

Correction

Correction: Yang et al. Operational Decisions on Remanufacturing under the Product Innovation Race. *Sustainability* 2023, 15, 4920

Dexiang Yang ¹, Qin Yang ^{2,*}  and Lei Zhang ³

¹ College of Management Science, Chengdu University of Technology, Chengdu 610059, China

² School of Aeronautics and Astronautics, University of Electronic Science and Technology of China, Chengdu 611731, China

³ School of Management and Economics, University of Electronic Science and Technology of China, Chengdu 611731, China

* Correspondence: yqin@uestc.edu.cn

The authors would like to make the following corrections about the published paper [1]. The changes are as follows:

(1) Replacing the “Remanufacturing Scenario” in Table 3.

Remanufacturing Scenario

(i) For $\frac{\gamma(b\gamma + b^2c + b^2ca - b - ba - b^2\gamma c - b\gamma c_n + c_n + bc_na + c_n)}{1 + a} < c_r < \frac{\gamma c_n}{1 + a}$,

Equilibrium decisions: $q_1^{Ri*} = \frac{1 - c_n - bc}{2}$, $q_n^{Ri*} = \frac{1 + a - c_n + c_r - \gamma}{2(1 + a - \gamma)}$, $q_r^{Ri*} = \frac{\gamma c_n - c_r - ac_r}{2\gamma(1 + a - \gamma)}$,
 $K^{Ri} = \frac{\rho(1 + a - 2\gamma + 2c_n c_r - a\gamma - c_n^2 - c_r^2 + \gamma^2)}{2(a + 2)(1 - \gamma)(1 + a - \gamma)}$.

Equilibrium profits:

$$\pi_T^{Ri*} = \frac{\left(\begin{aligned} &2\rho cb\gamma c_n - 2\rho\gamma c_n - 2\rho cb\gamma^2 c_n + 2\rho c^2 b^2 \gamma - 2\gamma c_n + \rho c_r^2 \\ &+ a\gamma c_n^2 - 2a\gamma c_n - 2\rho cb\gamma - b^2 c^2 \gamma - b^2 c^2 a\gamma + b^2 c^2 \gamma^2 + \gamma \\ &+ \rho\gamma a^2 - \rho\gamma^2 a + 2\rho\gamma^2 c_n - \gamma^2 c_n^2 + 2\rho\gamma a - 2\rho\gamma ac_n + a\gamma \\ &+ \rho\gamma c_n^2 + \rho c\gamma^2 a + 2\rho cb\gamma^2 + 2\rho cb\gamma ac_n + \rho\gamma + 2\rho c^2 b^2 \gamma a \\ &+ \gamma c_n^2 - 2\rho c^2 b^2 \gamma^2 - \rho\gamma^2 - 2\rho cb\gamma a + 2\gamma^2 c_n - \gamma^2 - 2\rho\gamma c_n c_r \end{aligned} \right)}{4\gamma(a - \gamma + 1)} - K(\delta_1^2 - 1)/2.$$

(ii) For $\frac{\gamma c_n}{1 + a} < c_r < \frac{1 + a - c_n - c_n a + b\gamma c_n - cb - cba}{b(1 + a)}$,

Equilibrium decisions: $q_1^{Rii} = \frac{1 + a - c_n - c_n a + c_n \gamma b - c_r b - bac_r - cb - cba}{2(1 + a - \gamma^2 b^2 + \gamma b^2 + \gamma b^2 a)}$,

$q_n^{Rii*} = \frac{1 + a + \gamma b^2 a + c_n \gamma b - \gamma b + \gamma b^2 + \gamma b^2 c_r + \gamma b^2 c - c_n - \gamma c_n b^2 - \gamma^2 b^2}{2(1 + a - \gamma^2 b^2 + \gamma b^2 + \gamma b^2 a)}$, $q_r^{Rii*} = bq_1^{Rii}$,

