

# The Averch-Johnson Effect

## Economics of Competition and Monopoly

### 1 Rate of Return Regulation

This form of regulation in its purest form takes costs as exogenous and observable and forms prices on the basis of observed costs included and appropriate rate of return on capital.

One of the principal criticisms that have arisen for the kind of rate of return regulation practised in the United States is that the incentive for productive efficiency are reduced. In particular the input choice of the regulated firm will be distorted. While this effect is widely quoted there are a number of misunderstandings regarding the nature and significance of the theoretical result and there has been a fairly substantial empirical literature that has questioned whether it is relevant in practice. We will look at the theoretical result to illustrate what it does or does not show and look at the empirical relevance.

The key aspect of rate of return regulation is that the principal restriction on the regulated firm is that the rate of return it can earn on capital is restricted to a value  $s$ . In order for the firm to be able to finance its operations, secure funds for its investments, the firm has to be able to earn a return equivalent to its cost of capital  $r$ . As it is difficult to determine the exact cost of capital and there is a hard constraint that the permitted rate of return should not be less than  $r$  the permitted rate  $s$  will typically be above  $r$ .

The usual (and somewhat misleading) statement of the Averch Johnson result is that because  $s > r$  there is an incentive for the firm to overinvest in capital to earn higher absolute values of profit. This can lead to a number of conclusions (some true some false). These can be characterised as.

**Proposition 1** *The input choice chosen by the firm subject to rate of return regulation will not be the cost minimising choice.*[TRUE]

**Proposition 2** *The capital labour ratio chosen by the firm subject to rate of return regulation will be greater than the cost minimising capital labour ratio for the given the level of output.[TRUE]*

**Proposition 3** *The capital labour ratio chosen by the firm subject to rate of return regulation will be greater than the capital labour ratio of the unregulated firm.[FALSE]*

**Proposition 4** *The problem is reduced when the permitted rate of return  $s$  converges towards the cost of capital  $r$ . [FALSE]*

Further discussion of the Averch Johnson model then develops this proposition.

**Proposition 5** *The regulated firm will produce an output level higher than that produced by an unregulated monopolist.[FALSE]*

## 1.1 The A-J Model

The model follows the following format. There are two inputs  $K$ , capital and  $L$ , labour. A wage rate  $w$  and a cost of capital  $r$ . There is a downward sloping demand curve for the final good  $p(q)$ . The firm's profit is given by,

$$\pi = p.q - w.L - r.K$$

and the regulatory constraint is that the rate of return (gross profit i.e. revenue minus variable (labour) costs as a proportion of capital) should not exceed a fixed value  $s$ . That is,

$$\frac{p.q - w.L}{K} \leq s > r$$

A diagrammatic exposition is given that indicates the process. 1 indicates in two dimensional space the iso profit curves that arise from different combinations of labour and capital.

2 indicates in three dimensional space the constraint  $\pi = v.K = (s - r)K$ .

