Regulatory Risk and the Cost of Capital

Determinants and Implications for Rate Regulation

Burkhard Pedell

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With 18 Figures and 13 Tables

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Foreword

One of the central objectives of the European Union is the liberalization of markets and, in particular, of utility sectors such as the telecommunications, postal services, and energy sectors. National regulatory systems and authorities are installed in order to control the transition process from monopolistic to liberalized markets. In this process, the determination of prices assumes a prominent role. As in the relevant network industries capital costs account for the largest share of total costs, this book addresses a central issue of (de-)regulation.

At the same time, a change in the concepts of cost accounting from a traditional, operation-based view, to a more market-based view can be observed in Germany. These trends form the background for the analysis contained in this book. Burkhard Pedell develops a comprehensive concept for the study of regulatory risk and its implications for cost-orientated rate regulation that is founded in state-of-the-art economic research. The concept includes the major variables of regulation that are relevant to the risk (adjusted cost of capital) of rate-regulated firms and investigates the interdependences between them.

Central problems such as the circularity between regulation and investors' expectations, the commitment of the regulator, the employed depreciation methods and their connection to the interest rate, the determination of the regulatory rate base and the capital market-based assessment of the cost of capital are discussed. Answers to all these problems are given building on modern economic theory and the findings of empirical research. Two prominent results concern the depreciation method and the regulatory rate base: It is shown that, in many situations, depreciation should not be based on historical costs but on used replacement costs. Convincing arguments emphasize that, in a system of rate regulation, the book value of assets, and not market value of capital, should be used in the regulatory rate base.

In this book, the problems associated with the assessment of risk (adjusted cost of capital) for rate-regulated firms are comprehensively discussed. It develops a theoretically and empirically well-founded concept for the determination of cost-orientated prices in such firms. The results presented in this book advance existing research and are well-suited to

supporting the process of deregulation. Therefore, they will prove useful both to regulators in European and other countries as well as regulated firms.

Munich, January 2006 *Prof. Dr. Dr. h.c. Hans-Ulrich Küpper*

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Stuttgart, January 2006 *Prof. Dr. Burkhard Pedell*

Contents

1 Introduction

Investments in infrastructure are of paramount importance for the functioning of an economy. However, it cannot be taken for granted that an efficient level of infrastructure investment is attained. If utilities are owned by private investors and if at the same time their rates are regulated by the government or by governmental agencies, the regulatory regime is of crucial relevance for investment incentives and, accordingly, for the level of investment. Therefore, extraordinary care has to be exercised when designing as well as when changing a regulatory scheme; this holds true in particular during processes of market liberalization and deregulation.

The California energy crisis is a vivid example of how inconsistencies in the regulatory regime can lead to a shortage of energy supply and seriously endanger the financial viability of utilities.[1] There are indicators that the Scandinavian Norpool risks to face similar difficulties,[2] and also for the UK shortages already have been predicted.[3] Continental Europe has seen a decrease of investment over the last years, but so far no shortages of energy supply are expected.[4] In Germany, investment in electricity generation and distribution has continuously declined since 1984 except for a short period after the reunification.[5]

However, the extraordinarily hot and dry summer of 2003 in Europe has shown that the reserve margin in power supply in continental Europe decreases towards zero when hydro-electric and wind power plants fail and nuclear power plants cannot run to full capacity due to the heating of rivers that provide cooling water. In some countries, e.g. Italy, electricity had to be cut off completely on a few days. The blackout in the northeastern U.S. and Canada on August 14, 2003, left some 50 million people without power, and underlined the vulnerability of the North American power grid. It did not come as a surprise to experts, as investment in the grid did not

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1 The reasons leading to the California electricity crisis are discussed in more detail in section 4.4.

2 Cf. Frankfurter Allgemeine Zeitung no. 38, February 14, 2003, p. 12.

3 Cf. Shuttleworth/MacKerron (2002, 26ff.).

4 Cf. UCTE (2002) and VDN (2002).

5 Cf. Karl (2003, 43).

keep pace with demand growth over the last ten years.[6] This very large blackout was followed by a series of blackouts in Europe during the summer of 2003. On August 28, 2003, a blackout during the evening rush hour paralyzed the London underground for more than half an hour.[7] Some three million people in Denmark and Sweden were left without electricity for several hours, after 20 percent of the electricity generation capacity had failed due to a series of technical defects.[8] On September 28, 2003, the last blackout in this series hit Italy, which is heavily dependent on power imports from other European countries. When thunderstorms caused damages to high-voltage lines and widely disconnected the Italian grid from the European network, parts of the Italian power supply collapsed for the better part of a day.[9]

