```
ClearAll["Global`*"]

(* Initialize by defining utilities, uhigh and ulow,
and state-contingent predicted utilities, uhighlow and ulowhigh *)

uhigh = u + Δ;

ulow = u;

uhighlow = ulow + (1 - α) Δ;

ulowhigh = ulow + α Δ;

(* Get predicted utilities when currently motivated and unmotivated, respectively *)

umot = μ uhigh + (1 - μ) ulowhigh;

uunmot = μ uhighlow + (1 - μ) ulow;

(* Create Lists of assumptions for ease of reference *)

(* η ∈ [0,1) reflects the degree to which return
 costs fall back to the firm upon return by consumers *)

asslist = {u > 0, Δ > 0, 1 > α > 0, 1 > μ > 0, 1 > η ≥ 0};

assand = u > 0 && Δ > 0 && 1 > α > 0 && 1 > μ > 0 && 1 ≥ η ≥ 0;

(* Define expected utility (for welfare) *)

exput = μ uhigh + (1 - μ) ulow;

(* Print umot and uunmot for comparison *)

FullSimplify[{umot, uunmot}]
{u + Δ (α + μ - α μ), u - (-1 + α) Δ μ}
```

■ Baseline

```
(* Strategy 1: exclusive targeting,
cater only to motivated consumers by charging p =
 pexcl equal to the predicted utility of motivated consumers umot *)

dexcl = μ; pexcl = umot; profexcl = FullSimplify[dexcl * (pexcl - c), asslist]
μ (-c + u + Δ (α + μ - α μ))

(* Compute Consumer Welfare and Total Welfare *)

cwexcl = FullSimplify[dexcl * (exput - pexcl), asslist];

(* Strategy 2: full targeting, cater to all consumers by charging p =
 pfull equal to the predicted utility of unmotivated consumers uunmot *)

dfull = 1;
pfull = uunmot;
proffull = FullSimplify[dfull * (pfull - c), asslist]
-c + u - (-1 + α) Δ μ

cwfull = FullSimplify[dfull * (exput - pfull), asslist];

(* Obtain cost threshold such that exclusive targeting preferred iff c > ctilde *)
```

```
temp = Simplify[Reduce[profexcl > proffull && assand, c, Reals], asslist]
```

$$c > u + \frac{\Delta\,\mu\,\left(-1-\alpha\,\left(-2+\mu\right)+\mu\right)}{-1+\mu}$$

```
ctilde = temp[[2]]
```

$$u + \frac{\Delta\,\mu\,\left(-1-\alpha\,\left(-2+\mu\right)+\mu\right)}{-1+\mu}$$

```
(* Cooling Off Policy is unchanged as Return Costs do not apply *)
```

■ Return Policy

```
(* Strategy 1: Exclusive targeting,
cater only to initially motivated consumers who consume in the motivated state *)

(* Internalize costs equal to μ [initial purchase] ×
 (1-μ) [fraction of consumers returning the good] ×
 ηc [degree of internalization times cost] *)
(* demand prices and profit under return policy
 if only motivated consumers are targeted *)

dexclrp = μ^2;
pexclrp = uhigh;
profexclrp = FullSimplify[dexclrp * (pexclrp - c) - μ (1 - μ) η c]
```

$$\mu\,\left(-c\,\eta+(u+\Delta)\,\mu+c\,\left(-1+\eta\right)\,\mu\right)$$

```
cwexclrp = FullSimplify[dexclrp * (uhigh - pexclrp), asslist];

(* Strategy 2: Intermediate targeting,
cater only to second period motivated consumers by charging p =
 pmedrp equal to predicted utility in motivated state by unmotivated consumers *)

dmedrp = μ;
pmedrp = uhighlow;
profmedrp = FullSimplify[dmedrp * (pmedrp - c) - (1 - μ) η c, asslist]
```

$$-c\,\eta+(u+\Delta-\alpha\,\Delta)\,\mu+c\,\left(-1+\eta\right)\,\mu$$

```
cwmedrp = FullSimplify[dmedrp * (uhigh - pmedrp), asslist];

(* Strategy 3: Full targeting, cater to all consumers by
 charging price equal to consumption utility in unmotivated state *)

dfullrp = 1;
pfullrp = ulow;
proffullrp = FullSimplify[dfullrp * (pfullrp - c)]
```

$$-c+u$$

```
cwfullrp = FullSimplify[exput - pfullrp];

(* Thresholds from pairwise comparison of strategies *)

(* Threshold 1: Medium targeting preferred to full targeting iff c > c1rp *)

Simplify[Reduce[profmedrp > proffullrp && assand, c, Reals], asslist]
```

$$\left(u+c\,\left(-1+\eta\right)\right)\,\left(-1+\mu\right) > \left(-1+\alpha\right)\,\Delta\,\mu$$

```
temp = FullSimplify[Solve[profmedrp == proffullrp, c], asslist]
```

$$\left\{\left\{c \to \frac{u - u\,\mu + \left(-1+\alpha\right)\,\Delta\,\mu}{\left(-1+\eta\right)\,\left(-1+\mu\right)}\right\}\right\}$$

```
c1rp = c /. temp[[1]]
```

$$\frac{u - u\,\mu + \left(-1+\alpha\right)\,\Delta\,\mu}{\left(-1+\eta\right)\,\left(-1+\mu\right)}$$

```
(* Threshold 2:
 Exclusive targeting preferred to intermediate targeting iff c > c2rp *)
```

```
Simplify[Reduce[profexclrp > profmedrp && assand, c, Reals], asslist]
```

