Exclusionary Minimum Resale Price Maintenance

John Asker[y]and Heski Bar-Isaac[z]

NYU Stern & NBER, and NYU Stern

May 12, 2011

Abstract

An upstream manufacturer can use minimum resale price maintenance (RPM) to exclude potential competitors. RPM lets the incumbent manufacturer transfer profits to retailers. If entry is accommodated, upstream competition leads to fierce downstream competition and the breakdown of RPM. Hence, via RPM, retailers 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 also discuss empirical and policy implications, as well as the exclusionary potential of other methods of sharing profits between upstream and downstream firms, such as slotting fees and revenue sharing.

JEL Codes: K21, L42, L12, D42

1 Introduction

A manufacturer engages in resale price maintenance (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. In the US, for almost one hundred years, 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 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 Sha er (1991), Jullien and Rey (2007), and Rey and Verge (2009) for formal treatments).[3]

Largely in response to the **per se** status of RPM, a number of papers were written in the latter part of the last century to explore pro-competitive justi cations for RPM (prominent examples include Telser (1960), Marvel and McCa erty (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.

In 2007, the Supreme Court nally overturned the **per se** rule against minimum RPM in the U.S. in the **Leegin** case, which decided that cases involving minimum RPM should be decided on a \rule of reason" basis.[4] That is, courts are now required to balance the potential e ciency bene ts 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. In the wake of the **Leegin** decision, economists advising antitrust enforcers are now forced to provide explicit theories for competitive harm that arise from RPM and must be able to quantify the extent of this harm.

This paper develops a model of competitive harm that arises from the exclusion of a more e cient entrant by an incumbent manufacturer. In our framework, minimum RPM is necessary for this to occur. Our framework, therefore, builds a foundation for pursuing the third basis of antitrust harm raised in the **Leegin** decision (see **Leegin** at p.894)| the potential for RPM to be used to provide margins to distributors that will likely disappear

---

[1] Dr M Med Co v J D. Pk Son , 220 U.S. 373 (1911)

[2] A ps violation means that the party bringing the case is not required to establish in evidence that harm to competition occurred. Instead, it is presumed by the mere existence of the conduct. Horizontal price- xing tser ps violation. Posner p.176)es evolution of the Court's treatment of the ps rule for RPM.

[3] The extent to which RPM impacts consumer welf6re varies over time and jurisdiction, often due to

if entry occurs, resulting in exclusion.[5] In the model, exclusion is naked in the sense that minimum RPM serves no purpose other than to provide distributors with incentives to exclude a potential entrant; that is, with no possibility of entry, there would be no reason to employ RPM. The primary contribution of this paper is its rigorous framework for exploring the idea of RPM as an exclusionary device. 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.

At the heart of this paper is a familiar intuition: RPM limits downstream competition and, so, can allow downstream retailers to earn relatively high profits. Indeed, it is precisely these profits (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 profits to entice retailers to provide the desired level of service. However, here, we highlight a more harmful implication of such profits.[6] If an entrant cannot establish itself without some retailer support, then retailers may be hesitant to accommodate an entrant since following manufacturer entry, retail competition will be more intense.[7] Even if the entrant manufacturer can offer RPM, retailers will shop among the manufacturers for better terms that allow them to compete more intensely with other retailers.[8] Seeking to prevent the industry from evolving in this direction, which reduces the profitability of the whole industry (and, in particular, their own profitability), retailers will not accommodate entry.

The incumbent manufacturer, by an appropriate choice of RPM, can ensure that the industry as a whole earns the profits that a monopolized industry would earn, and, through an appropriate choice of the wholesale price, divide these profits between itself and the retail sector. To exclude entry, the incumbent must ensure that every retailer earns more than a competing manufacturer entrant could offer the retailer to stock its product; however, this may still allow the incumbent positive profits. Therefore, according to this theory, **both** the retail sector **and** the incumbent manufacturer gain from RPM.[9] This is in contrast to

---

[5]The first two bases for harm are RPM as a practice facilitating upstream collusion and as a practice facilitating downstream collusion.

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

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

[8]A more efficient entrant cannot simply replicate the incumbent manufacturer, since he faces a competitor. Even though all retailers might prefer an RPM agreement with the entrant, there is no way that they could commit to stick to such an agreement, absent collusion.

[9]In line with this observation, Overstreet (1983, p.145) 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 to the mid-1970s, depending on the state(s) involved.

much of the policy discussion that suggests that there is less reason for antitrust concern when a manufacturer instigates RPM.

First, we set out the theory and illustrate the central mechanism through a simple model with homogeneous retailers. In contrast to much of the RPM literature, and in order to highlight our mechanism, there is no possibility of pre- or post-sale service. Retailers simply distribute the goods that they receive from the upstream manufacturer. We analyze a single market. Entry, of course, may reflect a manufacturer expanding from an existing geographic location or adding a new product line that appeals to a new consumer segment.