The importance of adequate investment in infrastructure is emphasized by all these experiences. This view is shared by the European Commission, which estimates the investment needs for power generation capacity in the European Union, including acceding countries as well as Switzerland and Norway, to be 250 billion Euros until the year 2020, and aims to promote investment in the grid and generation capacity by a draft law presented on December 3, 2003.[10] The U.S. Energy Policy Act of 2005, signed into law on August 8, 2005, among other things, aims to promote investment in generation and transmission capacity by means of massive tax incentives.[11] Clearly, security of supply is not an absolute end in itself, but has to be traded off against the cost of providing this security when determining the adequate level of investment.[12]

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6 The Economist, August 21, 2003, interviewed several energy experts and came to the conclusion: "Sadly, the signs are that America's grid was ripe for blackout."

7 Cf. Frankfurter Allgemeine Zeitung no. 201, August 30, 2003, p. 12. However, this blackout was not due to lack of investment in generation capacity or in the grid, as argued in spontaneous reactions, but was due to a faultily installed system of emergency power.

8 Cf. Financial Times Deutschland, September 24, 2003; Frankfurter Allgemeine Zeitung no. 232, October 7, 2003, p. T1.

9 Cf. Frankfurter Allgemeine Zeitung no. 227, September 30, 2003, p. 13.

10 Cf. Frankfurter Allgemeine Zeitung no 279, December 1st, 2003, p. 11.

11 Cf. Frankfurter Allgemeine Zeitung no. 175, July 30, 2005, p. 11.

12 This point is also stressed by MacKerron/Lieb-Doczy (2003). Para. 1 of the German Bundestarifordnung Elektrizität (BTOELt) obliges electricity companies to ensure provision of electricity as secure as possible *and* at prices as low as possible. Clearly, these two conflicting objectives cannot be maximized simultaneously.

Investments of regulated utilities are usually characterized by a high portion of sunk costs; especially investments in energy, water, communication and transport infrastructure are highly irreversible. The high degree of irreversibility makes these investments potentially risky. At the same time, most infrastructure investment is characterized by economies of scale. Combined with irreversibility, this creates monopolistic bottlenecks[13] that call for some form of permanent governmental intervention in order to prevent the abuse of market power.[14] Examples of monopolistic bottlenecks are distribution networks for electricity, natural gas and water as well as the local loop in the fixed line telecommunications network, the so-called last mile.[15] If the way of regulation is taken by the government in order to discipline market power, retail pricing for consumers and access pricing for competitors to monopolistic bottlenecks are issues of central interest.

The outlined examples show that it is of the utmost importance to keep investment incentives alive by allowing investors an adequate rate of return including appropriate compensation for risk. With insufficient rates, private investors are reluctant to bear the investment risk, which would result in a correspondingly higher system reliability risk to be borne by consumers. The issue is even more important if, as in the case of electricity in the U.S. and in Europe, in the coming years large parts of the existing infrastructure will call for renovation or replacement. Incentives for new investment by investor-owned utilities only exist if it can be expected that investments will be profitable over their entire lifetime on average. Ultimately, this requirement cannot be ignored by any form of rate regulation; as a consequence rate regulation has to be orientated towards the long-run cost of the regulated firm.[16] As most regulated industries, such as telecommunications, transport and energy, are extremely capital-intensive, immense emphasis has to be placed on the determination of the cost of capital, made up of interest and depreciation, when setting the level of regulated rates.

The Bundeskartellamt, the German Federal Cartel Office, on February 19, 2003, ordered the Thüringer Energie AG (TEAG), an affiliate of the E.ON group, to immediately lower the rates charged to competitors for access to its grid. The decision was justified by the Cartel Office in particular

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[13] Monopolistic bottlenecks are characterized in more detail in section 2.1.1.

[14] Possible objectives of rate regulation are discussed in section 2.2.

[15] However, the local loop in telecommunications is exposed to increasing competition by substitutive technologies; see section 2.1.2.

