Working Paper

Yardstick competition
Theory, design, and practice

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Summary (in Dutch)

Doel en ambitie

In sommige markten leidt directe concurrentie tussen bedrijven of instellingen (*agenten*) niet tot maatschappelijk gewenste resultaten. Een methode om partijen toch prikkels te geven om efficiënt te produceren is maatstafconcurrentie (Yardstick competition). Bij deze vorm van regulering worden prestaties van agenten vergeleken met agenten die zich in een vergelijkbare positie verkeren. Door financiële consequenties te verbinden aan de vergelijking krijgen partijen een prikkel om efficiënt te produceren.

In het buitenland is de nodige ervaring opgedaan met deze methode. In Nederland is maatstafconcurrentie nog grotendeels onbeproefd en ook relatief onbekend. Deze studie heeft vier doelen:

1. Een bruikbare definitie en een indeling in verschillende typen maatstafconcurrentie geven.
2. Voorwaarden identificeren waaronder maatstafconcurrentie een kansrijk regulerings-instrument kan zijn.
3. Voorgaande twee punten illustreren met behulp van buitenlandse toepassingen.
4. Een onderzoeks- en beleidsagenda bepalen.

Definitie en typologie

De gemakkelijkste manier om maatstafconcurrentie uit te leggen is om te denken aan een regionaal monopolie, bijvoorbeeld een waterbedrijf. Er kunnen goede redenen zijn waarom we niet willen dat waterbedrijven direct met elkaar concurreren om de gunsten van de klant. Aan de andere kant willen we ook graag dat waterbedrijven efficiënt opereren. Omdat de tucht van de markt hiervoor geen soelaas biedt, kunnen waterbedrijven onderling vergeleken worden. Er kan een maatstaf bepaald worden van efficiëntie, bijvoorbeeld de gemiddelde efficiëntie in de sector. Een toezichthouder kan bepalen dat waterbedrijven die beter dan het gemiddelde scoren de winst kunnen behouden, terwijl minder presterende bedrijven gestraft worden.

Maatstafconcurrentie kan zowel in het publieke als private domein gebruikt worden. Bij private bedrijven wordt dan de winst verdeeld door een toezichthouder, terwijl bij publieke instellingen de overheid het budget verdeelt. Bij het verdelen van het budget kan gekeken worden naar prestaties achteraf of naar inputs vooraf, al naar gelang welke beter gemeten kan worden. Voorts kan nog onderscheid gemaakt worden tussen het verdelen van het gehele budget of maar een gedeelte.

Wanneer maatstafconcurrentie?

Wil maatstafconcurrentie aantrekkelijk zijn, dan moet in ieder geval aan vier voorwaarden zijn voldaan. Ten eerste moet er een vorm van marktfalen bestaan, bijvoorbeeld sterke vormen van schaalvoordelen. Ten tweede moeten agenten vergelijkbaar zijn, anders valt er geen zinnige maatstaf te bedenken of is er eenvoudigweg geen vergelijkingsmateriaal. Ten derde moeten agenten private informatie hebben. Agenten met private informatie kunnen geprikkeld worden om die informatie te benutten om efficiënter te produceren terwijl de correlatie nodig is om ervoor te zorgen dat agenten over dezelfde type informatie beschikken. Ten vierde, moet de output van partijen verifieerbaar zijn.

Bovenstaande voorwaarden zijn noodzakelijk, maar nog niet voldoende. Zo kunnen er bij maatstafconcurrentie ongewenste neveneffecten optreden. De belangrijkste hiervan zijn: (i) agenten kunnen een prikkel hebben om op kwaliteit of andere niet gemeten variabelen te bezuinigen; (ii) de intrinsieke motivatie van agenten kan afnemen; (iii) agenten kunnen minder gaan investeren in zaken waar ook andere agenten in de sector baat bij hebben (*industry-specific investments*).

Naast deze neveneffecten kan het succes van maatstafconcurrentie ook door praktische zaken belemmerd worden. Zo zijn er vaak problemen met meetbaarheid en met het corrigeren voor verschillen tussen agenten. Zo blijkt het vaak lastig om voor in het verleden gedane verschillende niveaus van investeringen adequaat te corrigeren.

Alvorens te oordelen dat het verstandig is maatstafconcurrentie toe te passen, dienen deze factoren afgewogen te worden tegen de baten.

Toepassing in buitenland

Er zijn verschillende vormen van maatstafconcurrentie, variërend van private of publieke toepassingen, regulering op output of inputvariabelen, en betrekking hebbend op het gehele budget of slechts een gedeelte. Voor alle onderscheiden varianten hebben we een buitenlandse illustratie gevonden. Bij private toepassingen krijgt maatstafconcurrentie het karakter van een price cap (de zogeheten RPI-X). Deze wordt toegepast bij waterbedrijven in het Verenigd Koninkrijk en locale tele-communicatiecarriers in de Verenigde Staten. Bij de eerste is het belangrijk om de kwaliteit te waarborgen. Dit moet via aanvullende regulering geregeld worden. Bij de laatste speelt het dynamische karakter van de sector een cruciale rol. Maatstafconcurrentie is hierdoor kwetsbaarder, omdat eigenlijk de maatstaf permanent herzien moet worden.

Bij publieke toepassingen is er een onderscheid tussen input- en outputfinanciering. Een illustratie van outputfinanciering biedt het wetenschappelijk onderzoek in het Verenigd Koninkrijk. Door budgetten van universiteiten af te stemmen op output is men er in geslaagd een impuls te geven aan concurrentie tussen universiteiten. Dit dreigt wel ten koste te gaan van onderwijstaken. Hier zal dus aanvullende regulering nodig zijn. Ook kan er een gevaar bestaan van het ondermijnen van regionale doelen (regio's met een zwak presterende universiteit worden benadeeld).

Een illustratie voor inputfinanciering is het Medicare programma in de Verenigde Staten (voorziening voor gehandicapten en ouderen). Uit de beschikbare gegevens bleek dat dit project een succes is, in de zin dat agenten efficiënter zijn gaan opereren. Het aandachtspunt van kwaliteit is aangepakt met aanvullende regulering.

Tot slot wordt in Israël een schema toegepast waarbij de best presterende scholen een bonus krijgen. Deze vorm van regulering (*carrot regulation)* is kansrijk indien slechts afgerekend kan worden op een gedeelte van de output, bijvoorbeeld omdat een gedeelte niet observeerbaar is. De eerste ervaringen in Israël lijken gunstig, in de zin dat scholen efficiënter zijn gaan opereren. Ook in Engeland en de V.S. wordt thans geëxperimenteerd met *carrot regulation*.

Conclusie en toepassing Nederland

Maatstafconcurrentie kan toegepast worden in situaties waarin gewone concurrentie tussen agenten niet tot maatschappelijk gewenste uitkomsten leidt. Prestaties van agenten worden onderling vergeleken en na eventuele correcties omgezet in verschillende beloningen. Hierdoor worden agenten geprikkeld efficiënter te produceren.

Er zijn enkele voorbeelden uit het buitenland bestudeerd. Deze studie geeft vooral aan dat er interessante kansen liggen, maar is niet voldoende specifiek om met vertrouwen te kunnen zeggen dat toepassingen zonder meer wenselijk zijn. Op basis van het beschikbare materiaal zijn de volgende conclusies omtrent toepasbaarheid in Nederland gerechtvaardigd:

- Het verdient aanbeveling de mogelijkheden van diverse vormen van maatstafconcurrentie te onderzoeken voor Nederland.
- Veel nutssectoren voldoen aan de basisvereisten voor het toepassen van maatstafconcurrentie. Te denken valt aan elektriciteit (waar het al gebeurt), gas, water, kabel en wellicht ook vormen van openbaar vervoer.
- Ook bij verschillende segmenten binnen onderwijs en zorg lijkt aantrekkelijk om prikkels in te bouwen. Vooral *carrot regulation* lijkt hier aangewezen. Aandachtspunt bij deze sectoren zijn kwaliteit (waarvoor vaak aanvullende

regulering nodig is) en niet-kwantificeerbare maatstaven (die vaak op een of andere manier meegewogen dienen te worden).

- Andere denkbare toepassingen zijn woningbouwcorporaties, uitvoering sociale zekerheid, paspoorten en andere homogene gemeentelijke diensten.

Preface

More and more, governments and regulators are seeking ways to enhance incentives to operate efficiently in situations where direct competition is unable to yield appropriate incentives. Yardstick competition is a regulatory tool that might do the job in sectors such as education, health care and utilities. So it is no surprise that the Dutch government is interested. It is more surprising that there is a relative lack of knowledge and practical experience in the Netherlands. This exploratory study sets a modest first step to increase knowledge.

This study was conducted by Marcel Canoy, Frank Hindriks and Ben Vollaard. We are grateful to the steering committee of the Ministry of Economic Affairs, and for the co-financing of that Ministry. Comments by Jan Potters and Eric van Damme were highly appreciated. As usual, Kathy Schuitemaker did a good job in the editing of the manuscript.

Henk Don, Director CPB

1.   Introduction

1.1.   Background

A policy and research trend is to assess whether it is advisable to introduce (more) incentives in sheltered or public sectors. These sectors are for (often) good reasons sheltered from direct competition. That does not imply that there are no possibilities to enhance the incentives of agents to operate in an efficient way.

Yardstick competition (henceforth: YC) is a regulatory instrument that can be used if direct competition between agents does not exist or does not lead to desirable outcomes. The regulator rewards the agents on the basis of their relative performance and therefore generates incentives for promoting efficiency. Agents are forced to compete with a 'shadow-firm' whose performance is determined by average or best practices in the industry. An important reason to use YC is the existence of market power due to regional monopolies. Examples are network industries and statutory monopolies such as hospitals.

YC seems appealing at first sight, because of its conceptual simplicity and the potential benefits that are associated with it. However, in spite of the simplicity of the underlying idea, the application of YC can be quite complicated. Furthermore, whether the potential benefits can be realised is often hard to assess. The main concerns are heterogeneity between firms (which leads to difficulties comparing firms), quality degradation incentives (which reduces benefits of the scheme) and possible side effects of YC (e.g. effects on non-measured variables).

To date, the number of actual applications of YC is limited. The only (planned) application of YC in the Netherlands that we know of is in electricity distribution. YC might also be applied to (parts of) health care and education, as experiences in the US and UK show, possibly in combination with other regulatory schemes. It is important to be able to determine whether there are more opportunities to apply YC successfully. Since not much is known about YC and its applicability in the Netherlands, there is a need for more knowledge about YC, both empirically and theoretically.

1.2.   Aim of the study

The aim of this study is to create clarity about the possibilities for the application of YC. We address three questions: First, what is YC? Second, which factors need to be considered in order to decide whether it makes sense to implement YC in a particular sector? Third, what lessons can be learned from existing applications of YC for the Netherlands? Each of the following chapters of the study focuses on one of these

questions.

The added value of the study is twofold. First, the study provides an overview of the theory of YC and the main related problems that are analyzed in the literature. Such an overview was not available previously. This theoretical part is more than a survey, as we propose a set of applicability conditions that have to be met in order for it to make sense to consider YC with respect to a particular industry. Second, the potential benefits and problems of YC are evaluated by discussing some applications of this regulatory scheme.

This study has a wider relevance than just the theory and design of YC, and is potentially of interest to people who want to know more about incentive regulation. YC is an example of incentive regulation, which is the design and implementation of rules that encourage regulated firms to achieve desired objectives by granting some but not complete discretion to the firms. Granting some discretion to the firms allows them to improve their efficiency while retaining some of the gains they realize. Almost all aspects of YC that are discussed bear on incentive regulation more generally.

1.3. Theoretical framework

The theoretical framework of this study uses the principal-agent framework for analysing the relationship between the government or regulator (principal) and government agencies or regulated firms (agents). The principal-agent framework is applicable to regulation because of the prominence of incentive problems and information asymmetries in regulation.

Issues will be explicated using notions such as 'incentive properties', 'power of the incentive scheme', 'private information' and 'moral hazard.' These terms (see Glossary for an explanation) concern features of the relation between the regulator or principal and regulated agents, the way in which certain rules motivate agents, whether information is available for the regulator or not, and what effects this may have. The terms are used throughout the study and some familiarity with these notions will be beneficial.

The terms 'regulator' and 'principal' will be used interchangeably throughout this study. The same holds for the terms 'regulated firms' and 'regulated agents', though we should add that there is no presumption that the agents are privately owned. The issue of private versus public ownership is considered in section 2.3. Principal agent theory commonly starts from the assumption that the objective of the principal is to maximise overall welfare, more specifically: to maximise the sum of profits and consumers' surplus. We use this assumption throughout the study. In section 2.2, more specific goals of

regulation are discussed and we address some of the trade-offs that may exist between different objectives in section 3.2. With respect to the agents, the objective is assumed to be the maximisation of profits subject to an effort constraint.

1.4. Overview of the study

Chapter 2 covers the theory of YC. It starts by introducing the notion of incentive regulation, of which YC is an example. The primary focus of incentive regulation is static efficiency. Subsequently, the concept of YC is defined and seven applicability conditions that have to be met in order to implement this regulatory scheme are suggested. The chapter ends by distinguishing three ways in which YC can be applied, and by considering some alternatives to YC.

Chapter 3 addresses the design of YC. The first half of that chapter focuses on the effects of YC with regard to other objectives than static efficiency. These effects need to be taken into account as there may be trade-offs between promoting static efficiency and other objectives that regulation might have. These trade-offs are analysed and some suggestions are made how they can be influenced. The second half of the chapter addresses potential problems that might undermine the success of YC, such as the danger of regulatory capture.

Chapter 4 continues by considering the practice of YC. Some of the existing applications are surveyed. To the extent that it is possible, it also provides an evaluation of YC with respect to the design issues discussed in chapter 3. Furthermore, the relevance of YC for Dutch industries is considered. The conclusions of the study are summarised in chapter 5. This chapter contains a list of seven steps that should be taken if one considers the application of YC to a specific sector, and presents the core conclusions that have been drawn with respect to the Netherlands. Finally, the appendix contains a glossary.

2.   Theory

2.1   Introduction

YC is a regulatory scheme that rewards regulated firms on the basis of how their performance compares with the performance of similar firms in the same sector. If a regulated firm is more efficient than the firms to which it is compared, it will make more than normal profits. This provides a strong incentive for improving performance if better technology becomes available or if inefficiencies exist. In more technical terms, the *power of the incentive scheme* is high in case of YC.

