Errata file for
"Common Pool Resources: Strategic Behavior, Inefficiencies, and Incomplete Information," Cambridge University Press

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March 18, 2026

1. **Preface:**
   - Page xiii, line 11, should read "the effect that **his** appropriation..."
   - Page xvii, line 10, should read "and then **chooses** whether to..."
2. **Chapter 1:**
   - Page 3, line 29, should read "If a regulator **sets** ..."
   - Page 4, line 31, should read "firm or **firms'** ..."
3. **Chapter 2:**
   - Page 8, line 20, should read: "chooses **his** appropriation level q_i to maximize **his** profits as ..."
   - Page 9, line 8, should read: "Every agent chooses **his** ..."
   - Page 10, line 5, should read: "revenue and **marginal cost** exactly offset each other."
   - Page 14, line 17, should read "...and $a \geq 1$ and $b \geq 0$ are both positive parameters. Recall that $b \geq 0$ indicates that..."
   - Page 17, line 3, should read: "... where $CS = \int_0^Q p(Q)\,dQ - p(Q)\,Q$ denotes ..."
   - Page 18:
     - Line 22, should read: "much marginal costs"
     - Line 23, should read: "in **his** own costs but also the increase in **his** rival's"
     - Line 25, should read: "that **his** appropriation imposes ..."
   - Page 19:
     - Line 5, should read: "decreases in **his** rival's appropriation ..."
     - Footnote 7, line 3, should read: "Figure 2.5" not Figure 2.4.
   - Page 20, line 20, should read: "... where $CS = \int_0^Q (1-Q)\,dQ - (1-Q)\,Q$."
   - Page 21:
     - Expression (2) should read as follows

$$\frac{\partial W}{\partial q_1} = (1-\lambda)(q_1+q_2) + \lambda\left(1 - 2(q_1+q_2) - \frac{2(q_1+q_2)}{S}\right) = 0$$
$$\frac{\partial W}{\partial q_2} = (1-\lambda)(q_1+q_2) + \lambda\left(1 - 2(q_1+q_2) - \frac{2(q_1+q_2)}{S}\right) = 0$$

- Expression (3) should read as follows

$$2\left(1-\lambda\right)q^{SO}+\lambda\left(1-4q^{SO}-\frac{4q^{SO}}{S}\right)=0$$

- Expression (4) should read as follows

$$q^{SO}\left(\lambda\right)=\frac{\lambda S}{2\left(3\lambda S+2\lambda-S\right)}$$

- Line 9. Add the following at the end of the line: "which is positive if and only if $3\lambda S+2\lambda-S>0$ that, solving for λ, yields $\lambda>\overline{\lambda}\equiv\frac{S}{2+3S}$. Cutoff $\overline{\lambda}$ satisfies $\frac{\partial\overline{\lambda}}{\partial S}=\frac{2}{(2+3S)^2}$ and attains a maximum at $\lim_{S\to\infty}\overline{\lambda}=\lim_{S\to\infty}\frac{1}{\frac{2}{S}+3}=\frac{1}{3}$, so that positive units are always socially optimal, $q^{SO}\left(\lambda\right)>0$, when the policy weight satisfies $\lambda\geq\frac{1}{3}$."
- Line 10 should have $q^{SO}\left(1\right)=\frac{S}{4(1+S)}$ and remove "as in our discussion at the beginning of this section".
- Expression (5) should read as follows

$$\frac{\partial q^{SO}\left(\lambda\right)}{\partial\lambda}=-\frac{S^2}{2\left(3\lambda S+2\lambda-S\right)^2}$$

- Page 22, line 7, should read: "... **his** appropriation produces on **the** other fishermen,"
- Page 24:
  - Line 1, should read: "increases **his** appropriation ..."
  - Line 2, should read: "where **his** marginal revenue ..."
  - Line 12, should read: "firm i's marginal cost MC_i **increases** ..."
- Page 27, line 21. Please change emission fee to **appropriation fee**.
- Page 28:
  - Line 15. The expression should be $q^*\left(N+1\right)=S\left(1-t_i\right)$.
  - Line 18. Remove the index i for the appropriation fee $t_i=0$.
  - Line 25. Change emission fee to **appropriation fee**.
- Page 29:
  - The first displayed equation should read

$$\frac{S\left(1-t_i\right)}{N+1}=\frac{S}{2N}$$

  - Line 3, should read "we find $2N-2Nt_i=N+1$ and ..."
  - The second displayed equation should read

$$t_i^*=\frac{N-1}{2N}$$

  - Line 4, should read "is increasing in the number of firms, N, since

$$\frac{\partial t_i^*}{\partial N}=\frac{1}{2N^2}>0."$$

  - Line 6 to 7, should read "socially optimal aggregate output, $Q^{SO}=\frac{S}{2}$, regardless ..."
  - Line 9 to 10, should read "$q^*\left(t_i\right)$, exceeds q_i^{SO}, requiring a positive fee ..."
  - Line 12 to 13, should read "while $q_i^{SO}=\frac{S}{2N}$ decreases more rapidly in N, leading the regulator to set a more stringent emission fee. While ..."
- Page 30, lines 13 to 14. Remove 'How is it affected by an increase in parameter α? Interpret.' in part (a).

4. **Chapter 3:**
   - Page 38:
     - Line 8, should read "... to denote **profits** evaluated ..."
     - Line 11, should read "... second-period equilibrium **profits**,"
   - Page 39, line 18 should read "... the stock **hits** ..."
   - Page 40, line 28 should read "... as **in** Exercise 3.8."
   - Page 41:
     - Expression (3) should read
     $$q_i\left(q_j\right) = \frac{S-(1-r)\,x}{2} - q_j$$
     - Expression (4) should read
     $$2q^{SO} = \frac{S-(1-r)\,x}{2}$$
   - Page 42, line 5. Capitalize the word **Exercise**.
   - Page 43, Figure 3.1. Change its numbering from 3.I to **3.1**.
   - Page 44:
     - The second line of the first displayed equation should read
     $$= \frac{5\left[S\delta\left(1-r\right)\right]}{72}$$
     - Line 24 should read $q = \frac{S}{(N+1)(S+1)}$.
     - The second line of second displayed equation should read
     $$= \frac{S}{\left(N+1\right)^2\left(S+1\right)}$$
   - Page 45:
     - The first displayed equation should read
     $$\frac{S}{\left(N+1\right)^2\left(S+1\right)} \geq F$$
     - Line 8 should read "$\sqrt{\frac{S}{S+1}} \geq \sqrt{F}\left(N+1\right)$"
     - The second displayed equation should read
     $$N \leq N^* \equiv \sqrt{\frac{S}{F\left(S+1\right)}} - 1$$
     - Line 10 to 12 should read "$F < \frac{S}{S+1}$, which intuitively means that the fixed entry cost is relatively low, a reasonable assumption in most CPRs."
     - Line 13 to 15 should read "$\pi_i^{Entry} = \frac{S}{(N+1)^2(S+1)}$, which increases in S but decreases in N."
   - Page 46:
     - The second line of the second displayed equation should read
     $$= \int_0^{Q^*}\left(1-s\right)ds - N\frac{q^*\left[q^*+\left(N-1\right)q^*\right]}{S} - \left(N\times F\right),$$
     - The third expression should read
     $$\max_{N\geq 1} W = \frac{NS\left[NS+2\left(S+1\right)\right]}{2\left(N+1\right)^2\left(S+1\right)^2} - NF$$

