Why Regulate?
- Regulation of an industry is required when it is not possible or desirable to introduce competition as a way of reducing market power
  - For example, in electricity and water distribution introducing competition would involve replicating a distribution network which would be economically inefficient

Aim of Regulation
- In an industry characterised by monopoly supply, lack of competition allows the monopolist to charge a price above marginal cost reducing the welfare of consumers
- Regulation acts as a mechanism to set prices at a level which increases economic welfare whilst still providing the monopolist with an incentive to supply
Intuition behind Shleifer’s model

- In 1985, Shleifer proposed a new form of regulation
  - Criticised the prevailing regulatory regime known as “Cost of Service” regulation
    - Under this type of regulation, the regulator adjusts prices to equal costs
    - Prevents welfare losses from monopoly pricing but gives the firm no incentive to minimise costs
    - The regulator does not have sufficient information to know what the appropriate cost level should be
  - Shleifer argued that what the regulator needed was:
    "...some simple benchmark other than the firm’s present or past performance, against which to evaluate the firm's potential"

- Shleifer suggests comparing similar regulated firms
  - The regulator can use the costs of comparable firms to calculate the firm's attainable cost level
  - For example, rewarding hospitals on the basis of costs incurred by comparable hospitals in treating patients with the same disorder

2. Theory of Yardstick Competition with Identical Firms
Model assumptions:
- N risk-neutral firms, operating in an environment with no uncertainty, facing the same demand curve \( q(p) \) in separate markets.
- Firms are identical. They face the same constant marginal costs \( c_0 \) and the same cost-reduction technology \( R(c) \).
- Lump sum transfers \( T \) are available to the regulator.

In this model firm profits are defined as:

\[
\Pi = [(p - c) \cdot q(p)] - R(c) + T
\]

Profits = (price - marginal cost) \times \text{quantity} - \text{Cost reduction expenditure} + \text{Cash transfers}

Consider the case where \( R(c) \) is known to the regulator.

The regulator assigns equal weight to producer and consumer welfare.

Regulator optimisation problem is:

\[
\begin{align*}
\text{Maximise Society Welfare subject to } & \Pi \geq 0 \\
\Pi &= [(p - c) \cdot q(p)] + T - R(c)
\end{align*}
\]

The optimisation conditions for this problem are:

\[
p^* = c^* \quad \text{price = marginal cost}
\]

\[
\text{MC of cost reduction} = \text{MB of cost reduction}
\]

\[
R(c^*) = T^*
\]
Yardstick Competition with Identical Firms

Consider the case where \( R(c) \) is unknown to the regulator:

<table>
<thead>
<tr>
<th>Game stage</th>
<th>Cost of service</th>
<th>Yardstick</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulator announces “rules of the game”</td>
<td>( p = c )</td>
<td>( p = c )</td>
</tr>
<tr>
<td></td>
<td>( T = R(c) )</td>
<td>( T = \overline{R} )</td>
</tr>
<tr>
<td>Firms simultaneously invest in cost reduction</td>
<td>( MC \neq MB )</td>
<td>( MC = MB )</td>
</tr>
<tr>
<td></td>
<td>( R(c) = 0 )</td>
<td></td>
</tr>
<tr>
<td>Outcome is implemented</td>
<td>Not socially optimal</td>
<td>Socially optimal</td>
</tr>
</tbody>
</table>

Yardstick competition delivers the first best outcome because firm and regulator optimisation conditions coincide. The optimal outcome is revealed to the regulator and attained as the outcome. This result crucially depends on the assumption that the regulator’s “rules of the game” announcement are credible. In practice regulators are unlikely to let a deviating firm go out of business especially in industries such as the utilities where security of supply issues are paramount.
Identical firms – Average cost pricing

- Cash transfers are rarely available to the regulator
  - Shleifer proposes an average cost pricing approach
  - Due to fixed cost-reduction expenditure average costs are decreasing in this model.
  - Thus average cost pricing yields higher prices

- This approach delivers the second-best outcome

- Average cost pricing used in the example of Medicare
  - Medicare defines 500 diagnosis groups
  - Based on physician diagnosis each patient is assigned to a group
  - The hospital is compensated for patient treatment by a fixed fee based on his group
  - This fee is the mean average cost of treating patients of that group in other hospitals

