MFN Clauses and the Agency and Wholesale Models in Electronic Content Markets

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Abstract. I investigate strategic interactions and market outcomes in the "agency model" and "wholesale model" of sales, and also most-favored-nation (MFN) clauses. MFN clauses have pro-competitive effects under the agency model, encouraging retail entry and investment, which may be especially important in new markets. Adopting the agency model can also have pro-competitive effects. Indeed, consumers always prefer this model despite the fact that it leads to initial price increases. I relate my results to events in the market for electronic books.

1. Introduction

I investigate the "agency model" and "wholesale model" of sales, which are two distinct ways of structuring relations between suppliers and retailers and of determining final retail prices. I analyze how these sales models effect strategic interactions in general, and in particular how they effect the profits of retailers and suppliers, and the welfare of consumers.

I show the following. First, most-favored-nation (MFN) clauses can have pro-competitive effects under the agency model, rather than the negative effects that are commonly assumed to arise. Second, adopting the agency model can raise retailer profits and encourage entry and investment. Even when entry and investment are fixed, consumers benefit from the agency model—even though retail prices increase immediately following its adoption.

It is useful to clarify what the agency and wholesale models are and why one might care about them before continuing. The wholesale is very traditional, and in it suppliers set per-unit wholesale prices to retailers, who are then free to impose whichever markups they choose as they set retail prices. The agency model is very different, and in it suppliers set retail prices and then split revenue with retailers according to pre-determined shares.

The agency model was recently adopted by electronic book ("e-book") retailers Amazon and Apple and publishers supplying them, and is also commonly used by companies that support marketplaces for applications ("apps") usable on various mobile devices such as smartphones and tablet computers. As such it is of more than purely theoretical interest to understand the differences between these two sales models.

The e-book market and the agency model are currently objects of antitrust scrutiny both in the US and the EU. The reason is that retail prices for many e-books significantly increased

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consequent to the adoption of the agency model. This is despite the fact that Apple entered the e-book market (thus challenging the primary incumbent Amazon) at the same time that the agency model was adopted.

Also of interest and concern to regulators are the most-favored-nation clauses that have been adopted in the e-book market. These clauses guarantee that suppliers do not discriminate between retailers by offering them different prices, and are widely considered to be tools to raise prices or otherwise extract more surplus from the market at the expense of consumers.

To my knowledge, I am the first to assess the differences between the agency and wholesale models and to investigate the role of MFNs under the agency model. My analysis allows for both differentiated retailers and differentiated suppliers, multiple periods, and consumer lock-in to retailers. In the e-book market, consumer lock-in may exist because a consumer becomes accustomed to using, for example, Amazon's e-book store or e-book reading app, leading them to use Amazon as their primary channel for future purchases.

I now provide a bit more detail regarding my main results. Under the agency model, most-favored-nation clauses serve to transfer surplus away from suppliers and towards retailers. Consumers are not harmed—in equilibrium MFNs do not increase retail prices.

By raising retailer profits, MFNs also encourage retailers to enter or otherwise invest in the market. Because consumers are beneficiaries of retail entry and investment, the overall effect of such clauses is to raise social surplus and consumer surplus in particular. Encouraging retail investment is important in many markets, but perhaps most especially in new markets such as the e-book market in which retailers play a central role in building the market.

My next set of results concern the effect of moving to the agency model from the wholesale model. Doing so raises the profits of retailers whenever the differentiation of suppliers is higher than that of retailers. An implication is that the agency model itself can spur investment and entry by retailers, similar to how MFNs within the agency model can.

The reason that retailers may prefer the agency model is that it reduces the intense incentives to compete on price within the wholesale model; such incentives exist because retailers desire to lock in consumers so that they may be harvested in later periods. Although abandoning the wholesale model quenches initial price competition between retailers, I show that it actually limits the ability of retailers to harvest consumers later on.

An implication is that moving to the agency model has somewhat subtle price effects; although initial prices do increase, future prices decline relative to the wholesale model. It follows that the observation of price increases following the adoption of the agency model is not sufficient to conclude that there has been harm to consumers. Rather, a complete assessment of consumer welfare must take a longer term perspective.

Indeed, I show that consumers unambiguously prefer the agency model. That is, future price decreases are significant enough to make up for the initial price increases that occur when the market moves to the agency model.

Suppliers may benefit from the agency model. One reason is that the agency model may spur retail entry, as explained above, potentially allowing suppliers to avoid facing a monopoly retailer. Hence, even if suppliers were to prefer the wholesale model conditional on retail entry, they may be willing to accept the agency model if it ensures retail competition.

I emphasize that the overall goal of my analysis is not to provide a complete description of each event and fact surrounding any particular market, such as that for e-books. Rather, I seek to provide a general and abstract assessment of the agency and wholesale models, and of MFNs. That said, my results are consistent with several key facts surrounding the e-book market, and generate additional insight.

For example, my analysis explains why prices would go up following the adoption of the agency model, as has been observed in the e-book market. But I caution that prices may end up being lower in the future under the agency model. My results also indicate why an incumbent monopoly retailer would not wish to use the agency model, but why an entrant might, and also why an incumbent might prefer it once entry has occurred. This is consistent with the facts of the e-book market, in which the incumbent (Amazon) did not push for the agency model, which only arose due to Apple's insistence on it as a condition of its entry.

There are two important limitations of my analysis. First, I do not consider the presence of alternative, higher-cost distribution channels and formats. In the e-book market, this would correspond to physical books sold through "brick-and-mortar" stores. Second, I do not consider platform pricing issues. In the e-book market, this would involve pricing of devices that host applications for reading e-books.

I discuss these limitations in detail in the Conclusion. A brief summary of that discussion is as follows. First, it is not hard to argue that the emergence of a new low-cost channel may pose a major threat to suppliers if that channel is monopolized, even if the alternative channel continues to exist. Moreover, the cost advantage of new channels may render the existing channels obsolete, suggesting that it is useful to think about how competition works in new channels, abstracting away from the old. Second, on most physical devices, including most Android and all Apple devices, consumers have a choice of e-book applications. Thus, while platform pricing issues may be interesting, competition also exists within platforms.

Before proceeding with the formal analysis, I briefly discuss the related literature. There are many papers on MFN clauses, but most of them focus on ways in which such clauses can be used to raise prices or otherwise harm consumers, as in Cooper (1986), Butz (1990), and Baker (1996). DeGraba and Postlewaite (1992) and McAfee and Schwartz (1994) investigate the extent to which such clauses can raise the profits of a monopolist selling through two franchised retailers by allowing the franchisor to avoid a time-inconsistency problem that.

In contrast to these analyses, MFN clauses in my analysis differ in two main ways. First, they do not involve any sort of time inconsistency or dynamic issues whatsoever. Second, they can have pro-competitive effects as opposed to working to raise prices.

The only other paper (to my knowledge) that deals directly with the issue of MFNs in an agency model is Gans (2012). Gans considers both lock-in and MFN clauses in a model with a single platform and a single application. In his model, consumers consider joining the platform and then possibly buying the application. Application prices are determined after consumers join, subjecting them to a hold-up problem that is sufficiently intense that no equilibrium exists in which the platform owner charges a positive fee. MFN clauses are assumed to limit the maximum price of the application, which mitigates the hold-up problem and permits the existence of an equilibrium in which consumers join the platform.

In my model MFNs encourage investment through a very different mechanism and typically have no effect on application prices in equilibrium. Additionally, I provide a broader assessment of the differences between the agency model and the wholesale model.

The remainder of my paper is structured as follows. Section 2 highlights the role of MFNs in a simple static environment with a monopoly supplier and competing retailers. Section 3 extends the model to allow for multiple periods, lock-in, and upstream competition. Section 4 analyses this model, focusing on comparing the wholesale model to the agency model. Section 5 concludes.