In this environment there are always equilibria in which entry is accommodated since, if a retailer anticipates that some other retailer will accommodate the entrant, then it will be keen to accommodate the entrant as well, and, thus, such beliefs can be self-sustaining. We note, however, that in such equilibria, RPM agreements play no useful role and, hence, would not be used in practice. Our focus on equilibria where entry is excluded is, perhaps, further justified by the observation that if such an exclusionary equilibrium exists, then not only would it involve RPM, but also all retailers would prefer it to an accommodating equilibrium.[10]

We characterize the conditions under which an exclusionary equilibrium can be sustained in our baseline model and describe properties of such equilibria. In particular, we highlight the welfare loss associated with exclusionary equilibria, which may be of practical use to policy makers in quantifying harm. In addition, we discuss empirical screens useful for assessing whether such equilibria are feasible and, if so, for determining preliminary

participants than can often be achieved, especially as explicit coordination may be illegal. However, these cases are clearly of interest, We, therefore, enrich the model to incorporate the possibility of these kinds of coordination. Broadly, we nd that coordination post-entry makes it more di cult, or less likely, that the incumbent excludes the entrant. However, there are still cases where the incumbent prefers to and can successfully exclude the entrant. Further and perhaps surprisingly, while one might suppose that a retailer cartel should maximize retailers' pro ts and so lead to the entry of an e cient manufacturer, a retailer cartel is unable to commit not to restrict output (and set a higher retailer price). As a result an entrant may face relatively low sales and be unable to recoup entry costs in the presence of a retailer cartel, though it may be able to in its absence. Thus, retailer coordination, by itself, may lead to exclusion to the detriment of retailers (and to the bene t of the incumbent).

In addition to addressing post{entry collusion of various forms, we also consider extensions that allow for di erentiation, either at the retail level or between the incumbent and entrant in the manufacturing segment. Beyond showing the robustness of the results, these extensions highlight that competition (as captured by the degree of di erentiation between rms) in either the retail or the wholesale segment can exacerbate or alleviate exclusionary pressure, depending on the degree of di erentiation.

Aside from the RPM literature already discussed, another related literature is that on naked exclusion arising from exclusive dealing arrangements (See Ch. 4 of Whinston (2006), Rey and Tirole (2007), and Rey and Verge (2008) for useful overviews). In this literature, the closest papers to ours are Fumagalli and Motta (2006) and Simpson and Wickelgren (2007), which explicitly consider exclusive dealing arrangements between manufacturers and retailers. Earlier papers, by Rasmusen, Ramsayer and Wiley (1991), and Segal and Whinston (2000) are distinct in assuming that buyers (equivalently, retailers) act as local monopolists. Our setting di ers from that presented in this line of research in that we build on a repeated game framework instead of exploiting contractual externalities arising from scale economies; although the coordination-style game that lies at the heart of this literature nds a close analog in our setting. Our model is most distinctive in the ease with which exclusion can occur in intensely competitive markets (i.e., Bertrand). In this setting, one way we depart from the well-known `no-exclusion' result of Fumigalli and Motta (2006) is by resorting to a repeated{game environment. This gives a setting in which the impact of a single retailer's actions on industry pro ts can be imposed on that retailer. In this respect, a similar avor is found in Simpson and Wickelgren's (2007) model, where exclusion in

2 RPM and exclusion

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 pro-efficiency reasons for RPM and exclusion.[12]

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.[13]

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

---

[12] Indeed, as discussed above, 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 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 "pro-efficiency" rationales and exclusion.

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

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 McCaerty (1985) for a chemical analysis supporting this claim) and the manufacturer has close to complete control of existing output. The lack of product dierentiation makes theories of RPM enhancing service or other non-price aspects of inter-brand competition dicult to reconcile with the facts. Clearly, there was no reason to use RPM to facilitate collusion on the part of reners, since the trust already had achieved that end. The grocers may well have 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 ts 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 dierentiation between retailers. This gives the model the avor 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 prots 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 oers an RPM agreement which, over time, more than compensates the retailers for any one-o access payment that the entrant may be able to aord. At its heart, the RPM agreement is successful in that it forces individual retailers to internalize the impact of competition on the protability 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 benet 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 rm initiated the agreement— is entirely consistent with the exclusionary eect explored here.

3   The baseline model

There are two manufacturers who produce identical goods. Total market demand in each period in this market is given by $q(p)$. All rms discount future prots with discount factor .

One manufacturer is already active in the market (the incumbent) and another is a

9

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. In order to enter the market, the entrant has to sink a fixed cost of entry $F_e \in [0, \overline{F} = (1 - \alpha)(c_i - c_e) q(c_i)]$. 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. In practice, this fixed cost may be difficult for an antitrust authority to evaluate and turns out to play a somewhat limited role in our baseline analysis; consequently, in the analysis, we often focus on the limiting case where $F_e = 0$. It is important, however, that the entrant is considered to be present in the market **only if** a retailer accommodates entry — i.e., an entrant is not perceived to have entered until its products are available to final consumers.[16]

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.

Contracting between manufacturers and retailers occurs on two fronts: first, when the entrant seeks to obtain a retail presence; and, second, when a manufacturer sells its product to a retailer (that is, when exchange occurs). Each setting is dealt with in more detail in the next two paragraphs.

As described above, for the entrant to gain a retail presence at least one retailer must agree to stock the product. This means that the retailer must be better off stocking the product than not. To this end, the entrant can offer any form of payment (lump sum or otherwise) to induce a retailer to carry its product.[17] Once a retailer has agreed to stock a product, it is always stocked. If the entrant's product is stocked by a retailer, the entrant joins the incumbent in the set of (perpetually) active firms.[18]

Conditional on being present in the market, a manufacturer sells to retailers via a per-unit wholesale price, w_i or w_e, depending on whether the price is set by the incumbent or the entrant. Manufacturers are not permitted to price discriminate across retailers or over the quantity sold.[19] Each manufacturer also has the option of setting a per-unit

---

[16] We assume that vertical integration is prohibitively costly. We also assume that a merger or acquisition of the incumbent by the entrant is not feasible.