– The fourth expression should read

$$\frac{\partial W}{\partial N} = \frac{S\,(S+1-N)}{(N+1)^3\,(S+1)^2} - F$$

– Line 16 should read "$S = 9$ and $F = 0.1$, we obtain that the unregulated equilibrium number of firms is $N^* = \sqrt{\frac{10\times 9}{9+1}} - 1 = 2$."

– Line 17 should read

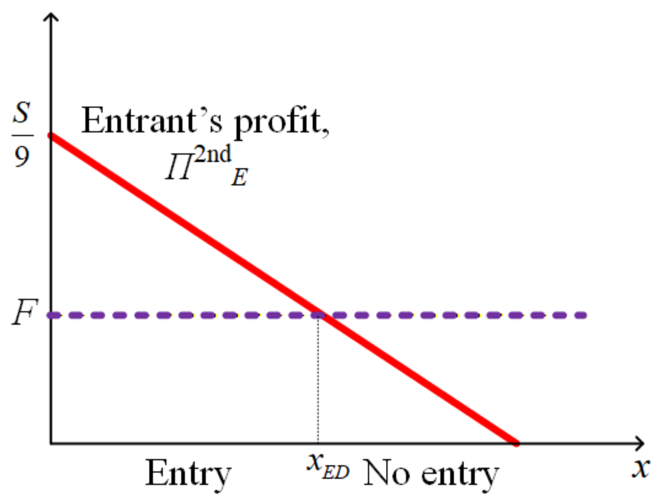
$$\frac{9\,(9+1-N)}{(N+1)^3\,(9+1)^2} = \frac{1}{10}$$

which simplifying yields $N \approx 1.008$, so that $N^* = 2 > 1 = N^{SO}$.

- Page 47:
  – line 3 should read "... into the CPR**,** it only considers ..."
  – Line 6 should read $q^* = \frac{S}{(N+1)(S+1)}$.
- Page 48, replace lines 2 to 9 and the first two expressions with "...obtain that $N = S+1$, so a more abundant resource supports higher N^{SO}.

5. **Chapter 4:**

- Page 57. Figure 4.1 should be a line, not a curve. The figure should look like this.



- Page 59.
  – Line 8 (immediately below the second displayed equation) should read "is negative if $1 - \frac{\delta(1-r)}{4} < \frac{2x}{S}$ holds which, after solving for x, yields $x > \frac{S[4-\delta(1-r)]}{8} \equiv x^{SO}$, where x^{SO} is the socially optimal extraction in the first period (as shown in Section 3.4), where x^{SO} satisfies $x_E > x^{SO}$. Therefore, we can say that the incumbent's profits decrease in x, which implies that..."
  – The first line of the third displayed equation should read

$$\Pi^{ED} = \left[x_{ED} - \frac{x_{ED}^2}{S}\right] + \delta\left[\frac{S-(1-r)\,x_{ED}}{4}\right]$$

- Page 60.
  – Line 5 should read "$S > 9\frac{1}{100} = 0.09$..."
  – Line 8 should read "$0.097 \leq S \leq 0.193$, as depicted in Figure 4.2 by the two crossing points..."
  – Line 10 should read "$0.097 \leq S \leq 0.193$..."

- Page 61. The first displayed equation should read

$$DI = x_{ED} - x^{SO} = \frac{S - 9F}{1 - r} - \frac{S\left[4 - \delta\left(1 - r\right)\right]}{8}$$

- Page 62, line 27. Exercise 4.4, immediately before part (a), add "The incumbent's first-period cost function is, then, $C(x) = \frac{\alpha x^2}{S}$ where x denotes first-period appropriation."

6. **Chapter 5:**

- Page 67, line 4. should read "is **a** NE of"
- Page 68, lines 15 and 19, should read "appropriation **decisions".**
- Page 71, line 12, should read "obtaining $\frac{a}{1-\delta}$, rather..."
- Page 72.
  - The fourth expression should read

$$d\frac{1}{1-\delta} \geq c + d\frac{\delta}{1-\delta}$$

  - Line 14 to 17 should read "which simplifies to $d\frac{1-\delta}{1-\delta} \geq c$. Since $d > c$ by definition, it holds for all values of δ."
- Page 73.
  - Change from the label of Figure 5.I to Figure 5.1.
  - Line 17, should read "at a **in** all subsequent periods."
- Page 75, line 17, should delete "being" reading instead as "...as neutral as possible".
- Page 76.
  - Line 9, should delete "they" reading instead as "information **as she** did..."
  - Line 11, should delete "their" reading instead as "informed about **her..."**
  - Line 14, should delete "their" reading instead as "submit **her** token deposits"
- Page 77, line 29, should read "$b > a$, $d < c$, and $a > d$."
- Page 79, line 27, should remove "which is".
- Page 80, line 7, should read "about its catches".

7. **Chapter 6:**

- Page 85.
  - Change the label of Figure 6.I to Figure 6.1.
  - Line 9 should read "$x_L = \frac{5}{3} \simeq 1.67$".
- Page 90, line 9 should read "... that the stock **was** high."
- Page 92.
  - The first expression should read

$$\begin{aligned} -\left(x_H - x_H^*\right) - \left(x_H - x_U^*\right) &= x_U^* + x_H^* - 2x_H \\ &= -\frac{\left(1-p\right)S_H\left(S_H - S_L\right)}{6\left[pS_L + \left(1-p\right)S_H\right]}, \end{aligned}$$

  - The second expression should read

$$\begin{aligned} -\left(x_L - x_L^*\right) - \left(x_L - x_U^*\right) &= x_U^* + x_L^* - 2x_L \\ &= \frac{pS_L\left(S_H - S_L\right)}{6\left[pS_L + \left(1-p\right)S_H\right]}, \end{aligned}$$

- Page 93. The title of exercise 6.2, at the bottom of the page, should read "Two periods facing uncertainty."
- Page 94. Line 6 should read "parameter values $N = 2$, $S_H = 10$, and $S_L = 5$."

