Online Supplement for "Impact of the Cannibalization Effect between New and Remanufactured Products on Supply Chain Design and Operations"

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Figures S1 and S2 demonstrate the impact of γ on revenue/cost/pricing/demand in the linear model for different values of σ_{1i} and σ_{2i}. In each figure, (a) shows the change in revenue and total cost associated with γ. (b) shows the prices of new and remanufactured products in γ. (c) shows the change in the demands for new and remanufactured products. (d) represents the change in total demand.

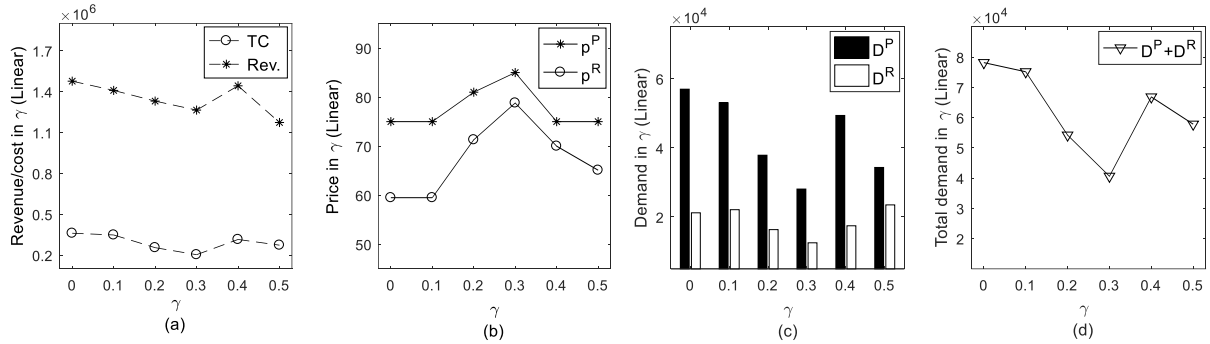

Figure S1 Impact of γ on revenue/cost/price/demand (linear model, $\sigma_{1i} = \sigma_{2i} = 0.1$)

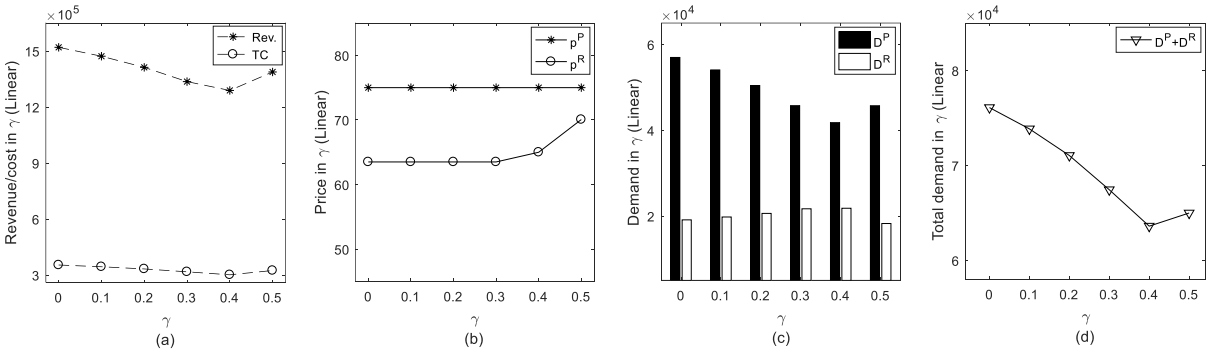

Figure S2 Impact of γ on revenue/cost/price/demand (linear model, $\sigma_{1i} = 0.1; \sigma_{2i} = 0.2$)

Figures S3 and S4 demonstrate the impact of δ on revenue/cost/demand in the inverted model when σ_{1i} and σ_{2i} take different values. In each figure, (a) and (b) show the change in revenue and total cost associated with δ, respectively. (c) shows the change in the demands for new and remanufactured products and total demand.