[17] The contract space is left unrestricted here, as no further structure is required. 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, in making this assumption, we analyze the extreme case that makes it as difficult as possible for the incumbent to foreclose entry.

[18] That is, a firm has to sink the fixed cost of entry only once.

[19] In the model, there is no incentive to discriminate across retailers, so this assumption is not restrictive.

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.[25] We present the timing with fixed costs paid only after accommodation, first, since the analysis is a little simpler and, second, since this timing reinforces the importance and central role of retailer accommodation.[26]

The transfer, **R**, serves as an inducement to a retailer to carry the entrant's product. We restrict this transfer to be paid only to one retailer, but given that all retailers are perfect substitutes in the baseline 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 given single retailer also chooses not to accommodate. By considering an inducement **R** paid to a given single retailer, we maximize the chance that this retailer would want to deviate from the exclusionary equilibrium and, hence, study a case in which exclusion is, if anything, harder to attain.

What is crucial is the requirement that at least one retailer agree to carry the entrant's good for the entrant to become active. Hence, the transition from the state of the market **M** to state **C** requires a retailer to agree to stock the entrant's product. 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-entry; in particular, it is assumed that following entry, the incumbent remains present as a competitive threat that does not require retailer-accommodation.

---

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

[26] 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 can make exclusion easier than in the model we present here. We are grateful to a referee for pointing this out.

4 Analysis

Before analyzing the game outlined in Section 3, consider the behavior of an incumbent with no threat of entry. In the absence of RPM, 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, $p_i^m = \arg\max(p - c_i)q(p)$, and earn monopoly profits. It can do no better with RPM, and so without the threat of entry, in this model, RPM plays no role.[27]

We characterize the Markov Perfect Nash equilibria of this game, where the states are given by the type of the current market structure. That is, following the notation in Figure 1, the state space is the finite set $\{M, C\}$. We use Markov Perfection to remove the possibility of firms' colluding post-entry. However, note that since a "deviating" retailer who accommodates entry changes the state from M to C, the equilibrium play in state M resembles a collusive outcome among retailers—we highlight that this can be beneficial for the incumbent manufacturer in excluding a rival.[28] We first consider the absorbing state following entry (that is, the state C) and then turn to 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., $w_e = w_i = c_i$.[29] 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

---

[27] Indeed, this reasoning has led some commentators to suggest that a monopolist's use of RPM reflects that retail service is an important factor (see, for example, Winter 2009).

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

[29] 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 equilibria since they involve weakly-dominated strategies that make little empirical sense and are not robust to trembling-hand style equilibrium refinements.

14

the sense that they earn no pro ts. The 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 de nition, here there is no RPM. Since our equilibrium concept is Markov Perfection, there is no way to sustain pricing above c_i: The state-space does not admit the possibility of collusion and a punishment phase that could be used to deter undercutting. This reasoning yields the following result.[30]

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

1. $\pi_i^{Entry} = 0$ for the incumbent;

2. $\pi_r^{Entry} = 0$ for any retailer; and

3. $\pi_e^{Entry} = (c_i \quad c_e)q(c_i)$ for the entrant.

Given this characterization for periods following entry, we can turn to characterize the full game. Our interest is in highlighting when exclusion via RPM is possible in equilibrium. However, there are always equilibria with no exclusion. 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 rst period (in state M) and the entrant o ers $R = 0$ and $p_e = w_e = c_i$ in state M .

Proof. Consider a period where 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 o er of $R = 0$. If one retailer accepts the entrant's o er, 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

this entry, retailers anticipate making no profit in the current or future periods (following Lemma 1), and so it is weakly optimal to accommodate (and would be strictly so if the entrant offers any $R > 0$).

It is easy to verify that 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.

Note that here, there is no RPM (since if $w_e = c_i$, then Bertrand competition among retailers would lead to the same retail price). ∎

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 entrant offers a payment of $R = \epsilon > 0$ to any accommodating retailer then an equilibrium would exist in which all retailers accommodate entry. That is, if all other retailers accommodate it would be strictly optimal for an entrant to also accommodate, since, at the very least, they get a payment R as opposed to not accommodating and getting a payment of zero. Clearly, any such payment $R = \epsilon > 0$ is unnecessary from the point of view of the entrant, since equilibrium only requires best responses to be weakly optimal. That is, the no exclusion equilibrium can involve no cost to the entrant as described in Lemma 2.

It is worth noting that, in setting up the model in Section 3.1, we assumed away the option of the entrant to offer a payment of $R = \epsilon > 0$ to all accommodating retailers, since our interest is in equilibria in which all retailers choose not to accommodate the entrant (exclusionary equilibria). As will become clear in the following analysis, for such an equilibrium to exist it must be the case that, if all other retailers are not accommodating, then any retailer also chooses not to accommodate. By considering an inducement R paid to a single retailer, we maximize the amount that the entrant would pay to any retailer and so also chance that this retailer would want to deviate from the exclusionary equilibrium; hence, we study a case in which exclusion is, if anything, harder to attain.

