Exclusion due to RPM, Slotting Fees, Loyalty Rebates and other Vertical Practices*

John Asker[†] and Heski Bar-Isaac[‡]
NYU Stern & NBER, and NYU Stern

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Abstract

Resale price maintenance (RPM), slotting fees, loyalty rebates and other related vertical practices can allow an incumbent manufacturer to transfer profits to retailers. If retailers accommodate entry, upstream competition leads to fierce downstream competition, and the breakdown of these profit transfers. Thus, in equilibrium, retailers can internalize the effect of accommodating entry on the incumbent's profits. Retailers may prefer not to accommodate entry; and, if entry requires downstream accommodation, entry can be deterred. We discuss the empirical and policy implications of this aspect of vertical contracting practices.

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[†]Email: jasker@stern.nyu.edu
[‡]Email: heski@nyu.edu

1 Introduction

This paper investigates how to express, in an equilibrium framework, claims that vertical practices, such as resale price maintenance (RPM), slotting fees or loyalty rebates, lead to the exclusion of potential entrants. The vertical practices of interest are those that create rents for retailers without carrying a contractual obligation for exclusivity. Hence, we are interested in contracting practices between upstream manufacturers and retailers that *do not* obligate retailers to serve only one firm (for instance, an exclusive dealing agreement would lie outside the sphere of interest). Examples include allowing the manufacturer to set the price at which a retailer sells to consumers (RPM); periodic lump-sum payments to retailers above and beyond those required in distribution agreements (through slotting fees or loyalty rebates); and market division schemes (such as the allocation of clients to specific retailers or the use of exclusive territories). Formalizing the equilibrium theory supporting claims that these practices can have an exclusionary effect is important if antitrust policy, based on such claims, is to have a solid economic foundation.

We explore equilibria that can arise when an upstream incumbent uses a vertical practice, of the sort outlined above, to share industry profits with retailers. We show that if entry by another upstream manufacturer leads to competition that reduces industry profits, and entry requires accommodation by retailers, then equilibria exist in which retailers do not accommodate the entrant. This results in exclusion. In essence, the vertical practice creates a quasi-rent that retailers, in equilibrium, have an incentive to protect. Hence, they do not accommodate entry; ensuring that subsequent competition does not erode these quasi-rents.

Of the set of practices that we consider, resale price maintenance (RPM) is currently among the most controversial. A manufacturer engages in RPM when it sets the price at which its distributors must sell its product to consumers. Minimum RPM involves the manufacturer setting a price floor for its distributors, whereas maximum RPM involves the manufacturer setting a price ceiling. For almost one hundred years in the U.S., following the Supreme Court's 1911 decision in *Dr. Miles*,[1] minimum RPM was a *per se* violation of Section 1 of the Sherman Act, though statutory exemptions have existed at times (see Overstreet (1983) for a useful history and for data on the use of RPM under these exemptions).[2] The most cited concern about minimum

[1] *Dr. Miles Medical Co. v. John D. Park and Sons*, 220 U.S. 373 (1911)

[2] A *per se* violation means that the party bringing the case is not required to establish

RPM — a concern that persists to this day — is that it constitutes a practice that facilitates retailer and manufacturer collusion, by coordinating pricing and making monitoring easier (see Yamey (1954) and Telser (1960) for early examples, and Shaffer (1991), Jullien and Rey (2007), and Rey and Vergï¿œ (2009) for formal treatments).

Largely in response to the *per se* status of RPM, a number of papers explore pro-competitive justifications for RPM (prominent examples include Telser (1960), Marvel and McCafferty (1984), Klein and Murphy (1988), Deneckere, Marvel, and Peck (1996, 1997), and Marvel (1994)). These papers suggest that RPM can be in the interest of both manufacturers and consumers.

The Supreme Court finally overturned the *per se* rule against minimum RPM in the U.S. in 2007, in the *Leegin* case, which decided that cases involving minimum RPM should be determined on a "rule of reason" basis.[3] That is, courts are now required to balance the potential efficiency benefits of RPM against the potential anti-competitive harm. In reaching this decision, the court relied heavily on the pro-competitive theories of RPM that had been developed in the economics literature. That said, in the majority decision, the court noted a series of potential sources of competitive harm, including [4]

> A manufacturer with market power, by comparison, might use resale price maintenance to give retailers an incentive not to sell the products of smaller rivals or new entrants.

This paper provides a formal equilibrium foundation for this statement.[5] The online appendix contains further discussion.

Other vertical practices have raised similar concerns. For instance, plaintiffs in the *Intel* case argued that Intel used lump-sum rebates that were

in evidence that harm to competition occurred. Instead, it is presumed by the mere existence of the conduct. Horizontal price-fixing agreements are another example of a *per se* violation. Posner (2001, p.176ff) describes the evolution of the Court's treatment of the *per se* rule for RPM.

[3] *Leegin Creative Leather Products, Inc. v. PSKS, Inc.*, 551 U.S. 877 (2007); all page references are to the judgement as it appears in this reporter.

[4] Ibid at p.894

[5] For further (informal) commentary, and examples in which RPM had an exclusionary effect, see Cassady (1939, p. 460), Bowman (1955), Yamey (1954 p. 22) Gammelgaard (1958), Zerbe (1969), Eichner (1969), and, more recently following *Leegin*, Elzinga and Mills (2008) and Brennan (2008).

contingent on the loyalty of hardware manufactures (particularly Dell) to Intel, in the face of increased competitive pressure from AMD microprocessors.[6] They argued that these payments were, in effect, a 'bribe' to hardware manufacturers to help maintain Intel's dominant position, with the threat being that increased use of AMD microprocessors would carry with it the elimination of these loyalty payments. In our framework, this threat is credible in that, following entry, the equilibria we investigate are such that the upstream incumbent has no incentive to offer such payments, and so downstream firms lose this rent stream following entry. This gives them an incentive to not accommodate the entrant. Thus, our framework helps explain how the fact pattern alleged in *Intel* could lead to exclusion.[7]

Of course, in the *Intel* example, one may wonder why AMD could not compensate the hardware manufacturers for their lost rents. We allow for such a payment and show that it can be incompatible with profitable entry.

Many other vertical practices, such as slotting fees (discussed in Shaffer (1991)) and market division schemes such as exclusive territories, can be understood in our framework. While we focus on RPM and, to a lesser extent, lump-sum loyalty rebates (due to their current policy relevance), we also discuss how these other practices can lead to exclusionary outcomes.

The primary contribution of this paper is its rigorous framework for expressing the idea that these vertical practices can have an exclusionary effect. It also gives some preliminary guidance about screens for, and empirical measures of, exclusion, which can be constructed from data using econometric methods that are standard in empirical industrial organization.

The following provides a simple sketch of the basic elements of our framework: Consider a market with one incumbent manufacturer and a potential entrant interacting over many periods. The incumbent and entrant produce exactly the same product and have exactly the same marginal cost. There is no cost of entry; however, at least one of the n retailers has to agree to stock

[6] *State of New York v. Intel Corporation*, drawing from the November 2009 complaint of the New York Attorney General, available at `http://www.oag.state.ny.us/mediacenter/2009/nov/NYAGvIntelCOMPLAINTFINAL.pdf` downloaded 29 November 2011.

[7] De Graba and Simpson (2010) discuss the *Intel* case in depth and propose a theory of harm along similar lines. We provide a rigorous framework that grounds their informal treatment in an explicit equilibrium model. Most of the other work on loyalty rebates does not consider exclusion (see, for instance, Greenlee et al. (2008)), although related exceptions include Marx and Shaffer (2004) and Ordover and Shaffer (2007).

the entrant's good for the entrant to gain access to consumers. The retailers are perfect substitutes and bear no cost other than the wholesale price. For illustrative purposes, we let manufacturers use RPM.

The incumbent monopolist manufacturer begins by setting the retail price at the monopoly price to maximize industry profits. It shares these profits with downstream retailers by setting a wholesale price below the level that would elicit the monopoly price p^m absent RPM (without this restraint, retailers compete ï¿œ la Bertrand and drive retail prices down to marginal cost, which is set by the wholesale price). The role of RPM is to prevent the retail price from falling, — RPM protects retailer profits. If π is the monopoly profit, then the most profit an incumbent manufacturer could share with each of n retailers is π/n. Given that the potential entrant has identical costs to the incumbent, the highest lump sum the entrant could offer a single retailer (to allow it to sell through the retailer, thereby slightly undercutting the incumbent's price for a period) is π.[8] The retailer, accepting this offer, knows that accommodating entry destroys all future profits (post-entry competition resembles one-shot Bertrand). Thus, RPM facilitates exclusion if the retailer's flow of benefits from refusing the entrant are greater than the one-time payment received from accommodating: that is, if the stream of per-period profits π/n is greater than the one-time payment π.

Three aspects of the model are worth highlighting: 1) To get access to the market, the entrant needs retailers to agree to stock its product. Neither vertical integration nor creating an alternative channel is possible; 2) following entry, the incumbent remains a competitive threat and does not simply disappear;[9] and, 3) the repeated game structure may admit other forms of collusion or cooperation to be supported, whether tacit or otherwise. We focus on equilibria that do not have these features, largely to separate the exclusionary effect from any collusive story.[10] Hence, our framework can be applied in settings where there is no evidence of coordinated effects. That

[8] If the incumbent could drop prices immediately, the entrant would not be able to offer anything, unless it had a cost advantage, making exclusion easier to maintain.

[9] If firms pay a fixed cost to operate each period this may not be warranted, particularly in applications where products are not differentiated.

[10] The related work of Klein and Murphy (1988) has the same (implicit) feature. Indeed, any static model, when applied to an empirical example, is implicitly selecting out repeated game interactions. This may be reasonable, given that coordinating successfully on collusion is difficult, even for explicit cartels (see Porter (1983) or Genesove and Mullins (2001)).

said, in Section 4, we consider examples in which, for example, manufacturers collude post-entry, and show that that exclusion can still occur via our basic mechanism. More generally, due to the multiplicity of equilibria in supergames, the existence of some coordination in many instances can be either orthogonal to the exclusionary effect we explore or even complement it. In the online appendix, we give an (extreme) example in which we discuss how a cartel among retailers might affect the market, finding that the cartel removes the need for any exclusionary instrument imposed by the manufacturer.[11]

At the heart of this paper is a familiar intuition: Each vertical practice we consider allows retailers to capture a portion of the industry rents that the market power of the incumbent generates. Indeed, it is precisely these quasi-rents (and the threat of losing them) that have been used to provide a pro-competitive theory of RPM: Klein and Murphy (1988) argue that manufacturers can use these quasi-rents to entice retailers to provide the desired level of service. However, here, we highlight a more harmful implication of such quasi-rents.[12] If an entrant cannot establish itself without some retailer support, then retailers may be hesitant to accommodate an entrant since more competition upstream will reduce industry rents, and, hence, the quasi-rents enjoyed by retailers. [13] In effect, the service that the retailers provide to increase industry profits is the exclusion of a potential entrant. Therefore, according to this theory, *both* the retail sector *and* the incumbent manufacturer can gain from these exclusionary practices.[14] This is in contrast, for instance, to much of the policy discussion that suggests that there is less reason for antitrust concern when a manufacturer instigates a vertical practice or restraint.

A related literature is that on naked exclusion arising from explicit exclusive dealing arrangements (See Ch. 4 of Whinston (2006), Rey and Tirole (2007), and Rey and Vergï¿œ (2008) for useful overviews). A recent strand

[11]The online appendix is available at `http://people.stern.nyu.edu/jasker/ExclusionAppendix.pdf`. The same example is in Asker and Bar-Isaac (2011).

[12]Shaffer (1991) also does this, in the context of RPM (and slotting fees) facilitating collusive outcomes among retailers.

[13]Comanor and Rey (2001) make a related point in the context of exclusive dealing.

[14]In line with this observation, Overstreet (1983, p.145ff) describes lobbying by both manufacturers and retailers for the 'Fair-Trade' statutes that created exemptions from liability for RPM. These statutes lasted from the 1930s through the mid-1970s, depending on the state(s) involved.

of this literature considers the effect of competition between retailers (in particular, Fummagalli and Motta (2006), Wright (2009), Abito and Wright (2008), Simpson and Wickelgreen (2007) and Johnson (2011). The most important difference between the exclusive dealing literature and this paper is that we consider exclusion — whether via RPM, loyalty rebates or some other practice, — arising from equilibrium understanding between an incumbent manufacturer and retailers, as opposed to an explicit exclusivity clause in an enforceable contract. That is, choosing to accommodate an entrant is not a breach of any contractual term in our setting. With no explicit exclusive contract, issues that arise in the literature — such as the nature of damages in the event of contractual breach — are not relevant in our environment. Given this, it is unsurprising that the equilibrium prevalence of exclusion is very different.[15]

This paper continues by focusing on RPM as a motivating example and expository vehicle. In Section 2, we describe the model, casting it in terms of RPM. Section 3 formalizes the intuitions presented above and establishes them in the more general framework introduced in Section 2. Section 3 provides a formal characterization. Section 4.1 shifts the focus away from RPM and discusses how other practices, such as slotting fees, loyalty rebates and quantity restrictions, can be understood through the framework developed in Sections 2 and 3. In Sections 4.2 and 4.3, we discuss extensions of the model to differentiated products markets and alternative forms of post-entry market conduct. In Section 5, we draw out policy implications of the analysis, including some implications for screens indicating the potential for exclusion. We then conclude.

2 A model

In this section, we build a model that explores the equilibrium foundation of the intuitions discussed above. To do this, we need to make a preliminary modeling choice about how an upstream incumbent gives downstream retailers a stake in industry profits. Given the recent Supreme Court decision regarding RPM in *Leegin*, we use RPM as the vehicle through which to illustrate our model. That said, this underlying structure is more general: The RPM model we develop here essentially applies to any form of interaction in

[15]For instance, in Simpson and Wickelgren (2007), the entrant always enters (Proposition 2), whereas this is not always the case in our environment.

which retailers' rents are made conditional on the amount they sell (by creating a margin between the wholesale price and the retail price, RPM allows retailers to capture rents, which depend on the amount they actually sell). In Section 4.2, we make explicit the modeling changes that are required if some practice other than RPM is employed (e.g. due to a lump-sum payment such as a slotting fee). The essential features of equilibria that result in exclusion, however, are robust to these small changes.