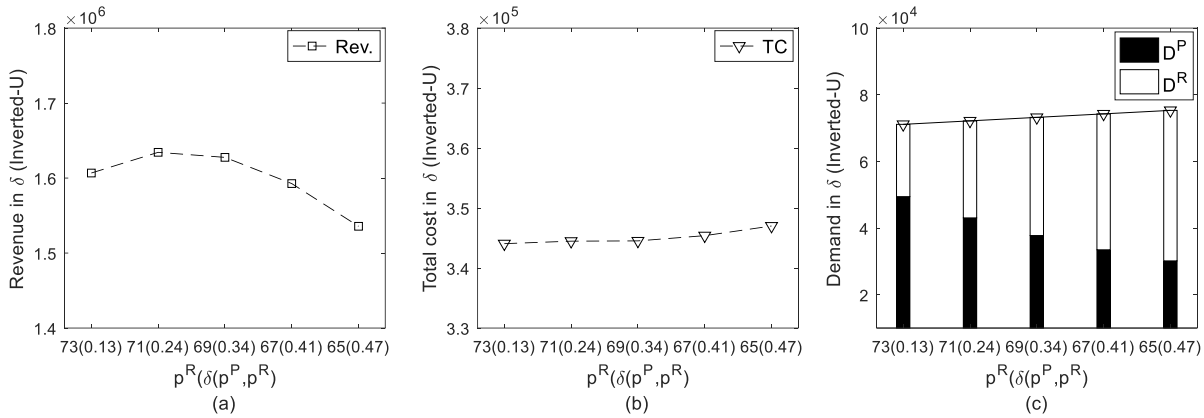

Figure S3 Impact of δ on revenue/cost/demand (inverted-U model, $\sigma_{1i}=0.2;\sigma_{2i}=0.1$)

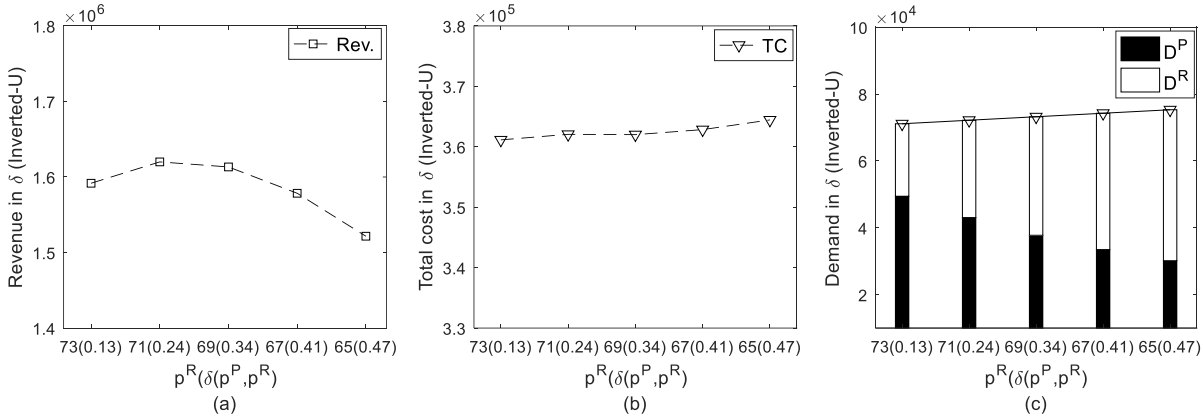

Figure S4 Impact of δ on revenue/cost/demand (inverted-U model, $\sigma_{1i}=0.2;\sigma_{2i}=2$)

Table S1 shows the supplementary experiment results of the number and position of selected DCs with variations in $p^R(\delta)$ in the inverted-U model.

Table S1 Number and position of DCs in $p^R(\delta)$ in the inverted-U model

$\lvert I\rvert=\lvert J\rvert$	σ_{1i}	σ_{2i}	p^R	73	71	69	67	65
			$\delta(p_i^P,p_i^R)$	0.13	0.24	0.34	0.41	0.47
25	0.1	0.1	No. of DCs	4	4	3	3	3
			Pos. of DCs	[1,4,6,22]	[1,4,6,22]	[0,4,6]	[0,4,15]	[0,4,15]
25	0.1	0.2	No. of DCs	4	4	3	3	3
			Pos. of DCs	[1,4,6,22]	[1,4,6,22]	[0,4,6]	[0,4,15]	[0,4,15]
25	0.1	0.5	No. of DCs	4	4	3	3	3
			Pos. of DCs	[1,4,6,22]	[1,4,6,22]	[0,4,6]	[0,4,6]	[0,4,15]
25	0.5	0.5	No. of DCs	3	3	3	3	3
			Pos. of DCs	[4,6,21]	[4,6,21]	[0,4,6]	[0,4,6]	[0,4,6]
25	1	1	No. of DCs	3	3	3	3	3
			Pos. of DCs	[4,6,21]	[4,6,21]	[0,1,4]	[0,1,4]	[0,4,6]
30	0.1	0.1	No. of DCs	5	4	4	4	4