2. The role of most-favored-nation clauses in the agency model

In this section I consider the effect of most-favored-nation clauses in the agency model, abstracting away from upstream competition (which is introduced in Section 3). The key feature of the agency model is that retailers do not determine final prices. Rather, the supplier of a given product sets retail prices, and the resulting profits are split between the supplier and retailers.

2.1. **The model.** There are two retailers, A and B, who are situated at the ends of a (unit-length) hotelling line and who sell a product produced by a monopoly supplier, U, at zero cost, to consumers uniformly distributed across this line. Consumers have use for at most one unit of the product, with the utility of a consumer located at point x who consumes from retailer A being $v - p_A - tx$, where p_A is the price charged by retailer A and $t > 0$ is a differentiation parameter. Instead buying from retailer B generates utility $v - p_B - t(1-x)$. As a technical convenience to limit the number of cases that must be considered, I suppose that $v \in (t, 2t)$, which will ensure that the market is covered in equilibrium but rules out corner solutions in certain out-of-equilibrium circumstances.

There are two stages to this game. First, A and B simultaneously offer revenue shares $r_i \in [0, 1]$, $i \in \{A, B\}$, to the supplier. Second, the supplier U sets retail prices p_i and consumers choose which if any retailer to purchase from (a consumer makes a purchase only if it generates non-negative utility). The resulting profits are then split between firms so that retailer i receives the share $1 - r_i$ of profits generated by sales through its store, with the supplier keeping the rest.

If there are (industry-wide) MFN contracts, then the supplier is constrained to set $p_A = p_B$. In this case it is straightforward to show that, for any given $r_i > 0$, it is optimal for the monopolist to set

$$p_A = p_B = v - \frac{t}{2}.$$

These prices make the consumer situated at $x = 1/2$ indifferent between purchasing a good or not, and also indifferent between purchasing from either one retailer or the other.

In the absence of MFNs, the supplier is free to charge whichever prices it chooses. Because $v > t$, it is optimal to sell to all consumers. Hence, U's problem is equivalent to choosing some marginal consumer x such that consumers between A and x shop at A and all others shop at B. Prices are chosen to extract surplus from the marginal consumer, so that

$$p_A = v - tx, \text{ and } p_B = v - t(1 - x). \tag{1}$$

The profit function of the supplier is given by

$$\pi^U = r_A p_A x + r_B p_B (1 - x),$$

with associated derivative

$$\begin{aligned} \frac{d\pi^U}{dx} &= r_A \left(p_A + x \frac{dp_A}{dx} \right) + r_B \left(-p_B + (1 - x) \frac{dp_B}{dx} \right) \\ &= r_A p_A - r_B p_B + r_A x \frac{dp_A}{dx} + r_B (1 - x) \frac{dp_B}{dx}. \end{aligned} \tag{2}$$

In an abuse of notation, I will refer to the optimal value of x simply as x. Using the values for prices given in (1), this optimal value is given by

$$x = \frac{v(r_A - r_B) + 2r_B t}{2t(r_A + r_B)}. \tag{3}$$

Note that this yields $x \in [1 - \frac{v}{2t}, \frac{v}{2t}]$, although of course it must also be that $x \in [0, 1]$—the assumption that $v < 2t$ ensures that this requirement holds so that this expression for x may be used without concern.

The only caveat (which applies to the both the case with and without MFNs) is that if $r_A = r_B = 0$, U earns zero profits regardless of its choices and so is indifferent to what prices it charges. I assume that U selects $x = 1/2$ in this situation, which is the limit of its choice for $r_A = r_B = \epsilon$ as ϵ goes to zero.

2.2. **MFNs as devices to raise retailer profits.** I now examine how MFNs influence market outcomes. In the presence of MFNs, the analysis is extremely straightforward. Because U is constrained to set $p_A = p_B$, and because it is always optimal to set $p_A = p_B = v - \frac{t}{2}$, retailers can influence neither prices nor their market shares through their choices of r_i.

Therefore, in the presence of MFNs both firms choose to keep all profits for themselves: $r_A = r_B = 0$.

The situation is different in the absence of MFNs. In this case, offering a higher share r_i to U allows i to gain a greater share of the market, and moreover increases the overall revenue generated through this retailer. On the other hand, raising r_i lowers the actual share of this revenue that i receives. Hence, retailers face a tradeoff when they increase r_i.

To verify this, first note that it is convenient to describe how x changes with r_i by applying the implicit function theorem to Equation (2). This gives

$$\frac{\partial x}{\partial r_A} = \frac{v - 2tx}{2t(r_A + r_B)} > 0, \text{ and } \frac{\partial x}{\partial r_B} = \frac{-(v - 2t(1-x))}{2t(r_A + r_B)} < 0,$$

where the inequalities follow from the fact that $x \in [1 - \frac{v}{2t}, \frac{v}{2t}]$. Thus, when firm i offers U a greater share r_i of the revenue, U responds by selling more products through i.

To see the stronger result that there is an increase in the actual profits generated by a retailer, say retailer A, as r_A is increased, consider that (using Equation (1))

$$\frac{\partial x p_A}{\partial r_A} = x\frac{\partial p_A}{\partial r_A} + \frac{\partial x}{\partial r_A}p_A = -tx\frac{\partial x}{\partial r_A} + \frac{\partial x}{\partial r_A}(v - tx) = (v - 2tx)\frac{\partial x}{\partial r_A} > 0,$$

where the inequality follows from the facts that $x \in [1 - \frac{v}{2t}, \frac{v}{2t}]$ and that $\frac{\partial x}{\partial r_A} > 0$.

Hence, retailers face a tradeoff when they offer the supplier a higher share r_i. The fact that there is some positive reason to offer such higher shares, however, ensures that retailers have some incentive to compete to offer higher r_i to the supplier, unlike the case with MFNs.

Proposition 1. *In the presence of MFNs, retailers claim the entire industry surplus in the market: there exists a unique equilibrium and it is symmetric with $r_A = r_B = 0$.*

In the absence of MFNs, there exists a unique equilibrium and it is symmetric with $r_A = r_B = r^*$, where

$$r^* = \frac{(v - t)^2}{v^2} \in (0, 1).$$

As t increases so that retailers become more differentiated, their incentive to compete on r_i decreases and in equilibrium they offer the supplier a smaller share of profits. On the other hand, as t becomes small the supplier gains a larger share. Indeed, if I were to dispense with the assumption that $v \in (t, 2t)$ (made to limit the number of cases that must be considered) then it would be easy to show that retailer profits go to zero, and r^* goes to one, as t goes to zero.

An immediate corollary of Proposition 1 is that MFNs raise retailer profits at the expense of the supplier. Additionally, MFNs are competitively neutral from the standpoint of consumers.

Corollary 1. *In the agency model, MFNs have no impact on retail prices or consumer purchasing decisions, but strictly raise the profits of retailers and lower the profits of the supplier.*

Intuitively, MFNs soften the competition in r_i between retailers, allowing them to gain a greater share of overall profits—retailers desire MFNs and mutually benefit from them, while it is the supplier who is harmed. Moreover, this comes at no harm whatsoever to consumers, who face the same prices and make the same purchasing decision as in the absence of MFNs.

Indeed, an implication of Corollary 1 is that MFNs can encourage investment and entry by retailers. This may also increase consumer well-being.

The view of MFN clauses suggested by Corollary 1 differs dramatically from the views put forth in the existing literature. This is not to suggest that the existing literature is wrong, but instead that MFNs work very differently in the agency model (all prior related work with the exception of Gans (2012) assumes the wholesale model is in effect).

For example, Baker (1996) argues that MFNs can lead to higher prices for consumers if they work to prevent discounting by suppliers to certain downstream firms. Similarly, he argues that such clauses may soften competition between manufacturers by making selective price cuts less attractive, leading to an overall increase in wholesale prices. In both of these stories, consumers are harmed and (at least some) retailers are harmed as well.

