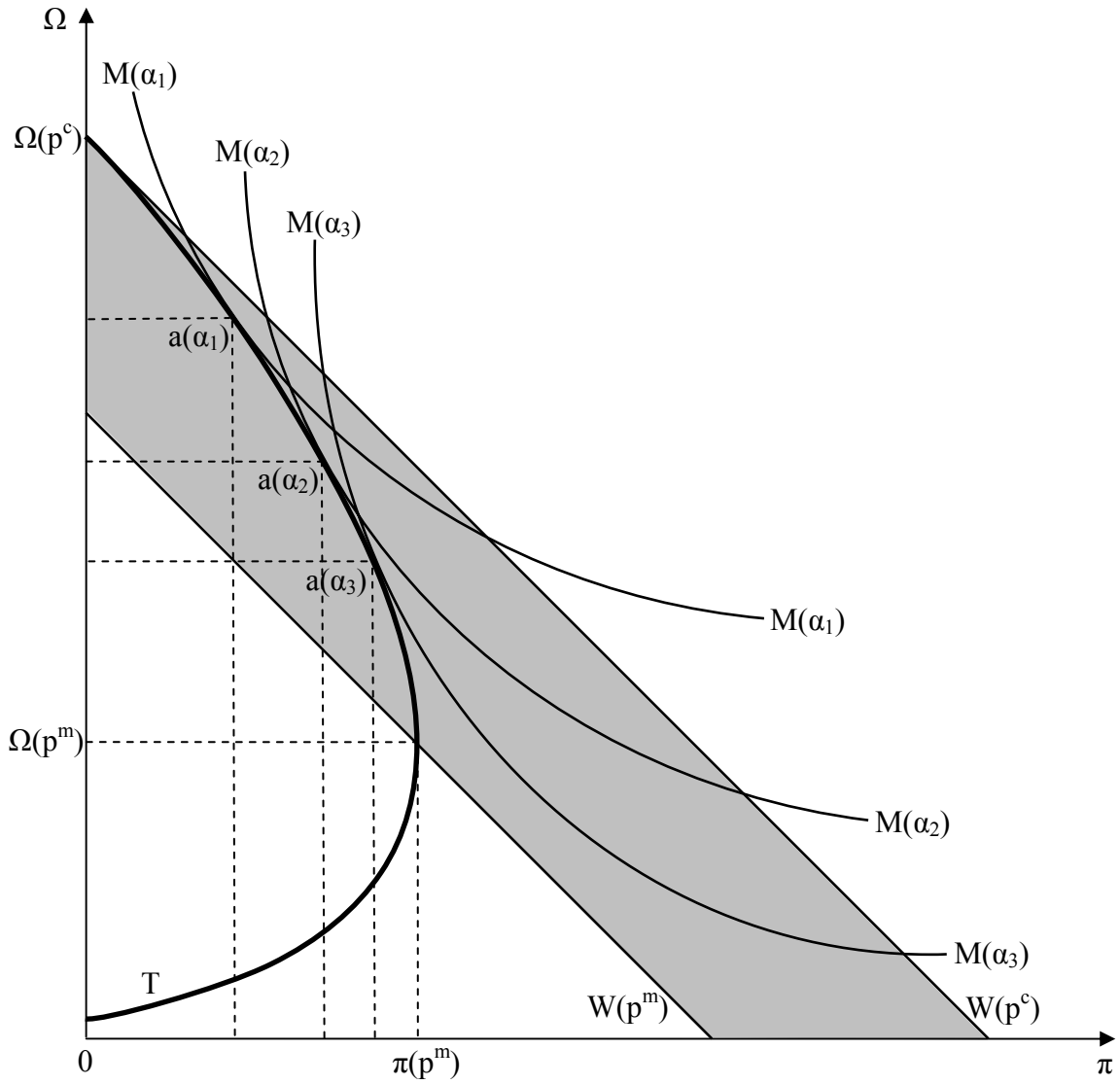
The possible welfare losses due to misregulation are quite different in competitive and non-competitive network areas. Therefore a deeper analysis of regulatory risk requires a disaggregated approach as its normative foundation. Based on the normative framework explained in section 2.1, in the following two sections the regulatory risk in competitive network areas (section 3) and the regulatory risk in non-competitve network areas (section 4) will be analysed separately.

3 Regulatory risk in competitive network areas

As long as network industries were treated as special sectors exempted from general competition law and network providers were protected against market entry by legal entry barriers, the choice of the regulatory basis was not regarded as problematic in the process of implementing regulatory instruments. In the U.S., for example, rate-of-return regulation was applied globally to the regulated firm. But also after the liberalisation of network industries, overregulation may occur due to discriminatory behaviour of regulatory agencies. Examples are the regulation of telecommunications service markets (e.g. Knieps, 2005), the regulation of local transportation services (e.g. Weiss, 2006) or long distance bus services (e.g. Maertens, 2005).

[5] In the present context it is sufficient to take the expected value of the welfare loss as risk measure. It belongs to a popular class of downside risk measures called lower partial moments (cf. Ebert, 2005, pp. 22 f.).