			Pos. of DCs	[8,12,13,20,25]	[8,12,13,20]	[8,12,13,20]	[8,12,13,20]	[8,12,20,23]
30	0.1	0.2	No. of DCs	5	4	4	4	4
			Pos. of DCs	[8,12,13,20,25]	[8,12,13,20]	[8,12,13,20]	[8,12,13,20]	[8,12, 20,23]
30	0.1	0.5	No. of DCs	4	4	4	4	4
			Pos. of DCs	[8,12,13,20]	[8,12,13,20]	[8,12,13,20]	[8,12,13,20]	[8,12, 20,23]
30	0.5	0.5	No. of DCs	4	4	4	4	4
			Pos. of DCs	[8,12,13,20]	[8,12,13,20]	[8,12,13,20]	[8,12, 20,23]	[8,12, 20,23]
30	1	1	No. of DCs	4	4	4	4	4
			Pos. of DCs	[8,12,13,20]	[8,12,13,20]	[8,12,13,20]	[8,12, 20,23]	[8,12, 20,23]

Table S2 demonstrates the experimental results for the comparison between uniform and independent policies in the linear model

Table S2 Comparison between uniform and independent policies in the linear model

$\lvert I\rvert=\lvert J\rvert$	T	σ_{2i}	γ	Rev_I	Rev_U	$\overline{\nabla}$
10	7	0.1	0.3	588092	586372	**0.29%**
10	7	0.2	0.3	587759	586006	**0.30%**
10	7	0.5	0.3	586267	584189	**0.35%**
10	14	0.1	0.3	576311	574623	**0.29%**
10	14	0.2	0.3	575893	574180	**0.30%**
10	14	0.5	0.3	574073	572268	**0.31%**
10	30	0.1	0.2	596214	595655	**0.09%**
10	30	0.2	0.2	595744	595189	**0.09%**
10	60	0.5	0.2	593790	592919	**0.15%**
10	60	0.1	0.1	572292	569580	**0.47%**
10	60	0.2	0.1	571738	568917	**0.49%**
10	60	0.5	0.1	569410	566454	**0.52%**
15	7	0.1	0.3	830875	829032	**0.22%**
15	7	0.2	0.3	830349	828559	**0.22%**
15	7	0.5	0.3	828318	826224	**0.25%**
15	14	0.1	0.3	814819	812365	**0.30%**
15	14	0.2	0.3	814300	811776	**0.31%**
15	14	0.5	0.3	812054	809325	**0.34%**
15	30	0.1	0.2	848885	848079	**0.09%**
15	30	0.2	0.2	848316	847516	**0.09%**
15	60	0.5	0.2	845607	844797	**0.10%**
15	60	0.1	0.1	817662	813123	**0.56%**
15	60	0.2	0.1	816898	812460	**0.54%**
15	60	0.5	0.1	813809	809402	**0.54%**

Table S3 shows the variation of specific prices for each retailer with respect to cannibalization coefficient in the linear model. In what follows, $\hat{p}^{P}$ represents the price of new products for each retailer and $\hat{p}^{R}$ means the price of remanufactured products for each retailer.

