SUMICSID

Use of Menu of Incentive Contracts

AG2:V4 – DRAFT REPORT

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Disclaimer

This is a draft of the final report on a pre-project on the use of a menu of incentive contracts, commissioned by the Norwegian Water Resources and Energy Directorate (*NVE*) under the premises of the AG2 working group, delivered 2003-08-18 by the authors, professors Per AGRELL and Peter BOGETOFT for SUMICSID AB.

The contents has been subject only to a brief review from the Commissionee and expresses only the viewpoint of the authors, who exclusively bear the responsibility for any possible errors.

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Summary

Menus play an important role in modern economics. A menu of contracts or regulatory schemes can improve social welfare by improving coordination and by facilitating incentive provision.

In the regulation of electricity distribution, it may be advantageous to take into account specific demand and cost characteristics in the different concession areas. This may call for alternative regulation in the different areas. At the same time, the proposed regulation must be viable under strategic behavior and asymmetric information. This may call for less than full adaptation of the regulation to the local conditions.

In this sub-project, we illustrate the basic ideas of menu based regulation and we discuss the pros and cons of such an enlargement of the regulatory tool-box. In addition, we outline two specific menu proposals that have been discussed in the reform project. The primary aim is to present the ideas and provide a platform from which the consultants and industry and regulatory representatives in the NVE working groups can develop specific proposals.

1. Introduction

Background

1.01 The Norwegian Water Resources and Energy Directorate (NVE) is appointed regulator for the electricity distribution and transmission sectors in Norway. Currently, NVE operates an individualized revenue-cap system for electricity distribution concessionaires with five-year regulation periods. The regulatory regime will be unconditionally revised effective from 2007, which means that the regulator NVE on behalf of the Oil- and Energy Department (OED) of the Government will investigate alternative regimes until 2004, when they have to be settled. To anchor the potential reforms, the investigations are to be intensified during 2003. The OED has commissioned a study by SNF on the principles of network regulation (von der Fehr et al., 2002), which will guide the further work where applicable.

1.02 Based on individual reflection and the SNF report, NVE defined five pre-projects that was concluded in 2002 and early 2003:

FP 1: Degrees of freedom in the NVE choice of regime?

FP 2: Ex-post vs. ex-ante regulation.

FP 3: Survey of existing evaluations of the current regime.

FP 4: Efficiency analysis and benchmarking in regulation.

FP 5: Incentives for non-grid technological innovation in regulation.

1.03 Based on the pre-projects, three working groups (AG1,2,3) was established to investigate three projects further:

AG1: Investments and price signals

AG2: Yardstick and ex-post regulation

AG3: Revenue base and actual costs

1.04 The AG2 on yardstick will continue in particular the work initiated in pr-projects 2 and 4. It has been decided to stress three sub-projects within AG2, viz

V1: Dynamic regulation

V2: Norm values

V4: Use of menu of incentive contracts

1.05 This report is a draft of the final report of the last of these sub-project, V4. Initially, brief observations on the possible use of menus were given in FP1 and FP2. The report directly refers to an applied proposal for menus in report V1.

Objectives

1.06 The aim of this sub-project is to start investigating the usefulness of menus of incentives contracts in the present or future regulatory settings. In the overall planning of the regulatory reform, the present sub-project is considered to be a first (pre-)project on menus that may later be expanded and integrated with the other projects and working groups.

1.07 The sub-project definition by NVE suggests to

i. Briefly define and outline the theoretical foundation for a menu of contracts

ii. Make a few illustrations of possible usages in regulation of Norwegian nets

iii. Make practical evaluations of the use of menus in view of results from other sub-projects and from the other working groups.

1.08 It follows that the challenge in this sub-project is in part pedagogical. Although it is popular among theorists to think in terms of menus, the applications are limited – or more precisely, the fact that actual contracts involve menu elements is often over-looked. We will try to boost the pedagogical side by numerous figures and examples referring in part to actual contracts in different sectors and in part to possible usages within e-distribution. We emphasize that the latter examples are only suggestive at this stage and we encourage the reader to use industry-specific information to suggest better usages.

1.09 In addition to the pedagogical aspects, we will stress the economic aspects. In terms of the economics of menus, we propose the following additions to the sub-project sketch by NVE.

1.10 We propose to look at menus as a way not only to handle private information about the actual inefficiencies (the adverse selection

problem emphasized in the NVE project definition). Based on our theoretical contributions and practical analysis of a series of actual contracting schemes, we suggest that menus may be useful also simply to exploit – more or less publicly known – differences among the firms. It could, for example, be potentially useful to let the regime depend on the objectives of the firm.

1.11 Also, we will demonstrate how several of the features in today's regime have menu characteristics. This goes for example for the KILE principle. The linkage of known regulatory features with the menu idea can, in our experience, be a very simple way to make the idea accessible.

1.12 In this connection, we will also discuss some notions of fairness that goes with alternative interpretations of contracts. Giving net companies with significantly different conditions or preferences a common treatment may obviously be far less egalitarian than treating the different companies differently.

1.13 Last but not least, we will emphasize the practical aspects of a selection of the theoretically most promising menus. We will discuss, for example, the data needed, the impact if the net companies do not fully understand the use of a menu (bounded rationality) etc. We will take a dynamic perspective also and propose a few alternative sequences in which menus can be introduced.

Outline

1.14 We start in chapter 2 by the basic challenges in the design of a regulatory regime. An regulation must ensure coordination, motivation and minimization of transaction costs. We then discuss how menus can contribute to these objectives. In chapter 3, we first set the stage by defining a property that we want to regulate. We discuss how to make use of menus to exploit differences among the distribution companies in chapter 4. Some specific menu proposals are given in chapter 5. Chapter 6 concludes and outlines some natural next steps.

2. Regulatory challenges

Menus as a regulatory instrument

2.01 The design of an appropriate regulation involves choosing the right mechanisms in the specific context. The context can be defined via the characteristics of the institution, the clients and the industry. Likewise, the regulatory mechanism can be defined by its overall philosophy and via the more specific instruments that are put to work. For an extended discussion, see chapter 2 in FP2 and V2.

2.02 A menu of contracts or regulations is a regulatory instrument more than a regulatory approach or philosophy. It can be used in several types of regulations, heavy handed or light handed, static or dynamic, DEA based or norm based etc. The reason is that menus can contribute to some of the fundamental objectives of any regulation, c.f below.

2.03 Despite of its wide-spread potentials, it is our clear impression, that menus are more widely used in context that are more well-developed and mature. In new contractual relationships, the first attempts are often quite simple and involve a standardized treatment of all cases, cf Bogetoft and Olesen(2003). As the parties become more used to a contract and as the possible gains from better adaptation to local conditions becomes more and more obvious, menus are introduced. From this perspective, electricity distribution in Norway seem an obvious candidate for menu based regulation.

Fundamental objectives

2.04 In the FP2 report, we stressed the importance of coordination, motivation and transaction costs:

Coordination: ensure that the right services are produced at the right time and place.

Motivation: ensure that the parties have individual incentives to make coordinated decisions.

Transaction costs: ensure that coordination and motivation are provided at the lowest possible cost.

2.05 A regulation must coordinate the action of independent individuals, ensure that individuals have private motives to implement their part

of a coordinated plan, and ensure that coordination and motivation is accomplished at least possible transaction costs. For an expanded discussion, see FP2 on Ex post Regulation.

2.06 Traditional expositions on menus stress the motivational aspects. In particular the possibility to save information rents in an asymmetric information (adverse selection context) by using a menu is often emphasized. We deviate. In our view, the primary aim of regulation in general and menu based regulation in particular is to improve coordination. The asymmetry of information (in some cases) opens the door for extraordinary information rents related to this coordination, as low cost firms can always imitate high costs firms and hereby expropriate the efficiency difference. In turn this may call for sub-optimal coordination to reduce incentive costs.

Create larger cake

2.07 One way to think of coordination is as follows: By creating a better adaptation between costs and benefits, social welfare can be increased. It is the creation of a larger social benefit cake that is the primary purpose, although we may have to forgo some increases in the coordination benefits, the cake, to limit information rents, i.e. to ensure a reasonable division of the cake among firms and consumers.

2.08 The use of a menu of regulation schemes is one way to increase the social welfare cake. The advantage of a menu is that we can exploit differences among consumer and firms. Instead of using a common, nation wide system, we can adopt to the local cost and benefit conditions and hereby improve welfare. Instead of trying to make everyone happy by the same product, we differentiate the product to take advantage of local demand and cost conditions.

