Incentives to Prey in Vertical Relationships and the Retailers' Buying Power.*

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Abstract

This article analyzes how upstream Bertrand competition is distorted when we introduce repetition of interactions within a vertical relationship. We argue that, in a two-period setting, a downstream monopsonist may prevent a producer to prey on a less efficient upstream competitor in order to preserve its future buying power towards the efficient supplier. We point out an equilibrium where the efficient supplier grants high tariff concessions to the monopsonist retailer and thus reaches to become its exclusive supplier in the first period. Moreover, when producers offer linear contracts, there is another equilibrium where the retailer maintain both suppliers in the first period. In this latter case, for high value of future, producers make the retailer pay for enjoying manufacturer's competition in the second period: producers jointly realize the first period monopoly profit whereas competing à la Bertrand. Result do not qualitatively change when considering the case of an upstream monopolist dealing with competing retailers.

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1 Introduction

Taking into account the repetition of interactions between firms throughout time may deeply change firms behavior. Tacit collusion or predatory pricing strategies will, for instance, naturally appear in a dynamic setting while they would not find any rational funding in a one shot competition game. In this paper, we propose to analyze how the upstream competition is distorted when we take into account time and repetition of the interactions within a vertical relationship. We argue, that, in a dynamic setting, a downstream monopsonist may prevent an efficient producer to prey on a less efficient upstream competitor. The reason is the retailer has an incentive to maintain the inefficient producer on the upstream market in order to preserve its future buying power towards the efficient supplier. We point out that another source of buying power can thus be the extra tariff concessions an efficient supplier has to grant to a monopsonist retailer to become its exclusive supplier. It results that the manufacturer preys a less efficient upstream competitor and benefits of a lessen upstream competition in the next periods. However, there may exist another strategy at the equilibrium when future does matter: the producers make the retailer pay the high price in the first period for enjoying competition benefit in the next periods. In the latter case, whereas competing à la Bertrand, the upstream producers realize a monopoly profit and we thus point out another solution to the Bertrand paradox.

Our paper is first encompassed in the recent literature in industrial economics that focused on buying power, an issue that was raised by recent retail merger waves.[1] The closer work to our article in this stream of literature is perhaps that of Inderst and Shaffer (2005) who show in a static setting how threatening to delist an inefficient supplier can be a profitable strategy for a monopsonist retailer to obtain tariff concessions. Such a threat artificially raises the retailer's reserve profit leading to a greater buying power toward the efficient producer. In our article, the source of buying power is clearly based on the dynamic setting rather than on bargaining arguments.

This article is also related to the more traditional literature devoted to predatory pricing strategies. If predatory pricing (namely low prices in order to push a rival out to bankruptcy) has been largely analyzed in the literature with an horizontal competition framework[2], it is much less studied in a vertical structure context. However, Aghion and Bolton (1987)'s original article pointed out how an incumbent producer could sign an exclusive contract with a downstream retailer in order to deter the entry of a potentially more efficient upstream competitor. In their

[1]See for example, Fumagalli and Motta (2000) where buyer power may grant high quantities ordered and thus favor an efficient firm entry. See also Inderst and Wey (2003) on how large quantities orders may favor buying power with convex supply costs.

[2]See for example the seminal paper by Milgrom and Roberts (1982).

model, when the entrant is efficient enough, no contract between the incumbent producer and the monopsonist retailer can deter its entry. But, if the entrant enjoys a small cost advantage, the incumbent succeeds to deter its entry by offering an exclusive contract to the retailer, and this outcome will be socially harmful. In our article, we do not authorize commitment on "exclusivity contracts" but only general tariff offers (linear and non linear pricing). A recent work from Biglaiser and De Graba (2001) also analyzes how a vertically integrated producer may, thanks to a price squeeze, reduces its retailer's incentive to eliminate a downstream competitor in order to raise the future profit for the whole vertical chain. Contrary to us, their underlying issue is the delegation by the producer of a retailer's predatory strategy at the downstream level.

Our article may finally be related to another stream of literature devoted to 'dual sourcing' and 'split awards', born from the interest in procurement auctions design by the US Department of Defense (see McMillan (2003)). The main issue of this literature concerns the supplying a sole buyer (the Government) with one or several suppliers. Dual sourcing can lead to competition benefits but, as the total cost for a split award is the sum of bids, by posting a high price for split awards, a producer can induce the buyer to rather adopt a sole sourcing strategy. Anton and Yao (1992) show that dual sourcing can be a solution to avoid sellers' coordination at the detriment of the sole buyer when there is a strong asymmetry of information on costs between suppliers. While informational issue are out of scope in our article (perfect information framework), we exhibit an equilibrium where both suppliers are also able to coordinate, thanks to vertical interactions repetition, to the expense of the sole retailer.[3]

In this article, we point out that two different types of equilibria may appear. The first one is an exclusive supply from the most efficient producer. We find that, under financial constraints, the manufacturer needs to heavily decrease its wholesale price for inducing the retailer to renounce to future profits from effective upstream competition in the next period. This result thus shows that if the value granted by firms to the future revenues is high enough, it becomes too costly for the efficient producer to prey its inefficient competitor. The retailer will thus be supplied by both firms at each period and this second equilibrium outcome is socially inefficient. This is paradoxical as a high valuation of future profits should also reinforce the efficient producers' incentive to prey its competitor. However, exploiting the retailer's dependence on second period manufacturer's competition becomes even more profitable for producers: they

[3]While updating a previous version of this paper we found a recent working paper by Biglaiser and Vettas (2004) which extends dual sourcing analysis to a two-period game with a buyer strategic behavior. In their model, a producer disappears if it sells its whole capacity in the first period, making the buyer dependent on the remaining one. Within such a framework, they obtain no pure strategy Nash equilibrium in price, reflecting the classic problem with capacity constraints and price competition. However, they interestingly find out mixed strategy equilibria that they interpret as the buyer using dual sourcing in order to preserve competition in the second period. Our result is close in spirit but differs both from the assumptions (producers may disappear here because of financial constraints) and from the equilibria (we here obtain several pure Nash strategy equilibria in prices).

are indeed able to get strictly positive profits through high wholesale prices.

In the second section, we present the framework and solve the static game, that is the benchmark case. In the third section, we look for the subgame perfect pure Nash equilibria of the two-period game and comment our main results. We then extend our model to non linear tariffs and partially relax financial constraints through loans in the fourth section. Section 5 analyzes a dual framework where the monopoly is at the upstream level, and section 6 concludes.