Another interesting argument put forth by Baker (1996) is that the mere observation that retailers want MFNs need not mean that MFNs end up raising retailer profits. In particular, it may be that an MFNs is beneficial to a firm if it is one of a small number of firms them (for example, if this helped it economize on search or bargaining costs), but that widespread adoption of MFNs ends up allowing suppliers to avoid costly discounting and charge higher prices. In such a scenario, downstream firms collectively would be better off if MFNs were banned. Indeed, Morton (1997) provides empirical support for claim that MFNs may have the effect of raising wholesale prices.

My analysis is not subject to this possibility; in the agency model, retailers truly do benefit from MFNs. In fact, it is easy to show that the equilibrium outcome is identical whether one firm or both firms possess an MFN.

Another view of MFNs in vertical relationships is that of DeGraba and Postlewaite (1992) and McAfee and Schwartz (1994). These authors identify a time-inconsistency problem that may limit the profits of a franchisor who contracts sequentially with franchisees, and explore the effectiveness of MFNs in resolving the problem. In contrast, I show that MFNs work to raise the profits of retailers at the expense of suppliers, and that this effect exists independently of the sort of time-inconsistency issue that they focus on. Additionally, a crucial element in their analyses is that franchisors utilize two-part tariffs, which means that under sequential contracting the franchisor has an incentive to conspire with later franchisees. Such effects are absent from my model, and indeed MFNs serve no role under the wholesale model, as I show in more detail in Section 3.

Gans (2012) also considers MFNs in the agency model. His focus is very different from mine. He looks at a platform pricing environment with a single platform and a single app, and shows that MFNs can mitigate a hold up problem faced by the end consumer. The reason is that MFNs impose an exogenous pricing constraint on the fee for the app, which encourages consumers to join the platform.

I now argue that there are three circumstances in which MFNs are not merely competitively neutral, but in fact pro-competitive. The first case is where, for some reason, there are asymmetric revenue shares r_i, as might be the case if the shares are determined sequentially or via some sort of asymmetric bargaining process. To investigate, suppose that (exogenously) $r_A \neq r_B$.

In this situation, MFNs raise social surplus by ensuring efficient consumption decisions by consumers. To see why, recall that without an MFN U has an incentive to manipulate prices so as to distort demand away from whichever retailer is offering it less advantageous terms. While this benefits U and one retailer, it hurts the other retailer. Moreover, by so skewing consumer demand, overall transportation costs of consumers increase; such costs are minimized when $x = 1/2$.

In other words, MFNs ensure that consumers base their final purchasing decisions on the underlying differentiation between the retail channels, leading all consumers to purchase from their most-preferred retailer. This raises overall surplus. Nonetheless, imposing MFNs in this case is not a pareto improvement for consumers; MFNs lead to a decline in one price but an increase in the other.

Proposition 2. *Suppose that (exogenously) $r_A \neq r_B$. Then imposing MFNs increases social surplus, lowers the profits of U, increases the profits of the retailer offering the smaller r_i*

but lowers the profits of the other retailer, and makes some consumers better off but other consumers worse off.

I now turn to two other reasons why MFNs can be pro-competitive.

2.3. **MFNs as devices to encourage entry.** Here I consider the effect of MFNs on entry. Because MFNs raise retailer profits, the presence of MFNs encourages retail entry which in turn raises social surplus.

To see this formally, augment the model above with an initial stage in which both A and B must choose whether to enter the market, where entering requires a non-recoverable investment $F > 0$. I consider pure-strategy equilibria.

Proposition 3. *MFNs increase the level of entry and raise consumer surplus. In particular, there exists values F_1, F_2, and F_3, with $0 < F_1 < F_2 < F_3$, such that the following statements are true.*

(1) *For $F < F_1$ both retailers enter whether there are MFNs or not.*
(2) *For $F \in [F_1, F_2]$ only a single retailer enters if there are not MFNs, but both enter if there are MFNs.*
(3) *For $F \in (F_2, F_3]$, only a single retailer enters.*
(4) *For $F > F_3$, no retailer enters.*
(5) *MFNs strictly raise consumer surplus if $F \in [F_1, F_2]$ but otherwise have no effect on consumer surplus.*

This differs from the typical perspective on the effect of MFNs on entry, which is that MFNs restrict entry, especially by potential discount players. For example, as Baker (1996) discusses, if an entrant requires a lower-cost access to an input in order to successfully compete against an incumbent, then entry may be unprofitable if incumbents have MFNs.

In other words, in the standard story an incumbent demands an MFN because that reduces the incentive of the supplier to offer discounts to an entrant, which may lower the entrant's profits and impede entry. However, in the agency model the main role of an MFN is to reduce the incentives of downstream firms to compete against one another for preferential treatment from the supplier, and hence MFNs raise entry incentives.

It should be noted that in the evolution of the e-book market, the incumbent player was Amazon and the entrant was Apple. Apple demanded MFNs as a condition of its entry, and also the adoption of the agency model in the industry. Thus, Proposition 3 presents the possibility that MFN clauses provided an important inducement for Apple to enter the e-book market. (In Section 3 I investigate whether adoption of the agency model itself might also help retailers.)

2.4. **MFNs as devices to encourage post-entry investments.** Here I show that MFNs raise investment incentives even conditional on both retailers being in the market.

Augment the basic model above (in which both retailers are in the market) with an initial stage in which both A and B select investment levels $e_i \geq 0$ at convex cost $c(e_i)$, where these costs determine the value v that consumers place on consumption according to the increasing concave function $v(e_1 + e_2)$. I assume that $t = v(0)$ and $v(e) < 2t$ for all values, with $v'(0) = \infty$ and $\lim_{e \to \infty} v'(e) = 0$.

The investments under consideration increase the overall willingness to pay of consumers. These might include marketing expenditures or improvements in the sales or consumption experience. This formulation provides a simple framework, but the underlying logic of the main result below does not hinge on this exact specification.

An equilibrium of this game is an investment level e_i^* for each firm and revenue shares r_i^* such that (i) the r_i^* comprise an equilibrium given the aggregate investment level $e_1^* + e_2^*$, (ii) investment levels e_i are optimal given how they influence retailer profits. I consider symmetric equilibria, so that $e_1^* = e_2^* = e^*$ and $r_A = r_B = r^*$.

Proposition 4. *MFNs raise the profits of both retailers and lead to strictly higher investment levels. MFNs raise consumer surplus.*

Proposition 4 flows directly from the basic idea that MFNs raise the share of surplus that retailers claim. Hence, the result is robust to other modeling choices regarding the investments of retailers—so long as investments become more attractive when retailers' share of the profits increases, MFNs will encourage investments.

Retailer investments can be important for the success of products and even of entirely new markets. For example, the e-book market becomes more attractive to consumers when more retailers invest in their online storefronts, allowing consumers to more easily shop for books. Online stores can be very sophisticated, allowing consumers to read reviews, quickly search for specific books or types of books (such as those within a particular genre or by a certain author), and receive customized recommendations based on past purchases or search behavior. Additionally, e-book retailers typically provide software apps that are used to actually read the books, or even design the hardware on which the apps run; investments in these products is also important to the overall success of the market. Finally, advertising and promotion by trusted firms may be crucial for building demand, especially in new markets.

Thus, when retailer investments are crucial to the success of a new market, MFNs may provide needed incentives to provide such investments, benefiting overall welfare and consumers in particular.

2.5. **The inequivalence of MFNs and resale price maintenance.** The results above demonstrate that an MFN is a vertical restraint that raises retailer profits and thereby encourage investments that benefit consumers. This is conceptually similar to the role that (minimum) resale price maintenance (RPM) can play, as described by Telser (1960).

However, there is an important distinction between these two tools. The literature on RPM generally assumes that the upstream firm has commitment power—RPM will be enforced. However, there may be reasons why U might not wish to enforce RPM ex-post, thereby rendering it useless. Indeed, this is the case in the agency model presented above.

To see this, augment the basic model above by adding an initial stage in which U proclaims RPM in the form of a stated price floor $\underline{p}$, retailers then select r_i as before, and then U chooses whether to enforce RPM. Enforcing RPM means that p_A and p_B must be above $\underline{p}$, whereas not enforcing RPM means that U can select any prices it wants.