In the model, two manufacturers produce identical goods. Manufacturers sell to consumers via retailers. Total market demand in each period in this market is given by $q(p)$. There are infinitely many periods of competition. All firms discount future profits with discount factor δ.[16]

One manufacturer is already active in the market (the incumbent), and another is a potential entrant (the entrant). The incumbent's constant marginal cost of manufacturing is given by c_i and the entrant's by c_e, where $c_i \geq c_e \geq 0$. We assume that $c_i < p_e^m$, where p_e^m is the price that would be charged by a monopoly with cost c_e.

There are $n \geq 2$ retailers in this market. Retailers are perfect substitutes for each other, and their only marginal costs are the wholesale prices that they pay to the manufacturers.[17]

The interactions between the manufacturers and retailers are described, together with the timing of the game, below.

2.1 Timing

We consider an infinitely repeated game in which there are two possible types of period, corresponding to different states of the manufacturer market, which we denote M (incumbent monopolist), and C (competition). The game begins in state M at $t = 1$. In this period, the incumbent is active, but the potential entrant has yet to decide whether or not to enter. The order of moves within a period in state M is as follows:

1. The incumbent sets a retail price and a corresponding wholesale price (p_i, w_i) for all retailers; then,

[16] Realistic values for δ and the per-period demand $q(p)$ depend, as in all repeated games, on the interpretation of a "period," which should be thought of as the length of time it takes for firms in a market to react to a change in circumstances.

[17] If there is only a single retailer, so that, in effect, the industry is always monopolized, or, similarly, if retailers do not compete but operate as local monopolists or as final consumers, efficient entry can never be deterred as in the standard Chicago-school argument.

2. the entrant attempts to enter by offering a transfer, $R \in [0, \infty)$, to a single retailer, payable if entry is accommodated, and also by committing to an associated retail price and a corresponding wholesale price (p_e, w_e). These prices apply in the current period, if entry occurs; then,

3. retailers simultaneously choose to accept (accommodate entry) or reject the entrant's offer;

4. if no retailer accommodates the entrant, then transactions occur, period profits are realized, and the period ends, with the state of the manufacturer market in the next period continuing to be M; otherwise,

5. if at least one retailer accommodates, then the entrant can choose either to pay the fixed cost, F_e, or not, where $F_e \in [0, \frac{(c_i - c_e)q(c_i)}{1-\delta}]$. The upper bound on this fixed cost will ensure that an entrant, faced with a market with competition (no exclusionary RPM), will want to enter this market.

6. Following that decision, transactions occur, period profits are realized, and the next period begins. This next period, though, will be a competitive period, in which the state is C if the entrant incurs the fixed cost.

A period in state C involves a simultaneous-move game in which both the incumbent and entrant compete by setting a minimum retail price (should they wish) and a wholesale price.

Note that in this timing, we suppose that the fixed cost of entry is paid only if a retailer accommodates entry; this is a realistic assumption, for example, if the entrant needs access to final consumers for final product configuration or for the marketing of a new-product launch. Similar results apply if the fixed costs of entry are paid ex-ante as long as the entrant is not considered active until a retailer has accommodated the entrant.[18] We present the timing with fixed costs paid only after accommodation since,

[18]There would, therefore, be three states of the game. In addition to M (where the entrant has not entered), and C (where there is competition between incumbent and entrant), there could be periods where the entrant has sunk its fixed costs of entry, but no retailer has yet accommodated entry.

first, the analysis is a little simpler and, second, this timing reinforces the importance and central role of retailer accommodation.[19]

The transfer, R, serves as an inducement to a retailer to carry the entrant's product.[20] We restrict this transfer to be paid only to one retailer, but given that all retailers are perfect substitutes in the model, this is not restrictive: Our interest is in equilibria in which all retailers choose not to accommodate the entrant (exclusionary equilibria). For such an equilibrium to exist, it must be the case that, if all other retailers are not accommodating, then any particular retailer also chooses not to accommodate. By considering an inducement R paid to a single retailer, we maximize the chance that this retailer would want to deviate from the exclusionary equilibrium. Thus, we study a case in which exclusion is, if anything, harder to attain, as compared to the case in which every accommodating retailer gets a payment.

We let each manufacturer set both a wholesale and a retail price. We say that a manufacturer imposes RPM if the retail price is different from the one that retailers would adopt if they were to face only the wholesale price. The rationale for this definition is that if an unfettered retailer would, independently, charge the price that a manufacturer preferred, with no need for any (potentially costly) monitoring or enforcement, then RPM plays no role.[21]

What is crucial is the requirement that at least one retailer agree to carry the entrant's good for the entrant to become active. The effect of such an agreement, which is effectively an assurance of perpetual market access, is to guarantee competition between the two manufacturers in all periods post-

[19] The exclusive dealing literature has the retailers choosing to accommodate entry or not, prior to the entrant committing to any offer. If we adjusted our timing in this way, the inability of the entrant to commit to transfers post-accommodation could make exclusion easier than in the model we present here.

[20] The contract space is left unrestricted here. If the entrant were limited to only offering transfers indirectly (for example, through a relatively low wholesale price), this would only make it more difficult for the entrant to transfer surplus and compensate the retailer for accommodating its entry. Thus, we analyze the extreme case that makes it as difficult as possible for the incumbent to foreclose entry.

[21] In the absence of an entrant, Bertrand competition among retailers ensures that the retail price will simply be equal to the wholesale price that the incumbent manufacturer charged. The incumbent can, therefore, charge a wholesale price equal to its monopoly price and earn monopoly profits. So, without the threat of entry, in this model, RPM plays no role. Indeed, this reasoning has led some commentators to suggest that a monopolist's use of RPM indicates that retail service is an important factor (see, for example, Winter 2009).

entry; in particular, it is assumed that following entry, the incumbent remains present as a competitive threat that does not require retailer-accommodation.

3 Analysis

We focus on and characterize Markov Perfect Nash equilibria of the game described in Section 2, where the states are given by the type of the current market structure. That is, the state space is the finite set $\{M, C\}$.

We use the specification of the state space (together with the Markov Perfection assumption) to reduce the set of possible post-entry conduct to correspond to the static (Bertrand) equilibrium. In particular, since this paper is not about 'standard' collusion, the specified state space rules out collusion between firms post-entry. It also removes the possibility of coordination via usual repeated game strategies between retailers pre-entry.[22] We discuss the impact of relaxing these assumptions in Section 4.

We first consider the absorbing state following entry (that is, the state C) and then consider the entry decision (state M).

Suppose that the state is C, so that the period game has both the entrant and the incumbent active and simultaneously setting (w_i, p_i) and (w_e, p_e). Since the manufacturers' goods are identical and the retailers are perfect substitutes, the equilibrium resembles a standard Bertrand equilibrium. The equilibrium has the wholesale price set at the marginal cost of the less efficient incumbent (c_i) and all retailers purchasing at this price from the more efficient entrant — i.e., $w_e = w_i = c_i$.[23] The retail price (which, in the model, we assume is determined by manufacturers through RPM) will also be set at c_i since at any higher price, any manufacturer could attract all the retail customers by undercutting by an epsilon increment. The entrant has no incentive to force a lower price since it is assumed that $c_i < p_e^m$ where p_e^m is the price that would be charged by a monopoly with cost c_e. Note that Bertrand competition among retailers (since they are perfect substitutes) implies that RPM plays no role in this case and that competition among retailers is intense, in the sense that they earn no economic profits. The

[22]The interaction between collusion and resale price maintenance is explored in Jullien and Rey (2007).

[23]Since the entrant's cost is lower than the incumbent's, there are actually a range of equilibria that involve the incumbent's pricing between c_e and c_i and the entrant just undercutting. As is standard, we ignore these implausible equilibria.

same outcome would arise — that is, retailers would set a retail price equal to $w_e (= c_i)$ — whether or not the entrant used RPM, and so according to our definition, here there is no RPM. This reasoning yields the following result.

Lemma 1 *Post-entry (that is, when the state is equal to C) per-period profits are:*

1. $\pi_i^{Entry} = 0$ *for the incumbent;*
2. $\pi_r^{Entry} = 0$ *for any retailer; and*
3. $\pi_e^{Entry} = (c_i - c_e)q(c_i)$ *for the entrant.*

Given this characterization for periods following entry, we can turn to characterizing the full game. Our interest is in highlighting when exclusion is possible in equilibrium. However, there are always equilibria with no exclusion.[24] We illustrate an example of such a no-exclusion equilibrium in Lemma 2 below.

Lemma 2 *There is always an equilibrium in which entry takes place in the first period (in state M), and the entrant offers $R = 0$ and $p_e = w_e = c_i$ in state M.*

Proof. Consider a period in which the state of the market is M, and consider that part of the period in which retailers simultaneously choose whether to accept or reject the entrant's offer of $R = 0$. If one retailer accepts the entrant's offer, then the best response set of all other retailers will also include acceptance, as long as it is individually rational in the current period. This is because acceptance by one retailer ensures that entry occurs. If one retailer accommodates entry, then the entrant will get access to the market and be able to generate a retail price that undercuts all retailers that supply the incumbent's good. This steals the market from the incumbent and from retailers who sell the incumbent's good. Given this entry, retailers anticipate making no profit in the current or future periods (following Lemma 1), and so

[24] Inasmuch as both exclusionary and non-exclusionary equilibria exist, exclusion may require co-ordination (if only in beliefs over the equilibrium being chosen) among the downstream retailers. As discussed Section 4 of the online appendix on historical accounts of exclusion, sometimes this has been achieved through explicit downstream coordination via, for instance, trade associations.

it is weakly optimal to accommodate (and would be strictly so if the entrant offers any $R > 0$).

The incumbent choosing $p_i = w_i = c_i$ is a best response to the entrant offering $R = 0$ and $p_e = w_e = c_i$ in state M when the incumbent expects that the entrant will be accommodated. Clearly, it is a best response for the entrant to choose $R = 0$ and $p_e = w_e = c_i$ in state M. ■

The equilibrium illustrated in Lemma 2 reflects a broader class of equilibria in which entry occurs. For instance, following the logic in the proof, if the game were adjusted such that the entrant could offer a payment of $R = \epsilon > 0$ to any accommodating retailer, then an equilibrium would exist in which all retailers accommodate entry. Clearly, any such payment $R = \epsilon > 0$ is unnecessary, since equilibrium requires best responses to be only weakly optimal. That is, the no-exclusion equilibrium can involve no cost to the entrant, as described in Lemma 2.

We now turn to the necessary and sufficient conditions for an exclusionary equilibrium to exist. By exclusionary, we mean an equilibrium in which the retailers never accommodate entry. We show that the use of RPM by the incumbent can generate this exclusion.

Entry depends on whether a retailer will agree to carry the entrant's products. Hence, the retailers' equilibrium strategies in state M are determinative. As argued above, and illustrated in Lemma 2, there is an aspect of coordination around the retailers' behavior. To determine the possibility of an exclusionary equilibrium, therefore, we must focus on the case in which a retailer anticipates that no other retailer will accommodate the entrant. Exclusion is an equilibrium if, under these circumstances, a retailer prefers not to accommodate the entrant. We denote by $\pi(Y, N)$ and $\pi(N, N)$ the net present value of lifetime profits for a retailer who accommodates entry, or not, when anticipating that all other retailers do not accomodate. Exclusion, therefore, requires that $\pi(N, N) \geq \pi(Y, N)$.

Since exclusion results in zero profit for the entrant, the entrant will always be happy to transfer as much surplus as is required to make sure that a retailer prefers to accommodate — that is, $\pi(Y, N) > \pi(N, N)$ — if the alternative is exclusion, subject to meeting a non-negative discounted-profit-stream constraint. The maximal surplus that the entrant could transfer to a retailer is given by first covering the fixed cost of entry and then transferring the remainder of the profit that can be earned in the current period, if entry occurs, plus the discounted value of all future profits in state C. The latter is easily determined, given the characterization of per-period profits in Lemma 1. To compute the former, note that if the incumbent offers (w_i, p_i), then the entrant would maximize its surplus extraction in the current period by setting a retail price of $\hat{p}_e = \min\{p_i, p_e^m\}$.[25] Thus, the maximal value of $\pi(Y,N)$ that the entrant can generate is

$$\max \pi(Y,N) = (\hat{p}_e - c_e)\, q(\hat{p}_e) + \frac{\delta}{1-\delta}(c_i - c_e)\, q(c_i) - F_e. \tag{1}$$

This can be implemented through different combinations of R and (w_e, p_e) — for example, by setting $w_e = c_e$ and $R = \frac{\delta}{1-\delta}(c_i - c_e)\, q(c_i) - F_e$.

We now turn to the incumbent's problem and, in particular, consider the maximal value of $\{\pi(N,N) - \max \pi(Y,N)\}$, subject to the incumbent's making non-negative profits, to investigate whether the incumbent *can* foreclose entry. In practice, the incumbent would wish that retailers earn only enough profits for them to prefer not to accommodate entry — that is, so that $\pi(N,N) = \max \pi(Y,N)$ — and keep any additional profits; determining if $\max\{\pi(N,N) - \max \pi(Y,N)\} > 0$ provides a necessary and sufficient condition for the existence of an exclusionary equilibrium.