2 The framework and the static game

We assume that a retailer R faces at each period a downstream demand for 2 units of a good and consumers are ready to pay 1 for each unit. There are two upstream manufacturers: $M1$ and $M2$. Each of them can produce 2 units of the good. Manufacturer $M1$ has a zero unit cost, whereas the marginal (average) cost for manufacturer $M2$ is $0 \leq c \leq 1$. $M2$ is therefore assumed to be less efficient than $M1$. Manufacturers' products are perfect substitute from consumers' point of view (homogeneous good). Profits coming from the second period game will be classically evaluated with a discount factor δ with $0 < \delta < 1$, in the first period.

The game at each period is the following: manufacturers $M1$ and $M2$ make simultaneously take-it or leave-it wholesale price offers to the retailer (denoted respectively w_1 and w_2). The retailer accepts or refuses each offer and decides his supply strategy. He then sets the final price and resells the good to consumers.

We consider a two-period game, and we assume that if no unit are bought to one manufacturer, it exits the market and become inactive in the next period. There are several justifications for such assumption. The first one can rely on financial constraints. When the manufacturer's prospects depends heavily on one retailer. The absence of revenues for one period can then push the firm out of market. Opportunity costs can indeed be high enough to make the firm change of activities (or product range), or short-term financial constraints can make the firm go bankrupt. The firm can also need to meet profit hurdles to remain in the market in the future, as argued in Biglaiser and DeGraba (2001) or Bolton and Scharfstein (1990). Another justification can be inherent to switching costs. Once engaged in a particular relationship with one firm for a period, a retailer may incur significant and important switching costs if he decides to change his supply policy by buying from another supplier. This can come from a *learning-by-doing* argument, as in Lewis and Yildirim (2002, 2005), where not producing for one period increases the unit cost of a firm on the second period (technology obsolescence). It therefore undermines the retailer's decision to switch suppliers since the rival becomes more and more inefficient as long as it is not elected. However, switching costs may also result from the nature of the good traded between a retailer and a supplier (in agrofood industry). For instance, a retailer carefully designing his own brand product may not be able to switch between suppliers because his own product relies on a bespoke recipe. Testing a new supplier could indeed take up to 1 or 2 years before being sure the new supplier meets the retailer's requirements making the threat to switch to a new supplier a not credible one (OFT Report on "Buyer Power in Post-Merger Markets", 2005, p. 86). The report also argues that as consequence: "multiple sourcing can be thought as a strategy undertaken by buyers to increase their buyer power. By having contracts with a number of suppliers, the buyer was able to rapidly switch supplies [...] to the producer offering the lower price". We also assume that entry is not free on this market.

Because each manufacturer is able to supply the whole demand, the retailer has three possibilities at the first period. He can buy exclusively from $M1$ or $M2$, or he can purchase one unit to each manufacturer. This first period choice has a crucial consequence for period 2 market structure because if the retailer bought 2 units to one manufacturer, the rival producer is then inactive in period 2. Therefore, buying exclusively from one manufacturer implies that in the next period, the retailer will face this very manufacturer only. No upstream competition will occur.

In a one-shot game, the classic (static) equilibrium is given by the Bertrand solution and consists in an offer of $w_1 = c - \varepsilon$ and $w_2 = c$. The retailer thus buys two units to $M1$. Profits are then: $\pi_{M1} = 2c$, $\pi_{M2} = 0$ and $\pi_R = 2(1-c)$. The competition in price leads the efficient manufacturer to get all the market with some rent because of its competitive advantage. The downstream retailer also makes positive profits thanks to upstream competition ($M2$ constitutes a threat for $M1$ so the latter is obliged to set a wholesale price lower than c). Social welfare is maximal since the two units are produced by the efficient manufacturer only: $SW = 2$.

3 The two-period equilibrium

Contrary to the static game, the possibility for manufacturer $M2$ to exit the market at the end of period 1 if it has sold no unit will matter. Indeed, in a static framework, potential competition with $M2$ forces $M1$ to leave some rent to the retailer. In a dynamic scheme, if the retailer only deals with $M1$ in the first period, the absence of competition in the second period will force the retailer to make zero profit. We show that there exists in the dynamic game an opportunistic retailer's behavior consisting in maintaining the inefficient supplier in the first period for some values of the discount factor in order to preserve his future buying power. In this section, we denote the period with a superscript t for wholesale prices and profits.

In a first time, we will consider the retailer's decision of period 1 as given, and we thus look for the subgame Nash equilibria for period 2 (backward induction). Suppose that the retailer in period 1 chose to buy 2 units from $M1$. Because of our assumption of exit, on period 2, the retailer faces $M1$ alone. The manufacturer therefore proposes $w_1^2 = 1$, gets a profit $\pi_{M1}^2 = 2\delta$

because he sells two units, and R makes no profit. The very parallel situation is when the retailer chose $M2$ in period 1 to buy 2 units. In this case, $M2$ proposes $w_2^2 = 1$, gets a profit $\pi_{M2}^2 = 2(1-c)\delta$, and R makes no profit.

If in period 1 the retailer decided to buy 1 unit to each manufacturer, the two producers are then active on period 2 and upstream competition leads to the one-shot game outcome. The manufacturer $M1$ proposes $w_1^2 = c - \varepsilon$ and gets all the market. Profits are thus: $\pi_R^2 = 2\delta(1-c)$, $\pi_{M1}^2 = 2\delta c$ and $\pi_{M2}^2 = 0$.

Each manufacturer has always the temptation to propose a first period wholesale price low enough in order to become the exclusive supplier of the retailer. This will insure the selected manufacturer to achieve a monopoly profit in the second period. However, wholesale price concession each manufacturer must make in order to hit the exclusive contract are bounded.

Lemma 1: To become R's exclusive supplier in the first period, $M1$ best reply's wholesale price is $w_1^1 = \max[w_2^1 - 2\delta(1-c), 0]$ while $M2$'s best reply is $w_2^1 = \max[w_1^1 - 2\delta(1-c), c]$. In the race to exclude each other, the only existing potential exclusion Nash equilibrium when $\delta \leq \frac{c}{2(1-c)}$. It is such that $w_2^1 = c$, $w_1^1 = c - 2\delta(1-c)$ and $M1$ wins the first period exclusivity.