Clearly, U has no ex-post incentive to enforce RPM. Most particularly, faced with asymmetric revenue shares r_i, U will act as described earlier, biasing prices in order to push demand towards the channel offering it better terms. Knowing the RPM will not be enforced, retailers will ignore it, leading to the equilibrium market sharing rules r^* that emerge in the absence of MFNs.

In other words, U has no incentive to enforce contractual provisions that it dislikes ex-post. In contrast, MFNs are enforced by retailers, and hence do not rely on the ability of U to commit itself to a course of action. Therefore, although MFNs and RPM are similar conceptually, in some cases MFNs can achieve outcomes that RPM cannot.

3. Upstream competition and consumer lock-in

Here I present an extension of the model above that incorporates two new elements. First, there is competition between suppliers. Second, there are two periods, and consumer lock-in.

3.1. **The demand side.** I begin by describing the demand side of the market. To accommodate differentiation between both retailers and suppliers in a tractable fashion, I construct the model so that consumers make their decisions using a two-stage process whereby first a retailer is selected and then a particular product is. To this end, consider the first period and suppose that a given consumer has already chosen whether he will purchase from A or B (I return to the details of this initial decision shortly).

Upon deciding on either A or B, a random variable $x \in [0, 1]$ is realized that gives this consumer's location on a circle of circumference one, where x is uniformly distributed. There are N products, also spaced uniformly around the circle, where each product i has associated price p_{in}^1, for $i \in \{A, B\}$ and $n \in \{1, ..., N\}$; the superscript 1 indicates these are first-period prices. A consumer x who has chosen retailer i purchases the product n that maximizes

$$v - t_u d(x, n) - p_{in}^1,$$

where $d(x, n) \geq 0$ gives the distance between x and product n and $t_u > 0$ is a parameter measuring upstream differentiation. No purchase is made if $\max_n[v - t_u d(x, n) - p_{in}^1] < 0$. Thus, it is as if this consumer lives in a standard "circular city," although his exact location within that city is not determined until after his choice of A or B.

In the second period, this consumer again chooses a product to buy, but this time faces prices p_{in}^2. It is simplest to imagine that the goods are nondurable, but it is equivalent to instead assume that the goods in period two are completely different than in period one, or that the consumer has a new realization of x in period two that is sufficiently distant from his initial location.

Faced with second-period prices each consumer purchases the product n that maximizes

$$v - t_u d(x, n) - p_{in}^2,$$

subject to this leading to a non-negative payoff. There is lock-in in this model, so that $i \in \{A, B\}$ is given by the choice made in period one. Thus, no consumer has the prospect of buying from A in period two if he bought from B in period one, and similarly consumers who bought from A in period one do not have the option to purchase from B in period two.

I now return to the initial choice of A or B. Define

$$U(p) = E_x[\max_n(v - t_u d(x, n) - p)\,|x] = v - p - \frac{t_u}{4n},$$

where the final equality requires that $p + t_u/4n \leq v$. In words, $U(p)$ gives the expected within-period utility (as x varies) of a consumer given that all products are priced at p. Also let $\bar{p}_i^1$ and $\bar{p}_i^2$ denote the average price of the products sold by i in periods one and two, respectively. That is,

$$\bar{p}_i^\tau = \frac{1}{N} \sum_{n=1}^{N} p_{in}^\tau,$$

for $\tau \in \{1, 2\}$.

Let y denote the mass of consumers who choose to purchase from A. I assume that y is defined implicitly by

$$U(\bar{p}_A^1) + U(\bar{p}_A^2) - t_d y = U(\bar{p}_B^1) + U(\bar{p}_B^2) - t_d(1 - y).$$

This is equivalent to consumers being distributed along a hotelling line with A and B at the ends, with (downstream) differentiation parameter t_d (representing a cost borne in period one only), and given that consumers observe the average price levels.[1] Note that if it were the case that $\bar{p}_A^2 = \bar{p}_B^2$ then it would also be that

$$y = \frac{\bar{p}_B^1 - \bar{p}_A^1 + t_d}{2t_d}, \tag{4}$$

corresponding to a static hotelling demand system with prices $\bar{p}_i^1$.

This completes the description of the demand side of the market. Below I separately consider the supply side under the agency model and the wholesale model, and state appropriate results related to equilibrium of the overall market. I restrict attention to equilibria that are symmetric (either within or between retailers or both if possible).

3.2. **The supply side and equilibrium in the agency model.** Under the agency model, suppliers simultaneously set prices within each channel and in each period. As above, r_A and r_B denote the share of revenues given to the suppliers, where these shares are fixed across periods and taken as given by the suppliers.

I begin by considering prices in period two. Note that, due to consumer lock-in, there is no interaction between the prices charged through one retailer and what happens with consumers locked into the other retailer. Consider a representative supplier, say firm 1, choosing its price for, say, retailer A. For notational simplicity I suppress retailer subscripts and write this price simply as p_1^2, and let the prices of all other firms selling through this retailer this period be equal and given by p^2, with x_1 denoting the demand for supplier 1. Thus, 1 is interested in maximizing

$$r_A p_1^2 x_1(p_1^2, p^2) = r_A p_1^2 \left(\frac{p^2 - p_1^2 + \frac{t_u}{N}}{t_u} \right).$$

This is proportional to a firm's profits in a standard circular city model, and hence generates the same best-response function as in such a model. In particular, within a given channel, suppliers' second-period best-response functions are independent of the revenue shares r_i.

It follows that the (symmetric) second-period equilibrium prices are independent of channel, and given by

$$p^2 = p_A^2 = p_B^2 = \frac{t_u}{N},$$

and the demand served by each supplier is $1/N$.

Now consider the first period from the perspective of supplier 1, given that all other suppliers are charging p_A^1 and p_B^1 through the respective channels. Firm 1's profit function is

$$r_A y \left[p_{A1}^1 x_{A1}^1 + p_{A1}^2 x_{A1}^2 \right] + r_B (1-y) \left[p_{B1}^1 x_{B1}^1 + p_{B1}^2 x_{B1}^2 \right],$$

[1] This interpretation also requires that consumers believe each firm is charging the same price within a given retailer.

where y is the mass of consumers who purchase from retailer A, given by Equation (4), and x^{τ}_{A1} and x^{τ}_{B1} give the proportion of consumers who demand this firm's product contingent on selecting either retailer A or B, $\tau \in \{1, 2\}$.

Incorporating what is known about second-period pricing and demand, this reduces to

$$r_A y \left[p^1_{A1} x^1_{A1} + \frac{t_u}{N^2} \right] + r_B (1 - y) \left[p^1_{B1} x^1_{B1} + \frac{t_u}{N^2} \right].$$

Because consumers are not yet locked into a retailer in period one, each supplier's prices influence which retailer consumers purchase from. Indeed, the same basic effect is in play as in Section 2, so that each supplier has an incentive to bias prices to drive demand to whichever channel is offering it a greater revenue share.

The following condition provides a more precise statement.

Proposition 5. *In the agency model, second-period retail prices are given by* $p^2_A = p^2_B = \frac{t_u}{N}$*. If* $r_i > r_j$*, then first-period retail prices satisfy* $p^1_i < \frac{t_u}{N} < p^1_j$*. Hence,* $r_A = r_B$ *implies that* $p^1_A = p^1_B = \frac{t_u}{N}$ *in period one.*

3.3. **The supply side and equilibrium in the wholesale model.** I now turn to the wholesale model. In each period τ, suppliers simultaneously set retailer-specific wholesale prices w^{τ}_{in}, and then retailers set retail prices. To ensure that the analysis is tractable, I assume that retailers have a limited ability to price discriminate: retailers set prices to each consumer x conditional on which interval this consumer lies in, that is, conditional on which two products are closest to him. Effectively, this means that all consumers lying between products n and $n+1$ observe prices for these two products that may differ from the prices observed by consumers located between, say, products $n-1$ and n or $n+1$ and n. However, in equilibrium all consumers are charged the same prices for each good. (Note that allowing suppliers to similarly price discriminate in the agency model considered above has no effect on the equilibrium.)