$$K^{Rii} = \frac{\rho \left[\begin{aligned} &1 + a + 2\gamma^2 b^2 c_n + \gamma^4 b^4 - 2\gamma^3 b^4 + \gamma^2 b^4 + 2cb^3 \gamma^2 \\ &- \gamma^3 b^4 a + \gamma^2 b^4 a - 2c_n \gamma^2 b^3 - c_n^2 \gamma^2 b^2 - c_r^2 b^4 \gamma^2 \\ &- c^2 b^4 \gamma^2 + 2c_n^2 \gamma^2 b^3 - c_n^2 \gamma^2 b^4 + 2c_r b^3 \gamma^2 - \gamma^2 b^2 a \\ &+ 2\gamma b^2 a - 2c_n \gamma b - c_n^2 - 3\gamma^2 b^2 + 2\gamma b^2 + 2c_n^2 \gamma b \\ &+ 2c_n \gamma b^2 c_r + 2c_n \gamma b^2 c - 2c_n^2 \gamma b^2 - 2c_r b^4 c_r^2 \\ &+ 2c_n \gamma^2 b^4 c_r + 2c_n \gamma^2 b^4 c - 2c_n c_r b^3 \gamma^2 - 2c_n cb^3 \gamma^2 \end{aligned} \right]}{2(a + 2)(1 - \gamma^2 b^2 + \gamma b^2)(1 + a - \gamma^2 b^2 + \gamma b^2 + \gamma b^2 a)}.$$

Equilibrium profits:

$$\pi_T^{Rii*} = \pi_1^{Rii*} + \pi_2^{Rii*} = (p_1 - c_n)q_1 + (p_n - c_n)q_n + (p_r - c_r)q_r - cbq_1 - K((1 + a)^2 - 1)/2.$$

(2) Replacing the statement of Proposition 3.



Citation: Yang, D.; Yang, Q.; Zhang, L. Correction: Yang et al. Operational Decisions on Remanufacturing under the Product Innovation Race.

Sustainability 2023, 15, 4920.

Sustainability 2023, 15, 12116.

<https://doi.org/10.3390/su151612116>

su151612116

Received: 3 July 2023

Accepted: 10 July 2023

Published: 8 August 2023



Copyright: © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

Proposition 3. *The profits under the remanufacturing scenario are higher than that of no remanufacturing (i.e., $\pi_T^{R*} > \pi_T^{N*}$) if, and only if, the cost of c_r is not pronounced (i.e., $c_r < c_r^\Delta$); otherwise, the opposite is true.*

(3) Replacing the statement of Proposition 5.

Proposition 5. *Under the partial remanufacturing scenario, the total environmental impact increases with the remanufacturing cost, that is, $\partial E^R / \partial c_r > 0$; however, under the full remanufacturing scenario, the opposite is true, that is, $\partial E^R / \partial c_r < 0$.*

(4) Replacing the statement of Proposition 6.

Proposition 6. *The threshold values of c_r^Δ increase with the collection target of b , i.e., $\partial c_r^\Delta / \partial b > 0$; moreover, the equilibrium quantities $\partial q_1 / \partial b < 0$.*

(5) Replacing the “Analysis of the Scenario with Remanufacturing” in Appendix A.

Applying backward, starting from Period 2 again. In Stage 1 of Period 2, the manufacturer sets (q_n, q_r) to maximize the profit in Period 2. That is,

$$\Pi_2^R = (p_n - c_n)q_n + (p_r - c_r)q_r - cbq_1$$

subject to $q_r \leq bq_1$, and $q_n, q_r > 0$.

To maximize the problems with constraints, like [52] and [41], we write the above problem as following the Lagrangean:

$$L = (p_n - c_n)q_n + (p_r - c_r)q_r - cbq_1 + \lambda(bq_1 - q_r)$$

Using the KKT optimality conditions:

$$\begin{aligned} \frac{\partial L}{\partial q_n} &= 1 + a - 2q_n - 2q_n a - 2\gamma q_r - c_n \\ \frac{\partial L}{\partial q_r} &= \gamma - 2\gamma q_n - 2\gamma q_r - c_r + \lambda \\ \lambda(bq_1 - q_r) &= 0 \end{aligned}$$

The above equations have two solutions. They depend on whether λ are greater than or equal to zero.