Proof.
See appendix A. ■

Solving the entire two-period game, we obtain the following proposition:

Proposition 1 *There exists three types of subgame perfect Nash equilibria in pure strategies of this two-period game. For $\widetilde{\delta}(c) = \frac{2-c}{4(1-c)}$, and $\delta^*(c) = \frac{c}{3(1-c)}$, the three possible equilibria types are:*

(i) If $\widetilde{\delta} < \delta \leq 1$, there is a continuum of Nash equilibria defined by the following conditions: $w_1^1 + w_2^1 = 2$, $w_1^1 \geq \frac{1}{3}(4 - 2\delta(1-c))$ and $w_2^1 \geq \frac{1}{3}(4 - c - 2\delta(1-c))$; R buys one unit to each supplier in the first period, and then only to $M1$ at a price $w_1^2 = c$ in the second period;

(ii) If $\delta^* < \delta \leq \widetilde{\delta}$, the only Nash equilibrium is such that $w_1^1 = \frac{2c}{3} + 2\delta(1-c)$ and $w_2^1 = \frac{c}{3} + 2\delta(1-c)$; R buys one unit to each supplier in the first period, and then only to $M1$ at a price $w_1^2 = c$ in the second period;

(iii) If $\delta \leq \delta^*$, the only Nash equilibrium is such that $w_1^1 = c - 2\delta(1-c)$, $w_2^1 = c$; R buys 2 units to $M1$ (exclusivity) at $w_1^1 = c - 2\delta(1-c)$ in the first period, and at $w_1^2 = 1$ in the second period.

Proof. See Appendix B. ■

The Figure 1 depicts the different subgame Nash equilibria depending on the parameters δ and c. We adopt the convention that $(M1 - M2; M1)$ means that the retailer buys one unit to each manufacturer in the first period and then only to $M1$ in the second period. Similarly,

$(M1; M1)$ denotes an exclusive supply from manufacturer 1 over the two periods.

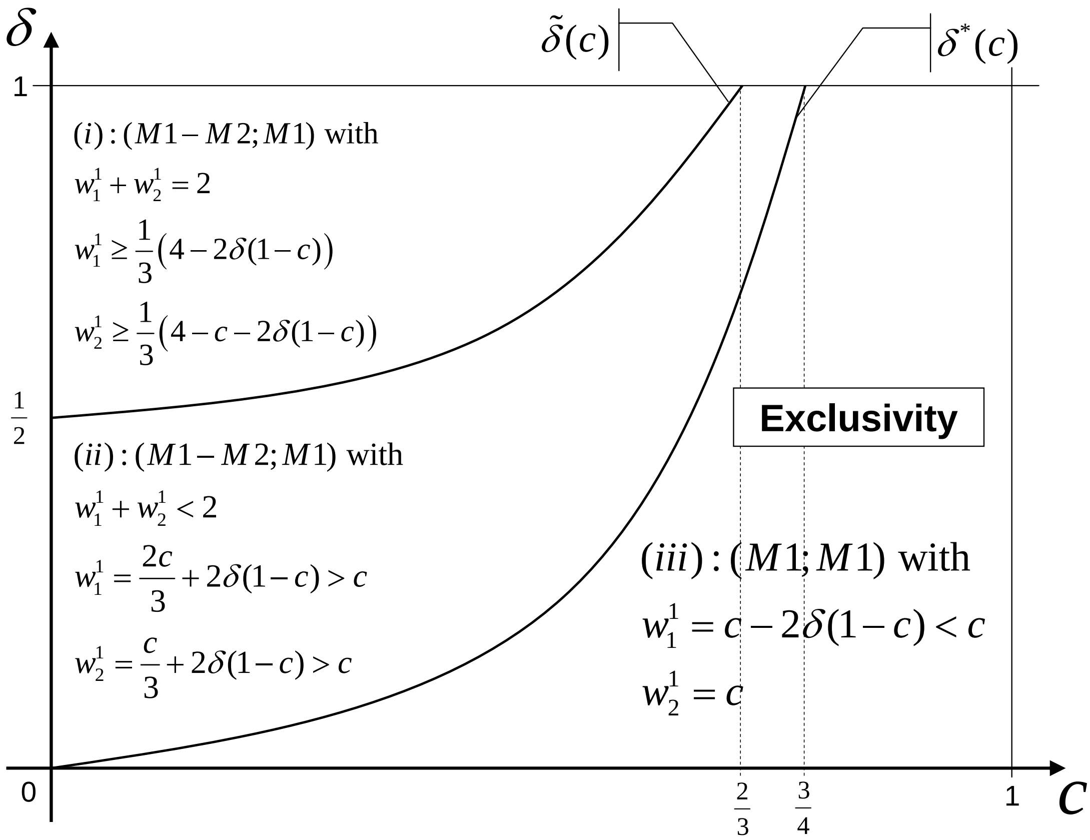

Figure 1: Wholesale prices equilibria of the two-period game.

Intuitively, when δ is low enough $\delta \leq \delta^*(c)$, the retailer grants few value to the second period profit: $M1$ has thus less to pay to become his exclusive supplier from the first period. As c rises, this upper bound on δ is improved. Indeed, it is easier for $M1$ to become R's exclusive supplier because $M2$ is relatively more inefficient and therefore not a very interesting leverage for the future (when c increases, the retailer's second period profit if he maintains both producers in the first period decreases).

When δ is intermediate, $\delta^*(c) < \delta \leq \widetilde{\delta}(c)$, it becomes too costly for $M1$ to become the retailer's exclusive supplier in the first period. This is paradoxical since when δ rises, the profits $M1$ could expect from a predatory pricing strategy also increase. The latter assertion is true, but, when δ increases, because the retailer attaches a greater value to his second period profit, producers also know that the latter is ready to accept higher wholesale prices rather than to break its supplying relationship with any of them. Indeed, $M1$ and $M2$ are able to set higher first period wholesale prices at the equilibrium. Because $M2$ is less efficient than $M1$, it is natural that the incentive to deviate is stronger for $M1$, and the rent $M2$ is able to extract from the retailer is thus smaller than the one $M1$ gets. However, in the two-period game, the inefficient firm may now realize a strictly positive profit while it would always have been zero in the static game.

When δ is high, $\widetilde{\delta}(c) < \delta \leq 1$, $M1$ and $M2$ can extract in the first period all the rent from their relationship with R by setting $w_1^{1*} + w_2^{1*} = 2$. Note that Manufacturer 1, despite the fact consumers' willingness to pay for each unit is equal to 1, can benefit of its relative efficiency *vis-à-vis* M2 and of the retailer's dependence on competition by demanding a wholesale price greater than 1. This occurs when $w_1^{1*} \geq \frac{1}{3}(4 - 2\delta(1-c)) > 1$, that is for $\widetilde{\delta}(c) < \delta < \frac{1}{2(1-c)}$.