Note that $\pi(N,N)$ is determined as the discounted value of the stream of surplus that accrues to the retailers if all retailers deny access — that is, $\frac{1}{1-\delta}\frac{1}{n}(p_i - w_i)q(p_i)$, where the factor $\frac{1}{n}$ reflects the fact that the n retailers share the market evenly when charging the same retail price. Note that since p_i can affect $\hat{p}_e$ and, thereby, affect $\max \pi(Y,N)$, as defined in (1), the problem need not reduce to choosing p_i and w_i to maximize $(p_i - w_i)q(p_i)$; however, w_i does not affect the entrant's problem and so the incumbent would choose $w_i = c_i$ to guarantee itself non-negative profits and guarantee retailers all the surplus generated. The incumbent's problem, therefore, is reduced to choosing p_i in order to maximize

$$\frac{1}{1-\delta}\frac{1}{n}(p_i - c_i)q(p_i) - \left((\hat{p}_e - c_e)\, q(\hat{p}_e) + \frac{\delta}{1-\delta}(c_i - c_e)\, q(c_i) - F_e \right). \tag{2}$$

First note that if $p_i \geq p_e^m$, then the problem is trivially solved by setting $p_i = p_i^m$. Consider, instead, the case $p_e^m > p_i$, and note that the above

[25] Note that the entrant's wholesale price is irrelevant in determining the maximum that the entrant can transfer to a retailer since any profits $(w_e - c_e)q(\widehat{p}_e)$ that the entrant earns can be transferred either as part of the lump sum R or through choosing $w_e = c_e$ instead.

expression can be rewritten as

$$\max_{p_i<p_e^m}(\frac{1}{1-\delta}\frac{1}{n}-1)(p_i-c_i)q(p_i)-(c_i-c_e)q(p_i)-\frac{\delta}{1-\delta}(c_i-c_e)q(c_i)+F_e. \quad (3)$$

If $\frac{1}{1-\delta}\frac{1}{n}>1$, then, since $p_i<p_e^m\leq p_i^m$, the incumbent prefers to set p_i as high as possible, both to make the first term in the above expression larger and to make the second term smaller. However, this corner solution takes us back to the previous case, where the incumbent would prefer to set $p_i=p_i^m$. Instead, if $\frac{1}{1-\delta}\frac{1}{n}<1$, then regardless of the incumbent's choice,

$$\max_{p_i<p_e^m}(\frac{1}{1-\delta}\frac{1}{n}-1)(p_i-c_i)q(p_i)-(c_i-c_e)q(p_i)-\frac{\delta}{1-\delta}(c_i-c_e)q(c_i)<0,$$

and so as long as F_e is small enough, the incumbent can never foreclose entry.[26]

This discussion establishes the following:

Proposition 1 *Suppose that $\frac{1}{1-\delta}\frac{1}{n}>1$. Then, an exclusionary equilibrium (one in which the entrant does not enter) exists if and only if*

$$F_e+\frac{1}{1-\delta}\frac{1}{n}\left(p_i^m-c_i\right)q\left(p_i^m\right)\geq\left(p_e^m-c_e\right)q\left(p_e^m\right)+\frac{\delta}{1-\delta}\left(c_i-c_e\right)q\left(c_i\right). \quad (4)$$

If $\frac{1}{1-\delta}\frac{1}{n}<1$ and fixed costs, F_e, are sufficiently small, there is never an exclusionary equilibrium.

The following corollary is immediate and formalizes the discussion in the introduction.

Corollary 1 *An entrant with marginal cost $c_e=c_i$ can always be excluded if $\frac{1}{1-\delta}\geq n$.*

While Proposition 1 is derived assuming that RPM allows a manufacturer to set the retail price directly, all that is required for the incumbent to implement the exclusion illustrated here is minimum RPM. That is, what the manufacturer needs to do is ensure that sufficient rents are transferred to retailers in the M state (the state in which only the incumbent is active).

[26]Note that meaningful exclusion may still occur for higher values of F_e.

To do this, the incumbent must ensure that retailers enjoy a large enough margin. This is done by removing the ability of retailers to undercut each other below a price set by the incumbent — that is, precisely the point of minimum RPM.

A comparison of the no-exclusion equilibrium illustrated in Lemma 2 (in which the accommodating retailers get zero rents) with the exclusionary equilibrium in Proposition 1 makes it clear that the retailers are better off in the exclusionary equilibrium. On this basis, one might think that the exclusionary equilibrium is more compelling, as it is both individually and collectively better for the retailers. This argument is somewhat similar in spirit Segal and Whinston's (2000) use of coalition-proof SPNE to narrow the set of potential equilibria in the context of exclusive dealing.

3.1 The distortionary effect of exclusion

In this setting, the efficiency cost of an exclusion comes from two sources (less amortized fixed costs, if any).

First, there is the productive efficiency loss from having a low-cost manufacturer excluded from the market. In the model above the per-period loss in producer surplus from this exclusion is $(c_i - c_e)\, q\,(c_i)$.

The second source of inefficiency is due to a loss of consumer surplus. As argued in the paragraphs leading to Lemma 1, the retail price of the good, if entry occurs, is given by c_i. In examining the possibility of foreclosure, Proposition 1 determines when exclusion is feasible. However, as long as the condition in Proposition 1 is met, there could be many equilibria in which entry is foreclosed. In all reasonable equilibria, however, the retail price for the good is given by p_i^m, with multiplicity arising from the differences in the division of producer surplus between manufacturer and retailers, via the choice of the wholesale price.[27] Thus, the second source of per-period welfare loss is the difference in consumer surplus generated at $p = p_e^m$ and $p = c_i$ that is not captured by the incumbent as part of its monopoly rent.[28]

[27] Formally, there may be other (unreasonable) equilibria that arise from the multiplicity and coordination among retailers discussed in Section 3. For example, all retailers may play the (perverse but) equilibrium strategy to deny entry only if the incumbent sets a retail price $(p_i^m - k)$ for some constant k low enough. Then, the incumbent would impose a price of $(p_i^m - k)$ using RPM. We argue that the sort of equilibrium selection process that is required by such an equilibrium is unconvincing. In any case, it does not undermine our main point: that RPM can support exclusionary equilibria.

[28] We implicitly assume that the Hicksian and Marshallian demand curves are the same

3.2 The range of exclusion

Next, we turn our attention to the range of costs that can be excluded using minimum RPM in this manner. The upper bound on this range is given by Corollary 1 above. That is, if $\frac{1}{1-\delta} \geq n$, then the range of excluded costs is $[\underline{c}_e, \overline{c}_e]$, where $\overline{c}_e = c_i$. To articulate the lower bound, the value of F_e needs to be fixed. To examine the size of a 'smallest' range of exclusion, we set $F_e = 0$.[29]

Corollary 2 *Provided that* $\frac{1}{1-\delta} \geq n$ *and* $F_e = 0$, *the lowest marginal cost that can be excluded,* $\underline{c}_e$, *is implicitly defined by*

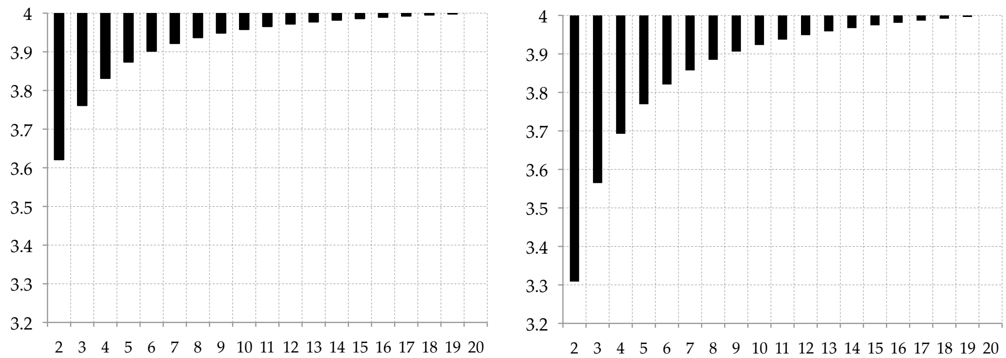
$$\frac{1}{1-\delta}\left(p_i^m - c_i\right)\frac{1}{n}q\left(p_i^m\right) = \left(p_e^m - c_e\right)q\left(p_e^m\right) + \frac{\delta}{1-\delta}\left(c_i - c_e\right)q\left(c_i\right). \qquad (5)$$

A sense of the extent to which exclusion is possible can be obtained from Figure 1, which compares the exact range of the excluded costs of the entrant for two parametrizations of the model, as the number of retailers changes. The panel on the left is computed using a constant elasticity demand curve, while the right uses a linear specification. The specifications are generated so that the incumbent's monopoly price in both settings is the same. The marginal cost of the incumbent is equal to four. The black columns show the values of c_e that can be excluded in equilibrium.

The simulations suggest that the range of costs that can be excluded is sufficiently large to be economically meaningful. In the specification on the left (which uses a constant elasticity demand specification), when there are two, five, and ten retailers, the lowest excluded cost is 90.5, 96.8, and 99.0 percent of the incumbent's marginal cost, respectively. In the specification on the right (which uses a linear demand specification), the corresponding percentages are 82.7, 94.2, and 98.1. Recall that these simulations assume that there are no fixed costs of entry and, so, measures of the extent of possible exclusion are conservative.

(due to, say, quasi-linear utility).

[29] A bound on this range that uses information only about the incumbent firm can be derived by substituting p_e^m for $p_e^m\left(\underline{c}_e\right)$ in Equation (5). This yields $\left(c_i - \underline{c}_e\right) \leq \frac{\left(p_i^m - c_i\right)}{n}\frac{q\left(p_i^m\right)}{q\left(c_i\right)}$. Note that the right-hand side is based on information that is potentially estimable using observable price and quantity data.



Notes: The horizontal axis shows the number of retailers in the market. The vertical axis indicates excluded values of c_e. The left panel uses the demand specification $\log(q) = 5.6391 - \frac{7}{3}\log(p)$. The right panel uses $q = 10 - p$. In both panels, $c_i = 4$, $F_e = 0$, and $\delta = 0.95$.

Figure 1: The interval of excluded costs

4 Discussion and Extensions

In this section, we discuss various extensions of the basic model. We show how the framework can be applied to market-division schemes, slotting fees and loyalty rebates — that is, other practices that create retailer quasi-rents by either creating artificial retail margins or by providing lump-sum payments. We then discuss extensions to differentiated goods markets and various relaxations of the Markov Perfect Nash equilibrium restriction (equivalently, we allow the state space to be enriched).

4.1 Using the framework to analyze other types of surplus-sharing arrangements

The model, as exposited above, considered RPM agreements between the incumbent and the retailers. Unsurprisingly, the basic framework is easily adjusted to accommodate other forms of surplus sharing between the incumbent and the retailers. A helpful distinction is between mechanisms that operate by creating retailer margins and those that use lump-sum payments.

A market-division scheme that matches consumers to specific retailers is an example of a scheme that creates a retailer margin, but is not RPM.[30]

[30] When retailers are perfect substitutes selling a homogeneous good, this is the analog of using exclusive territories.

The simplest way to model this is to allocate consumers so that each retailer faces a demand curve given by $\frac{1}{N}q(p)$ and can act as a monopolist toward these consumers. Then, if the incumbent sets $w_i = c_i$, each retailer will set a price of p_i^m.This allows the incumbent to implement exactly the same rent transfers as considered in Proposition 1. Aside from this adjustment, the analytics for deriving the conditions for existence of exclusionary equilibria follow those in the RPM case. When $F_e \in [0, \frac{\delta(c_i-c_e)q(c_i)}{1-\delta}]$ the condition in Equation (4) is necessary and sufficient. When $F_e \in [\frac{\delta(c_i-c_e)q(c_i)}{1-\delta}, \frac{(c_i-c_e)q(c_i)}{1-\delta}]$, the condition in Equation (4) is merely sufficient.[31]

The model needs slightly more substantive adjustments to accommodate lump-sum payments, such as slotting fees or loyalty payments (as alleged in the *Intel* case). In what follows, we show how the model needs to be adjusted and the analytics that result.

The main difference is in the structure of the game. The timing outlined in Section 2.1 needs to be adjusted so that the order of moves in state M are now:

1. The incumbent sets a wholesale price (w_i) and a lump-sum payment R_i, for all retailers; then,

2. the entrant attempts to enter by offering a transfer, $R_e \in [0, \infty)$, to a single retailer, payable if entry is accommodated, and also by committing to a wholesale price (w_e); then,

3.– 6. are unchanged.

Lastly, a period in state C involves a simultaneous-move game in which both the incumbent and entrant compete by setting a wholesale price and can offer lump-sum payments if they wish.

The analysis follows the logic of Section 3. Provided that $F_e \in [0, \frac{\delta(c_i-c_e)q(c_i)}{1-\delta}]$, the necessary and sufficient condition for an exclusionary condition remains the same, that:[32]

[31] In this range, the entrant cannot cover its fixed cost without retaining some profits from the entry period. Depending on the instruments available, some additional inefficiency may arise from double margin problems as the entrant raises its wholesale price. This may make exclusion easier.

[32] Again, if $F_e \in [\frac{\delta(c_i-c_e)q(c_i)}{1-\delta}, \frac{(c_i-c_e)q(c_i)}{1-\delta}]$ then the condition is merely sufficient (see the previous footnote).

$$F_e + \frac{1}{1-\delta}\frac{1}{n}\left(p_i^m - c_i\right) q\left(p_i^m\right) \geq \left(p_e^m - c_e\right) q\left(p_e^m\right) + \frac{\delta}{1-\delta}\left(c_i - c_e\right) q\left(c_i\right). \quad (6)$$

Note that the entrant implements the transfer on the right-hand side by setting $w_e = c_e$ in the entry period and letting the accommodating retailer earn one period of monopoly profits from charging p_e^m, and setting $R_e = \frac{\delta}{1-\delta}\left(c_i - c_e\right) q\left(c_i\right) - F_e$.

The observation that the same form of equilibrium can be generated using a range of instruments raises the question of why, in one setting, RPM might be used, while lump-sum loyalty payments or slotting fees might be used in another. Is there a sense in which one is optimal under certain conditions? This paper is directed at understanding the equilibrium foundation for concerns about the exclusionary effect of instruments like RPM, slotting fees and loyalty payments, and, hence, this question lies outside the scope of this paper. However, we offer a few observations: First, other parts of the literature have noted different 'efficiency' reasons for using different instruments (see, for instance, the survey in Katz (1989) or Krishnan and Winter (2007) for a recent example); second, different jurisdictions have different legal treatments of these instruments (for instance, the current state-level enforcement posture toward RPM creates uncertainty as to the advisability of using it, see Eyers (2011)); third, different schemes may have different monitoring costs in different settings (see Mortimer (2008) for an example of technological advances shaping the nature of contracts); fourth, some instruments may have other effects, whether by facilitating collusion or some other form of anticompetitive conduct; fifth, in the timing adopted above, lump-sum payments have to be made by the incumbent in a period in which entry actually occurs. If some friction means payments can not be made conditional in some way, and some probability of a very-low-cost entrant appearing exists, then this may be a disincentive to use lump-sum instruments.

In any case, our point is merely that, to understand why one instrument is used over another, all these (and likely other) factors need to be balanced. Our framework suggests that, from the point of view of generating an exclusionary equilibrium, RPM, slotting fees, loyalty payments, market-division schemes (such as exclusive territories) and similar vertical practices can be largely equivalent.

4.2 Manufacturer collusion, and incumbent exclusion

The structure of the baseline model sets a particular model of competition post-entry: competition in the style of one-period Nash in the C state. Examination of Condition (4) in Proposition 1 makes it clear that the view the modeler takes of competition post-entry will have an impact on the range of exclusion that is possible. Given the structure of our state space, the Markov Perfect Nash Equilibrium selects a simple competitive equilibrium post-entry.

