Vertical control of a distribution network – an empirical analysis of magazines

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Abstract

How does an upstream firm determine the size of its distribution network? And what is the role of vertical restraints? To address these questions we develop two empirical models of outlet entry. In our benchmark coordinated entry model, the upstream firm sets market-specific wholesale prices, so that it can implement the first-best number of outlets in every market. In a more realistic restricted/free entry model, the upstream firm can only set a uniform wholesale price, a common practice in many sectors. As a second-best solution, the upstream firm may want to directly restrict entry in markets where business stealing (encroachment) is high, and allow free entry elsewhere. We apply the model to magazine distribution, and subsequently assess the profitability of alternative vertical restraints. A ban on restricted licensing would reduce profits by only a limited amount, so that the business rationale for restricted licensing should not be sought in the prevention of encroachment. Furthermore, market-specific wholesale prices would implement the first-best, but the profit increase would be small, providing a rationale for the commonly observed uniform wholesale prices. Finally, uniform franchise fees are much less effective than a uniform wholesale prices to cope with local market differences.

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1 Introduction

A firm deciding on the size of its distribution network faces the following trade-off. On the one hand, additional retail outlets lead to greater geographic coverage and hence market expansion. On the other hand, they also raise the fixed costs of distribution. The theory of vertical restraints shows how a non-integrated upstream firm can resolve this trade-off without a need to directly control the size of its distribution network. Vertical restraints in the form of price instruments or "payment schemes" are in principle sufficient to achieve the optimal number of retail outlets. In particular, for a given (optimal) retail price, it is sufficient to either set a suitable linear wholesale price or a fixed franchise fee. This serves to both achieve the optimal number of retail outlets under free entry, and to transfer all profit rents to the upstream firm.

Since economic theory suggests that payment schemes are sufficient to achieve the optimal number of retail outlets, it is puzzling why in practice firms often directly control the size of their distribution networks, through restricted licensing policies such as refusal to sell. In this paper we investigate a simple possible explanation, i.e. the fact that payment schemes may be imperfect. In particular, demand and cost conditions may vary widely across local markets, yet firms often follow a policy of uniform wholesale prices and franchise fees, unrelated to the local circumstances. Furthermore, franchise fees are often a small source of upstream revenues and may thus not even be sufficient to cover the upstream firm's own fixed costs of dealing with a retail outlet. Both facts (uniform payment schemes and low fixed fees) have been extensively documented since at least Bhattacharyya and Lafontaine (1995). Applying Rey and Vergé's (2008) classification of vertical restraints, if customized "payment schemes" cannot easily be implemented, then "provisions limiting the parties rights" may form a second-best alternative to control the number of retail outlets across local markets.

To assess the role of restricted licensing in the presence of imperfect payments schemes, we provide a theoretical framework and apply it with an empirical analysis of magazine distribution. In many countries newspapers and magazines are distributed through a network of small, specialized retail outlets or "press shops". Publishers do not grant exclusive territories, but they restrict the number of licenses after a screening process of new applications. This practice has received the attention of competition policy authorities. Most notably, in 1993 the U.K. Monopolies and Mergers Commission (MMC, now Competition Commission) undertook a detailed investigation to assess the publishers' refusal to supply practices. It concluded that a ban on restricted licensing would not be warranted, arguing that this could lead to a surge of new outlets and sharp increases in distribution costs. However, the MMC' s investigation did not offer a satisfying explanation why publishers would want to refuse to supply in the first place, and why they would not simply use wholesale prices to influence the number of retail outlets under free entry. More recently, in 2008 the U.K.'s Office of Fair Trading again looked into the licensing policies of newspaper and magazine publishers, yet the incentives for licensing are still not well understood. We use the magazine case in the U.K. as a motivating example, but our actual empirical analysis is based on the Belgian magazine market, for which we obtained a detailed data set and which is similar in many respects.