(i) $\lambda = 0$. Solving the gradient conditions with $\lambda = 0$, we have

$$q_n = \frac{1 + a - c_n - \gamma + c_r}{2(1 + a - \gamma)}, q_r = \frac{\gamma c_n - ac_r - c_r}{2\gamma(1 + a - \gamma)} \quad (1)$$

(ii) $\lambda > 0$. Solving the system, we obtain

$$q_n = \frac{1 + a - 2\gamma bq_1 - c_n}{2(1 + a)}, q_r = bq_1, \lambda = \frac{2\gamma bq_1 - 2r^2 bq_1 + 2\gamma bq_1 a - \gamma c_n + c_r + ac_r}{(1 + a)} \quad (2)$$

(6) Replacing the “Appendix B. Proof of Proposition 1”.

(i) For $\frac{\gamma(b\gamma + b^2c + b^2ca - b - ba - b^2\gamma c - b\gamma c_n + c_n + bc_n a + c_n)}{1 + a} = \underline{c}_r < c_r < \bar{c}_r = \frac{\gamma c_n}{1 + a}$,

Solving $K^{Ri} - K^N = \frac{\rho(ac_r^2 - 2c_r c_n a + c_n^2 \gamma a - 2c_r c_n - c_n^2 \gamma^2 + 2c_n^2 \gamma + c_r^2)}{2(a^2 + 3a + 2)(\gamma - 1)(1 + a - \gamma)}$, we find that whether $K^{Ri} - K^N > 0$ depends on the numerator of the above equation. Then, let $t = ac_r^2 - 2c_r c_n a + c_n^2 \gamma a - 2c_r c_n - c_n^2 \gamma^2 + 2c_n^2 \gamma + c_r^2$, we can obtain:

$c_{r1} = \frac{c_n + ac_n + c_n \sqrt{-(a+1)(\gamma-1)(a-\gamma+1)}}{a+1}$, $c_{r2} = \frac{c_n + ac_n - c_n \sqrt{-(a+1)(\gamma-1)(a-\gamma+1)}}{a+1}$. Comparing $c_{r1}, c_{r2}, \underline{c}_r$ and $\bar{c}_r$, we find that $\underline{c}_r < \bar{c}_r < c_{r1} < c_{r2}$, which means $K^N > K^{Ri}$.

(ii) For $\frac{\gamma(b\gamma+b^2c+b^2ca-b-ba-b^2\gamma c-b\gamma c_n+c_n+bc_na+c_n)}{1+a} = \underline{c_r} < c_r < \bar{c_r} = \frac{\gamma c_n}{1+a}$, solving

$$K^{Rii} - K^N = \frac{\rho \left[\begin{aligned} &2c_n^2\gamma^2b^3 + 2\gamma c_n b^2c_r + 2\gamma c_n b^2c + 3c_n^2\gamma b + 2\gamma c_n b^2 - 2\gamma b^2ca \\ &- 2\gamma bc_na + c_n^2\gamma^2b^3a + 2c_n^2\gamma ba - 2c_n^2\gamma b^2a - 2c_n\gamma b^3c - 2c_r b^2\gamma a \\ &+ 2c_n\gamma b^2a + c_r^2b^3\gamma a + c^2b^3\gamma a + 2c_r b^3c\gamma - 2c_n\gamma b^3c_r + 2\gamma c_n b^2c_r a \\ &+ 2\gamma c_n b^2ca - 2c_r b^2\gamma - c_n^2\gamma^3b^3 + c_r^2b^3\gamma + c^2b^3\gamma - 2c_n b c_r a - 2c_n^2\gamma b^2 \\ &- 2c_n b c a - 2c_n\gamma b^3ca + 2c_r b^3c\gamma a - 2c_n\gamma b^3c_r a + 2c_n + 2c_n a \\ &- 2c_n^2a - 2c_n b c - 2b\gamma c_n - 2\gamma b^2c - 2c_n b c_r + b\gamma - 2c_n^2 + \gamma b a \end{aligned} \right]}{2(a+2)(1-\gamma^2b^2+\gamma b^2)(1+a-\gamma^2b^2+\gamma b^2+\gamma b^2a)} \quad \text{we}$$