Corollary 1 *When firms grant enough value to future profits, namely if $\delta > \widetilde{\delta}(c)$, producers are able to replicate the profit a monopoly would obtain (leaving no rent at all to the retailer) by exploiting the retailer's dependence on the presence of both producers in the second period.*

Proof. In equilibria (i), the sum of wholesale prices equal to the consumers' willingness to pay for the two units of product (whatever their distribution between M1 and M2). The retailer makes zero profit even in presence of two manufacturers who annihilate potential competition. ■

Considering a monopsonist retailer buying from two upstream producers competing *à la Bertrand*, and introducing time and repetition in their interactions, leads to another solution to the Bertrand Paradox. It is interesting to note that even if $c = 0$, these equilibria (i) and (ii) still exist. However, when $c = 0$, whereas no collusion with classical trigger strategies would be sustainable for $\delta < \frac{1}{2}$, producers here achieve a strictly positive profits setting their input price at $w_1 = w_2 = 2\delta > 0$. Moreover, if collusive equilibria arise only in infinitely repeated games, the monopoly profit is reached here for some high enough discount factor values, even if the number of period is finite or known.

To see in-depth how the retailer's buying power is affected by the dynamic game framework, we define the ratio of retailer's profits over manufacturer(s)' one in each type of equilibrium. In the static game (benchmark), this leads to:

$$\alpha^s = \frac{\pi_R}{\pi_{M1}} = \frac{2\delta(1-c)}{2\delta c} = \frac{1}{c} - 1$$

In the dynamic game, we get:

$$\alpha^d = \frac{\pi_R^1 + \pi_R^2}{\pi_{M1}^1 + \pi_{M2}^1 + \pi_{M1}^2} \text{ when M2 is present in the first period.}$$

Computation for each dynamic equilibrium and comparison with α^s gives:

$$\alpha^s - \alpha^d = \begin{cases} \frac{(2-c)(1-c)}{c(2+c(2\delta-1))} > 0 & \text{eq. (i)} \\ \frac{1}{c} - \frac{1}{2\delta} - \frac{1}{2-c} > 0 & \text{eq. (ii)} \\ \frac{\delta(1-c)}{c(\delta(1-2c)-c)} < 0 & \text{eq. (iii)} \end{cases}$$

For equilibria (i) and (ii), the retailer does not improve his buying power in the vertical structure compared to a static setting. The surplus is indeed captured by both manufacturers who take advantage of the retailer's dependence upon the competition outcome of the second period. Making the retailer pay a high price for maintaining the inefficient manufacturer in the first period decreases therefore the retailer's buying power. However, in equilibrium (iii), the retailer is able to improve his situation because of the exclusivity offer proposed by manufacturer M1. Tariff concessions made on the first period wholesale price by M1 exceeds retailer's vanished profits in the second period compared to a static game. Note that such exclusivity offer made by $M1$ is induced by the fact that the retailer is prone to maintain the inefficient supplier if such an offer is not made. Buying power for R is thus increased because of this very credible threat to maintain $M2$ as a bargaining leverage (effective in the two others equilibria). So contrary to what the intuition was suggesting (maintaining a inefficient supplier is a way obtain tariff concession from the efficient one), the retailer's buying power is only increased when he signs exclusivity, and the inefficient supplier is not maintained. In a static outcome, the absence of strategic issues between periods (like the inefficient supplier survival), does not allow to take fully into account another source of buying power.

Finally, the social surplus in the dynamic game is maximized when manufacturer $M1$ produces two units at each period (because surplus shares between agents do not matter), and therefore, $SW = 2(1+\delta)$. But the social surplus achieved in the dynamic equilibrium when $\delta > \delta^*(c)$ is given by: $SW = 2(1+\delta) - c$. The inefficient supply from $M2$ generated by R in period 1 in order to enjoy buying power benefits in the second period harms social welfare.

4 Extensions

In the previous section, we assumed that contracts between the manufacturers and the retailer were linear tariffs, and that positive profit constraints were binding for each period, but not over two periods. In this section, we first relax the linear wholesale price assumption, and second, we authorize agents to borrow money for period 1 anticipating their profits on period 2 (it is a way to relax the financial constraint).

4.1 Non linear tariffs

To take into account non linear contracts, we now assume in the two-period basic setting that each producer i may offer a unit price w_i if the retailer buys him only one unit of product, and another unit price z_i if the retailer buys him two units. We first consider the retailer's decision of period 1 as given, and we thus look for the subgame Nash equilibria in period 2.

Suppose that the retailer in period 1 chose to buy 2 units to $M1$. Because of our assumption of exit, on period 2, the retailer faces $M1$ alone. The manufacturer therefore proposes $w_1^2 = z_1^2 = 1$, gets a profit $\pi_{M1}^2 = 2\delta$ because he sells two units, and R makes no profit. If the retailer chose to buy 2 units to $M2$ in period 1, then $M2$ proposes $w_2^2 = z_2^2 = 1$, gets a profit $\pi_{M2}^2 = 2(1-c)\delta$, and R makes no profit. If R bought from both producers in the first stage of the game, $M1$ and $M2$ thus compete *à la Bertrand* in the second stage and $M1$ offers $w_1^2 = z_1^2 = c$ and thus gains all the market realizing a profit $\pi_{M1}^2 = 2c\delta$ because he sells two units, and R makes a positive profit of $\pi_R^2 = 2(1-c)\delta$. The introduction of a non linear tariff does not therefore change the resolution of this second stage. However, solving the first stage is now modified in the following way with non linear tariffs.

Let us find the conditions for $M1$ to win the exclusivity in the first stage.We consider $M2$ tariff offers (w_2^1, z_2^1) as given. For exclusivity we thus need:

$$2(1 - z_1^1) \geq (1 - w_1^1) + (1 - w_2^1) + 2\delta(1 - c) \tag{1}$$

$$\text{and } 2(1 - z_1^1) > 2(1 - z_2^1) \tag{2}$$

Condition (1) insures that the retailer would gain a better profit giving exclusivity to $M1$ in period 1 rather than buying from both producers, and condition (2) insures that the retailer would obtain a better profit granting exclusivity to $M1$ rather than to $M2$ in period 1. This latter condition (2) was always satisfied when (1) was true in the linear tariff case. Rewriting (1) and (2), we obtain the new conditions:

$$w_1^1 \geq 2 - w_2^1 + 2\delta(1 - c) - 2(1 - z_1^1) \tag{3}$$

$$z_1^1 < z_2^1 \tag{4}$$

Thus, the producer M1 has to set a smaller price than M2 for both units in order to have a chance to win the retailer's exclusivity. The producer M1 also has to set a price high enough for only one unit sold in order to discourage the retailer to buy one unit from each manufacturer in the first period. This latter condition clearly differs from the linear tariff case since we now have a lower bound on w_1^1. We here underline that this mechanism is parallel to the one exhibited in Anton and Yao (1992)'s paper concerning split awards auctions. In their model a buyer may divide its orders between two suppliers through a "split award auction" or buy all from a single supplier through "winner takes all auction". They show that since a split award price is the sum of the offered bids by both suppliers, each of them can unilaterally convince the retailer to adopt a "winner take all auction" rather than a split award by bidding a very high price in the later case. Similarly, we find here that by offering a very high "one unit" price to the retailer, the efficient producer is able to convince the retailer to rather buy him the two units. Financial constraint also impose $w_1^1 + w_2^1 \leq 2$ in the first period. We then obtain the following proposition.