Without this assumption, the presence of both upstream and downstream differentiation causes the demand curve and overall objective function faced by any given supplier to be very complex. Generally a retailer would wish to adjust all N retail prices by different amounts in response to the change in a single supplier's wholesale price, and moreover this is so even fixing the retailer's overall market share. Moreover, the basic results of this section turn out to be driven by economic forces (explained below) that seem unlikely to hinge crucially on this particular assumption.

Consider period two. Because consumers are locked into their retailers, each retailer chooses prices for each interval of consumers so as to maximize the profits from that interval. Note that the number of consumers y buying from A and $1-y$ buying from B has no effect on the pricing. Rather, these are simply level effects, and so I ignore them herein.

Consider a representative interval of length $1/N$ between, say, products 1 and 2. Suppressing time and retailer-specific notation, the indifferent consumer x_1 satisfies

$$p_1 + \frac{t_u}{N} = p_2 + t_u\left(\frac{1}{N} - x_1\right) \Longleftrightarrow x_1 = \frac{p_2 - p_1 + \frac{t_u}{N}}{2t_u}, \tag{5}$$

which is of course the demand given the price difference $p_2 - p_1$ from a hotelling interval of length $1/N$. However, unlike in a standard hotelling model, the retailer sets both prices and hence internalizes any pricing externalities. To maximize its profits, it chooses

$$p_1 = v - t_u x_1. \tag{6}$$

Given a choice of p_1 and x_1, the maximum price that can be charged for product 2 is $p_2 = v - t_u\left(\frac{1}{N} - x_1\right)$.

Again suppressing time and retailer-specific notation, the representative per-interval profit function of a retailer is

$$(p_1 - w_1)x_1 + (p_2 - w_2)\left(\frac{1}{N} - x_1\right).$$

The retailer maximizes this subject to the Equations (5) and (6). The optimal selection leads to a value of x_1 given by

$$x_1 = \frac{w_2 - w_1 + \frac{2t^u}{N}}{4t^u}.$$

To derive the equilibrium wholesale prices, suppose that all suppliers other than 1 are charging w. Because 1 is selling to consumers located on either side of it, it wishes to maximize

$$2w_1x_1 = w_1\left(\frac{w - w_1 + \frac{2t^u}{N}}{2t^u}\right).$$

Differentiating to obtain the first-order condition and imposing $w_1 = w$ yields second-period wholesale prices (including full time and retailer-specific notation) of

$$w_{An}^2 = w_{Bn}^2 = w^2 = \frac{2t_u}{N}.$$

Now consider the first period. Because each retailer will set the same second-period prices, consumers base their decision between A and B solely on first-period prices, or more specifically on average prices $\bar{p}_A^1$ and $\bar{p}_B^1$, so that the mass choosing A is given by Equation (4).

Proceeding in a manner similar to that taken above, consider a retailer maximizing profits within a given interval, say that between products 1 and 2, subject to the additional constraint that the average price within that interval equals $\bar{p}$, where I am suppressing retailer and time notation. The indifference condition of the marginal consumer implies that

$$p_2 = p_1 - \frac{t_u}{N} + 2t_u x_1.$$

Incorporating this into the constraint

$$\frac{p_1 + p_2}{2} = \bar{p}$$

gives

$$p_1 = \bar{p} + \frac{t_u}{2N} - t_u x_1.$$

Define $\tilde{v} = \bar{p} + \frac{t_u}{2N}$, and observe that within this interval the retailer wishes to maximize

$$(p_1 - w_1)x_1 + (p_2 - w_2)\left(\frac{1}{N} - x_1\right).$$

subject to the constraints in Equations (5) and (6) with $\tilde{v}$ replacing v. Thus, this is the same maximization program from period two, with $v = \tilde{v}$. However, the optimal choice x_1 from that problem does not involve v, and so the optimal choice here does not involve $\tilde{v}$ (or, more particularly, $\bar{p}$) and moreover coincides with the earlier solution.

Ergo, suppliers face the same within-retailer objective function as in period two, but with an overall objective function of

$$w_{An}x_{An}y + w_{Bn}x_{Bn}(1 - y),$$

where y depends on the underlying wholesale prices (via their determination of retail prices).

I now argue that there exists a solution to the first-period wholesale pricing problem that coincides with the one in the second period. Suppose that all suppliers other than 1 are charging the same price both within and across platforms. Then, it is optimal for 1 to charge the (identical) static best-response wholesale price to each retailer, regardless of how y might vary. In other words, because rivals' prices are the same across retailers, 1 is indifferent to which retailer consumers go.

This means that it is an equilibrium for suppliers to charge the same wholesale prices they would if they ignored the impact of their pricing on consumer retailer choice. These are the same as the equilibrium second-period wholesale prices, given by $2t_u/N$. Hence, equilibrium first-period wholesale prices are

$$w_{in}^1 = \frac{2t_u}{N}.$$

The only remaining question is what first-period retail price levels $\bar{p}_i^1$ are. To answer this question, note that A chooses $\bar{p}_A^1$ to maximize

$$\left[\left(\bar{p}_A^1 - w_A^1\right) + \left(p_A^2 - w_A^2\right)\right] y = \left[\bar{p}_A^1 - \left(w_A^1 + w_A^2 - p_A^2\right)\right]\left(\frac{\bar{p}_B^1 - \bar{p}_A^1 + t_d}{2t_d}\right).$$

This is the same profit function faced by a standard static hotelling competitor with marginal costs $w_A^1 + w_A^2 - p_A^2$, given that consumers have transportation costs t_d. The same is true for B. Hence,

$$\bar{p_i}^1 = t_d + w_i^1 - (p_i^2 - w_i^2) = t_d + \frac{2t_u}{N} - \left(v - \frac{t_u}{2N} - \frac{2t_u}{N}\right).$$

In words, the first expression indicates that consumers face a first-period retail price equal to the first-period wholesale price plus the retailer-specific transportation cost, less the retailer's second-period margin. Retailers subsidize the first-period price due to the fact that consumers become locked in.

The following proposition summarizes the work above.

Proposition 6. *There exists a unique symmetric equilibrium under the wholesale model of sales. In it, first and second-period wholesale prices are equal and given by*

$$w_{in}^{\tau} = \frac{2t_u}{N}.$$

Retail prices are given by

$$p_{in}^2 = v - \frac{t_u}{2N} \quad \text{and} \quad p_{in}^1 = t_d + \frac{2t_u}{N} - (p_{in}^2 - w_{in}^2)$$

Each consumer purchases from the retailer nearest him.

3.4. **The role of MFNs.** Here I confirm that MFN clauses serve the same role with upstream competition as they did in the case with a monopolized upstream.

Proposition 7. *In the agency model with upstream competition, MFNs raise the profits of retailers, lower the profit of suppliers, and have no influence on prices or consumer surplus. In the wholesale model, MFNs have no effect whatsoever.*

The intuition for the first part of this result is identical to that from Corollary 1—in the presence of MFNs, a retailer who offers suppliers a larger share of profits is not rewarded with additional market share. Hence, competition in r_i is softened by MFNs, leading to higher retailer profits. It follows that MFNs may have the same effects on entry and investment by retailers discussed in Section 2.

The reason that MFNs have no effect in the wholesale model is that suppliers have no incentive to bias wholesale prices in their absence. As shown in the analysis of franchise agreements by DeGraba and Postlewaite (1992) and McAfee and Schwartz (1994), such an incentive can exist when suppliers negotiate sequentially with downstream firms and two-part tariffs are utilized. Conceptually, in those analyses it is not just that negotiations take place sequentially, but rather that the first franchisee to reach agreement with a supplier will already have paid the fixed component of the contract and presumably also have made other investments in the franchise, giving it limited strength to renegotiate if the supplier then offers a more attractive wholesale offer to the second franchisee. The incentive to offer the second franchisee a better deal only exists in those models if two-part tariffs are used.