A comparison of the no-exclusion equilibrium illustrated in Lemma 2 (in which the accommodating retailers get zero rents) to the exclusionary equilibrium illustrated below, 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 to the use of coalition-proof SPNE employed by Segal and Whinston (2000) in

narrowing the set of potential equilibria in the context of exclusive dealing.[31]

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 minimum 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. It is helpful to examine

met (with (N; Y) = (Y; Y

that accrues to the retailers if all retailers deny access — that is, $\frac{1}{1}\frac{1}{n}(p_i - w_i)q(p_i)$, 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, clearly, 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

$$\frac{1}{1}\frac{1}{n}(p_i - c_i)q(p_i) - (\hat{p}_e - c_e)q(\hat{p}_e) + \frac{1}{1}(c_i - c_e)q(c_i) - F_e \; . \qquad (2)$$

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 expression can be rewritten as

$\max_p$

cm215F8 10.9091 Tf330(problem,)

Thus, the efficiency loss from exclusionary RPM, in the baseline model of Section 3, is given by

$$
\text{RPM Welfare Cost} \quad = \quad \frac{1}{1}
$$

Notes: The horizontal axis is the number of retailers in the market. The vertical axis is the di erence between $c_i = 4$ and either the exact measure of $\underline{c_e}$ (the grey column; $c_i \quad \underline{c_e}$) or the upper bound computed using Equation (7) (grey

marginal costs. Recall that these simulations assume that there are no xed costs of entry and, so, these likely underrepresent the extent of possible exclusion.

Particularly in markets where there are relatively few retailers and, hence, where the exclusionary potential of a minimum RPM agreement is greatest, the bound appears to be useful. When there are only two retailers, the additional range indicated by the bound is seven and eight percent of the length of the true interval, for the constant elasticity and linear speci cations, respectively.

5   Relaxing the Markov assumption

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. The Markov Perfect Nash Equilibrium assumption, given the structure of our state space, does the job of restricting us to this simple competitive equilibrium post entry.

Relaxing the MPNE assumption makes the equilibrium set, post-entry, become much bigger. In analyzing any potentially exclusionary scenario then, the analysis has to take a view as to what 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 simplest, most widely appropriate, and most commonly applied notion of equilibrium (at least in empirical work): static Nash (for an overview see Ackerberg et al (2007)).[36]

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 e ects were present.) Di erent post-entry equilibria rely on the dynamic nature of the game and build on more involved dynamic strategies. While these are familiar to the industrial organization economist, in practice they may require greater co-ordination on the part of market participants in coalescing expectations around this equilibrium play, and it may be relatively di cult to establish such an equilibrium.[37]   Indeed, our structure suggests that an incumbency advantage is

---

[36] Where empirical work in IO has explicitly taken into account dynamics, it has tended to be in a 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)).

[37] We argue here intuitively, but one way to think about comparing di erent equilibria is by their com-

obtained from the notion that the exclusion equilibrium in the baseline model is relatively simple, insofar as equilibrium play depends only on the market structure.

In this section, we relax the MPNE assumption and 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.

5.1   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 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 longterm agreement to stock the product).[38]

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 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 $(p_e; w_e)$ 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 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

---

plexity. For example, it may be possible to consider the minimal number of states required by a finite-state automaton used to replicate the equilibrium strategy, along the lines of Rubinstein (1986).

[38] 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.

Proposition 2 Suppose that $\frac{1}{1}-\frac{1}{n} > 1$. Then an exclusionary equilibrium (one in which the entrant does not enter) exists if and only if

$$F_e + \frac{1}{1}-\frac{1}{n}(p_i^m - c_i)q(p_i^m) \quad (p_e^m - c_e)q(p_e^m) + \frac{1}{1}[(p_e - c_e)\,q(p_e) \quad (1 \quad)(n \quad 1)\,(p_e \quad c_i)\,q(p_e)] \tag{11}$$

Note that the di erence between the proposition above and Proposition 1 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 pro ts to the entrant and retailers associated with doing that. The expression in square brackets captures the entrant's ow pro t from exclusion, net of transfers to retailers needed to e ect the exclusion, together with the individual retailer's ow pro t in this regime.

In general, as one would anticipate, Condition (11) is a more stringent condition than the analogous Condition (4) in Proposition 1 where post-entry play is Nash. This follows since post-entry collusion between retailers and the entrant allow for greater industry pro ts that can be shared through an RPM scheme between the entrant and retailers. However, the constraints (8) and (9) on this collusion, together with potentially high xed costs that the entrant must pay to enter, suggest that there is still room for the incumbent to exclude the entrant. It is easily veri ed by example. For instance, taking the parameter values in Figure 3, where demand is $q = 10 \quad p$, $= 0:95$ and 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 $F_e \in [308:6; 360]$:[40]

5.2 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. 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 o 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

---

[40]

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.[41] 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):[42]

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

$$q_e \, [p(q)$$

$$\text{Collude} = q\,(p_e^m)\,(p_i^m - c_i) - (c_i - c_e)\,q\,(c_i)\,\frac{(p_i^m - c_i)}{(p_e^m - c_e)}$$

This bound is tight when $c_i = c_e$.

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

large share of any subsequent agreement would not be credible in the face of the temptation to deviate. However, prior to the xed cost being sunk, it can be cheap for the incumbent to exclude the entrant since the xed cost o sets much of the rent that the entrant might expect to earn post entry (and this reduces how much the entrant can a ord 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 e ective, 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.