Regulatory schemes differ with respect to the incentive power of the scheme. Traditional cost-of-service regulation does not provide incentives for promoting (productive) efficiency at all, as prices are primarily based on historical cost. Usually, prices will be indexed to inflation and the price of inputs. The result is that firms will be able to recover all costs that are made. Schemes that fall under the heading of incentive regulation share a relatively high power of the incentive scheme. Firms bear greater risks as they can make a profit or a loss. As a compensation for this risk, they are also able to retain (part of) the profit they generate.

The incentive scheme influences many aspects other than (static) efficiency. It is likely to have effects on quality, investment, and the behavior between firms and regulator. For instance, regulatory schemes with a high power of incentive may be good for efficiency, but might be detrimental for quality. We start in section 2.2 by defining YC. The main reason for applying YC and the conditions that have to be met for its implementation are considered in section 2.3. Section 2.4. discusses incentive regulation in general. We also include a list of objectives regulation may have.

2.2   Defining Yardstick Competition

Consider markets where agents have low incentives for promoting productive efficiency, when competition is weak or absent. YC implies that the principal reimburses agents according to their relative performance: their efficiency is compared to that of other agents that offer similar products or services, and their revenues - and thereby their profits or budgets- are made dependent on this. This reward mechanism induces a process of competition between agents.

Alternatively, YC can be circumscribed as a way of linking financial consequences to the outcome of a benchmarking procedure. A third characterisation of YC, that highlights the ability the agents have to influence the outcome, is the following: 'YC is a type of tournament in which [agents] engage in a contest for the lowest costs.'

(Lehman and Weisman, 1996: 137)[1]

There are different ways on which to base the reimbursement. Should one consider the performance of the most efficient agent, or the average performance?[2] The average may be made agent-specific by calculating an average for each agent based on all his competitors. Whether the costs of the agent itself are included in the average or not may have important repercussions for the incentive properties of the scheme, as the costs the agent chooses will have or have no consequences for the price it can charge. Reimbursement may be based on marginal or average cost. A transfer can be included in order to cover investments in cost reduction, et cetera. This flexibility in how YC can be implemented allows the scheme to be applied to a variety of different settings.[3]

In Shleifer's (1985) seminal paper a shadow agent is created for each agent.[4] The shadow agent is based on all agents except the one that is considered, i.e. on n-1 agents if n is the total number of agents. For each shadow agent, the mean marginal cost level is determined by taking the average of the marginal costs of all the agents that constitute the shadow agent. Subsequently, for each agent the principal sets price equal to the marginal cost of its shadow agent. Furthermore, the principal makes a lump-sum transfer to the agents in order to cover the expenditures on cost reduction according to the same procedure. If lump-sum transfers are not feasible, the principal may resort to an average-cost pricing rule. Furthermore, if the firms are not fully homogeneous, the principal corrects for heterogeneity in as far as it is observable.

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[1] Up to the seventies, the term YC was used for the situation in which a state-owned firm competes with privately owned firms. The state-owned firm would serve as the benchmark or yardstick (see Harrison 1979). Occasionally, this idea is revived (Heuvelhof and Twist 2000, p.29). Shleifer (1985) is responsible for the modern definition.

[2] Laffont and Tirole (1993) use the term cost-reimbursement, which makes sense as many of the regulated firms previously operated under cost-of-service regulation working with budgets. Approaching the matter analytically instead of historically, the notion of a price-setting rule, however, may be more appropriate, as in many cases consumers will pay the price set by the regulator.

[3] The design of the price setting rule and its incentive properties have hardly received any attention thus far. Currently, Jan Potters at Tilburg University is working on an experiment that focuses on this issue. At the point of writing this paper, the results of this investigation have not yet become available.

[4] It has taken a long time before the topic received substantial attention since Shleifer's (1985) paper. In 1994, Laffont claims that the topic is 'still largely neglected' (524). Theoretical papers that have YC as their main focus are Bivand and Szymansky (1997), Bogetoft (1997), Dalen (1998), and Sobel (1999). See chapter 4 for some empirical papers.

The agents to which YC is applied may either be regulated firms or government agencies. In the former case, the customers pay the price, whereas the government usually pays it in the latter case. A problem in providing incentives to government agencies is that they cannot be rewarded in the same way as private agents. The easiest way to solve this problem is assuming budget maximisation instead of profit maximisation. It may be, however, that managers are motivated less by pursuing budget maximisation than by aiming at profit maximisation. In that case, a regulator may resort to other kinds of rewards.

First, it may threaten to fire the management if efficiency is too low. Second, it may determine salaries of management according to the relative performance of the agency. Similar measures can be used for motivating employees. If neither is possible, the regulator cannot do much more than benchmark the agents and publish the results. If there are certain standards within the relevant organisations concerning performance and employees have an intrinsic motivation to meet them, making benchmarking outcomes public may have a similar effect to providing financial incentives.

Three versions of YC

YC can be applied to different kinds of situations and different types of agents. The following scheme tries to structure this discussion by grouping types of YC in three categories.

Category 1 Relative performance between private firms
Category 2 Relative performance between public organisations
Category 3 Awards for best performing agents

Two questions (Q1 and Q2) enable a distinguishing between the three versions of YC.

Q1: is total revenue or the budget as a whole allotted through YC or only part of the resources by awarding a price?

Categories 1 and 2 refer to total revenue or budget, whereas category 3 only refers to part of the population or budget/revenue.

Q2: who pays the price for the product, the government, an insurance company, or the consumers?

This question determines whether category 1 or 2 is appropriate. Figure 2.1 illustrates the different versions.

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Figure 2.1   Three Kinds of YC

X: either revenues or only additional resources (a prize) are awarded through YC;
Y: either price or budget per product is regulated.
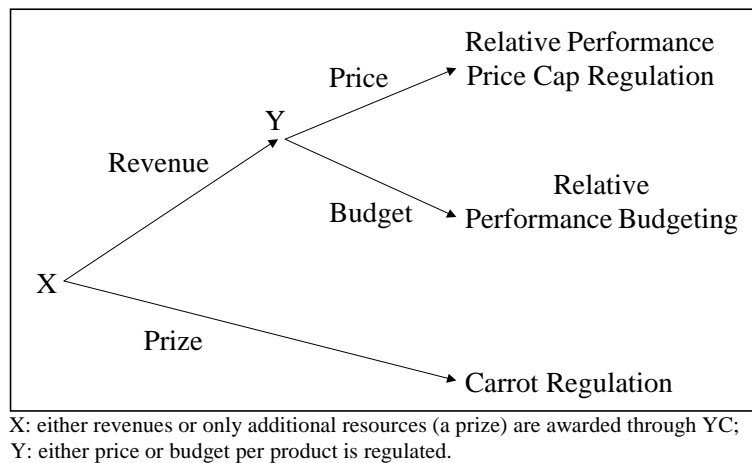
In case of a privately owned firm, the consumer usually pays the price. In case of a publicly owned firm, the government awards a budget per product to the regulated agencies. If consumers pay for the product, YC can be seen as a specific form of price cap regulation where the cap is based on relative performance. We refer to this as relative-performance price cap regulation. If instead the government or an insurance company pays a budget per product, the term relative performance budgeting is used.

Price cap regulation is a means to control the development of price of a certain firm or a certain sector over time. A frequently used scheme is RPI - X price cap regulation. This scheme allows for nominal price increases to correct for inflation - RPI stands for retail price index - while it obliges firms to cut price by X per cent in order to correct for efficiency increases that are deemed to be feasible. Burns and Estache acknowledge that YC can be seen as a form of price cap regulation:

> Under a very simple design in which prices of the various products are capped individually, as in gas or electricity in Argentina, it simply require the regulator to forecast future productivity growth, and not to adjust prices for past excess profits. The regulator can look backwards at the firm's historic achievements, or can use comparative information from other similar businesses (YC). (1998, p.4)

When the government pays for a budget, other types of problems occur. Since the consumers do not have to pay, it becomes less likely that they take the cost of production properly into account in their decision. Joyce (1993) discusses some other

dangers of using relative performance budgeting, some of which will be discussed in the next chapter.[5] Apart from consumer incentives, another difference between price caps and budget regulation is that price cap regulation is forward looking, i.e. it takes possible future efficiency gains into account, whereas budget regulation usually is backward looking. With respect to relative performance budgeting, it is possible either to award the budget prospectively or retrospectively. The agency is either output or input financed.

In case of input financing agents are paid a fixed fee for processing some type of input. Revenues are only related to the number of inputs. If the firm is able to process the input at lower cost than the fixed fee, it makes a profit. If the firm is not able to do so, it incurs a loss. Under this type, called *prospective payment budgeting*, output is not directly measured. The regulator only gathers information on costs of delivery for processing some type of input, without really knowing what type of product is delivered. Problems with measuring the isolated effect of services are one rationale for using this type of budgeting. However, one of the preconditions for prospective payment budgeting is that the activity is well defined, with a beginning (e.g. admission to the hospital) and an end (e.g. discharge). Compared to a system of retrospective fee-for-service system, i.e. cost-reimbursement, prospective payments provide stronger incentives to keep costs below a certain threshold, the fixed fee. To set the fee at the appropriate level, the regulator needs information on technology of the companies.

Output financing means that agents are rewarded on basis of their output. This type of regulation is called *relative performance budgeting* and involves contests for budget among organizations. In contrast to prospective payment budgeting, individual performance is measured. As output is often multi-dimensional and hard to quantify, experts assess the performance, leaving room for subjective judgements.

The theory of incomplete information learns that prospective payment can be effective when adverse selection is the main problem. Without moral hazard, efforts can be perfectly monitored so that input financing is enough to create incentives. Without adverse selection but with moral hazard, the technology is verifiable but not the effort, so that output financing creates effort incentives.

[5] Among other things, she notes that it is important to make the objectives and the priorities of agencies clear in order to have a good basis for what aspects to measure. Furthermore, she states that the pace of reform is an important determinant of success as reform is a complex process, and that local and state governments have had limited success in using performance measures beyond the individual agency.).

If only additional resources are allotted to the agents by awarding a prize to the winner of a contest between regulated firms, the kind of YC at issue is *carrot competition* (category 3). This notion was suggested by Bagnoli and Borenstein (1991).[6] Carrot competition aims at inducing firms to expand output by allowing them to compete with one another for larger shares of a reward (output prize). The background of this idea is that a monopolist or a full cartel, or firms in an oligopolistic industry produce less in total than firms in perfect competition do. The underlying idea is that the regulator can entice the regulated agents to compete, as the winner(s) will receive a prize. It is argued that awarding such a reward will lead to efficiency increases that are larger than the size of the reward. With incomplete information potentially all agents try to 'run as hard as they can' to get the prize. Still, it is said that such schemes 'will not, in general, achieve the first-best outcome,' (Bagnioli and Borenstein 1991: 132). Note that carrot regulation can easily be applied to other dimensions than output.

As we will see in chapter 4, some important distinctions can be made within two of these three types. With respect to relative performance price cap regulation, the most important dimension concerns the kind of technical change that occurs within the industry. If technical change enhances productive efficiency without changing the technology in a more fundamental way, YC may be a permanent solution to the problem of a lack of incentives for promoting efficiency. If, however, technology changes in a way that makes earlier arguments of market failure outdated, YC can at most be a transitory solution. In the case of network industries, technology can change in such a way that the costs of duplicating the network become acceptable and competition can be maintained naturally instead of artificially through YC (Auriol and Laffont 1992).

Summarizing:

YC is a regulatory scheme that consists of the application of an artificial form of competition. It is designed for situations where competition is absent or fails; more specifically in situations where agents have low incentives to promote cost efficiency. Competition is emulated by rewarding agents according to their relative efficiency. YC can be applied to public as well as private firms and can involve the full revenue/ budget or only parts.

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[6] We perceive the difference between Carrot competition and other types of YC as follows: whereas Shleifer's model of YC redirects the incentives of a firm by using information that is extracted from other firms, Bagnoli's and Borenstein's model relates the incentives of a firm directly to the actions of other firms and itself.

2.3 The applicability of YC

The (free) market is not always the best means for the provision of products and services. Still, if one allows a monopoly to produce goods and services one would like to give the monopoly proper incentives. Consider e.g. a network for the transportation of some good, such as a network of railway tracks or power lines. Usually, it is prohibitively expensive to duplicate such a network. If one agent owns the network and supplies the good as well, he may earn high economic rents. Such rents may result in inefficiencies, since the agent does not have proper incentives to promote cost reduction.

Since an improper alignment of incentives is the underlying problem of the situation described, some kind of incentive regulation is needed. As we have seen, incentive regulation aims at redirecting incentives in order to promote efficiency. Problems of asymmetric information usually make it difficult to achieve this redirection by direct regulation. YC can solve part of the problems that are caused by these informational asymmetries. We now turn to the discussion of the requirements that have to be met in order for YC to be applicable.

Four requirements for YC

YC cannot be applied to just any sector. Whether it can be applied depends on the kind of market failure involved, among other things. This section considers four (necessary but not sufficient) requirements for the application of YC: the *market failure requirement*, the *comparability requirement*, the *private information requirement* and *verifiability*. If these requirements are met, YC can in principle be implemented. It does not mean that it is also necessarily optimal to implement YC. This is only the case if (i) the benefits outweigh the costs and (ii) other regulatory instruments score worse.

Before we discuss the requirements, we introduce regional monopolies as a paradigm case, i.e. a case where it is clear that the four requirements are met.

Regional monopolies: a paradigm case

Agents are usually similar or homogeneous if the main difference is that they serve different regions. This may hold for statuary monopolies such as the ones in health care. Consider the case of hospitals. In spite of the fact that hospitals usually provide for a variety of different services, hospitals in different regions may be very similar. As entry within a region is limited and consumers depend on the expertise of the doctors, there often is a lack of competition between hospitals. As a consequence the incentives to enhance static efficiency are low. In such a situation, the introduction of artificial competition through YC may be a means for providing incentives to increase efficiency.

The reason why YC may be an effective instrument for regional monopolies is that it is likely that the requirements discussed below are met. The comparability requirement is usually met because of the fact that regional differences are often fairly small for most products and services. Furthermore, regional differentiation is a likely source of market failure in terms of a lack or absence of competition in the product market: regional monopolies can be seen as an instance of local monopolies. The private information requirement is met because of asymmetric and often correlated information. Hence, regional monopolies can be seen as the paradigm case for applying YC. In light of this, it is not surprising that Shleifer (1985) considers a franchised monopoly in his seminal treatment of YC. The underlying idea is that YC is relevant for a set of identical regulated firms that serve different markets (Shleifer 1985: 320).

