

Yardstick Competition

Economics of Competition and Monopoly

The core discussion of yardstick competition comes from Shleifer (1985).¹ Shleifer noted that cost of service (rate of return) regulation gives no incentive for cost reduction, at least in its simple static form. Therefore there is a need for alternative regulatory instruments. The basic framework arises in a moral hazard context.

1 Basic moral hazard framework

The firm has a base unit cost c_0 but can also engage in cost reducing effort, e , which generates a realised cost of $c = c_0 - e$. Effort is costly and therefore the firm must be rewarded for the effort. The cost function of effort is $C(e)$ where $C'(e) > 0$ and $C''(e) \geq 0$. Efficient effort, e^* , is where the marginal benefit of cost reduction is equal to the marginal cost of the effort.

The regulator can observe realised unit costs, c and can observe the realised cost of effort reduction $C(e)$ but does not know the parameters of the cost reduction function therefore does not know the optimal level of effort.

If the regulator did know the efficient level of effort, the efficient regulatory scheme is then to ask the firm to set a price equal to the efficient cost $c^* = c_0 - e^*$ and pay a lump sum to the firm equal to $C(e^*)$ the cost of efficient cost reduction.

In the absence of such information the regulator can only condition prices and transfers on the observed costs there is no means to encourage cost reduction and $e = 0$.

¹Andrei Shleifer (1985) A theory of yardstick competition, *Rand Journal of Economics* Volume 16 p319-327

2 Performance comparison

Now suppose that, instead of one firm, there are n identical firms that the regulator is regulating. The regulator can set a regulatory scheme whereby the price firm i is able to set is equal to

$$\bar{c}_i = \frac{1}{n-1} \sum c_j$$

and

$$\bar{C}_i(e) = \frac{1}{n-1} \sum C_j(e)$$

Now the price the firm is able to charge is not determined by its own level of effort but instead by the average level of effort that the other firms engage in. What is the best that the firm can do? Because the price per unit is fixed it receives the full benefit of reducing unit costs. As a result the incentive is there for efficient cost reduction. Cost of service regulation is replaced by price cap regulation with the price cap set in a mechanistic manner from observation on identical firms. However the firm only obtains zero profit because the regulator is eliminate any informational rent by using the observations on the other firms to regulate prices.

There are three immediate problems with such a scheme of regulation.

1. Firms are required to act in a non co-operative manner. If there is no co-operation a firm will make a loss if it does not engage in the efficient level of effort. However all firms could collude to engage in no effort at which point we return to cost of service regulation. The regulator needs therefore to be wary about information exchange between firms.
2. The regulator must be able to force an inefficient firm to make a loss. Suppose that despite the incentive scheme the firm does not engage in cost reducing effort. Its revenue will not cover its high unit costs. If the regulator is obliged to set a regulatory scheme that enables the firm to cover its costs, regardless of the firm's own actions, it may have to change the regulatory scheme *ex post* and the prospect of this *ex post* change could eliminate any incentive for the firm to engage in effort.
3. Firms are usually risk averse. When costs vary due to factors outside the control of the firm such as measurement error, luck, weather etc.

the firm will only be willing to accept the Shleifer scheme in its pure form if they are risk neutral. If the firm is risk averse there must be a risk premium paid to the firm. In order to work as insurance this premium must be paid as a lump sum that is not dependent upon the uncertain cost measure. However as the lump sum becomes a more important part of overall compensation so the proportion of rewards that are dependent upon costs falls, and there is less incentive for the firm to engage in cost reducing effort.

4. There is another side to the risk issue. Once explicit notice of taken of such measurement error in devising the yardstick competition scheme then there is an insurance effect for the firm because prices are determined less by idiosyncratic errors which are sifted out by comparison with other firms. Therefore when firms are risk averse and idiosyncratic factors can be allowed for in the yardstick competition framework an insurance effect will be provided relative to regulation as an isolated firm.

3 Performance comparison with non identical firms.

It will be rare that regulated firms are identical. In practice, water companies, for example, vary in their size and the costs of both collecting and distributing water. Therefore a simple comparison of unit costs may not be helpful as a way of regulating the firm. However we may use various exogenous cost drivers as a way of controlling for cost heterogeneity between firms and retain the essential features of the yardstick competition model. The details of such comparative efficiency measurement is dealt with in much more detail in the QT module. However, at the moment we can simply observe two points of difficulty.

1. In order to obtain valid estimates of the nature of heterogeneity we must have sufficient degrees of freedom. The number of observations on firms must be sufficiently large to obtain reasonably precise statistical estimates of the effects of cost drivers.
2. In order to obtain valid estimates *all* relevant cost drivers must be observed.

4 Implicit versus explicit incentives

In defining a principal agent contract there will typically be explicit incentive mechanisms such as that a manager's remuneration will depend upon the share price. However it is not always the case that a contract can specify such incentives. There may instead be implicit incentives that cause the manager to engage in effort. These may be in the form of the probability of promotion or increased alternative job offers from a reputation gained for ability. However such incentives may not be able to be formally written into the contract.

In the form of principal agent contract for a regulated firm there may be an absence of explicit relation between current price and current cost because price must be set before costs are observed. However there is an implicit (dis)incentive that arises because future prices will depend to some extent upon past effort. This does not have to be an explicit (dis)incentive. It is not usual for the regulator at the time of periodic review to apply a mechanistic formula based upon previous costs but instead some judgment about future costs, which includes information about past costs is made.

Shleifer's core yardstick competition scheme is a mechanistic proposal for price setting and is therefore an explicit incentive scheme.