Figure 2: Regulatory risk in competitive network areas



In the following the risk of a regulatory intervention in competitive network areas due to the discretionary behaviour of regulatory agencies will be analysed. Because any regulatory intervention in competitive markets leads to welfare losses, we can derive a regulatory production possibility set whose efficient surface can be characterised by means of a transformation function T with $T(\pi(p), \Omega(p)) = 0$ as shown in figure 2 (cf. Spulber, 1989, p. 95, fig. 2.3.1). $\Omega(p)$ and $\pi(p)$ denote consumer surplus and profit, both depending on the price. Consumer surplus is maximised with competitive price p^c and zero profit. In this case welfare level $W(p^c)$ is reached. Profit is maximised with monopoly price p^m. Due to

the dead-weight loss of monopolistic price setting, in this case only the lower welfare level $W(p^m)$ is reached.

To clarify the argument, in the following the most simple case of a regulatory agency with unlimited competencies (delegated by the legislator) is analysed. Depending on the relative influence of interest groups (parameter α) the agency will choose a point a on T between $W(p^c)$ and $W(p^m)$, realising it by appropriate price setting.[6] The maximum welfare level $W(p^c)$ follows from the maximisation of the influence function M subject to the constraint of the transformation function in the special case of $\alpha = 0$. The (lowest) welfare level $W(p^m)$ is the result in the special case $\alpha = 1$. For any parameter $\alpha_i \in (0,1)$ the maximisation of $M(\alpha_i)$ leads to a welfare-inferior outcome $W(a(\alpha_i)$ with $W(p^m) < W(a(\alpha_i) < W(p^c)$.

Any point in the relevant range of the transformation function is a possible point of tangency and possesses a positive probability, if ex ante the relative influence of interest groups is unknown.[7] A welfare loss due to over-regulation can be expected almost with certainty (consumer interest maximisation is only a special case), the magnitude of the welfare loss depending on the relative strength of the interest groups. Based on the risk measure introduced in section 2.2, the regulatory risk in competitive network areas can be measured as follows:

$$\rho_c = W(p^c) - \sum_i \theta_i \cdot W(a(\alpha_i))$$

The telecommunications sector in Europe is an illustrative example. The regulatory mandate specified in the Framework Directive and the Access Directive provides unspecific regulatory obligations with a subsequent large scope for discretion by the different regulatory agencies in Europe (cf. Blankart, Knieps,

---

[6] Regulatory agencies usually have a broad set of regulatory instruments available to pursue their goals. A different analysis of these instruments would not lead to further insights in the present context. To simplify the exposition it is assumed that the agency can reach any desired point on the transformation function by adjusting the price.

[7] In figure 1 three M-isoquants are displayed as examples, each representing a different α_i.

Zenhäusern, 2007, pp. 416 f.). In markets that are competitive, irrespective of country-specific characteristics, contradictory conclusions have been drawn by different national regulatory agencies and these were accepted by the European Commission. The Swedish and Finnish regulatory agencies concluded that their international call markets are effectively competitive, whereas in Hungary, Portugal, and Ireland these markets are considered to be in need of being regulated. So far 334 cases regarding ex ante regulation have been assessed by the European Commission, but a consistent treatment from a normative point of view is still lacking (cf. Knieps, 2005, pp. 79-80).

4 Regulatory risk in non-competitive network areas

The discretionary behaviour of regulatory agencies has been especially discussed in connection with missing investment incentives in regulated industries due to regulatory opportunism (e.g. Newbery, 2000; Gans, King, 2003). The problem of regulatory agencies not adhering to original agreements (e.g. compensation rules) was already noticed by Kolbe, Tye, Myers (1993). They call it "problem of moral hazard" (p. 53) and find it to be unsolvable. They illustrate it with the gunfighter example:

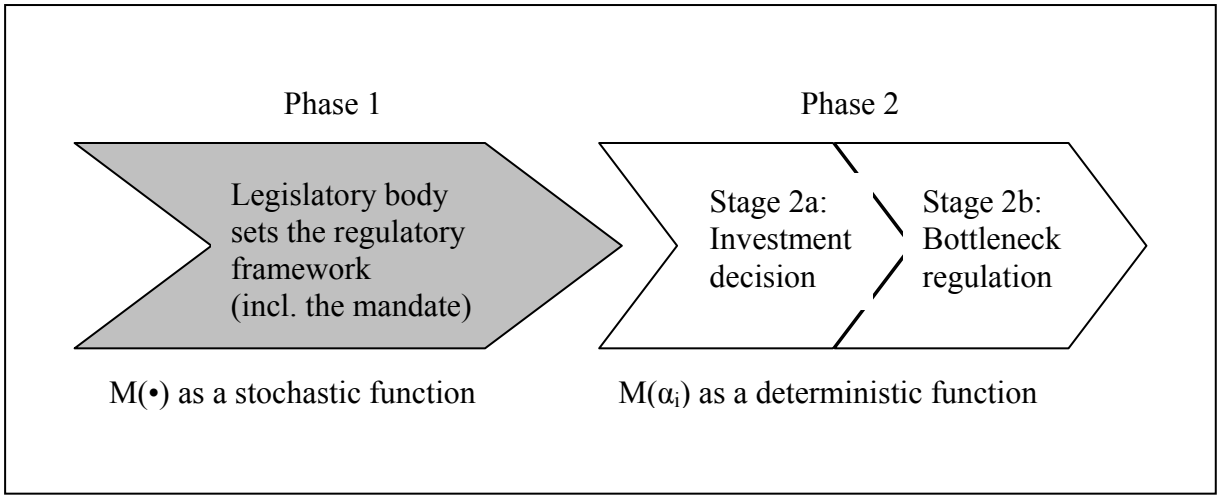
> "The problem of moral hazard may be illustrated by a somewhat whimsical example. Suppose a world famous gunfighter invites a tenderfoot to a poker game, but reserves the right to pull out his gun and change the rules at any time. What up-front risk premium does the tenderfoot require if he is to join the game? [...] If the risk premium itself is also subject to seizure during the game (i.e., if the amount of the potential loss is also under the control of the gunfighter), there is no risk premium great enough to induce the tenderfoot to play because the tenderfoot can never hope to do anything but lose all assets brought to the table. The game never takes place" (Kolbe, Tye, Myers, 1993, pp. 53 f., footnote omitted).