8. **Chapter 7:**

- Page 97. Change the label of the figure, from Figure 7.I to Figure 7.1.
- Page 99. Lline 24 should read "...thus allowing for any probability $\mu(S_H|x) \in [0,1]$. However, for..."
- Page 103.
  - Line 7. x_L should have L as a subscript.
  - The second displayed equation should read

$$x_L \leq \frac{5\left[9(3+r) - \sqrt{5\left[72(1+r) + 13(1-r)^2\right]}\right]}{36}$$

  - The third displayed equation should read

$$x_L \geq \frac{5\left[9(3+r) - \sqrt{5\left[72(1+r) + 13(1-r)^2\right]}\right]}{72}$$

  - The fourth displayed equation should read

$$x_L \in \left[\frac{5\left[9(3+r) - \sqrt{5(13r^2+46+85)}\right]}{72}, \frac{5\left[9(3+r) - \sqrt{5(13r^2+46+85)}\right]}{36}\right]$$

  - The fifth displayed equation should read

$$x_L = \frac{5\left[9(3+r) - \sqrt{5(13r^2+46+85)}\right]}{36}$$

- Page 104. The displayed equation should read

$$\begin{aligned}\text{Separating effort} &= x_{L,NE} - x_L \\ &= \frac{5(3+r)}{8} - \frac{5\left[9(3+r) - \sqrt{5(13r^2+46+85)}\right]}{36} \\ &= \frac{5\left[2\sqrt{5(13r^2+46+85)} - 9(3+r)\right]}{72}\end{aligned}$$

- Page 105. The displayed equation should read

$$\frac{\partial(x_{L,NE} - x_L)}{\partial r} = \frac{5}{72}\left[\frac{2\sqrt{5}(13r+23)}{\sqrt{13r^2+46+85}} - 9\right]$$

- Page 111.
  - Line 2 a **pooling** effort of $\frac{37-r}{72}$.
  - The first displayed equation under point 3 should read

$$\frac{\partial(x_{H,E} - x_{L,NE})}{\partial\delta} = -\frac{(4S_H - 9S_L)(1-r)}{72}.$$

9. **Appendix A:**

- Page 124.
  - Line 21, after matrix A.6, should read "firm 2's best response is $BR_2(M) = h$ since...".
  - Line 22, after matrix A.6, should read "firm 2's best response is $BR_2(L) = m$ because...".

10. **Appendix B:**

- Page 137.
  - The third and fourth displayed equations should read

$$t_1 = \frac{5 - 8\alpha}{2(1 - 4\alpha)}$$
$$t_2 = \frac{1 - \alpha}{1 - 4\alpha}$$

  - The fourth to sixth line should read "where t_1 is positive when $\alpha < \frac{1}{4}$ or $\alpha > \frac{5}{8}$. Similarly, fee t_2 is positive when"
  - The fifth displayed equation should read

$$\frac{1 - \alpha}{1 - 4\alpha} > 0$$

  - The seventh line should read "that simplifies to $\alpha < \frac{1}{4}$."
- Page 139.
  - The first displayed equation should have $q_i \geq 0$ beneath the maximization operator that reads

$$\max_{q_i \geq 0} \ (1 - \alpha_j) \underbrace{\left(q_i - \frac{q_i(q_i + q_j)}{S} \right)}_{\pi_i} + \alpha_i \underbrace{\left(q_j - \frac{q_j(q_i + q_j)}{S} \right)}_{\pi_j}$$

  - The third displayed equation should read

$$q_i(q_j) = \frac{S}{2} - \frac{1}{2} q_j - \underbrace{\frac{\alpha_i}{1 - \alpha_j} \frac{q_j}{2}}_{\text{New term}}.$$

  - The fourth displayed equation should read

$$\frac{\partial q_i(q_j)}{\partial \alpha_i} = -\frac{1}{1 - \alpha_j} \frac{q_j}{2} < 0,$$

  - The fifth displayed equation should read

$$\frac{\partial q_i(q_j)}{\partial \alpha_j} = -\frac{\alpha_i}{(1 - \alpha_j)^2} \frac{q_j}{2} < 0.$$

- Page 140.
  - The answer to part (b) should be replaced with the following.
    * Substituting $q_j = \frac{S}{2} - \frac{1+\alpha_j-\alpha_i}{2(1-\alpha_i)} q_i$ into $q_i = \frac{S}{2} - \frac{1+\alpha_i-\alpha_j}{2(1-\alpha_j)} q_j$, we obtain

$$q_i = \frac{S}{2} - \frac{1 + \alpha_i - \alpha_j}{2(1 - \alpha_j)} \left[\frac{S}{2} - \frac{1 + \alpha_j - \alpha_i}{2(1 - \alpha_i)} q_i \right]$$

    Solving for q_i, equilibrium appropriation of firm i becomes

$$q_i^* = \frac{(1 - \alpha_i) S}{3 - \alpha_i - \alpha_j}$$

which is decreasing in α_i but increasing in α_j since

$$\frac{\partial q_i^*}{\partial \alpha_i} = -\frac{(2-\alpha_j) S}{(3-\alpha_i-\alpha_j)^2} < 0$$
$$\frac{\partial q_i^*}{\partial \alpha_j} = \frac{(1-\alpha_i) S}{(3-\alpha_i-\alpha_j)^2} > 0$$

so that firm i appropriates the resource less intensively when it owns a larger share of rival firm j (higher α_i), but more intensively when the other firm owns a larger share of this firm (higher α_j).

* Substituting q_i^* and q_i^* into firm i's profit function, we find

$$\begin{aligned}\pi_i^* &= \frac{\left[S-q_i^*-q_j^*\right]\left[(1-\alpha_j) q_i^* + \alpha_i q_j^*\right]}{S} \\ &= \frac{S(1-\alpha_j)}{(3-\alpha_i-\alpha_j)^2}\end{aligned}$$

which is increasing in α_i but decreasing in α_j because

$$\frac{\partial \pi_i^*}{\partial \alpha_i} = \frac{2(1-\alpha_j) S}{(3-\alpha_i-\alpha_j)^3} > 0$$
$$\frac{\partial q_i^*}{\partial \alpha_j} = -\frac{(1-\alpha_i+\alpha_j) S}{(3-\alpha_i-\alpha_j)^3} < 0$$

so that firm i earns more profits when it owns more shares in firm j (higher α_i), but less when its rival firm j owns a larger share of this firm (higher α_j).

