

# Loss Leading as an Exploitative Practice

(Chen and Rey 2012)

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This document describes the steps to generate Figure 1.

## Analytical Solutions

### Baseline

In the baseline, the firm L has monopoly power over A and B. This is derived in the main text:

$$\pi_{AB}^m = \frac{w_{AB}^2}{4}$$

### Case (i): $w_{AB} < w'_B$

In this scenario, as discussed in the main text, firm L exploits its monopoly power over A. Since  $w'_B > w_A$ , a subset of consumers who purchase B from firm S will also purchase A from L. If firm L applies zero margin,  $r_A = 0$ , then the share of consumers is  $\min\{w'_B/2, w_A\}$ . Let us consider the two cases:

- If  $w_A < w'_B/2$ , then demand is  $w_A - r_A$ . Profits are:

$$\pi_A^m := \max_{r_A} r_A(w_A - r_A)$$

- If  $w_A \geq w'_B/2$ , then demand at zero margin is  $w'_B/2$ . The optimal margin is at least  $w_A - w'_B/2$ , because it does not reduce demand until this level. Profits are:

$$\pi_A^m := r_A(w_A - [r_A - (w_A - w'_B/2)]) = r_A(w_A - r_A)$$

From the FOC,  $r_A^m = w_A/2$ , so that  $\pi_A^m = w_A^2/4$ .

### Case (ii): $2w'_B \leq w_{AB}$

As derived in the main text:

$$\pi_{AB}^* = \pi_{AB}^m + \frac{(c_B - c'_B)^2}{4} > \pi_{AB}^m$$

### Case (iii): $w'_B \leq w_{AB} < 2w'_B$

As derived in the main text:

$$\tilde{\pi}_{AB}^* = (w_{AB} - w'_B)w'_B + \frac{(c_B - c'_B)^2}{4}$$

Since profits are increasing in  $w_{AB}$ , conceptually consider that  $u_A$  increases *ceteris paribus*, we know that there is a level  $w_{AB}$  such that profits match the baseline level  $\pi_{AB}^m$ . This occurs when  $w_{AB} = w'_B + w_B$ , graphically, at the point where the two lines cross. To derive this threshold, consider that  $w_{AB} = w'_B + \tau, \tau \in [0, w'_B)$ . Then, equating both profits:

$$\begin{aligned}\pi_{AB}^m = \tilde{\pi}_{AB}^* &\Leftrightarrow \frac{w_{AB}^2}{4} = (w_{AB} - w'_B)w'_B + \frac{(w'_B - w_B)^2}{4} \\ &\Leftrightarrow \frac{(w'_B + \tau)^2}{4} = \tau w'_B + \frac{(w'_B - w_B)^2}{4} \\ &\Leftrightarrow \frac{\tau^2}{4} + \frac{2\tau w'_B}{4} = \tau w'_B + \frac{w_B^2}{4} - \frac{2w'_B w_B}{4} \\ &\Leftrightarrow \frac{\tau^2}{4} = \frac{2\tau w'_B}{4} + \frac{w_B^2}{4} - \frac{2w'_B w_B}{4} \\ &\Leftrightarrow \tau^2 - 2w'_B \tau + w_B(2w_B - w'_B) = 0\end{aligned}$$

The roots of this quadratic equation are:

$$\tau = w'_B \pm (w'_B - w_B) = \begin{cases} 2w'_B - w_B > w'_B \\ w_B \end{cases}$$

Only the smaller (second) root is admissible in this third case, so that  $\tilde{\pi}_{AB}^* = \pi_{AB}^m$  whenever  $w_{AB} = w'_B + w_B$ .

## Simulation

Parameters:

```
cA <- 0
cB.p <- 0
uA.0 <- 1
uA.1 <- 5 # st. uA.1 > 2*uB
uB <- 2 # st. uA.0 < uB < uA.1
min.wB <- .5 # 0 < wB < uB
```

Vectors:

```
cB.seq <- seq(from=cB.p, to=uB-min.wB, by=.02)
uA.seq <- seq(from=uA.0, to=uA.1, by=.02)
cB <- c(rep(uB-min.wB, length(uA.seq)), rev(cB.seq))
uA <- c(uA.seq, rep(uA.1, length(cB.seq)))

wA <- uA - cA
wB.p <- uB - cB.p
wB <- uB - cB
wAB <- wA + wB
```

