

Technical change and the declining rate of profit

Paul Cockshott

March 11, 1996

let K = capital stock : h
let δ = rate of depreciation : t^{-1} we assume that this is a small negative number

let w = wages : ht^{-1}

let p = profit : ht^{-1}

let capitalist consumption = c : ht^{-1}

let a = accumulation : ht^{-1}

let total labour supply = L : ht^{-1}

let surplus value $s = L - w$

We will use primed notation for derivatives with respect to time.

$$(1) K' = a + \delta K$$

$$(2) p = L - w + \delta K$$

$$(3) p = a + c$$

$$(4) r = \frac{p}{K}$$

We wish to obtain r' the rate of change of the rate of profit with respect to time.

Differentiating (4) we get

$$(5) r' = P(K^{-1})' + K^{-1}p'$$

But $(K^{-1})' = -K^{-2}K'$ and $p' = (a + c)'$, if we assume that capitalist consumption is fixed this simplifies to $p' = a'$.

By (2) and (3) we have

$$(6) a = L - w - c + \delta K,$$

if we assume L, w, c all are constants then $a' = +\delta K'$. Substituting into (5) we get

$$(7) r' = \frac{-p}{K^2}K' + \frac{\delta K'}{K}$$

substituting in (1) we get

$$r' = \left(\frac{-p}{K^2} + \frac{\delta}{K}\right)(a + \delta K)$$

substituting for a and p we get

$$r' = \left(\frac{(w - L - \delta K)}{K^2} + \frac{\delta}{K}\right)(L - w - c + 2\delta K)$$

Taking $s = L - w$ this simplifies to

$$(8) \quad r' = \frac{cs - s^2}{K^2} - \frac{2s\delta}{K}$$

We now have two terms affecting the rate of profit the first due to the change in the organic composition, the second to the cheapening of the elements of constant capital. Clearly, we have $cs < s^2$ when accumulation is occurring since $c < s$, so the first term is negative.

But if we have a cheapening of constant capital δ will be negative, so the second term tends to raise the rate of change of the rate of profit (r'). But by (2) this occurs at the cost of a reduction of the actual rate of profit.

Effectively a cheapening of the elements of constant capital so reduces the level of profits that accumulation is choked off, which is why the effect is to slow the subsequent fall in profits.

An example

Assume capital stock $K = 1000$, available labour $L = 200$, wages $w = 100$ and capitalist consumption $c = 50$. If there is no cheapening of the elements of constant capital then the rate of profit $r = 0.1$, and the rate of change of the rate of profit will be $r' = -0.005$ or a fall of half a percent per year.

If we assume a 5 percent per annum cheapening of the elements of constant capital, then the rate of profit falls by (2) to $r = 0.05$, half of what it was before, and at this rate of profit there is no money for accumulation as a result the capital stock declines by 50 per year and the rate of profit rises by half a percent per year. This roughly describes the sort of thing going on in the UK today.

A cheapening of the elements of constant capital thus implies a period of lower profits and economic stagnation until the rate of profit eventually rises again due to the depreciation of the capital stock and accumulation resumes.

Thus for any given rate of surplus value, cheapening and capitalist consumption there is a potential long run equilibrium rate of profit.