The market failure requirement (A)

In order to have a reason to consider YC in the first place, there must be some kind of market failure. A central question is for what kind of market failure YC can provide a solution. The primary market failure for which YC may provide a solution is the presence of natural and statuary monopolies. A prime example is a network industry where there exist regional natural monopolies. Considering the key role that the (relative) efficiency of the agents plays in this regulatory scheme, the underlying idea

> *YC requires the presence of a* <u>market failure</u> *and of* <u>private information</u>.
> *Conditions that have to be met for its application are* <u>comparability</u> *and* <u>verifiability</u>

of applying YC to natural and statuary monopolies is that in the absence of such regulation the firms have *low incentives for promoting static cost efficiency*.

The comparability requirement (B)

YC is a regulatory scheme based on relative efficiency. Hence, it is necessary to compare agents in order to apply YC. This implies that two conditions have to be met. First, the sector that is considered as a target of YC must consist of *several* agents. Second, these agents have to be largely similar with respect to technology. These two conditions can be used as criteria for a preliminary selection of sectors in which YC can in principle be implemented. The former is the multiple-agents criterion, whereas the latter is designated as the homogeneity criterion. Together, these criteria make up the comparability requirement.

The private information requirement (C)

In situations where the market failure requirement holds, the agents commonly know

how they might improve on efficiency, both in terms of effort and in terms of technology. Frequently, the same options are open to each of them. More technically, costs typically co-vary across agents since they produce under similar circumstances. This implies that if private agents are triggered to use this information, efficiency can be enhanced. The regulator cannot enforce these improvements top-down since it lacks the information to do so, i.e. the agents have what is called private information.

A second aspect of the information requirement refers to the type of information asymmetries. A situation in which information co-varies across agents and to which the principal does not have access is known as one of *correlated private information*. The existence of such correlated private information allows the regulator to filter uncertainty concerning common technology shocks. The underlying process is the following. If a certain efficiency-enhancing technology becomes available to all firms without the regulator knowing this, this information will become available to her during the application of YC. As firms artificially compete with one another, the accounting data of all firms will show a downward trend in costs and the regulator can conclude that common opportunities are being exploited. In effect, the benchmarking process extracts the private information of the firms. Because of the correlation of cost information across agents, the principal can set sector standards against which to measure the relative performance of individual agents. She does not have to know what the most efficient way is of producing a certain good or service. Determining who is the most efficient agent will do. In other words, setting a sector standard and linking this standard to, for instance monetary, rewards will suffice to provide incentives for promoting cost efficiency. As a consequence of the increased incentive to promote cost efficiency, the private information problem is solved, even though the agents do not directly transfer the information to the regulator: the informational asymmetry remains, but the informational rents are extracted.

Summarizing, the private information requirement is necessary for two reasons. Firstly, it generates potential benefits to trigger agents to exploit their informational advantage. Second, if the information is correlated, the informational asymmetry can be used to compare the agents, without having to explicitly reveal the information.

The verifiability requirement (D)

In order to apply YC, the regulator needs to determine the relative efficiency of the agents. Two conditions have to be met for this. First, the information that is required for the benchmarking part of YC has to be made available. In particular, data on demand and accounting data about total cost and profit are needed, or more technically, they have to be observable. Second, the information and the benchmarking results that are based on it have to be able to stand up in court. The reason for this is that the regulated

firms may sue the regulator if they disagree with the regulatory scheme that is applied to them. In other words, the information and the benchmarking results have to be verifiable.[7] As verifiability presupposes observability, the observability condition and the verifiability condition may be summed up as follows: information on demand and accounting cost and profit, as well as the benchmarking results that are based on it, need to be verifiable. Together, these conditions make up the verifiability requirement.

2.4 Incentive regulation and the objectives of regulation

This section puts YC in perspective of a broader class of incentive regulation. In general, incentive regulation can be defined as the design and implementation of rules that encourage a regulated firm to achieve desired objectives by granting some, but not complete, discretion to the firm (see Sappington 1994, p.246; Sappington and Weisman 1996, p.3, and Kridel et al. 1996, p.271).[8] Two elements that are crucial in incentive regulation are the specification of the objectives by the regulator and the *amount of discretion* that is granted to the firms. The objectives should be well specified and their attainment should be feasible which means that due attention must be paid to potential conflicts between goals at the design stage of a regulatory scheme.

The amount of discretion granted to the firms depends on the asymmetries of objectives and of information between the regulator and the regulated firms (see Sappington 1994, pp.246-47, and Sappington and Weisman 1996, p.3). The objectives of the regulator or society on the one hand and regulated firms on the other are likely to diverge. Asymmetries between objectives pull in the direction of less discretion for the firms, because a lack of control can lead to results that are contrary to the goals set by the regulator. Regulated firms must act in the best interests of their shareholders, while the regulator is taken to base its regulation on more broadly defined social objectives, which include the interests of the consumers. Asymmetries between societal interests and private objectives can provide a justification for regulation *per se*.

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[7] Information is verifiable if it is observable by an independent third party. Laffont and Tirole use a closely related definition: something is verifiable if it 'can be (costlessly) described ex ante in a contract and ascertained ex post by a court' (1991: 161). An advantage of this definition is that it makes the notion 'observable by an independent third party' more precise: it is related to contractability and the legal system. The drawback of this definition is that it excludes the possibility of making something verifiable by incurring certain costs related to collecting reliable observations.

[8] Regulation in this paper is defined as the application of sector-specific rules. The underlying claim is that the (free) market requires only generic rules that apply equally to all industries.

Apart from asymmetries between goals, the amount and quality of information available to regulator and regulated firms is likely to diverge. Most of the time, regulated firms have information about the regulatory environment, for instance pertaining to cost structure and consumer demand, that is superior to that of the regulator. If that is the case, leaving some discretion to the firms is important, as firms know best how to achieve a certain goal in the best way. In such a situation, resorting to full command and control would lead to a trade-off between the costs of the inferior information of the regulator and the possibilities of exploiting the information advantage by the firms.

Providing the right incentives is often superior to extensively commanding and controlling the behavior of the regulated firms. Providing such incentives implies that regulated firms will be able to retain at least some of the profits they generate. The argument for this is expressed by Sappington and Weisman as follows: 'It is generally impossible to usurp all realized gains for consumers without simultaneously destroying the incentives that created the gains in the first place.' (1996, p.18) In light of this, it can be concluded that asymmetries of information justify the use of incentive regulation in particular.

YC is the regulatory scheme that has a high power of incentive, as it allows for a strong form of competition within regulation. Some of the issues that are analysed in this study do not only concern YC in particular, but are relevant for a wider range of regulatory schemes that all share the feature of having a high-powered incentive scheme. This will be especially helpful at the stage of deciding which regulatory scheme to use, as the power of the incentive scheme provides a perspective for comparing YC to alternatives (see below). The study, then, has a wider relevance than just YC.

The objectives of regulation

The potential objectives of regulation are many. We have grouped them under the following five headings: efficiency, equity, quality, supply ensurance, and the environment (see Sappington 1994 and Kridel et al. 1996 for similar lists). One may distinguish between two kinds of **efficiency** in this context: static, and dynamic efficiency. Static efficiency encompasses both *allocative* and *productive* efficiency. Allocative efficiency is optimal if price equals marginal cost. Given that some product should be supplied at all, the following holds: if the price is higher (or lower) than marginal cost, the amount produced is too low (or too high) from the perspective of social welfare. Only if the two are equal to one another, there is no dead-weight loss. Productive efficiency concerns short run cost minimisation, where the short run is that period in which technology does not change. Finally, dynamic efficiency concerns long run cost minimisation and the efficiency gains achieved by investing in new assets.

Just as efficiency, **equity** is a notion that covers a lot of ground. Equity is related to the distribution of income. The income distribution that results from an efficient situation may be perceived as unfair. Because of this, there may be a trade-off between efficiency and equity. As a result, an efficient situation may call for some *redistribution*.

Quality is often a main concern in regulation. What is at issue here is not only the quality of the product, but also of the service that comes with the product, for instance with respect to maintenance. In addition to this, the range of products that is offered - i.e. the extent of product differentiation - can be seen as an aspect of quality. With respect to many regulated industries, **supply ensurance** is an important matter of concern to the regulator. Two key aspects of this are *continuity in supply* and *universal service*. Finally, protection of the **environment** is frequently seen as a goal of regulation. Often, this includes promoting conservation.

If any of these five goals is not met to a sufficient extent by firms through competition, there is a reason to introduce some form of regulation (recall that regulation was defined as the application of sector-specific rules; see footnote 8). Some of these goals require only a light form of regulation that pertains to a limited set of aspects of production or management. If efficiency is the objective that is not met to a sufficient extent without regulation, incentive regulation may be a good tool to use.

A thorough analysis of objectives and the trade-offs that exist between them is not a guarantee for the success of the implementation of a regulatory scheme. Apart from the effectiveness of the regulatory scheme, another important question is whether the regulation that is applied is efficient. The application of regulatory schemes can be very costly in terms of the administrative burden that it places on the principal and the agent. For instance, the agent has to fulfil the requirements that the regulatory scheme imposes on him, such as supplying certain information and implementing the regulatory rules. An important means of achieving regulatory efficiency is by using simple rules. In order for regulation to be successful, such issues need to be considered as well. Another aspect of regulatory success is strategic behavior. Strategic behavior can occur either between the agents themselves (collusion) or between the agents and the principal (regulatory capture). Such strategic behavior can compromise both the effectiveness and the efficiency of regulation. Especially if one or both of these are compromised substantially, one should consider whether an alternative coordination mechanism from YC is more appropriate (see below).

From cost reimbursement to price caps

YC is one of many forms of incentive regulations. This section describes some other types of regulation and summarizes strong and weak points of each type of regulation.

Price caps

We have just seen that a specific kind of YC is similar to a specific kind of price cap regulation. If the price cap is based on relative performance, the scheme looks like YC. This follows because all four of the requirements of YC will be satisfied in that case.[9] However, this does not mean that there are no important differences between YC and the standard situations in which price cap regulation is applied.

We note five differences. First, price cap regulation can be applied to a monopolist, i.e. without possibilities of comparison, whereas YC cannot. Second, price cap regulation is often applied to an incumbent that has a lot of market power, while there are competitors in the market who are not subject to the price cap regulation. Third, price caps are not necessarily based on relative performance. Fourth, substantial heterogeneity's between agents do not prohibit the application of price cap regulation. The price cap can for example be indexed on the rate of technical change in the economy as a whole. Fifth, the incentive power of a price cap scheme may be lower than that of YC, either because the X factor is not determined by measuring relative performance, or because some kind of sharing rule is used. If a sharing rule is used, a part of the profits of the regulated firm must benefit the consumers. They can be reimbursed, for example.

Benchmarking and Regulation by Embarrassment

YC is sometimes confused with benchmarking. Benchmarking, however, is only the first half of YC. The second half consists of linking financial consequences to the benchmarking results. Because no direct financial consequences are attached to benchmarking, it can be applied to a wider comparison group. E.g. benchmarking is often done internationally, whereas this seems much harder for YC. In terms of the requirements formulated above, the comparability requirement has to be met in order to be able to benchmark. However, neither the market failure, nor the private information requirement has to be met for benchmarking. Private firms may resort to benchmarking in order to be able to keep up or compete more fiercely with their competitors.

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[9] It only makes sense to apply price cap regulation if the market failure requirement (A) is satisfied. The price cap can only be based on relative performance if the comparability requirement (B) is satisfied. Problems of asymmetric information are virtually always present in applications of price cap regulation. Finally, assuming that a price cap will only based on relative performance if the ensuing price cap is believed to be sustainable, also if the regulator is forced to defend herself in court - the verifiability requirement will be satisfied as well.

Sometimes the publication of benchmarking results is thought to be sufficient for providing the right incentives. In a sense, the publication of benchmarking results can be seen as some kind of reward based on relative efficiency, if managers care about reputation effects. Furthermore, it may have positive effects on corporate culture, or - more generally - on the norms and values of managers and employees. We will call this kind of regulation *regulation by embarrassment*. [10]

Sometimes it is unlikely that the incentives from reputation effects are equal to the incentives that are created by financial rewards. In such a situation, YC will outperform regulation by embarrassment. However, it may be that managers and employees intrinsically care about reputation, or they are triggered by consumer organizations or other countervailing powers. This means that, if they hear about the benchmarking results, they will be intrinsically motivated to improve their performance in order to become better or possibly the best, without financial rewards being necessary.

It is also possible to provide non-monetary rewards within an organization, for instance by showing appreciation for certain behavior. It is hard to judge the relative importance of monetary versus non-monetary rewards. In sectors where quality is very important, such as in statutory monopolies such as in health care and education, non-monetary rewards may play an important role and relating financial incentives too close to performance may be detrimental to performance as a whole if intrinsic motivation is crowded out. This observation provides an argument to use prospective relative performance budgeting in these sectors. Alternatively, one may resort to a form of carrot regulation, where only a small part of the budget is awarded in virtue of relative performance.

In short, whether YC is superior to merely publishing the results of a benchmarking process depends on the extent to which agents are intrinsically motivated to be better than previously or better than others. If such intrinsic motivation is substantial, linking financial consequences to the benchmarking results may be counterproductive. Note finally that whether this is the case or not, may depend on the kind of sector one considers and the strength of the effect may depend on the kind of behavior that is considered. [11]

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[10] This term was suggested to us by Jan Potters who ascribes it to Newbery.

[11] Generalising from the example, one may venture that sectors in which quality standards are crucially important may have developed norms to the effect that people are intrinsically motivated to perform well. In addition to this, such sectors may attract people who are primarily intrinsically motivated. Note that social acceptance may also motivate agents to perform well (Pettit 1990). Taking public appreciation as a measure of social acceptance, the public image of certain jobs

A definite advantage of regulation by embarrassment by publishing benchmarking results is that the burden of regulation is smaller as compared to that of the design and implementation of YC. Reasons for this are, for instance, the fact that it is unnecessary to determine a cost-reimbursement rule. Furthermore, negotiations with regulated firms are not needed and the verifiability requirements for the benchmarking results will be less stringent. Note, however, that the resources needed for a thorough benchmark study alone may already be quite substantial.