- The answer to part (c) should be replaced with the following.
  * Without equity shares, $\alpha_i = \alpha_j = 0$, aggregate appropriation is $Q^*(0,0) = \frac{2S}{3}$. In the presence of aggregate shares, aggregate appropriation, however, is

$$\begin{aligned}Q^*(\alpha_i,\alpha_j) &= \frac{(1-\alpha_i) S}{3-\alpha_i-\alpha_j} + \frac{(1-\alpha_j) S}{3-\alpha_i-\alpha_j} \\ &= \frac{(2-\alpha_i-\alpha_j) S}{3-\alpha_i-\alpha_j}\end{aligned}$$

that falls below $Q^*(0,0)$ since

$$\frac{(2-\alpha_i-\alpha_j) S}{3-\alpha_i-\alpha_j} < \frac{2S}{3}$$

simplifies to

$$\alpha_i + \alpha_j > 0$$

that holds for all strictly positive equity shares, $\alpha_i, \alpha_j > 0$. Intuitively, when every firm takes account of the rival firm's profits and appropriates less intensively, the tragedy of the commons is ameliorated.

- Page 147, part c, should read "Use your results from Exercise 3.4...".
- Page 148.
  - The first displayed equation should read

$$\begin{aligned}SI &= q_i^*(x) - q_i^{SO}(x) \\ &= \frac{S-(1-r)x}{N+1} - \frac{S-(1-r)x}{2N} \\ &= \frac{(N-1)\left[S-(1-r)x\right]}{2N(N+1)}\end{aligned}$$

- The fifth line should read "which simplifies to $N < \sqrt{2} + 1 \simeq 2.41$"
- Remove the ninth line that read "However, when $r = 1$ and/or $\delta = 0$, the value of SI is not zero."

- Page 151.
  - Line 24 should read "where $DI = \frac{5[S\delta(1-r)]}{72}$ from Section 3.5,"
  - The third displayed equation should read

$$\begin{aligned} DI_2 - DI &= \frac{S[9 + 2\delta(1-r)]}{108} - \frac{5\,[S\delta(1-r)]}{72} \\ &= \frac{S[18 - 11\delta\,(1-r)]}{216} \end{aligned}$$

- Page 152. Line 1 should read "even if $\delta = 0$ and $r = 1$,"
- Page 155.
  - Line 1 should read "we obtain a first-period appropriation $x_E = 4.99$."
  - The first displayed equation should read

$$\begin{aligned} \Pi^{AE} &= \left[x_E - \frac{x_E^2}{10}\right] + \frac{2\,(20 - x_E)}{9\,(24 - x_E)} \\ &= 2.68. \end{aligned}$$

  - The fourth displayed equation should read

$$\begin{aligned} \Pi^{ED} &= \left[x_{ED} - \frac{x_{ED}^2}{S}\right] + \frac{\delta}{4}\left[\frac{S - (1-r)\,x_{ED}}{b\,[S - (1-r)\,x_{ED}] + 1}\right] \\ &= \frac{9\delta F}{4} + \frac{[S - 9F(1+bS)]\,[9F\,(1+rbS) - rS]}{(1-r)^2\,(1-9bF)^2\,S} \end{aligned}$$

  - Line 13 should read "a negative profit of $\Pi^{ED} = -19.42$."
  - Line 15 should read "$\Pi^{AE} = 2.68 \geq -19.42 = \Pi^{ED}$."
- Page 156.
  - The second displayed equation should read

$$(q_i + q_j) + \left(1 - \frac{2q_i + q_j}{S - (1-r)x}\right) - \frac{q_j}{S - (1-r)x} = 0.$$

  - The seventh displayed equation should read

$$q^{SO} = \frac{S - (1-r)\,x}{2\,[2 - S + (1-r)\,x]}.$$

- Page 157.
  - The first displayed equation should read

$$\begin{aligned} W^{2nd} &= q^{SO}\left[q^{SO} + 2\left(1 - \frac{q^{SO}}{S - (1-r)\,x}\right)\right] \\ &= \frac{S - (1-r)\,x}{2\,[2 - S + (1-r)\,x]}. \end{aligned}$$

  - The second displayed equation should read

$$\max_{x \geq 0} \underbrace{\frac{x^2}{2}}_{CS^{1st}} + \underbrace{\left(x - \frac{x^2}{S}\right)}_{PS^{1st}} + \delta\underbrace{\left(\frac{S - (1-r)\,x}{2\,[2 - S + (1-r)\,x]}\right)}_{W^{2nd}}$$

- The third displayed equation should read

$$x+1-\frac{2x}{S}-\frac{\delta\,(1-r)}{[2-S+(1-r)\,x]^2}=0$$

- The fourth displayed equation should read

$$1+\frac{4x}{5}-\frac{90}{(80-9x)^2}=0$$

- Page 158.
  - The first displayed equation should read

$$\begin{aligned} DI &= x_{ED}-x^{SO} \\ &= \frac{S-9F}{1-r}-\frac{S\,[9-2\delta\,(1-r)]}{18} \\ &= \frac{10-9\frac{1}{100}}{1-\frac{1}{10}}-\frac{10\left[9-2\times\left(1-\frac{1}{10}\right)\right]}{18} \\ &= 7.05. \end{aligned}$$

  - Line 2 should read "... in the welfare function (7.05)"
- Page 166.
  - Line 9 should read "a payoff stream of $a+\delta\,(d-t)$."
  - Line 15 should read "from deviating is $(b-t)+\delta\,(d-t)$".
  - The first expression should read

$$a+\delta\,(d-t)>(b-t)+\delta\,(d-t)$$

  - Line 18 should read "which simplifies to $a>b-t$, or $t>b-a$, which does not hold..."
  - Line 27 to 29 should read "(High, Low) and (Low, High). Suppose in the second period players play (Low, High). By playing (Low, Low) in the first period, player 1's discounted payoff is $a+\delta c$, which falls below that of deviating to high appropriation in the first period of $b-t+\delta c$ since $a+\delta c<b-t+\delta c$ reduces to $t<b-a$ that holds. Suppose in the second period players play (High, Low). By playing (Low, Low) in the first period, player 1's discounted payoff is $a+\delta\,(b-t)$, which falls below that of deviating to high appropriation in the first period of $b-t+\delta\,(b-t)$ since $a+\delta\,(b-t)<b-t+\delta\,(b-t)$ reduces to $t<b-a$ that holds. A similar argument applies to player 2, so that the cooperative outcome cannot be sustained in the twice-repeated game."
- Page 169.
  - The fourth displayed equation should read

$$a\left(\frac{1-\delta^{T+1}}{1-\delta}\right)\geq b+\delta d\left(\frac{1-\delta^{T}}{1-\delta}\right),$$