find that whether $K^{Rii} - K^N > 0$ depends on the numerator of the above equation. Then, similar to scenario (i), we can yield the roots of:

$$c_{r1} = \frac{\left[2b\gamma - 2b\gamma c_n - 2\gamma b^2c - 2\gamma b^2ca + 2\gamma c_n b^2 - 2\gamma bc_na + 2c_n\gamma b^2a + 2c_n a + 2c_n \right. \\ \left. + 2\gamma ba + 2(c_n^2(1-\gamma^2b^2+\gamma b^2)(1+a)(1+a-\gamma^2b^2+\gamma b^2+\gamma b^2a))^{1/2} \right]}{2(b\gamma + \gamma ba)b}$$

$$c_{r2} = \frac{\left[2b\gamma - 2b\gamma c_n - 2\gamma b^2c - 2\gamma b^2ca + 2\gamma c_n b^2 - 2\gamma bc_na + 2c_n\gamma b^2a + 2c_n a + 2c_n \right. \\ \left. + 2\gamma ba - 2(c_n^2(1-\gamma^2b^2+\gamma b^2)(1+a)(1+a-\gamma^2b^2+\gamma b^2+\gamma b^2a))^{1/2} \right]}{2(b\gamma + \gamma ba)b}$$

Comparing c_{r1} , c_{r2} , $\underline{c_r}$ and $\bar{c_r}$, we find that $\underline{c_r} < \bar{c_r} < c_{r1} < c_{r2}$, which means $K^N > K^{Rii}$. In sum, we can conclude that remanufacturing is always detrimental to the incentives for new product innovation (i.e., $K^R < K^N$).

(7) Replacing the “Appendix C. Proof of Proposition 2”.

Based on Table 1, $\frac{\partial K^{Ri}}{\partial c_r} = \frac{\rho(c_n - c_r)}{(a+2)(1-\gamma)(a-\gamma+1)} > 0$ and

$$\frac{\partial K^{Rii}}{\partial c_r} = \frac{\rho\gamma b[b\gamma + c_n - c_r b^2\gamma - b\gamma c_n - \gamma b^2c + \gamma c_n b^2]}{2(a+2)(1-\gamma^2b^2+\gamma b^2)(1+a-\gamma^2b^2+\gamma b^2+\gamma b^2a)} > 0.$$

In sum, we can conclude that under the remanufacturing scenario, the incentives for new product innovation increase with the remanufacturing cost, that is, $\partial K^R / \partial c_r > 0$.

(8) Replacing the “Appendix D. Proof of Proposition 3”.

Based on the outcomes in Table 1, we can find that $\pi_T^{Ri*} - \pi_T^{N*} = \frac{(c_r - rc_n + ac_r)^2}{4r(1+a-r)(1+a)} > 0$. This means that $\pi_T^{Ri*} - \pi_T^{N*} > 0$ is always true.

(ii) For $\frac{\gamma(b\gamma+b^2c+b^2ca-b-ba-b^2\gamma c-b\gamma c_n+c_n+bc_na+c_n)}{1+a} = \underline{c_r} < c_r < \bar{c_r} = \frac{\gamma c_n}{1+a}$, After the observation of