Relaxing this structure enlarges the equilibrium set. In analyzing any potentially exclusionary scenario, the analysis has to model competition, post-entry looks like — that is, select a particular equilibrium from this set. Our baseline model adopts the post-entry equilibrium that we view as the most commonly applied notion of equilibrium: static Nash.[33]

However, in some settings, there may be evidence to suggest that other forms of post-entry equilibrium may be appropriate (for instance, drawing the analogy to merger analysis, if strong evidence supporting some sort of coordinated effects were present.) In the online appendix, we formally examine a variety of alternative equilibrium structures; in all of them, exclusionary equilibria can be supported over some range of the parameter space. In what follows, we sketch two such alternatives.[34]

One alternative structure is to give an entrant the ability to induce equilibria that mimic the incumbent's exclusionary equilibria illustrated in the baseline model. Allowing the entrant to do this (weakly) increases the entrant's post-entry profit. The increase is weak in the sense that, if the entrant's marginal cost is sufficiently low, the entrant is better off not excluding the incumbent, as the profit sharing required to do this can decrease profits by more than just setting $p_e = c_i$ and retaining all generated profits (i.e., playing as per Lemma 1). Hence, it is unsurprising that, when the entrant's marginal cost is low, and the fixed cost is high, exclusion by the incumbent can still occur.[35]

Another alternative structure is to allow manufacturers to collude post-

[33] Where empirical work in IO has explicitly taken into account dynamics, it has tended to be in an MPNE framework (Doraszelski and Pakes (2007) and Ackerberg et al. (2007)). Even in these settings, pricing is often assumed to be resolved according to static Nash, and dynamics enter through investment decisions (see, for example, Collard-Wexler (2011)).

[34] The formal treatment is also available in Asker and Bar-Isaac (2011)

[35] Obviously, regardless of who ends up excluding whom, welfare and competition are still harmed.

entry. This gives the incumbent the option of accommodating entry and then initiating a cartel, which raises the question of whether exclusion can still be desirable.

One possible form of manufacturer collusion would involve the entrant simply paying off the incumbent for not producing at all. This is essentially an acquisition. Since we have assumed that the entrant (for whatever reason) cannot buy out the incumbent, we consider a different form of collusion. We consider collusion in which the manufacturers cannot make explicit lump-sum payments to each other (that is, no sidepayments). Given this restriction, and retaining the assumption that the retail sector plays single-stage Bertrand, this means that collusion is brought into effect by splitting the market in some way between the entrant and incumbent (Harrington (1991) investigates the same cartel problem).[36]

Thus, the incumbent has a choice of whether to accommodate entry and collude, or to exclude the entrant by transferring rents to the retailers (via RPM). It can be shown that, when the difference between the incumbent's and entrant's marginal costs is sufficiently large, and when fixed costs of entry are large enough, exclusion is the more profitable policy for the incumbent.

The underlying force at work is that the entrant cannot credibly commit to give the incumbent a high collusive rent. Indeed, once entry has occurred and the fixed cost is sunk, a low-cost entrant requires a high proportion of market quantity to be induced to cooperate in a collusive agreement. This is because the difference between the collusive payout and the competitive payout is comparatively small. Any commitment to give the incumbent a large share of any subsequent agreement would not be credible in the face of the temptation to deviate. Thus, the incumbent makes relatively little profit in the cartel. However, prior to the fixed cost being sunk, it can be cheap for the incumbent to exclude the entrant since the fixed cost offsets much of the rent that the entrant might expect to earn post-entry (and this reduces how much the entrant can afford to compensate retailers for accommodating).

Lastly, note that this argument was developed for the case in which the incumbent faces a single potential entrant. If the incumbent were to face many entrants, then exclusion would continue to be equally effective, while accommodation and subsequent collusion would become a markedly less attractive option. Thus, relative to manufacturer collusion, exclusion becomes more likely as potential entrants become more numerous.

[36] For an empirical analog, consider the lysine cartel described in de Roos (2006).

4.3 Product Differentiation

We now discuss the effect of product differentiation on the exclusionary equilibrium illustrated in the baseline model. We restrict the discussion to the case in which manufacturers are differentiated, although similar intuition applies if retailers are differentiated.[37] The central finding is that greater product differentiation can make exclusion easier for the incumbent, particularly when the entrant's marginal cost is significantly lower than the incumbent's.

Paraphrasing Equation 4, for exclusion to work it must be that

$$\frac{1}{1-\delta}\frac{1}{n}\pi_i^m \geq \pi_e^{\text{entry period}} + \frac{\delta}{1-\delta}\pi_e^{\text{post entry}} - F_e.$$

We consider differentiation in the context of a standard Hotelling line. Consumers are distributed uniformly on the line with quadratic costs parameterized to ensure full coverage. The incumbent sits at the left end of the line. The entrant can be either close to or far from the incumbent. Thus, prior to entry, the maximum quasi-rent that the incumbent can transfer to the retailers is unaffected by differentiation. Hence, differentiation affects the entrant's profit in the entry period ($\pi_e^{\text{entry period}}$) and in periods following entry ($\pi_e^{\text{post entry}}$). The entrant's profit in the entry period is strictly decreasing as it moves from being close to being far from the incumbent on the Hotelling line. This is because, as the manufacturers get more differentiated, the entrant has to offer a lower price to steal the marginal consumer away from the incumbent. We refer to this as the 'business-stealing effect'.

Once entry has happened, the impact of differentiation on the entrant's profits depends on a trade-off between this business-stealing effect and the familiar 'competition-softening effect' of differentiation. If the entrant's marginal cost is similar to the incumbent's, then the competition-softening effect dominates. However, if the entrant has much lower marginal costs than the incumbent, the value of competition-softening is relatively low, and the entrant is better off with comparatively less differentiation, as this makes it easier to steal consumers without dropping price too much below the entrant's monopoly level (business-stealing).

Thus, in moving from a position somewhat close to the incumbent to a position somewhat further away, the relative impacts of the business-stealing effects and competition-softening effects can mean that both $\pi_e^{\text{entry period}}$and

[37] For a formal treatment of both cases, see the online appendix or Asker and Bar-Isaac (2011).

$\pi_e^{\text{post entry}}$ decrease.[38] Thus, particularly if the entrant's marginal cost is low and the fixed cost of entry is high, an increase in product differentiation between the incumbent and the entrant can make it easier for the incumbent to exclude the entrant.

5 Policy implications

The use of vertical restraints to exclude potential rivals can be, in some instances, understated relative to other competitive concerns. For example, the 2010 E.U. Vertical Guidelines provide a general analysis of vertical restraints articulating (in paragraph 100) that anticompetitive foreclosure is a primary concern. However, in listing the anticompetitive harm of exclusive distribution (in paragraph 151) and exclusive customer allocation (paragraph 168), the guidelines note the use possible use of exclusive distribution for collusion, and downstream foreclosure, but not upstream foreclosure — the case analyzed in this paper.

In the context of RPM, regulators have recognized the possibility of exclusion; notably, the Supreme Court in *Leegin* and the E.U. Guidelines on Vertical Restraints.[39] In contrast, most of the economics literature, perhaps due to a reasonable desire to explain why rule of reason might be more appropriate than *per se* treatment of RPM, has not focused on this possible cause of harm (see the literature discussed in Footnote 5 of this paper for exceptions). Thus, the absence of a formally-articulated theory (such as that in this paper) has, perhaps, led to less attention being given to this cause than is warranted.[40]

In addition, we provide a counterpoint to some of the screens that have been suggested for determining whether various practices are problematic. In particular, policy makers (such as in the OECD (2008) roundtable) and

[38] Deneckere (1983), Chang (1991), and Ross (1992) point out similar effects in the context of collusion in differentiated products markets.

[39] "[A] manufacturer with market power . . . might use resale price maintenance to give retailers an incentive not to sell the products of smaller rivals or new entrants" (*Leegin* p.894); and that "[R]esale price maintenance may be implemented by a manufacturer with market power to foreclose smaller rivals" (E.U. Vertical Guidelines p.64, paragraph 224).

[40] For example, the OFT's submission to the OECD roundtable on RPM (2008) does not address this cause of harm in outlining economic theories (pp. 204-207); nor does the United States' submission in its review of theories of anti-competitive uses (pp.218-9), and, more generally, there is no mention of exclusion at all in this 300-page OECD report.

commentators have suggested that antitrust authorities should distinguish between manufacturer- and retailer-initiated RPM. For example, the *Leegin* ruling (p.898), citing Posner (2001), states:

> It makes all the difference whether minimum retail prices are imposed by the manufacturers in order to evoke point-of-sale services or by the dealers in order to obtain monopoly profits.

In this context, it is worth highlighting that in the exclusion theory articulated above, both the incumbent dealer and retailers stand to gain from RPM, and either side might initiate RPM for the purpose of exclusion. Bowman (1955), in particular, provides several examples of this.

Similarly, while the importance of competition (or lack of it) is often stressed, our analysis suggests a more nuanced view. We show that differentiation can have ambiguous consequences for the possibility of exclusion, though our analysis clearly relies on some upstream market power. In particular, if the strength of competition between manufacturers (or retailers) is measured using cross-price elasticities, then increased competition may strengthen (or weaken) the potential for exclusion.

Where our theory is unambiguous is in saying that, all things being equal, adding an extra retailer makes exclusion harder. In particular, this observation suggests that our theory should be less relevant in markets with a large number of retailers. This observation also suggests a complementarity between upstream and downstream exclusion: An upstream monopolist hoping to prevent a rival's entry can gain from downstream exclusion insofar as this reduces the number of firms that he has to pay off to ensure upstream exclusion.

Our analysis also highlights a necessary condition for the range of vertical practices we consider to be used to exclude an entrant manufacturer: It is critical that the entrant requires an accommodating retailer to compete; if it is easy for an entrant to vertically integrate or otherwise deal directly with final consumers, there is no possibility of exclusion in our model. Similarly, another critical assumption in the model is that an incumbent manufacturer does not disappear immediately post-entry, leaving the entrant and retailers to share monopoly profits; instead, industry profits shrink following entry, providing the opportunity for the incumbent to use RPM, or some other vertical practice, to share surplus with retailers and foreclose entry.

Lastly, we show that when a monopolist uses RPM, antitrust harm can still emerge. In particular, in markets in which the good sold is undifferentiated (such as — recalling the American Sugar Refining Company example in Marvel and McCafferty (1984) — sugar) and a dominant firm exists, the use of RPM can be a cause for concern. Existing efficiency-based theories of added service or anti-competitive theories of collusion facilitation have trouble with this environment, as neither fits the institutional setting.

Unfortunately, the above discussion suggests that many existing screens for the existence of harm deserve cautious application.

6 Conclusion

This paper presents a formal model in which an incumbent manufacturer is able to exclude a more efficient entrant by using any of a range of vertical practices. Examples include allowing the manufacturer to set the price at which a retailer sells to consumers (RPM); periodic lump-sum payments to retailers above and beyond those required in distribution agreements (some slotting fees and loyalty rebates); and market-division schemes (such as the allocation of clients to specific retailers or the use of exclusive territories). These practices increase the retailers' profits in the event that they refuse to accommodate entry. This makes it prohibitively expensive for the potential entrant to enter. The recent policy developments in Europe and the U.S. have generated a renewed need for theoretical and empirical work on how vertical practices may harm competition. This paper explores exclusion as a theory of harm by grounding it in a theoretical framework, applicable in a range of settings. This provides a foundation for further research in the area, both theoretical and empirical.

In this paper, we focus on the extent to which a range of vertical practices, on their own, can be used to generate exclusion (absent an explicit contractual exclusivity restriction). However, it is easy to see how exclusivity provisions in an agreement between retailers and a manufacturer can reinforce, or be reinforced by, the exclusionary effect of these practices. In practice, one might consider exclusivity as giving explicit form to the agreement and, possibly, helping coordinate the equilibrium, while the practices we consider may well render implicit form, especially in the face of uncertain enforceability of an exclusivity provision. To this extent, one might view RPM (or any other practice we consider) and exclusive dealing as being, in some instances, complementary exclusionary devices.

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Online Appendix (Not for Publication): Extensions to "Exclusion due to RPM, Slotting Fees, Loyalty Rebates and Related Vertical Practices"

John Asker* and Heski Bar-Isaac†
NYU Stern & NBER, and NYU Stern

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In keeping with the use of RPM as our expository vehicle in the main body of the paper, everything in this appendix is cast in terms of RPM. We begin by reminding the reader of the structure of the model. Then we give a formal treatment of three instances in which the state-space/MPNE assumption is relaxed: first, when the entrant can play the same exclusionary tactic as the incumbent post-entry; second, when the manufacturer can collude post-entry; and, third, we consider an example of a retailer cartel being present. Following that, we consider the model with manufacturer and retailer differentiation and work through a formal example in each case. We finish with several historical accounts of RPM being used to induce an exclusionary effect.

1 Model structure

To save the reader the trouble of referring back to the original paper, we begin by reiterating the structure of the baseline model. Figure A1 shows the structure of moves within a period, assuming only two retailers;[1] transitions between periods are indicated by a dotted line and the updating of the period counter, $t = t + 1$. There are two possible types of period, corresponding to different states of the manufacturer market, which we label M (incumbent monopolist), and C (competition).

*Email: jasker@stern.nyu.edu
†Email: heski@nyu.edu
[1]Figure A1 shows two retailers for expositional ease only. All arguments apply to the n-retailer case.

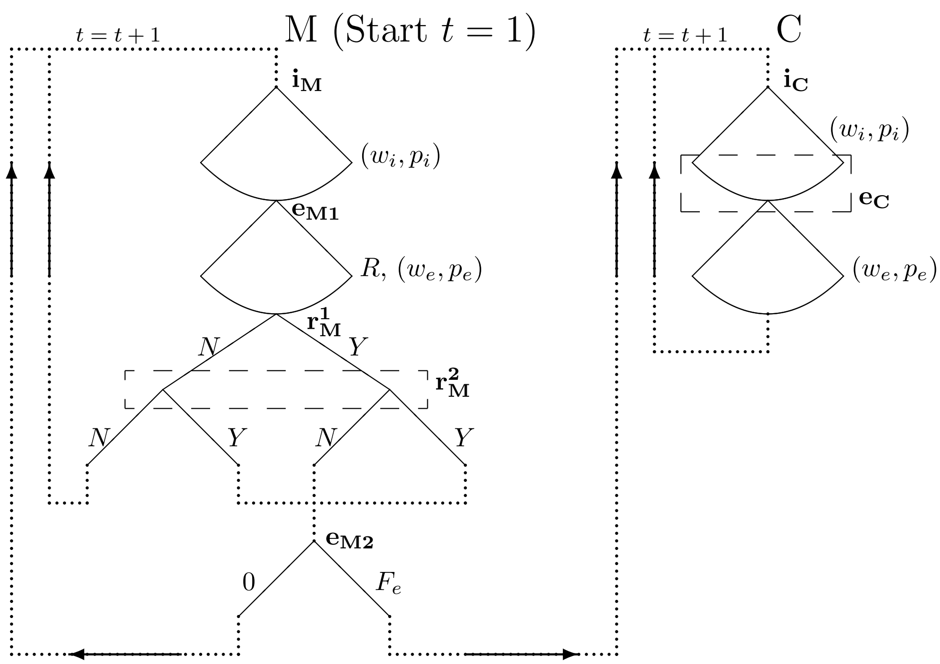

Figure A1: A schematic of the sequence of moves within periods and the transitions from one state to another, with two retailers.

