When to Take or Forgo New Product Exclusivity:

Balancing Protection from Competition against Word-of-Mouth Spillover

Renana Peres
Christophe Van den Bulte

WEB APPENDIX

This Web Appendix presents the analysis of the game-theoretic model.

HOW CROSS-BRAND WOM AFFECTS THE PROFITABILITY OF EXCLUSIVITY

Table A1 reports the equilibrium profits, and Table A2 reports the equilibrium prices, for both the exclusivity and no-exclusivity scenarios denoted by the subscripts *ex* and *nex*. To simplify the notation without loss of generality, we normalize the demand parameters m, β, θ, γ and δ by setting $\beta = 1$, and define a new parameter $\eta = (1-\alpha)\theta$. The latter captures the intensity of competition driven by the combination of the fraction of shared customers $(1-\alpha)$ and the cross-price sensitivity θ in that segment.

The expressions are too complex to lend themselves to detailed comparative statics, so we focus on the question under what conditions firm A would like to take or forego exclusivity. To do so, we compute the difference in net present value with and without exclusivity:

(A1) $$\Delta\Pi_A = \Pi_{A_{nex}} - \Pi_{A_{ex}} = \Pi_{A1_{nex}} + \rho\Pi_{A2_{nex}} - \left(\Pi_{A1_{ex}} + \rho\Pi_{A2_{ex}}\right).$$

Using the results from Table A1, this equals:

(A2) $\Delta\Pi_A = \frac{1}{2}(m-c)^2 \cdot$

$$\left(\frac{(2+3\eta)((\alpha-2)(2+\eta)^2(2+3\eta)+2(1+\eta)(-4+(-6+(\alpha-2)\delta)\eta+2(\text{á}-2)\gamma(1+\eta))\rho)}{4(2+\eta)^2(2+3\eta)^2+(\alpha-2)(1+\eta)(\delta\eta+2\gamma(1+\eta))^2\rho}\right.$$

$$+\frac{(1+\eta)(2+\eta)^2(2+3\eta)^2(4+\gamma+\delta+(2+\gamma+\delta)\eta)^2\rho}{(-2(2+\eta)^3(2+3\eta)+(\gamma+\delta)(1+\eta)(-\delta\eta(1+\eta)+\gamma(2+4\eta+\eta^2))\rho)^2}$$

$$-2(1+\eta)(-2(2+\eta)^2(2+3\eta)+(2+\gamma+\delta)(1+\eta)(-\delta\eta(1+\text{ç})+\gamma(2+4\eta+\eta^2))\rho)$$

$$\left.*\frac{(8-3(-1+\alpha)^3\theta^3+2\gamma\rho+(-1+\alpha)^2\theta^2(14+\gamma\rho-\delta\rho)+\eta(20+4\gamma\rho-\delta\rho))}{(-2(2+\eta)^3(2+3\eta)+(\gamma+\delta)(1+\eta)(-\delta\eta(1+\eta)+\gamma(2+4\eta+\eta^2))\rho)^2}\right)$$

This expression is still too complex an expression for detailed comparative statics, but the key insights can be obtained graphically. First, note how the parameters m and c enter the profit expressions in Table A1 and eq. (A2) only through the multiplier $(m-c)^2$ scaling the entire profits up or down. These two parameters do not affect whether foregoing exclusivity is profitable or not. Second, we make the profits in both periods equally important to the firm by setting $\rho = 1$. That leaves us with the own-brand WOM effect γ, and what are expectedly the three key factors driving the advantages and disadvantages of exclusivity. The two drivers of the intensity of competition, α and θ, expectedly lead to seeking the protection from competition, whereas the cross-brand WOM effect δ expectedly leads to seeking the positive externality of competition.

Figure A1 shows the interplay for the two competition parameters, α and θ, and the cross-brand WOM parameter δ for $\gamma = 2$. When $\beta = 1$ and $\rho = 1$, values of γ larger than 2 can generate negative profits in some regions of Figure A1. With $\gamma = 2$, both firms' participation constraints are met in the parameter space shown in Figure A1. We vary α over its entire feasible range from 0 to 1 and δ over its feasible range from 0 to $\gamma = 2$. The price competition parameter θ has no logical upper bound, but since it is normalized using $\beta = 1$, the maximum value of 4 used in

Figure A1 implies that own-price sensitivity in Segment 2 can be up to 5 times higher without exclusivity ($\beta + \theta$) than with exclusivity (β).