  - The fifth displayed equation should read

$$\delta\geq\frac{b-a}{b-d}+\underbrace{\frac{a-d}{b-d}\delta^{T+1}}_{\text{New Term}}.$$

  - The sixth displayed equation should read

$$(T+1)\ln\delta\leq\ln\frac{(a-b)+(b-d)\,\delta}{a-d}.$$

– The last displayed equation should read

$$T \geq \widehat{T} \equiv \frac{\ln \frac{(a-b)+(b-d)\delta}{a-d}}{\ln \delta} - 1.$$

- Page 170.
  – Line 9 to 10 should read "appropriation level x_i for every firm i, as follows"
  – The first displayed equation should read

$$\max_{\{x_i\}_{i=1}^N \geq 0} p \underbrace{\left[x_i - \frac{x_i (x_i + X_{-i})}{S_H}\right]}_{\pi_i \text{ if the stock is high}} + (1-p) \underbrace{\left[x_i - \frac{x_i (x_i + X_{-i})}{S_L}\right]}_{\pi_i \text{ if the stock is low}}$$
$$+ p \sum_{j \neq i} \underbrace{\left[x_j - \frac{x_j (x_j + X_{-j})}{S_H}\right]}_{\pi_j \text{ if the stock is high}} + (1-p) \sum_{j \neq i} \underbrace{\left[x_j - \frac{x_j (x_j + X_{-j})}{S_L}\right]}_{\pi_j \text{ if the stock is low}}$$

  – The second displayed equation should read

$$p\left(1 - \frac{2x_i + X_{-i}}{S_H}\right) + (1-p)\left(1 - \frac{2x_i + X_{-i}}{S_L}\right)$$
$$-p\left(\frac{\sum_{j \neq i} x_j}{S_H}\right) - (1-p)\left(\frac{\sum_{j \neq i} x_j}{S_L}\right) = 0.$$

  – The third displayed equation should read

$$x_i (x_j, X_{-i}) = \frac{S_H S_L}{2\left[p S_L + (1-p) S_H\right]} - \frac{1}{2}\left(\sum_{j \neq i} x_j + X_{-i}\right).$$

  – Line 14 should read "$X_{-i}^{SO} = \sum_{j \neq i} x_j^{SO} = (N-1)\, x^{SO}$"
  – The fourth displayed equation should read

$$x^{SO} = \frac{S_H S_L}{2\left[p S_L + (1-p) S_H\right]} - (N-1)\, x^{SO}.$$

  – The fifth displayed equation should read

$$x^{SO} = \frac{S_H S_L}{2N\left[p S_L + (1-p) S_H\right]}.$$

- Page 171.
  – The first displayed equation should read

$$\begin{aligned} SI &= x^* - x^{SO} \\ &= \frac{S_H S_L}{(N+1)\left[p S_L + (1-p) S_H\right]} - \frac{S_H S_L}{2N\left[p S_L + (1-p) S_H\right]} \\ &= \frac{(N-1)\, S_H S_L}{2N(N+1)\left[p S_L + (1-p) S_H\right]}. \end{aligned}$$

  – Line 5 to 6 should read "$SI_L = \frac{(N-1)S_L}{2N(N+1)}$ when the stock is low and $SI_H = \frac{(N-1)S_H}{2N(N+1)}$ when the stock is high"
  – The second displayed equation should read

$$\begin{aligned} SI_H - SI &= \frac{(N-1)\, S_H}{2N(N+1)} - \frac{(N-1)\, S_H S_L}{2N(N+1)\left[p S_L + (1-p) S_H\right]} \\ &= \frac{(N-1)(1-p)(S_H - S_L)\, S_H}{2N(N+1)\left[p S_L + (1-p) S_H\right]}. \end{aligned}$$

- Line 7 to 8 should read "which is positive since $S_H > S_L$, implying that $SI_H > SI$."
- The third displayed equation should read

$$SI_L - SI = \frac{(N-1)\,S_L}{2N\,(N+1)} - \frac{(N-1)\,S_H S_L}{2N\,(N+1)\,[pS_L + (1-p)\,S_H]}$$
$$= -\frac{p\,(N-1)\,(S_H - S_L)\,S_L}{2N\,(N+1)\,[pS_L + (1-p)\,S_H]}.$$

- Line 10 should remove the word "also".
- Line 11 to 13 should read "Intuitively, incomplete information gives rise to additional (less) inefficiencies than when firms are informed about the low (high) stock level."

• Page 172.

- Line 1 to 2 should read "consumer surplus, $\frac{(\sum_{i=1}^{N} x_i)^2}{2}$, plus the expected profits of every firm i, that solves"
- The first displayed equation should read

$$\max_{\{x_i\}_{i=1}^{N} \geq 0} \frac{\left(\sum_{i=1}^{N} x_i\right)^2}{2} + p\underbrace{\left[x_i - \frac{x_i\,(x_i + X_{-i})}{S_H}\right]}_{\pi_i \text{ if the stock is high}} + (1-p)\underbrace{\left[x_i - \frac{x_i\,(x_i + X_{-i})}{S_L}\right]}_{\pi_i \text{ if the stock is low}}$$
$$+ p\sum_{j\neq i}\underbrace{\left[x_j - \frac{x_j\,(x_j + X_{-j})}{S_H}\right]}_{\pi_j \text{ if the stock is high}} + (1-p)\sum_{j\neq i}\underbrace{\left[x_j - \frac{x_j\,(x_j + X_{-j})}{S_L}\right]}_{\pi_j \text{ if the stock is low}}$$

- The second displayed equation should read

$$x_i + X_{-i} + p\left(1 - \frac{2x_i + X_{-i}}{S_H}\right) + (1-p)\left(1 - \frac{2x_i + X_{-i}}{S_L}\right)$$
$$-p\left(\frac{\sum_{j\neq i} x_j}{S_H}\right) - (1-p)\left(\frac{\sum_{j\neq i} x_j}{S_L}\right) = 0.$$