10 principals of good design

2.09 Starting with the general objectives, coordination, motivation and transaction costs, we derived 10 principal concerns in regulatory design in chapter 4 of FP2. We shall not discuss these in details here, but we recall the different concerns in table 2.1 below since they provide a useful set of criteria against which to evaluate alternative menus.

Concern	Focus
1. Coordinate production	Coordination
2. Balance the pros and cons of decentralization	
3. Minimize the costs of risk and uncertainty	
4. Reduce the costs of post-contractual opportunism	Motivation
5. Reduce the costs of pre-contractual opportunism	
6. Do not kill cooperation	
7. Motivate long-term concerns	
8. Balance the pros and cons benefits of renegotiation	Transaction costs
9. Reduce direct costs of contracting	
10. Use transparent contracts	

Table 2-1 Ten concerns of contracting

3. Control of a property

3.01 In this chapter, we discuss four common ways to provided incentives. They can all be used as part of a menu of contracts. In this sense, they are common building blocks in design of a menu instrument, and they can help understand the idea of providing incentives to firms and companies.

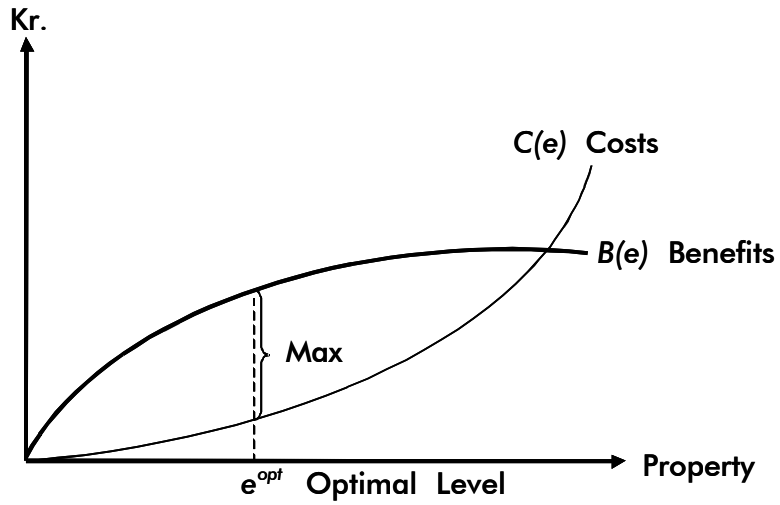
A property

3.02 There are many aspects or properties of electricity distribution that society may want to regulate, e.g. quality, reliability, installed distribution capacity, environmental impact etc. The regulation of some of these aspects may benefit from a menu based approach as it may not be optimal to have the some level of the properties in all firms and regions.

3.03 To set the stage for the discussion, consider a case where we want to regulate some property e. This property may be a quality parameter, a quantity measure, a timeliness property etc.

3.04 The costs to the distribution company and the benefits to the consumers that results from different levels of the property, eg different quality levels, are indicated in Figure 3-1 below.

3.05 The socially optimal level of the property gives the largest difference between benefits and costs. Under normal conditions, this is also a level, where marginal costs equal marginal benefits, i.e. where the slope of the two curves in Figure 3-1 are equal.



Figur 3-1 Regulation of one property

Steering mechanisms

3.06 Given a reasonable amount of information about costs and benefits, the (near) optimal property level eopt can be determined. The natural next question is how the regulator can steer the firms (or consumers) to choose these levels ?

3.07 There are several such ways and in this chapter we outline some important ones and discuss their pros and cons in a not so perfect world of uncertainty and asymmetric information. The methods can all be used as parts of the menu schemes we discuss in the next chapters.

3.08 To avoid a to lengthy discussion, we stress providing incentives to the firms and largely ignore incentive provision for consumers. We emphasize, however, that a parallel treatment directed towards the motivation of consumers are possible, although the network property of electricity distribution do somewhat limit the ability of individual consumers to choose different levels of at least some quality parameters etc

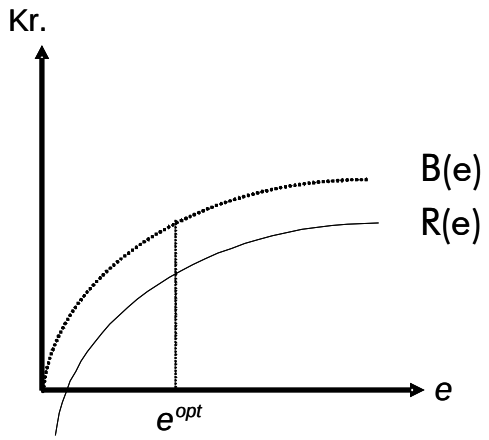
3.09 The rest of this chapter can be skipped at first reading. A reader seeking a quick introduction to the main ideas of using a menu– and less to the details of menus - may at this point jump directly to the next chapter.

Generalized revenue plan

3.10 One possibility is to use a generalized revenue plan where the firm is reimbursed an amount R(e) equal to the consumers benefit B(e) minus a lump sum (property independent) payment A:

$$R(q) = -A + B(q)$$

The lump sum amount A can be chosen as any value between 0 and $B(e^{opt})-C(e^{opt})$. High values means that all the gains from adoption to the optimal property level go to the consumers and low values means that the gains go the firm. This scheme is illustrated in figure 3.2 below.



Figur 3-2 Generalized price plan

The generalized scheme is advantageous by leading to optimal quality levels for all possible cost functions. The regulator does not need to know and constantly track changes in the costs function except to determine the range in which A can be chosen. On the other hand, the regulator needs considerable information about the benefit function and the information about B(.) may be difficult to communicate to the firms, especially in the multiple dimensional case, where several properties are controlled at the same time.

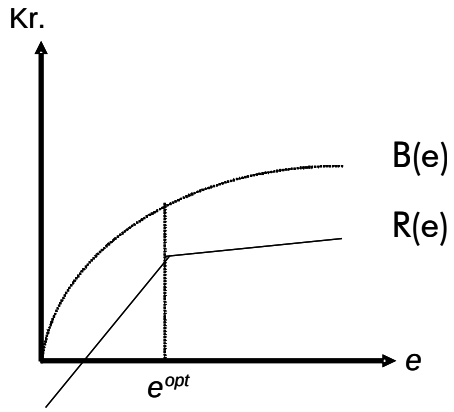
Two-price scheme

3.11 A second possibility – and the one we shall use in the graphical illustrations in the next chapters - is to use a so-called two-price scheme where the firm is paying a lump sum amount A for the right to make decisions about e, and where the firm is paid a relative high

price p_1 for improvements in e, when e is below the optimal level, and a small price p_1-p_2 for e increases when e is already above the optimal level:

$$R(e) = -A + p_1 e - p_2 \max\{e - e^{opt}, 0\}$$

This scheme is illustrated in figure 3.3 below.



Figur 3-3 Two-price plan

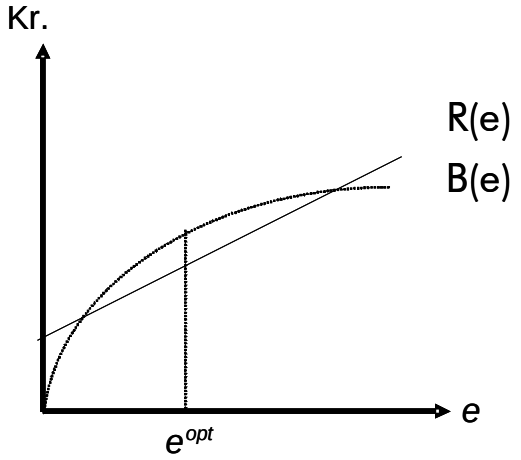
The advantages of this scheme are its relative simplicity making it easy to communicate and to adapt to. In addition, the outcome is less sensitive to changes in costs and benefits than the restriction based approach. The disadvantage is of course that the regulator needs some information about the firm´s cost function to design the kink point.

Marginal-price scheme

3.12 A third possibility is to use a so-called marginal-price scheme where the firm is paid a lump sum amount A plus a relative small price p for improvements equal to the marginal value to the consumes in optimum:

$$R(q) = A + pq$$

This scheme is illustrated in figure 3.4 below.



