(I) (1) WE CAN INTERPRET λ & ϕ AS FOLLOWS

(i) $0<\lambda<1$: IF $L_A \uparrow$ by 1 unit $\dot{A} \uparrow$ by less than 1 unit $\Rightarrow$ "STEPPING ON EACH OTHER TOES" : WHEN THE # OF RESEARCHERS $\uparrow$ IT IS HARDER TO DISCOVER NEW THINGS

(ii) $\phi<1$: $\uparrow$ IN A $\Rightarrow \uparrow \dot{A}$, IN OTHER WORDS A HIGHER STOCK OF IDEAS FACILITATES THE PRODUCTION OF NEW IDEAS $\Rightarrow$ "STANDING ON SHOULDERS OF GIANTS"

(2) $\boxed{\hat{A}}$ CALCULATION NOW (4) IS: $\dot{A} = \delta L_A \Rightarrow \boxed{\frac{\dot{A}}{A}} = \hat{A} = \boxed{\frac{\delta L_A}{A}}$

$\boxed{\hat{k}}$ CALCULATION $\hat{k} = \hat{K} - \hat{L} = \hat{K} - n$

USING EQUATION (3) :

$$\frac{\dot{K}}{K} = s_K \frac{Y}{K} \Rightarrow \hat{K} = s_K \frac{Y}{K} \frac{}{L} = s_K \frac{y}{k}$$

DIVIDING & MULT. BY L

THEN $\boxed{\hat{k}} = \hat{K} - n = \boxed{s_K \frac{y}{k} - n}$

$\boxed{\hat{y}}$ CALCULATION - DIVIDING (1) BY L :

$$y = \frac{Y}{L} = \left(\frac{K}{L}\right)^{\alpha} \left(A \frac{L_Y}{L}\right)^{1-\alpha} = k^{\alpha} A^{1-\alpha} s_Y^{1-\alpha}$$

$\Rightarrow$ TAKING GROWTH RATES

$$\boxed{\hat{y} = \alpha \hat{k} + (1-\alpha)\hat{A} + (1-\alpha)\hat{s}_Y}$$

(3) ALONG A BGP, THE STOCK OF IDEAS (A) & ALL PER CAPITA / PER WORKER VARIABLE ARE GROWING AT A CONSTANT RATE.

i.e.

$\hat{A}$ = CONSTANT, $\hat{y}$ = CONSTANT

$\hat{k}$ = CONSTANT

(4) FROM (2) WE HAVE THAT

$$\hat{A} = \delta \frac{L_A}{A}$$

ALONG A BGP, $\hat{A}$ CONSTANT $\Rightarrow \hat{L}_A = \hat{A}$

SINCE $\hat{L}_A = n$ BY ASSUMPTION,

ALONG A BGP: $\boxed{\hat{A} = n}$

(5) $\hat{y}$ ALONG B.G.P.

ONE OF THE CONDITIONS FOR BGP IS

$\hat{k}$ = CONSTANT

- FROM (2) WE HAVE THAT $\hat{k} = s_K \frac{y}{k} - n$

$\Rightarrow s_K \frac{y}{k}$ CONSTANT $\Rightarrow \frac{y}{k}$ CONSTANT $\Rightarrow$

$$\hat{y} = \hat{k}$$

- FROM (3) WE HAVE THAT

$$\hat{y} = \alpha \hat{k} + (1-\alpha)\hat{A} + \underbrace{(1-\alpha)}_{0} \hat{s}_Y^{=0}$$ by ASSUMP THAT $\hat{s}_Y = 0$

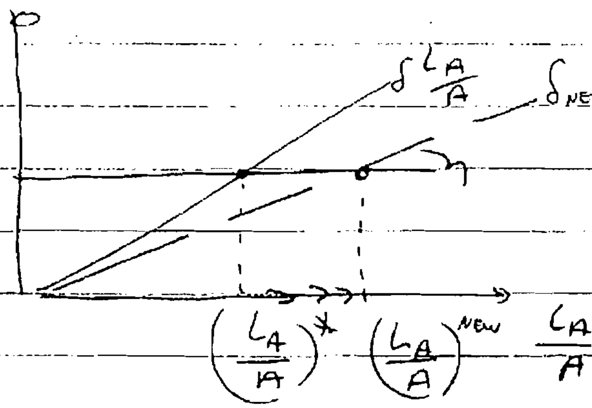
$\Rightarrow (1-\alpha)\hat{y} = (1-\alpha)\hat{A}$

$\Rightarrow \boxed{\hat{y} = \hat{A}}$ then $\boxed{\hat{y} = n}$

(6) C.S. WE LOOK AT THE BEHAVIOR OF $\hat{A}$

$\hat{A} = \delta \frac{L_A}{A}$ always

$\hat{A} = n$ along BGP



AT BGP, WE HAVE $\frac{L_A}{A} = \left(\frac{L_A}{A}\right)^*$

If $\delta \downarrow \Rightarrow$

THE NEW S.S. VALUE OF $\frac{L_A}{A}$ IS

HIGHER: $\left(\frac{L_A}{A}\right)^{NEW}$ ~~[illegible]~~ BUT $\hat{A}$ IS STILL n at THE NEW STEADY STATE (OR ALONG THE NEW BGP)