What Kolbe, Tye, Myers refer to as "moral hazard" is usually termed "opportunism", leading to the problem of underinvestment.[8] The gunfighter is in a sense the perfect opportunist. The question arises if the analogy to the behaviour of regulatory agencies really makes sense. Williamson (1983) has shown that hostages can serve as perfect or imperfect substitutes for binding contracts. Hostage solutions presuppose that the loss of the hostage would really lead to a utility loss for the transaction partner. In the case of a regulatory agency acting under the influence of interest groups this cannot be assumed by a regulated firm. It is well known that regulatory authorities cannot be forced into welfare-maximising behaviour. In particular, regulatory authorities as part of the bureaucracy cannot be fined (Knieps, 2005, p. 90). The solutions for the problem of underinvestment developed in an unregulated market context do not work in a regulatory environment.

Due to the sequential nature of the irreversible investment decision by the regulated firms (stage 2a) and the access regulation to the monopolistic bottleneck implemented by the regulatory agency (stage 2b) a regulation induced hold-up problem arises, depending on the relative influence of interest groups. It is important to note that investment takes place in phase 2, i.e. after realisation of $M(\alpha_i)$ is known. It will be shown that this leads to an underinvestment problem which cannot be overcome by the regulatory agency itself. Whereas the literature on regulatory opportunism only focuses on phase 2, the explicit introduction of phase 1 of the two-phases approach is required (as outlined in section 2.2) in order to derive the regulatory risk due to the problem that the regulatory agency cannot be committed to welfare-maximising behaviour (see Fig. 3).

[8] The term "moral hazard" is misleading, because – as will be shown – this is not a problem of asymmetric information.

Figure 3: The two-phases approach in non-competitive network areas



To elaborate the concept of regulatory risk in non-competitive network areas, in the following (as before in section 3) the most simple case of a regulatory agency with unlimited discretionary powers to regulate firms with market power in non-competitive network areas will be analysed. The starting point is the modelling framework developed in Besanko, Spulber (1992), which concentrates only on phase 2. This framework will be generalised by means of a transition from a deterministic influence function $M(\alpha_i)$ to a stochastic influence function $M(\bullet)$. Thus the legislative phase 1 of determining the regulatory mandate has to be considered explicitly. The production technology in the regulated market is characterised by irreversible investments. The more capital is irreversibly invested ex ante, the lower the operating cost ex post. In Phase 2 two periods have to be distinguished. In both periods one central decision has to be made. In period 1 investment takes place (stage 2a), and in period 2 production and consumption (stage 2b). To simplify the exposition the output quantity is assumed to be independent of the price (inelastic demand) and exogenously given.[9]

At the beginning of period 1 the regulated firm decides upon the magnitude of its capital investment K, which cannot be altered in period 2. The cost per unit of capital investment is r and has to be covered in period 2.[10] The magnitude of

[9] Therefore all investments, prices, profits etc. can be normalised on one unit of output.

[10] The problem of discounting can thus be neglected. It is assumed that r represents all relevant opportunity cost (depreciation and interest) of the capital investment.

K is determined by the regulated firm. The regulatory agency uses price-cap regulation as regulatory instrument. In the present simplified context this means that the agency determines the magnitude of the regulated price p at the beginning of period 2. When setting the price cap the agency is influenced by interest groups, represented by the Cobb-Douglas influence function

$$M(\alpha_i) = M(\Omega, \pi_{gross}; \alpha_i) = \Omega^{1-\alpha_i} \cdot \pi_{gross}^{\alpha_i}$$

In this case the producer surplus π_{gross} does not represent the net profit (π_{net}), but the gross profit of the firm (contribution margin), i.e. before subtracting the opportunity cost of the capital investment. This difference is central to the argument. The reason for ignoring all capital cost in the price setting process is its irrelevance for all interest groups (and therefore also the regulatory agency), because in period 2 their magnitude ($r \cdot K$) can no longer be altered.