Figur 3-4 Marginal price scheme

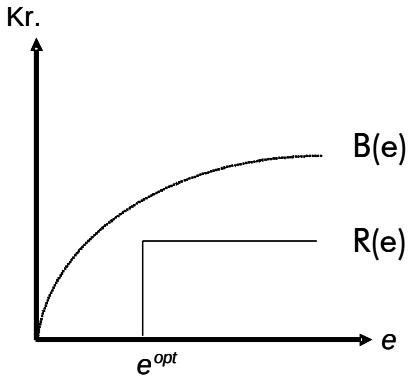
The advantages of this scheme are its relative simplicity making it easy to communicate and to adapt to. In addition, the outcome is not too sensitive to changes in cost and benefits. On the other hand, the estimation of marginal value in optimum must be rather precise requiring good initial information about the costs and benefits.

Restriction based scheme

3.13 The final possibility we will consider here is to use a restriction based scheme. This is similar to the familiar use of minimal requirements on several parameters in electricity distribution. In this scheme, the reimbursement to the firm equals A if it comply with minimal standards and the penalty otherwise is very large

$$R(e) = A \text{ if } e=e^{opt} \text{ and very negative otherwise}$$

Again, the lump sum amount A can be chosen as any value between 0 and $B(e^{opt})-C(e^{opt})$. High values means that all the gains from adoption to optimal quality go to the firm and low values that the gains go the consumers. This scheme is illustrated in figure 3.5 below.



Figur 3-5 Restriction based scheme

The advantages of this scheme are its simplicity making it easy to communicate and to adapt to. On the other hand, it optimality is extremely sensitive to variations in the cost and benefits function. It is therefore primarily useful in those cases, where the benefit or cost curves are kinked with a sharp decrease in marginal value or a sharp increase in marginal costs at e^{opt}.

Robustness to changes in costs and benefits

3.14 All the schemes above require information about benefits and – except for the generalized payment plan – costs. Since such information is noisy at best, it is important in the choice of regime to consider the impact of having mis-specified costs and benefits – or to have changes in costs and benefits over time. We have already indicated that he generalized scheme is the most robust to changes in cost structure and the restriction based among the lest robust schemes in this respect. We shall not expand any further on this, but we note that there are some general guidance to be picked up in the economic planning literature, and that in practice sensitivity analysis and simulations will be useful.

Menu and decision rights to the best informed

3.15 Traditionally, must aspects of electricity distribution is delegated to the firms to decide and indeed this is the perspective we have used in the discussion of implementation above. This is particularly relevant when we consider common regimes where all costumers by the public goods character of for example quality levels are going to enjoy the same property level. For other properties however it is possible to let the consumers decide, either trough consumers associations or on an individual basis. This could be the case for example with voltage quality or more obviously, for some of the individual business qualities (response time etc). The four implementation mechanism above can conceptually be turned

around to cover consumer based implementation. In such cases, as part of demand management, the regulator should set up payment schemes or price plans stating what the consumers should pay for different levels of the property, e.g. different levels of the required quality.

3.16 A key question in the allocation of decision right is who has the best information. If the costs are relatively stable and foreseeable but the benefit structure is hard to elicit, the consumers should be allocated the decision rights and they should pay a lump sum for these rights. If on the other hand benefits are relatively well described but costs are complicate and likely to vary over time, the firm based regime is preferable.

A note on KILE

3.17 Observe that the KILE principle, whereby consumers are compensated for lost loads, is an example of the marginal price scheme discussed above. As such, the KILE approach is certainly an interesting amendment to the traditional CPI-X model in Norway.

3.18 From a theoretical perspective, however, the KILE approach is less than optimal. The marginal value of quality will depend on the quality level at which we are targeting. Since the socially optimal quality level will depend on the concession area due to variations in benefit and cost functions, there is no reason to expect that the marginal values should be the same in different areas. Even if the same type of consumers are affected, the rewards and punishments should ideally depend also on the firms cost (via the optimal quality level that we are targeting at).

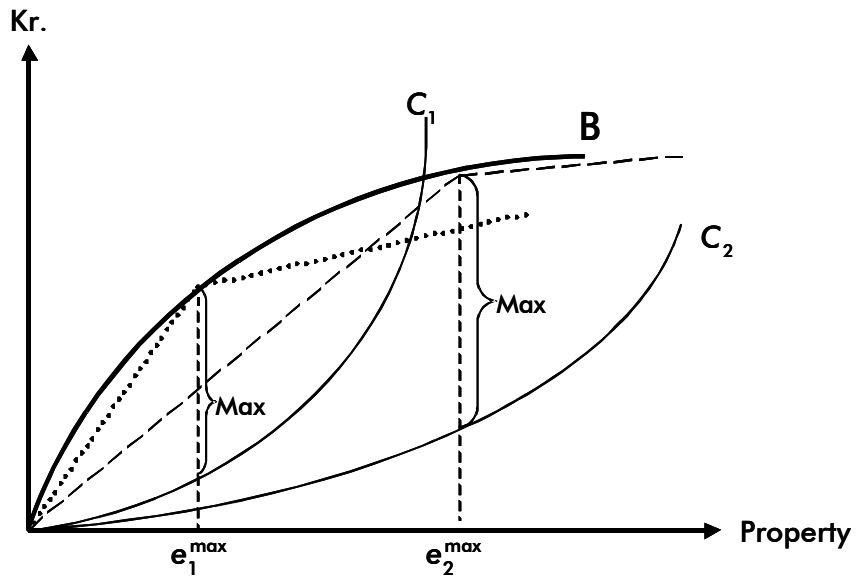
4. Different costs

4.01 In this chapter, we will illustrate how a menu of incentive schemes can improve social welfare, when there are differences among the costs of different firms (distribution companies). As part of the future work, we shall give a parallel treatment of differences at the demand (benefit) side.

4.02 On the cost side, the differences may be due to different labor markets, different climates, different owner-ship structures, different objectives, different equity and solidity of the firms etc.

Adapting to different costs

4.03 The firm differences make it socially optimal to produce different levels of the property in the different areas. This is illustrated in Figure 4-1. Here e^{max}_1 is the optimal level of the property, say quality, in a region with cost function C_1, and e^{max}_2 is the optimal level when C_2 is the cost function.



Figur 4-1 Adaptation to different costs

4.04 The differences in costs structure can be exploited by offering the firms two possible payment schemes corresponding to the two dotted curves in Figure 4-1. Alternative steering mechanisms can be used as explained in the last chapter.

Self-selection of regulation

4.05 In the illustrated case, a firm with private information about its costs will choose the payment plan that leads to the socially optimal adaptation of the property level. The reason is that the firms cannot increase its profit further by deviating in the level of the property it produces nor by choosing the regulation intended for the other type of firm.

Structural impact

4.06 One may fear that taking into account the local cost conditions may preserve structural inefficiencies in the sense that high cost firms may be given especially favorable conditions and hereby be able to survive. It should be noted, however, that this really depends on the parameters of the different schemes that are offered. In general, however, the efficient firms always have a chance to imitate the less inefficient ones. Hence, any excess payment to inefficient firms will spill over and as such not eliminate the possibility of low cost firms to out-perform high costs ones.

Numerical Example

4.07 To provide a numerical example of the adaptation to different costs, assume that the firms in the industry take two forms: One, type L, can easily produce low property levels and the other, type H, is more geared towards delivery of large values of the property. This is reflected in Table 4-1 below.

	Property level e		
	1	2	3
Benefit	4.00	6.00	7.00
Cost type L	1.00	2.00	5.00
Cost type H	2.00	3.00	3.50

Tabel 4-1 Numerical example

4.08 Now, assuming that the benefit curves are the same in the two regions, as illustrated in the first row of Table 4-1, we would ideally like firms of type L to produce the property at level 2 and firms of type H produced property level 3. These are the levels that maximize social welfare, i.e. differences between benefits and costs.

4.09 This situation can be ensured by offering each firm a choice between two incentive contracts:

Contract A:
If you produce e=2, you get revenue cap R_2=4, otherwise you get nothing

Contract B
If you produce e=3, you get revenue cap R_3=7, otherwise you get nothing

4.10 It is easy to see that firms of type L will choose the contract A and implement e=2 and that firms of type H will choose contract B and implement e=3. This gives them profits 4 and 3.50 respectively while the choice of the other contracts would have given them less. In other words, it is in the best interests of the firms to choose the contracts we have planned for them, i.e. to self-select the contract optimally. The regulator therefore do not need to know the type of a particular firm, only what types may be around. This is beneficial as the regulator can forgo monitoring the firms.