Proposition 2 *There exist a continuum subgame perfect Nash equilibria in pure strategy of this game. The Nash equilibria are such that:* $w_1^1 \in [c + 2\delta(1-c); 2 - c]$, $z_1^1 = c - \varepsilon$, $w_2^1 = c$, $z_2^1 = c$ *and* $z_1^2 = 1$. *R buys exclusively from* $M1$ *in the first and in the second period.*

Proof. See Appendix C. ■

This proposition clearly shows that if producers propose non linear tariffs, the exclusion equilibrium appears for the whole set of δ values, since such tariff desing gives more room for manœuvre to manufacturers, especially to the efficient one. It leads to less supply diversity as M1 is now able to design more sharply the contract that will give him exclusivity by encouraging the retailer to buy him 2 units rather than one (with a high price). One conclusion towards competition policy here is that non linear tariffs limit the inefficiencies on social welfare due to the retailer's incentive to maintain the inefficient producer in the first period.

Another possible extension to test the robustness of Proposition 1 qualitative results is to consider inter-period loans. In other words, the non-negative profits constraint should not apply at the end of each period, but rather over the two periods.

4.2 Authorizing loans

We now assume that producers and the retailer may incur a loss in the first period but still have to get non negative profits over the two periods. If a producer or the retailer realizes a loss amounting to L in the first period, he can now borrow this amount to a bank, and reimburse it in the next period plus an interest rate r. As usual, we assume that the discount factor δ and this interest rate r are related by the following inverse relationship: $\delta = \frac{1}{1+r}$.

Thus, introducing the possibility for firms to get loans only modifies the financing constraints for firms. We first need to determine these new financing bounds constraining manufacturers' and the retailer's strategies. In the second period of the game, constraints are equivalent to our benchmark case since it is the last period of the game, no loans are subscribed. However, in the first period, all constraints are modified. First, $M1$ (resp. $M2$) is no more constrained to set a wholesale price lower or equal to $2 - w_2^1$ (resp. $2 - w_1^1$) in the first period as the retailer, because of a loan, may now be able to pay more. The consumers' willingness to pay that was previously the upper bound on the sum of wholesale prices is now outreached by the maximum loan the retailer can contract with a bank and amount to $w_1^1 + w_2^1 \leq 2[1+\delta(1-c)]$. Indeed, the retailer may borrow a positive amount in the first period if no producer has won exclusivity. Second, the producer $M2$ may borrow a strictly positive amount in the first period only if this allows him to achieve exclusivity. Finally, the producer $M1$ can borrow a strictly positive amount whether he became R's exclusive supplier or if the two producers were maintained by the retailer in the first period. Besides, the best reply functions identified in our basic setting remain unchanged but are now submitted to theses new financing constraints. We first obtain the following Lemma, close to Lemma 1:

Lemma 2: To become R's exclusive supplier in the first period, $M1$ best reply's wholesale price is $w_1^1 = \max\{w_2^1 - 2\delta(1-c); -\delta\}$ and $M2$'s best reply is $w_2^1 = \max\{w_1^1 - 2\delta(1-c);$ $c - \delta(1-c)$. In the race to exclude each other, the only existing exclusion Nash equilibrium is such that $w_2^1 = c$ and $w_1^1 = c - 2\delta(1-c)$, leading to the exclusivity for $M1$.

Proof.
See appendix D. ■
Solving the entire two-period game leads to the following proposition.

Proposition 3 *There exists two subgame perfect Nash equilibria in pure strategy of this two-period game with authorized loans (where $\delta^*(c) = \frac{c}{3(1-c)}$):*

(ii) If $\delta > \delta^*(c)$, the only Nash equilibrium is such that $w_1^1 = \frac{2c}{3} + 2\delta(1-c)$, $w_2^1 = \frac{c}{3} + 2\delta(1-c)$, R buys one unit to each supplier in the first period, and then only to $M1$ at a price $w_1^2 = c$ in the second period;

(iii) If $\delta \leq \delta^*(c)$, the only Nash equilibrium is such that $w_1^1 = c - 2\delta(1-c)$, $w_2^1 = c$, R buys 2 units to $M1$ in the first period (exclusivity) and only to $M1$ at a price $w_1^2 = 1$ in the second period.

Proof. See Appendix D. ■

In fact, when $(c, \delta) \in [0,1] \times [0,1]$, we know from Lemma 2 that $M1$ (resp. $M2$) always has to take into account the risk to be excluded by $M2$ (resp. $M1$). Thus, the two firms will try to choose the highest price possible in order to thwart its rival exclusion strategy, that is: $w_1^1 = \frac{2c}{3} + 2\delta(1-c)$ and $w_2^1 = \frac{c}{3} + 2\delta(1-c)$. One can check that for theses prices, the retailer's financing constraint is always fulfilled. In fact, manufacturers would have an incentive to deviate if $\delta \geq \frac{2-c}{2(1-c)} \geq 1$, but this threshold is not relevant for $(c, \delta) \in [0,1] \times [0,1]$. Moreover, when $\delta < \delta^*$, $M1$ always has an incentive to deviate towards an exclusion equilibrium by setting $w_1^1 = c - 2\delta(1-c)$ while $M2$ sets its lowest price ($w_2^1 = c$) in case the two producers would be maintained in the first period . When $M1$ decides $w_1^1 = c - 2\delta(1-c)$, one can verify that $M2$ can never afford to exclude $M1$ because it would lead him to borrow a too high amount that he could never reimburse in the second period.

Relaxing the financial constraint of the retailer and the manufacturer does not qualitatively change Proposition 1 results. Both kind of equilibria (accommodation with wholesale price higher than marginal cost, or exclusivity with predation wholesale price) do still exist.