[16] Riechmann/Schulz (1996, 386) share the view that, ultimately, every form of rate regulation should be cost-orientated.

on the grounds that TEAG had inflated its access rates by using an excessively high cost of equity. The Cartel Office for the first time made use of the option to verify the cost calculations of a firm. According to the Cartel Office the lowering of rates will cut revenues of TEAG by approximately ten percent. Meanwhile numerous law-suits against electric utilities because of supposedly excessive rates are pending in court.[17] The decision of the Cartel Office was overruled by the Oberlandesgericht Düsseldorf [Higher Regional Court] on February 11, 2004, on the very grounds that the Cartel Office only has competences for monitoring abusive pricing policies, but not for auditing individual cost elements and calculation procedures.[18]

The Regulierungsbehörde für Telekommunikation und Post (RegTP),[19] the federal German Regulatory Authority for Telecommunications and Posts, lowered the interconnection rates that competitors have to pay to Deutsche Telekom AG (DTAG) by approximately 9.5 percent with effect from December 1st, 2003.[20] According to press reports, this will bring about a loss of sales volume for DTAG ranging in the dimension of a low triple-digit Million € amount.[21] These cases underline the fundamental importance of assessing the appropriate risk-adjusted rate of return for rate-regulated utilities as well as the dimension of the impact of regulatory rate setting on the revenue situation of regulated utilities. It is therefore all the more important that the regulator exercises special diligence when assessing the risk-adjusted cost of capital.

In the special case of rate-regulated firms, the risk heavily depends on the very design of the regulatory regime. Existing research in this field builds on one of two different approaches to regulatory risk. The first ap-

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[17] For this decision, see Bundeskartellamt (2003, in particular 22ff.); see also Financial Times Deutschland, February 19, 2003.

[18] See the press release of the Oberlandesgericht Düsseldorf on February 12, 2004, available at www.olg-duesseldorf.nrw.de.

[19] In July 2005, when its responsibility was extended to include the regulation of electricity and gas, RegTP was renamed Bundesnetzagentur. In the following, the name RegTP is used, as all references are before that time.

[20] Rate regulation in the German telecommunications sector is regulated by the Telekommunikationsgesetz (TKG) [Telecommunications Act], by the Telekommunikations-Entgeltregulierungsverordnung (TEntgV) [Ordinance on rate regulation in the telecommunications sector], as well as by additional Verwaltungsvorschriften im Bereich Kostenrechnung [Administrative regulations of cost accounting] published in Amtsblatt 5/2001 (p. 647f.) of the RegTP. For the development of the German telecommunications sector over time, see Witte (2002).

[21] Cf. Frankfurter Allgemeine Zeitung no. 278, 29.11.2003, p. 15.

proach involves investigating how systematic risk, i.e. the covariance with a market portfolio as measured by the beta factor, is affected by regulation as compared to a non-regulated firm. According to the familiar buffering hypothesis,[22] established by Peltzman (1976), rate regulation acts as a buffer that protects a regulated firm against external shocks, and, consequently, reduces the risks a regulated firm is exposed to. In some cases, even the extreme view is supported that rate regulation eliminates all risks of the regulated firm. For instance, the German Federal Cartel Office, in its decision against TEAG, argues that TEAG is not exposed to any risk due to regulation, and, consequently, the risk-less interest rate should be used as the cost of capital.[23] Less extreme positions argue that risks are not completely eliminated by rate regulation, but that they are at least unequivocally reduced. For instance, the German Monopoly Commission, in a recent special report on the development of competition in telecommunications and postal services, argues with respect to the divisional cost of capital of DTAG that, in principle, risk is higher in non-regulated businesses as compared to regulated businesses. However, rate regulation takes away pricing flexibility from the firm, which might even increase the vulnerability to external shocks.

The second approach addresses asymmetric regulatory risks.[24] These are caused by regulatory measures that make the cash flow distribution of the regulated firm (more) asymmetric, in particular by regulatory measures that cut off the upper (and/or lower) tail of the distribution. Both approaches deliver an abundance of individual findings; however, a comprehensive concept of regulatory risk has yet to evolve.

Against this background, the following analysis aims at developing such a comprehensive concept of regulatory risk and integrating the existing theoretical and empirical patchwork. The focus of this investigation is (1) on explaining how the design of the regulatory system and process influences the risk of a rate-regulated firm, and (2) on analyzing how rate regulation and, in particular, regulatory risk affect the appropriate methods for the determination of the regulatory rate base and for the assessment of the adequate allowed rate of return. To this end, the major design variables of rate regulation are identified and systematized into three clusters: variables determining the scope of regulation, regulatory system variables, and regulatory accounting variables. The impact of these variables on the risk that a regulated firm is exposed to is thoroughly analyzed.

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[22] The buffering hypothesis is discussed in detail in section 3.3.2.

[23] See Bundeskartellamt (2003, 23); this view is shared by the expert opinion of Zimmermann (2003, 49).

[24] Asymmetric regulatory risk is discussed in detail in section 3.3.3.