4.11 The contracts A and B developed above are only illustrative, There are many other contracts doing the same. Moreover, modifications could easily be introduced to take into account uncertainty about the resulting property level, cost levels etc. Here we just illustrate one modification of the contracts – namely the sharing of social benefits among the consumers and the firms. Contracts A and B above give all the adaptation benefits to the firms. We could have modified and have given all the benefits to the consumers instead. In that case, we should simply choose revenue caps equal to the cost levels. This leads us to modified contracts A* and B*:

Contract A:*
If you produce e=2, you get revenue cap R_2=2, otherwise you get nothing

*Contract B**
If you produce e=3, you get revenue cap R_3=3.5, otherwise you get nothing

First best or second best

4.12 The illustrations in Figure 4-1 and Table 4-1 are particularly simple as they allow for first best adaptation of the property to the underlying costs functions even when the latter is private information to the firm. By "first best" we mean that we could do no better even if all information was public. Hence, the fact that firm costs are

private information to them is not a problem here, and there is no need for monitoring.

4.13 In other cases, as emphasizes by the so-called ad verse selection literature, we would typically have to bias the property level to save on information rents. We shall illustrate this next, but we suggest that this is a detail. The important message is that the logic and gains from adaptation of cost and benefits remains the same.

A second best menu

4.14 To illustrate the necessary adjustments in some cases, consider a setting like in Figure 4-2 below. If we plan to let both types of firms implement their first best levels, the low cost firm C_2 will always get a rent of at least the $C_1(FB_1)$-$C_2(FB_1)$, i.e. it will earn at least the vertical distance between the two cost curves at the FB_1 line. The reason is that the low cost firm can produce this property $C_1(FB_1)$-$C_2(FB_1)$ cheaper than the high cost firm can.

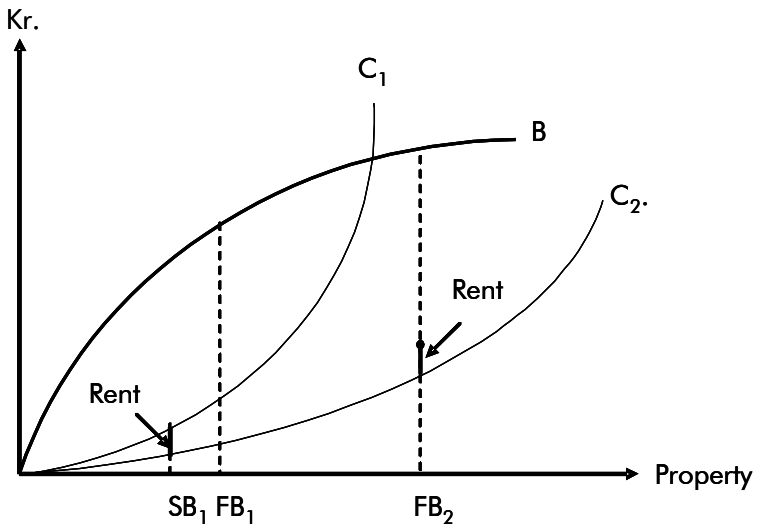


Figure 4-2 Bias in second best solutiom

4.15 Note that if we bias the production of the high cost C_1 firm downwards – say to SB_1 - the rents diminishes to $C_1(SB_1)$-$C_2(SB_1)$. The resulting contracts (using restriction based regulations for simplicity) from which the firm can choose could in this case be:

Contract High Cost:
If you produce at least SB_1, you get revenue $R_1 = C_1(SB_1)$,
otherwise you get nothing

Contract Low Cost:
If you produce at least FB_2, you get revenue $R_2=C_2(FB_2)$ + $(C_1(SB_1)-C_2(SB_1)$, otherwise you get nothing

4.16 The optimal bias, i.e. the reduction of FB_1 to SB_1, depends on the benefit curve and the likelihood of the two cost types. We leave out the details but observes that optimal second best production levels can be determined.

More examples

4.17 Up until now, we have illustrated the basic idea of improving social welfare by adjusting a given property to variations in the costs in the different regions. We note that there are many variant of this theme that can be developed in more details. We will not do so at this stage, but we will mention some of the possible properties that one could form menus over.

4.18 The single property illustrations above could, for example, be used to regulate properties like quality, reliability, capacity, consumer coverage, environmental protection etc

4.19 In an extended interpretation, cost differences could also reflect differences in risk aversion or differences in beliefs. If different firms have different beliefs as to the likely developments in costs and demands and / or if their risk carrying capacity vary, some may prefer simple CPI-X regulation while others may prefer a ex post yardstick competition scheme. This is the idea of the first stage in our study on AG2 - V1: Dynamic regulation, and we shall provided extended illustrations in chapter 6 below.

4.20 A third source of possible menus is cost differences in multiple properties. If the distribution company produces multiple services, say coverage degree and reliability, and the relative costs of these depends on the region, then it is socially attractive to let the mix of services vary from one region to the next. Again, such differences can be implemented via a menu of contacts.

4.21 A particularly interesting version of the multiple property story is derived from differences in time horizon and time preferences. Some may be more impatient than others, and one could design revenue cap formula that allow for more or less fast adaptation of payments to changes in the supply and demand conditions, including the sales

volume and the investment levels. Again, we shall provided extended illustrations in chapter 6 below.

Different benefits

4.22 In this chapter, we have focused on the utilization of differences in firm costs. It is possible to give a parallel treatment of the use of a menu to account for differences in the need for and usage of electricity in different areas. This is particularly relevant in case of quality regulation. We leave this for future examinations.

5. Specific proposals

5.01 In this chapter, we will develop in some more details two proposals for menus of contracts that could be introduced in the Norwegian regulation at this stage.

5.02 We emphasize that the proposals are not fully outlined, and that we at this stage do not offer any full scale analyses of the proposals. Still, the more specific proposals can help concretize the ideas of menus and hopefully encourage the working groups to think more along the lines of menu design in the future.

5.03 Also, it would be advantageous in a later phase to make more comprehensive empirical assessments of the impacts of introducing such systems. Such evaluations could proceed along the lines of Agrell, Bogetoft and Tind(2002). In that study, we made empirical estimates of the impact of using either a pure CPI-x system, a dynamic DEA based yardstick scheme or a hybrid of the two along the lines of the present Norwegian scheme. Also, following the principles of Andersen and Bogetoft(2003), the impact of different behavioral characteristics, including bounded rationality and inabilities to catch up, can be investigated.

A MENU WITH EX-ANTE REVENUE CAP AND YARDSTICK

5.04 In the first stage of the dynamic regulation regime outlined in V1, we propose to introduce a menu of two schemes from which the distribution companies can choose. One scheme is a classical CPI-x revenue cap scheme and the other is a modern yardstick scheme to set a revenue cap.

5.05 The main focus of the dynamic regulation is to move towards increased competition and improvements in efficiency. However, since the first stage marks the transition from an earlier hybrid regime, two added concerns at this stage are: assessment of firm objectives and regulatory continuity. We will now analyze the proposal in some more details.

Ex-ante revenue cap

5.06 The CPI-x scheme essentially works using the formula

$$R(t) = C(0)(1 - x)^t$$

where $R(t)$ is allowable revenue in time t, $C(0)$ is actual costs in the base year and x is a general productivity improvement parameter. We have not introduced a price or volume index like it is commonly done, also in the present Norwegian regulation. They are ignored to simplify the analysis. This has no importance since we also assume that prices and volumes are fixed. Hence, the simplification has no impact on the analysis – and lifting the assumption would not impact the relative attractiveness of the schemes for the firms.

5.07 To illustrate this scheme, assume that firm has an original allowed revenue C(0) =100 Mkr, and that the regulator contemplates a productivity improvement of x = 2%. In this case the revenues will now be independent of industry costs, R(1) = C(0)(1-0.02) = 98 Mkr, R(2) =C(0)(1-0.02)(1-0.02) = 96.04 Mkr, R(3) = C(0)(1-0.02)3 = 94.112 Mkr etc. The regime extracts mechanically 2% of the cap, irrespective of industry or firm performance. At the end of the period, in year T, the current cost should not be used to update the regime, as this reduces the efficiency incentives (the ratchet effect).