$$\pi_T^{Rii*} - \pi_T^{N*} = \frac{\left[\begin{aligned} &\gamma ba^2 - 2c_n c_r - 4c_n c_r a + 2\gamma c_n b c_r a - 2c_n b^2 c \gamma^2 a - c^2 b^3 \gamma^2 \\ &- \gamma^2 b + 2\gamma c_n b^2 c + c_n^2 \gamma b + 2c_n^2 \gamma - 4\gamma b^2 ca - 4\gamma b c_n a + 2\gamma^2 bc \\ &+ 2cb\gamma c_n a + 2c_n^2 \gamma ba + 2c^2 b^3 \gamma a + 4\gamma c_n b^2 ca - 2\gamma c_n a + 2a^2 c_r \\ &+ c^2 b^3 \gamma - 2c_n b^2 c \gamma^2 - 2c_r b c a^2 - 2c_n \gamma b a^2 - 2c_n c_r a^2 \\ &+ 2\gamma^2 b c_n a + 2\gamma c_n b c_r - 4c_r b c a - c_r^2 b + 2c_r - 2b\gamma c_n - 2\gamma b^2 c \\ &- 2\gamma c_n + 4ac_r + 2cb\gamma c_n + b\gamma + 2\gamma ba - 2c_r bc - 2c_r^2 ba_n \\ &+ 2c_n^2 \gamma a - \gamma^2 ba + 2cb^2 \gamma^2 - 2c_n^2 \gamma^2 b - c_r^2 ba^2 + 2c_n \gamma b^2 ca^2 \\ &+ c_n^2 \gamma ba^2 + c^2 b^3 \gamma a^2 - 2b^2 c \gamma a^2 + 2cb^2 \gamma^2 a - c_n^2 \gamma^2 ba - c^2 b^3 \gamma^2 a \end{aligned} \right]}{4(\gamma^2 b^2 - 1 - a - \gamma b^2 - \gamma b^2 a)(1+a)} \quad \text{we}$$

find that whether $\pi_T^{Rii*} - \pi_T^{N*} > 0$ depends on the numerator of the above equation. Then, solving the above equation, we can yield the roots as follows:

$$c_{r1} = \frac{\left[\frac{2a - 2c_n a - 2cba - 2cb - 2c_n + 2 + 2b\gamma c_n}{+2(1 - c_n - cb)\sqrt{(1+a)(1+a-r^2b^2+rb^2+rb^2a)}} \right]}{2b(1+a)}$$

$$c_{r2} = \frac{\left[\frac{2a - 2c_n a - 2cba - 2cb - 2c_n + 2 + 2b\gamma c_n}{-2(1 - c_n - cb)\sqrt{(1+a)(1+a-r^2b^2+rb^2+rb^2a)}} \right]}{2b(1+a)}$$

comparing c_{r1} , c_{r2} , c_r and $\bar{c}_r$, we find that, for any $c > 0$, then $c_r < c_{r2} < \bar{c}_r < c_{r1}$. That is, if, and only if, the cost of $c_r < c_{r2}$, then $\pi_T^{Rii*} > \pi_T^{N*}$, otherwise, $\pi_T^{Rii*} < \pi_T^{N*}$.

In sum, we can conclude that the profits under the remanufacturing scenario are higher than that of no remanufacturing (i.e., $\pi_T^{R*} > \pi_T^{N*}$) if, and only if, the cost of c_r is not pronounced (i.e., $c_r < c_r^\Delta = c_{r2}$); otherwise, the opposite is true.

(9) Replacing the “Appendix E. Proof of Proposition 4”.

Since $E^R = i_d(q_1^{R*} + q_n^{R*})$, then we can obtain

$$(i) \text{ For } \frac{\gamma(b\gamma + b^2c + b^2ca - b - ba - b^2\gamma c - b\gamma c_n + c_n + bc_n a + c_n)}{1+a} = \underline{c}_r < c_r < \bar{c}_r = \frac{\gamma c_n}{1+a},$$

$$E^{Ri} - E^N = i_d \frac{(ac_r + c_r - \gamma c_n)}{2(a+1)(1+a-\gamma)} < 0 \text{ is always true.}$$

$$(ii) \text{ For } \frac{\gamma(b\gamma + b^2c + b^2ca - b - ba - b^2\gamma c - b\gamma c_n + c_n + bc_n a + c_n)}{1+a} = \underline{c}_r < c_r < \bar{c}_r = \frac{\gamma c_n}{1+a},$$