Regarding the determination of the regulatory rate base, at the center of the debate is the question of whether the market value of capital or the book value of assets should be employed. While from a financial theory perspective it is clear that investors expect to earn an appropriate return on the market values of capital, international regulatory practice requires the book value of assets to be used. There is a deficit in the academic debate when it comes to detecting and analyzing explanations for this conflict and showing how it can be reconciled; this investigation contributes towards closing this gap. Furthermore, specific methodical issues concerning cost of capital assessment for rate-regulated firms are elaborated, i.e. the circularity of rate regulation, the sharing of risks between capital owners and rate payers, the length of the regulatory review period, the regulation of the capital structure as well as the conversion of a post-tax to a pre-tax WACC (weighted average cost of capital).

The results of the analysis can be used to explain observed differences in the cost of capital of regulated firms across industries, countries and time, as well as to set an appropriate rate of return in regulatory hearings, most notably when the regulatory regime undergoes major changes or when benchmarks of firms subject to a different regulatory regime are used. Furthermore, they can be used to improve the design and the implementation of regulatory systems.

The investigation is organized as follows (see Figure 1.1): In Chapter 2, fundamental elements of cost-orientated rate regulation are explained, i.e. models, objectives, the process, cost concepts and types of rate regulation. Furthermore, the role of the cost of capital is compared across different types of rate regulation, as well as with its role in non-regulated firms. Chapter 3 and chapter 4 analyze the impact of regulation on the risk of the regulated firm, with the cause and effect chain turned upside down. Starting from a descriptive framework of rate regulation and an analysis of the fundamental circularity and time-inconsistency problems, firstly the effects of rate regulation on risk (section 3.3) and secondly the direct and indirect transmission mechanisms (section 3.4) are investigated in detail. Thirdly, a regulatory control panel is developed that comprises individual design variables of rate regulation that, ultimately, are the causes of regulatory risk (chapter 4). Chapter 5 and chapter 6 show how rate regulation is reflected in the appropriate methods for the determination of the regulatory rate base and for the assessment of the adequate allowed rate of return. Chapter 7 is by way of conclusion.

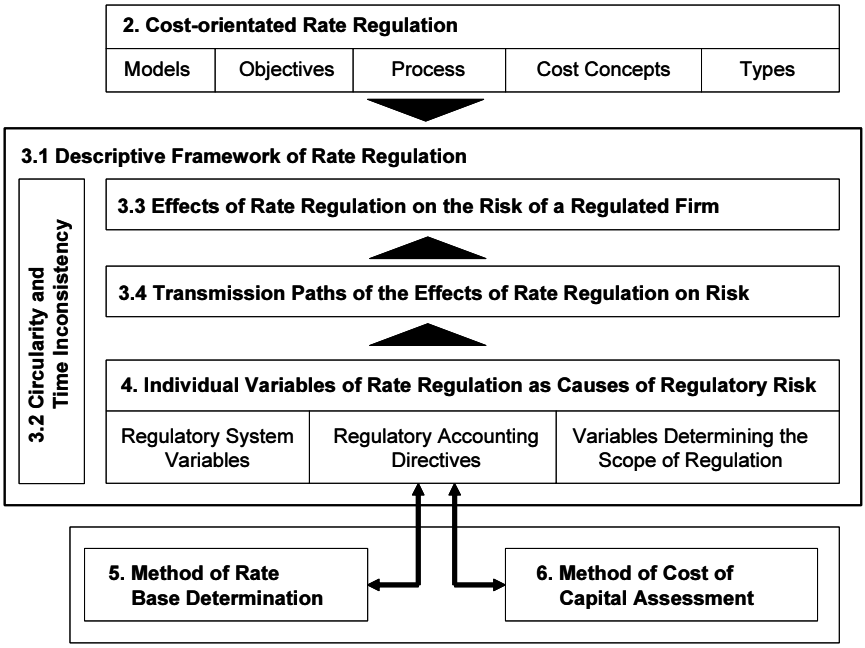

Figure 1.1. Organization of the analysis

2 Basic Elements for a Comprehensive Concept of Regulatory Risk – Models, Objectives, Process, Cost Concepts and Types of Rate Regulation

2.1 Characterization of the Two Basic Models of Rate Regulation

Regulation of rates, in principle, can be based on two different models: the monopolistic model and the competitive model.[25]

2.1.1 Monopolistic Model of Rate Regulation

The monopolistic model assumes subadditivity of costs due to economies of scale or economies of scope. This means that there is a natural monopoly, i.e. one firm is able to serve the complete market more efficiently than several firms. If all investment were reversible, according to the theory of contestable markets, this firm would be disciplined by potential competitors in its price setting behavior. However, if investment is irreversible,[26] relevant costs of the established firm that has already sunk its investments are lower than those of potential competitors, which means that market entry barriers are erected. Only the combination of subadditivity *and* sunkness of costs establishes a stable monopoly position, as depicted in Figure 2.1. In this case, the main objective of rate regulation is ensuring provision of regulated services at low prices while, at the same time, profitability of the regulated firm and incentives for replacement and new investment in the regulated business must be guaranteed if the services are to be provided by the private sector.