- The third displayed equation should read

$$x_i\,(x_j, X_{-i}) = \frac{S_H S_L}{2\,[pS_L + (1-p)\,S_H] - S_H S_L}$$
$$- \frac{[pS_L + (1-p)\,S_H] - S_H S_L}{2\,[pS_L + (1-p)\,S_H] - S_H S_L} X_{-i} - \frac{pS_L + (1-p)\,S_H}{2\,[pS_L + (1-p)\,S_H] - S_H S_L}\sum_{j\neq i} x_j.$$

- Line 6 should read "that $X_{-i}^{SO} = \sum_{j\neq i} x_j^{SO} = (N-1)\,x^{SO}$."
- The fourth displayed equation should read

$$x^{SO} = \frac{S_H S_L}{2\,[pS_L + (1-p)\,S_H] - S_H S_L} - (N-1)\,x^{SO}.$$

- The fifth displayed equation should read

$$x^{SO} = \frac{S_H S_L}{N\,[2\,(pS_L + (1-p)\,S_H) - S_H S_L]}.$$

• Page 173.

- The first displayed equation should read

$$SI = x^* - x^{SO}$$
$$= \frac{S_H S_L}{(N+1)\,[pS_L + (1-p)\,S_H]} - \frac{S_H S_L}{N\,[2\,(pS_L + (1-p)\,S_H) - S_H S_L]}$$
$$= \frac{S_H S_L\,[(N-1)\,(pS_L + (1-p)\,S_H) - N S_H S_L]}{N\,(N+1)\,[pS_L + (1-p)\,S_H]\,[2\,(pS_L + (1-p)\,S_H) - S_H S_L]}.$$

- Line 2 to 3 should read "$SI_L = \frac{S_L(N-1-NS_L)}{N(N+1)(2-S_L)}$ when the stock is low and $SI_H = \frac{S_H(N-1-NS_H)}{N(N+1)(2-S_H)}$ when the stock is high), and defining $\overline{S} \equiv pS_L + (1-p)\, S_H$, we ..."
- The second displayed equation should read

$$\frac{S_H\left[2\left(N-1-NS_H\right)\overline{S}^2 - \left(2\left(N-1\right)-NS_H^2\right)S_L\overline{S} + N\left(2-S_H\right)S_H S_L^2\right]}{N\overline{S}\left(N+1\right)\left(2-S_H\right)\left(2\overline{S}-S_H S_L\right)}$$

- Line 5 should read "which is **positive** if the number of firms, N, ..."
- Line 8 should read "yielding $\overline{S} = 5p + 10\,(1-p) = 5\,(2-p)$, and"
- The third displayed equation should read

$$-\frac{5\left[40N - (2-p)(1+49N) + (1+9N)(2-p)^2\right]}{4N(N+1)(2-p)(3+p)}.$$

- Line 9 should read "Evaluating this expression at $p = 1/2$, we obtain"
- The fourth displayed equation should read

$$\frac{5\,(53N-3)}{84N\,(N+1)}$$

- Line 10 to 14 should read "that is positive since $N > 1$. Therefore, static inefficiencies satisfy $SI_H > SI$, implying that the static inefficiency is larger under complete information, SI_H, than incomplete information, SI; as in part (a)."
- The fifth displayed equation should read

$$\frac{S_L\left[2\left(N-1-NS_L\right)\overline{S}^2 - \left(2\left(N-1\right)-NS_L^2\right)S_H\overline{S} + N\left(2-S_L\right)S_H^2 S_L\right]}{N\overline{S}\left(N+1\right)\left(2-S_L\right)\left(2\overline{S}-S_H S_L\right)}$$

- Page 174.
  - The first displayed equation should read

$$-\frac{5\left[30N - (2-p)(2+23N) + (1+4N)(2-p)^2\right]}{3N(N+1)(2-p)(3+p)}.$$

  - Line 3 should read "Evaluating this expression at $p = 1/2$, we obtain"
  - The second displayed equation should read

$$-\frac{5\,(6N-1)}{63N\,(N+1)}$$

  - Line 4 to 8 should read "that is negative since $N > 1$. Therefore, static inefficiencies satisfy $SI_L < SI$, implying that the static inefficiency is larger under incomplete information, SI, than complete information, SI_L; as in part (a)."
  - Line 15 should read "parameter values $N = 2$, $S_H = 10$, and $S_L = 5$."
  - The fourth displayed equation should read

$$1 - \frac{2q_i + q_j}{S_k - (1-r)\,x} = 0,$$

- Page 175. The fifth displayed equation should read

$$\max_{x\geq 0}\ \underbrace{p\left(x - \frac{x^2}{S_H}\right) + (1-p)\left(x - \frac{x^2}{S_L}\right)}_{\mathbb{E}(\pi^{1st})} + \underbrace{\delta\left(\frac{pS_H + (1-p)\,S_L - (1-r)\,x}{9}\right)}_{\mathbb{E}(\Pi_i^{2nd})}$$

- Page 176. Add the following after the first displayed equation.
  - "Inserting first-period appropriation, x^*, into second-period appropriation levels, q_H and q_L, we obtain equilibrium appropriation levels of

$$(x^*, q_H, q_L) = \left(\frac{85}{18(2-p)}, \frac{5\,(127-72p)}{108\,(2-p)}, \frac{5\,(55-36p)}{108\,(2-p)} \right),$$

    which are only a function of the probability that the stock is high, p. In particular, first-period appropriation, x^*, increases while second-period appropriation (both when firms observe that the stock is high and low) decreases in probability p since

$$\begin{aligned} \frac{\partial x^*}{\partial p} &= \frac{85}{18\,(2-p)^2} > 0 \\ \frac{\partial q_H}{\partial p} &= -\frac{85}{108\,(2-p)^2} < 0 \\ \frac{\partial q_L}{\partial p} &= -\frac{85}{108\,(2-p)^2} < 0 \end{aligned}$$

    As expected, second-period appropriation is larger when the stock is high than when it is low, $q_H > q_L$, since $127 - 72p > 55 - 36p$ simplifies to $p < 2$, which holds by definition."
- Page 179.
  - Line 6 should read "$x_H = \frac{S_H}{3(1+S_H)}$"
  - The first displayed equation should read

$$\begin{aligned} x_H - x_U^* &= \frac{S_H}{3\,(1+S_H)} - \frac{S_L S_H}{3\,[pS_L + (1-p)\,S_H + S_L S_H]} \\ &= \frac{S_H\,(1-p)\,(S_H - S_L)}{3\,(1+S_H)\,[pS_L + (1-p)\,S_H + S_L S_H]} \end{aligned}$$

