ELL 707

30.01.2020

BFS 3.3

i) Equilibrium point

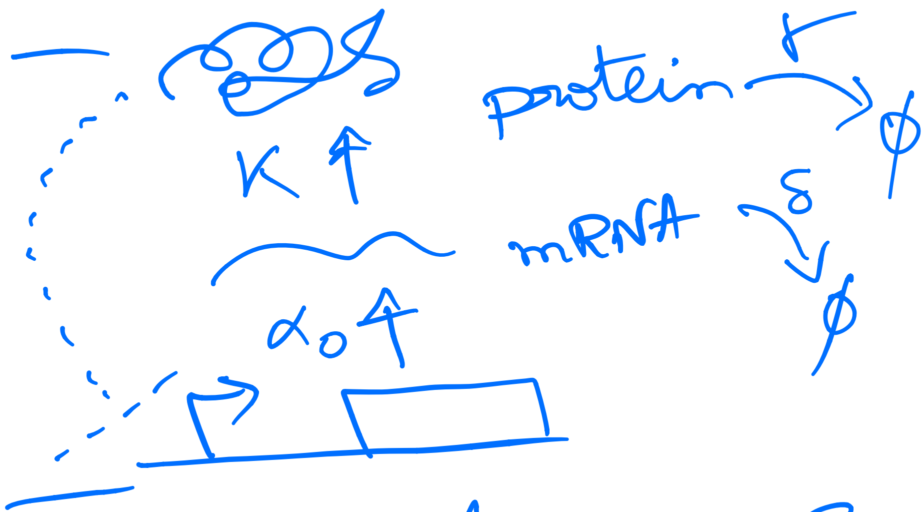
$$\frac{dm_p}{dt} = 0 = \frac{dP}{dt}$$

$$m_p^* = \frac{\alpha_0}{\delta}$$

$$P^* = \frac{K}{\gamma} \cdot \frac{\alpha_0}{\delta} + \frac{d(t)}{\gamma}$$

open loop

$= 0$ for steady-state calculation



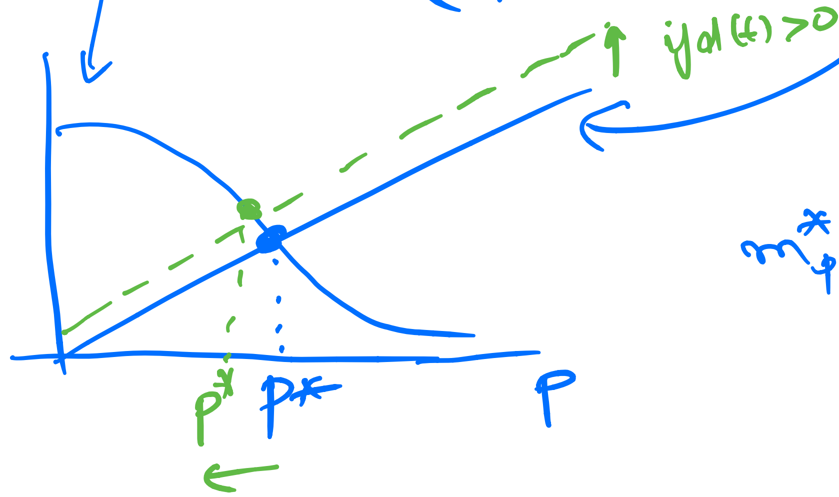
$= 0$

$$\alpha_0 + \frac{\alpha}{1 + (P/K)^n} = \delta m_p$$

These are different

$$K m_p = \gamma P - d(t)$$

$$\Rightarrow \alpha_0 + \frac{\alpha}{1+\left(P/K\right)^n} = \frac{\delta}{\chi}\cdot \gamma P - \frac{d(t)}{\chi}$$