Cost reimbursement and rate of return regulation

In the 'old' days public monopolies were regulated either by cost reimbursement or by rate of return regulation. Cost reimbursement basically requires monopolies to request permission to invest and contains no incentives whatsoever. The same applies to rate of return regulation. When monopolies actually produce goods or services for which the public has to pay (e.g. utilities), rate of return regulation checks for monopoly prices, but does not give incentives for cost reductions. It is therefore a good instrument when one has a reasonable idea what costs should be. Under perfect information on costs, rate of return regulation, cost reimbursement and RPI-X coincide.

Summing up

The various regulation schemes, including all types of YC, are summed up in a table that shows strength and weaknesses.

may be important for performance as well. With respect to the kind of behavior that is particularly susceptible to norms of expressive rationality, it may be that quality-enhancing behavior is more sensitive to norms of expressive rationality than efficiency-enhancing behavior.

Scheme	Strength	Weakness
Cost reimbursement	Good if information asymmetries are limited or agents are altruistic	Low incentives
Rate of return regulation	Good check on market power	Low incentives
Benchmark	Provides proper incentives if norms an values are important or if countervailing powers are strong	Provides poor incentives if monetary incentives are important
Carrot	Balances between monetary and non-monetary incentives	Vulnerable if there is a lot of heterogeneity in population
Relative budgets	Gives proper incentives if monetary incentives are important within government	Can be detrimental to activities that are not regulated
RPI-X	High incentives	Can lead to excessive profits if information asymmetries are high

Unchecked public monopolies whose costs are reimbursed, give the weakest incentives, closely followed by rate of return regulation (these two can coincide). Benchmarking can give better or worse incentives, depending on the value of reputation losses. Carrot regulation goes a step further since it adds a monetary reward to performance. Relative budget regulation is weaker than RPI-X since the latter is forward looking.

2.5   Conclusion

In this chapter, we have considered incentive regulation in general and YC in particular. YC can be seen as a form of incentive regulation with a high power of incentive. As the main focus of incentive regulation is on static efficiency, a discussion of other objectives such as dynamic efficiency and quality has been left for the next chapter. Four requirements for YC have been discussed. The core idea of YC is that one can extract informational rents from sufficiently similar agents that are inefficient from the public perspective by comparing their performance with one another and link financial consequences to the results of the comparison. Prime candidates for the application of YC are regional monopolies that are either natural or statuary monopolies.

We have distinguished between three ways of applying YC. First, yardstick competition can be applied as an instance of price cap regulation. Second, it can be applied within a budget system to government agencies. Third, YC can consist in awarding a prize to the most efficient regulated agent. As we will see in the next chapter, it is also possible to apply a version of YC to other dimensions than efficiency. Finally, we have discussed

some alternatives to YC: certain forms of price cap regulation, benchmarking, regulation by embarrassment, procurement, and natural competition. This is especially relevant for determining whether YC should be applied, and, if so, whether it is just a temporary phase in a process towards regular competition or not.

3.   Design

3.1   Introduction

Now that we have dealt with the concept of YC and the primary reason of its use in regulatory policy, we turn to the design of YC. In putting regulatory theory into practice, one has to be explicit about the objectives that regulation should aim at. Five objectives have been distinguished in section 2.4. Static efficiency - being the prime objective of YC - has been considered in the previous chapter. In section 3.2, we will address the effects of YC on other objectives and the trade-offs that exist between them. The focus will be on dynamic efficiency, and on quality. The guiding question will be how one can design the regulatory scheme of YC in such a way that objectives other than static efficiency are served as well.

Section 3.3 considers some constraints on the regulatory process that have to be taken into account at the design stage. First, the relative efficiency of firms has to be determined and the heterogeneity's between them have to be taken into account. Second, the regulatory process itself is costly. The costs of applying YC have to be weight against the expected efficiency gains. Third, the possibility of strategic behavior between agents has to be taken into account. These three considerations have implications for how to design the regulatory scheme in practice. What is more, they are important factors for deciding whether YC should be applied in the first place. Section 3.4 concludes this chapter.

3.2   Multiple objectives of regulation

It is hard to design regulatory schemes that meet all of the objectives of regulation and its constraints as discussed in chapter 0 because of the trade-offs between some of them. For instance, protecting the environment may require detailed and complicated rules. Such rules, however, go at the expense of simplicity and, therefore, of regulatory success. Alternatively, the attempt of promoting efficiency might go at the expense of quality. Even between different kinds of efficiency, there may be trade-offs, as is acknowledged in the following passage:

> Some regulatory regimes may not satisfy all of these objectives. For example, a regime that focused too strongly on incentives to promote allocative efficiency may prejudice productive efficiency gains, and also distort investment incentives. On the other hand, a regime that offered strong profit incentives to improve efficiency would not be allocatively efficient and could engender popular discontent about the conduct of regulation. (Burns and Estache 1998, p.2)

In order to design a satisfactory regulatory scheme, one needs to know the trade-offs between the objectives as well as the importance that is attached to each of them. In other words, the relative weights of the objectives sometimes involves political choices.

Since lack of cost reductions incentives is the main reason to regulate with YC, the primary goal of YC is static efficiency. From what has been said in the previous chapter, it should be clear that the incentives for static efficiency, encompassing both allocative and productive efficiency, are high under YC. The effects of YC on the other possible objectives of regulation are less clear and are addressed in the remainder of this chapter. The effects of YC on dynamic efficiency are discussed in section 3.2.1, whereas quality is discussed in section 3.2.2.

The remaining objectives are not analyzed in detail. Supply ensurance and environmental issues are usually covered by rules that do not fall under or affect incentive regulation. Furthermore, they can often be dealt with in the same way as quality. With regard to equity we make the following three observations. First, the application of YC is likely to result in relatively stable prices, which consumers perceive as fair. Second, artificial competition often still yields agents fair returns e.g. because of asymmetric information (information rents). Third, it may occur that firms make substantial profits under YC. These profits can be the result of efficiency gains relative to the competitors. If this is perceived as unfair, one may decide to switch to another regulatory regime. Whether equity concerns are so pressing that it dominates efficiency concerns is a political decision and, as such, beyond the scope of this study. In short, with respect to certain equity issues YC seems to perform fine; with regard to some other, whether it does is a matter of political choice that should be left to politicians.[12]

3.2.1 Dynamic efficiency

The primary goal of YC is static efficiency. The effect it has on dynamic efficiency, however, is important as well. It is often assumed that competition is bad for investment, especially for innovative investment opportunities. We will argue that this is not necessarily the case. Furthermore, we point out that the effect of YC on dynamic efficiency may depend on the kind of investment that is involved - whether it is a generic or an industry-specific investment.

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[12] Laffont (1994, 521) states: 'More efficiency can only be induced at the cost of higher rents.' Burns and Estache (1998) discuss the sustainability problems this can cause.

Competition and dynamic efficiency

Dynamic efficiency encompasses technical progress, research and development, investments in implementing new technology, and diffusion of new technology throughout the relevant sectors or the entire economy. The Schumpeterian idea is that competition is bad for dynamic efficiency, because some market power would be necessary for funding innovative investments, as without market power there are no rents. This is, however, only one side of the coin.

In a situation of perfect competition, economic profits are zero, not accounting profits. Economic profits are zero if accounting profits suffice to earn a market return on investments. Such a market return suffices to attract funding from external sources. Sometimes it is assumed that firms make zero economic profits only in the long run. Furthermore, an increase in competition may discipline managers and employees to decrease slack or exert more effort also with respect to dynamic efficiency, as the survival of the firm is at stake. Empirical research is not clear-cut either, slightly favoring the 'competition is good for dynamic efficiency' idea though. Nickel (1994: 741) finds that 'competition, either measured by increased numbers of competitors or by lower levels of rents, is associated with higher rates of total factor productivity growth.'

YC and dynamic efficiency

The presumption that competition is bad for dynamic efficiency is also popular with respect to YC. Both Dalen (1998) and Sobel (1999) present theoretical models with this result. However, they do not take the disciplining effect of competition into account that - as we saw in chapter 2 -provides the reason why YC is applied in the first place. Another important factor is that YC is unlikely to lead to cut-throat competition anyway (see above). Firms are able to retain the (informational) rents they make. Regulatory schemes are not constantly revised. Hence good performing firms can realize profits during a regulatory period.

This analysis is supported by that of Sappington and Weisman (1996: 11-13). They warn against the presumption that substantial profits by regulated firms constitute evidence of a lenient or lax form of regulation. Instead, high profits may be evidence of the successful application of incentive regulation resulting in predicted gains for consumers and unpredicted gains for the firms. If the outcomes are compared to, for instance, rate-of-return regulation, both agents and principal may gain substantially by the introduction of incentive regulation.

Generic versus firm-specific investments

Dalen (1998) distinguishes firm-specific investments from industry-specific investments. Industry-specific investments affect the technology available to all other firms in the industry. Examples of such investments are investments related to network technology and investments that lead to innovations that could be copied by other firms. In contrast, firm-specific investments have no spill-overs and improve the technology of the investing firm only. Examples are region-specific investments or tacit knowledge about organisational efficiency.

YC results in an increase in the incentives for firm-specific investments (Dalen 1998: 107, 119). An intuitive explanation for this effect starts from the observation that YC reduces the amount of private information of the firms. The resulting increase in information available to the regulator enables her to extract a larger part of the rents. However, it only does so with respect to elements that are common to all agents (recall that according

> *YC is likely to promote dynamic efficiency, although it will shift the emphasis from generic to firm-specific investments.*

to the private information requirement the private information had to be correlated). Firm-specific private information is not filtered out. Hence, firms are able to use that information to their advantage.

Dalen explains his conclusion about the relative attractiveness of firm-specific investments as follows:

> The explanation for the result is that YC enables the regulator to filter uncertainty caused by common technology shocks. Reduced uncertainty about technology makes the incentive scheme more high-powered, and this, in turn, increases the firms' value of having private information about the remaining firm-specific part of the technology. (1998: 108)

The prospects for rents due to investments in commonly available technology decreases as a consequence of YC. The prospects for firm-specific investments, however, remain the same. Hence, the relative benefits of the two kinds of investments change, and firms are likely to put more emphasis on firm-specific investments.

Dalen (1998) concludes that there is a positive effect of YC on dynamic efficiency with respect to firm-specific investments. Note that this positive effect is relative to weaker incentive schemes.

3.2.2   **Quality**

In addition to efficiency, maintaining or improving quality is commonly seen as an important objective of regulation. YC provides an incentive to cut costs. From the perspective of the regulator, the goal is to improve efficiency. However, if regulated agents aim at maximising profits, they may want to decrease costs by lowering the level of quality provided, if they can get away with it. This phenomenon is called quality shaving. Alternatively, it is called the *crowding-out effect*, as incentives to cut costs crowd out incentives to produce high quality. This potential serious side effect is an example of a more general side effect of regulation. Firms focus on aspects that are regulated and do not put effort anymore in aspects that are not regulated.

Quality shaving is likely to occur when the regulatory situation changes from cost-plus regulation - for which quality is no problem as the expenses made for providing high quality are reimbursed - to incentive regulation in general and YC in particular. Note that quality encompasses both the quality of the product itself, and the quality of the service that comes with it. Since quality is often difficult to verify, this can be a real danger for the success of high-powered incentive schemes in general and YC in particular. This differs from the situation of competition where consumers (can) switch if quality is low. Note however that YC can be complemented with carrot regulation applied to quality. This and other alternatives are discussed in the remainder of this subsection.

A Consumer-Based Index of Quality

From an informational perspective, it is clear that the interesting case is that in which quality is observable and unverifiable. Assuming that quality is observable is quite plausible: 'Quality is usually observable by consumers either before or after consumption.' (Laffont and Tirole 1991: 161) If it is also verifiable, there is no need to discuss it in the context of incentive regulation, as in such a situation the regulator can impose a quality target directly. Therefore, we focus on the case in which it is observable and unverifiable.

> *Quality can be regulated by* <u>carrot regulation</u> *or* <u>regulation by embarrassment</u> *based on user-panels*

The way of addressing the risk of quality shaving is by *making* quality verifiable. This can only be done if it is weakly unverifiable. Something is weakly unverifiable if observations of an independent third party stand up in court, but cannot be collected without incurring certain costs (cf. footnote 7). One way of doing this is by constructing an index for quality based on the observations of consumers. However, this is costly,

especially because the observations have to be reliable in order to be able to stand up in court. In practice, user panels can be used as a means for verification. User panels are data sets on a set of consumer-satisfaction variables. Once quality has been made (weakly) verifiable, the regulator can reward or punish the firm depending on the level of quality that is provided.

One way of rewarding agents that produce high quality is by awarding a price to the agent(s) that perform(s) best, i.e. by applying *carrot regulation* to the quality dimension of production. As we saw in section 2.4, the reward or punishment does not need to be monetary. Publishing the results of user panels may suffice, as long as it can plausibly be assumed that regulated firms care about their reputation. This would be a case of *regulation by embarrassment*. Note that carrot regulation for quality is the mirror image of minimum quality standards. Which one is preferred depends on whether the downside risk (health) is dominant or upside improvements. It also depends on the costs of verification.

A Market-Based Index of Quality

Instead of collecting observations from consumers, one can construct a quality index from market data. This alternative starts from the intuition that if quality is high, demand will be higher than if quality is low, given the price of the product. If this is the case, quality can be inferred from data on demand and prices. A quality index can be constructed that is based on the level of sales corrected by the price charged by the firm. Subsequently, the regulator can reward or punish the firms she regulates based on this index. (Laffont and Tirole, 1991)

The problem with this proposal is that it is difficult to implement, as the inference of quality from sales and prices can only be made either by assuming other things to be equal, or by adjusting for these other things. For instance, if sales increase and the price remains the same this may be due to a higher quality, but it may just as well be due to an increase in income or a change in preferences. Adjusting for all relevant factors is a hazardous endeavour.