The game begins in state M at $t = 1$. In this period the incumbent is active, but the potential entrant has yet to decide whether or not to enter. The order of moves within a period in state M is as follows:

1. the incumbent sets a retail price and a corresponding wholesale price (p_i, w_i) for all retailers (node $\mathbf{i_M}$); then,

2. the entrant attempts to enter by offering a transfer, $R \in [0, \infty)$, to a single retailer, payable if entry is accommodated, and also by committing to an associated retail price and a corresponding wholesale price (p_e, w_e) (node $\mathbf{e_{M1}}$); then,

3. retailers ($\mathbf{r_1}$ and $\mathbf{r_2}$) simultaneously choose to accept (accommodate entry) or reject the entrant's offer (if more than one accepts, then the recipient of R is chosen at random) (nodes $\mathbf{r^1_M}$ and $\mathbf{r^2_M}$).[2]

[2]The dashed box in Figure 2 represents an information set.

4. if no retailer accommodates the entrant, then transactions occur, period profits are realized, and the period ends, with the state of the manufacturer market in the next period continuing to be M; otherwise,

5. if at least one retailer accommodates, then the entrant can choose either to pay the fixed cost, F_e, or not (node $\mathbf{e_{M2}}$). Following that decision, transactions occur, period profits are realized, and the next period begins. This next period, though, will be a competitive period, in which the state is C if the entrant incurs the fixed cost.

A period in state C involves a simultaneous move game in which both the incumbent and entrant compete by setting a minimum retail price (should they wish) and a wholesale price.

2 Collusion, and incumbent exclusion

In this section, we allow for different possible equilibria in the post-entry game. First, the entrant and the retailers could try to exclude the incumbent in much the same way the incumbent excludes the entrant in the baseline model. Second, we might imagine that the incumbent accommodates entry and the manufacturers collude post-entry. Lastly, the retailers may collude. We consider each of these three cases in the following subsections, and show that, in each case, exclusion of the entrant by the incumbent, via RPM, may still occur.

2.1 Post–entry exclusion of the incumbent

In this section we consider the ability of an entrant to induce exclusion of the incumbent, should entry occur. To do this we have to both relax the state-space/MPNE assumption and also relax the assumption in the baseline model that, once entry occurs, a firm can always get retail access (that is, retailer accommodation also carries with it some form of long-term agreement to stock the product).[3]

The analysis proceeds in a series of steps. First, we derive the equilibrium play when both the entrant and the incumbent are active in the market (analogous to play in the

[3]We ignore the possibility of any liquidated damages that the incumbent may be able to recover from retailers who breach a wholesale agreement. We speculate that, following Aghion and Bolton (1987) or Simpson and Wickelgren (2007), that such an agreement could be to the ultimate advantage of the incumbent, by making it costly for the retailers (and hence entrant) to exclude.

state C). Then we examine how this post-entry play impacts the ability of the incumbent to exclude an entrant.

We consider play post-entry in which the entrant offers a contract $(\tilde{p}_e, \tilde{w}_e)$ to each retailer, if all retailers excluded the incumbent in the previous period (or if entry by the entrant occurred). If a retailer does not exclude the incumbent in the previous period, the game reverts to the equilibrium described in Lemma 1 in the paper (in which the retailers get zero rents).

For such a contract to induce exclusion of the incumbent, it must be the case that no individual retailer wishes to deviate. The benefit to deviating is that a retailer can expect to get a share in the profits earned by the incumbent in the deviation period. Since the incumbent gets zero profit if it is excluded, the incumbent is indifferent between being excluded and giving a deviating retailer all the profits earned in the deviating period. Hence, the maximum a deviating retailer could expect to earn by deviating is determined by the profit earned on the incumbent's good in the period in which it gets access to the market. The gain to a retailer from not deviating is the net present value of the profits afforded to them by complying with the entrant's RPM-like strategy. This gives the following condition for exclusion of the incumbent by the entrant following entry, given a set of prices $(\tilde{p}_e, \tilde{w}_e)$:

$$\frac{1}{1-\delta}\frac{1}{n}\left(\tilde{p}_e - \tilde{w}_e\right) q\left(\tilde{p}_e\right) \geq (\tilde{p}_e - c_i) q(\tilde{p}_e) \tag{1}$$

It should be noted that the entrant may choose not to try to induce exclusion if the profit from doing so is less than the profit from just accommodating entry. That is, it is individually rational for the entrant to induce exclusion, given a set of prices $(\tilde{p}_e, \tilde{w}_e)$, if:

$$\left(\tilde{w}_e - c_e\right) q\left(\tilde{p}_e\right) \geq (c_i - c_e) q(c_i) \tag{2}$$

The optimal price for the entrant to choose is given by maximizing the entrant's profits with respect to $(\tilde{p}_e, \tilde{w}_e)$, subject to the above two constraints. That is,

$$\tilde{p}_e^* = \underset{(\tilde{p}_e, \tilde{w}_e)}{\arg\max} \left(\tilde{w}_e - c_e\right) q\left(\tilde{p}_e\right) \qquad \text{s.t. (1) and (2)}$$

imposing equality on equation (1) and noting that equation (2) holds with equality when

$\tilde{p}_e = c_i$, allows the program to be reduced to solving

$$\tilde{p}_e^* = \arg\max_{\tilde{p}_e \geq c_i} \left(\tilde{p}_e - c_e\right) q\left(\tilde{p}_e\right) - (1-\delta)n\left(\tilde{p}_e - c_i\right) q\left(\tilde{p}_e\right). \tag{3}$$

Note that the optimal $\tilde{p}_e$, denoted $\tilde{p}_e^*$, will be less than p_e^m, the entrant's monopoly price.[4]

This completes the characterization of play following entry when the entrant seeks to exclude the incumbent. In what follows we assume that this play occurs following entry and investigate whether there exists scope for the incumbent to still induce the exclusionary style equilibrium we discuss in the baseline model. Proposition 1 in the paper can be adjusted as follows to account for the different pattern of play post–entry.

Proposition 1 *Suppose that $\frac{1}{1-\delta}\frac{1}{n} > 1$. Then an exclusionary equilibrium (one in which the entrant does not enter) exists if and only if*

$$F_e + \frac{1}{1-\delta}\frac{1}{n}(p_i^m - c_i)q(p_i^m) \geq (p_e^m - c_e)q(p_e^m) + \frac{\delta}{1-\delta}\left[\left(\tilde{p}_e^* - c_e\right) q\left(\tilde{p}_e\right) - (1-\delta)n\left(\tilde{p}_e^* - c_i\right) q\left(\tilde{p}_e^*\right)\right] \tag{4}$$

Note that the difference between the proposition above and Proposition 1 in the paper is that the continuation value post-entry is changed to take into account the possibility of exclusion of the incumbent by the entrant, and the entrant's profits associated doing that. The expression in square brackets captures the entrant's flow profit from exclusion, net of transfers to retailers needed to effect the exclusion.

In general, as one would anticipate, Condition (4) is a more stringent condition than the analogous Condition (4) in Proposition 1 of the paper, where post-entry play is Nash. This follows since post-entry collusion between retailers and the entrant allow for greater industry profits that can be shared through an RPM scheme between the entrant and retailers. However, the constraints (1) and (2) on this collusion, together with potentially high fixed costs that the entrant must pay to enter, suggest that there is still room for the incumbent to exclude the entrant. It is easily verified by example. For instance, taking the parameter values in Figure 1 of the paper, where demand is $q = 10 - p$, $\delta = 0.95$ and

[4] When the incumbent excludes the entrant in the baseline model, the incumbent's retail price is p_i^m. The different pricing behavior by the entrant in this analogous situation is a function of the concavity of the profit function coupled with the observation that $c_i > c_e$ implies $p_i^m > p_e^m$.

the marginal costs are $c_i = 4$ and $c_e = 1$, then, supposing that there are two retailers, the incumbent can use RPM to foreclose entry by an entrant for all values of $F_e \in [302.7, 360]$.[5]

2.2 Manufacturer collusion

We keep the retail sector as in the baseline model (i.e., competitive) and consider collusion among manufacturers post-entry. In doing so, we consider the scenario suggested by the cartel formed by Arbuckle and the American Sugar Company following Arbuckle's entry (see the historical examples at the end of this appendix). The question we ask is: Under what conditions would an incumbent prefer to exclude an entrant when colluding post-entry is an option?

One form of manufacturer collusion would involve the entrant simply paying off the incumbent for not producing at all. This is essentially an acquisition. Since we have assumed, so far, that the entrant (for whatever reason) cannot buy out the incumbent, we consider a different form of collusion. We consider collusion in which the manufacturers cannot make explicit lump-sum payments to each other (that is, no sidepayments). Given this restriction, and retaining the assumption that the retail sector plays single-stage Bertrand, this means that collusion is brought into effect by splitting the market in some way between the entrant and incumbent (Harrington (1991) investigates the same cartel problem).

Specifically, we assume that the entrant and incumbent collude on the price and the quantity that each provides to the market. Hence, the collusive agreement is over $< q_e, q_i >$ where the total market quantity, q, is equal to $q_i + q_e$, and the market price is $p(q)$. Employing a grim-trigger-strategy equilibrium, a collusive market split following entry must satisfy the following condition for the entrant (with an analogous condition for the incumbent):[6]

Entrant's cooperation condition if $p(q) < p_e^m$:

$$q_e [p(q) - c_e] \geq (1 - \delta) q [p(q) - c_e] + \delta (c_i - c_e) q(c_i) \tag{5}$$

Entrant's cooperation condition if $p(q) \geq p_e^m$:

$$q_e [p(q) - c_e] \geq (1 - \delta) q(p_e^m) [p_e^m + c_e] + \delta (c_i - c_e) q(c_i) \tag{6}$$

[5]Note that the upper bound on the fixed cost here is the one assumed throughout. Beyond this level the entrant would not enter in a competitive market regardless of an incumbent's use of RPM.

[6]Here, consistent with our approach in Section 4, we restrict attention to strategies that are not weakly-dominated; that is, we suppose that the incumbent does not set a price below c_i. For an interesting analysis of collusion with asymmetric firms that does not impose such a constraint, see Miklos-Thal (2010).

The entrant's cooperation condition says that, if cooperation occurred in previous rounds, the entrant will continue to cooperate (in which case, the return in each period is their quantity allocation multiplied by the margin they earn) as long as the continuation value from deviating is less than the return from cooperating. The continuation value under a deviation is the one-period opportunity to just undercut the cartel price and meet total market demand at that price, followed by profits in the stage game (as per Lemma 1 of the paper) thereafter.

Faced with these conditions, there is a range of $< q_e, q_i >$ combinations that the manufacturer cartel can support. Lemma 1 below states an upper bound on the profit the incumbent can earn in the incumbent-optimal cartel.

Lemma 1 *An upper bound on what an incumbent can earn per period from colluding with an entrant is:*

$$\pi^{Collude} = \delta q\left(p_e^m\right)\left(p_i^m - c_i\right) - \delta\left(c_i - c_e\right) q\left(c_i\right) \tfrac{\left(p_i^m - c_i\right)}{\left(p_e^m - c_e\right)}$$

This bound is tight when $c_i = c_e$.

Proof. The profit an incumbent could obtain from the incumbent-optimal collusive scheme is given by the solution to

$$\max_{q, q_i} \left(p\left(q\right) - c_i\right) q_i, \tag{7}$$

subject to the cooperation constraints of the incumbent and the entrant. We proceed by relaxing the constraint set and considering only the entrant's cooperation constraint. First we show that the incumbent-optimal cartel allocation occurs when q lies below $q\left(p_e^m\right)$.

Toward a contradiction, we assume that incumbent-optimal cartel allocation occurs when $p(q) < p_e^m$. The cooperation constraint of the entrant when $p(q) < p_e^m$ implies

$$q_i \leq \delta q - \frac{\delta\left(c_i - c_e\right) q\left(c_i\right)}{p\left(q\right) - c_e}. \tag{8}$$

Allowing the relaxed version of the above maximization problem to be written as (once it is observed that the cooperation constraint of the entrant must bind in the incumbent-optimal agreement)

$$\max_{q} \quad \frac{p\left(q\right) - c_i}{p\left(q\right) - c_e}\left(\delta q\left(p\left(q\right) - c_e\right) - \delta\left(c_i - c_e\right) q\left(c_i\right)\right), \tag{9}$$

which can be further rewritten as

$$\max_q \quad \overline{\pi}(q) \quad \equiv \quad \max_q \quad \frac{\pi_i(q)}{\pi_e(q)}\left(\pi_e(q) - \pi_e^c\right), \tag{10}$$

where π_e^c is the competitive profit of the entrant (that is, $(c_i - c_e)\, q(c_i)$).

Taking the derivative with respect to q yields

$$\begin{aligned} \frac{\partial \overline{\pi}(q)}{\partial q} &= \frac{\pi_i'(q)}{\pi_e(q)}\left(\pi_e(q) - \pi_e^c\right) + \frac{\pi_i(q)}{\pi_e(q)}\pi_e'(q) - \frac{\pi_e'(q)\,\pi_i(q)}{\left(\pi_e(q)\right)^2}\left(\pi_e(q) - \pi_e^c\right) && (11) \\ &= \frac{\pi_i'(q)}{\pi_e(q)}\left(\pi_e(q) - \pi_e^c\right) + \frac{\pi_i(q)\,\pi_e^c}{\pi_e(q)^2}\pi_e'(q) && (12) \end{aligned}$$

.

Evaluating this derivative at any point in the interval $[q(p_e^m), q(c_i)]$ yields

$$\left.\frac{\partial \overline{\pi}(q)}{\partial q}\right|_{q \in [q(c_i), q(p_e^m)]} < 0, \tag{13}$$

where we have used the fact that, in this interval, $\pi_i'(q) < 0$ and $\pi_e'(q) \leq 0$. Hence, the optimal level of q lies below $q(p_e^m)$, establishing the contradiction.