5 Performance comparison and dynamic incentives

5.1 Core framework

We formalise this following Meyer and Vickers (1997).² Using previous terminology we say that the realised cost of the firm at time period t is given by,

$$c_t = c_0 - a - e_t - u_t$$

where c_0 is the common cost component across all firms and all time periods. a is a random ability parameter that varies across firms but not time. e_t is

²Margaret Meyer and John Vickers, Performance comparison and dynamic incentives, *Journal of Political Economy*, 1997, Volume 105 No 3 p547-581 especially pages 550-557

the effort the firm engages in, in time t , and u_t is a noise term (measurement error, the weather, etc). The regulator can only observe realised costs not intrinsic ability or effort.

In evaluating the effect of the two random components, a and u_t on cost we define

$$\tau = \frac{\text{var}(a)}{\text{var}(a) + \text{var}(u)}$$

If variation in intrinsic ability a is large relative to more idiosyncratic variation u then τ is close to 1 and past cost observations are more informative about likely future costs. If there is lot of noise ($\text{var}(u)$ is high) then the regulator will not infer much about future costs from past costs.

The regulator sets price in the price review according to

$$p_{t+1} = c_0 - E(a|c_t) - E(e_{t+1}) + C(e = E(e_{t+1}))$$

Where $E(a|c_t)$ is the expected value of a based upon the observation of c_t , $E(e_{t+1})$ is the expected level of effort that firm will engage in in period $t + 1$ and $C(e = E(e_{t+1}))$ is the cost to the firm of engaging in that level of effort. If price regulation will end after the $t + 1$ price review period then $e_{t+1} = e^*$ the firm will engage in the efficient level of effort because it will not be penalised in the future for current cost reductions. However effort in period t will have been reduced by the order of $1 - \tau$. This is because the firm receives the full benefit of cost reduction in the first period but then loses a proportion τ due the future price cut in response to past effort on the part of the firm. Therefore the firm will not engage in as much initial effort. This is the ratchet effect in operation.

5.2 Performance comparison

With yardstick regulation we have another firm (firm j to our original firm i) in a symmetric position with which we can make comparisons. There are two parameters that are important to introduce at this stage.

$$\eta = \text{corr}(a_i, a_j)$$

$$\rho = \text{corr}(u_i, u_j)$$

If the ability a of firms i and j are highly correlated then η is close to 1 and we may potentially learn a lot about the ability of firm i from observing firm j . If the shocks that affect firm i are correlated with the shocks that affect firm j so that ρ is close to 1 again we may potentially learn a lot about the ability of firm i from observing firm j . If $\eta = \rho = 0$ then the shocks and ability are uncorrelated and so there is no advantage to possessing a yardstick firm.³ With the existence of a (meaningful) yardstick firm the extent to which the current period cost reductions of firm i are passed on to the future price of firm i is given by Ψ ⁴ where $\Psi > \tau$ if and only if $\rho > \eta$. The intuition for this is that if $\rho > 0$ and $\eta = 0$ then we can separate out the common shocks (weather) and future prices depend to a greater extent on the past costs of firm i although this means that firm i is punished to a greater extent for good past performance. If $\rho = 0$ and $\eta > 0$ then previous costs of firm j become more important in evaluating the future price for firm i and therefore the past costs of firm i are less important, so firm i is willing to engage in more effort. The overall effect depends upon which effect is stronger i.e whether $\Psi > \tau$ or vice versa.

Until this point we have maintained an implicit assumption that the firm is risk neutral. As we saw before the firm is more likely to be risk averse. However yardstick competition, properly implemented, will always reduce risk because as long as there is some value to the information (either $\eta \neq 0$ or $\rho \neq 0$) then the firm's susceptibility to idiosyncratic errors will be reduced. As yardstick competition enables better evaluation of the effort that the firm has engaged in it will reduce the variability of the prices that the firm will be required to charge and therefore reduce the risk premium the firm requires. The overall advantage of yardstick competition depends upon the sum of the insurance effect and the ratchet effect.

³Technically it is possible that η and/or ρ could be negative, this would imply that when firm j is inefficient firm i is more likely to be efficient. Although this is possible and the information would then be useful for yardstick competition purposes the possibility will be ignored as a special case.

⁴see Meyer and Vickers (1997) p555 if you are interested in the precise technical definition of Ψ .

6 Relative price regulation

One solution to the ratchet effect dilemma and the associated problems of under-investment is proposed by Mayer and Vickers (1996)⁵. Allowable prices in this scheme depend upon the profits of other regulated firms, the yardsticks, rather than own profits. In the same way that Shleifer's proposal eliminates the incentive to raise costs (reduce effort) relative price or profit regulation eliminates the problem of profit measurement associated with profit sharing schemes. The future profits/prices of firm i do not depend upon the current profits of firm i but on the average profits of the other firms in the sector so there is no incentive not to maximise current profits and no incentive to distort current profits.

In fact this is a simplification, formally yardstick competition of this form is an explicit incentive scheme, yet because of the the heterogeneity of firms and the different determinants of profits, the scheme is likely to be implicit rather than explicit and therefore lose some of its power.

The principal message of both the Meyer and Vickers and Mayer and Vickers⁶ papers is that the response to the ratchet effect should not be to introduce sliding scale or profit sharing regulation but instead to make better use of the the range of comparative information available to regulate firms.

⁵Colin Mayer and John Vickers, Profit Sharing Regulation: An Economic Appraisal, *Fiscal Studies* Vol 17 No 1 p1-18 - the proposal is usually associated with Colin Mayer rather than John Vickers

⁶It's not just to confuse you! Meg Meyer and Colin Mayer are unrelated academics, both at Oxford with Vickers before he moved to the Office of Fair Trading