Table S3 specific prices for each retailer with respect to γ in the linear model

Retailer ID	γ =0		γ =0.1		γ =0.2		γ =0.3		γ =0.4		γ =0.5	
	$\hat{p}^P$	$\hat{p}^R$	$\hat{p}^P$	$\hat{p}^R$	$\hat{p}^P$	$\hat{p}^R$	$\hat{p}^P$	$\hat{p}^R$	$\hat{p}^P$	$\hat{p}^R$	$\hat{p}^P$	$\hat{p}^R$
0					85	79.2						
1					75	59.5						
2					85	79.2						
3					85	79.2						
4					75	59.5						
5					85	79.2						
6					75	59.5						
7					85	79.2						
8					85	79.2						
9	75	59.5	75	59.5	75	59.5	85	75.8	75	70	75	65.1
10					85	79.2						
11					85	79.2						
12					85	79.2						
13					85	79.2						
14					85	79.2						
15					75	59.5						
16					75	59.5						
17					75	59.5						
18					85	79.2						
19					75	59.5						

Table S4 shows the variation of specific prices for each retailer with respect to periodic review (T) in the linear model

Table S4 specific prices for each retailer with respect to T in the linear model

Retailer ID	T=7		T=14		T=30		T=60		T=90	
	$\hat{p}^P$	$\hat{p}^R$	$\hat{p}^P$	$\hat{p}^R$	$\hat{p}^P$	$\hat{p}^R$	$\hat{p}^P$	$\hat{p}^R$	$\hat{p}^P$	$\hat{p}^R$
0							85	81.5		
1							85	81.5		
2							85	81.5		
3							85	81.5		
4							85	81.5		
5							85	81.5		
6							75	59.5		
7	75	59.5	75	59.5	75	59.5	85	81.5	85	81.5
8							85	81.5		
9							85	81.5		
10							85	81.5		
11							85	81.5		
12							75	59.5		
13							85	81.5		
14							85	81.5		
15							85	81.5		

16	85	81.5
17	75	59.5
18	85	81.5
19	85	81.5

Figure S5 illustrates the impact of manufacturer capacity (Cap^{MF}) on the revenue, average price, and total demand in the inverted-U model. In each figure, (a) shows the change in revenue associated with Cap^{MF}. (b) shows the change in the demands for new and remanufactured products. (c) represents the average prices of new and remanufactured products in Cap^{MF}.

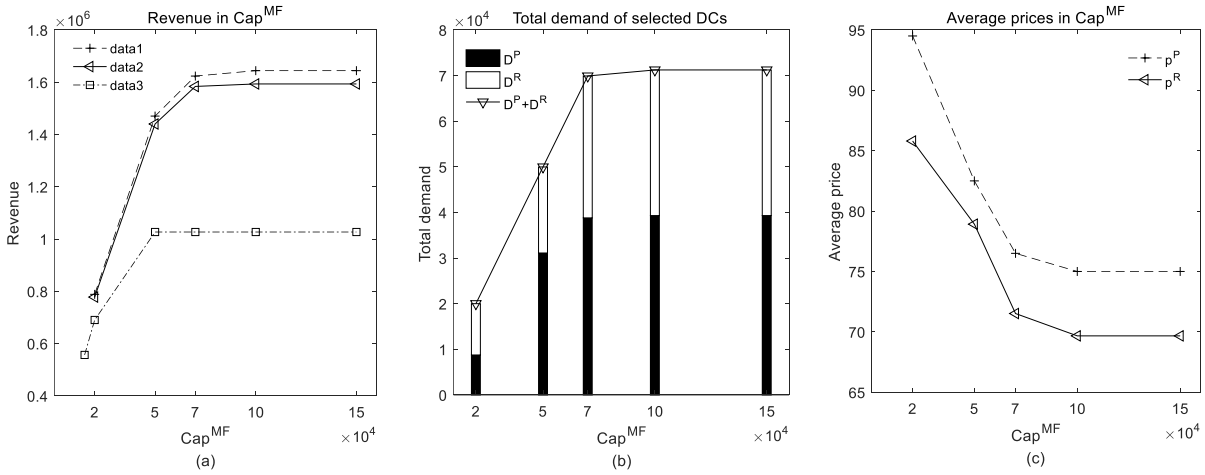

Figure S5 Change of revenue/average price/total demand in Cap^{MF} in the inverted-U model

Table S5 presents the impact of manufacturer capacity (Cap^{MF}) on the number and position of selected DCs in the inverted-U model.

Table S5 number and position of DCs when Cap^{MF} changes in inverted-U model

Cap^{MF}	20000	50000	70000	100000	150000
No. of DCs	2	3	5	5	5
Pos. of DCs	[1,18]	[1,6,7]	[6,12,16,17,18]	[6,10,16,17,18]	[6,10,16,17,18]