The shaded area in Figure A1 indicates under what conditions temporary exclusivity is more profitable than competition. Conversely, the non-shaded area indicates under what conditions the profit-maximizing firm would forego temporary exclusivity and start competing immediately. Several insights emerge. First, when firms have no locked-in customers (α= 0) and there is no cross-brand WOM (δ = 0), exclusivity is always preferred. This is the standard protection-from-competition rationale for exclusivity. Second, when firms have no locked-in customers ($\alpha = 0$) but there is strong cross-brand word-of-mouth (δ about 1.5 or more), a firm is better off foregoing temporary exclusivity provided that price competition is not too intense (θ not larger than about 2.5). This is consistent with the result by Xie and Sirbu (1995). Third, the fraction of locked-in customers α and the strength of cross-brand WOM δ have a dramatic impact on whether exclusivity is preferred or not. Together, they greatly dominate the effect of the intensity of price competition θ. This is conveyed by the fact that the shaded area roughly coincides with the lower-left half of the cube. So, even when price competition is intense, a moderate amount of cross-brand WOM is enough to make a firm give up exclusivity provided that a sufficiently large fraction of the market is locked in.

A fourth insight is that the amount of overlap is not only the dominant determinant for how much cross-brand WOM is required to forego exclusivity, it also affects the much weaker relation between cross-brand WOM and intensity of price competition. This is conveyed by the difference in slope and curvature of the surface at very low versus high values of α. At very low levels of α, more intense price competition θ requires more cross-brand WOM δ to forego of exclusivity. At very high levels of α, the reverse is true. So, when both the intensity of price competition θ and the level of lock-in α are high, further increases in the intensity of price competition lead to a decrease rather than an increase in the amount of cross-brand WOM necessary to forego exclusivity. In cases with extremely high θ and α, cross-brand WOM is not even required for a profit maximizing firm to forego exclusivity. This is conveyed by the white area in the back right corner at the bottom of Figure A1. We discuss this surprising result further in the next section.

FOREGOING EXCLUSIVITY EVEN WITHOUT CROSS-BRAND WOM

Figure A1 suggests that a profit maximizing firm may prefer foregoing exclusivity in period 1 even when there is no cross-brand WOM. To explore this further, we set $\delta = 0$ and let the within-brand WOM γ, fixed at 2 in Figure A1, vary between 0 and 2. The shaded area in Figure A2 indicates under what conditions temporary exclusivity is more profitable than competition.

The small non-shaded area in the back right top corner indicates that a profit-maximizing firm would forego temporary exclusivity and start competing immediately, even when there is no cross-brand WOM whatsoever, when there are high levels of customer lock-in, own-firm WOM, and intensity of price competition. This sounds quite paradoxical at first, but is reminiscent of the classic result by Klemperer (1987) that loyalty programs and switching costs may have a perverse effect: Even though they decrease competition and increase profitability once customers have been made loyal, firms will be induced to compete intensely to acquire customers in the early stages of market development. The ferocious competition to attract new customers may more than dissipate the benefits of reduced competition later on. Figure A2 suggests that something similar can happen with temporary exclusivity and exogenous lock-in.

Say firm A decides to be exclusive in period 1. If the within-brand WOM effect is strong but there is no cross-brand WOM, firm A will have a large boost in its base level demand in period

2. Firm B, in contrast, will have no such boost and will be forced to compete aggressively on price in order to get sales in the shared segment. When the demand of shared customers is very price sensitive, such price aggression is effective in helping B compete against A. In response, A is forced to charge lower prices in period 2 than if it had allowed firm B to enter in period 1. The loss in profits in period 2 may more than compensate for the boost in profits in period 1, especially if the difference in monopoly versus duopoly profits in period 1 is small because much of the sales come from locked-in rather than shared customers. So, to avoid aggressive price competition by the late entrant who suffers a WOM handicap, the early entrant may prefer not to be a monopolist early on. By allowing or even inviting the other firm into the market early on, both can benefit from their own-brand WOM later on, which allows both firms to charge higher prices, and the could-be-temporary-monopolist to make more profits as a twice-duopolist. The mechanism at work is similar to that noted by Klemperer (1987), except that the sequence of ferocious versus softened competition is reversed and that lock-in is exogenous rather than endogenous.

