How to get the Gordon Growth Model from the Generalized Dividend Valuation Model?

The Generalized Dividend Valuation Model:

$$P_0 = \frac{D_0 \times (1+g)}{(1+k_e)} + \frac{D_0 \times (1+g)^2}{(1+k_e)^2} + \ldots + \frac{D_0 \times (1+g)^\infty}{(1+k_e)^\infty}$$

If we multiply both side by $\frac{1+k_e}{1+g}$, we get:

$$P_0 \times \frac{1+k_e}{1+g} = D_0 + \frac{D_0 \times (1+g)}{(1+k_e)} + \ldots + \frac{D_0 \times (1+g)^{\infty-1}}{(1+k_e)^{\infty-1}}$$

Subtract equation 1 from equation 2, we get:

$$P_0 \times \frac{1+k_e}{1+g} - P_0 = D_0 - \frac{D_0 \times (1+g)^\infty}{(1+k_e)^\infty}$$

If we assume that growth rate g is smaller than the required return on equity k_e, then we know:

$$\frac{(1+g)^\infty}{(1+k_e)^\infty} \to 0$$

Hence:

$$P_0 \times (\frac{1+k_e}{1+g} - 1) = D_0$$

$$P_0 = \frac{D_0 \times (1+g)}{(k_e - g)} = \frac{D_1}{(k_e - g)}$$