4. The wholesale model versus the agency model of sales

Here I use the model with supplier competition and consumer lock-in developed above to examine how moving from a wholesale model of pricing to an agency model influences the market equilibrium and the payoffs of consumers, retailers, and suppliers. Throughout, I take the revenue shares as given and equal under the agency model, so that $r_A = r_B = r < 1$.

My first result deals with market prices, and follows directly from Propositions 5 and 6.

Corollary 2. *For v sufficiently large, moving from the wholesale model to the agency model raises first-period retail prices but lowers second-period retail prices.*

It is certainly the case that e-book prices rose following the move to the agency model, so that the prediction regarding first-period prices in Corollary 2 is consistent with the facts. The prediction that future prices might be lower under the agency model, however, is novel and suggests that the effect of moving to that sales model is somewhat subtle.

There are two distinct intuitions for why retail prices within the two periods move in different directions as the market moves to an agency model. The reason that first-period prices rise under the agency model follows from the fact that suppliers and retailers value consumer lock-in very differently. From a retailer's perspective, having a consumer locked into its channel rather than its rival's is valuable as this allows it to monopolize the consumer in the future. Suppliers, however, have no preference whatsoever as to whether consumers are locked into retailer A or instead B. After all, retailers sell their products, at the same per-unit profits, through both retailers.

Consequently, when retailers set prices they compete very aggressively in the first period, leading to low prices in that period. In contrast, suppliers have no incentives to subsidize first-period prices. So long as the second-period market is sufficiently valuable (as measured by v), the incentive to subsidize in period one is sufficiently strong that first-period prices are higher under agency than under wholesale.

The reason that the opposite conclusion on prices holds in the second period follows readily from the fact that consumers are locked into a retailer at that time. This means that under the wholesale model, each retailer internalizes price competition between suppliers and ensures that retail prices are high. Under the agency model, this lock does not have the same effect because suppliers continue to compete directly with one another in retail prices, leading to lower retail prices.

In other words, the model predicts that second-period prices should be lower under the agency model because the agency model ensures that retail competition is left in the hands of all N suppliers as opposed to monopoly retailers.

4.1. **Retailer profits.** I now show that competing retailers may prefer either model, where the preference is driven strongly by the relative strength of downstream and upstream differentiation.

Proposition 8. *The profits of retailers A and B are higher under the agency model than under the wholesale model if and only if*

$$2(1-r)\frac{t_u}{N} > t_d.$$

Proposition 8 says the retailers prefer the agency model so long as the share of profits that they claim from the market under the agency model exceeds the measure t_d of the differentiation between retailers. Given that t_u/N is a measure of suppliers' (gross) profits in the agency model—which is the same as the model in which they sell through a perfectly competitive downstream— this Proposition also says that agency is preferred by retailers so long as supplier differentiation is relatively large compared to retailer differentiation (and r is not too big).

An intuition for why retailers might prefer the agency model follows from the fact that the agency model kills the intense first-period price competition that would otherwise prevail, leading to higher first-period prices. More precisely, by placing pricing power in the hands of suppliers (who do not care to which retailer consumers become locked), retailers avoid the intense upfront competition for consumers that leads to the dissipation of second-period profits. Hence, even though second-period profits are lower for retailers under the agency model, these profits are not dissipated. This force pushes for overall retailer profits to be higher under agency.

However, there is also a force that pushes for overall profits to be lower under the agency model. First-period prices under agency do not incorporate the differentiation that exists between retailers, measured by t_d. Intuitively, because suppliers sell through both channels, the equilibrium outcome of their pricing conflict ignores retailer differentiation, and discarding retailer differentiation in this manner pushes towards lower retailer profits.

To see these arguments more formally, turn first to the wholesale model and observe that Proposition 6 implies that the sum of retailer profits across both periods (suppressing supplier and retailer-specific subscripts) is

$$(p^1 - w^1) + (p^2 - w^2) = [t_d - (p^2 - w^2)] + (p^2 - w^2) = t_d.$$

Under the wholesale model, retailers dissipate second-period rents and so their profits are solely determined by their inherent differentiation.

Turning to the agency model, Proposition 5 implies that the sum of retailers' profits is simply their share $1 - r$ of profits that would be generated if suppliers competed in both periods through a perfectly competitive retail segment, given by

$$2(1-r)\frac{t_u}{N}.$$

Comparing these two profit expressions proves Proposition 8.

An important implication of Proposition 8 is that the agency model can encourage entry and investment by retailers. In light of Corollary 1 and Propositions 3 and 4, it can be seen that choosing between the agency model and the wholesale model has effects similar to the choice between having MFNs or not in the agency model.

The prospect that the agency model may raise retailer profits so as to encourage entry and investment is consistent with the facts surrounding the e-book market. Apple agreed to enter that market only after suppliers acceded to adopt the agency model throughout the entire e-book market; prior to Apple's entry the wholesale model was in place.

Apple certainly needed to make many investments to become a significant player in the e-book market, especially given the presence of a powerful incumbent, Amazon. Apple needed not only to expand its online store to include books but also to reach agreements with many supplies, advertise and promote its store, and develop an app to allow e-books to be read on the iPad.

Note that Proposition 8 requires that there is in fact competition between retailers; a monopolist retailer faces no competitive threat and so does not subsidize consumer purchases in the first period. Because the agency model leads to lower second-period prices (even with a monopolist retailer), the agency model is unattractive to a retailer in the absence of meaningful retail competition.

Proposition 9. *If there is a single retailer, then its profits are higher under the wholesale model.*

This explains why Amazon might have little incentive to push for the agency model prior to entry by Apple. Of course, Proposition 8 suggests that Amazon might prefer the agency model once Apple has actually entered the market.

I now show that it is possible to extend the model to incorporate asymmetric duopolists, and that so doing opens the possibility that retailers would have differing opinions on the value of moving to the agency model. Suppose that in period one consumers have an additional preference for retailer A, where this preference is denoted by $\Delta > 0$ and might correspond to the quality differences between the two retailers.

Intuitively, firm A will tend to prefer the wholesale model because it allows it to extract more surplus associated with its higher quality. In contrast, A does not fare as well under the wholesale model, and tends to prefer agency. (At least, this intuition is valid in a range of Δ, although not everywhere.)

Proposition 10. *Suppose that there are two retailers, but that retailer A has a quality advantage $\Delta > 0$. Then there exist parameters such that A prefers the wholesale model, but B prefers the agency model.*

A weaker firm, say a potential entrant into a market with a powerful incumbent, might prefer the agency model even though the incumbent does not. This is supportive of the idea presented above that the agency model can encourage retail entry and investment.

4.2. **Consumer welfare.** I now turn to consumer welfare. Corollary 2 above indicates that there are diverging effects on prices in the two models; consumers face lower initial prices under the wholesale model but higher future prices. Nonetheless, consumers have clear preferences over the two sales models.

Proposition 11. *Consumer welfare is higher under the agency model.*

Despite the fact that intense first-period price competition in the wholesale model causes retailers to dissipate—indeed, transfer to consumers— the entirety of their second-period (monopoly) profits, consumers unambiguously prefer the agency model. To understand why, consider the welfare of a typical consumer. Under either model of sales, this consumer chooses the same retailer and, contingent on his realization of x, consumes the same products. Hence, the only consideration from a welfare perspective is how retail prices differ under the two models. Indeed, to prove Proposition 11, it is sufficient to show that the sum (across periods) of retail prices is less under agency.

From Proposition 5, retail prices under agency are identical across periods and given by t_u/N, for a total sum of $2t_u/N$.