Lowering the Power of Incentive Scheme

If quality cannot be verified at any costs, i.e. if quality is unverifiable in the strong sense, it is impossible to construct a quality index. In such a case, there is no alternative to taking the crowding-out effect as given and accepting its implication. Laffont and Tirole (1991) argue that the implication is that 'the more important quality is, the lower the power of an optimal incentive scheme.' (163)

This also holds if only certain aspects of quality are important but yet unverifiable. Dalen (1997) expresses this when he writes: 'There is a general view that incentive contracts that make transfers and budgets dependent on verifiable variables result in poor performance on the unverifiable aspects of production.' (139) He concludes that '[i]f these aspects are important, the regulator may choose not to use incentive contracts, or, less dramatically, reduce the power of the incentive scheme.' (139-40). If the notion of quality is broadened as to include safety considerations for the employees, this means that in high-risk sectors the incentive scheme should be relatively low-powered. This also applies to sectors where environmental concerns are particularly pressing, such as, for instance, the provision of nuclear power.

Lowering the power of the incentive scheme means in effect abandoning full-fledged YC as a regulatory scheme for the sector under consideration. The implication of a lower-powered incentive scheme is that the trade-off between rent and the provision of quality is different. Providing high quality becomes less costly, as the rents that one earns are not as strongly influenced by the costs that are made on quality as in the case of YC.

In sum, in order to promote the provision of quality in a sector that is regulated by YC, the regulator needs to construct a quality index. The quality index can either be based on user panels and consumer-satisfaction data, or it can be based on demand and supply data in the relevant sector. The regulated firms can subsequently be rewarded or punished depending on how they score on this index. Note that the reward or punishment does not need to be monetary, as regulation by embarrassment may be particularly effective with respect to the regulation of quality. If it is not feasible to construct a reliable quality index, the alternative is to lower the power of the incentive scheme and abandon YC as the appropriate regulatory scheme for the sector that is considered.

3.3   Aspects of regulatory success

In chapter 2, we have seen that YC is suited to promote static efficiency. In the previous sections of this chapter, we have discussed how YC fares with respect to other objectives, notably dynamic efficiency and quality. In the remainder of this chapter, we address some constraints that have to be met in order for a particular application of YC to be successful.

In section 3.3.1, we discuss two methods for measuring relative performance as well as the problem of accounting for heterogeneity. In section 3.3.2, the costs of regulation are considered. Finally, in section 3.3.3 we address the potential for strategic behavior amongst the agents themselves and between the agents and the regulator. More

specifically, we will discuss the problems of collusion and regulatory capture.

3.3.1 Measurement and heterogeneity

In order to set a price in a yardstick scheme, the relative efficiency of the regulated firms needs to be determined. There are several measurement techniques that can be used for this. The most common ones are Data Envelopment Analysis (DEA), and Stochastic Frontier Analysis (SFA).[13] A problematic feature of these techniques is that they are likely to result in different outcomes, while the measurements on which prices are based should be verifiable, i.e. they should stand up in court. It is clear that the determination of relative efficiency is of crucial importance to the application of YC.

These problems are exacerbated by heterogeneity's between the firms that should be taken into account. Only those efficiency differences that are due to factors that are within the control of the firms, i.e. endogenous ones, should play a role in the price-setting process. Exogenous influences, such as regional differences between wages, should be corrected for in the measurement process. This is easier, the more constant the exogenous variables are. Especially in a situation in which they are constant, the measurement results are likely to be fairly robust (Burns and Estache 1998, p.13). A typical example of hard-to-cope heterogeneity's is sunk costs. How to deal with differences in investment cost levels in the past? These past decisions can influence performance in a substantial way and it not always easy to correct for them. See box 3.1 for a short discussion on sunk costs.

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[13] A third method of measuring productivity growth is the Total Factor Productivity (TFP) approach. This method aims at establishing how much growth in the supply of a certain product can be ascribed to growth in labor, intermediate inputs, and capital respectively. The part of output growth that is left unexplained, the residual, is seen as productivity growth. What results from the measurement is an estimate of the average productivity growth that has been achieved in a certain industry. An important assumption of this method is that the technology used by the most efficient firms does not differ much from that of other firms. This makes the method less fit as a method for determining relative efficiency, as the maximal feasible level of efficiency is not determined in a satisfactory way.

> *Box 3.1   YC and sunk costs*
>
> Different agents often have different investment histories. The investment history can have a strong impact on YC, since it complicates comparisons. This is not mainly a result of the fact that it is sometimes hard to determine levels of sunk investments. More important is that fact that it is hard to assess the impact of differences in previous investment levels on current performance.
>
> There is no easy solution here. At the one extreme, the problem exists but is solved by simply correcting for it. At the other extreme, comparisons are made so difficult that the comparability requirement of Chapter 2 is not met anymore, making YC not an appropriate scheme.

Measurement techniques

As said above, there are several ways of measuring relative efficiency. We briefly discuss the two most common ones. For more detailed discussions, we refer to reader to Coelli et al. (1998). The first method that we consider is Stochastic Frontier Analysis (SFA). A key feature of this method is that it requires the imposition of a certain functional specification on the production process, i.e. it is a parametric method. The flip-side of this disadvantage is the fact that one comes to know which factors are responsible for changes in efficiency. This method starts from the assumption that the error term is distributed in an asymmetric way. One aims at estimating a *frontier*: the likelihood of an observation to be beyond the frontier is small.[14]

The second method is Data Envelopment Analysis (DEA), which is also a method for estimating production frontiers. A key feature of this method is that it is non-parametric: it does not require a functional specification of or a prior restriction on the relation between inputs and outputs. Instead, a frontier is estimated that provides information on the amount of inputs that are minimally needed for producing a given amount of output. As such, the method is more flexible than SFA, although it does not reveal much about the mechanisms behind the changes in efficiency. The central question that the method tries to answer is whether there is a cheaper combination of inputs than the one that is actually used.[15]

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[14] In fact, two error terms are included in the estimation process: the first capturing random effects, such as bad weather and strikes; the second capturing the extent of inefficiency.

[15] Bogetoft (1997) discusses this method in relation to YC.

These methods may result in different measurement outcomes. The problem is exacerbated if firms have a multi-dimensional output. The consequences for policy are:

> A regulator looking for yardstick inputs to the review of the utilities' X-factors might argue that the non-parametric model has indicated the need for a tight price cap to provide the incentives to reduce the dispersion of measured inefficiency. The utilities can appeal to the stochastic model to show that their different performances are due to the random factors of luck, weather, and so on, when their different characteristics are taken into account. (Weyman-Jones 1995, p.440)

A natural response to this possibility for the regulator is to apply both methods and compare the outcomes in a detailed manner before using the results for determining the price-setting rule. Furthermore, various sensitivity analyses can increase the quality of the ultimate judgement concerning relative efficiency. Moreover, as long as errors are perceived as being relatively small they are swallowed up by the informational rents, thereby unaffecting incentives.

Heterogeneity and idiosyncratic shocks

Quite often one will have to correct for differences between regions, such as differences in input prices between regions (Lehman and Weisman 1996 refer to this as staggered YC). There are two sides to this. First, one has to measure differences between firms and relate those differences to factors that explain them. Second, one has to make a choice between which factors are endogenous and which factors are exogenous. In theory, this matter can be traced by the measurement process as well. However, in practice this is not always feasible.

A major advantage of the fact that YC is based on *relative* efficiency is that factors that influence all firms equally do not require much attention. Such *aggregate shocks* have the same impact on all firms while they have no effect on relative efficiency. Because of this, they can easily be traced and incorporated in the level of prices that is set. This implies that both industry-wide technical change and market-wide changes in demand are automatically taken into account.[16] As such, YC has a built-in flexibility and

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[16] Recall that the fact that common technology shocks are filtered out during the application of YC is the driving force of the asymmetric impact YC has on industry-specific versus firm-specific investments (section 3.2.1). Note, however, that if the differences between firms that enable a certain firms to make investments specific only to itself are observable, they will be taken into account in the measurement process as exogenous heterogeneity's and, hence, will

adaptability to aggregate dynamic developments.

This is different with respect to *idiosyncratic shocks*, e.g. a change in relative input prices. Idiosyncratic shocks are changes in heterogeneity's between firms. They must be taken seriously, for one thing because negative idiosyncratic shocks pose a real threat to the profitability of the regulated firms that are affected by them. Means of coping with such idiosyncratic shocks must be incorporated in particular yardstick schemes in order to ensure flexibility with respect to such idiosyncratic developments.

Apart from this, they pose a real problem for the application of YC because they are very difficult to measure. Heterogeneity's including changes in differences between firms may be an important reason for not applying YC to a particular industry. Note, however, the following remark by Shleifer: 'Even if diversity is not adequately incorporated into the pricing formula, YC is likely to outperform cost-of-service regulation.' (1985, p.326). Moreover there will always be some scope for ex-post corrections if the case is clear-cut. Another way out of this measurement problem is to reverse the evidence: let firms prove that shocks are idiosyncratic.

The ultimate goal of the measurement of relative efficiency is, of course, to determine a price setting rule for the regulated firms. It is important to realize that there is both a backward looking and a forward-looking aspect to this. The backward looking aspect consists of, first, determining best or average past practice and, second, incorporating the result that comes out of this process in the price. The latter should be done in such a way that inefficient firms have an incentive to attain the level of efficiency of the best or the average firm. In concrete terms, this means to set price equal to least or average cost.

The forward-looking aspect pertains to expected productivity growth within the industry that changes the attainable level of efficiency even for the most efficient firm. This aspect is, of course, more difficult to determine than the backward looking aspect as it requires one to predict the future. For this forward-looking aspect total factor productivity (TFP) growth analysis is especially helpful, as it can be used to find an average trend in productivity growth that can, in certain circumstances, be extrapolated to the future (cf. footnote 13).

Note that especially in the face of high uncertainty concerning the future, the regulator may target the change in prices instead of regulating the level of prices. This weaker form of YC is based on the presumption that according to an estimate of the rate of

not benefit the investing firm.

productivity growth all firms should be able to meet a certain price reduction target without encountering financial difficulties (Burns and Estache 1998, p.13).

3.3.2   The cost of regulation

Regulatory success also depends on the level of costs that are associated with the implementation of the regulatory prescriptions. It would be detrimental to the regulatory endeavour if the costs outrun the benefits. In other words, if the costs are higher than the benefits, one should reconsider whether there should be any regulation at all. There are two kinds of costs that have to be considered. The first is the shadow cost of public funds. The second is the direct burden of regulation.

With respect to the first kind of cost, we have to bear in mind that money spent by the government is money that has been or will be raised by levying distortionary taxes. In this context, the term shadow cost of public funds is frequently used.

The second kind of cost of regulation is the direct burden of regulation. This consists of two components. On the one hand there are the costs that are made by the firms that are regulated in order to comply with the regulatory prescriptions. Examples of this are the costs of meeting the requirements with respect to the provision of certain information. On the other hand, the regulator incurs costs for applying the regulatory scheme.

Apart from the costs that are incurred for the application of regulation per se, costs that are specific to YC are the ones that are made for determining the relative efficiency of the firms, i.e. the costs of producing the benchmarking results. In section 3.3, the measurement methods have been discussed. There we have seen what complications can be involved in establishing the relative efficiency of firms. From that analysis it can for instance be inferred that the more heterogeneous regulated firms are, the costlier the benchmarking process will be. Furthermore, it has been stressed that the results should be verifiable. This increases the costs as well.

3.3.3   Strategic behavior

As said in section 2.4, regulation is a matter of institutional design, the key of which is redirecting the incentives of the agents. The agents, however, can behave strategically vis-a-vis the regulatory scheme. The regulated agents may try to undermine the regulatory scheme either by colluding with one another or by influencing the actions of the regulator. If the agents succeed in influencing the regulator in such a way that the decisions of the regulator become biased in their favor at the expense of other regulatory objectives, the regulator is "captured" by them. We start by considering two kinds of collusion: collusion on cost reduction and collusion on information. We then go on to

discuss the issue of regulatory capture.[17]

Collusion

An issue of strategic behavior that is important is collusion between the regulated firms. Just as in non-regulatory environments, regulated firms have an incentive to collude in order to earn more profits or, more generally, have a higher level of utility. However, whereas non-regulated firms can collude directly on prices, regulated firms cannot, since the pricing rule is determined by the regulator. Instead, they can either collude on the cost reduction process or on information.

These two kinds of collusion were already mentioned by Shleifer (1985). He points out that '[a]n important potential limitation of YC is its susceptibility to collusive manipulation by participating firms. At issue is whether firms can slow down the cost reduction without losing money or even make money over time as YC price and transfer rules are used repeatedly.' (ibid. 327) It was pointed out early in the analysis of YC that firms have an incentive not to reduce costs because they derive utility from exerting little effort. However, the strength of this incentive depends on the design of the details of the yardstick scheme that is implemented.

Recall that according to the price setting rule of YC price is based on reported costs. Regulated agents may collude explicitly by agreeing not to reduce costs at all or to reduce it only slowly. They can also collude implicitly by just not reducing costs or reducing it only by a small amount. Without agreeing on this explicitly, they can use their behavior to signal their intentions. Other firms will find out about their behavior from the outcome of the application of the price setting rule. For instance, if nobody cuts their costs, price will be equal to cost for all agents. If only one agent cuts her costs, the other agents can infer from the lower price that at least one agent did not collude with them (without knowing who). Note, however that strategic behavior can also occur without any collusion.

It may matter which price setting rule is used, as the extent to which one's own behavior affects the outcome hinges on this. Consider, for instance, the situation in which an average cost price setting rule is used. If the average used to set the price for firm i is based on the costs of all the other firms exclusive of firm i itself, the incentive to deviate from collusive behavior may be higher than if firm i is included in the base of the price setting rule. In the former situation, it does not matter in the short run for the price firm

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[17] See Neven et al. (1993) for some general rules or principles that may decrease the risk of regulatory failure.

i may charge how high she sets her costs. This gives her a strong incentive to cheat.

If, however, firm i herself is included in the base from which the average is calculated, her own behavior affects her own price as well. If she lowers her cost, she knows that the price will decrease. This changes the trade-off between the effort of reducing costs and the effect this has on price. The incentive to keep costs constant, and by doing this signal to the other agents that she is willing to collude, increases.

Concerning collusion on information, Shleifer (1985) notes that in the case of Medicare 'the moral hazard associated with reporting severity is great.' (326) It is clear why there is an incentive for the firms in the sector to collude on information, i.e. to misreport costs: if reported costs are higher than actual costs, price will be higher as well. Misreporting is illegal, of course, but it is not always observable, let alone verifiable. It seems more difficult to address this version of collusion by changing the details of the incentive properties of the design. Shleifer (1985, 327) also argues that the fact that regulated firms may not know who cheated decreases the sustainability of collusive strategies. In addition to this, he argues that the number of firms and the ability of the regulator to impose specific measures against collusion - such as choosing unit costs that are vastly higher than those of a very similar firm - limits the scope for collusion.