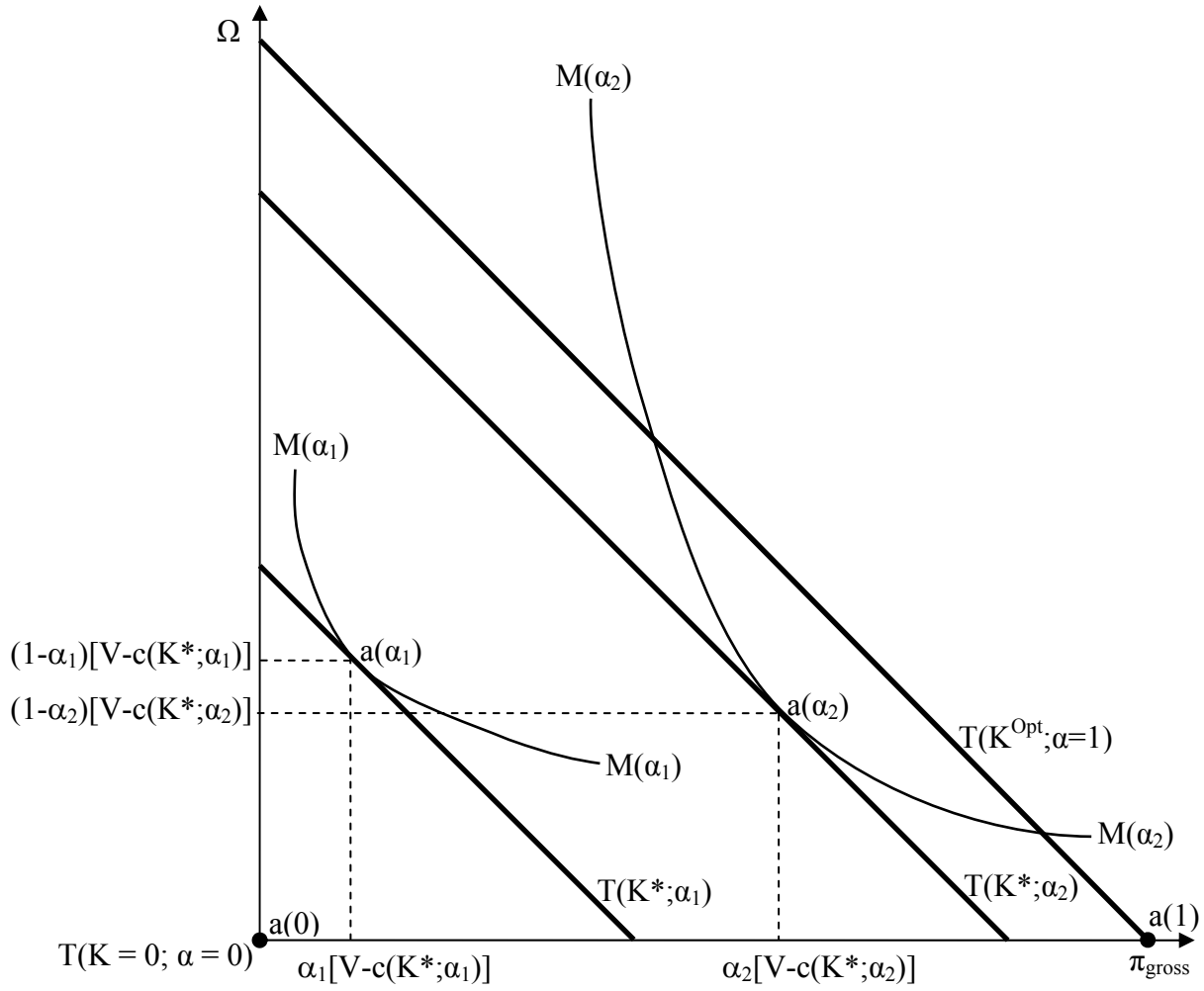
In period 2 it is only redistribution that matters. What is available for redistribution is the difference $V - c(K)$ between the willingness to pay of consumers per unit of output (V) and the operating costs per unit of output (c). V as well as c is identical for every unit of output. V is a parameter and c is a function c(K) with the following properties: $c' < 0$ and $c'' > 0$.[11] For every unit of output $\Omega = V - p$ denotes the consumer surplus and $\pi_{gross} = p - c(K)$ denotes the gross profit of the regulated firm. The magnitude of K, as decided in period 1, determines the amount available for redistribution in period 2. The more capital is invested in period 1, the lower the operating cost and the larger the amount available for redistribution. The transformation function introduced in section 3 (see T in figure 2) simplifies to a straight line with a negative slope of 45°. The central difference is that the position of T is not given exogenously any more, but depends on the capital investment K, which in itself depends (in equilibrium) on the regulated price and is therefore influenced by the interest groups. If more capital is invested this leads to a shift of the transformation function in the direction of the upper right corner (see figure 4).[12]

---

[11] E.g. the function $c(K) = 1/K$.

[12] This is a modified version of Besanko, Spulber (1992, p. 157, fig. 1), generalised for a stochastic influence function M(•).

Figure 4: Regulatory risk in non-competitive network areas



In the modelling framework of Besanko, Spulber all stochastic elements are absent. Without any stochastic element the prerequisite of any risk consideration is missing. Not only ordinary market risk is ignored, but there is also no basis for the analysis of regulatory risk. To incorporate the possibility of regulatory risk along the lines of the approach introduced in section 3, a generalisation of Besanko, Spulber (1992) seems to be straightforward. Since now phase 1 becomes relevant, α becomes a stochastic parameter. For every $\alpha_i \in (0,1)$ the regulated price, determined by the regulator in period 2 influenced by interest groups, can be derived by maximisation of $M(\alpha_i)$ subject to constraint T(K), using the following Lagrange approach:

$$L = \Omega^{1-\alpha_i} \cdot \pi_{gross}^{\alpha_i} + \lambda(V - c - \Omega - \pi_{gross})$$

$$\frac{\partial L}{\partial \Omega} = (1 - \alpha_i) \cdot \frac{\pi_{gross}^{\alpha_i}}{\Omega^{\alpha_i}} - \lambda = 0$$

$$\frac{\partial L}{\partial \pi_{gross}} = \alpha_i \cdot \frac{\Omega \cdot \pi_{gross}^{\alpha_i}}{\Omega^{\alpha_i} \cdot \pi_{gross}} - \lambda = 0$$

$$\frac{\partial L}{\partial \lambda} = V - c - \Omega - \pi_{gross} = 0$$

Solving these equations simultaneously leads for every α_i to the values

$$\Omega = (1 - \alpha_i) \cdot (V - c)$$

$$\pi_{gross} = \alpha_i \cdot (V - c)$$

Recognising that c depends on the magnitude of K as chosen in period 1, we can characterise the regulated price p in period 2 as

$$p(K, \alpha_i) = \alpha_i \cdot V + (1 - \alpha_i) \cdot c(K)$$

If the regulator maximises consumer surplus (special case $\alpha = 0$), he only allows the recovering of the operating costs c(K). If, on the contrary, the regulator maximises gross profit (special case $\alpha = 1$), the price is as high as the consumers' willingness to pay and extracts all consumer surplus.