This interpretation follows from the price expressions in Table A2. For the same range of parameters used to construct Figure A2 (so both net present values are non-negative and participation constraints are met), both firms charge the same price in period 2 in the scenario without exclusivity but the late entrant charges a lower price than the early entrant in the scenario with exclusivity. Also, comparing the prices in period 2 between scenarios shows that, in response, firm A sets a lower price if it enjoyed exclusivity in period 1 then when it did not. This difference increases with values of α, γ, and ϑ, ultimately resulting in lower total net present value indicated by the white area in the upper right corner of Figure A2.

Table A1: Equilibrium profits in each period

No exclusivity	
	Period1
$\Pi_{A1_{nex}}$	$-\frac{(m-c)^2(1+\eta)((1+\eta)\rho(\gamma+\delta+2)(\gamma(\eta(\eta+4)+2)-\delta\eta(\eta+1))-2(\eta+2)^2(3\eta+2))(\eta(\rho(\gamma(\eta+4)-\delta(\eta+1))+3\eta^2+14\eta+20)+2\gamma\rho+8)}{((1+\eta)\rho(\gamma+\delta)(\gamma(\eta(\eta+4)+2)-\delta\eta(\eta+1))-2(\eta+2)^3(3\eta+2))^2}$
$\Pi_{B1_{nex}}$	$-\frac{(m-c)^2(1+ç)((1+\eta)\rho(\gamma+\delta+2)(\gamma(\eta(\eta+4)+2)-\delta\eta(\eta+1))-2(\eta+2)^2(3\eta+2))(\eta(\rho(\gamma(\eta+4)-\delta(\eta+1))+3\eta^2+14\eta+20)+2\gamma\rho+8)}{((1+\eta)\rho(\gamma+\delta)(\gamma(\eta(\eta+4)+2)-\delta\eta(\eta+1))-2(\eta+2)^3(3\eta+2))^2}$
	Period2
$\Pi_{A2_{nex}}$	$\frac{(m-c)^2(1+\eta)(2+\eta)^2(2+3\eta)^2(4+\gamma+\delta+(2+\gamma+\delta)\eta)^2}{2(-2(2+\eta)^3(2+3\eta)+(\gamma+\delta)(1+\eta)(-\delta\eta(1+\eta)+\gamma(2+\eta(4+\eta)))\rho)^2}$
$\Pi_{B2_{nex}}$	$\frac{(m-c)^2(1+\eta)(2+\eta)^2(2+3\eta)^2(4+\gamma+\delta+(2+\gamma+\delta)\eta)^2}{2(-2(2+\eta)^3(2+3\eta)+(\gamma+\delta)(1+\eta)(-\delta\eta(1+\eta)+\gamma(2+\eta(4+\eta)))\rho)^2}$
Exclusivity	
	Period1
$\Pi_{A1_{ex}}$	$\frac{(m-c)^2(\alpha-2)(3\eta+2)((\eta+1)\rho(2\gamma(\eta+1)+\delta\eta)+(3\eta+2)(\eta+2)^2)(-(\eta+1)\rho(2\gamma(\eta+1)+\delta\eta)((\alpha-2)(2\gamma(\eta+1)+\delta\eta)-6\eta-4)-2(\eta+2)^2(3\eta+2)^2)}{((\alpha-2)(1+\eta)\rho(2\gamma(\eta+1)+\delta\eta)^2+4(\eta+2)^2(3\eta+2)^2)^2}$
$\Pi_{B1_{ex}}$	0
	Period2
$\Pi_{A2_{ex}}$	$\frac{(m-c)^2(1+\eta)(2+\eta)^2(2+3\eta)^2(8+12\eta-(\alpha-2)(\delta\eta+2\gamma(1+\eta)))^2}{2(4(2+\eta)^2(2+3\eta)^2+(\alpha-2)(1+\eta)(\delta\eta+2\gamma(1+\eta))^2\rho)^2}$
$\Pi_{B2_{ex}}$	$\frac{(m-c)^2(1+\eta)(-2(\alpha-2)\gamma^2(\eta+1)^2\rho+(\alpha-2)\delta(\eta+1)(\eta+2)(\gamma\rho+6\eta+4)+(\eta+2)(3\eta+2)(\eta((\alpha-2)\gamma-12)-8)+(\alpha-2)\delta^2\eta(\eta+1)\rho)^2}{2((\alpha-2)(1+\eta)\rho(2\gamma(\eta+1)+\delta\eta)^2+4(\eta+2)^2(3\eta+2)^2)^2}$