Ex-post yardstick

5.08 The yardstick scheme essentially works as follows

$$R(t) = C(t) + \rho(C^*(t) - C(t))$$

where $R(t)$ is the revenue cap at time t, $C(t)$ is the firm's cost at t (less taxes, charges to superior grids), ρ is the incentive power and $C^*(t)$ is the yardstick cost at t.

5.09 The yardstick cost is calculated as the efficient cost at the level of operation of the individual firm. Different techniques can be used to determine the yardstick, including DEA as discussed at length in FP2 and FP4, or model firms, as discussed in V2. In any case, the yardstick is formed by exogenous observations so that the firm cannot gain on increasing in cost. To simplify the notation we have suppressed the outputs and exogenous conditions of the firms. The idea is however that this will be accounted for in the determination of the yardstick (and the ex ante revenue) along the usual lines, cf again FP2, FP4 and V2.

5.10 The incentive power $0 < \rho < 1$ is the only discretionary parameter in the regime. It defines the percentage of cost-sharing in case of a deviation from the target. Further work is necessary to set the exact magnitude of ρ, cf. eg Agrell, Bogetoft and Tind(2002). In the

analysis below, we simply assume that ρ is larger than the marginal value of slack in the firms.

5.11 To illustrate, assume that he benchmark/yardstick cost for the operation of a firm is calculated ex-post to C*(1) =100 Mkr for year 1. Assume an incentive power ρ = 50%. The revenues will now depend on the actual performance so that, R(1) = C(1) + 0.50(100 ? C(1)). If the firm is 10% more efficient than the yardstick, i.e., C(1) = 90, R(1) = 90 + 0.50(100 90) = 95. If the firm is 10% less efficient than the yardstick, i.e., C(1) = 110, R(1) = 110 + 0.50(100 ?110) = 105.

The menu

5.12 To summarize the system that we are analyzing, we assume that the regulatory period lasts T years, t=1,…,T, and that each and every firm at the end of the last regulatory period, i.e. at t=0, chooses which regime they want to be operating under.

5.13 The menu that they are offered is a choice between two incentive contracts:

CPI-x Contract
Your revenue cap is developing according to the formula
$R(t)=C(0)(1-x)^t$ *for* $t=1,\ldots,T$

Yardstick Contract
Your revenue cap is developing according to the formula
$R(t)=C(t)+\rho(C^*(t)-C(t))$ *for* $t=1,\ldots,T$

Risks in the two regimes

5.14 Observe that in the CPI-x regime, the revenue caps in the next T years are known with certainty. In the yardstick regime, on the other hand, the revenue caps will depend on the costs of the other firms as we go along. From an immediate point of view, this suggests that the CPI-x scheme is the most certain and attractive for firms that would like to know their commercial conditions in advance.

5.15 This logic is however misleading. *Facing a certain income stream in cases under variations in the underlying costs is not particularly "safe". From this perspective, the yardstick scheme may be more attractive as it incorporates the actual operating conditions*. We will demonstrate this below.

Types of firms

5.16 The distribution companies may differ in several ways. From a regulatory perspective, the objectives and the efficiency are particularly important characteristics. It is also characteristics that the regulator may not observe directly and where it may be better to let the firms reveal their characteristics via the choice from a menu of contracts.

5.17 To keep the analysis simple at this stage, we propose to capture firm characteristics by their costs at the end of the last regulation

$$C(0)=C^*(0)(1+s)$$

where s is the slack mark-up in the operations of the firm. Observe that the cost efficiency of the firm is therefore C*(0)/C(0) or 1/(1+s). The idea is now that the firms have superior information about s compared to the regulator. The firms know their own s and the regulator does not, nor does the regulator necessarily know C*(0).

5.18 Slack at t=0 is an indication of both objectives and abilities to be efficient. A efficient firm that have been profit maximizing will have s=0. A less capable firm that are trying to profit maximize - but not entirely successful in so doing - will have a positive slack mark-up. So might a firm purposing other objectives, e.g. a worker owned company seeking to compensate its owners via good working conditions etc.

5.19 We emphasize that there are several reasons why it may be fully rational to be inefficient, cf. Bogetoft and Hougaard(2002). We shall not go into details here but only accept the possibility of alternative motivations. It is easiest to think of them here as

- Profit maximizers
- Budget maximizers

5.20 The firms may also differ with respect to their ability to be efficient and the time need to catch up. We shall not model these variations in great details here but we emphasize that it is possible to simulate the likely impact of introducing new schemes under different assumptions about the abilities to catch up, i.e. different assumptions about how to vary s. For a recent elaborate study along these lines, see Andersen and Bogetoft(2003).

Productivity – stipulated, expected, and realized

5.21 The CPI-x regime is based on an ex ante stipulation of the productivity gains in the next regulatory period. This gain, the x, is typically determined via a productivity analysis, e.g. a DEA based analysis of Malmquist productivity as in the present Norwegian setting. Besides pure analysis, an element of regulator-industry negotiations usually enters the final selection of x.

5.22 A distribution company may believe that it is able to improve its efficiency at a faster or slower rate that x. By y we denote the expected productivity gains of a given firm. The relationship between x and y is important in the initial choice between a CPI-x and a Yardstick scheme.

5.23 Stipulated productivity x and expected productivity y may both differ from the ex post realized productivity z. Ex ante, and in particular at the time where the menu choice takes place, z is a stochastic variable and the choice is based solely on x and y as long as the firms are risk neutral.

Firms choice of scheme

5.24 Consider a firm with historical costs $C(0)=C^*(0)(1+s)$.

5.25 If the firm chooses the CPI-x alternative, the allowed revenue over the T periods, ignoring discounting for simplicity, is

$$R(CPI\text{-}x) = C(0)(1-x)+ C(0)(1-x)^2+ C(0)(1-x)^3+..+ C(0)(1-x)^T$$

or equivalently

$$R(CPI\text{-}x) = (C^*(0)(1+s)*((1-x-(1-x)^{T+1})/x)$$

5.26 If the firm chooses the yardstick scheme, its expected revenue cap will be

$$R(Yardstick) = C^*(0)(1-y)+ C^*(0)(1-y)^2+ C^*(0)(1-y)^3+..+ C^*(0)(1-y)^T$$

or equivalently

$$R(Yardstick) = C^*(0)*((1-y-(1-y)^{T+1})/y)$$

since with ρ larger than the firms internal value of slack, it will be a best response to eliminate all slacks, and presuming that more firms do so, the yardstick costs will be the minimal possible costs.

5.27 We see therefore that a budget maximizing firm will go for the CPI-x alternative if and only if

$$R(CPI\text{-}x) = R(Yardstick)$$

or equivalently

$$s = B/A - 1$$

where

$$A = (1\text{-}x\text{-}(1\text{-}x)^{T+1})/x$$

$$B = (1\text{-}y\text{-}(1\text{-}y)^{T+1})/y$$

5.28 Figure 5-1 below illustrates the choice of scheme for different types of firms, and for different values of the stipulated and expected productivities. The firms are characterized by their slack mark-up s as given on the vertical axis. The stipulated productivity x is given on the horizontal axis. The expected productivity y is represented by the three level curves, one, the upper, for y=0, the middle for y=5% and the lower for y=0.10%.