  - Remove line 9 and the second displayed equation.
  - Line 10 to 11 should read "which is positive, so that $x_H > x_U^*$. Intuitively, allowing for market power leads the uninformed firm ..."
  - The third displayed equation should read

$$\begin{aligned} x_L - x_U^* &= \frac{S_L}{3\,(1+S_L)} - \frac{S_L S_H}{3\,[pS_L + (1-p)\,S_H + S_L S_H]} \\ &= -\frac{pS_L\,(S_H - S_L)}{3\,(1+S_L)\,[pS_L + (1-p)\,S_H + S_L S_H]} \end{aligned}$$

  - Line 15 to 16 should read "which is negative, so that $x_L < x_U^*$, implying that the uninformed firm appropriates the resource more intensively ..."
  - Line 21 in footnote 1 should read "$x_H = \frac{S_H}{3(1+S_H)}$"
  - Line 23 in footnote 1 should read "$x_L = \frac{S_L}{3(1+S_L)}$"
  - Line 25 to 28 should have footnote 2 removed.
- Page 180.
  - Line 1 should read "$x_H = \frac{S_H}{3(1+S_H)}$"
  - The first displayed equation should read

$$\begin{aligned} x_H - x_H^* =& \frac{S_H}{3\,(1+S_H)} - \frac{S_H}{2} \left(\frac{1}{S_H+1} - \frac{S_L}{3\,[pS_L + (1-p)\,S_H + S_L S_H]} \right) \\ =& -\frac{(1-p)\,S_H\,(S_H - S_L)}{6\,(1+S_H)\,[pS_L + (1-p)\,S_H + S_L S_H]} \end{aligned}$$

- Line 4 to 7 should read "which is negative. Hence, we find that $x_H < x_H^*$. Intuitively, allowing for market power, the privately informed firm exploits the resource more intensively than when all firms observe the stock."
- The second displayed equation should read

$$\begin{aligned} x_L - x_L^* &= \frac{S_L}{3\left(1+S_L\right)} - \frac{S_L}{2}\left(\frac{1}{1+S_L} - \frac{S_H}{3\left[pS_L + (1-p)\,S_H + S_L S_H\right]}\right) \\ &= \frac{pS_L\left(S_H - S_L\right)}{6\left(1+S_L\right)\left[pS_L + (1-p)\,S_H + S_L S_H\right]} \end{aligned}$$

- Line 10 to 11 should read " which is positive. Therefore, we conclude that $x_L > x_L^*$, so the privately informed firm exploits the resource less intensively than when all firms observe the stock."

- Page 181. The last displayed equation should read

$$\pi_E^{2nd} = \frac{(2-\alpha)^2}{9\alpha}\left[S - (1-r)\,x\right].$$

- Page 182.
  - The first displayed equation should read

$$\max_{x\geq 0}\left[x - \frac{x^2}{S_H}\right] + \delta \underbrace{\left[\frac{(2\alpha-1)^2}{9\alpha^2}\left[S_H - (1-r)\,x\right]\right]}_{\pi_I^{2nd}}.$$

  - The second displayed equation should read

$$1 - \frac{2x}{S_H} - \delta\frac{(2\alpha-1)^2\,(1-r)}{9\alpha^2} = 0$$

  - The fourth displayed equation should read

$$\Pi_H^{AE} = \left[x_H - \frac{x_H^2}{S_H}\right] + \delta\left[\frac{(2\alpha-1)^2}{9\alpha^2}\left[S_H - (1-r)\,x_H\right]\right].$$

- Page 183.
  - The second displayed equation should read

$$\begin{aligned} &\left[x_H - \frac{x_H^2}{S_H}\right] - \left[x_L - \frac{x_L^2}{S_H}\right] \\ &\geq \delta\left[\frac{S_H - (1-r)\,x_L}{4} - \frac{(2\alpha-1)^2}{9\alpha^2}\left[S_H - (1-r)\,x_H\right]\right] \end{aligned}$$

  - The fourth displayed equation should read

$$\max_{x\geq 0}\left[x - \frac{x^2}{S_L}\right] + \delta \underbrace{\left[\frac{(2\alpha-1)^2}{9\alpha^2}\left[S_L - (1-r)\,x\right]\right]}_{\pi_I^{2nd}}.$$

  - The fifth displayed equation should read

$$1 - \frac{2x}{S_L} - \delta\frac{(2\alpha-1)^2\,(1-r)}{9\alpha^2} = 0$$

- Page 184.

– The first displayed equation should read

$$\Pi_L^{AE} = \left[x_{L,E} - \frac{x_{L,E}^2}{S_L}\right] + \delta\left[\frac{(2\alpha-1)^2}{9\alpha^2}\left[S_L - (1-r)\,x_{L,E}\right]\right].$$

– The second displayed equation should read

$$\begin{aligned}&\left[x_{L,E} - \frac{x_{L,E}^2}{S_L}\right] - \left[x_L - \frac{x_L^2}{S_L}\right] \\ &\leq \delta\left[\frac{S_L - (1-r)\,x_L}{4} - \frac{(2\alpha-1)^2}{9\alpha^2}\left[S_L - (1-r)\,x_{L,E}\right]\right]\end{aligned}$$

– Line 11 to 12 should read "Solving in this context for x_L, we obtain

$$x_L \in \left[\frac{5\left[9\alpha^2(3+r) - A\right]}{72\alpha^2}, \frac{5\left[9\alpha^2(3+r) - A\right]}{36\alpha^2}\right]$$

– The fourth displayed equation should read

$$A \equiv \sqrt{72\alpha^2(2-\alpha)(7\alpha-2)(1+r) + (1-r)^2\left[81\alpha^4 - 16(2\alpha-1)^4\right]}$$

– The fifth displayed equation should read

$$x_L = \frac{5\left[9\alpha^2(3+r) - A\right]}{36\alpha^2}$$

- Page 185.
  – The fifth displayed equation should read

$$\begin{aligned}\text{Separating effort} &= x_{L,NE} - x_L \\ &= \frac{5(3+r)}{8} - \frac{5\left[9\alpha^2(3+r) - A\right]}{36\alpha^2} \\ &= \frac{5\left[2A - 9\alpha^2(3+r)\right]}{72\alpha^2}.\end{aligned}$$

  – Figure B.1 should be replaced with the following one.