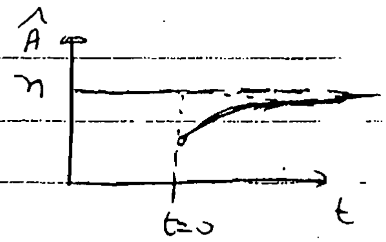
THE INTUITION IS THAT BECAUSE $\delta \downarrow$, FOR A WHILE A GROWS SLOWER THAN L_A & $\frac{L_A}{A} \uparrow$ UNTIL THE NEW EQUILIBRIUM IS REACHED

AT $t = 0$, $\hat{A}_{t_0} = \delta_{NEW} \frac{L_A}{A}$ IS BELOW n, then

THE RATIO $\frac{L_A}{A}$ GOES UP SINCE

$\hat{A}_{t_0} = \delta_{NEW} \left(\frac{L_A}{A}\right)^* < \hat{L}_A$

$\qquad\qquad\qquad\qquad\quad \shortparallel$
$\qquad\qquad\qquad\qquad\quad n$



↳ THE GROWTH RATE OF IDEAS GOES DOWN TEMPORARILY & THEN RETURNS TO n.

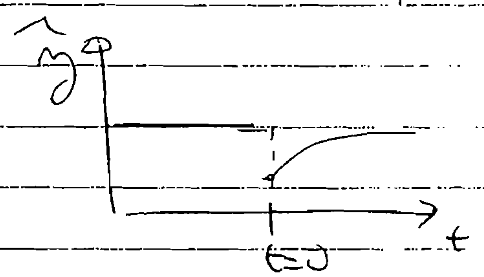
$$\hat{y} = \alpha \hat{k} + (1-\alpha)\hat{A}$$

ALSO $\hat{k} = s_K \frac{y}{k} - n = k^{\alpha-1} \underbrace{A^{1-\alpha} s_Y^{1-\alpha}}$

AT $t=0$ $\hat{A}$ GOES DOWN, $\hat{k}$ DOES NOT CHANGE

$\Rightarrow$ $\hat{y}$ GOES DOWN.

AFTER THE ADJUSTMENT IS COMPLETED THE GROWTH RATE $\hat{y}$ RETURNS TO n

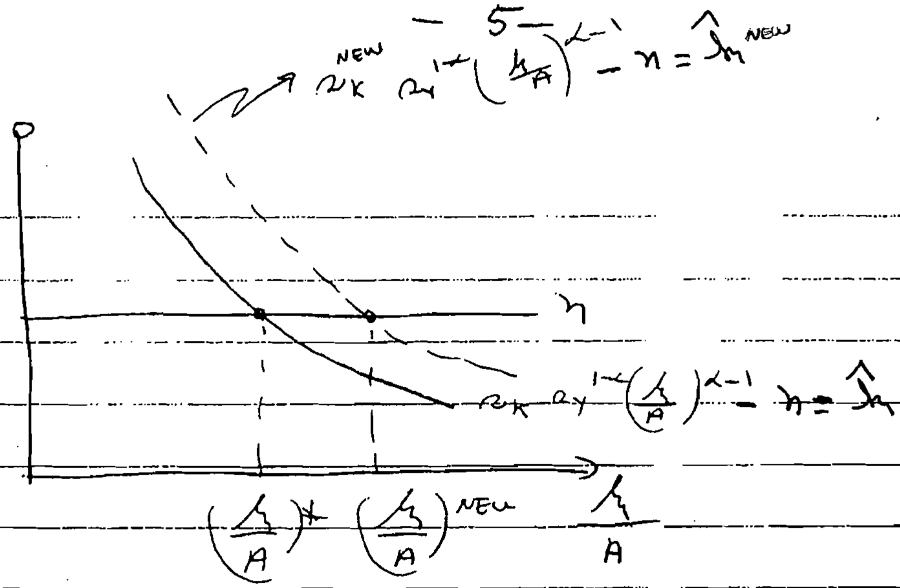


(7) FROM (1)

$$y = k^{\alpha} A^{1-\alpha} s_Y^{1-\alpha} \quad \& \quad \hat{k} = s_K \frac{y}{k} - n$$

$$\Rightarrow \frac{y}{k} = k^{\alpha-1} A^{1-\alpha} s_Y^{1-\alpha} = \left(\frac{k}{A}\right)^{\alpha-1} s_Y^{1-\alpha}$$

$$\boxed{\hat{k} = s_K \, s_Y^{1-\alpha} \left(\frac{k}{A}\right)^{\alpha-1} - n}$$



At $t=0$, $a_K \uparrow$ $\Rightarrow$ Curve shifts right

$\Rightarrow$ At new BGP $\frac{k}{A}$ higher but still $\hat{k} = n = \hat{y}$

therefore there are only temporary effects

As $a_K \uparrow$ at $t=0$, $\hat{k} > n$

Since $\hat{A} = n$ $\Rightarrow$ $\frac{k}{A} \uparrow$

Since $\hat{y} = \alpha \hat{k} + (1-\alpha)\hat{A} + (1-\alpha)\hat{a}_Y$

$\hat{y} \uparrow$ at $t=0$