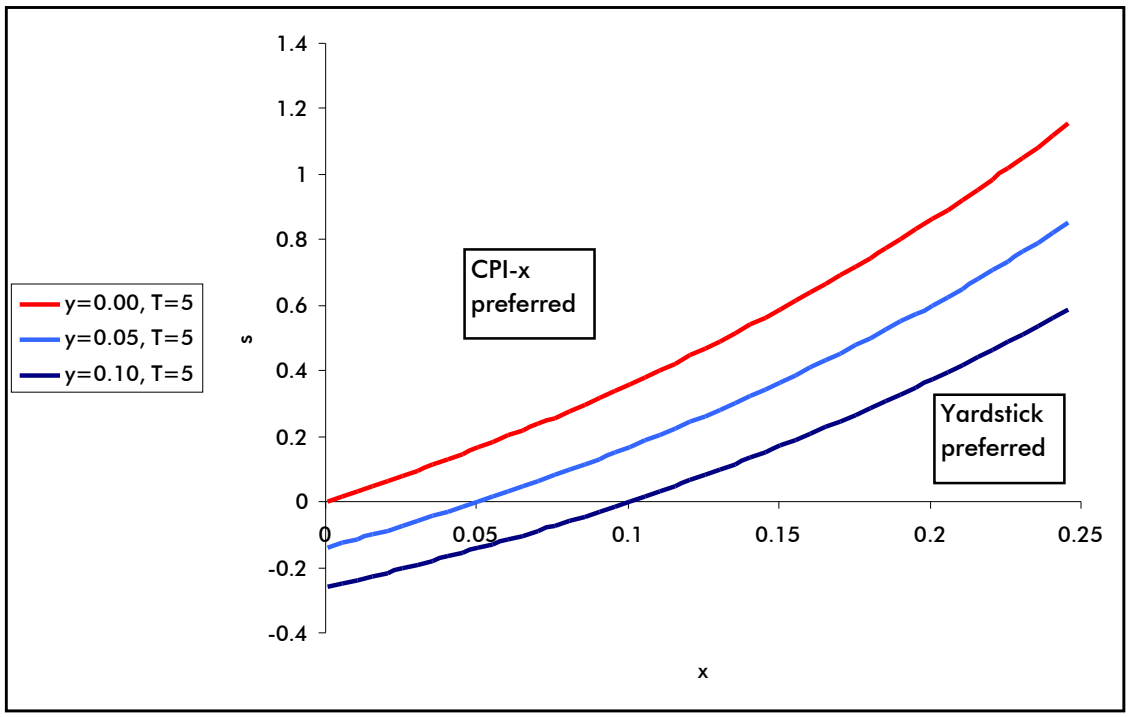


Figure 5-1Choice between CPI-x and Yardstick

5.29 We see that the CPI-x scheme is the preferred regime for a firm with considerable slack in the past and as long as the stipulated productivity in the future is not too large compared to the expected productivity gains. Observe that the regulator by setting x higher will force more firms to switch the yardstick regime. Put differently, the

yardstick scheme safeguards against unrealistic stipulations of productivity gains.

5.30 Figure 5-2 below illustrates how the regulatory period affect the choice of regime. In all cases, the expected productivity is zero, y=0, and the different level curves represent different time lengths, T=4,6, and 8.

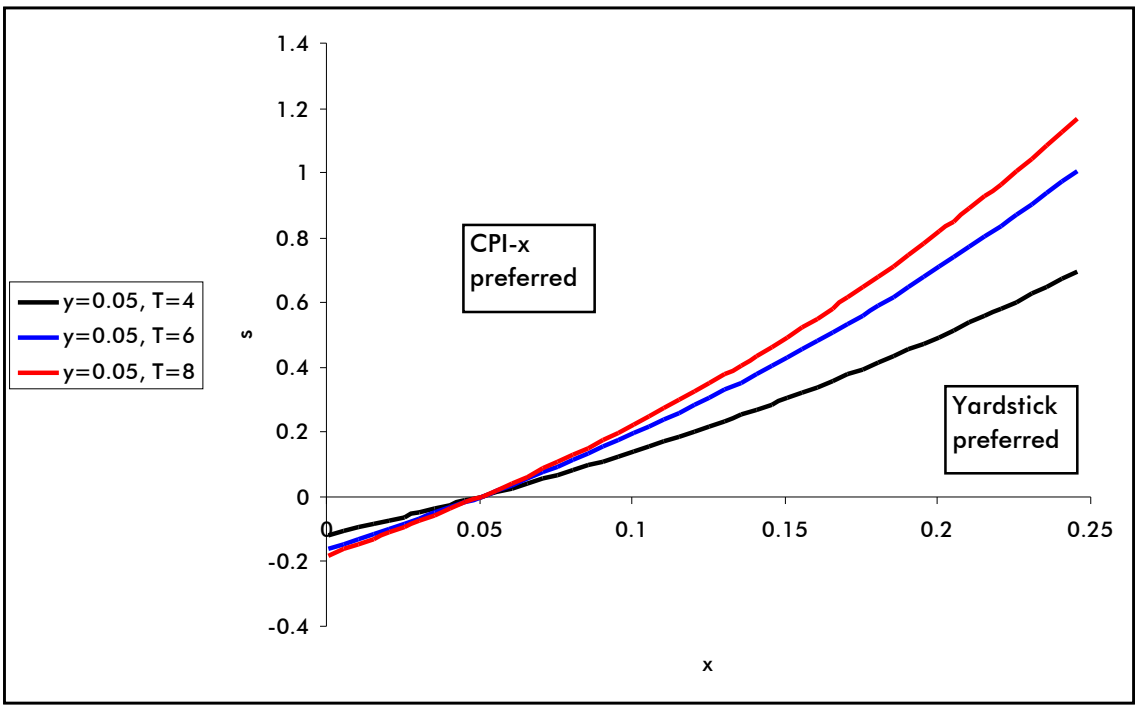


Figure 5-2 Menu choice as a function of the length of the regulatory period.

5.31 Higher level curves corresponds to longer regulatory periods. We see therefore that more firms will move to the yardstick regime the longer the regulatory period. The explanation is that with a long freezing of a too high stipulated productivity, firms will be better off by having the productivity (re)set ex post at the realistic level.

Profit maximizing firms

5.32 A profit maximizing firm would in principle act in the same way since the costs would be independent of the regime so that profit maximization would be equivalent to revenue maximization. To see this, note that costs in the regulatory period would amount to

$$\text{Costs} = C^*(0)(1+s)(1-y) + C^*(0)(1+s)(1-y)^2 + \ldots + C^*(0)(1+s)(1-y)^T$$

or equivalently

$$\text{Costs} = C^*(0)(1+s)\,(1-y-(1-y)^{T+1})/y\,)$$

as long as the slack mark-up is fixed. Also, if the slack mark-up can be reduced under one scheme, it can most likely be reduced under both schemes.

5.33 One can argue however that a profit maximizing firm will not have slack in the previous period, i.e. s=0. This means that profit maximizing firms will be more inclined to select the yardstick regime. In particular, the yardstick scheme will be preferred if the stipulated productivity is higher than the expected productivity. This is a likely scenario when the estimation of productivity gains cannot entirely disentangle individual reduction of inefficiency among the inefficient firms from the frontier shifts

Risk aversion

5.34 We have assume above that firms are risk neutral. If this is not the case, it may affect the choice between the CPI-x and the yardstick alternative.

5.35 Common risk affecting the whole industry will make the Yardstick alternative more attractive. One way to model this would be to assume that $y=E(z) - r*Var(z)$ with the interpretation that there is a risk premium r in the determination of expected productivity.

5.36 Firm-specific risks, on the other hand, will tend to make the CPI-x alternative more attractive. The reason is that firm specific variations will make the yardstick cost less predictable. If there is considerable such risk, it may be favorable to choose a yardstick estimation method that is more robust, e.g. to use traditional econometric models, stochastic frontier models or stochastic DEA models rather than the deterministic DEA models used so far in Norwegian regulation.

Ratchet effect

5.37 In the analysis above, we have ignored the updating of revenue cap from one regulation period to the next. A classical problem with the CPI-x regime is that firms will tend to under perform and pad costs in one regulation period in order to "improve" the starting value and hereby the revenue caps in the next regulation period. This so-called *ratchet effect* makes the CPI-x regime more attractive for the firms and may increase the instances in Figure 5-1 where the CPI-regime is selected. At the same time, it makes the CPI-x alternative less attractive for the consumers which may suggest a counteracting increase in x.

5.38 If, on the other hand, the regulator signals a (possible) willingness to eliminate the CPI-x alternative in the next regulation period, the Yardstick alternative may become more attractive in the present period as well. The reason is that the firm may want to prepare for harder competition in the future by a gradual trimming of the organization.

Consumer costs

5.39 The firms choose the CPI-x alternative as long as their expected revenue – and therefore also the expected costs to the consumers – exceeds the expected revenue from the yardstick scheme. By increasing the stipulated x, the regulator can make more firms switch to the yardstick regime and hereby reduce consumer costs. The attractive feature of for example the DEA-based yardstick scheme, discussed at length in FP2, is that this change of "menu presume" can be done without fear of bankruptcy since the allowed costs are always equal to minimal costs needed to operate a distribution company.