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[25] Cf. Carne/Currie/Siner (1999, 4ff.).

[26] The application of a perfect contestability standard that assumes reversibility of investment to irreversible investment does not seem appropriate; see section 4.2.1. For the causes and effects of irreversibility of investment, see in more detail Pedell (2000, 69ff.).

	irreversibility / sunk costs	reversibility / no sunk costs
economies of scale/ natural monopoly	monopolistic bottleneck	monopolist disciplined by potential competitors
no economies of scale / no natural monopoly	competition of several active competitors	competition of several active competitors

Figure 2.1. Characteristics of monopolistic bottlenecks[27]

The balancing of interests between regulated utility and consumers is at the core of the discussion about objectives of monopoly regulation. It is aimed at preventing the abuse of monopoly power, while maintaining the benefits of economies of scale. If a universal service obligation without (or with restricted) scope for price discrimination is imposed on the monopolist, competitors have the chance for cream skimming, i.e. they compete for the consumers whose costs are below the uniform price set by the regulator. For this reason, the government can decide to protect regulated monopolists against competition, e.g. by demarcation contracts that grant them regional monopolies without competition in exchange for a universal service obligation, as had been the case in the German energy sector until the liberalization in 1998. A similar scheme had been established by the so-called regulatory compact in the U.S. energy sector.[28]

2.1.2 Competitive Model of Rate Regulation

In contrast, rate regulation in the competitive model principally aims at simulating competition or actually admitting and stimulating competition. Complete or partial opening up of hitherto protected monopolies for competition is what is usually understood as deregulation.[29] In this case, the regulator has to make sure that rates are set at least at such a level that current acquisition costs of assets as well as operating expenditures and return on investment are covered. Otherwise, new competitors have no chance to

[27] Cf. Knieps (2001, 33).

[28] For a more detailed discussion of universal service obligations, see section 4.3.1.

[29] In the majority of cases, deregulation brings about only modifications, not a complete removal of regulatory interventions. For the difficulties associated with the concept of deregulation, see Crew/Kleindorfer (2001, 2ff.).

enter the market. This is done to avoid predatory pricing of the incumbent monopolist. Conversely, the established firm loses market share to an unreasonable extent if the regulator sets it rates way above the competitive level. The risk of competitive distortion is especially large if the incumbent firm is unilaterally subject to rate regulation and new competitors have pricing flexibility, i.e. if there is an asymmetric scheme of rate regulation.

In most network industries, the incumbent firm(s) has (have) monopolistic bottlenecks that are characterized by economies of scale and irreversibility of investment, as depicted in Figure 2.1. Examples are the last mile in telecommunications (local loop)[30] as well as local distribution networks for electricity, natural gas and water. Duplication of these monopolistic bottlenecks would not be efficient from the perspective of the overall economy. In order to induce fair competition in the rest of the network, non-discriminating access to these essential facilities has to be granted by rate regulation. As soon as competition is working, rate regulation should be confined to monopolistic bottlenecks.[31]

In most instances, high access prices will advantage a vertically integrated incumbent regulated utility, as this makes it more difficult for new entrants to compete in the retail market.[32] Therefore, it is not surprising that the level of rates and, in particular, the adequate allowed rate of return are contentious between regulator and regulated utility, particularly in the case of access pricing. If competition is admitted in the retail market, too high a level of retail rates may even represent a risk for the incumbent regulated utility, as it becomes more vulnerable to competition.

2.2 Systematization of the Objectives and Principles of Rate Regulation

Fundamentally the aim of rate regulation is the prevention of abuse of market power in monopolistic bottleneck areas. When setting concrete

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[30] However, copper wire house connections in telecommunications are increasingly exposed to substitution competition by wireless technologies (wireless local loop), by internet telephony (voiceoverIP) as well as by data transfer technologies over the power cable (powerline) and the TV cable.

[31] See Knieps (2001, 101ff.), who argues that regulation should be phased out as soon as competition is working.

[32] If the incumbent utility is not active in the retail market, the case is less clear cut, as the revenue increasing direct effect of higher access prices has to be traded off against the indirect effect on volume.