$$\text{solving } E^{Rii} - E^N = i_d \frac{\begin{bmatrix} 2c_n\gamma a + \gamma bc_r a + \gamma bca + \gamma^2 b + c_n\gamma ba^2 - cb^2\gamma^2 a \\ +cb^2ra^2 - c_n\gamma^2 ba + \gamma bc + \gamma bc_r - a^2c_r - \gamma ba^2 \\ -\gamma a + \gamma^2 ba - cb^2\gamma^2 - 2ac_r - 2c_n\gamma^2 b - 2b\gamma a - \gamma \\ +c_n\gamma b + 2c_n\gamma + 2\gamma b^2ca + 2c_n\gamma ba - c_r - b\gamma + \gamma b^2c \end{bmatrix}}{2(a+1-\gamma^2b^2+\gamma b^2+\gamma b^2a)(a+1)}, \text{ we}$$

find that whether $E^{Rii} - E^N < 0$ depends on the numerator of the above equation. Then, solving the above equation, we can yield the root of:

$$r \frac{\begin{bmatrix} bca - 1 + c_nba^2 - rb^2ca + cb^2a^2 - c_n\gamma ba + 2cb^2a \\ +2c_nba + c_nb + cb^2 + b\gamma a + 2c_na - ba^2 - \gamma b^2c \\ -2c_n\gamma b - 2ba + 2c_n - b + b\gamma - a + bc \end{bmatrix}}{1-b\gamma a - b\gamma a^2 + a^2a}.$$

When $c_r > c_{r1}$ $E^{Rii} - E^N < 0$ is true.

Comparing c_{r1} , $\underline{c}_r$ and $\bar{c}_r$, we find that $c_{r1} < \underline{c}_r < \bar{c}_r$.

Then, we can conclude that, for any $\underline{c}_r < c_r < \bar{c}_r$, $E^{Rii} - E^N < 0$ is always true.

In sum, we can conclude that the presence of remanufacturing is always beneficial to the environment, that is, $E^N > E^R$.

(10) Replacing the “Appendix F. Proof of Proposition 5”.

$$(i) \text{ For } \frac{\gamma(b\gamma + b^2c + b^2ca - b - ba - b^2\gamma c - b\gamma c_n + c_n + bc_n a + c_n)}{1+a} = \underline{c}_r < c_r < \bar{c}_r = \frac{\gamma c_n}{1+a}$$

$$\partial E^{Ri} / \partial c_r = \frac{1}{2(a-\gamma+1)} > 0 \text{ is always true.}$$

$$(ii) \text{ For } \frac{\gamma(b\gamma + b^2c + b^2ca - b - ba - b^2\gamma c - b\gamma c_n + c_n + bc_n a + c_n)}{1+a} = \underline{c}_r < c_r < \bar{c}_r = \frac{\gamma c_n}{1+a},$$

$$\partial E^{Rii} / \partial c_r = \frac{-b(1+a-b\gamma)}{2(a+1-\gamma^2b^2+\gamma b^2+\gamma b^2a)} < 0 \text{ is always true.}$$

Under the partial remanufacturing scenario, the total environmental impact increases with the remanufacturing cost, that is, $\partial E^R / \partial c_r > 0$; however, under the full remanufacturing scenario, the opposite is true, that is, $\partial E^R / \partial c_r < 0$.

(11) Replacing the “Appendix G. Proof of Proposition 6”.

Based on the analysis of Proposition 3, we find that, for $\frac{\gamma(b\gamma + b^2c + b^2ca - b - ba - b^2\gamma c - b\gamma c_n + c_n + bc_n a + c_n)}{1+a} = \underline{c}_r < c_r < \bar{c}_r = \frac{\gamma c_n}{1+a}$, there is a threshold of $c_r^\Delta = c_{r2} = \frac{\left[\frac{2a - 2c_n a - 2cba - 2cb - 2c_n + 2 + 2b\gamma c_n}{-2(1 - c_n - cb)\sqrt{(1+a)(1+a-r^2b^2+rb^2+rb^2a)}} \right]}{2b(1+a)}$ then

for $\partial c_r^\Delta / \partial b = \frac{\left[\frac{a - c_n a + \gamma b^3 c a + 1 + \gamma b^3 c - c_n - \gamma^2 b^3 c}{(c_n - 1) \sqrt{(1+a)(1+a - \gamma^2 b^2 + \gamma b^2 + \gamma b^2 a)}} \right]}{b^2 \sqrt{(1+a)(1+a - \gamma^2 b^2 + \gamma b^2 + \gamma b^2 a)}}$ we find that for any $c > 0$, $\partial c_r^\Delta / \partial b > 0$ is always true.