5 Upstream Monopoly and Downstream Duopoly

In this section, we reverse the structure of the model and we analyze a vertical relationship made up with an upstream monopoly M supplying two competing retailers $R1$ and $R2$. The retailer $R1$ is assumed to have no cost whereas $R2$ has a positive marginal retailing cost $c \geq 0$, and is thus less efficient than $R1$. M can produce at most two units of good which is the total demand on the market, and thus a retailer may offer 0, 1 or 2 units of products to the consumers. If a retailer is not supplied by the producer in the first period, we assume that he will become inactive in the second period of the game. The explanation here is that it would be too costly for the retailer to regain a positive demand in the second period if he had not been able to satisfy consumer's demand in the first period. Indeed, it is well known that even powerful retailers cannot afford to delist the most famous brands (also called *must-stock brands*) without incurring a substantive loss in their profit (modeled here with extreme zero profits). Moreover, the entry of a new retailer in period 2 is assumed to be impossible because of institutional barriers to entry. This could be the translation of government legislation that generally impedes a new retailer to open a store wherever and whenever he wants. There is indeed a complex, lengthy, and uncertain administrative process to follow.All the other assumptions are the same as in the former framework of section 2, except that it is now the retailers who are assumed to make a take-it or leave-it wholesale price offers to the manufacturer. We first solve the second period of the game.

Suppose the two retailers have resold M's product in the first period, they are thus still competing in the second period. $R1$ offers $w_1^2 = 1-c$ and the manufacturers thus only supplies $R1$. Profits in the second period are thus $\pi_M^2 = 2(1-c)$, $\pi_{R1}^2 = 2c$ and $\pi_{R2}^2 = 0$. Suppose now that only retailer's $R1$ has offered the product to consumers in the first period. $R1$ has thus a downstream monopoly position and thus set $w_1^2 = 0$; profits are: $\pi_M^2 = 0$ and $\pi_{R1}^2 = 2$. Symmetrically, if only $R2$ has been supplied by M in the first period, $R2$ offers $w_2^2 = 0$ in the second period and thus profits are: $\pi_M^2 = 0$ and $\pi_{R2}^2 = 2(1-c)$. We now turn to the resolution of the first period of the game.

In the first period, each retailer now has an incentive to bid a higher price than its rival (overbid) to buy manufacturer's product in order to become the sole retailer and thus realize a monopoly profit in the second period.

Lemma 3: To become M's exclusive seller in the first period, $R1$ best reply wholesale price offer is $w_1^1 = Min[w_2^1+2\delta(1-c), 1]$ while $R2$'s best reply is $w_2^1 = Min[w_1^1+2\delta(1-c), 1-c]$. However, the only potential exclusion equilibrium appears if $\delta \leq \frac{c}{2(1-c)}$, is such that $w_1^1 = 1-c+2\delta(1-c)$ and $w_2^1 = 1-c$, and $R1$ wins the first period exclusivity.

Proof. The proof is very similar to the proof of lemma 1. [4] ■

Solving the entire game leads to the following proposition, analogous to Proposition 1.

Proposition 4 *There exists three types of subgame perfect Nash equilibria in pure strategies of this two-period game. For* $\widetilde{\delta}(c) = \frac{2-c}{4(1-c)}$, *and* $\delta^*(c) = \frac{c}{3(1-c)}$, *the three possible equilibria types are:*

(i) If $\widetilde{\delta} < \delta \leq 1$, *there is a continuum of Nash equilibria defined by the following conditions:* $w_1^1 + w_2^1 = 0$; *M supplies one unit to each retailer in the first period, and only to $R1$ in the second period at a price* $w_1^2 = 1-c$;

[4]Details can be delivered by authors upon demand.

(ii) If $\delta^* < \delta \leq \widetilde{\delta}$, the only Nash equilibrium is such that $w_1^1 = 1 - \frac{2c}{3} - 2\delta(1-c)$ and $w_2^1 = 1 - \frac{c}{3} - 2\delta(1-c)$; M supplies one unit to each retailer in the first period, and then only to R1 in the second period at a price $w_1^2 = 1 - c$;

(iii) If $\delta \leq \delta^*$, the only Nash equilibrium is such that $w_1^1 = 1 - c + 2\delta(1-c)$, $w_2^1 = 1 - c$; M supplies 2 units to R1 in the first period (exclusivity) at $w_1^1 = c - 2\delta(1-c)$, and at $w_1^2 = 0$ in the second period.

Proof. The proof is similar to Appendix B. ■

The borderlines determining the different equilibria are the same as in Figure 1. However, it turns out that the three equilibria have very different interpretations. First of all, the exclusion equilibria is thus obtained thanks to an interesting mechanism pointed out by Kirkwood (2005): a retailer can prey a less efficient retailer offering to the producer a wholesale price so high that its rival can't follow. This is an original way to prey, since usually, when considering horizontal relationships (also the former case of this article), a predatory pricing translates into a low price. Here, the predatory pricing strategy leads to a high price. There is also another interesting equilibrium where the manufacturer, unless in a monopoly position, accept to supply the retailers for free. This may happen because when the manufacturer grants a high value to its future profit he will prefer to supply both retailers in the first period in order to keep an effective competition in the second period. Anticipating this, the retailers exploit the manufacturer's need to supply both of them demanding him to renounce entirely to its profit. In such a case, the two retailers, even the inefficient one, exert a strong buying power power towards the manufacturer.

6 Conclusion

With this article, we wanted to show that taking into account dynamics in vertical relationships matters. Indeed, we proved that, when producers offers linear take-it or leave-it contracts to a downstream monopsonist, a two period setting game does not only change the structure of the market (the inefficient supplier remains present) but also the behavior of the agents (both manufacturers are able to price above marginal cost by exploiting the retailer's plot). However, social surplus is affected by the retailer's opportunistic decision to maintain the inefficient supplier as a bargaining leverage, because of the inefficient supplier's cost. Relaxing the financial constraints of the firms trough loan possibilities do not change qualitatively the results. Besides, turning the structure upside-down by considering a monopolist upstream firms facing two suppliers reveals the duality of Proposition 1: predation in retailing translates into high wholesale prices, which is quite uncommon in vertical relationships literature.

A closely related issue could consist in introducing imperfect upstream competition by considering, for instance, that producers offer different substitute varieties of a product. In such a case, our main results are likely to be maintained. However, the effects on social welfare would be ambiguous since the positive effect of more varieties available for consumers should be put in balance with the negative effect of maintaining an inefficient producer.

Further research could also address how to incorporate competition at the retail sector. Our intuition is that the margin destruction resulting from downstream rivalry between retailers may reinforce their incentives to use an inefficient supplier as a bargaining leverage with the upstream manufacturers. Besides, the activity of the inefficient manufacturer will no more depend on one retailer only. If one distributor decides to buy to the inefficient producer, the rival retailer can enjoy the inefficient supplier presence without the need to pay a high price. A free-rider problem may thus arise in the context of downstream competition. However, such opportunistic strategy from at least one retailer still harm social welfare because the inefficient manufacturer is maintained on the market.