Turning to the wholesale model, Proposition 6 shows that the first-period price charged by, say, retailer A is

$$t_d + w_A^1 - (p_A^2 - w_A^2).$$

Adding the second-period price p_A^2 to this gives a total price across periods of

$$t_d + w_A^1 + w_A^2.$$

Under the wholesale model, consumers effectively pay a total price given by the sum of the wholesale prices and the term t_d. From Proposition 6, $w_A^1 = w_A^2 = 2t_u/N$, so that the total price paid by consumers is

$$t_d + \frac{4t_u}{N} > \frac{2t_u}{N},$$

where the term on the right is the total price under agency. This proves Proposition 11.

This result can be stated simply in words as follows. Under the agency model, there is no retailer markup and so it is as if suppliers compete through a perfectly competitive retail segment, leading to prices t_u/N in each period. Under the wholesale model, supplier competition is softened in both periods because retailers do not fully pass through wholesale price cuts, which leads to higher wholesale prices $2t_u/N$ in each period.[2] Because consumers must pay at least the total wholesale price across both periods (although they may pay less than the wholesale price in period one), they pay more under the wholesale model. The fact that consumers also pay the retailer-differentiation term t_d under the wholesale model further strengthens this result.

4.3. **Supplier profits.** I now turn to the profits of suppliers under the different sales models. As mentioned above, one feature of the wholesale model is that it softens price competition between suppliers. Hence the following result is intuitive and also follows immediately from Propositions 5 and 6.

Proposition 12. *The profit of suppliers is higher under the wholesale model.*

This result might seem to be at odds with the facts surrounding the e-book market; suppliers agreed to move to the agency model, following Apple's lead. However, this does not actually contradict Proposition 12. The reason is that Apple sought to establish the agency model as a condition of its entry into the e-book market, suggesting that a more appropriate question is whether suppliers prefer a monopolist retailer under the wholesale model or duopolist retailers under an agency model.[3]

To investigate this, suppose that a monopoly retailer has bargaining clout over suppliers that allows it to dictate some wholesale price w_M to retailers. Additionally, suppose that entry by a competing retailer will occur if and only if there is an agency model; this is a reasonable possibility in light of Propositions 8 and 10.

Faced with this tradeoff, there are indeed circumstances under which suppliers prefer to adopt the agency model.

[2]This is related to a result of Bonanno and Vickers (1988), who show that suppliers operating through exclusive retailers may gain by remaining "vertically separated" as opposed to being integrated.

[3]Recall that Proposition 9 indicates that a monopolist retailer prefers the wholesale model.

Proposition 13. *Suppose that a retail monopolist can impose wholesale prices w_M, and that retail competition exists only if the agency model is adopted. Then suppliers prefer the agency model if and only if*

$$w_M < r\frac{t_u}{N}.$$

Recall that rt_u/N is the per-unit profit that accrues to suppliers in a single period under the duopoly agency model. Thus, Proposition 13 is extremely simple and merely says that if a monopolist retailer has sufficient bargaining leverage, suppliers prefer the agency model so long as it ensures the presence of another viable retailer.

I now pursue a slightly more subtle reason that suppliers might prefer the agency model, based on the observation that different sales models might induce different marketing and promotional incentives in retailers.

More precisely, in many markets (including the book market) consumers' choice sets influenced by marketing and promotion, in addition to word of mouth and external reviews. In the e-book market in particular, it is easy for retailers such as Apple and Amazon to modify their online stores so as to influence the set of products consumers are likely to consider, for example by revealing new alternative to consumers.

From consumers' perspective, such guidance is useful in that it may lead to better choices. Suppose that a retailer can, through its understanding of consumer preferences and application of marketing and promotional tools, effectively increase the number of products from which consumers may choose. Within the confines of this model, this amounts to increasing the number of products from some value N_L to $N_H > N_L$. The discovery of new alternatives raises social welfare by lowering the expected travel costs of consumers.

There is a more strategic issue at play from the perspective of retailers and suppliers. An increase in N intensifies wholesale price competition and thereby raises retailers' second-period profits at the expense of supplier's profits—assuming that the wholesale model is in effect. In contrast, under the agency model an increase in competition between suppliers consequent to an increase in N lowers the overall profit that retailers and overall split.

In other words, within any given period the agency model effectively aligns the incentives of suppliers and retailers, whereas in the wholesale model they are at odds. It follows that adopting the agency model lessens the incentives of retailers to market and promote in a way that increases competition between books; this benefits suppliers.

Proposition 14. *Suppose that in the second period each retailer chooses either $N = N_L$ or $N = N_H > N_L$. Then:*

(1) *Under the agency model retailers choose N_L, but choose N_H under the wholesale model.*

(2) *For $N_H - N_L$ sufficiently large, supplier profit is higher under the agency model.*

5. Conclusion

My investigation of agency and wholesale markets may be relevant for antitrust analysis in addition to advancing our basic understanding of how these markets work. Beyond providing a basic framework and introductory analysis, there are two main contributions.

First, MFN clauses may serve various pro-competitive roles in the agency model, and when they are not clearly pro-competitive they are ambiguous with respect to their effect on consumers. Second, adopting the agency model can raise retailer profits and encourage entry and investment. Even when entry and investment are fixed, consumers benefit from the agency model—even though retail prices increase immediately following its adoption.

There are at least two limitations of my analysis, and so it serves only as an initial foray. One limitation that is relevant for the e-book market, but also may matter in future applications, is that I do not explicitly model the existence of an alternative channel for suppliers, namely higher-cost "brick-and-mortar" stores selling physical copies of books. Accommodating this possibility might be a very interesting direction for future analysis.

It is not hard to show that the emergence of new and lower-cost channels can potentially be a significant threat rather than an opportunity to suppliers, at least when suppliers compete against each other. The emergence of a new monopolized low-cost channel can be a threat because suppliers may not credibly be able to refuse to sell to it, which means that it will have significant bargaining power. A lone supplier who chooses not to sell to, say, Amazon would be at significant disadvantage to any retailer selling through Amazon, because Amazon's lower cost structure allows it to be very competitive with physical books and bookstores. In other words, the monopolist of a very low-cost channel can execute a "divide and conquer" type strategy, leading to lower margins for suppliers than would exist in the absence of this low-cost channel. This might be called the "Wal-Mart effect." In the long run, old channels might even vanish.

Even if traditional channels do not disappear, they may be somewhat irrelevant to the function of new channels. Thus, it is of interest to consider the e-book market in isolation from traditional markets.

A second limitation is that I do not consider platforms as such, but in the real world the main e-book retailers also sell physical devices that host the applications that are used to read e-books. Investigating the role of platforms may be an interesting extension.

Nonetheless, it should be noted that on many existing hardware devices there are competing e-book applications. For example, on the Apple iOS platform, consumers have access to an Amazon app and also an Apple app, and on most Android devices, consumers have access to an Amazon app and a Google app (and in principle Apple could provide an app on that platform as well). Additionally, with the possible exception of early devices produced by Amazon that functioned exclusively as e-readers, all hardware devices of relevance today serve many functions and it is far from clear that device pricing is heavily tilted by the e-book market.

Omitted proofs (partial collection)

All formal results are either proven in the body of the text above or follow immediately from the arguments in the text, with the exception of Propositions 1, 4, 5, 7, 10, and 14. In this section I present proofs of these results.

Proof of Proposition 1: I prove this result in a number of steps. First, I will rule out any equilibrium in which $r_A = 0$ or $r_B = 0$. Second, I will show that there exists a symmetric equilibrium and that it is unique (among symmetric equilibria). Third, I will prove several properties regarding the best-response functions and, fourth, show that these imply there are is no other equilibrium.

Denote the best response function of firm i by BR_i, where subscripts will be suppressed where there is no confusion, given that firms are symmetric. Throughout, I will adopt the perspective of A.

I first show that $r_i > 0$ in equilibrium for each i. Suppose that $r_B = 0$. Then for any value of $r_A > 0$, $x = v/2t$, and hence A can always raise its profits by lowering r_A to another positive value. Hence, the only candidate equilibrium when $r_B = 0$ is the one where it is also the case that $r_A = 0$, so suppose this is the case.