Transaction costs

5.40 From the point of view of the regulator, there is not much difference in the transaction cost of the different regimes. In a pure CPI-x regime, some model or study must be developed to set x. This model must be estimated on several years of historical data. In the regulation period, data must be collected to control compliance with the model and to ensure repayment of excess charges. In a Yardstick regime, the chosen model or a similar cost model will have to be run with new data every year. So, the running costs of administrating a yardstick scheme may be higher than of a CPI-x scheme. On the other hand, the review phase, where a new X is set, will be more demanding in the CPI-x regime. Of course, a menu-based regime requires both set of activities but as indicated, there is considerable overlap and the extra administrative burden for a menu is therefore limited. Moreover, the regulator may save some on the negotiations as it is always offering a safeguard against the high stipulated productivities X, namely the Yardstick alternative.

5.41 From the point of view of the firms, the reporting requirements in the CPI-x and Yardstick regimes are more or less the same. The extra burden of the menu is therefore associated with the new options, i.e. with the problem of choosing between the CPI-x and the Yardstick. Hopefully, however, the extra possibilities outweigh the decision making costs. Indeed, it should do so as the firms always

have the option of making an arbitrary choice of for example the CPI-x scheme.

Continuity

5.42 The ex-ante regime offers a clear alternative, a safe revenue with no extra incentives and a general X. By varying the single discretionary parameter x in a pre-determined manner, NVE can also credibly signal the explicit "price of safety". The firms opting for this alternative abstain from further incentives, but gain time and resources to adjust smoothly to future regulation. Note that the performances of the firms under this regime are considered when calculating the yardstick cost for the competitive firms, but not the inverse. Also, a firm cannot shift policy during a regulatory period, neither retroactively, which preempts opportunistic choices.

Further evaluations

5.43 Above we have discussed a series of effects of introducing a CPI-x – Yardstick menu. In particular we have discussed rent extraction, risk exposure, consumer costs, ratchet effects, transaction costs and continuity. We will provide an additional evaluation below. We emphasize, however, that a comprehensive qualitative and quantitative evaluation cannot be undertaken in the framework of the present project, but we recommend that is undertaken as part of the subsequent projects.

A MENU WITH DIFFERENT UPDATING FREQUENCIES

5.44 One of the difficulties of the present Norwegian scheme is the evaluation of the capital basis. The ages of the nets differ and the book values may not properly reflect the size of the grid, nor the need for reinvestments. This has created what is sometime referred to as the old-net-problem according to which the revenue cap may not allow sufficient revenue for the necessary reinvestments.

Background

5.45 To understand the problem, recall that the core of the current NVE regulation regime is an ex-ante revenue cap for periods t=1,..., 5 years, calculated as

$$R_t = PI_{t,t-1} \bullet QI_{t,t-1} \bullet (1 - \pi - \varphi \bullet G_t) \bullet R_{t-1}$$

where $PI_{t,t-1}$ is an inflation adjustment factor, $QI_{t,t-1}$ is a quantitative adjustment factor (equal to $y_{pow}^{t} - y_{pow}^{t-1})/2\ y_{pow}^{t-1}$ where y_{pow}^{t} is the gross output of power at time t), π is an imposed cost efficiency requirement (1.5% in NVE (1997)) (a proportional revenue reduction), G_t is a measure of individual inefficiency (equal to $\min\{(1-E_0)/(1-E_{min}),1\}$, where E_0 is the historical cost efficiency at time 0 in the CCR DEA model, E_{min} is the lower limit for efficiency scores (0.70 during 1999) and φ is the annual efficiency catch-up factor (3% in NVE (1997)).

5.46 The maximum revenue is given as

$$R_t \leq c_t + \gamma^{max} \bullet X^{cap}_t$$

where γ^{max} denotes the maximum allowed rate-of-return (15% in NVE (1997)), X^{cap}_t denotes the capital base of the agent at time t and c_t is the actual cost at time t. The revenue floor is analogously given as

$$c_t + \gamma^{min} \bullet X^{cap}_t \leq R_t$$

where γ^{min} denotes the minimum prescribed rate-of-return (2% in NVE (1997)).

5.47 In the 2001 revision, some of the parameters have been changed. Most notably, the maximal allowed return on capital has been increased to 20% and the individual requirements imposed on the most inefficient firms (with efficiency less than 70%) have been increased. Also, the quantity index IQ has been replaced by a normative parameter based on the increase in number of new buildings as a proxy for the number of new costumers and increase in energy delivered.

5.48 A crucial part of the present regime is the determination of initial values. The revenue cap at the outset of a regulatory period is determined as

$$R_0 = c_0 + Depr_0 + \gamma \bullet X^{cap}_0$$

where c_0 is the yearly operating and maintenance costs in the review period, $Depr_0$ is the depreciation, X^{cap}_0 is the book value and γ is the so-called NVE interest which is approximately 7-8 %. (There are small modifications in the real system as can be seen in the NVE excel file "Inntektsrammeberegning" on www.nve.no. The formula here is $[(c_0 + Depr_0 + \gamma_t \bullet X^{cap}_0)PI_{t,0} + (Netloss * Powerprice_t)](1-Ineff.factor)$ indicating that that the NVE interest rate is not set once and for all but are updated is view of the actual development in interests. Also, net-losses are compensated directly at updated prices – but subject to an efficiency requirement just like the OpEx and CapEx elements).

5.49 The general idea of this starting value is that $Depr_0$ should cover reinvestments, $\gamma \bullet X^{cap}_0$ should cover the cost of capital and that new investments should be compensated for by the volume index.

5.50 Depreciations are standardized using linear depreciation schemes on the firms actual, historical costs of acquiring the equipment.

The problem

5.51 Now, it is clear that two firms with essentially the same equipment may have different book values and hereby get different cost of capital allowance in the revenue cap. Also, two firms with essentially the same equipment and therefore the same needs for reinvestments may nevertheless face different depreciation allowances since their acquisition prices may have differed. (as a curiosum, we note that inefficiencies in historical investment may actually be attractive!). This means that some firms may find it harder to make the necessary reinvestments.

5.52 Another way to illustrate this problem is to think of firms in different phases of the investment cycle. In an "expansion phase", reinvestments may exceed the projected depreciation rate. In a "contraction phase" reinvestments may fall short of the projected depreciation rate. Their resulting return on capital may therefore vary quite considerable around the NVE interest rate. However, if the only problem with the grid investment valuation is the intertemporal timing of the cycle, the menu in itself does not improve social welfare. Firms, exposed to an infinite horizon of expansions and contraction cycles, would internalize their effects and finance them in an optimal manner.

5.53 Now, the impact of such deviations between reinvestments and depreciations is most likely that excess rents are given to some firms

- "new nets" with high book values, high depreciations or in a contraction phase

to avoid that other firms

- "old nets" with low book values, low depreciations or in a expansion phase)

fall short of funds. This is a classical effect of making everyone subject to the same system, as explained in chapter 4.

A possible solution

5.54 A possible solution would be to offer two contracts, one favorable for the "old-net" types and another more favorable for the "new-net" types.

5.55 One aspect that can be varied is the frequency by which the capital basis and the depreciation streams are update. Intuitively, a more frequent updating will tend to favor old nets by the extra investments entering into the capital basis and the depreciation stream, and a more seldom updating will favor new nets by the reduction in capital having only a delayed impact on depreciation and return on capital.

The menu

5.56 We propose to introduce an in-period updating option such that we have two contracts – the traditional one, fixed in the regulation period, and an alternative contract, where the depreciation pattern and the capital basis and hereby the capital cost are updated as we go along

5.57 The menu that they are offered is a choice between two incentive contracts:

Fixed contract:
Like the present Norwegian regulation with

Initial values	$R_0 = c_0 + Depr_0 + \gamma \bullet X^{cap}_0$
In-period revenue cap	$R_t = Pi_{t,t-1} \bullet Qi_{t,t-1} \bullet (1\text{-}Eff) \bullet R_{t-1}$ *for* $t=1,\ldots T$
End period updating	$X^{cap}_T = X^{cap}_0 + \Sigma_{t=1}^{T}\ Reinv - \Sigma_{t=1}^{T}\ Depr$

Sequential contract:
A sequence of T fixed contracts, each of which has a time horizon $T=1$.

5.58 The reinvestment is assumed to be found by adjusting the total investments for the fraction that are associated with an increase in activities (volume).

5.59 The firms may, at the outset of a regulation period choose one of these schemes.

5.60 We have assumed annual updating in the sequential scheme above. This is only done to provide a concrete example. To reduce the administrative burden, one could introduce less frequent updating, say once in the middle of a five year regulation period. Indeed, the numerical example we present below involves only one extra updating. It lies beyond the scope of this project to make optimal calibration of menu schemes, but we suggest that a single extra updating in a five year period may well be an alternative worthwhile more examination.