Profit functions:

```

piA.m <- ifelse(wAB<=wB.p, (wA^2)/4, NA)
piAB.m <- (wAB^2)/4
piAB.star <- ifelse(wAB>=2*wB.p, piAB.m + (cB-cB.p)^2/4, NA)
piAB.tilde <- ifelse(wAB>=wB.p & wAB<=2*wB.p, (wAB-wB.p)*wB.p + (cB-cB.p)^2/4, NA)

```

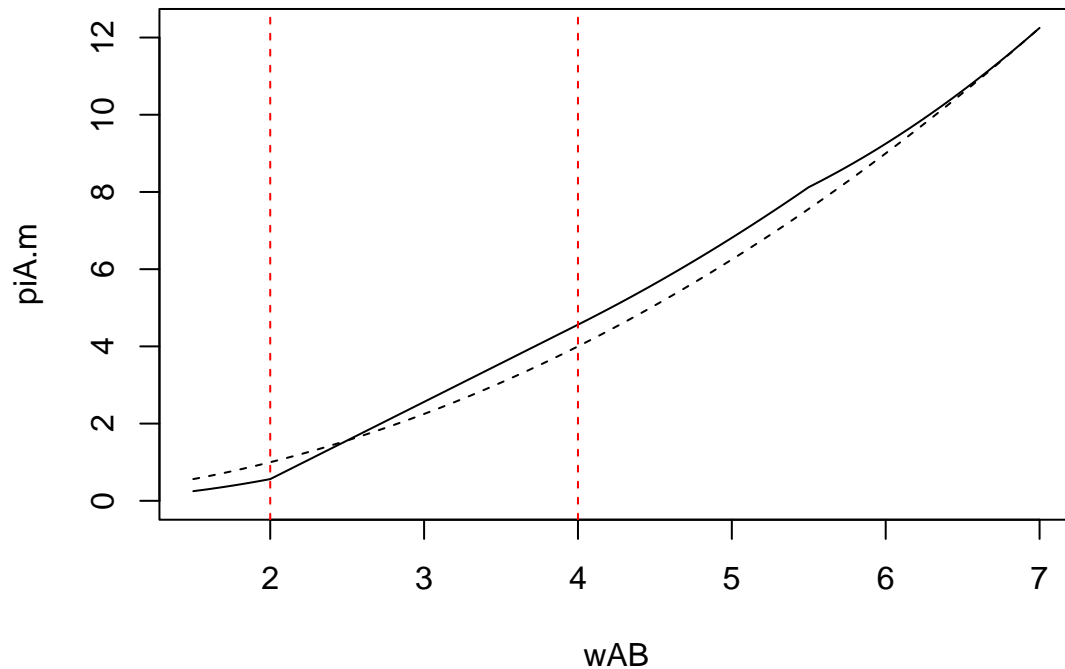
Raw plot:

```

ymax <- max(piAB.star, na.rm=T)

# case 1
plot(wAB, piA.m, xlim=c(min(wAB), max(wAB)), ylim=c(0, ymax), ty="l")
# case 2
lines(wAB, piAB.star)
# case 3
lines(wAB, piAB.tilde)
# baseline
lines(wAB, piAB.m, lty=2)
# thresholds
abline(v=wB.p, lty=2, col="red")
abline(v=2*wB.p, lty=2, col="red")

```



Adjusted plot:

```

plot(wAB,piA.m,xlim=c(min(wAB),4.5),ylim=c(0,6),ty="l",ylab="profits",
     #xaxt="n", yaxt="n"
     )
# case 2
lines(wAB,piAB.star)
# case 3
lines(wAB,piAB.tilde)
# baseline
lines(wAB,piAB.m,lty=3)
# cases
abline(v=wB.p,lty=3,col="red")
abline(v=2*wB.p,lty=3,col="red")
# legend
legend("top", legend="baseline", lty=3,cex=.7)
text(1.75, 3.5, " Case (i)",cex=.7)
text(1.75, 3, "wAB<wB'",cex=.7)
text(4.3, 3.5, " Case (ii)",cex=.7)
text(4.3, 3, "wB'<wAB<2wB'",cex=.7)
text(2.5, 3.5, " Case (iii)",cex=.7)
text(2.5, 3, "2wB<2wAB'",cex=.7)

```