The costs of the capital investment are irrelevant when the regulatory agency sets the price in period 2; however, they are highly relevant for the regulated firm when determining the investment level K in period 1. The firm will anticipate the effect of K on p when maximising its objective function (net profit):

$$\pi_{net}(K, \alpha_i) = p(K, \alpha_i) - c(K) - r \cdot K = \alpha_i \cdot V - \alpha_i \cdot c(K) - r \cdot K$$

The optimal investment level K* of the firm, maximising net profit subject to the regulatory constraint, is characterised by the following condition:

$$-\frac{dc}{dK} \equiv -c' = \frac{r}{\alpha_i}$$

The relative influence of the interest groups is of central importance. The more the regulator is influenced by consumer interests, the less will be invested. More interesting is the comparison with the welfare optimum. Due to the assumption of an exogenously given output quantity, with the price having no allocative function, the only relevant criteria for welfare maximisation is cost minimisation by setting K adequately. The total cost per unit of output consists of the operating cost c(K) and the cost of the capital investment rK. The cost-minimal capital investment K^{Opt} is reached, when

$$-\frac{dc}{dK} \equiv -c' = r$$

In the special case α = 0 there is no investment at all, because any investment would lead to a negative net profit.[13] For all parameter values $\alpha_i \in (0,1)$ there is some investment, but the chosen level K* is lower than the cost-minimising (and welfare-optimal) level K^{Opt}. Only in the special case α = 1 does the net-profit-maximising investment level K* equal the cost minimising level K^{Opt}.

From a social welfare point of view the reference point is the total cost minimum $c(K^{Opt}) + rK^{Opt}$, which can be used to calibrate risk measures – in analogy to the ones introduced in section 3.[14] Depending on α_i the lower investment level $K^*(\alpha_i) < K^{Opt}$ results in a welfare loss whose magnitude is measured by the waste of costs

$$c(K^*(\alpha_i)) + r \cdot K^* - c(K^{Opt}) - r \cdot K^{Opt}$$

Therefore a measure of regulatory risk in non-competitive network areas can be stated more precisely as

$$\rho_{nc} = \sum_i \theta_i \cdot [c(K^*(\alpha_i)) + r \cdot K^*] - c(K^{Opt}) - r \cdot K^{Opt}$$

---

[13] This case corresponds to the case analysed in Newbery (2000, pp. 35 f.) using a deterministic, linear influence function.

[14] In the present modelling framework the determination of minimal total cost is not problematic, because of the absence of any market risk that could lead to estimation errors à la Ahn/Thompson (1989).

5 The impossibility of compensating for regulatory risk

The regulatory risk of an intervention in competitive network areas, even though there is no justification for such an intervention from a normative point of view, can of course not be compensated for. The declared objective of a regulatory agency is rent distribution between the interest groups, depending on their relative strength. Similarly, a compensation of the regulatory risk in non-competitive network areas is not incentive-compatible, because the agency is maximising M ex post and not ex ante. So there is no obvious reason why the chosen magnitude of rent distribution should be further adjusted by means of an additional compensation.

In the simple modelling framework of Besanko, Spulber (1992) the calculation of the necessary revenues for covering total cost is straightforward. This also holds in more complex settings with asymmetric market risks, where the compensation can be calculated in analogy to the risk of "junk bonds" (cf. Kolbe, Tye, Myers, 1993, p. 25, fig. 2-2).[15] Depending on the specifics of the relevant investment project different revenues for covering the expected cost are necessary (cf. Gans, King, 2003, p. 270). But the original source of the problem does not disappear after calculating the necessary cost recovery, because the real problem is the missing ability of the regulatory agency to make ex ante credible commitments regarding the regulated prices ex post (cf. Gans, King, 2003, pp. 168 f.).

As a means of overcoming the commitment problem the concept of access holidays has recently gained interest in the current debate on regulation. Access holidays means an obligation on the part of the regulatory agency to not regulate a new infrastructure facility during an ex ante pre-determined time period. It is assumed that the regulatory agency is able to credibly commit to access holi-

[15] The underinvestment problem can also be modelled in a setting with market risks, incorporating the possibility of a project being a "flop" (cf. Newbery, 2000, chap. 2; Gans, King, 2003). But this was done with a deterministic M-function, i.e. there is some market risk but no regulatory risk. In the present case of a stochastic M-function the extent of underinvestment is stochastic, depending on the influence of interest groups.

days, despite the fact that it is not able to credibly commit to ex post access prices. The idea is that access holidays should create incentives to invest the optimal amount of capital from a social welfare point of view (cf. Gans, King, 2003, pp. 168 f.).