To sum-up, this is in our view a first attempt to take into account financial liquidity constraints in a dynamic Bertrand competition framework with a strategic monopsonist retailer. This article brings one more explanation to the origin of the retailing buying power, also as another solution to the Bertrand Paradox.

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Appendix

A. Proof of Lemma 1

We now partially solve the game in the first period.

- For w_1^1 fixed, $M2$'s best reply, if he attempts to win R's exclusivity, would be to offer a w_2^1 satisfying the following condition:

$$\left(1-w_1^1\right)+\left(1-w_2^1\right)+2\delta\left(1-c\right)\leq 2\left(1-w_2^1\right) \tag{5}$$

  The above condition insures the retailer finds profitable to buy 2 units to $M2$ rather than one unit to each manufacturer in the first period. Thus, if $M2$ sets $w_2^1 = \max[w_1^1 - 2\delta\left(1-c\right), c]$, then this wholesale price is low enough to compensate the retailer from not making competition between producers play in the second period and high enough to respect its financial constraint in the first period of the game($w_2^1 \geq c$).

- For w_2^1 fixed, $M1$'s best reply, if he attempts to win R's exclusivity, would be to offer w_1^1 such that:

$$\left(1-w_1^1\right)+\left(1-w_2^1\right)+2\delta\left(1-c\right)\leq 2\left(1-w_1^1\right) \tag{6}$$

  The above condition insures the retailer finds profitable to buy 2 units to $M1$ (rather than just one) in the first period. It can be rewritten: $w_1^1 = \max[w_2^1 - 2\delta\left(1-c\right), 0]$, because $M1$ has to set $w_1^1 \geq 0$ in order to respect its financial constraint.

If the two manufacturers compete for retailer's exclusivity, there exist only one potential exclusion equilibrium where $M1$ wins R's exclusivity in the first period and such that: $w_2^1 = c$, and $w_1^1 = c - 2\delta(1-c) > 0$ when $\delta \leq \frac{c}{2(1-c)}$.

B. Proof of Proposition 1

We have to determine the best reply for $M1$ and $M2$ in order to be maintained by the retailer in the first period of the game.

- Let us first consider w_1^1 as given. If $M1$ does not win R's exclusive supply, he thus realizes a profit: $\pi_{M1}^{(1)} = w_1^1 + 2\delta c$. If $M1$ try to win R's exclusivity in the first period we know from Lemma 1 that he had to set a price $w_2^1 - 2\delta(1-c)$ and his resulting profit is thus $\pi_{M1}^{(2)} = 2(w_2^1 - 2\delta(1-c)) + 2\delta$. $M2$ always prefer, if he can do it, to deter a potential exclusivity between R and $M1$. His best pricing reply is therefore $w_2^1(w_1^1)$ such that $\pi_{M1}^{(1)} \geq \pi_{M1}^{(2)}$. Of course this best reply price always has also to be higher than $M2$'s unit cost c and to respect $w_1^1 + w_2^1 \leq 2$ (maximum consumers' willingness to pay for the two units). Thus:

$$w_2^1(w_1^1) = \max\left\{min\left\{\frac{w_1^1}{2} + \delta(1-c); 2 - w_1^1\right\}; c\right\}$$

When $\delta \leq \frac{3c-2}{2(1-c)}$, we have $2-c < \frac{1}{3}(4-2\delta(1-c)) < 2(c-\delta(1-c))$. Consequently, M2's best reply function is $w_2^1 = c$. When $\delta > \frac{3c-2}{2(1-c)}$, we have $2(c-\delta(1-c)) < \frac{1}{3}(4-2\delta(1-c)) < 2-c$. It follows that M2's best reply function can be rewritten as:

$$w_2^1(w_1^1) = \begin{cases} c & \text{if } w_1^1 < 2(c-\delta(1-c)) \text{ or } w_1^1 \geq 2-c \\ 2 - w_1^1 & \text{if } \frac{1}{3}(4-2\delta(1-c)) \leq w_1^1 < 2-c \\ \frac{w_1^1}{2} + \delta(1-c) & \text{if } 2(c-\delta(1-c)) \leq w_1^1 < \frac{1}{3}(4-2\delta(1-c)) \end{cases} \quad (7)$$

- Let us now consider w_2^1 as given. If $M2$ does not try to win R's exclusive supply, he thus realizes a profit: $\pi_{M2}^{(2)} = (w_2^1 - c)$. If $M2$ races for R's exclusivity in the first period we know from Lemma 1 that he has to set a price $w_1^1 - 2\delta(1-c)$ in order to convince R and his resulting profit would thus be $\pi_{M2}^{(1)} = 2(w_1^1 - 2\delta(1-c) - c) + 2\delta(1-c)$. $M1$ always prefer to deter a potential exclusivity between R and $M2$, his best pricing reply is therefore $w_1^1(w_2^1)$ such that $\pi_{M2}^{(2)} \geq \pi_{M2}^{(1)}$. Of course this best reply price also has to respect R's financial constraint: $w_1^1 + w_2^1 \leq 2$. Thus $w_1^1(w_2^1) = Min[\frac{w_2^1+c}{2} + \delta(1-c), 2 - w_2^1]$. Rewriting $M1$'s best reply function in case he does not try to exclude $M2$, we have:

$$w_1^1(w_2^1) = \begin{cases} \frac{w_2^1+c}{2} + \delta(1-c) & \text{if } w_2^1 \leq \frac{1}{3}(4-c-2\delta(1-c)) \\ 2 - w_2^1 & \text{if } w_2^1 > \frac{1}{3}(4-c-2\delta(1-c)) \end{cases} \quad (8)$$

The interior point is such that $w_2^{1*} = \frac{w_1^{1*}(w_2^{1*})}{2} + \delta(1-c)$ where $w_1^{1*}(w_2^{1*}) = \frac{w_2^{1*}+c}{2} + \delta(1-c)$ Solving leads to:

$$w_1^{1*} = \frac{2c}{3} + 2\delta(1-c) \text{ and } w_2^{1*} = \frac{c}{3} + 2\delta(1-c)$$

Such a solution satisfies the financial constraint as long as $w_1^{1*} + w_2^{1*} \leq 2$, that is $\delta \leq \widetilde{\delta}(c) = \frac{2-c}{4(1-c)}$. Otherwise $w_1^{1*} + w_2^{1*} = 2$, $w_1^{1*} \geq \frac{1}{3}(4-2\delta(1-c))$ and $w_2^{1*} \geq \frac{1}{3}(4-c-2\delta(1-c))$. However, M1 wins the exclusivity supply for the retailer when $w_1^{1*} = \frac{2c}{3} + 2\delta(1-c) < 2(c-\delta(1-c))$, that is when $\delta < \delta^*(c) = \frac{c}{3(1-c)}$. In such as case, $w_1^{1*} = c - \delta(1-c)$ as stated in Lemma 1.