3. Yardstick Competition with Heterogeneous Companies
Yardstick Competition with Heterogeneous Companies

- Analysis so far has assumed identical firms
  - Theory of yardstick competition can be generalised to heterogeneous companies if the regulator is able to observe the characteristics that make the firms differ
  - Assume firms have observable exogenous characteristics $\theta$, i.e. these are characteristics that cannot be altered by the firm

- The first-best outcome can still be achieved
  - The earlier analysis for homogenous firms showed that the first-best outcome could be achieved because the firm’s profit maximising decisions coincides with the social optimum
  - With heterogeneous firms this result can be replicated, however, setting the price becomes more complex
  - The regulator must run a regression of costs on the characteristics that determine diversity

$$c = m + b\theta$$

where $c$ is the firm’s cost level and $\theta$ is a vector of exogenous characteristics

- Regulator sets $p_i = c_i$ and sets the transfer to the firm equal to the predicted cost-reduction expenditure for the firm, taking into account the firm’s characteristics $\theta$

This result can be shown diagrammatically

- The average cost per unit across the industry is $m$
  - At $P^* = m$, monopolist A makes a profit whilst monopolist B makes a loss
  - But, monopolist B faces higher costs because of the impact of some exogenous characteristic $\theta$
  - The regulator can shift the price cap from $m$ to $m+b\theta$, however, monopolist B must still continue to reduce costs to ensure that in the long-run, $\pi \geq 0$

Yardstick Competition with Heterogeneous Companies

- **Accuracy of this approach**
  - If the regulator is able to observe accurately all the potential factors that cause the differences between firms, i.e. if the $R^2$ of the regression equation is equal to one, then the first-best outcome is achieved.
  - But, if some heterogeneity is not accounted for, then the actual outcome will differ from the optimum.
    - The higher the $R^2$ of the regression, the smaller the divergence between the actual and optimum outcomes.

- **Problems with this method**
  - Omitted variable bias
    - If the regression is run on an incorrect vector of exogenous factors $θ$, then the calculated value of $b$ will be incorrect and thus it becomes highly unlikely that the social optimum is achieved.
  - Endogenous variables
    - The assumption is made that the differentiating factors are not affected by decisions made by the firms – this may not always be realistic.

4. Yardstick Competition in the UK Water Industry
Yardstick Competition in the UK Water Industry

- Regional structure of the water industry allows regulator to make comparisons between firms
  - UK water industry was initially regulated according to RPI+K, a special case of RPI-X regulation which allowed the water companies to claw-back the costs of investment
    - Yardstick competition was used in the initial K setting process
  - A comparative efficiency review was undertaken by the Department of the Environment
    - Took into account the influence of outside factors such as the size of the distribution area, no. of customers etc, to explain differences in unit operating costs
    - Factors were combined into an “explanatory factor index” using the approach outlined by Shleifer
    - The review placed the water companies into four efficiency bands which determined the assumed reduction in operating costs

Problems with Yardstick Competition in practice

- Difficult to accurately define operating costs as the water companies had some discretion over the classification of costs as opex and capex
  - In addition, the study did not take into account that in the long-run capex can substitute for opex
  - The output measure that acts as the denominator of unit costs is hard to define, for example, should leakages count as output
  - The regressions run did not include a measure for genuine random differences such as climatic differences

- Yardstick competition was initially described as data ‘light’
  - In reality, to generate accurate models of the differences between companies requires significant quantities of data and econometric modelling skills
5. Conclusions

Conclusion

- Yardstick competition has brought the attention of regulation literature to creating appropriate incentives for firms
- It enables regulators to induce competition between firms serving different markets
- However:
  - Implementation for heterogeneous firms requires subjectivity
  - The scheme is susceptible to collusive manipulation by participating firms
  - Competition between utilities leads to a reduction of information sharing between firms with regard to technical or other problems. This hinders the cost reduction process (Sawkins, 1995)
- Literature attention toward hybrid regulatory systems
  - Yardstick competition can play an important role in future regulatory efforts as part of a hybrid regulatory scheme