The question arises, however, whether the problem of regulatory opportunism can really be solved within phase 2 by shifting the regulatory intervention from the ex post (stage 2b) to the ex ante situation (stage 2a) and simplifying the regulatory parameter (price regulation versus length of regulation). For every future realisation of $M(\alpha_i)$ the regulatory agency has different incentives to break the promised agreement about the length of the access holidays (depending on the relative future strength of influence of the interest groups). Neither can the problem of regulatory opportunism be solved by means of a simplification of the regulatory parameter. Because the implementation of access holidays only occurs after the investment has been made, an incentive effect for future investments is excluded. The missing commitment ability regarding the adherence to access holidays is associated with the same regulatory uncertainty as the compensation for all cost and risk in future price regulation. The root of the problem is to be found in the inability of the regulatory agency to commit itself to welfare-maximising solutions due to a stochastic M-function (arising in phase 1). The regulatory risk carries forward into missing compensation and missing commitment to access holidays.

6 The disaggregated regulatory mandate

Due to the regulatory agency's lack of commitment capability in relation to the regulated sector, compensations cannot reduce the regulatory risk. Instead, the institutional solution to this problem can be found in a disaggregated regulatory mandate from the legislator. Only by imposing an appropriate constraint of the regulatory agency's discretionary freedom of action can the regulatory agency achieve commitment capability to implement welfare-maximising behaviour and thus reduce regulatory risk (cf. Knieps, 2005, pp. 81 ff.; Knieps, 2007, pp. 190 ff.).

In the regulatory mandate the competencies of the regulatory agency for implementing regulation are prescribed. It defines the competencies of the regulatory agencies and constrains the scope of their discretionary actions. The regulatory mandate has to be embedded within the legal framework of regulation. Reform efforts must start with the re-design of the regulatory mandate, so that regulatory agencies have economically efficient incentives, and double regulation, misregulation, over- and under-regulation are avoided. As regards the remaining field of activity, however, the expertise of the relevant regulatory agency should be trusted. In the following, the basic elements of a disaggregated regulatory mandate based on disaggregated regulatory economics will be presented.

The regulatory risk in competitive network areas, as characterised in section 3, can be reduced if the following constraints to regulatory agencies are implemented by law:

(1) Prohibition of measures leading to market closure. Market entry and exit must be possible in all network areas.

(2) Prohibition of market power regulation outside of network areas – functionally defined by the legislator – where monopolistic bottlenecks may still exist, because all other network areas are clearly competitive from a normative point of view.

Regulatory risk in non-competitive network areas, as characterised in section 4, can be reduced if the following obligations to regulatory agencies are implemented:

(1) To apply price-cap regulation for disciplining the market power of monopolistic bottlenecks, in combination with a prohibition of price structure regulation.

(2) Not to disturb the financial viability of the regulated firm. When determining the minimum price level, the point of reference should be decision-relevant cost, including opportunity cost of capital investment.

(3) To adhere to a differentiated localisation and regulation of monopolistic bottlenecks; the necessity of this regulation is to be reviewed periodically (due to the phasing-out potentials of monopolistic bottlenecks).

The disaggregated regulatory mandate constitutes a binding constraint of the regulatory agency's freedom of action and thus reduces the regulatory risk of an excessive regulatory base as well as the regulatory risk of underinvestment.

Literature

Ahn, Chang Mo, Thompson, Howard E. (1989), "An Analysis of Some Aspects of Regulatory Risk and the Required Rate of Return for Public Utilities", *Journal of Regulatory Economics*, Vol. 1, pp. 241-257.

Becker, Gary S. (1983), "A Theory of Competition Among Pressure Groups for Political Influence", *Quarterly Journal of Economics*, Vol. 98, No. 3, pp. 371-400.

Besanko, David, Spulber, Daniel F. (1992), "Sequential-Equilibrium Investment by Regulated Firms", *Rand Journal of Economics*, Vol. 23, No. 2, pp. 153-170.

Blankart, Charles B., Knieps, Günter, Zenhäusern, Patrick (2007), "Regulation of New Markets in Telecommunications: Market Dynamics and Shrinking Monopolistic Bottlenecks", *European Business Organization Law Review,* Vol. 8, pp. 413-428.

Buckland, Roger, Fraser, Patricia (2001), "Political and Regulatory Risk in Water Utilities: Beta Sensitivity in the United Kingdom", *Journal of Business Finance and Accounting*, Vol. 28, No. 7-8, pp. 877-904.

Ebert, Udo (2005), "Zur Messung von Risiko", in: S. Müller, T. Jöhnk and A. Bruns (eds.), *Beiträge zum Finanz-, Rechnungs- und Bankwesen: Stand und Perspektiven*, Deutscher Universitäts-Verlag, Wiesbaden, pp. 17-33.

Ergas, Henry et al. (2001), Regulatory Risk, Paper prepared for the ACCC Regulation and Investment Conference, Manly, 26-27 March, Draft Version.

Gaggero, Alberto A. (2007), "Regulatory Risk in the Utilities Industry: An Empirical Study of the English-Speaking Countries", *Utilities Policy*, Vol. 15, No. 3, pp. 191-205.

Gans, Joshua, King, Stephen (2003), "Access Holidays for Network Infrastructure Investment", *Agenda*, Vol. 10, No. 2, pp. 163-178.

Knieps, Günter (1997), "Phasing out Sector-Specific Regulation in Competitive Telecommunications", *Kyklos*, Vol. 50, Fasc. 3, pp. 325-339.