5.61 Given the background of this proposal, we tend to think of it as the present Norwegian system supplemented with an option to ask for more frequent updating. It is worthwhile to note, however, that we can also think of it as a system like the present Norwegian system supplemented with an option to fix the revenue scheme for a longer period of time, say 10 years

Long contract:
Like the present Norwegian regulation with T=10

Short contract:
Like the present Norwegian regulation

Numerical illustrations

5.62 To get an impression of the impact of sequential updating, and to see how the attractiveness of the two schemes depend on the type of firm, we now consider some numerical illustrations.

5.63 We compare the fixed and sequential updating schemes with T=2. That is, the long contract is fixed over two time period while the short contract is updated after each period.

5.64 We assume that operating and maintenance costs are by the usual OpEx elements in the regulation and that new investments are compensated via the volume measure. We focus only on the impact on the revenue cap from capital stock, the reinvestment and the depreciation

5.65 The numerical parameters have been chosen to approximate a case, where a mid-period updating is introduced into the present Norwegian regime. Thus we assume that the yearly depreciation varies around 6% corresponding to variations around 15% in a two

and a half year time period. Similarly, the return on capital is approximately 20% in a two and a half year time window corresponding to the present approximately 8% yearly NVE-interest rate.

5.66 In the different regimes, we have calculated the cash flows from the capital part in the two periods, i.e.

$$Cash\ Flow_t = Return\ on\ Capital_t + Depreciation_t - Reinvestments_t$$

5.67 Also, we have calculated the capital base at the end of the regulation period, i.e.

$$Capital_T = Capital_0 - Depr._1 - Depr_2 - Reinvest_1 + Reinvest_2$$

5.68 To maximize revenue (and profits) firms will be interested to maximize both period cash flows and the end period capital base.

5.69 In Table 5-1 below, the impact of different relationships between depreciations and reinvestments are summarized.

Initial Capital = 100

r	i	d	Menu	Cash Flow 1	Cash Flow 2	End Capital
0.20	0.20	0.10	Fixed	10.00	10.00	120.00
			Sequential	10.00	13.00	119.00
0.20	0.20	0.20	Fixed	20.00	20.00	100.00
			Sequential	20.00	20.00	100.00
0.20	0.10	0.20	Fixed	30.00	30.00	80.00
			Sequential	30.00	26.00	82.00
0.20	0.15	0.10	Fixed	15.00	15.00	110.00
			Sequential	15.00	16.50	109.50
0.20	0.10	0.15	Fixed	25.00	25.00	90.00
			Sequential	25.00	23.25	90.75

Table 5-1 Optimal updating

5.70 We see for example that if a firm make reinvestments equal to i = 20% of the initial capital base, and the depreciation only amounts to d = 10 % of the capital base, the impact of sequential updating is to increase cash flow with 3 (from 10 to 13) in the second time period and to lower the end capital with 1 (from 120 to 119).

5.71 Table 6-1 confirms the intuition that sequential updating will benefit the "old net" types with depreciations less than the needed reinvestments while the fixed regime will be preferred by "new-net" types with stipulated depreciations exceeding the real depreciations.

5.72 Also, table 6-1 illustrates that the firms will self-select the regime intended for them. Hence, the regulator need not know the types of the firms. The firms will reveal their types.

SOME EVALUATION

5.73 We close this chapter by briefly evaluating the two menus from the point of view of the ten criteria listed in chapter 2.

Coordinate costs and benefits

5.74 This is the primary motivation for the two menus, to take into account that the firms may have different potentials and different needs to make investments. Offering them a uniform contract is therefore sub-optimal. In general, by adopting the scheme to the specific needs of different types of companies, the total costs to the consumers could be reduced without having the firms suffer.

Balance the pros and cons of decentralization

5.75 Both menus rely on decentralized choices by the firms. This is advantageous since the firms are better informed about their risk attitudes, their efficiency and their expectations about future productivity improvements (in the CPI-x – Yardstick menu) and about the balance between projected and real depreciations in the Fix – Sequential menu).

Minimize the costs of risk and uncertainty

5.76 The primary aim of menus is not in risk sharing, but in incentive provision. Practically, this can be implemented for the yardstick option as an "equity" system towards NVE or the clients as a collective, where positive and negative contributions are accumulated over time. Thus, even if the revenue cap is recalculated annually with varying outcomes for the regulated firm, the actual allowable tariffs may be smoothed over several years. The potentially riskaverse clients can thus enjoy smoothed and pseudo-independent tariffs that separate the incentive provision problem from the allocation of risk. Analogously, the firm can hedge its financing risks optimally over the capital market, including their performance incentives, and have no benefit in such risk transfer.

Reduce the costs of post-contractual opportunism

5.77 All schemes, the menus and the individual parts, provide incentives to minimize costs and hereby reduce the moral hazard issue. The CPI-x has the drawback of the ratchet effect, though, which makes it advantageous to have firms move towards the yardstick alternative. In this sense, the proposals have a – perhaps minor – advantage compared to the incumbent regime.

Reduce the costs of pre-contractual opportunism

5.78 Again, this lies at the heart of the menus. The aim is precisely to cope with adverse selection problems which lead to excessive consumer costs since all firms should be able to survive under one regime which must therefore involve a higher general revenue cap.

Motivate long-term concerns

5.79 Both menus contribute positively to long-term behavior. The CPI-x – Yardstick menu prepares the firm for increased competition while the Fixed-Sequential menu facilitates appropriate reinvestment.

5.80 In terms of the structural impact, there is no reason to expect that the contracts should have any negative impact. Of course, a consequence of the Fixed-Sequential menu may be that firms can survive at a lower scale by not requiring enough capital base to absorb investment cycles. On the other hand, the menu does not discourage attractive mergers. Similarly, movements towards minimal costs, as encouraged by the Yardstick scheme, will make the firms more attractive in a consolidation phase.

Balance the pros and cons of renegotiation

5.81 By incorporating more firm-specific information in the basic regulation scheme, some of the fruitful renegotiations are accounted for in advance.

Reduce direct costs of contracting

5.82 The CPI-x and Yardstick schemes basically require the same collection of information. Still, the need to handle multiple regimes may slightly increase the burden on the regulator.

Use transparent contracts

5.83 Use of a menu increases the costs of regulation since the firms have to make a choice of scheme. On the other hand, it may reduce their need to find other means of adjusting their conditions to the regulation, e.g. via the financial market.

6. Future Work

6.01 The current pre-project has intended to show the attractiveness and feasibility of menus in the Norwegian regulation of electricity distribution. Examples have been forwarded from current proposed reforms, such as transitory yardstick regimes, and from incumbent investment problems. The report also offers some conceptual results to understand and guide research for additional use of menus in regulation, e.g., in quality and service provision.

6.02 To further advance the development of these instruments, we propose a number of concrete projects under the current reform policy:

A. Review of potential menu candidates

6.03 There are a number of issues in the current and future regulation that potentially give rise to diversity among the firms. In certain of the se cases, menus could provide mutually beneficial solutions and provide cost-efficient coordination and motivation. Examples include varying labor markets, climates, ownership structures, firm objectives, equity and solidity of the firms, investment horizon, capital costs, beliefs and managerial preferences. Menus could also provide incentives for choices in quality, reliability, capacity, consumer coverage, environmental protection, etc. We believe that the working group could be an excellent vehicle for the advancement of such review of menu candidates.

B. Screening and pre-analysis of menu candidates

6.04 Information economic analysis can usually quickly reveal whether a particular decision problem from project A is apt for menus. In analyzing the incentives, information and outcome of a decision, the added value of a menu-based regulation can be clarified and judged against its costs. Examples of such pre-analysis are provided in Chapter 5 of this report and the authors and their collaborators could provide support to the working group in this task.

Calibration and consequence analysis of menus

6.05 Assuming that a careful screening, such as project B, results in a limited number of potentially promising projects, there is still ample work to be assured before practical implementation. The calibration

of parameters, variable choices and definitions and the wording of options require a judicious analysis of current and intended regulation. Then, a full consequence analysis using actual or historic data for options and choices should be carried out to prevent surprises and to assure its applied value. Examples of such analyses are found in Agrell, Bogetoft and Tind (2002) for the choice of CPI-X and yardstick regimes in Sweden using panel data for five years and more than 220 distributors.

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