C. Proof of Proposition 2

From condition (4), we know that $M1$ will always set $z_1^1 = c - \varepsilon$ while $z_2^1 = c$ to get an exclusive supply agreement rather than to let $M2$ possibly become the sole supplier.

Let us now assume that w_2^1 is fixed, $M1$'s best response depends on its strategy. If $M1$ excludes $M2$, its profit would be: $\pi_{M1}^e = 2c + 2\delta$, while its profit if $M2$ is maintained is $\pi_{M1}^m = w_1^1 + 2\delta c$. Thus, $M1$ would like to exclude $M2$ if $w_1^1 < 2c + 2\delta(1-c)$. The best reply price for $M1$ (taking into account the $w_1^1 + w_2^1 \leq 2$ financial constraint) is thus :

$$w_1^1 = \begin{cases} 2c + 2\delta(1-c) & \text{if } w_2^1 < 2(1-c)(1-\delta) \\ 2 - w_2^1 & \text{otherwise} \end{cases} \quad (9)$$

If now w_1^1 is fixed, $M2$'s best response is to fix a wholesale price in order to be maintained in the first period. He thus has to set w_2^1 in order to reverse the inequality (3). $M2$ thus sets a wholesale price $w_2^1 \leq 2 - w_1^1 + 2(1-c)(\delta - 1) < 2 - w_1^1$ because $\delta < 1$. However positive margin $w_2^1 \geq c$ must be satisfied. This leads to:

$$w_2^1 = \begin{cases} 2c - w_1^1 + 2\delta(1-c) & \text{if } w_1^1 < c + 2\delta(1-c) \\ c & \text{otherwise} \end{cases} \tag{10}$$

Crossing best reply functions we thus obtain a continuum of Nash equilibria : $w_2^1 = c$ and $w_1^1 \in [c + 2\delta(1-c); 2-c]$, besides $z_1^1 = c - \varepsilon$ and $z_2^1 = c$. $M1$ is always able to set a price low enough to convince the retailer to maintain its relationship, but he rather selects the highest price $w_1^1 = 2 - c$ leading R to choose him as its exclusive supplier in the first period.

D. Proof of Lemma 2 and Proposition 3

- **Proof of Lemma** 2**:** It is immediate to see that Lemma 2 is equivalent to Lemma 1 unless for the financial constraints imposed to manufacturers. In case $M1$ attempts to exclude $M2$ in the first period the lowest unit price it can afford to offer to R is: $-L1$, with $2L1$ the maximum amount he may reimburse in the second period when it is alone on the supply market. Therefore, $L1 = \delta$. Similarly, when $M2$ attempts to exclude $M1$ in the first period the lowest unit price it can afford to offer is: $c - L2$, with $2L2$ the maximum amount $M1$ may reimburse in the second period when it is alone on the supply market. Thus $L2 = \delta(1-c)$.

- **Proof of proposition** 3: R is now able to subscribe a loan in the first period and its maximum loan in case he maintains the two manufacturers in the first period amounts to: $LR = 2\delta(1-c)$. Thus R may accept w_1^1 and w_2^1 offers as long as: $w_1^1 + w_2^1 \leq 2 + LR$. Moreover, the lower bound on price offer by manufacturers when they do not try to exclude each other can be modified. If $M1$ simply attempts to remain in the first period, its lower bound price is now : $w_1^1 \geq -2\delta c$. However, in the case where $M2$ intends to remain in the first period, its lower bound price still: $w_2^1 \geq c$.

  The best reply function for M1, given w_2^1, is thus:

  $$w_1^1(w_2^1) = \max\left\{min\left\{\frac{w_2^1 + c}{2} + \delta(1-c); 2(1+\delta(1-c)) - w_2^1\right\}; -2\delta c\right\}$$

  It can be rewritten as follow:

  $$w_1^1(w_2^1) = \begin{cases} \frac{w_2^1+c}{2} + \delta(1-c) & \text{if } c < w_2^1 \leq \frac{1}{3}(4 - c + 2\delta(1-c)) \\ 2(1+\delta(1-c)) - w_2^1 & \text{otherwise} \end{cases} \tag{11}$$

  The best reply function for M2, given w_1^1, is given by:

  $$w_1^1(w_1^1) = \max\left\{min\left\{\frac{w_1^1}{2} + \delta(1-c); 2(1+\delta(1-c)) - w_2^1\right\}; c\right\}$$

When $\delta < \frac{3c-2}{4(1-c)}$, the optimum for M2 is the corner solution that is: $w_2^1(w_1^1) = c$. However, if $\delta \geq \frac{3c-2}{4(1-c)}$, the best reply function becomes now:

$$w_2^1(w_1^1) = \begin{cases} c & \text{if } w_1^1 \leq 2(c-\delta(1-c)) \text{ or if } w_1^1 > 2(1+\delta(1-c)) - c \\ \frac{w_1^1}{2} + \delta(1-c) & \text{if } 2(c-\delta(1-c)) < w_1^1 \leq \frac{2}{3}(2+\delta(1-c)) \\ 2(1+\delta(1-c)) - w_1^1 & \text{if } \frac{2}{3}(2+\delta(1-c)) < w_1^1 \leq 2(1+\delta(1-c)) - c \end{cases} \quad (12)$$

The interior point is such that $w_2^{1*} = \frac{w_1^{1*}(w_2^{1*})}{2} + \delta(1-c)$ where $w_1^{1*}(w_2^{1*}) = \frac{w_2^{1*}+c}{2} + \delta(1-c)$ Solving leads to:

$$w_1^{1*} = \frac{2c}{3} + 2\delta(1-c) \text{ and } w_2^{1*} = \frac{c}{3} + 2\delta(1-c)$$

The financial constraint is always respected because $c < 1$ directly implies $w_1^{1*} + w_2^{1*} = c + 2\delta(1-c) < 2 + 2\delta(1-c)$. However, M1 wins the exclusivity as soon as $w_1^{1*} = \frac{2c}{3} + 2\delta(1-c) < 2(c-\delta(1-c))$, that is when $\delta < \delta^*(c) = \frac{c}{3(1-c)}$. In such as case, $w_1^{1*} = c - \delta(1-c)$ as stated in Lemma 2.