Knieps, Günter (2005), "Telecommunications Markets in the Stranglehold of EU Regulation: On the Need for a Disaggregated Regulatory Contract", *Journal of Network Industries*, Vol. 6, No. 2, pp. 75-93.

Knieps, Günter (2006), "Sector-Specific Market Power Regulation versus General Competition Law: Criteria for Judging Competitive versus Regulated Markets", in: F.P. Sioshansi und W. Pfaffenberger (eds.), *Electricity Market Reform: An International Perspective*, Elsevier, Amsterdam et al., pp. 49-74.

Knieps, Günter (2007), *Netzökonomie: Grundlagen, Strategien, Wettbewerbspolitik*, Gabler, Wiesbaden.

Knieps, Günter, Weiss, Hans-Jörg (2007), "Reduction of Regulatory Risk: A Network Economic Approach", Discussion Paper No. 117, Institute for Transport Economics and Regional Policy, University of Freiburg, September.

Kolbe, A. Lawrence, Tye, William B., Myers, Stewart C. (1993), *Regulatory Risk: Economic Principles and Applications to Natural Gas Pipelines and other Industries*, Kluwer Academic Publishers, Boston/Dordrecht/London.

Laffont, Jean-Jacques, Tirole, Jean (2000), *Competition in Telecommunications*, Cambridge, Massachusetts, London

Maertens, Sven (2005), "Liberalisierung notwendig: Intercity-Busverkehr in Deutschland, *Internationales Verkehrswesen*, Vol. 57, No. 6, pp. 251-256.

Myers, Stewart C. (1972), "The Application of Finance Theory to Public Utility Rate Cases", *Bell Journal of Economics and Management Science*, Vol. 3, No. 1, pp. 58-97.

Newbery, David M. (2000), *Privatization, Restructuring, and Regulation of Network Utilities*, MIT Press, Cambridge (Mass.) and London.

Pedell, Burkhard (2006), *Regulatory Risk and the Cost of Capital: Determinants and Implications for Rate Regulation*, Springer, Berlin and Heidelberg.

Peltzman, Sam (1976), Toward a More General Theory of Regulation", *Journal of Law and Economics*, Vol. 19, August, pp. 211-240.

Posner, Richard A. (1974), "Theories of Economic Regulation", *Bell Journal of Economics and Management Science*, Vol. 5, No. 2, pp. 335-358.

Spulber, Daniel F. (1989), *Regulation and Markets*, MIT Press, Cambridge (Mass.) and London.

Spulber, Daniel F., Besanko, David (1992), "Delegation, Commitment, and the Regulatory Mandate", *Journal of Law, Economics and Organization*, Vol. 8, No. 1, pp. 126-154.

Stigler, George J. (1971), "The Theory of Economic Regulation", *Bell Journal of Economics and Management Science*, Vol. 2, No. 1, S. 3-21.

Stone, Bernell K. (1973), "A General Class of Three-Parameter Risk Measures", *Journal of Finance*, Vol. 28, No. 3, pp. 675-685.

Weingast, Barry R.,Moran, Mark J. (1983), "Bureaucratic Discretion or Congressional Control? Regulatory Policymaking by the Federal Trade Commission", *Journal of Political Economy*, Vol. 91, No. 5, pp. 765-800.

Weiss, Hans-Jörg (2006), "Die Probleme des ÖPNV aus netzökonomischer Sicht", in: Lasch, Rainer/Lemke, Arne (Hrsg.), *Wege zu einem zukunfts-trächtigen ÖPNV: Rahmenbedingungen und Strategien im Spannungsfeld von Markt und Politik*, Erich Schmidt Verlag, Berlin, S. 119-147.

Williamson, Oliver E. (1983), “Credible Commitments: Using Hostages to Support Exchange”, American Economics Review, Vol. 73/4, pp. 519-540.

Wright, Stephen, Mason, Robin, Miles, David (2003), A Study into Certain Aspects of the Cost of Capital for Regulated Utilities in the U.K., Report commissioned by the U.K. Economic Regulators and the Office of Fair Trading, London, February.

Als Diskussionsbeiträge des
Instituts für Verkehrswissenschaft und Regionalpolitik
Albert-Ludwigs-Universität Freiburg i. Br.
sind zuletzt erschienen:

95. **G. Knieps**: Neuere Entwicklungen in der Verkehrsökonomie: Der disaggregierte Ansatz, erschienen in: Nordrhein-Westfälische Akademie der Wissenschaften (Hrsg.), Symposium „Transportsysteme und Verkehrspolitik“, Vorträge 17, Schöningh-Verlag, Paderborn, 2004, S. 13-25

96. **G. Knieps**: Telekommunikationsmärkte zwischen Regulierung und Wettbewerb, erschienen in: Nutzinger, H.G. (Hrsg.), Regulierung, Wettbewerb und Marktwirtschaft, Festschrift für Carl Christian von Weizsäcker, Verlag Vandenhoeck & Ruprecht, 2003, S. 203-220

97. **G. Knieps**: Wettbewerb auf den europäischen Transportmärkten: Das Problem der Netzzugänge, erschienen in: Fritsch, M. (Hrsg.), Marktdynamik und Innovation – Gedächtnisschrift für Hans-Jürgen Ewers, Duncker & Humblot, Berlin, 2004, S. 221-236

98. **G. Knieps**: Verkehrsinfrastruktur, erschienen in: Akademie für Raumforschung und Landesplanung (Hrsg.), Handwörterbuch der Raumordnung, Hannover 2005, S. 1213-1219

