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4) $\frac{P}{KT} = A + B\frac{\mu^\alpha}{KT} \ni \mu^\alpha = \frac{1}{B}(p - KTA)$ (1)

$\frac{P}{KT} = C + D\left(\frac{\mu^\gamma}{KT}\right)^2 \ni \mu^\gamma = \sqrt{\frac{KT}{D}(p - KTC)}$ (2)

From (1) & (2):

$$G^\alpha = \int \mu^\alpha dN^\alpha = \int \frac{1}{B}(p - KTA)\, dN^\alpha = \frac{N^\alpha}{B}(p - KTA)$$

$$G^\gamma = \int \mu^\gamma dN^\gamma = \int \left(\frac{KT}{D}[p - KTC]\right)^{1/2} dN^\gamma = N^\gamma \sqrt{\frac{KT}{D}(p - KTC)}$$

but $V = \frac{1}{N}\left(\frac{\partial G}{\partial p}\right)_{T,N}$:

$$V^\alpha = \frac{1}{N^\alpha}\frac{\partial}{\partial p}\left(\frac{N^\alpha}{B}(p - KTA)\right)$$

$$= \frac{1}{B} \quad (3)$$

$$V^\gamma = \frac{1}{N^\gamma}\frac{\partial}{\partial p}\left(N^\gamma \sqrt{\frac{KT}{D}(p - KTC)}\right)$$

$$= \frac{KT}{2D}\left[\frac{KT}{D}(p - KTC)\right]^{-1/2} \quad (4)$$

From (3) & (4):

$$V^\alpha - V^\gamma = \frac{1}{B} - \frac{KT}{2D}\left[\frac{KT}{D}(p - KTC)\right]^{-1/2}$$

#

$$P = A + BM^{\alpha}$$

$$P = C + D(M^{\gamma})^2$$

at equilibrium:

$$M^{\alpha} = M^{\gamma}$$

$$P = C + D\left(\frac{P-A}{B}\right)^2$$

$$P = C + \frac{D}{B^2}(P^2 - 2AP + A^2)$$

$$0 = C + \frac{D}{B^2}P^2 - \frac{2AD}{B^2}P + \frac{DA^2}{B^2} - P$$

$$\Rightarrow P^2 - \left(2A + \frac{B^2}{D}\right)P + \left(A^2 + \frac{CB^2}{D}\right) = 0$$

$$P = \frac{\left(2A + \frac{B^2}{D}\right) \pm \left(\left(2A + \frac{B^2}{D}\right)^2 - 4\left(A^2 + \frac{CB^2}{D}\right)\right)^{1/2}}{2}$$

$$= \frac{1}{2}\left[\left(2A + \frac{B^2}{D}\right) \pm \frac{B}{D}\left(4(A-C)D + B^2\right)^{1/2}\right]$$

$$p = kT\left(A + \frac{B^2}{2D} \pm \frac{B}{2D}\sqrt{B^2 + 4D(A-C)}\right) \quad \#$$

Two solutions?

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