We start from a simple theoretical framework where an upstream firm cannot charge a sufficiently high fixed franchise fee to cover all of its fixed distribution costs. The upstream firm may in principle use resale price maintenance in combination with a linear per-unit wholesale fee: this achieves both the optimal number of retail outlets under free entry and extracts all profit rents. There would be no need for restricted licensing. The optimal wholesale fee is such that the variable profit gains of market expansion are just balanced against the fixed costs from an additional retail outlet. However, such a per-unit wholesale fee would only work if it can be customized to the local market conditions, most importantly the extent of market expansion. We focus on the common case where the upstream firm is constrained to charge a uniform wholesale fee across markets. The optimal wholesale fee then still involves the trade-off between market expansion and fixed costs, but only at the aggregate level across all markets. At the level of each individual market, the upstream firm may now have an incentive to restrict entry. We show this is the case in those markets where the market expansion effects are too small to compensate for the upstream firm's fixed cost for an additional retail outlets. Put differently, if the upstream firm cannot set a market-specific wholesale price, it may want to directly restrict the number of licenses in those markets where business stealing (or "encroachment") is too strong relative to its fixed costs.

Based on this theoretical framework, we introduce an empirical model to explain the number of retail outlets as observed in a cross-section of local markets. The model consists of two equations. First, the revenue equation describes total revenues as a function of the number of retail outlets, after controlling for market demographics. This equation enables us to assess to which extent additional outlets lead to market expansion or rather business stealing. Second, the entry equation describes the equilibrium number of retail outlets per market. We consider two possible entry models. In both models the upstream firm maximizes its own profits subject to a non-negativity constraint on the retail outlets' profits. The models differ in the instruments available to the upstream firm. Under differentiated, market-specific wholesale prices, we obtain a model of *coordinated entry*. In each market the number of retail outlets maximizes the sum of the upstream and downstream profits, trading-off market expansion against fixed costs. This model, which serves as our simple benchmark for comparison, results in the first-best solution (from the perspective of the firms). In contrast, under uniform wholesale prices, we obtain a more realistic model where markets are in one of two regimes: *restricted entry or free entry.* The upstream firm prefers to restrict entry in markets where market expansion is too low (i.e. "encroachment" is too high), and allows free entry in markets where market expansion is sufficiently high (limited encroachment). This model of restricted licensing yields a second-best outcome when price instruments are limited.

The entry equation serves two purposes. First, it provides reasonable exclusion restrictions (mainly market size) to estimate the extent of market expansion from entry. Second, it enables us to uncover the fixed costs per outlet, as well as the share of the fixed costs borne by the upstream firm. The estimated market expansion effect and fixed cost information form the basis for our policy counterfactuals where we assess the effects of alternative vertical restraints.

Our main empirical findings can be summarized as follows. We consider the coordinated entry model as a simple benchmark and favour the restricted/free entry model since it is more realistic and consistent with the reported uniform wholesale price contracts in the magazine industry. We find evidence that additional entry causes significant market expansion, but also business stealing or "encroachment". The outlet elasticity in a representative market is 0.29: a 10% increase in the number of outlets raises total revenues by 2.9% but reduces revenues per outlet by 7.1%. More importantly, we find substantial variation in the extent of market expansion/business stealing across markets. The outlet elasticity ranges from 0.13 in markets with a high outlet density to 0.46 in markets with a low outlet density. This variation across markets is responsible for a refusal to supply practice in almost 50% of the markets, i.e. in those markets where market expansion is too low to justify the fixed costs borne by the upstream firm.

We subsequently perform policy counterfactuals to assess the role of vertical restraints. If the upstream firm would set a customized, market-specific wholesale price to implement the first-best, this would raise profits by only 2.3%. Hence, the uniform wholesale price policy performs relatively well as a second-best instrument from the perspective of the upstream firm. Furthermore, a government ban on restricted licensing would raise the number of outlets by about 15%, but would reduce the upstream firm's profits by about 2.3%. The drop in profits is so small because the upstream firm simultaneously raises its wholesale price as a way to indirectly discourage entry. Indeed, if we hold the wholesale price constant, a ban on restricted licensing would raise the number of outlets by almost 80% and reduce profits by 7%. We finally extend the counterfactuals to consider the role of fixed franchise fees. Uniform franchise fees are a much less effective instrument than uniform wholesale prices to cope with differing local market conditions. Furthermore, fixed franchise fees require a much higher degree of differentiation than wholesale prices to implement the first-best.