5.3 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.[45] The retail cartel we have

than the post-entry, per-period pro t 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 pro ts 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 pro ts, and possibly more than if it had to use RPM as an exclusionary device.
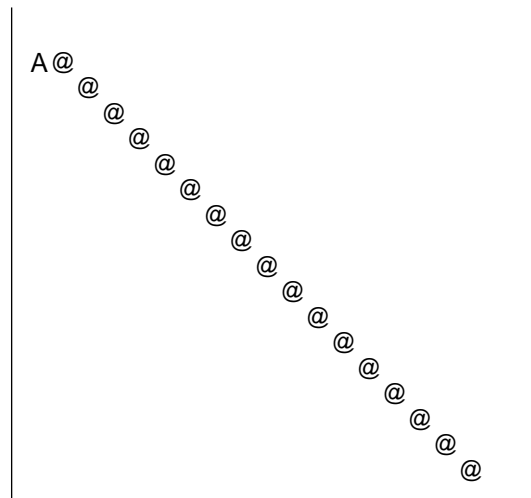
Hence, collusion by the retailers in the product market creates a series of problems that can work to the incumbent's advantage. Indeed, in the case illustrated here, it can remove the need for minimum RPM as an exclusionary device altogether. Instead, maximum RPM becomes useful for the incumbent to mitigate the distortion caused by the cartel, resulting in highly pro table exclusion.[46]

6 Di erentiation

Our baseline model is deliberately stark and simple in order to aid the presentation; how-

Following the logic of the baseline model, there is an equilibrium where the incumbent

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 $\delta \in [0, 1]$ 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 $A - (\delta - x)^2 - p_e$ from purchasing from the entrant at price p_e. We suppose that A is sufficiently high that the market is always covered by a high high

downstream differentiation ($\frac{d\pi_e^{post}}{d\theta} = 0$); retailers' post-entry profits are strictly increasing in the extent of differentiation ($\frac{d\pi_r^{post}}{d\theta} = 1$); accommodating profits are decreasing in the extent of differentiation ($\frac{d\pi_{ac}^m}{d\theta} < 0$); and the retailers' profits with only the incumbent and RPM can either be increasing or decreasing in the extent of differentiation ($\frac{d\pi_r^{RPM}}{d\theta} = \ \ < 0$ if $\theta > \frac{1}{4}$ and $\frac{d\pi_r^{RPM}}{d\theta} = \frac{1-2\theta}{2} > 0$ if $\theta < \frac{1}{4}$).

The directions of these comparative statics are intuitive. First, notice that π_e^{post} is independent of θ, 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 ($\frac{d\pi_r^{post}}{d\theta} = 1 > 0$); 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 $\theta = \frac{1}{4}$ 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 (14) is negligible; then, since $\frac{d\pi_e^{post}}{d\theta} = 0$, 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 $\theta < \frac{1}{4}$ and δ is small enough since $\frac{d\pi_{ac}^m}{d\theta} < 0$ and $\frac{d\pi_r^{RPM}}{d\theta} > 0$ for $\theta < \frac{1}{4}$.

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.

7 Policy implications

Antitrust practitioners and academic economists have long debated RPM (the OECD (2008) roundtable provides a wide-ranging discussion; Matthewson and Winter (1998) and Winter (2009) provide useful overviews).[52] Recognizing that \respected economic analysts . . . conclude that vertical price constraints can have procompetitive e ects" (p.1), the U.S. Supreme Court, in its 2007 **Leegin** ruling, overturned the 1911 **Dr. Miles** decision that viewed RPM as a **per se** antitrust violation. Similarly, in the E.U., the 2010 Guidelines on Vertical Restraints allow parties to plead an e ciency defense under Article 101(3) (see p.63, paragraph 223). These new antitrust regimes, therefore, require antitrust authorities and other interested parties to trade o the consumer and social bene ts of RPM against the possible harm. To this end, clearly articulated theories of harm are necessary.

It is interesting to note that both **Leegin** and the E.U. Guidelines on Vertical Restraints explicitly highlight that \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 \resale price maintenance may be implemented by a manufacturer with market power to foreclose smaller rivals" (p.64, paragraph 224). 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 Section 2 of this paper for exceptions). Thus, the absence of a formally-articulated theory has, perhaps, led to less attention to this cause than is warranted among some policy makers.[53]

In addition to reinforcing the idea that RPM can be used as a means of upstream exclusion, in presenting this formally-articulated theory of harm, we provide a counter-

---

[52] Our analysis, in line with much of the literature and policy discussion, is focused on minimum resale price maintenance. Extending the model to allow for asymmetric downstream rms can allow a role for maximum resale price maintenance (or price ceilings) in tandem with minimum resale price maintenance (price oors). For example, consider a downstream segmented market, where in one segment a monopolist dealer operates and in the other segment dealers are competitive. A price ceiling can overcome the usual double mark-up problem in the monopolized downstream market creating greater overall industry pro ts,

point to some of the screens that have been suggested for determining legitimate uses of RPM. Policy makers (such as in the OECD (2008) roundtable) and 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

Unfortunately, the above discussion suggests that many existing screens for the existence of harm deserve cautious application. Should concerns regarding exclusion be raised, the bound suggested in Section 4.2 might provide a useful first indication of whether the scope of possible exclusion is large enough to be problematic. This bound can be estimated by using standard methods (see Ackerberg et al. (2007)). The use of this bound may be helpful in much the same way that a simple Lerner index is helpful in the evaluation of market power. If there is little indication that exclusion would be large enough to matter in an economic sense, then existing screens are likely reasonable. Otherwise, the use of RPM by a manufacturer with considerable market dominance may warrant further inspection, where, perhaps, under current screens it would not.