Three conclusions follow from this analysis of collusion. First, collusion forms a potential danger for the success of YC, as agents can collude on cost reduction or on information. Second, the extent to which collusion is a danger can be influenced by the design of the scheme to be implemented, notably by the kind of price setting rule that is used. Third, for various reasons collusion does not seem as big a problem as in other situations.

Regulatory capture

If a regulator is captured, one or more regulated agents influence the regulator in such a way that she makes decisions that favor them in a way that hurts the social welfare excessively. Social welfare is hurt excessively if the consequences of regulation do not reflect the weighted objectives for that regulation. Because of the danger of regulatory capture, transfers are a problematic means for regulation and are usually prohibited in regulatory practice. This does not exclude the use of carrot regulation, as its application is made publicly known, is (or should be) controlled in a way that ensures objectivity, and the prize awarded through carrot regulation is only a small fraction of the total budget of regulated agents.

3.4   Conclusion

If there are inefficiencies in a certain sector due to monopoly power or due to suboptimal regulation, the application of YC is likely to result in substantial efficiency gains. Whereas it is fairly uncontroversial that static efficiency will benefit, the effects of YC with respect to the other objectives deserve special attention. To assess whether it is indeed in society's interest to implement YC, the benefits must outweigh the costs. Possible aspects that can influence costs are:

1. Dynamic efficiency

YC is likely to result in a larger share of firm-specific investment versus sector-specific investments.

2. Quality

YC provides an incentive to cut on unobservable aspects of production, supply, and service. Because of this, it is important to construct some kind of quality index with financial consequences attached to it in order to sustain a sufficient level of quality.

There are several constraints that apply to the regulatory process, ranging from pragmatic aspects such as determining the extent of heterogeneity to strategic behavior between agents. Furthermore, these need not be independent from one another. With respect to this kind of aspects, we conclude the following:

3. Measurement and heterogeneity

Measurements need to be verifiable. Therefore, it is advisable to use more than one method of measuring relative efficiency and to submit the results to a sensitivity analysis. It should also take into account that firms differ. More heterogeneity means less efficiency gains and more regulatory costs. Too much heterogeneity may be very damaging to the application of YC.

4. Cost of regulation

If the regulatory costs outrun the remaining efficiency gains, YC is not an appropriate scheme for the sector at hand. Apart from direct cost there are also costs of collusion, informational rents and regulatory capture.

4. Experiences with YC

4.1 Introduction

In the previous chapters we discussed a range of theoretical issues that are of interest when applying YC. Aim of this chapter is to learn how these questions of design are being addressed in practice. To that end, we review some of the experiences with the actual implementation of YC in regulatory policy. As a side issue - and to enable an assessment on possibilities for a wider application of YC in the Netherlands- we perform a 'quick scan' type qualitative cost-benefit analysis on YC for each case. These scans are by no means exhaustive, but form a first idea about the pros and cons of YC in individual cases and point at areas that need further research.

From Chapter 2 we already inferred that the basic principle of YC - introducing artificial competition between regional monopolists on the basis of their relative performance - can be found in quite distinct regulatory schemes. In reality the same can be observed: regional monopolists can be private companies subject to price regulation, or (semi) public organizations that receive budgets from the government. Consequently, the way in which YC is incorporated differs widely.

Following chapter 2, we distinguish three ways in which YC has been incorporated. First, we deal with the implementation of YC for private companies that are subject to price regulation. Then, we discuss two ways in which YC has been implemented for (semi) public organizations that receive budgets from the government - prospective payment budgeting and relative performance budgeting. Third, we discuss carrot regulation, where agents compete for a prize.

For each mode of YC, we separately evaluate the issues on design raised in chapter 3: dynamic efficiency, quality, heterogeneity, and regulatory costs.

For price regulation (section 4.2) we selected water and sewerage service in the UK and local telecommunication exchange services in the US. For relative performance budgeting we selected research funding in the UK (section 4.3.3). For prospective payment budgeting (section 4.3.2) we discuss the Medicare health program in the US. Carrot regulation (section 4.4) is illustrated with the aid of the allocation of teachers' salaries in Israel. In section 4.5 we draw conclusions on the way in which design issues have been addressed in different settings. Each section has the same structure: description, benefits, costs, evaluation and applicability to the Netherlands.

Table 4.1 provides an overview of the experiences with YC that we will discuss in the sections 4.2 to 4.4. The fourth column shows sources to which we refer the reader for further information.

Table 4.1   *Overview of some experiences with YC*

Area of application	Sector	Country	Main References
Price regulation	Water	UK	OFWAT (1998, 1999, 2000)
	Telecommunication	US	Vogelsang and Mitchell (1997), FCC (1999)
Budgeting	Healthcare	US	Phelps (1997), Shleifer (1985)
	Scientific research	UK	HEFCE (1998), HEFCW (1998), Koelman and Venniker (2000)
Carrot	Secondary education	Israel	Lavy (1999)

4.2   YC and price cap regulation

4.2.1   Introduction

Price cap regulation is a commonly used instrument to discipline private companies with market power. Especially companies in network industries like telecommunication or water are often subject to price regulation. After all, companies owning the regional network often hold dominant positions on their home market.

Price cap regulation involves setting ceilings on price increases. The cap is adjusted only with some lag. Individual companies retain an incentive to cut costs and to produce efficiently, because in the short run their behavior has no effect on the prices they are permitted to charge, and they will be able to keep any additional profits resulting from reduced costs. Besides, asymmetric information yields them some information rents. To set price caps, the regulator needs information on technology of the companies. The regulator will have to make an estimate of the efficiency improvement for the next few years. When comparative performance information is used to provide such information, the price cap regulation contains an element of YC. Two examples where this indeed used, are the water industry in England and Wales and telecommunication in the US. These two are chosen to show potentially interesting differences between countries and/or between different types of industries, water being a less dynamic industry than telecommunication.

4.2.2   Price cap regulation of water and sewerage services (UK)

Description

The Office of Water Services (OFWAT) regulates the 26 private water (and sewerage) companies in England and Wales. These companies provide water supply and sewerage services to consumers and business. Although competition is developing in some segments, the companies have a monopoly for most of the services they provide. The natural monopoly characteristic is derived from the networks of mains and sewers.

It can be readily verified that the four requirements of YC of chapter 2 are met: there is market failure, firms are comparable, have private and correlated information and output is verifiable. Further, water companies are private companies and consumers pay for the product, so that the yardstick type is price cap regulation.

The public goals for regulating are: (i) preventing monopoly rents; (ii) stimulating productive efficiency; (iii) realizing high quality (safe) products and high quality of service; (iv) customer protection and supply insurance.

How can YC help in realizing these goals? Let us first describe how YC is implemented for water in the U.K.

OFWAT uses comparative performance measurement to introduce artificial competition among these regional monopolies. Relative performance determines the ceilings on what each company can charge. Each company has its own price caps for five-year intervals.

The assessment of future efficiency gains for each company is split into two elements: an industry-wide improvement of efficiency and company specific improvements depending on their relative efficiency. The assessment of company specific improvement is based on the difference between actual reported expenditures and average predicted expenditures, i.e. the yardstick. The yardstick is based on calculations with econometric models for several types of expenditures and, if the number of observations is low, unit cost comparisons. A distinction is made between cost of operations, capital maintenance costs and return on capital. To assess operating and capital maintenance costs OFWAT requires information on some 50 types of costs (e.g. costs of water treatment or costs of renewal of existing household water consumption meters). To adjust for differences in operating environments, OFWAT additionally requires information on a range of other variables, such as the proportion of supplies from rivers or the proportion of distribution input treated in works of capacity 25Ml/day or greater. Both types of variables are used to construct the econometric models showing the relation between input, expenditures and output.

| Box 4.1 | | Assessing relative performance: water service expenditure | | | |

Assessment of relative efficiency in water services encompasses two elements: operating cost and capital maintenance cost. Four econometric models describe the relation between several types of operating cost (resources and treatment, distribution, business activities, and power costs) and a limited number of explanatory variables (e.g. number of billed properties). The results from these four models are added together and compared to give an overview of each company's operating efficiency for the water service as a whole. The assessment for capital maintenance cost is based on four econometric models and a separate capital unit cost assessment. Areas modeled are resources and treatment, distribution infrastructure and non-infrastructure, and management and general. The results from the models are added together and combined with the results from the capital unit cost assessment, by taking an average. Capital unit cost is assessed by comparing company estimates of capital works unit costs for a range of standardized capital projects. Then, the companies are divided into five bands. The table below shows the results for all water companies.

Relative efficiency of water services (November 1999)

		E	D	C	B	A
	A	Northumbrian		Southern, Thames, Yorkshire, Dee Valley Portsmouth	Cambridge, North Surrey	
	B	Anglian, Bournemouth & West Hampshire	Severn Trent, Wessex, Sutton & East Surrey			York
Relative Operating efficiency[a]	C		South Staffordshire	Bristol, Tendring Hundred	Three Valleys	South West
	D			Dwr Cymru, Folkestone & Dover, Mid Kent		
	E			South East		
		E	D	C	B	A

[a] Relative capital maintenance efficiency.

Source: OFWAT, Future water and sewerage charges 2000-05. Final determinations, 2000, p. 93.
Note: Band A: well below predicted expenditure (within 5% of the yardstick), Band D: above predicted expenditure (105-115%), Band E: well above predicted expenditure (> 115%).

Companies are ranked on percentage differences to the yardstick. Individual company circumstances are taken into account by making adjustments for factors that are not reflected in the econometric analysis. Then, the ranked companies are each allocated to an expenditure band A, B, C, D or E. Some companies have a much better cost

performance than suggested by the models - these are banded as 'A' companies. Other companies' performance is not as good as the models suggest it should be and their actual expenditure is well above that which is predicted by the models - they are banded as 'E' companies. The relatively inefficient companies are expected to catch up with the leading companies, over a five-year period. Therefore, the X-factor is higher for the relatively inefficient companies than for the efficient ones. Box 4.1 provides an example of the assessment of one aspect of cost efficiency.

OFWAT adjusts price limits to reflect the overall standard of service provided to customers. To assess current performance and performance improvement, data is collected for more than 20 indicators of standard of service, ranging from water pressure to frequency of water supply meter reading.[18] Best and worst performance in each area is identified and maximum and minimum marks are awarded. Then, individual scores are weighted and added up. Where the standard of service is assessed as being significantly better than that provided by the industry generally, an increase in price limits in 2000-01 of 0.5 per cent has been made (5 companies). Where service is particularly poor relative to the industry, a reduction of 0.5 per cent has been imposed (5 companies).

Benefits

YC was successful in the sense that it prevented monopoly rents and stimulated productive efficiency. This last point is not self-evident. Sawkins (1995), however, argued quite forcefully that progress on efficiency is evident. The monopoly rent goal can also be realized by other means, e.g. public provision, but not the second. A plus for YC is that the sector is characterized by an absence of dynamics, in the sense of unexpected fluctuations in demand or technology. This implies that the scheme can be improved over time, i.e. the scheme is not transitory, but will last over a longer period of time.

Costs

Potential costs of applying YC are: (i) problems related to measurement and heterogeneity (ii) quality degradation; (iii) regulatory burden.

Ad(i) To sustain YC, a relatively large number of comparators must be retained. After all, supply of sufficient information on differing operating environments is necessary

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[18] Standard of service is assessed in five key areas: reliability of water supply, water distribution and quality, customer service, sewerage service, and environmental impact.

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to allow for reliable comparisons. The econometric models that are used are quite complex, in particular because they also incorporate different types of heterogeneity. One of the remarkable implications of using YC here is that special attention is needed with regards to mergers. The Water Act provides a special test that the Competition Commission must apply in determining whether a merger involving water (and sewerage) companies operates against the public interest. Guiding principle is that OFWAT's ability to make comparisons should not be prejudiced through the loss of a comparator. Public benefits such as efficiency gains through better utilization of economies of scale must be weighed against lower reliability of comparisons.

For mergers between two water (and sewerage) companies, price cuts have generally formed part of a package of measures designed to ameliorate the loss of a comparator. Since privatization in 1989, the number of water (and sewerage) companies has declined from 39 to 26 in 2000. Currently, there are only ten companies left that provide sewerage services. Consequently, the Competition Commission is very reluctant to accept mergers on the sewerage side. Two examples are the prohibitions of the proposed mergers between Severn Trent and South West Water and between Wessex Water and South West Water in 1996.[19]

Ad (ii) How does YC affect the realization of high quality (safe) products and high quality of service and customer protection and supply insurance? These issues are dealt with to a considerable extent (see e.g. Ministry of Housing Spatial Planning and the Environment 1998), but the effectiveness vis-a-vis other schemes is hard to assess.

Ad (iii) With regulatory burden we mean all the costs associated with regulation, i.e. monetary costs, potential mistakes, possibility of collusion, side effects of regulation. Total annual costs of the benchmarking exercise is estimated at £15,8m, i.e. £0.71 per customer served (Kingdom, 1998). The possibility of collusion seems fairly remote here (Sawkins, 1995), i.e. not higher than with other types of regulation. A side effect is the above-mentioned hampered possibility of allowing mergers.

Evaluation and applicability Netherlands

When assessing YC one needs to consider three things: (i) what are the benefits; (ii) what are the costs; (iii) how do these relate to other schemes.

The benefits were relatively easy to pin down: there were clear indications of efficiency

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[19] See http://www.competition-commission.gov.uk/severn.htm and
 http://www.competition-commission.gov.uk/wessex.htm

improvements. On the cost side the main concern is quality. More research is needed to find out if adequate measures can be implemented to guarantee quality. If yes, than YC seems more attractive than other regulatory instruments.

In principle YC can be implemented in the Netherlands, using an approach similar to the U.K. This is not a new insight (see e.g. Dijkgraaf et al 1997), but the reason that we give may be new. Water is an industry where parts of the industry have natural monopoly characteristics, also for the foreseeable future. The industry is unlikely to face competition on the level of customers and is not dynamic in the sense of demand or rapid technological changes. Apart from quality concern (which requires further investigation) potential disadvantages of YC seem relatively easy to meet.