Taken together, these results explain why an upstream firm may often use uniform wholesale prices despite differing local market conditions. Furthermore, the results indicate that the business rationale for restricted licensing is not the prevention of encroachment, since a uniform wholesale price can already do this job reasonably well. Hence, at least in our application, other motivations for restricted licensing appear more relevant, such as the maintenance of quality standards.

Contribution to the literature Our analysis contributes to the theoretical and empirical literature on vertical restraints, the empirical entry literature and to an understanding of the magazine market.

First, the theoretical literature shows how upstream firms can achieve the first-best retail price and the number of retail outlets (and extract all profits), by using any pair of the following three price instruments: resale price maintenance (RPM), a linear wholesale price or a fixed fee; see Dixit (1983), Gallini and Winter (1983), Perry and Groff (1985) and Shaffer (1995).[1,2] None of these papers explain why firms would want to restrict licensing, since payment schemes are sufficient to obtain the first-best. In our setting, firms do not have sufficient control to set differentiated wholesale fees and to set a fixed fee that is sufficient to cover their fixed costs. Firms may then want to restrict the number of entrants in those markets where market expansion effects are too low, i.e. where encroachment or business stealing is too high to justify the fixed costs from additional retail outlets.

A natural question is why firms do not have sufficient control to set customized payment schemes per local market. Bhattacharyya and Lafontaine (1995) use a large sample of different franchisors to document that most indeed use uniform wholesale prices and that fixed fees are only a modest part of their revenues. Both survey evidence and theoretical models provide explanations. According to Lafontaine's (1992) detailed survey, franchisors mainly adopt uniform contracts because of consistency and fairness towards their franchisees (73%) and because of a lack of benefits to adapt to the local circumstances (50%), and less so because of administrative (27%) or legal reasons (22%). Theoretical models explain uniform

[1]Gould and Preston (1965) provide an early analysis on RPM and the "outlets hypothesis". Mathewson and Winter (1984) provide a richer framework to analyse how alternative vertical restraints can also achieve the optimal service level, in addition to the optimal retail price and number of outlets.

[2]There is also an interesting theoretical literature on how competing upstream firms choose the number of franchises as a strategic tool. While early work suggested that firms may invest in many franchises to strategically commit to a high output, Rysman (2001) shows that (with homogeneous goods) firms choose a single franchise, and commit to a high output by using an appropriate two-part tariff.

contracts because of direct costs (Holmstrom and Milgrom, 1987), indirect opportunism costs (McAfee and Schwartz, 1994) or limited benefits from differentiated pricing (Bhattacharyya and Lafontaine, 1995).[3] Our own results mainly point to the limited benefits from differentiated wholesale pricing (in particular if combined with restricted licensing).

Second, the empirical literature on vertical restraints is still small, and has not looked at the question how vertical restraints can control the number of outlets in a distribution network. Instead, most of this literature focused on the question how vertical restraints can influence retail prices and competition; see Lafontaine and Slade (2007) for an overview of the empirical literature on vertical restraints. A main difficulty in empirical work is that wholesale tariffs are typically difficult to observe. Brenkers and Verboven (2006), Villas-Boas (2007) and Bonnet and Dubois (2010) compare alternative pricing models of vertical restraints. In the spirit of this literature we show how one may compare alternative entry models of vertical restraints.

Third, we build on the previous literature on market-level entry models. Ferrari and Verboven (2010) provide a concise overview of models with alternative assumptions regarding the entry process. Bresnahan and Reiss (1991) introduced a model of free entry, where firms enter if and only if variable profits exceed fixed costs. Berry and Waldfogel (1999) add a revenue equation to the free entry model to draw inferences about fixed costs. Ferrari, Verboven and Degryse (2009) modify the free entry model to coordinated entry, where firms choose the number of entrants to maximize industry profits. Our model with uniform wholesale prices is a further extension of the entry process, where each market is in one of two possible regimes: restricted or free entry.