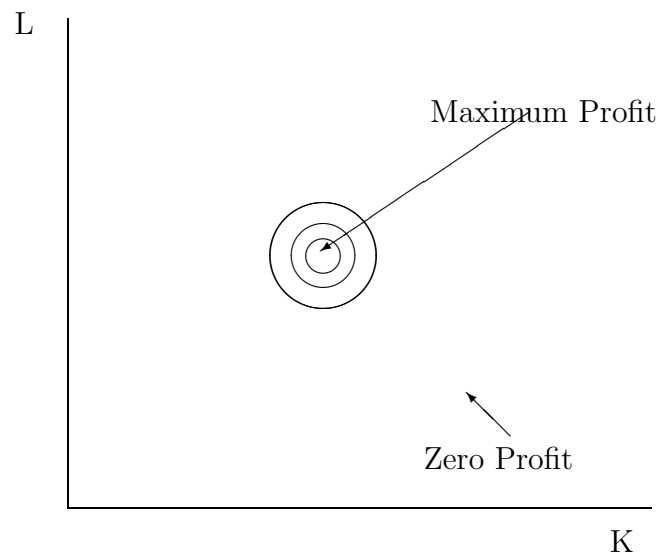


Figure 1: Isoprofit Curves

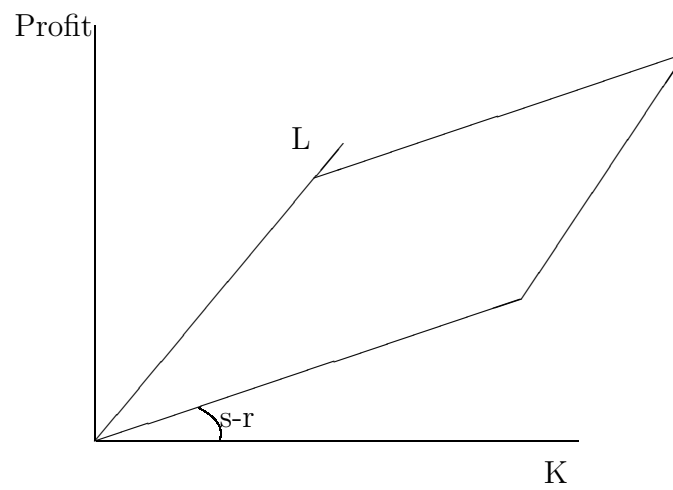


Figure 2: Profit Constraint

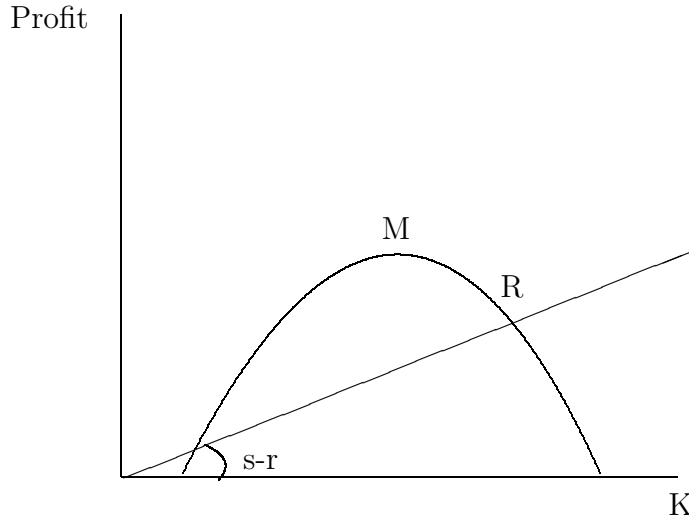


Figure 3: Profit hill and constraint

We can also combine one possible constraint with the profit function to indicate the possible profit combinations subject to the constraint.

We can indicate that relative to the efficient locus the regulated firm will be producing with more capital and less labour than is efficient hence must have a higher capital labour ratio. It will therefore not be efficient. This demonstrates the first two propositions.

The third proposition can be illustrated by means of diagrams to show that it is conceivable although not necessarily likely that the capital labour ratio may be lower than the unregulated monopolist. Note that they will typically produce different levels of output which account for the difference between propositions 2 and 3.

The fourth proposition is based upon a misunderstanding. The argument runs like this. If the firm earns a higher return on each unit of capital employed, i.e. as the value of  $s$  is higher, that increases the desire to use capital and so the problem is aggravated. In fact the truth is the opposite it is when the  $s$  converges to  $r$  that the problem becomes most severe. To see this note two aspects.

1. If there is no regulatory constraint i.e.  $s$  is set as high as the unregulated monopolists rate of return, then we have already shown that the unregulated monopolist will cost minimise and produce efficiently.
2. If the regulatory constraint is complete so that  $s = r$  then there is no

incentive to choose any particular input combination or minimise costs. Since the regulation effectively becomes cost of service regulation with reimbursement of all costs there is no incentive either to minimise costs or to choose any particular method for producing.

It is therefore the existence of the constraint rather than the fact that  $s > r$  that is the primary cause of the distortion. The constraint leads the firm to distort input choice.

The third false proposition which has been inferred about the Averch Johnson model is that because there is an incentive to overinvest in capital, output will be higher under rate of return regulation than under unregulated monopoly. This is not necessarily true. While there will be more capital employed there may be less labour employed and therefore output may be lower or higher accordingly depending upon the production function and the relative strengths of the two effects, increasing use of capital but potentially reducing use of labour.

## 1.2 Further aspects of the A-J effect

One tweak to the A-J model is that because the firm is operating where price is falling and marginal revenue may be negative it has an incentive to reduce output towards the monopolist's level of output if it can do so within the constraint. One possible way to do this is gold plating. If capital is purchased above cost or which has low or zero marginal product this increases capital without increasing output hence sales. Therefore price can remain high and the firm may restrict output below the level it would otherwise choose. If we return to the constraint

$$\frac{p.q - w.L}{K} \leq s > r$$

If the firm is an unregulated monopolist to start with one possible response to the regulatory constraint is to buy lots of unproductive capital that lowers the rate of return but leaves quantity and labour input unchanged.

In practice the regulator is not completely naive and is therefore aware of these possibilities and can take potential action to remedy them. Audit of investment projects is one way to prevent overcapitalisation. Another is the existence of a regulatory lag. In order to justify the higher prices that

are implied from an investment programme the firm must apply for a price increase and this is not instantaneous and the regulatory lag may be quite long. In this case the incentive for the firm to remain efficient is larger as it must make profits at the old price regime.

The empirical evidence is broadly suggestive of an overcapitalisation bias but it is beset with difficulties of comparability across different types of plant and the fact that plant choice is one element of the capitalisation decision. One factor that indicates the capitalisation bias in rate of return regulation is the very limited use of peak load pricing in those areas notably the US where it has been used. The gradual introduction of price cap type regulation has started however to change this.