$$E\left[\pi\left(b_i, A, k, p\right)\right] = \int_A \left[1 - \mathbf{1}_{\text{cap}}\left(w\left(A\right), p\right)\right] \times$$

$$\left[\begin{array}{c} \int_0^{\bar{b}_{\text{case1}}(A)} b_i P^\sigma \frac{Y}{A} p_i^{1-\sigma} - b_i^{\frac{2}{2-\alpha}} w\left(A\right)^{\frac{2-2\alpha}{2-\alpha}} \left(\frac{P^\sigma Y p_i^{-\sigma}}{A z_i}\right)^{\frac{2}{2-\alpha}} \left(\frac{\chi}{k_i}\right)^{\frac{\alpha}{2-\alpha}} \left[\left(\frac{2-2\alpha}{\alpha}\right)^{\frac{\alpha}{2-\alpha}} + \left(\frac{\alpha}{2-2\alpha}\right)^{\frac{2(1-\alpha)}{2-\alpha}}\right] df\left(b\right) \quad + \\ \int_{\bar{b}_{\text{case1}}(A)}^{\infty} \left(p_i z_i\right)^{\frac{2}{\alpha}} w\left(A\right)^{-\frac{2-2\alpha}{\alpha}} \frac{k_i}{\chi} \left[\left(\frac{2-2\alpha}{\alpha}\right)^{\frac{\alpha}{2-\alpha}} + \left(\frac{\alpha}{2-2\alpha}\right)^{\frac{2(1-\alpha)}{2-\alpha}}\right]^{-\frac{2-\alpha}{\alpha}} \left(\frac{2-\alpha}{2}\right)^{\frac{2}{\alpha}} \frac{\alpha}{2-\alpha} df\left(b\right) \end{array}\right.$$

$$\mathbf{1}_{\text{cap}}\left(w\left(A\right), p\right) \times$$

$$\left[\begin{array}{cc} \int_0^{\hat{\bar{b}}(A)} b_i P^\sigma \frac{Y}{A} p_i^{1-\sigma} - b_i^{\frac{2}{2-\alpha}} w\left(A\right)^{\frac{2-2\alpha}{2-\alpha}} \left(\frac{P^\sigma Y p_i^{-\sigma}}{A z_i}\right)^{\frac{2}{2-\alpha}} \left(\frac{\chi}{k_i}\right)^{\frac{\alpha}{2-\alpha}} \left[\left(\frac{2-2\alpha}{\alpha}\right)^{\frac{\alpha}{2-\alpha}} + \left(\frac{\alpha}{2-2\alpha}\right)^{\frac{2(1-\alpha)}{2-\alpha}}\right] df\left(b\right) & + \\ \int_{\hat{\bar{b}}(A)}^{\bar{b}_{\text{case2}}(A)} b_i P^\sigma \frac{Y}{A} p_i^{1-\sigma} - b_i^{\frac{1}{1-\alpha}} w\left(A\right) \left(\frac{P^\sigma Y}{A z_i p_i^\sigma}\right)^{\frac{1}{1-\alpha}} k_i^{-\frac{\alpha}{1-\alpha}} - \chi k_i df\left(b\right) & + \\ \int_{\bar{b}_{\text{case2}}(A)}^{\infty} \left(p_i z_i\right)^{\frac{1}{\alpha}} w\left(A\right)^{-\frac{1-\alpha}{\alpha}} k_i \left(1-\alpha\right)_i^{\frac{1-\alpha}{\alpha}} \alpha - \chi k_i df\left(b\right) & \end{array}\right] df$$

Write the first square bracket as:

$$\int_0^{\bar{b}_{\text{case1}}(A)} b_i p_i^{1-\sigma} C_1\left(A\right) - b_i^{\frac{2}{2-\alpha}} p_i^{-\frac{2\sigma}{2-\alpha}} k^{-\frac{\alpha}{2-\alpha}} C_2\left(A\right) df\left(b\right) + \int_{\bar{b}_{\text{case1}}(A)}^{\infty} p_i^{\frac{2}{\alpha}} k_i C_3\left(A\right) df\left(b\right)$$

where $\bar{b}_{\text{case1}}\left(A\right) = p_i^{\frac{2-\alpha+\alpha\sigma}{\alpha}} k_i C_4\left(A\right)$. Differentiate wrt p:

$$\int_0^{\bar{b}_{\text{case1}}(A)} -\left(\sigma-1\right) b_i p_i^{-\sigma} C_1\left(A\right) + \frac{2\sigma}{2-\alpha} b_i^{\frac{2}{2-\alpha}} p_i^{-\frac{2\sigma}{2-\alpha}-1} k^{-\frac{\alpha}{2-\alpha}} C_2\left(A\right) df\left(b\right) +$$
$$\left[\bar{b}_{\text{case1}}\left(A\right) p_i^{1-\sigma} C_1\left(A\right) - \left[\bar{b}_{\text{case1}}\left(A\right)\right]^{\frac{2}{2-\alpha}} p_i^{-\frac{2\sigma}{2-\alpha}} k^{-\frac{\alpha}{2-\alpha}} C_2\left(A\right)\right] f\left(\bar{b}_{\text{case1}}\left(A\right)\right) \frac{2-\alpha+\alpha\sigma}{\alpha} p^{\frac{2-\alpha+\alpha\sigma}{\alpha}-1} k C_4\left(A\right)$$
$$\int_{\bar{b}_{\text{case1}}(A)}^{\infty} \frac{2}{\alpha} p_i^{\frac{2-\alpha}{\alpha}} k_i C_3\left(A\right) df\left(b\right) - p_i^{\frac{2}{\alpha}} k_i C_3\left(A\right) f\left(\bar{b}_{\text{case1}}\left(A\right)\right) \frac{2-\alpha+\alpha\sigma}{\alpha} p^{\frac{2-\alpha+\alpha\sigma}{\alpha}-1} k C_4\left(A\right)$$

Differentiate with respect to k:

$$\int_0^{\bar{b}_{\text{case1}}(A)} \frac{\alpha}{2-\alpha} b_i^{\frac{2}{2-\alpha}} p_i^{-\frac{2\sigma}{2-\alpha}} k^{-\frac{2}{2-\alpha}} C_2\left(A\right) df\left(b\right) +$$
$$\left[\bar{b}_{\text{case1}}\left(A\right) p_i^{1-\sigma} C_1\left(A\right) - \left[\bar{b}_{\text{case1}}\left(A\right)\right]^{\frac{2}{2-\alpha}} p_i^{-\frac{2\sigma}{2-\alpha}} k^{-\frac{\alpha}{2-\alpha}} C_2\left(A\right)\right] f\left(\bar{b}_{\text{case1}}\left(A\right)\right) p_i^{\frac{2-\alpha+\alpha\sigma}{\alpha}} C_4\left(A\right) +$$
$$\int_{\bar{b}_{\text{case1}}(A)}^{\infty} p_i^{\frac{2}{\alpha}} C_3\left(A\right) df\left(b\right) - p_i^{\frac{2}{\alpha}} k_i C_3\left(A\right) f\left(\bar{b}_{\text{case1}}\left(A\right)\right) p_i^{\frac{2-\alpha+\alpha\sigma}{\alpha}} C_4\left(A\right)$$