4.2.3 Price cap regulation of local telecommunication exchange services (US)

Description

The Federal Communications Commission (FCC) regulates Local exchange carriers' (LECs) pricing of access to their local telecommunications networks. The LECs hold dominant positions in their home telephone market. They provide telecommunications services to end users within the boundaries of local access and transport areas. Several other providers of telecommunications services have to interconnect with the LEC to reach final customers. Providers include inter-exchange carriers (providing long-distance services), enhanced services providers (supplying various value-added network services, such as answering services), and competitive access providers (providing alternatives to the local loop). The LECs have been required to provide non-discriminatory access to and interconnection with these non-affiliated companies that may be their competitors.

The public goals for regulating are: (i) preventing monopoly rents; (ii) stimulating productive efficiency; (iii) making sure interconnection is achieved at reasonable terms.

The FCC uses estimates of industry average productivity growth - the so-called X-factor - to set price caps for *interstate access services*. The price-cap rule applies to the thousands of service elements that are individually priced. However, the FCC provides LECs with some flexibility in setting prices by introducing service baskets (local loop services, traffic-sensitive services, special access services, and inter-exchange services). Within these baskets, prices of individual service elements are allowed to vary, as long as the weighted average of the prices does not exceed the price cap. The same price cap applies to all service baskets. To prevent that flexibility within the basket leads to undesired behavior like predatory pricing, two of the four baskets are made up of service

categories. The weighted average of prices of service elements within a service category is subject to a banding requirement (for instance plus or minus 5 per cent).

The 1990 and 1995 X-factors are based on trends in historical rate changes and an expected increase in productivity growth. The historical trends of access charges may reflect developments in both costs and profits. The regulatory regime can have an effect on both variables, with weak incentives to improve efficiency leading to higher rates. The replacement of rate-of-return regulation by price cap regulation in 1990 was expected to lead to lower rates. Therefore, a 'consumer productivity dividend' of 0.5 percent was added to the estimate of past productivity growth. A separate adjustment is made for 'exogenous' cost changes, which are changes outside the LEC's control (e.g. tax changes). LECs are allowed to increase their access charges by a measure of inflation minus the productivity offset. Thus LECs with below average performance have strong incentives to catch up with average industry performance. LECs with above average performance are rewarded by higher profit margins.

Not all LECs are full residual claimants however. Sharing requirements compel LECs to share a portion of their earnings above specified rates of return with access customers (i.e. price cap regulation is combined with rate-of-return regulation). The sharing requirements are intended to protect consumers against the possibility of an error in the establishment of the X-factor. LECs can choose between combinations of high X-factors and low sharing requirements or low X-factors and high sharing requirements. This 'menu of contracts' was intended to provide for differences in economic conditions faced by each LEC. However, heterogeneity among LECs has not been manifested through X-factor elections. Substantially all price cap LECs have, for some portion of time, elected the highest X-factor available. Therefore, heterogeneity does not seem to be a major determinant in the choice of X-factor.

Recently, the FCC proposed to introduce a single X-factor of 6.5 without a sharing requirement. Thus all LECs are subject to the same price cap. A low-end adjustment mechanism is thought to sufficiently address any heterogeneity that may exist among LECs. The mechanism provides for upward adjustment of the price cap if a LEC earns returns below a specified level in a given year. Moreover, a LEC may request the FCC to set it rates above the levels permitted by the price cap if it is able to show that the authorised rate levels will produce earnings that are so low as to be confiscatory. The sharing requirements are eliminated as they are thought to undercut the efficiency incentives of price cap regulation in much the same way as rate-of-return regulation.

Benefits

YC is successful in that it enhances static efficiency. It clearly outperforms no regulation since competition in local LEC's is far from mature. YC prevented monopoly rents (to a certain extent) and also realized the other goals, i.e. ensuring interconnection at reasonable terms.

Costs

Potential costs of applying YC are: (i) problems related to measurement and heterogeneity (ii) dynamics; (iii) regulatory burden.

Ad (i) Although heterogeneity did not seem to cause a lot of problems in the determination of the X, it may in other areas (Kridel, Sappington, and Weisman (1996) and Lehman and Weisman (1996)). Kridel, Sappington and Weisman (1996) conducted a survey of studies on the effects of incentive regulation in the telecommunications industry. Collectively, the studies examine productivity, investment, profit levels, new service offerings, and regulatory proceedings. They find no strong evidence that incentive regulation significantly reduced the costs of providing telephone service, nor has it substantially streamlined regulatory proceedings. Among other things, this is due to unobserved differences. There are also some concerns about quality of service (Resende 2000).

Ad (ii) The major problem in our view, lies in the dynamic nature of the industry. This refers both to technological change, which is hard to foresee, as well as future possibilities for competition by alternative infrastructure. The dynamic nature of the industry and the potential for future competition, makes YC vulnerable.

Ad (iii) There is no information known on the relative regulatory burden of this scheme.

Evaluation and Applicability Netherlands

When assessing YC one needs to consider three things: (i) what are the benefits; (ii) what are the costs; (iii) how do these relate to other schemes.

It is hard to assess on basis of the available evidence if YC is a success. Clearly the dynamic nature of the industry makes YC a vulnerable instrument. Given the nature of the market in the US, however, it is not clear which type of regulation would be preferred. or the applicability to the Netherlands we can be short: The Netherlands does not have a structure of regional monopolies, and hence cannot apply YC in this case.

4.3   YC in budgeting

4.3.1   Introduction

Relative performance budgeting means that the government or an insurance company pays for the product and budgets of the players are rewarded on basis of their relative performance. As the consumers do not have to pay, it becomes less likely that they take the cost of production properly into account in their decision. Therefore there often exist incentives problems and moral hazard. YC is intended to tackle these problems.

A shown in the previous section, with private companies the difference between dynamic (or alternatively: potentially competitive) and static markets was the important determinant if yardstick can be a success or not. In budgeting, other aspects become important. As argued in Chapter 2, there are two types of YC here, depending on whether output is the yardstick or input. We have an example for both types.

4.3.2   Health care services (US)

Description

Medicare is a large public health insurance program for elderly and disabled people. The US Health Care Financing Administration (HCFA or 'hick-fa') pays hospitals a fixed fee for treating patients covered by Medicare. The size of the fee is related to the physician's diagnosis of the patient. Each patient is assigned to one of the diagnosis-related groups (DRGs). To reduce within-group variability in cost of treating patients, no less than 500 DRGs are distinguished. The size of the fee is the average of costs of treating patients who fall into a particular DRG taken across comparable hospitals over the previous year. The payment for a patient within any DRG varies somewhat by region (e.g. to control for geographic variation in wages) and hospital type (e.g. teaching or non-teaching). The hospital receives the same revenue from Medicare no matter what is done to the patient during the hospital admission or how long the patient stays in the hospital. If a hospital can treat its patients for less than what it costs other hospitals to administer treatment, it retains the excess of its fee over its costs; if it cannot keep costs below fees, it incurs a loss. There is a specific adjustment for 'outliers', i.e. for those patients with excessive high costs of treatment.

Recently, a similar payment system has been implemented for hospitals in Italy, see Giammanco (1999).

Benefits

The prospective payment system proved to be effective at curbing cost growth. The efficiency improvement may be attributed to lower profit margins (Phelps, 1997: 425), more efficient behavior of doctors (concerning length of stay, intensity of treatment, admission), more efficient behavior of hospital management (personnel management) and probably also to more efficient medical technology. Since introduction, average length of stay among Medicare patients has declined remarkably (from 10.6 in 1980 to 8.1 days in 1993) (ibid.: 420).[20] Intensity of treatment (such as the frequency of physical therapy, frequency of laboratory test performed, etc.) also fell significantly (ibid.: 425). Admissions followed essentially the same pattern as length of stay upon the introduction of the system, but with a one-year lag before the response set in (ibid.: 426).[21] Hospital employment began to fall at the introduction of the system, and has remained very stable subsequently (ibid.: 427).

Costs

Adjusting for heterogeneity is important as the regulator sets the absolute level of the fee. Apparently, adjustment of individual hospital costs for geographic variation in wages and hospital type is sufficient.

Defining the long list of DRGs is essential to the prospective payment system. A costly element is the recurrent renegotiation of DRGs as experience with the system is gained. Since introduction of the scheme, numerous 'refinements' to DRGs have been implemented. Pooling hospitals with higher than average costs may lobby for such renegotiation. These renegotiations are thought to be successful in terms of profit margins on the side of hospitals (Shalala and Reinhardt, 1999).

What about side effects? Because of the strong incentives for hospitals to shorten stays and to choose the least expensive methods of care, the system raised concerns about possible declines in the quality of care for hospitalized Medicare patients.[22]

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[20] However, some of the recovery period is transferred outside the hospital, to skilled nursing facilities ('sniffs') or home health care.

[21] Contrary to intuition, the input-based system did not lead to an increase in admissions, probably because of the not-for-profit status of hospitals (Phelps, 1997: 426).

[22] Creaming of patients within DRGs is not possible, as hospitals are obliged to accept all patients.

To ensure quality of care, the HCFA introduced monitoring by professional review organizations (PROs). Each of the 53 PROs maintains a staff of medical experts whose single focus is on monitoring the quality of care in their state. Another measure to address quality concerns is the introduction of an element of competition in the provision of Medicare services. The HCFA contracts privately managed care plans (a combination of insurance and medical services) to service Medicare enrolees. The private providers will have to compete for customers to actually service Medicare beneficiaries: people have the free choice to enrol the government administered original Medicare plan or the private plans contracted by the government. To compete successfully for customers, the private plans will have to offer high quality services. Therefore, the managed care organisations put pressure on their contracted medical service providers to provide quality. The HCFA helps customers to make informed choices by making available information on costs, benefits and quality of Medicare health plans.[23]

A RAND study found that, overall, the system had no negative effect on patient outcomes and did not alter an already existing trend toward improved access of care (Kosecoff, 1990). Quality of care actually improved for most of the patient groups. Reviewing the available evidence, Phelps (1997) concludes that changes in length of stay precipitated by the system have not created any systematic degradation in patients' health. Thus, evidence from empirical studies indicates that stronger incentives for efficiency did not lead to lower quality.

So quality is an important concern but can be managed by supplementary measures such as professional review organizations.[24] Similar to RPI-X in UK's water industry there is not much scope for direct competition in the foreseeable future. Therefore the system can profit from learning effects as well.

Evaluation and applicability Netherlands

YC scored quite well here, and possibly better than other schemes, based on evidence we obtained. There is no direct obstruction to the introduction of a similar system in the Netherlands. In fact there are already discussions to introduce similar schemes in the Netherlands. The concern for the Netherlands is that quality concerns cannot be as easily addressed as in the US, where much more progress is made in making customer choice

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[23] The 'Medicare Health Plan Compare' is accessible at
http://www.medicare.gov/mphCompare/home.a sp

[24] The 'Medicare Health Plan Compare' is accessible at
http://www.medicare.gov/mphCompare/home.a sp

possible. Without that, there are dangers that YC leads to quality degradation. So one cannot do one (incentive schemes) without the other (quality checks).

4.3.3 Research funding (UK)

Description

The four UK higher education funding councils[25] are responsible for providing higher education institutions with the basic infrastructure required to undertake research - staff, equipment and facilities. The institutions are not-for-profit organizations: there is no residual claimant on the profit stream. The councils use a relative performance indicator as tool for allocation of research funding to higher education institutes (in other words a 'periodic rank order tournament'). The sum to be distributed is determined in advance (£804m in 1998-99). Under the 'dual funding support system', the Research Councils procure project-specific funds on the basis of competitive peer review.

In the periodic Research Assessment Exercise (RAE), each institution is awarded a rating, on a scale of 1 to 5* (five star), for the quality of its research in each of the 69 subject areas in which it made a submission. Subject panels consisting of members drawn from higher education institutions, industry, commerce and the professions conduct the assessment. There have been four RAEs to date, in 1986, 1989, 1992 and 1996. Each has been more systematic than the last. The next assessment will be in 2001.

Table 4.2   RAE ratings and funding weights (1996)

Research rating	Funding weights
1	0
2	0
3b	1
3a	1.5
4	2.25
5	3.375
5*	4.05

Table 4.2 shows how these ratings relate to funding. Ratings 1 and 2 attract no funding, while a rating of 5* attracts approximately four times as much funding as a rating of 3b for the same volume of research activity. The number of research active academic staff

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[25] The four councils include the Higher Education Funding Council for England (HEFCE), the Scottish Higher Education Funding Council (SHEFC), the Higher Education Funding Council for Wales (HEFCW) and the Department of Education for Northern Ireland (DENI)

is the most important measure of volume. Thus the total HEFCE research funds are equal to the product of volume and funding weight.

The institutions can choose which researchers they want to be assessed. They face a trade-off between volume and quality. For instance, a small number of high quality researchers may bring in much money, which can be used to subsidize researchers left out of the assessment.

As a result funding of research is highly selective. In 1998-1999, 75 per cent of HEFCE research funds will go to 26 higher education institutions. For a comprehensive description of the scheme, see Koelman and Venniker, (2000).

Benefits

Research is perceived to suffer more from moral hazard than from adverse selection. Therefore relative performance budgeting seems a good idea. Overall, quality of research is said to have increased since the introduction of relative performance budgeting. One of the positive points is the much more explicit attention given to the management of research activity and the development of research strategy. Also, it is likely that there has been a shift in resources from less performing to well performing universities, which is good for the average quality.

A study by McNay (1997) revealed indications for the following effects on the behavior and structure of institutions:

- tighter research policy, better research management, and more administration (reflected in staffing practices and organisational changes like the designation of a senior staff member as leader in the research area)
- structural changes toward gradual separation of education and research (research centers with staff freed from educational duties and graduate schools became the arenas for research).
- strategic internal allocation of funds over research units, i.e. from higher graded toward lower graded departments.

The last effect may have resulted because, from a financial point of view, 'improvers' were better than 'star performers at the funding ceiling'. Explanations are that institutions disagree with the judgement of the assessment panels, or that improvements in research productivity of middle graded units provide more value for money. In these cases, leaving institutions the freedom to determine the internal allocation enhances efficiency.

Costs

In the same study, at a more decentralized level, heads of departments reported, besides more effective management and higher quality, the following concerns (all supported by about 40% of the survey-population):

- focus on research at the cost of education (more undergraduate teaching done by part-timers and postgraduates)
- inhibition of new research areas and interdisciplinary research, encouragement of more conservative approaches
- encouragement to target output articles at prestige journals which were mainly read by other academics (including most RAE-panel members), rather than at professional journals which end-users are more likely to read.