At this supposed equilibrium, $x = 1/2$ and $p_A = p_B = v - t/2$, so that $\pi^A = \frac{1}{2}(v - t/2)$. If however A raised r_A to $\epsilon > 0$, then $x = v/2t$ and $p_A = v - tx = v - v/2 = v/2$, so that $\pi^A = (1-\epsilon)p_A x = (1-\epsilon)(v/2)(v/2t) = (1-\epsilon)v^2/4t$. As $\epsilon \to 0$, a sufficient condition for these profits to dominate those in which $r_A = 0$ is

$$\frac{v^2}{4t} > \frac{1}{2}(v - t/2) \iff (v-t)^2 > 0,$$

which is clearly true. Hence, from this point on I assume $r_i > 0$.

The second step is to see that there is exactly one symmetric equilibrium. Note that $\pi^A = (1 - r_A)p_A x$ and

$$\begin{aligned}\frac{\partial \pi^A}{\partial r_A} &= -p_A x + (1-r_A)x\frac{dp_A}{dr_A} + (1-r_A)p_A\frac{\partial x}{\partial r_A} \\ &= -(v-tx)x - (1-r_A)tx\frac{\partial x}{\partial r_A} + (1-r_A)(v-tx)\frac{\partial x}{\partial r_A}\end{aligned}$$

Setting this equal to zero at the values $r_A = r_B = r^*$ and $x = 1/2$, and using the fact that

$$\frac{\partial x}{\partial r_A} = \frac{v - 2tx}{2t(r_A + r_B)},$$

it is clear there is a unique solution given by

$$r^* = \frac{(v-t)^2}{v^2}.$$

The third step involves showing two properties of the best-response function BR, the first of these being that it is increasing with a slope less than one at r^*. Using the facts that

$$\begin{aligned}\frac{\partial^2 x}{\partial r_A^2} &= \frac{-4t^2(r_A + r_B)\frac{dx}{dr_A} - 2t(v - 2tx)}{4t^2(r_A + r_B)^2} \\ &= \frac{-2t(v-2tx) - 2t(v-2tx)}{4t^2(r_A + r_B)^2} \\ &= \frac{-(v-2tx)}{t(r_A + r_B)^2} < 0,\end{aligned}$$

and

$$\begin{aligned}\frac{\partial^2 \pi^A}{\partial r_B \partial r_A} &= -(v-2tx)\frac{\partial x}{\partial r_B} - (1 - r_A)t\frac{\partial x}{\partial r_B}\frac{\partial x}{\partial r_A} - (1 - r_A)tx\frac{\partial^2 x}{\partial r_B \partial r_A} \\ &\quad - (1 - r_A)t\frac{\partial x}{\partial r_B}\frac{\partial x}{\partial r_A} + (1 - r_A)(v - tx)\frac{\partial^2 x}{\partial r_B \partial r_A} \\ &= -(v-2tx)\frac{\partial x}{\partial r_B} - 2(1 - r_A)t\frac{\partial x}{\partial r_B}\frac{\partial x}{\partial r_A} + (1 - r_A)(v - 2tx)\frac{\partial^2 x}{\partial r_B \partial r_A} \\ &= -(v-2tx)\frac{\partial x}{\partial r_B} + \frac{(1 - r_A)(v - 2tx)(v - 2t(1-x))}{2t(r_A + r_B)^2} + \frac{(1 - r_A)(v - 2tx)(2x - 1)}{(r_A + r_B)^2}\end{aligned}$$

the implicit function theorem shows that

$$BR'(r^*) = \frac{r^* + 1}{r^* + 3} \in (0, 1).$$

Note that this fact, along with the fact that there is a unique symmetric equilibrium, implies that for $r < r^*$, it is the case that $BR(r) > r$ (and that if $r_B < r^*$, then $x > 1/2$). Similarly, if $r > r^*$, it is the case that $BR(r) < r$ (and that if $r_B > r^*$, then $x < 1/2$).

The second property of the best-response functions is that they are also increasing for all $r < r^*$. Because it was shown above that $\partial^2 \pi^A / \partial r_A^2 < 0$, it is sufficient to show that

$\partial\pi^A/\partial r_B \partial r_A > 0$. It is the case that

$$\begin{aligned}
\frac{\partial^2 \pi^A}{\partial r_B \partial r_A} &= -(v-2tx)\frac{\partial x}{\partial r_B} - (1-r_A)t\frac{\partial x}{\partial r_B}\frac{\partial x}{\partial r_A} - (1-r_A)tx\frac{\partial^2 x}{\partial r_B \partial r_A} \\
&\quad - (1-r_A)t\frac{\partial x}{\partial r_B}\frac{\partial x}{\partial r_A} + (1-r_A)(v-tx)\frac{\partial^2 x}{\partial r_B \partial r_A} \\
&= -(v-2tx)\frac{\partial x}{\partial r_B} - 2(1-r_A)t\frac{\partial x}{\partial r_B}\frac{\partial x}{\partial r_A} + (1-r_A)(v-2tx)\frac{\partial^2 x}{\partial r_B \partial r_A} \\
&= -(v-2tx)\frac{\partial x}{\partial r_B} + \frac{(1-r_A)(v-2tx)(v-2t(1-x))}{2t(r_A+r_B)^2} + \frac{(1-r_A)(v-2tx)(2x-1)}{(r_A+r_B)^2}
\end{aligned}$$

The first two terms are always positive, because x always lies in $[1-\frac{v}{2t}, \frac{v}{2t}]$). The third term is also positive, because as noted just above, $BR(r) - r > 0$ whenever $r < r^*$, ensuring that $x > 1/2$ and hence that $2x - 1 > 0$ in this region. It follows that $BR' > 0$ for all $r < r^*$ and hence $r < BR(r) < r^*$ in this region.

The fourth and final step is to show that there is no equilibrium other than the symmetric one identified above. To see this, suppose that there were one given by (r'_A, r'_B) where neither r'_A nor r'_B equals r^*. Suppose that $r'_B < r^*$. Then $r'_A = BR_A(r'_B) \in (r'_B, r^*)$, which implies that $r'_B = BR_B(r'_A) > r'_A > r'_B$, a contradiction.

Suppose instead that $r'_B > r^*$, which implies $r'_A = BR_A(r'_B) < r'_B$. If it were the case that $r'_A < r^*$, then $r'_B = BR_B(r'_A) < r^*$, a contradiction. So, it must be that $r'_A > r^*$, but this implies $r'_B = BR_B(r'_A) < r'_A$, which is also a contradiction. The result follows. ■

Proof of Proposition 4: First consider investment incentives when there exist MFNs. In this case, $r^* = 0$ for any induced value of v and each downstream firm serves half the market and earns second-period profits of $(v - t/2)/2$. The profit function of A, say, is

$$\frac{1}{2}\left(v(e_1+e_2) - \frac{t}{2}\right) - c(e_1),$$

for which the following first-order condition must be satisfied in equilibrium

$$\frac{v'(2e^*)}{2} = c'(e^*).$$

In the absence of MFNs, the profit function of A is

$$\frac{1}{2}(1-r^*)\left(v(e_1+e_2) - \frac{t}{2}\right),$$

where r^* depends on the investments e_i through their impact on v. The following first-order condition must hold in equilibrium

$$\frac{t^2(2v(2e^*)-t)}{v(2e^*)^3}\frac{v'(2e^*)}{2} = c'(e^*).$$

Comparing this condition with the corresponding one under MFNs, and defining $\tilde{v} = v/t$, it is clear that more investment occurs when there are MFNs so long as

$$\frac{t^2(2v-t)}{v^3} < 1 \Longleftrightarrow \frac{(2\tilde{v}-1)}{\tilde{v}^3} < 1 \Longleftrightarrow \tilde{v}^3 - 2\tilde{v} + 1 > 0.$$

Because $v(e) \in (t, 2t)$ for all values of e, $\tilde{v} \in (1, 2)$, and it is readily show that this condition holds. ■

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