Note: $\eta = (1-\alpha)\theta$; demand parameters m, β, θ, γ and δ are normalized by setting $\beta = 1$.

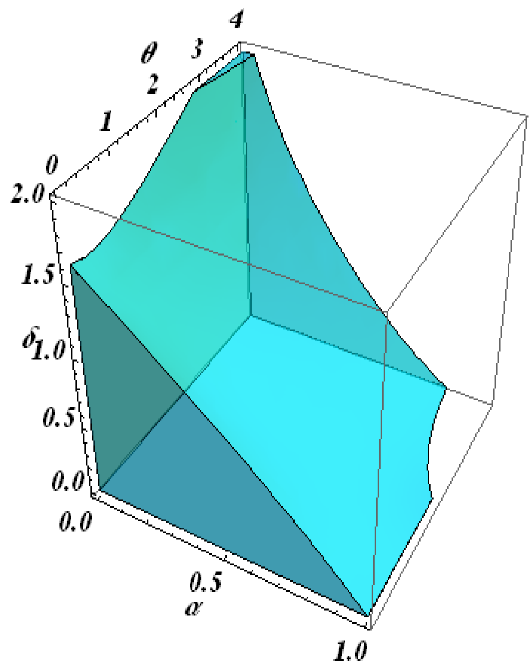
Table A2: Equilibrium prices in each period