8 Conclusion

This paper presents a formal model in which an incumbent manufacturer is able to exclude a more efficient entrant, by using minimum RPM to increase the profits of retailers in the event that they refuse to accommodate entry. This makes it prohibitively expensive for the potential entrant to enter. We formalize notions of exclusion due to RPM that have repeatedly surfaced in the economic literature, at least since the 1930s. The recent decision of the U.S. Supreme Court in **Leegin**, together with recent policy developments in Europe, has generated an increased need for theoretical and empirical work on how RPM may harm competition. This paper explores exclusion as a theory of harm by grounding it in a theoretical framework. This provides a foundation for further research in the area, both theoretical and empirical.

It is worth noting that, in our model, we explicitly restrict the use of lump-sum transfers. Indeed, only the entrant, via **R**, is able to use lump-sum transfers. In the case of the entrant, we do this since leaving the contract space unrestricted makes entry easier| if the entrant were unable to make such payments, then the range of exclusion would be greater (i.e., **R** = 0 by assumption). This makes our finding somewhat more robust. As is the case in all vertical contracting models, the choice of contract space is a difficult one, more guided by the application that is being explored than by a deep theory of contracting frictions. Here, our contracting space has been guided by a wish to understand the possible effects of minimum RPM.

Nevertheless, little in the model would change if the incumbent made lump-sum trans-

fers rather than shifting surplus via minimum RPM.[54] Indeed, the basic structure of the model suggests that exclusionary e ects could be generated by any pricing structure that has the e ect of transferring industry pro ts from the incumbent to the **n** retailers. To see this, simplify the environment so that the manufacturer and entrant have exactly the same marginal cost, **c**, and xed costs of entry are zero. In every other respect, keep things as they are in the baseline model, so that products are homogenous and retailers are perfect substitutes and bear no cost other than the wholesale price. Say the incumbent sets prices at or below the monopoly level such that it generates in pro ts each period. To get full access to the market, all the entrant needs is one retailer to accommodate. This means that the most that an entrant can pay an accommodating retailer is one period's worth of (since products are homogenous, by undercutting the incumbent the entrant can get all the industry pro ts in the period that he enters, and, due to Bertrand competition, prices go to marginal cost thereafter and everyone gets zero pro ts in future periods). The most that an incumbent would ever be able to transfer to a retailer to ensure exclusion is **=n** per period. Hence, for the exclusionary equilibrium illustrated in this paper to exist we would need, for each retailer, the net present value of payments from the incumbent to be equal to or to exceed the one-shot payo that an entrant could give. That is, we need

$$\frac{1}{(1-\quad)}\frac{1}{n} \qquad ,$$

which is satis ed when **n** (1) 1. So when = 0:95, **n** 20 is required for exclusion to be feasible. Note that the pro ts can be transferred to the retailers in many ways. In this paper, we focused on how RPM can be used to generate the transfer. However,

agreements may be able to be synthesized implicitly, by utilizing the promise of future rent transfers if exclusivity continues.

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

A   Omitted Proofs

Proof of Lemma 3

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

$$\max_{q_i; q} (p(q) - c_i) q_i; \tag{15}$$

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 $q(p_e^m)$.

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

$$q_i \geq q - \frac{(c_i - c_e) q(c_i)}{p(q) - c_e}: \tag{16}$$

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)

$$\max_q \frac{p(q) - c_i}{p(q) - c_e} (q(p - c_e) q$$

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

$$\left. \frac{@\tilde{\pi}(q)}{@q} \right|_{q \in [q(c_i); q(p_e^m)]} < 0; \tag{21}$$

where we have used the fact that, in this interval, $\ell_i'(q) < 0$ and $\ell_e'(q) \geq 0$. 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

$$q_i \geq \bar{q} \equiv \frac{(1-\lambda)\, q(p_e^m)\,[p_e^m - c_e] + \lambda\,(c_i - c_e)\, q(c_i)}{[p(q) - c_e]}. \tag{22}$$

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

$$\max_q \tilde{\pi}(q) \equiv \max_q \frac{\ell_i(q)}{\ell_e(q)}\,(\ell_e(q) - (1-\lambda)\,\pi_e^m - \lambda\,\pi_e^c) \tag{23}$$

and,

$$\frac{@\tilde{\pi}(q)}{@q} = \frac{\ell_i'(q)}{\ell_e(q)}\,(\ell_e(q) - (1-\lambda)\,\pi_e^m - \lambda\,\pi_e^c) + \frac{\ell_i(q)\,((1-\lambda)\,\pi_e^m + \lambda\,\pi_e^c)}{\ell_e(q)^2}\,\ell_e'(q); \tag{24}$$

further,

$$\left. \frac{@\tilde{\pi}(q)}{@q} \right|_{q=q(p_e^m)} < 0 \quad \text{and} \quad \left. \frac{@\tilde{\pi}(q)}{@q} \right|_{q \in [0; q(p_i^m)]} > 0; \tag{25}$$

noting that (22) implies $q_i = 0$ if $\ell_e(q) \leq (1-\lambda)\,\pi_e^m + \lambda\,\pi_e^c$.

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 (22) when the inequality binds and $q = q(p_e^m)$. To convert this conjecture to a proposition, it must be established that q_i is greatest when $q = q(p_e^m)$, as compared to any other point in the interval $[q(p_i^m); q(p_e^m)]$.