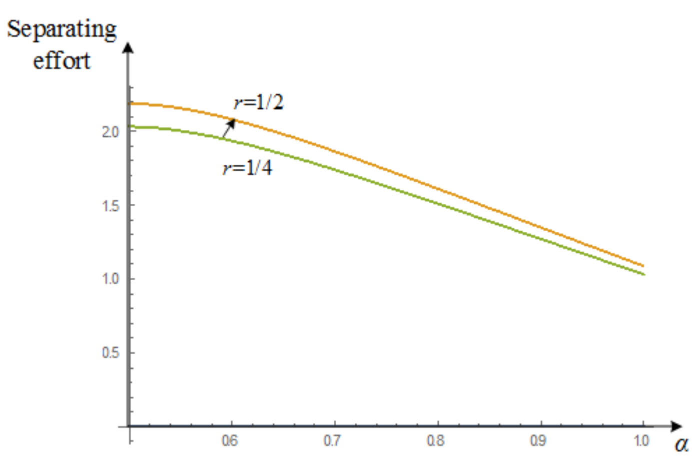


Figure B.1. Separating effort evaluated at $r = 1/2$ and at $r = 1/4$.

- Page 186.

– Line 3 should read "..., increasing the incumbent's incentives to..."
– Line 5 should read "shifts upwards as r increases."
– Line 7 should read "If $\alpha = 1$, the separating effort simplifies to $\frac{5[2A-9(3+r)]}{72}$, where term A is evaluated..."
– The first displayed equation should read

$$A \equiv \sqrt{72\,(2-1)\,(7-2)\,(1+r) + (1-r)^2\left[81 - 16\,(2-1)^4\right]}$$

– The second displayed equation should read

$$A = \sqrt{5\left[72\,(1+r) + 13\,(1-r)^2\right]}$$

– The third displayed equation should read

$$x_L \in \left[\frac{5\left[9\,(3+r) - \sqrt{5\left[72\,(1+r) + 13\,(1-r)^2\right]}\right]}{72}, \frac{5\left[9\,(3+r) - \sqrt{5\left[72\,(1+r) + 13\,(1-r)^2\right]}\right]}{36}\right]$$

– Line 11 (last sentence of Exercise 7.2) should read "...found in Section 7.3."

- Page 189. The last displayed equation should read

$$324x_L^2 - 81x_L\,(4-\delta)\,S_H + \left[81 - 9\,(7+5g)\,\delta + \delta^2\right] S_H^2 \geq 0$$

- Page 190.
  – The first displayed equation should read

$$x_L \leq \frac{\left[9\,(4-\delta) - \sqrt{\delta\,[162\,(3+5g) + 13\delta]}\right] S_H}{72}$$

  – The second displayed equation should read

$$x_L \geq \frac{\left[9\,(4-\delta) + \sqrt{\delta\,[162\,(3+5g) + 13\delta]}\right] S_H}{72}$$

- Page 191.
  – The first displayed equation should read

$$324x_L^2 - 81x_L\,(4-\delta)\,S_L + \left[81 - 9\,(7+5g)\,\delta + \delta^2\right] S_L^2 \leq 0$$

  – The second displayed equation should read

$$x_L \geq \frac{\left[9\,(4-\delta) - \sqrt{\delta\,[162\,(3+5g) + 13\delta]}\right] S_L}{72}$$

  – The third displayed equation should read

$$x_L \leq \frac{\left[9\,(4-\delta) + \sqrt{\delta\,[162\,(3+5g) + 13\delta]}\right] S_L}{72}.$$

– The fourth displayed equation should read

$$x_L = \frac{\left[9\left(4-\delta\right)+\sqrt{\delta\left[162\left(3+5g\right)+13\delta\right]}\right]S_L}{72}.$$

- Page 192.
  - The third displayed equation should read

$$16\left[45\delta\left(1+g\right)-\left(9-\delta\right)^2\right]S_H^2+162\left(4-\delta\right)^2 S_L S_H-81\left(4-\delta\right)S_L^2\geq 0.$$

  - The fourth displayed equation should read

$$4\left[5\left(1+g\right)-9\right]S_H^2+72S_LS_H-9S_L^2\geq 0$$

  - Line 12 to 15 should read: "which, solving for g, yields $g \geq \underline{g} \equiv \frac{16S_H^2-72S_LS_H+9SL^2}{20S_H^2}$, which is decreasing in the ratio $\frac{S_L}{S_H}$. Intuitively, when the high stock is much more plentiful than the low stock, where $\frac{S_L}{S_H}\to 0$, $\underline{g}\to 0.8$ entailing that a high growth rate is required for the stock to support entry deterrence. However, when the high stock reconciles with the low stock, where $\frac{S_L}{S_H}=1$, $\underline{g}=-\frac{47}{20}$, entailing that entry deterrence can be supported under any positive growth rates g."
  - Line 3 of footnote 3 should read $80\left(1+g\right)\geq 9$.
- Page 194.
  - Line 16 should read $x_{NE}=0.4143$
  - The last displayed equation should read

$$\Pi^{NE}=\left[(1-0.4143)\times 0.4143-\frac{0.4143^2}{5}\right]+\frac{1}{4}\left[\frac{5-\frac{3}{4}\times 0.4143}{6-\frac{3}{4}\times 0.4143}\right]=0.4143$$

- Page 195.
  - Line 8 should read $x_E=0.4156$
  - The fourth displayed equation should read

$$\Pi^{E}=\left[(1-0.4156)\times 0.4156-\frac{0.4156^2}{5}\right]+\frac{1}{9}\left[\frac{5-\frac{3}{4}\times 0.4156}{6-\frac{3}{4}\times 0.4156}\right]=0.2999$$

- Page 197.
  - The fourth displayed equation should read

$$x_{H,E}=0.4542.$$

  - The fifth displayed equation should read

$$\Pi_H^{AE}=\left[(1-0.4542)\times 0.4542-\frac{0.4542^2}{10}\right]+\frac{1}{9}\left[\frac{10-\frac{3}{4}\times 0.4542}{11-\frac{3}{4}\times 0.4542}\right]=0.3279.$$

  - The third line of sixth displayed equation should read

$$4.5833>0.4542$$

- Page 198. The third line of first displayed equation should read

$$2.0313>0.4143$$