We are now in a position to prove $\partial q_1 / \partial b < 0$ as follows.

(i) For $\frac{\gamma(b\gamma + b^2c + b^2ca - b - ba - b^2\gamma c - b\gamma c_n + c_n + bc_n a + c_n)}{1+a} = \underline{c}_r < c_r < \bar{c}_r = \frac{\gamma c_n}{1+a}$

$$\partial q_1^{Ri} / \partial b = -\frac{c}{2} < 0$$

(ii) For $\frac{\gamma(b\gamma + b^2c + b^2ca - b - ba - b^2\gamma c - b\gamma c_n + c_n + bc_n a + c_n)}{1+a} = \underline{c}_r < c_r < \bar{c}_r = \frac{\gamma c_n}{1+a}$,

$$\partial q_1^{Rii} / \partial b = q_1^{Rii} = \frac{\left[\begin{array}{l} 2\gamma^2 b a - c_n \gamma^2 b^2 a - a^2 c_r - 2\gamma b a^2 + \gamma c b^2 - c \gamma^2 b^2 \\ + c_r \gamma b^2 + 2b \gamma c_n - c_r \gamma^2 b^2 + c_n \gamma a - c_n \gamma^2 b^2 + c_n \gamma^3 b^2 \\ + 4b \gamma c_n a + c a^2 \gamma b^2 - a c_r \gamma^2 b^2 + 2c_r \gamma b^2 a + 2c \gamma b^2 a \\ - c a^2 - c + a^2 c_r \gamma b^2 - c a \gamma^2 b^2 - 2\gamma^2 b c_n a - c_r + c_n \gamma \\ + 2\gamma b c_n a^2 + 2\gamma^2 b - 2\gamma b - 2b \gamma^2 c_n - 2a c_r - 2c a - 4\gamma b a \end{array} \right]}{2(1+a - \gamma^2 b^2 + \gamma b^2 + \gamma b^2 a)^2}$$

Then, solving the above equation, we can yield the root of:

$$c_{r1} = \frac{\left[\begin{array}{l} 4b \gamma c_n a - c - c_n \gamma^2 b^2 a + c a^2 \gamma b^2 + 2\gamma c b^2 a - c a \gamma^2 b^2 \\ - 2\gamma^2 b c_n a + 2\gamma b c_n a^2 - 4\gamma b a + c_n \gamma^3 b^2 - c \gamma^2 b^2 \\ - c_n \gamma^2 b^2 + c \gamma b^2 + 2b \gamma c_n + 2\gamma^2 b a - 2\gamma^2 b c_n - 2\gamma b a^2 \\ + c_n \gamma a - 2b \gamma + 2\gamma^2 b + c_n \gamma - c a^2 - 2c a \end{array} \right]}{1 - a^2 \gamma b^2 - 2\gamma b^2 a + a \gamma^2 b^2 + \gamma^2 b^2 - \gamma b^2 + a^2 + 2a}. \text{ When } c_r > c_{r1} \partial q_1^{Rii} / \partial b < 0 \text{ is true.}$$

Comparing c_{r1} , $\underline{c}_r$ and $\bar{c}_r$, we find that $c_{r1} < \underline{c}_r < \bar{c}_r$.

Then, we can conclude that, for any $\underline{c}_r < c_r < \bar{c}_r$, $\partial q_1^{Rii} / \partial b < 0$ is always true.

In sum, we can conclude the equilibrium quantities as $\partial q_1 / \partial b < 0$.

The authors state that the scientific conclusions are unaffected. This correction was approved by the Academic Editor. The original publication has also been updated.

Reference

1. Yang, D.; Yang, Q.; Zhang, L. Operational Decisions on Remanufacturing under the Product Innovation Race. *Sustainability* **2023**, *15*, 4920. [[CrossRef](#)]

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.