Setting (22) to bind and taking the derivative of q_i with respect to q yields

$$\frac{@q_i}{@q} = 1 + \frac{(1-\lambda)\,q(p_e^m)\,[p_e^m - c_i] + \lambda\,(c_i - c_e)\, q(c_i)}{[p(q) - c_e]^2}\,\frac{@p(q)}{@q}. \tag{26}$$

From the first-order condition of the entrant's monopoly pricing problem,   probl(is)-q1 0 0 1 168.

the case that in the interval $[q(p_i^m); q(p_e^m)]$,

$$\frac{@p}{@q} \geq -\frac{(p(q) - c_e)}{q}; \tag{27}$$

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

$$\frac{@\hat{q}}{@q} \geq 1 - \frac{(1-\lambda) q(p_e^m)[p_e^m - c_i] + \lambda(c_i - c_e) q(c_i)}{[p(q) - c_e] q}. \tag{28}$$

Hence, provided that the numerator is less than the denominator, $\frac{@\hat{q}}{@q} > 0$, which is su cient for $q = q(p_e^m)$ to be the largest $\hat{q}_i$ in the relevant range. Note that if the numerator is greater than the denominator, then, from (22), $\hat{q}_i = 0$.

Hence, $\hat{q}_i$ is greatest when $q = q(p_e^m)$, as compared to any other point in the interval $[q(p_i^m); q(p_e^m)]$. This is su cient to establish that the incumbent's pro t is bounded from above by the pro ts that accrue from setting $p = p_i^m$ and $\hat{q}_i$ equal to that implied by (22) when the inequality binds and $q = q(p_e^m)$. This upper bound on pro t is given by

$$\pi^{Collude} = q(p_e^m)(p_i^m - c_i) - \lambda(c_i - c_e) q(c_i) \frac{(p_i^m - c_i)}{(p_e^m - c_e)}. \quad \blacksquare$$

Proof of Lemma 4

Proof. First, consider maximal industry pro ts 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 $(p - c_i)^{\rho}\overline{A - p}$; 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 $A - 1 - 2$ 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 indi erent between the incumbent and entrant would be at distance x from the entrant where $A - (A - 1) - (\delta - x)^2 = A - p - x^2$; it follows that the entrant would choose a price to maximize $(p - c_e)(\frac{(A-1-p+\delta^2)}{2\delta} + 1 - \delta)$, which yields a maximized value equal to $\frac{1}{8}\frac{(A+2\delta - c_e - \delta^2 - 1)^2}{\delta}$, where this expression is valid as long as the consumer that is indi erent between the incumbent's and the entrant's goods is interior; this requires that $\frac{(A - 1 - \frac{1}{2}A + \delta + \frac{1}{2}c_e - \frac{1}{2}\delta^2 - \frac{1}{2} + \delta^2)}{2\delta} < \delta$ or $A < 3 - c_e - (2 - 3\delta)\delta$, but this is inconsistent with the

43

earlier restriction that $A > 3 + c_i$. It follows that the entrant and accommodating retailer would charge a price $A - 1 - {}^2$ and cover the market and $\pi^m_{ac} = A - 1 - {}^2 - c_e$.

Finally, we turn to consider π^{post}_e. 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 $w_e \leq w_i$.[56] Although we assume full market coverage, there remain two cases to consider:[57]

(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 $p_e = c_i - {}^2$ and earn profits of $\pi^{post}_e = c_i - c_e - {}^2$; 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 $A - w_i - x^2 = A - w_e - (\ - x)^2$, and so $x = \frac{(w_e - w_i + {}^2)}{}$

Lemma 6 In the downstream differentiation case when A is sufficiently high that the market is fully covered, then

$$\pi_r^{RPM} = \begin{cases} \frac{1}{2}(A - \theta^2 - c_i) & \text{if } \theta \geq \frac{1}{4} \\ \frac{1}{2}(A - (\frac{1}{2} - \theta)^2 - c_i) & \text{if } \theta < \frac{1}{4} \end{cases}, \quad p_e^{post} = c_i - c_e,$$

$$\pi_r^{post} = \theta, \text{ and } \pi_{ac}^m = \begin{cases} 8 \\ \frac{1}{16}\frac{(A + (2\theta - \theta) - c_e)^2}{A - \theta - (2 + \theta) - c_e} & \text{if } \theta \geq \frac{1}{4} \text{ and } \theta^2 + 6\theta + c_e > A \\ A - \theta - (2 + \theta) - c_e & \text{if } \theta \geq \frac{1}{4} \text{ and } \theta^2 + 6\theta + c_e < A \\ \frac{1}{256}(4A + \end{cases}$$

most consumer indi erent; i.e., he will set p such that A   p   (+ $\frac{1}{}$

[19] Gammelgaard, Soren (1958), **Resale Price Maintenance**, Project No. 238, European Productivity Agency, Organisation for European Economic Cooperation, Paris.

[20] Gilligan, Thomas W. (1986), The Competitive Eﬀects of Resale Price Maintenance, **RAND Journal of Economics**, 17(4), 544-556.

[21] Green, Edward and Robert Porter (1984), Noncooperative Collusion under Imperfect Price Information, Econometrica, 52(1), 87-100.

[22] Harrington, Joseph E. Jr (1991), The Determination of Price and Output Quotas in a Heterogenous Cartel, **International Economic Review**, 32(4), 767-792.

[23] Hersch, Phillip L. (1994), The Eﬀects of Resale Price Maintenance on Shareholder Wealth: The Consequences of Schwegmann, **Journal of Industrial Economics**, 42(2), 205-216.

[24] Ippolito, Pauline (1991), Resale Price Maintenance: Empirical Evidence from Litigation, **Journal of Law and Economics**, 34(2), 263-294.