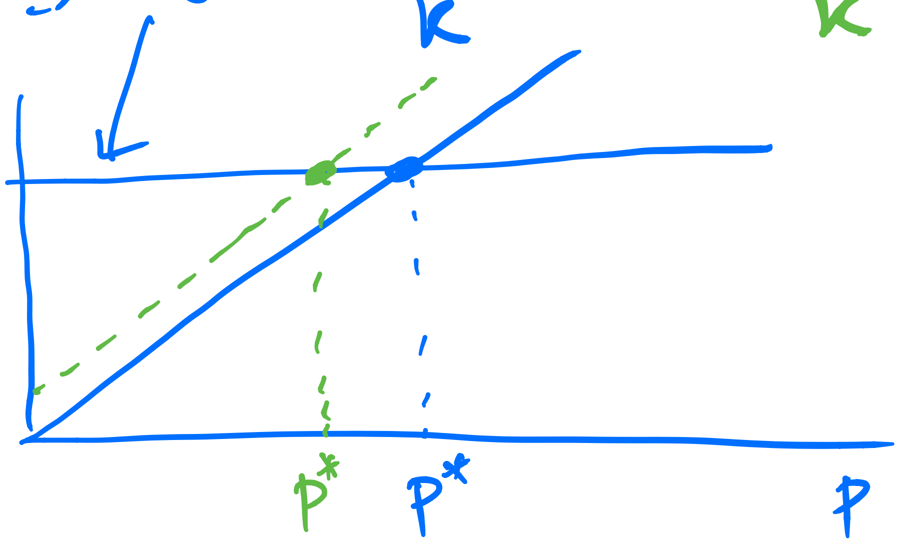


$$m_p^* = \frac{\delta}{\chi}\cdot p^*$$

for open loop,

$$K\frac{\alpha_0}{\delta} = \gamma P - d(t)$$

$$\Rightarrow \alpha_0 = \frac{\delta}{K}\gamma P - \frac{d(t)}{K}$$



What question do these graphs answer?

steady-state, $p^* = p^*(d(t))$

if $\underset{=0}{d(t)} \to \underset{\neq 0}{d(t)}$, how much does p^* change?

→ Calculate frequency response

→ Calculate p^* for $n=1$

→ some other thing

↳ 3.8

→ 2.1, 2.2, 2.3, 2.4, 2.5, 2.7, 2.8, 2.9, 2.10,

→ 5.1, 5.2, 5.3

$\overline{n=1}$, negative feedback, calculate steady-state

$$\underbrace{\alpha_0}_{=0 \text{ for simplicity}} + \frac{\alpha}{1+P/K} = \frac{\delta}{x}\cdot r P$$

$$\Rightarrow -\alpha + \frac{\delta}{x} r p + \frac{\delta}{x}\cdot r\cdot\frac{1}{K} p^2 = 0$$

$$\Rightarrow p^2 + K P - K\frac{\alpha}{r}\cdot\frac{x}{\delta} = 0$$

$$\Rightarrow p^* = \frac{1}{2}\left(\sqrt{K^2 + 4\frac{\alpha}{r}\cdot\frac{x}{\delta}\cdot K} - K\right)$$

$$\Rightarrow p^* = \frac{K}{2}\left(\sqrt{1 + \frac{4\cdot\frac{\alpha}{r}\cdot\frac{x}{\delta}}{K}} - 1\right)$$

Suppose $K >> \frac{\alpha}{F} \cdot \frac{\varkappa}{\delta}$,

$$\Rightarrow p^* = \frac{K}{2}\left(\left(1 + \frac{4\frac{\alpha}{F}\frac{\varkappa}{\delta}}{K}\right)^{1/2} - 1\right)$$

$$\simeq \frac{K}{2} \cdot \frac{1}{2} \cdot 4\, \frac{\frac{\alpha}{F}\frac{\varkappa}{\delta}}{K} = \frac{\alpha}{F} \cdot \frac{\varkappa}{\delta}$$

Suppose $K << \frac{\alpha}{F} \cdot \frac{\varkappa}{\delta}$

$$\Rightarrow \quad p^* \simeq \frac{K}{2}\left(\sqrt{\frac{4\frac{\alpha}{F}\cdot\frac{\varkappa}{\delta}}{K}} - 1\right)$$

$$= K\left(\sqrt{\frac{\alpha}{F}\cdot\frac{\varkappa}{\delta}/K} - \frac{1}{2}\right)$$