As a consequence, the correct constraint to work with is

$$q_i \leq q - \frac{(1-\delta)\, q(p_e^m)\,[p_e^m - c_e] + \delta\,(c_i - c_e)\, q(c_i)}{[p(q) - c_e]}. \tag{14}$$

Following the same procedure as above, the incumbent-optimal q is the solution to

$$\max_q \quad \tilde{\pi}(q) \quad \equiv \quad \max_q \quad \frac{\pi_i(q)}{\pi_e(q)}\left(\pi_e(q) - (1-\delta)\,\pi_e^m - \delta\pi_e^c\right) \tag{15}$$

and,

$$\frac{\partial \tilde{\pi}(q)}{\partial q} = \frac{\pi_i'(q)}{\pi_e(q)}\left(\pi_e(q) - (1-\delta)\,\pi_e^m - \delta\pi_e^c\right) + \frac{\pi_i(q)\left((1-\delta)\,\pi_e^m + \delta\pi_e^c\right)}{\pi_e(q)^2}\pi_e'(q)\,; \tag{16}$$

further,

$$\left.\frac{\partial \tilde{\pi}(q)}{\partial q}\right|_{q = q(p_e^m)} < 0 \quad \text{and} \quad \left.\frac{\partial \tilde{\pi}(q)}{\partial q}\right|_{q \in \left[0, q\left(p_i^m\right)\right]} > 0, \tag{17}$$

noting that (14) implies $q_i = 0$ if $\pi_e(q) \leq (1-\delta)\,\pi_e^m + \delta\pi_e^c$.

Hence, the optimal level of q lies in the interval $[q(p_i^m), q(p_e^m)]$. This leads to the conjecture that the incumbent's profit is bounded by the profits that accrue from setting $p = p_i^m$ and q_i equal to that implied by (14) when the inequality binds and $q = q\left(p_e^m\right)$. To convert this conjecture to a proposition, it must be established that q_i is greatest when $q = q\left(p_e^m\right)$, as compared to any other point in the interval $\left[q\left(p_i^m\right), q\left(p_e^m\right)\right]$.

Setting (14) to bind and taking the derivative of q_i with respect to q yields

$$\frac{\partial q_i}{\partial q} = 1 + \frac{(1-\delta)\, q\left(p_e^m\right)\left[p_e^m - c_i\right] + \delta\left(c_i - c_e\right) q\left(c_i\right)}{\left[p\left(q\right) - c_e\right]^2} \frac{\partial p\left(q\right)}{\partial q}. \tag{18}$$

From the first-order condition of the entrant's monopoly pricing problem, it must be the case that in the interval $\left[q\left(p_i^m\right), q\left(p_e^m\right)\right]$,

$$\frac{\partial p}{\partial q} \geq -\frac{\left(p\left(q\right) - c_e\right)}{q}, \tag{19}$$

with equality when $q = q\left(p_e^m\right)$. Hence, substituting this in yields

$$\frac{\partial q_i}{\partial q} \geq 1 - \frac{(1-\delta)\, q\left(p_e^m\right)\left[p_e^m - c_i\right] + \delta\left(c_i - c_e\right) q\left(c_i\right)}{\left[p\left(q\right) - c_e\right] q}. \tag{20}$$

Hence, provided that the numerator is less than the denominator, $\frac{\partial q_i}{\partial q} > 0$, which is sufficient for $q = q\left(p_e^m\right)$ to be the largest q_i in the relevant range. Note that if the numerator is greater than the denominator, then, from (14), $q_i = 0$.

Hence, q_i is greatest when $q = q\left(p_e^m\right)$, as compared to any other point in the interval $\left[q\left(p_i^m\right), q\left(p_e^m\right)\right]$. This is sufficient to establish that the incumbent's profit is bounded from above by the profits that accrue from setting $p = p_i^m$ and q_i equal to that implied by (14) when the inequality binds and $q = q\left(p_e^m\right)$. This upper bound on profit is given by $\pi^{Collude} = \delta q\left(p_e^m\right)\left(p_i^m - c_i\right) - \delta\left(c_i - c_e\right) q\left(c_i\right) \frac{\left(p_i^m - c_i\right)}{\left(p_e^m - c_e\right)}$. ■

This bound is constructed by observing that the incumbent-optimal collusive agreement involves setting a price between p_e^m and p_i^m, with the incumbent's quantity set by making the entrant's cooperation condition bind. The bound is reached by setting the collusive price equal to p_i^m, but with the the quantity supplied by the industry as a whole consistent with a price of p_e^m (and noting that the incumbent's quantity is decreasing in the price in this range).

It follows from Proposition 1 that a tight upper bound on the profit that an incumbent can enjoy in excluding an entrant is

$$\pi^{Exclude} = (p_i^m - c_i)\, q\,(p_i^m) - n\left[(1-\delta)\,(p_e^m - c_e)\, q\,(p_e^m) + \delta\,(c_i - c_e)\, q\,(c_i)\right] + (1-\delta)\, nF_e.$$

On the assumption that the incumbent can get its optimal surplus under either scheme, we can understand when the incumbent might prefer to exclude, rather than accommodate and collude, by comparing $\pi^{Exclude}$ and $\pi^{Collude}$.[7]

Examination of these conditions suggests that exclusion is attractive when entrants have low marginal costs, but high fixed costs. To see this, consider two polar cases, first the case where $c_e = c_i$. In this instance, the (best-case) return from collusion is $\delta\,(p_i^m - c_i)\, q\,(p_i^m)$, while the (best-case) return from exclusion is $(n\delta - 1)\,(p_i^m - c_i)\, q\,(p_i^m)$, which is always strictly less than the return from collusion, except when $\delta = 1$ and $n = 2$.[8] Next, consider the case where c_e is so low that $p_e^m = c_i$, but the fixed cost is so high as to make entry marginal in a competitive environment (that is, $F_e = \frac{1}{1-\delta}\,(c_i - c_e)\, q\,(c_i)$). In this instance, the incumbent's collusive return is equal to zero, while the exclusionary return is equal to the incumbent's monopoly profit.

The underlying force at work is that the entrant can not credibly commit to give the incumbent a high collusive rent. Indeed, once entry has occurred and the fixed cost is sunk, a low-cost entrant requires a high proportion of market quantity to be induced to cooperate in a collusive agreement since the difference between the collusive payout and the competitive payout is comparatively small. Any commitment to give the incumbent a large share of any subsequent agreement would not be credible in the face of the temptation to deviate. However, prior to the fixed cost being sunk, it can be cheap for the incumbent to exclude the entrant since the fixed cost offsets much of the rent that the entrant might expect to earn post entry (and this reduces how much the entrant can afford to compensate retailers for accommodating).

Lastly, note that this argument was developed for the case where the incumbent faces a single potential entrant. If the incumbent were to face many entrants, then exclusion would continue to be equally effective, while accommodation and subsequent collusion would become a markedly less attractive option. Thus, relative to manufacturer collusion, exclusion becomes more likely as potential entrants become more numerous.

[7] One reason to prefer one over the other is the relative ease of coordinating exclusion and collusion. In this subsection we ignore this consideration.

[8] Recall that fixed costs are assumed to be low enough to allow entry when the market is competitive, when $c_i = c_e$ that implies $F_e = 0$.

2.3 Retailer collusion

We now turn to the possibility of the retailers forming a cartel in the product market, while the manufacturers set the wholesale price competitively.[9] The retail cartel we have in mind is supported by standard grim-trigger strategies in a repeated game. Figure A2 depicts the market following entry, when the retailers collude in the product market. The retailers act like a monopolist, taking the wholesale price as given. Since the entrant has the lower marginal cost, the outcome of competition (as in Lemma 1 of the paper) is that the entrant serves the wholesale market. However, the monopoly distortion coming from the retailers means that some quantity less than $q(c_i)$ gets demanded. That is, we observe standard double marginalization. The amount transacted will either be $q(p_i^m)$, if the entrant charges a wholesale price of c_i, or some quantity $\tilde{q}$, if it is profitable to drop the wholesale price to induce the retail cartel to sell more quantity.

Regardless of the actual wholesale price the entrant sets, the entrant's profit is less than that described in Lemma 1 in the paper when everyone competes. That is, if everyone competes, the entrant's post-entry, per-period, profit is represented by rectangle ABFE. However, if the entrant charges a wholesale price of c_i, profits are ABCD, and if the entrant charges a wholesale price of $\tilde{p} < c_i$, then profits are GBJH.

Hence, if the fixed costs of entry are sufficiently high, such that $(1-\delta)F_e$ is greater than the post-entry, per-period profit when the retail cartel operates, then the entrant will not enter. This, of course, is good news for the incumbent. Indeed, the presence of the retail cartel can ensure that the incumbent need not expend resources on exclusion, whether via RPM or otherwise. Instead, the only problem the incumbent faces is how to mitigate the damage caused by the double-margin distortion imposed on its profits by the retailer cartel. If maximum RPM is available, then this is an easy contractual solution (set $w_i = p_i = p_i^m$). In the absence of maximum RPM, the incumbent still enjoys profits, and possibly more than if it had to use RPM as an exclusionary device.

[9] Another scenario might be that the retailers also use a repeated game mechanism to extract more-favorable terms from the manufacturers, wherein the threat to manufacturers might be to not stock the product. This could occur in combination with product-market collusion. Examining this case, which seems interesting and important, involves a substantial modeling exercise beyond the scope of this paper. We are unaware of any papers that consider a retail sector colluding to extract rents from upstream manufacturers and consumers simultaneously.

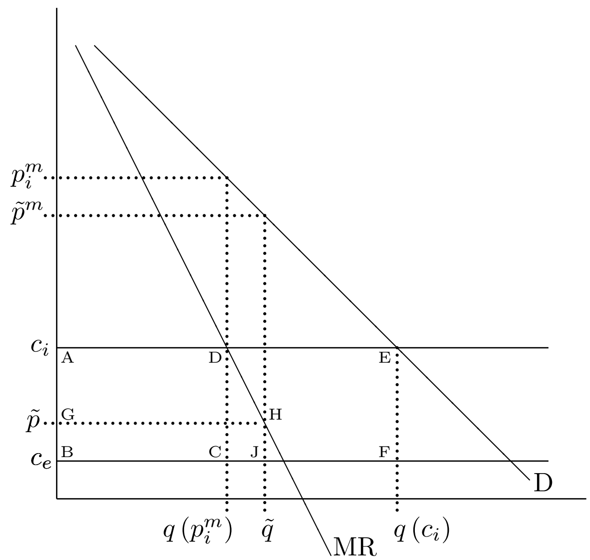

Figure A2: Pricing by a retailer cartel and the entrant's wholesale price response.

An important point is that the cartel suffers from not having the entrant in the market, since, with the entrant active, the wholesale price must decrease. This raises the question of why the retail cartel does not accommodate entry. The problem is that retailers are unable to commit to not colluding post-entry, and, hence, even if they are keen to accommodate the entrant, the entrant will stay away. Faced with this commitment problem, the retailers might be able to subsidize entry using a lump-sum transfer or increase their ability to commit to not colluding by using antitrust regulators and inviting regulatory scrutiny via, say, whistle-blowing behavior. Of course, either of these measures involves costs on the part of the retailers and, depending on the parameters, may not be worthwhile.

Hence, collusion by the retailers in the product market creates a series of problems that can work to the incumbent's advantage. Indeed, in the case illustrated here, it can remove the need for minimum RPM as an exclusionary device altogether. Instead, maximum RPM becomes useful for the incumbent to mitigate the distortion caused by the cartel, resulting in highly profitable exclusion.[10]

[10]When two manufacturers are present, reasoning analogous to that used in Lemma 1 of the paper implies that maximum RPM ceases to be useful.

3 Differentiation

Our baseline model is deliberately stark and simple in order to aid the presentation; however, the intuitions and economic forces apply more generally. In particular, in this section, we extend it first by allowing for differentiation between the incumbent and entrant manufacturers in Section 3.1, and then by allowing for differentiation among the downstream retailers in Section 3.2. These extensions not only show the robustness of our central result but also provide additional insight in highlighting that stiffer competition (through greater substitution at either the upstream or the downstream market) has subtle and non-monotonic effects.[11]

In order to provide analytic results, we consider firms that are differentiated along a Hotelling line with uniformly distributed consumers; however, first, we step back from the modeling details and highlight that, analogous to the baseline model, we can consider whether the incumbent can profitably exclude an entrant by breaking down the problem to characterizing the maximal static profits under the different possible market structures: (i) where the incumbent is a monopolist, (ii) in a period where a retailer accommodates the entrant, and (iii) in post-entry competition between the incumbent and entrant, where the entrant will be serving all retailers. We denote the per-period retailer profits under the most generous RPM arrangement that the incumbent can profitably offer by π_r^{RPM}; the payoffs to retailers and the entrant in a post-entry period by π_r^{post} and π_e^{post}, respectively; and the maximal combined payoffs for the entrant and accommodating retailer, in a period in which the entrant is accommodated by π_{ac}^m.[12]

Following the logic of the baseline model, there is an equilibrium where the incumbent can foreclose entry using RPM whenever every retailer prefers to continue with the most generous RPM arrangement rather than to accommodate the entrant even under the most generous terms that the entrant can offer (which involves transferring all of π_{ac}^m and the net present value of its post-entry profits net of fixed entry costs). It is convenient for presentation to assume that entry costs are equal to zero, in which case there is an equilibrium with entry foreclosure as long as $\frac{1}{1-\delta}\pi_r^{RPM} > \pi_{ac}^m + \frac{\delta}{1-\delta}\pi_e^{post} + \frac{\delta}{1-\delta}\pi_r^{post}$ or, equivalently,

[11] Another extension would be to consider two differentiated incumbent manufacturers, and investigate their incentive to exclude. As should be clear, the basic mechanism will persist should the incumbents be sufficiently differentiated.

[12] Note that in the baseline model, $\pi_r^{post} = 0$ since in that model retailers are homogeneous and compete in prices. Instead, when we allow for differentiated retailers, below, $\pi_r^{post} > 0$.

$$\pi_r^{RPM} > (1-\delta)\pi_{ac}^m + \delta(\pi_e^{post} + \pi_r^{post}). \tag{21}$$

3.1 Upstream differentiation

In this section, we extend the baseline by allowing for differentiation between the incumbent and entrant manufacturers. We suppose that retailers are undifferentiated and allow retailers to stock both of the upstream products. Clearly, a little differentiation has little impact on the foreclosure condition in (21), as compared to the baseline model; however, in this section, we also highlight that as differentiation increases, Condition (21) changes in important ways, and it can become either more or less difficult to satisfy.

