AVERCH-JOHNSON EFFECT

• Consider a regulated firm producing a single good with two factor inputs; capital $K$ and labor $L$.

• The firm’s production function is denoted by $f(K, L)$.

• The per unit costs of capital and labor are denoted by $r$ and $w$, respectively.

• The inverse demand function is denoted by $p(Q)$. 
EFFICIENT PRODUCTION
Let us suppose first the firm is forced to produce at a certain level $Q^*$. The optimal combination of inputs required to achieve this level of output is the solution to

$$\min_{K,L} rK + wL$$

s.t

$$f(K, L) \geq Q^*$$
Isoquant

slope depends on substitability between capital and labor
Minimal cost production

\[ f(K, L) = Q^* \]
Efficient “Path”
Note that at the optimal solution $E(Q^*) = (K^*, L^*)$ we have

$$\frac{\partial f(K,L)}{\partial K} : \frac{\partial f(K,L)}{\partial L} = \frac{r}{w}$$

The ratio of marginal productivity equals that of inputs.
RATE OF RETURN REGULATION
Let us denote by $\Pi(K, L)$ the firm’s profit for $K$ and $L$:

$$\Pi(K, L) = p(Q)Q - rK - wL$$

where $Q = f(K, L)$.

In their seminal paper, Averch & Johnson (1961) modeled rate of return regulation as a constraint of the form

$$\frac{p(Q)Q - wL}{K} \leq r^*$$
where \( r^* > r \) is the \textit{allowed} rate of return. Note that the previous equation can be rewritten as:

\[
\Pi(K, L) \leq K(r^* - r)
\]
Rate of Return Regulation
$O$ is the (unregulated) optimal profit combination and $M = (K^M, L^M)$ is the optimal solution to the problem:

$$\max_{K,L} \Pi(K, L)$$

s.t

$$\Pi(K, L) \leq K(r^* - r)$$

Note that at point $M$, the firm is also using maximum level of capital allowed.
RELATIONSHIP BETWEEN POINTS \( E \) AND \( M \)

Let us now consider the efficient production combination for output \( Q^M = f(K^M, L^M) \) say \( E(Q^M) = (K^*, L^*) \)

There are two possibilities:

- (Case A) Either \( K^* > K^M \) and \( L^* < L^M \)
- (Case B) Or \( K^* < K^M \) and \( L^* > L^M \)
Impossibility of Case A

Isoquant at $Q^M$
Case B (Averch-Johnson Effect)
In Case B, we have that the firm uses up more capital than is socially optimal. Mathematically,

\[
\frac{\partial f(K,L)}{\partial K} \quad \frac{\partial f(K,L)}{\partial L} = \frac{r - \alpha}{w}
\]

where \( \alpha < r \).
CRITICISMS OF AVERCH-JOHNSON RESULT

• There is very little empirical evidence supporting it.
• Assumptions are too strong.
• In particular, it ignores investment dynamics