$$c\,\left(\eta\,\left(-1+\mu\right) - \mu\right)\,\left(-1+\mu\right) + \mu\,\left(u\,\left(-1+\mu\right) + \Delta\,\left(-1+\alpha+\mu\right)\right) > 0$$

```
temp = FullSimplify[Solve[profexclrp == profmedrp, c], asslist]
```

$$\left\{\left\{c \to \frac{\mu\,\left(u+\Delta-\alpha\,\Delta-\left(u+\Delta\right)\,\mu\right)}{\left(\eta\,\left(-1+\mu\right)-\mu\right)\,\left(-1+\mu\right)}\right\}\right\}$$

```
c2rp = c /. temp[[1]]
```

$$\frac{\mu\,\left(u+\Delta-\alpha\,\Delta-\left(u+\Delta\right)\,\mu\right)}{\left(\eta\,\left(-1+\mu\right)-\mu\right)\,\left(-1+\mu\right)}$$

```
(* Threshold 3: Exclusive targeting preferred to full targeting iff c > c3rp *)
```

```
Simplify[Reduce[profexclrp > proffullrp && assand, c, Reals], asslist]
```

$$c + \left(u+\Delta\right)\,\mu^2 + c\,\eta\,\mu^2 > u + c\,\mu\,\left(\eta+\mu\right)$$

```
temp = FullSimplify[Solve[profexclrp == proffullrp, c], asslist]
```

$$\left\{\left\{c \to \frac{u - \left(u+\Delta\right)\,\mu^2}{\left(-1+\mu\right)\,\left(-1+\left(-1+\eta\right)\,\mu\right)}\right\}\right\}$$

```
c3rp = c /. temp[[1]]
```

$$\frac{u - \left(u+\Delta\right)\,\mu^2}{\left(-1+\mu\right)\,\left(-1+\left(-1+\eta\right)\,\mu\right)}$$

```
(* Reduce Cases *)
```

```
FullSimplify[c1rp > c3rp, asslist]
```

$$u\,\left(\eta - \eta\,\mu\right) + \Delta\,\mu\,\left(-1+\alpha\,\left(1+\mu-\eta\,\mu\right)\right) > 0$$

```
FullSimplify[c3rp > c2rp, asslist]
```

$$u\,\left(\eta - \eta\,\mu\right) + \Delta\,\mu\,\left(-1+\alpha\,\left(1+\mu-\eta\,\mu\right)\right) > 0$$

```
FullSimplify[c1rp < c3rp, asslist]
```

$$u\,\left(\eta - \eta\,\mu\right) + \Delta\,\mu\,\left(-1+\alpha\,\left(1+\mu-\eta\,\mu\right)\right) < 0$$

```
FullSimplify[c3rp < c1rp, asslist]
```

$$u\,\eta\,\left(-1+\mu\right) + \Delta\,\mu\,\left(1+\alpha\,\left(-1+\left(-1+\eta\right)\,\mu\right)\right) < 0$$

```
(* Sign of this determines ordering *)
```

- Show that Full to Exclusive is not possible for low η (know this for $\eta = 0$)

```
(* Towards Establishing this define difference between c2rp and ctilde *)

diff = FullSimplify[c2rp - ctilde, asslist]
```

$$\frac{\Delta\,\mu\,\left(-1+\alpha+\eta-2\,\alpha\,\eta+\left(-1+\alpha\right)\,\left(-1+\eta\right)\,\mu\right)+\mathtt{u}\,\left(\eta-\eta\,\mu\right)}{\eta\,\left(-1+\mu\right)-\mu}$$

```
diffder = FullSimplify[D[diff, η], asslist]
```

$$\frac{\mu\,\left(\mathtt{u}\,\left(-1+\mu\right)+\Delta\,\left(-1+\alpha+\mu\right)\right)}{\left(\eta+\mu-\eta\,\mu\right)^2}$$

```
(* Difference is monotone in η → if increasing,
then can rule out Full → Exclusive, otherwise upper bound on η ensures it *)
```

- Analyze Behavior for targeting combinations

```
(* Full Pre & Post *)

FullSimplify[{dfullrp == dfull, pfullrp < pfull, cwfullrp > cwfull}, asslist]
{True, True, True}

(* Full Pre & Intermediate Post *)

FullSimplify[{dmedrp < dfull, pmedrp > pfull, cwmedrp == cwfull}, asslist]
{True, True, True}

(* Excl Pre & Full Post *)

FullSimplify[{dfullrp > dexcl, pfullrp < pexcl, cwfullrp > cwexcl}, asslist]
{True, True, True}

(* Excl Pre & Intermediate Post *)

FullSimplify[{dmedrp == dexcl, pmedrp < pexcl, cwmedrp > cwexcl}, asslist]
{True, 1 + α (-2 + μ) < μ, True}

(* Excl Pre & Post *)

FullSimplify[{dexclrp < dexcl, pexclrp > pexcl, cwexclrp > cwexcl}, asslist]
{True, True, True}

(* Potential Additional Case: Full Pre & Excl Post *)
(* Only possible for η large *)

FullSimplify[{dexclrp < dfull, pexclrp > pfull, cwexclrp < cwfull}, asslist]
{True, True, True}

(* With market size additional case can be
 distinguished from other two (only relevant for large η) *)
```