First note that, as in the baseline case, $\pi_r^{post} = 0$ since there is Bertrand competition among retailers. In the post-entry game (state C), all retailers can stock both types of product, and Bertrand competition leads all retailers to price each product at the wholesale price and so erode all their profits. Also, note that differentiation between the entrant and the incumbent has no impact on profitability if the entrant is absent from the market; that is, π_r^{RPM} is independent of the degree of differentiation.

It follows that differentiation affects the foreclosure condition (21) only through its effect on π_{ac}^m and π_e^{post}. It is sufficient to consider π_e^{post} (and δ close to 1) to gain intuition for why differentiation can have non-monotonic effects on Condition (21). More differentiation can either increase or decrease the entrant's post-entry profits: If the entrant is much more efficient than the incumbent, then it may prefer little differentiation, as this would allow it to poach the incumbent's customers cheaply; instead, if the entrant and incumbent are competing on relatively level terms, then differentiation will weaken price competition in the post-entry game, and so increase the entrant's profits. That is, depending on the differences in costs, the entrant may either prefer to grab the entire market for a low price, or some of the market for a relatively high price.

These intuitions can be analytically illustrated by formally modeling and parameterizing the extent of differentiation between the incumbent and entrant manufacturers. We do so by adopting a standard Hotelling framework, where final consumers have preferences that are uniformly distributed along a line of length 1. The incumbent is located at 0, and the entrant is located at $\alpha \in [0, 1]$ along the line. Consumers face quadratic transport costs in consuming a product that is not at their ideal location; specifically, a consumer who is located at x gains net utility $A - x^2 - p_i$ from purchasing from the incumbent at price p_i

and gains $A-(\alpha-x)^2-p_e$ from purchasing from the entrant at price p_e. We suppose that A is sufficiently high that the market is always covered by a monopolist.

The available strategies and the timing of the game are identical to those considered in our baseline model, and the analysis proceeds in a similar fashion. The characterization of profits is a little more involved than in the baseline case, and we summarize the results in Lemma 2. We assume throughout that the market is fully covered (which, here, requires that $A > 3 + c_i$).

Lemma 2 *Maximal profits under different market structures are given by* $\pi_r^{RPM} = \frac{A-1-c_i}{n}$, $\pi_{ac}^m = A-1-\alpha^2-c_e$, $\pi_r^{post} = 0$ *and* $\pi_e^{post} = \left\{ \begin{array}{ll} \frac{1}{18}\frac{\left(4\alpha-c_e+c_i-\alpha^2\right)^2}{\alpha} & \text{if } \alpha(2+\alpha) > c_i - c_e > \alpha(2-5\alpha) \\ c_i - c_e - \alpha^2 & \text{otherwise} \end{array} \right\}$

Proof. First, consider maximal industry profits in the absence of the entrant. The assumption of full market coverage implies that $p_i^{RPM} = A-1$ and that $\pi_r^{RPM} = \frac{A-1-c_i}{n}$.

Note that the optimal price in the absence of full market coverage would maximize $(p-c_i)\sqrt{A-p}$; the solution is $p = \frac{2A+c_i}{3}$, and so the full market coverage assumption is equivalent to $\frac{2A+c_i}{3} < A-1$ or, equivalently, $A > 3 + c_i$.

Next, consider π_{ac}^m. Given that the rival retailers set their price at $A-1$, the entrant and accommodating retailer would agree on a retail price of $A-1-\alpha^2$ and cover the market. Trivially, this is the optimal strategy since if the higher-cost (and less centrally located) incumbent would cover the market, it is more attractive only for the entrant to do so. Formally, if the entrant charged a price p and was not covering the market, then the consumer indifferent between the incumbent and entrant would be at distance x from the entrant where $A-(A-1)-(\alpha-x)^2 = A-p-x^2$; it follows that the entrant would choose a price to maximize $(p-c_e)(\frac{\left(A-1-p+\alpha^2\right)}{2\alpha}+1-\alpha)$, which yields a maximized value equal to $\frac{1}{8}\frac{\left(A+2\alpha-c_e-\alpha^2-1\right)^2}{\alpha}$, where this expression is valid as long as the consumer that is indifferent between the incumbent's and the entrant's goods is interior; this requires that $\frac{\left(A-1-\frac{1}{2}A+\alpha+\frac{1}{2}c_e-\frac{1}{2}\alpha^2-\frac{1}{2}+\alpha^2\right)}{2\alpha} < \alpha$ or $A < 3-c_e-\alpha(2-3\alpha)$, but this is inconsistent with the earlier restriction that $A > 3+c_i$. It follows that the entrant and accommodating retailer would charge a price $A-1-\alpha^2$ and cover the market and $\pi_{ac}^m = A-1-\alpha^2-c_e$.

Finally, we turn to consider π_e^{post}. Note that Bertrand competition among retailers ensures a retail price of w_e for the entrant's product and w_i for the incumbent's product. We solve for the Nash equilibrium of the wholesale pricing game. Suppose that the incumbent chooses w_i and the entrant $w_e \leq w_i$.[13] Although we assume full market coverage, there remain two cases to consider:[14]

(i) The entrant serves the whole market. In this case, the incumbent would charge a price equal to c_i, and the entrant would charge $p_e = c_i - \alpha^2$ and earn profits of $\pi_e^{post} = c_i - c_e - \alpha^2$; or

(ii) both the entrant and the incumbent are active.

In this latter case, the incumbent charges w_i, and the entrant charges w_e, and here the indifferent consumer is x such that $A - w_i - x^2 = A - w_e - (\alpha - x)^2$, and so $x = \frac{(w_e - w_i + \alpha^2)}{2\alpha}$. It follows that the incumbent chooses w_i to maximize $(w_i - c_i)\frac{(w_e - w_i + \alpha^2)}{2\alpha}$. Since an incumbent monopolist would fully cover the market, it follows that the entrant, whose equilibrium price can later be easily verified to be below $A - 1$, will sell to all consumers that are located at any $y \geq \alpha$, and so the demand for the entrant is given by $(\frac{(w_i - w_e + \alpha^2)}{2\alpha} + 1 - \alpha)$. Therefore, the entrant chooses w_e to maximize $(w_e - c_e)(\frac{(w_i - w_e + \alpha^2)}{2\alpha} + 1 - \alpha)$.

The first-order conditions for the incumbent and entrant yield best-response functions $w_i^{BR}(w_e) = \frac{1}{2}w_e + \frac{1}{2}c_i + \frac{1}{2}\alpha^2$ and $w_e^{BR}(w_i) = \alpha + \frac{1}{2}c_e + \frac{1}{2}w_i - \frac{1}{2}\alpha^2$. We can solve for equilibrium by solving for the intersection of these best-response functions; this is at $w_e = \frac{4\alpha + 2c_e + c_i - \alpha^2}{3}$ and $w_i = \frac{2\alpha + c_e + 2c_i + \alpha^2}{3}$.

Note that this solution requires that $x \in (0, \alpha)$; that is, $\frac{\left(\frac{4\alpha + 2c_e + c_i - \alpha^2}{3} - \frac{2\alpha + c_e + 2c_i + \alpha^2}{3} + \alpha^2\right)}{2\alpha} = \frac{1}{6}\frac{2\alpha + c_e - c_i + \alpha^2}{\alpha} \in (0, \alpha)$ or equivalently $\alpha(2 + \alpha) > c_i - c_e > \alpha(2 - 5\alpha)$. Under this solution, $\pi_e^{post} = \frac{1}{18}\frac{(4\alpha - c_e + c_i - \alpha^2)^2}{\alpha}$ by substituting for w_e and w_i in the entrant's profits function.. ■

Lemma 2 allows us to populate Condition (21). In particular, it allows us to show that entry can be excluded when the upstream manufacturers are differentiated and that differentiation (greater α) can have a non-monotonic impact on the incumbent's ability to exclude the entrant. Confirming the general intuition discussed above that differentiation may either increase or decrease post-entry profits, depending on whether competition-softening or business-stealing dominate, it is immediate, following the characterization in Lemma 2, that if $c_i >> c_e$ then $\frac{d}{d\alpha}\pi_e^{post} = -2\alpha$; instead, consider the case $c_i = c_e$ and $\alpha > \frac{2}{5}$, then $\frac{d}{d\alpha}\pi_e^{post} = \frac{(4-3\alpha)(4-\alpha)}{18} > 0$.[15] Since $\frac{d}{d\alpha}\pi_r^{RPM} = 0$ and δ can be taken arbitrarily

[13] It is clear that this inequality will hold in equilibrium and can be easily verified after solving for equilibrium values.

[14] We continue to ignore equilibria in which the incumbent prices below cost, yet gets no demand.

[15] Note that the incumbent and the entrant are asymmetric here, and the entrant, even if enjoying the

close to 1, α need not have a monotonic effect on the foreclosure condition (21).[16]

In other words, if firms value the future highly, and if cost differences are large enough to make the entrant want to claim the entire market post-entry (business stealing), then more differentiation leads to a lower price being needed to ensure full market capture. In this instance, differentiation makes exclusion easier because profits post-entry are reduced. However, if cost differences are small, leading to market segmentation, then differentiation makes exclusion harder, as competition in the post-entry subgame is softened (competition-softening). This increases post-entry profits, making exclusion harder to implement.

3.2 Downstream differentiation

In this section, we revert to our baseline case in assuming that the entrant and incumbent sell goods that are homogeneous from the consumers' perspective, but allow for differentiation among retailers, again employing the Hotelling framework.

Specifically, we now suppose that there are only two retailers located on a line of length 1. We maintain symmetry between the retailers and allow for greater or lesser substitution between them by supposing that the retailers are located at a distance β from the half-way point on the line; one retailer, L, lies to the left (at $\frac{1}{2}-\beta$) and the other, R, to the right (at $\frac{1}{2}+\beta$) where $0 \leq \beta \leq \frac{1}{2}$. Again, we suppose that transport costs are quadratic so that a consumer, located at x, gains net utility $A-(x-\frac{1}{2}+\beta)^2-p_L$ from purchasing from the retailer on the left at price p_L and gains $A-(x-\frac{1}{2}-\beta)^2-p_R$ from purchasing from the retailer on the right at price p_R. We suppose that A is sufficiently high that the market is always covered by a monopolist.

As in Section 3.1 and our baseline model, entry is deterred as long as the foreclosure condition (21) is satisfied. The analysis is slightly more involved in this case insofar as differentiation among the retailers implies that in the absence of RPM, and in any post-entry subgame, retailers would earn positive profits; that is, $\pi_r^{entry} \neq 0$.[17] We begin by

same marginal cost, has an advantage in being more centrally located in terms of preferences. Thus, there is an effect here that the entrant prefers lower differentiation, as this reduces transport costs for the (uncontested) consumers to its right.

[16] For completeness, note that $\frac{d\pi_{ac}^m}{d\alpha} = -2\alpha < 0$. Since, in the period of entry, the incumbent enforces the high monopoly RPM price, and so the key effect is a business-stealing effect whereby the entrant seeks to undercut the incumbent and can do so more profitably the less differentiated are the products.

[17] We suppose that once the entrant has been accommodated by a single retailer, then in the post-entry game (state C) both retailers use the entrants good. This follows, as once entry occurs the non-accommodating retailer is faced with procuring a homogenous good, and will take the best terms, which by construction are available from the entrant. See the proof for additional detail.

characterizing properties of π_r^{entry} and other relevant profits.

Lemma 3 *In the downstream differentiation case when A is sufficiently high that the market is fully covered, then* $\pi_r^{RPM} = \left\{ \begin{array}{ll} \frac{1}{2}(A-\beta^2-c_i) & \text{if } \beta \geq \frac{1}{4} \\ \frac{1}{2}(A-(\frac{1}{2}-\beta)^2-c_i) & \text{if } \beta < \frac{1}{4} \end{array} \right\}$, $\pi_e^{post} = c_i - c_e$,

$$\pi_r^{post} = \beta, \text{ and } \pi_{ac}^m = \left\{ \begin{array}{ll} \frac{1}{16}\frac{(A+\beta(2-\beta)-c_e)^2}{\beta} & \text{if } \beta \geq \frac{1}{4} \text{ and } \beta^2+6\beta+c_e > A \\ A-\beta(2+\beta)-c_e & \text{if } \beta \geq \frac{1}{4} \text{ and } \beta^2+6\beta+c_e < A \\ \frac{1}{256}\frac{(4A+\beta(12-4\beta)-4c_e-1)^2}{\beta} & \text{if } \beta < \frac{1}{4} \text{ and } 1+\beta(20+4\beta)+4c_e > 4A \\ A-(\frac{1}{2}-\beta)^2-2\beta-c_e & \text{if } \beta < \frac{1}{4} \text{ and } 1+\beta(20+4\beta)+4c_e < 4A \end{array} \right\}.$$

Proof. First, consider maximal industry profits in the absence of the entrant. Note that since retailers are located at $\frac{1}{2}-\beta$ and $\frac{1}{2}+\beta$ on the Hotelling line, a consumer need only travel a maximal distance of $\max\{\frac{1}{2}-\beta,\beta\}$; the assumption of full market coverage implies that $p_i^{RPM} = \left\{ \begin{array}{ll} A-\beta^2 & \text{if } \beta \geq \frac{1}{4} \\ A-(\frac{1}{2}-\beta)^2 & \text{if } \beta < \frac{1}{4} \end{array} \right\}$ and that $\pi_r^{RPM} = \left\{ \begin{array}{ll} \frac{1}{2}(A-\beta^2-c_i) & \text{if } \beta \geq \frac{1}{4} \\ \frac{1}{2}(A-(\frac{1}{2}-\beta)^2-c_i) & \text{if } \beta < \frac{1}{4} \end{array} \right\}$.

Next, turning to the post-entry game, Bertrand competition among manufacturers with c_e sufficiently close to c_i, such that the entrant's monopoly price is above c_i, results in $w_i = w_e = c_i$ and the entrant making all sales. The full market coverage assumption, therefore, yields $\pi_e^{post} = c_i - c_e$.

Let us now consider retailers' post-entry period profits: Retailers set prices p_L and p_R while incurring a wholesale cost of c_i for the good. Suppose, as can be verified is the case in equilibrium, that the indifferent consumer will be between the two retailers; then, the indifferent consumer will be at a distance x from the left retailer where $A - p_L - x^2 = A - p_R - (2\beta - x)^2$, so $x = \frac{p_R - p_L + 4\beta^2}{4\beta}$, the demand for the left retailers is simply $\frac{1}{2} - \beta + \frac{p_R - p_L + 4\beta^2}{4\beta}$, and the demand for the right retailer is given by $\frac{1}{2} - \beta + 2\beta - \frac{p_R - p_L + 4\beta^2}{4\beta}$.