[25] Ippolito, Pauline and Thomas R. Overstreet (1996), Resale Price Maintenance: An Economic Assessment of the Federal Trade Commission's Case against Corning Glass Works, **Journal of Law and Economics**, 39(1), 285-328.

[26] Jullien, Bruno and Patrick Rey (2007), Resale Price Maintenance and Collusion, **RAND Journal of Economics**, 38(4), 983-1001.

[27] Klein, Benjamin and Kevin Murphy (1988), Vertical Restraints as Contract Enforcement Mechanisms, **Journal of Law and Economics**, 31(2), 265-297.

[28] Mailath, George and Larry Samuelson (2006), **Repeated Games and Reputations: Long Run Relationships**, Oxford University Press, Oxford.

[29] Marvel, Howard (1994), The Resale Price Maintenance Controversy: Beyond the Conventional Wisdom, **Antitrust Law Journal**, 63(1), 59-92.

[30] Marvel, Howard and Stephen McCaﬀerty, (1984), Resale Price Maintenance and Quality Certiﬁcation, **Rand Journal of Economics**, 15(3), 346-59.

[31] Marvel, Howard and Stephen McCaﬀerty (1985), The Welfare Eﬀects of Resale Price Maintenance, **Journal of Law and Economics**, 28, 363-79.

48

[32] Marx, Leslie and Greg Sha er (2004), Rent Shifting, Exclusion, and Market-Share Discounts, Working Paper.

[33] Miklos-Thal, Jeanine (2010) Optimal Collusion under Cost Asymmetry, **Economic Theory**, forthcoming; online version at http://dx.doi.org/10.1007/s00199-009-0502-9

[34] OECD (2008) **Policy Rountables: Resale Price Maintenance**

[35] Matthewson, Frank and Ralph Winter (1998) The Law and Economics of Resale Price Maintenance, **Review of Industrial Organization**, 13, pp. 57-84.

[36] Ordover, Janusz A., Garth Saloner and Steven C. Salop (1988), Equilibrium Vertical Foreclosure, **American Economic Review**, 80, pp. 127-42.

[37] Ornstein, Stanley and Dominique M. Hassens (1987), Resale Price Maintenance: Output Increasing or Restricting? The Case of Distilled Spirits in the United States, **Journal of Industrial Economics**, 36(1), 1-18.

[38] Overstreet, Thomas R. (1983), **Resale Price Maintenance: Economic Theories and Empirical Evidence**, Bureau of Economics Sta Report to the Federal Trade Commission.

[39] Posner, Richard A. (2001) **Antitrust Law: 2nd Edition** University of Chicago Press.

[40] Rasmusen, Eric, Mark Ramseyer and John Wiley (1991), Naked Exclusion, **American Economic Review**, 81(5), 1137-1145.

[41] Rey, Patrick and Thibaud Verge (2004), Bilateral Control with Vertical Restraints, **RAND Journal of Economics**, 35(4), 728-746.

[42] Rey, Patrick and Thibaud Verge (2009), Resale Price Maintenance and Interlocking Relationships, **Journal of Industrial Economics**, forthcoming.

[43] Rey, Patrick and Thibaud Verge (2008), \Economics of Veritical Restraints", Ch. 9 in **Handbook of Antitrust Economics**, Paolo Buccirossi (ed.), MIT Press, Boston.

[44] Rey, Patrick and Jean Tirole (2007), \A Primer on Foreclosure", Ch. 33 in **Handbook of Industrial Economics, Volume 3**, Mark Armstrong and Rob Porter (eds), North Holland, Amsterdam.

[45] de Roos, Nicolas (2006), Examining models of collusion: The market for lysine, **International Journal of Industrial Organization**, 24(6), 1083-1107.

[46] Ross, Tom (1992), Cartel Stability and Product Di erentiation, **International Journal of Industrial Organization**, 10(1), 1-13.

[47] Rubinstein, Ariel (1986), Finite Automata Play the Repeated Prisoner's Dilemma, **Journal of Economic Theory**, 39 , 83-96.

[48] Segal, Ilya and Michael Whinston (2000), Naked Exclusion: Comment, **American Economic Review**, 90(1), 296-309.

[49] Sha er, Greg (1991), Slotting Allowances and Resale Price Maintenance: A Comparison of Facilitating Practices, **RAND Journal of Economics**, 22(1), 120-135.

[50] Simpson, John and Abraham Wickelgren (2007), Naked Exclusion, E cient Breach and Downstream Competition, **American Economic Review**, 97(4), 1305-1320.

[51] Telser, Lester (1960), Why Should Manufacturers Want Fair Trade?, **Journal of Law and Economics**, 3, 86-105.

[52] Tirole, Jean (1988), **The Theory of Industrial Organization**, MIT Press, Cambridge.

[53] Whinston, Michael D. (2006), **Lectures on Antitrust Economics**, MIT Press, Cambridge.

[54] Winter, Ralph A. (2009), Presidential Address: Antitrust restrictions on single- rm strategies, **Canadian Journal of Economics**, 42, pp. 1207-1239.

[55] Yamey, Basil (1954), **The Economics of Resale Price Maintenance**, Sir Isaac Pitman & Sons, Ltd., London.

[56] Yamey, Basil (1966), Introduction: The Main Economic Issues, Ch.1 in **Resale Price Maintenance: A Comparative American-European Perspective**, Basil Yamey (Ed.), AdlineTransaction, Chicago.

[57] Zerbe, Richard (1969), The American Sugar Re nery Company, 1887-1914: The Story of a Monopoly, **Journal of Law and Economics**, 12(2), 339-375.