99. **G. Knieps**: Limits to the (De-)Regulation of Transport Services, erschienen als: “Delimiting Regulatory Needs” in: OECD/EMCT Round Table 129, Transport Services: The Limits of (De)regulation, OECD Publishing, Paris, 2006, S.7-31

100. **G. Knieps**: Privatisation of Network Industries in Germany: A Disaggregated Approach, erschienen in: Köthenbürger, M., Sinn, H.-W., Whalley, J. (eds.), Privatization Experiences in the European Union, MIT Press, Cambridge (MA), London, 2006, S. 199-224

101. **G. Knieps**: Competition in the post-trade markets: A network economic analysis of the securities business, erschienen in: Journal of Industry, Competition and Trade, Vol. 6, No. 1, 2006, S. 45-60

102. **G. Knieps**: Information and communication technologies in Germany: Is there a remaining role for sector specific regulations?, erschienen in: Moerke, A., Storz, C. (Hrsg.), Competitiveness of New Industries. Institutional Framework and learning in information technology in Japan, the US and Germany, Routledge (Routledge Studies in Global Competition, ed. by John Cantwell and David Mowery), 2007

103. **G. Knieps**: Von der Theorie angreifbarer Märkte zur Theorie monopolistischer Bottlenecks, in: Daumann, F., Okruch, S., Mantzavinos, C. (Hrsg.), Wettbewerb und Gesundheitswesen: Konzeptionen und Felder ordnungsökonomischen Wirkens, Festschrift für Peter Oberender, Andrássy Schriftenreihe, Bd. 4, Budapest 2006, S. 141-159

104. **G**. **Knieps:** The Different Role of Mandatory Access in German Regulation of Railroads and Telecommunications, erschienen in: Journal of Competition Law and Economics, Vol. 2/1, 2006, S. 149-158

105. G. **Knieps:** Aktuelle Vorschläge zur Preisregulierung natürlicher Monopole, erschienen in: K.-H. Hartwig, A. Knorr (Hrsg.), Neuere Entwicklungen in der Infrastrukturpolitik, Beiträge aus dem Institut für Verkehrswissenschaft an der Universität Münster, Heft 157, Vandenhoeck & Ruprecht, Göttingen, 2005, S. 305-320

106. G. Aberle: Zukünftige Entwicklung des Güterverkehrs: Sind Sättigungsgrenzen erkennbar? Februar 2005

107. G. Knieps: Versorgungssicherheit und Universaldienste in Netzen: Wettbewerb mit Nebenbedingungen? erschienen in: Schriftenreihe der Deutschen Verkehrswissenschaftlichen Gesellschaft: Versorgungssicherheit und Grundversorgung in offenen Netzen, Reihe B, B 285, 2005, S. 11-25

108. H.-J. Weiß: Die Potenziale des Deprival Value-Konzepts zur entscheidungsorientierten Bewertung von Kapital in liberalisierten Netzindustrien, Juni 2005

109. G. Knieps: Telecommunications markets in the stranglehold of EU regulation: On the need for a disaggregated regulatory contract, erschienen in: Journal of Network Industries, Vol. 6, 2005, S. 75-93

110. H.-J. Weiß: Die Probleme des ÖPNV aus netzökonomischer Sicht, erschienen in: Lasch, Rainer/Lemke, Arne (Hrsg.), Wege zu einem zukunftsträchtigen ÖPNV: Rahmenbedingungen und Strategien im Spannungsfeld von Markt und Politik, Erich Schmidt Verlag, Berlin, 2006, S. 119-147

111. G. Knieps: Die LKW-Maut und die drei Grundprobleme der Verkehrsinfrastrukturpolitik, erschienen in: Schriftenreihe der Deutschen Verkehrswissenschaftlichen Gesellschaft: Die LKW-Maut als erster Schritt in eine neue Verkehrsinfrastrukturpolitik, Reihe B, B 292, 2006, S. 56-72

112. C.B. Blankart, G. Knieps, P. Zenhäusern: Regulation of New Markets in Telecommunications? Market dynamics and shrinking monopolistic bottlenecks, erschienen in: European Business Organization Law Review (EBOR), Vol. 8, 2007, S. 413-428

113. G. Knieps: Wettbewerbspotenziale im Nahverkehr: Perspektiven und institutionelle Barrieren, erschienen in: Schriftenreihe der Deutschen Verkehrswissenschaftlichen Gesellschaft: Warten auf Wettbewerb: ÖPNV in Deutschland, Reihe B, 2007, S. 11-23

114. F. Birke: Universaldienstregulierung in der Telekommunikation heute: Herausforderungen, Chancen und Risiken – Ein historischer Ansatz, Mai 2007

115. G. Knieps, P. Zenhäusern: The fallacies of network neutrality regulation, Paper presented at the 18th European Regional ITS Conference, September 2-5, 2007, in Istanbul, revised version: September 2007

116. G. Knieps: Disaggregierte Regulierung in Netzsektoren: Normative und positive Theorie, erschienen in: in: Zeitschrift für Energiewirtschaft, 31/3, 2007, S. 229-236

117. G. Knieps, H.-J. Weiß: Reduction of Regulatory Risk: A Network Economic Approach, erscheint in: Tagungsband zur Konferenz über Regulierungsrisiken in Halle, März 2007, Nomos Verlag

118. G. Knieps, H.-J. Weiß: Regulatory Agencies and Regulatory Risk, November 2007