	No exclusivity
	Period1
$p_{A1_{nex}}$	$\frac{2(2+\eta)^2(2+3\eta)(c+m+c\eta)-(-2c+m(2+\gamma+\delta))(1+\eta)(-\delta\eta(1+\eta)+\gamma(2+\eta(4+\eta)))\rho}{2(2+\eta)^3(2+3\eta)-(\gamma+\delta)(1+\eta)(-\delta\eta(1+\eta)+\gamma(2+\eta(4+\eta)))\rho}$
$p_{B1_{nex}}$	$\frac{2(2+\eta)^2(2+3\eta)(c+m+c\eta)-(-2c+m(2+\gamma+\delta))(1+\eta)(-\delta\eta(1+\eta)+\gamma(2+\eta(4+\eta)))\rho}{2(2+\eta)^3(2+3\eta)-(\gamma+\delta)(1+\eta)(-\delta\eta(1+\eta)+\gamma(2+\eta(4+\eta)))\rho}$
	Period2
$p_{A2_{nex}}$	$\frac{(2+\eta)(2+3\eta)m(\eta(\gamma+\delta+2)+\gamma+\delta+4)-c(\eta+1)(\rho(\gamma+\delta)(\gamma(\eta(\eta+4)+2)-\delta\eta(\eta+1))+(\eta+2)(3\eta+2)(\gamma+\delta-2(\eta+2)))}{2(2+\eta)^3(3\eta+2)-(\eta+1)\rho(\gamma+\delta)(\gamma(\eta(\eta+4)+2)-\delta\eta(\eta+1))}$
$p_{B2_{nex}}$	$\frac{(2+\eta)(2+3\eta)m(\eta(\gamma+\delta+2)+\gamma+\delta+4)-c(\eta+1)(\rho(\gamma+\delta)(\gamma(\eta(\eta+4)+2)-\delta\eta(\eta+1))+(\eta+2)(3\eta+2)(\gamma+\delta-2(\eta+2)))}{2(2+\eta)^3(3\eta+2)-(\eta+1)\rho(\gamma+\delta)(\gamma(\eta(\eta+4)+2)-\delta\eta(\eta+1))}$
	Exclusivity
	Period1
$p_{A1_{ex}}$	$\frac{2m+\frac{2c(2+\eta)^2(2+3\eta)^2+(1+\eta)(\delta\eta+2\gamma(1+\eta))(c(4+6\eta)+m(-4-6\eta+(-2+\alpha)(\delta\eta+2\gamma(1+\eta))))\rho}{(2+\eta)^2(2+3\eta)^2}}{4+\frac{(-2+\alpha)(1+\eta)(\delta\eta+2\gamma(1+\eta))^2\rho}{(4+8\eta+3\eta^2)^2}}$
$p_{B1_{ex}}$	NA
	Period2
$p_{A2_{ex}}$	$\frac{(\alpha-2)^2(2\gamma(\eta+1)+\delta\eta)(\frac{2c(\eta+2)^2(3\eta+2)^2+(\eta+1)\rho(2\gamma(\eta+1)+\delta\eta)(c(6\eta+4)+m((\alpha-2)(2\gamma(\eta+1)+\delta\eta)-6\eta-4)}{(\eta+2)^2(3\eta+2)^2}}{2(\frac{(\alpha-2)^2(\eta+1)\rho(2\gamma(\eta+1)+\delta\eta)^2}{(3\eta^2+8\eta+4)^2}+4\alpha-8)(\eta+2)(3\eta+2)}$ $+\frac{2c(\text{ç}+1)(3\eta+2)+m(-(\alpha-2)(2\gamma(\eta+1)+\delta\eta)+6\eta+4)}{2(\eta+2)(3\eta+2)}$
$p_{B2_{ex}}$	$\frac{(\alpha-2)^2(\gamma\eta+2\delta(\eta+1))(\frac{2c(\eta+2)^2(3\eta+2)^2+(\eta+1)\rho(2\gamma(\eta+1)+\delta\eta)(c(6\eta+4)+m((\alpha-2)(2\gamma(\eta+1)+\delta\eta)-6\eta-4)}{(\eta+2)^2(3\eta+2)^2}}{2(\frac{(\alpha-2)^2(\eta+1)\rho(2\gamma(\eta+1)+\delta\eta)^2}{(3\eta^2+8\eta+4)^2}+4\alpha-8)(\eta+2)(3\eta+2)}$ $+\frac{2c(\eta+1)(3\eta+2)+m(\eta(-\alpha\gamma+2\gamma+6)-2(\alpha-2)\delta(\eta+1)+4)}{2(\eta+2)(3\eta+2)}$

Note: $\eta=(1-\alpha)\theta$; demand parameters m, β, θ, γ and δ are normalized by setting $\beta=1$.

Figure A1: How lack of customer base overlap α, price competition θ, and cross-firm WOM δ affect whether exclusivity is profitable

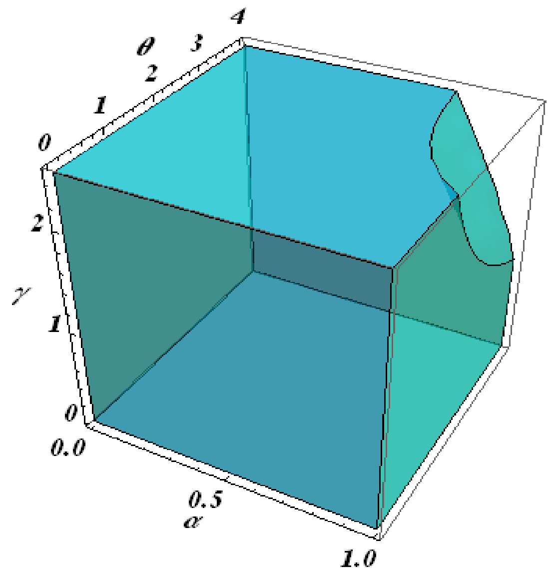
(Shaded area indicates exclusivity is more profitable than competition)



Note: Based on eq. (A5) assuming $\beta = 1$, $\rho = 1$, and $\gamma = 2$.

Figure A2: How lack of customer base overlap α, price competition θ, and within-firm WOM γ affect whether exclusivity is profitable even without cross-firm WOM

(Shaded area indicates exclusivity is more profitable than competition)



Note: Based on eq. (A5) assuming β = 1, ρ = 1, and δ = 0.