The left retailer maximizes profits by choosing p_L to maximize $(p_L - c_i)(\frac{1}{2} - \beta + \frac{p_R - p_L + 4\beta^2}{4\beta})$. The first-order condition yields $p_L = \beta + \frac{1}{2}c_i + \frac{1}{2}p_R$; and since the problem of the right retailer is symmetric, in equilibrium, $p_L = p_R = c_i + 2\beta$ and $\pi_R^{post} = \frac{1}{2}(c_i + 2\beta - c_i) = \beta$.

It remains to characterize π_{ac}^m. Without loss of generality, suppose that it is the left retailer who accommodates the entrant. The right retailer, as above, has a price of $A - \beta^2$ if $\beta \geq \frac{1}{4}$ and a price of $A - (\frac{1}{2} - \beta)^2$ if $\beta < \frac{1}{4}$. In each case, there are two possibilities. Note that, as above, the consumer that is indifferent between the left and right retailer is at a distance $\frac{p_R - p_L + 4\beta^2}{4\beta}$ as long as this takes a value in the range $[0, \frac{1}{2} + \beta]$. In this case, therefore, $\pi_{ac}^m = \max_p (p - c_e)(\frac{1}{2} - \beta + \frac{p_R - p + 4\beta^2}{4\beta}) = \frac{1}{16}\frac{(2\beta - c_e + p_R)^2}{\beta}$ with associated price

$\beta + \frac{c_e + p_R}{2}$ and, otherwise, the retailer sells to all the market and so will make the rightmost consumer indifferent; i.e., he will set p such that $A - p - (\beta + \frac{1}{2})^2 = A - p_R - (\beta - \frac{1}{2})^2$ so that $p = p_R - 2\beta$.

Summarizing, in case $\beta \geq \frac{1}{4}$, when $\frac{A - \beta^2 - (\beta + \frac{c_e + A - \beta^2}{2}) + 4\beta^2}{4\beta} < \frac{1}{2} + \beta$, $\pi_{ac}^m = \frac{1}{16} \frac{\left(2\beta - c_e + A - \beta^2\right)^2}{\beta}$ and if $\frac{A - \beta^2 - (\beta + \frac{c_e + p_R}{2}) + 4\beta^2}{4\beta} > \frac{1}{2} + \beta$, then $\pi_{ac}^m = p_R - 2\beta - c_e$. In the alternative case where $\beta < \frac{1}{4}$, then when $\frac{A - (\frac{1}{2} - \beta)^2 - (\beta + \frac{c_e + A - (\frac{1}{2} - \beta)^2}{2}) + 4\beta^2}{4\beta} < \frac{1}{2} + \beta$, $\pi_{ac}^m = \frac{1}{16} \frac{\left(2\beta - c_e + A - (\frac{1}{2} - \beta)^2\right)^2}{\beta}$ and if $\frac{A - (\frac{1}{2} - \beta)^2 - (\beta + \frac{c_e + A - (\frac{1}{2} - \beta)^2}{2}) + 4\beta^2}{4\beta} > \frac{1}{2} + \beta$ then $\pi_{ac}^m = p_R - 2\beta - c_e$. Simplifying these expressions yields the expression for π_m^{aq} in the statement of the lemma. ■

This result allows us to prove the following.

Lemma 4 *In the downstream differentiation case when A is sufficiently high that the market is fully covered, then the entrant's post-entry profits are independent of the extent of downstream differentiation ($\frac{d\pi_e^{post}}{d\beta} = 0$); retailers' post-entry profits are strictly increasing in the extent of differentiation ($\frac{d\pi_r^{post}}{d\beta} = 1$); accommodating profits are decreasing in the extent of differentiation ($\frac{d\pi_{ac}^m}{d\beta} < 0$); and the retailers' profits with only the incumbent and RPM can either be increasing or decreasing in the extent of differentiation ($\frac{d\pi_r^{RPM}}{d\beta} = -\beta < 0$ if $\beta > \frac{1}{4}$ and $\frac{d\pi_r^{RPM}}{d\beta} = \frac{1-2\beta}{2} > 0$ if $\beta < \frac{1}{4}$).*

Proof. These results are immediate from Lemma 3, though it is perhaps worth noting that the comparative statics of $\frac{d\pi_{ac}^m}{d\beta}$ are given by $\frac{d\pi_{ac}^m}{d\beta} = -\frac{1}{16}\left(A - 2\beta - c_e + 3\beta^2\right)\frac{A + \beta(2-\beta) - c_e}{\beta^2} < 0$ if $\beta \geq \frac{1}{4}$ and $\beta^2 + 6\beta + c_e > A$, $\frac{d\pi_{ac}^m}{d\beta} = -2(1+\beta) < 0$ if $\beta \geq \frac{1}{4}$ and $\beta^2 + 6\beta + c_e < A$, $\frac{d\pi_{ac}^m}{d\beta} = -\frac{1}{256}\left(4A - 12\beta - 4c_e + 12\beta^2 - 1\right)\frac{4A + 12\beta - 4c_e - 4\beta^2 - 1}{\beta^2} < 0$ if $\beta < \frac{1}{4}$ and $1 + \beta(20 + 4\beta) + 4c_e > 4A$, and $\frac{d\pi_{ac}^m}{d\beta} = -1 - 2\beta < 0$ if $\beta < \frac{1}{4}$ and $1 + \beta(20 + 4\beta) + 4c_e < 4A$. The inequalities can be shown by recalling that the full market coverage assumption—$A > 3 + c_i$—is maintained throughout. ■

The directions of these comparative statics are intuitive. First, notice that π_e^{post} is independent of β, as differentiation among retailers does not affect the nature of manufacturer competition (where products are undifferentiated). Post-entry profits for retailers increase if there is more differentiation ($\frac{d\pi_r^{post}}{d\beta} = 1 > 0$); this is for the standard reason that differentiation softens the intensity of price competition. In considering the profits under accommodation, loosely speaking, the non-accommodating retailer has a fixed price, and so differentiation does not soften price competition; instead, the entrant and accommodating retailer prefer little differentiation in the period of accommodation, as the primary effect is that it is less costly to undercut the other retailer. Finally, profits under RPM, with only the incumbent active, may be increasing or decreasing in the extent of differentiation—an integrated monopolist would prefer that $\beta = \frac{1}{4}$ in order to minimize consumer transport costs, and so either more or less differentiation than this would decrease π_r^{RPM}.

Overall, with several effects in play, cases can be found where retailer differentiation makes it easier or harder to exclude an entrant. For δ close to 1, the effect through π_{ac}^m in Condition (21) is negligible; then, since $\frac{d\pi_e^{post}}{d\beta} = 0$, the only effects are through π_r^{RPM} and π_r^{post}. It is easy to verify that the effect through π_r^{post} dominates, and so more retailer differentiation makes it harder to exclude an entrant. Instead, for lower values of δ, more differentiation can make it easier to exclude an entrant; for example, this will always be the case when $\beta < \frac{1}{4}$ and δ is small enough since $\frac{d\pi_{ac}^m}{d\beta} < 0$ and $\frac{d\pi_r^{RPM}}{d\beta} > 0$ for $\beta < \frac{1}{4}$.

Note that earlier studies have shown that product differentiation can have subtle and ambiguous effects on firms' ability to collude (see Deneckere (1983), Chang (1991), and Ross (1992)). We find similar results here where RPM allows duopolist retailers to split monopoly profits, but a retailer can "deviate" by accommodating an entrant, though such deviation leads to the static Nash outcome of the competitive game (albeit one where the retailers are supplied by the more efficient entrant rather than by the incumbent). In this context, our results here are perhaps not surprising but worth highlighting, particularly, as policy-makers have highlighted the extent of competition as an important factor for determining whether RPM is likely to be harmful.

4 Historical accounts of exclusion: Focusing on RPM

The idea that RPM may have exclusionary effects has a long history in the economics literature. As early as 1939, Ralph Cassady, Jr. remarked on the potential for distributors to favor those products on which they were getting significant margins via RPM, noting that since "manufacturers are now in a real sense their allies, the distributors are willing (nay, anxious!) to place their sales promotional effort behind these products, many times to the absolute exclusion of non-nationally advertised competing products"(Cassady (1939, p. 460)). Cassady's remarks are interesting in that they suggest a complementarity between some of the exclusionary and pro-efficiency reasons for RPM.[18]

[18] Indeed, Klein and Murphy (1988) highlight that a manufacturer's threat to withhold super-normal profits can be efficiency-enhancing by helping to ensure appropriate service at the retailer level. Instead, our paper argues that the possibility of losing these super-normal profits as a result of a changing market

Following Cassady's early remarks, the potential for RPM to be viewed as an exclusionary device did not surface again until the 1950s with the work of Ward Bowman in (1955) and Basil Yamey in (1954). Yamey describes a "reciprocating" role of price maintenance whereby, "(t)he bulk of the distributive trade is likely to be satisfied, and may try to avoid any course of action, such as supporting new competitors, which may disturb the main support of their security"(1954 p. 22). Yamey (1966) also raises the possibility of exclusion, suggesting that "Resale Price Maintenance can serve the purposes of a group of manufacturers acting together in restraint of competition by being part of a bargain with associations of established dealers to induce the latter not to handle the competing products of excluded manufacturers"(p. 10). The quote is particularly interesting in its suggestion of some complementarity between the possibility that RPM facilitates collusion, and the exclusionary effect. Gammelgaard (1958), Zerbe (1969), and Eichner (1969) make similar suggestions regarding the possibility of exclusion . More recently, following the *Leegin* decision, Elzinga and Mills (2008) and Brennan (2008) have discussed the exclusionary aspect of RPM that is mentioned in the majority judgement.[19]

Bowman (1955) describes several examples of RPM's use for exclusionary purposes involving wallpaper, enameled iron ware, whiskey, and watch cases. Many of these examples are drawn from early antitrust cases and involve a cartel, rather than a monopolist firm, as the upstream manufacturer instigating exclusion. Bowman also gives a few examples of implicit upstream collusion rather than explicit cartelization and the use of RPM for exclusion; specifically, he highlights the cases of fashion patterns and spark plugs. Given that a cartel will wish to mimic the monopolist as much as possible, these examples are consistent with the setting considered in this model. They also underline the complementarities between the view that RPM facilitates collusion, and the exclusionary perspective articulated here.

These cases often involve contracts that include more-explicit exclusionary terms in conjunction with the use of RPM. For example, in 1892, the Distilling and Cattle Feeding Company, an Illinois corporation, controlled (through purchase or lease) 75-100 percent of the distilled spirits manufactured and sold in the U.S. It sold its products (through distributing agents) to dealers who were promised a five-cents-per-gallon rebate provided

structure can lead to exclusion of an efficient manufacturer. To the extent that efficiency-enhancing rationales are more effectively implemented when more surplus is available, our framework would also suggest a complementarity between the traditional framing of "pro-efficiency" rationales and exclusion.

[19] None of the papers mentioned here develop a formal model.

that the dealers sold at no lower than prescribed list prices and purchased all their distillery products from their (exclusive) distributing agents. This example is also interesting in demonstrating the blurred line between practices best characterized as RPM and loyalty rebates, and suggests the usefulness of a conceptual framework able to accommodate a variety of related practices. [20]

Another well-documented example is that of the American Sugar Refining Company, discussed at some length by Zerbe (1969) (see, also, Marvel and McCafferty (1985)). The American Sugar Refining Company was a trust formed in 1887 that combined sugar-refining operations totaling, at the time of combination, approximately 80 percent of the industry's refining capacity. The principal purpose of the trust was to control the price and output of refined sugar in the U.S..[21] After a wave of entry and consolidation, by 1892, the trust controlled 95 percent of U.S. refining capacity. In 1895, the wholesale grocers who bought the trust's refined sugar proposed an RPM agreement. Zerbe reports that the proposal came in the form of "a threat and a bribe": The bribe was that, in return for the margins created by the RPM agreement, the grocers would not provide retail services to any refiner outside the trust. The threat was in the form of a boycott if the trust refused to enter into the RPM agreement. The exclusionary effect of the RPM agreement was only partial at best: In 1898, Arbuckle, a coffee manufacturer, successfully entered the sugar-refining business. In some regions, Arbuckle was unable to get access to wholesale grocers and had to deal directly with retailers. Thus, while not prohibiting entry, the RPM agreement may have significantly raised the entry costs of this new competitor by forcing it to integrate a wholesale function. Ironically, after several years of cutthroat competition, Arbuckle and the trust entered into a cartel agreement that persisted in one form or another until the beginning of the First World War.

The sugar trust is informative in that it involves RPM's use in a setting in which the product is essentially homogeneous (see Marvel and McCafferty (1985) for a chemical analysis supporting this claim) and the manufacturer has close to complete control of existing output. The lack of product differentiation makes theories of RPM enhancing service or other non-price aspects of inter-brand competition difficult to reconcile with the facts. Clearly, there was no reason to use RPM to facilitate collusion on the part of refiners, since the trust already had achieved that end. The grocers may well have

[20] As recorded in *U.S. v. Greenhut et al.* 50 Fed., 469, and *U.S. v. Greenhut et al.* 51 Fed., 205.

[21] See Zerbe (1969, p. 349), reporting testimony given to the House Ways and Means Committee by Havermeyer, one of the trustees.

wanted to facilitate collusion at their end, but the openness with which they negotiated with the trust suggests that it was more in the spirit of good-natured extortion: a margin in exchange for blocking entry.

The sugar example fits the setting considered in our model, in which an incumbent monopolist faces entry by a lower-cost entrant. All products are homogeneous, and there is no differentiation between retailers. This gives the model the flavor of cutthroat competition familiar from standard Bertrand price competition models. In particular, there is no scope for service on the part of retailers, and the manufacturer easily solves the classical double-marginalization problems by simply using more than one retailer. If the entrant enters, then retailers and the incumbent see profits decrease (to zero), and the entrant captures market demand at a price equal to the incumbent's marginal cost. To deter this entry, the incumbent offers an RPM agreement which, over time, more than compensates the retailers for any one-off access payment that the entrant may be able to afford. At its heart, the RPM agreement is successful in that it forces individual retailers to internalize the impact of competition on the profitability of the incumbent's product and on the margins of all retailers. A feature of the model, which sits well with the sugar example, is that both the incumbent and the retailers benefit from the RPM-induced exclusion. In this sense, the fact that the grocers suggested the RPM agreement in the sugar example—in contrast to the distilled spirits example in which the upstream firm initiated the agreement—is entirely consistent with the exclusionary effect explored here.

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