Another concern is that the RAE interferes with regional goals. In particular if the scheme is so harsh on bad performance as in the U.K. underperforming universities are locked in at the bottom: bad performance gives low budgets, low budgets do not make it easier to hire good people (in particular because there are external effects as well), without good people it is hard to improve. In normal competitive situations this is no big deal, on the contrary: competition is meant to separate the men from the boys. With research, however, a policy goal is to sustain high quality research and teaching in all regions.

There is also concern that the relative increase in attention to research may have a detrimental effect on teaching activity. There is very little impact on funding from the teaching quality assessments undertaken by the funding bodies. Research-only staff is appointed and some of the burden of teaching is transferred to PhDs. To date, no action has been taken to prevent that stronger incentives to conduct high-quality research may have negative effects on teaching.

Evaluation and applicability for the Netherlands

Incentive regulation can produce a lot of good things, also in scientific research. However in the U.K. it seems that they pushed it quite far, possibly to the detriment of teaching and regional goals. In the Netherlands the policy advisor AWT thinks there is a lot of scope for improvement. AWT doubts the optimality of the current, historically determined, distribution of funds. The current distribution is basically determined in 1982. A possibility for the Netherlands is to implement incentive regulation in a more modest way, putting a higher weight on teaching and without the lock-in effects just mentioned.

**4.4	Carrot Regulation**

**4.4.1	Introduction**

In Chapter 2 we defined carrot regulation as a scheme that allots only some additional resources. The prize is a bonus that will entice the regulated agents into performing as good as possible. The scheme has similarities to relative performance budgeting. This is the case because the scheme is output based. The difference lies in the underlying characteristics of a market. The difference can be based on the fact that only part of the output is observable. Alternatively, fairness reasons can lie at the heart of the partial scheme.

**4.4.2	Teachers' salaries (Israel)**

Description

The Israeli Ministry of Education uses a relative performance indicator as a tool for allocating additional resources to secondary schools (a 'periodic rank order tournament'). The sum to be distributed is determined in advance (about $1.4m in 1996). Schools are ranked according to their improvement in a composite performance indicator.

The indicator is based on changes in students' performance: (1) average number of credit units per student (dependent on the chosen difficulty level of study), (2) the proportion of students taking the matriculation track (required for enrolment at universities), (3) the average score in the matriculation examinations, (4) the proportion of students receiving a matriculation certificate, and (5) the school's drop-out rates. To control for factors influencing students' performance that are outside the control of schools, individual performance is measured relative to an expected base predicted from regressions controlling for the socio-economic background of the student body

The contest has a first, a second and a third prize. Thus only the top three performers gain awards. The distance between the winners is also taken into account in determining how the fixed prize is distributed among winners. Then, three quarter of the bonus is evenly distributed among the teachers and school staff; the rest is used to upgrade general work conditions of teachers in the school. The bonus is equal to about 1 to 2 percent of annual teachers' income at winning schools. As changes in performance are measured, schools with high absolute performance are not automatically winners. Schools will have to improve their students' performance to increase their chances.

As yet, this mode of YC is an experiment at 62 secondary schools. Next year, a similar award scheme will be introduced across the board at secondary schools in Israel. This

summer, a similar scheme will be introduced for all 24,000 primary and secondary schools in the United Kingdom. In a recent green paper, the UK Department for Education and Employment (DfEE) presents the School Achievement Award for high performing and rapidly improving schools, complementing individual performance pay. [26] The sum to be distributed is determined in advance (about £60 million per year). The proportion of awarded schools is likely to be between a quarter and a third. The lump sum transfer can be used for non-consolidated pay bonuses for staff. For the great majority of schools awards will be based on pupils' test scores (Key Stage test or GCSE/GNVQ results). The scheme will be designed to take account of differences in pupil intake which have a significant effect on a school's performance.

Benefits

Lavy (1999) provides empirical evidence suggesting that the teachers' performance incentives led to significant gains in four out of five achievement measures of high school graduates, including average test scores and the number of science and other credit units, but had no effect on the dropout rate.

Costs

We have no information on other quality concerns, but note that carrot regulation is much less prone to quality shaving than higher power incentive schemes. Other potential disadvantages, such as collusion, a high regulatory burden or heterogeneity hardly play a role here either. Possible side effects are of a different nature (and similar to Medicare). Teachers may divert attention from other activities that are not measured and benevolent teachers not sensitive for monetary incentives can become frustrated. Therefore it seems to make sense (i) not to put too much weight to the prizes; (ii) also try to incorporate 'softer' values in the scheme.

Evaluation and Applicability Netherlands

Both the U.K and in the U.S. consider implementing a scheme similar to Israel. Keeping in mind the remarks made above, it seems possible to implement it in the Netherlands as well.

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[26] The Green paper is titled 'Teachers: meeting the challenge of change', see http://www.dfee.gov.uk/teachers/greenpaper/

5.   **Conclusion**

In this study, we have portrayed yardstick competition both from the theoretical and from the empirical side. In this chapter, we present our conclusions concerning yardstick competition, its applicability in general and its applicability to the Netherlands in particular. In the concluding chapter we translate our theoretical and empirical investigation in a set of steps that are required for implementing yardstick competition properly. In addition to that, we make some comments about the dynamics of regulation.

We have characterized yardstick competition as the practice of linking financial consequences to benchmarking results. A yardstick effect has been identified as the use of information on relative efficiency of similar agents to control informational rents. Yardstick competition has been defined as a regulatory scheme that consists of the application of an artificial form of competition. It is designed for situations where agents have low incentives to promote cost efficiency. Many factors have turned out to be relevant for determining the applicability of the scheme and the way in which the scheme should be implemented. This section brings most of these factors together by presenting a list of steps that should be taken if one considers the application of yardstick competition.

Applying yardstick competition in eight steps

If the application of yardstick competition is considered, two stages should be distinguished in the regulatory process. The first concerns the question whether yardstick competition should be applied or not. The second concerns the actual implementation of a form of yardstick competition. In this section, we discuss both stages in light of the analysis of the preceding chapters. We present a list of eight steps. The first four concern the first stage, while the last four of them are only relevant to the second stage. Of course, the second stage is only relevant if the answer that comes out of the first stage is 'yes'.

Deciding whether to apply yardstick competition

Stage I yardstick competition yes or no

The *first* step is to properly delineate the market. The success of every application of yardstick competition depends on comparability and measurement, which makes it necessary to determine which products are produced by the industry and which inputs are used.

The *second* step consists of checking whether the four applicability conditions for

yardstick competition are met: market failure, comparability, private information and verifiability. As part of this step, other characteristics of the industry should be investigated as well, such as the rate and the kind of technical change that has occurred in the recent past. This step basically determines the benefits of yardstick competition.

The *third* step is to decide in which form yardstick competition should be applied (if at all). We distinguished between three kinds of yardstick competition in chapter 2: yardstick competition as a form of price cap regulation, relative performance budgeting, and carrot competition. In addition to this, it needs to be determined what other objectives, apart from static efficiency are important with respect to the industry that is investigated. We discussed dynamic efficiency and quality as regulatory objectives, as well as the trade-offs between them in chapter 3. It may be that some other type of regulation is needed in addition to yardstick competition in order to safeguard objectives other than (static) efficiency.

The last step of the first stage is to assess the side effects of yardstick competition. The most important of these are possibility of quality degradation and the consequences for the behavior of agents on aspects that are not regulated. If these side effects seem limited or can be mitigated effectively, a preliminary YES can be given to yardstick competition.

The YES is preliminary because stage II still has to determine whether regulatory costs do not outweigh benefits.

Stage II: if yes, how yardstick competition

The *fifth* step is to determine the relative efficiency of the firms to be regulated. We have seen that both Stochastic Frontier Analysis and Data Envelopment Analysis can be used to determine the relative efficiency and that applying both will enhance the verifiability of the measurements that will then be better suitable for substantiating policy decisions. Finally, estimation of efficiency gains that will be possible in the future should be made in order to accommodate future technical change.

The *sixth* step, is that the regulatory scheme should be designed in detail. This requires determining the price setting rule (or other rule), the review period, and the application of some regulatory instrument to goals other than efficiency, such as using regulation by embarrassment to regulate quality. Further issues that are important are the informational needs of the regulator, as well as the responsibilities firms have in providing the relevant information. An important aspect of this is that yardstick competition calls for a high degree of standardization of accounting procedures.

The *seventh* step is to determine the total regulatory cost of yardstick competition. After this step it can be determined whether the benefits outweigh the costs and how yardstick competition scores vis-a-vis other schemes.

The *eighth* step and final step is the maintenance and evaluation of the scheme. At predetermined intervals, the scheme has to be reconsidered: the relative efficiency of firms has to be determined again, as well as the price setting rule. Furthermore, it has to be checked whether the application is a success in the sense, for instance, that there is no collusion between regulated firms.

Eight steps for the application of YC

Stage I: YC, yes or no
1. Delineate market
2. Check whether the applicability conditions are met.
3. Decide which form of YC is applicable. Determine objectives other than static efficiency.
4. Determine side effects of YC
Stage II: YC, if yes, how?
5. Determine the relative efficiency of the agents.
6. Design the scheme.
7. Determine the regulatory costs.
8. Apply the review process and evaluate the scheme.

The Dynamics of Regulation

In applying yardstick competition, it is important to be aware of the dynamics of regulation. There are a lot of factors that determine whether applying a certain regulatory scheme is timely. Apart from determining the appropriate regulatory scheme, timing factors may influence the way in which a particularly scheme is applied. In addition to this, external factors may influence the length of the period during which a particularly regulatory scheme is applied. In the previous chapter, we saw that yardstick competition is sometimes applied only during a transition from regulation to free competition.

We consider informational needs and the kind of technical change as factors that determine the optimal dynamics of regulation. The former determines the speed in which one can move from a regulatory scheme with a low power of the incentive scheme to one with a high power of the incentive scheme; the last one influences the length of the period for which yardstick competition can be applied effectively.

Information

Information and administration must be standardized between firms in order for the application of yardstick competition to be successful. The more alike the informational and administrative procedures are, the easier it is to determine relative efficiency. In short, the quality of the data has to be high, especially since the costs of miscalculations are large for such high-powered incentive schemes as yardstick competition. High quality data are also needed for correcting for heterogeneity's between firms. Note that the regulated firms have a high stake in these matters and have an incentive to misrepresent their costs and their environment.

Technical change and institutional environment

The kind of technical change in a certain industry is important for the application of yardstick competition. In an industry in which process innovation is the main source of technical change, yardstick competition can be applied indefinitely. There will always be scope for efficiency gains. To assess the consequences of yardstick competition on technical change it is important with which regulatory scheme one compares. We suggest to compare yardstick competition with the current scheme.

In a network industry, the network technology may change as well. If instead of (just) process innovation, the technology of transfer and distribution improves over time, yardstick competition may become an inappropriate regulatory scheme as the industry can move into an industry with natural competition. In short, technical changes may make arguments for regulation obsolete. In telecommunications the need for regulation decreases, for instance, because of the developments in mobile phones and other means of communication, while competing the network are no longer prohibitively costly anymore.

Applying Yardstick Competition in the Netherlands?

Chapter 4 discussed five examples of yardstick competition. The question is if yardstick competition can be applied in the Netherlands as well. Two types of answers will be given to this question.

First, in general it seems quite likely that the Netherlands is not so much different from countries where yardstick competition is applied successfully. In that context this study yields quite strong results. It is in fact quite odd that incentive regulation has not been tried more frequently in the Netherlands. Even in sectors where a complete application of yardstick competition seems too risky, the lack of experiments with weaker incentive mechanisms remains questionable.

Second, on a more detailed level this study is more agenda setting in nature than actually pointing at clear-cut cases of yardstick competition. With the exception of telecommunications, the examples of Chapter 4 all meet the applicability conditions. Nevertheless one cannot conclude therefore on basis of this study that yardstick competition should be applied. This study can help to determine which aspects of these examples have to be investigated before deciding on yardstick competition. In addition, the study can help identifying other sectors, as well as it provides tools to do a sort of cost benefit analysis of yardstick competition for these sectors. We end the study with an overview of the steps of the first stage and a research agenda for each example.

Sector	Market	Applicable	Type	Research agenda
1 water	Water supply to consumer and business	Yes	RPI-X	Quality
2 telecoms	not relevant	No	not relevant	not relevant
3 health care	Health services to elderly and disabled	Yes	Prospective Payments	Quality
4 scientific research	University research	Yes	Relative Performance	Teaching and regional policies, not measurable variables
5 teachers	Salaries secondary schools	Yes	Carrot Regulation	Non-monetary incentives, not measurable variables

On a more general level:

- It seems that the applicability conditions are met in all network industries where there are regional monopolies, i.e. water, electricity, gas, cable television, and perhaps also buses. RPI-X or weaker types of incentive regulation could be investigated in these sectors.
- Many sectors within education and health seem to meet the applicability conditions as well. In particular carrot regulation seems to be promising for many of the cases where quality, non-monetary incentives and non-measurable variables are relatively important.

- Other possible applications are housing corporations, social security, passports and other homogenous municipality services.

Glossary

Agents =	Firm or governmental body that is regulated by the principle (see: principal).
Benchmarking =	Comparing agents without necessarily attaching financial consequences.
Carrot Regulation =	Regulation on basis of extra rewards (prizes) for best performing agents.
Correlated information =	Agents have correlated information if the information is of the same type, e.g. it reflects their costs.
Idiosynchratic Shocks =	Shocks that are relevant for only a subset of the population, e.g. management failures.
Principal =	Regulator
Regulation by Embarrassment =	If comparison results do not have direct financial consequences, but are published in order to provide incentives by 'embarrasing' underperforming agents.
RPI-X =	Retail Price Index corrected for a factor that reflects increases in productivity (X).

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Abstract

Yardstick competition is a regulatory instrument that can be used if direct competition between agents is low or absent. A typical example is a set of regional monopolies. The regulator compares the performance of various agents and rewards or punishes agents on basis of their relative performance. Despite its conceptual simplicity, yardstick competition is hardly used in the Netherlands.

This study first analyses the theory of yardstick competition. We then formulate necessary conditions for it to be applicable, and classify the various types of yardstick competition. We proceed with a number of international examples of yardstick competition in health care, education and utilities. We end by claiming that there is a lot of scope for worthwhile applications of yardstick competition in the Netherlands, although further research is needed to fully substantiate that claim.