Finally, our paper relates to other economic literature on the magazine market. This work has emphasized the potential two-sidedness of the market, i.e. advertizers value readers and readers value or dislike advertizers. Most theoretical work on two-sided markets has assumed that readers dislike advertizing (e.g. Anderson and Coate, 2005). However, recent empirical work indicates that readers may value advertizing (Kaiser and Wright, 2006) or may on balance be ad neutral (Kaiser and Song, 2009).[4] Since the role of advertizing is not the main focus of our paper, we do not attempt to resolve the debate on whether readers value or dislike advertizing, and instead follow a simplified approach. We assume a one-sided market with network externalities, where advertizers value readers, but readers do not value (nor

[3] Bhattacharyya and Lafontaine (1995) use a model of two-sided moral hazard to show that the optimal sharing rule between the franchiser and franchisee is independent of the scale of operation (arguably one of the most important sources of variation in local market conditions).

[4] Kaiser and Song (2009) look at several German magazines. They find that consumers tend to appreciate informative ads and dislike persuasive ads, suggesting ads may on balance be neutral.

dislike) advertizing. This leads to a simplified model where advertizing enters as a negative marginal cost component in the upstream firm's profit function.

The outline of the paper is as follows. Section 2 develops the theoretical framework. In Section 3 we provide the econometric model. Section 4 presents the industry background and data for our application. The empirical results are discussed in Section 5. Section 6 concludes.

2 Theoretical model

We present a theoretical model explaining how the upstream firm controls the number of its downstream retail outlets. We consider a multi-market setting where the upstream firm may not have sufficient price instruments at its disposal. First, it charges a fixed franchise fee that may not be sufficient to cover its own fixed costs of dealing with the retail outlets. Second, it may not be able to charge market-specific wholesale prices to obtain the first-best outcome. It would then set a second-best uniform wholesale fee, requiring the need to restrict entry in markets where business stealing is too strong to compensate for the fixed costs. In line with the institutional features of magazine distribution, we take as given the presence of resale price maintenance (RPM).

After introducing the framework, we first present the benchmark coordinated entry model, where the upstream firm can set market-specific wholesale prices to obtain the first-best number of retailers. We then present the more realistic restricted/free entry model, where the upstream firm can only set a uniform wholesale price and restricts entry in some markets to obtain the second-best outcome.

2.1 Framework

An upstream firm ("publisher") sells magazines to consumers through a network of downstream retail outlets ("press shops"), spread across a set of local markets i, $i = 1 \cdots M$. The upstream firm uses RPM to control a uniform retail cover price p. We will take this retail price as given, and hence suppress it as an argument from the demand function. We instead focus on how the number of retail outlets N_i affects demand. Total demand in market i is $Q_i(N_i)$, and demand per retail outlet is $q_i(N_i) \equiv Q_i(N_i)/N_i$. So both total demand and demand per outlet depend on the number of outlets. Define the outlet elasticity as the elasticity of total demand with respect to N_i, i.e. $\varepsilon_i(N_i) \equiv \frac{\partial Q_i(N_i)}{\partial N_i}\frac{N_i}{Q_i}$. We make the following two main assumptions on the effects of N_i on demand, holding price constant.

Assumption 1. Market expansion

$$Q_i'(N_i) \geq 0 \text{ or } \varepsilon_i(N_i) \geq 0$$

Assumption 2. Business stealing or encroachment

$$q_i'(N_i) \leq 0 \text{ or } \varepsilon_i(N_i) \leq 1$$

According to Assumption 1, entry implies increased product diversity and hence (weakly) raises total demand (holding prices constant). According to Assumption 2, products are substitutes so that entry lowers the demand per outlet. For example, the CES model used in Gallini and Winter (1983) or Perry and Groff (1985) satisfies these assumptions. Assumptions 1 and 2 amount to saying that the outlet elasticity $\varepsilon_i(N_i)$ lies between zero and one. As such, $\varepsilon_i(N_i)$ measures the extent of market expansion versus business stealing following entry: if $\varepsilon_i(N_i)$ is close to zero, there is mainly business stealing (close substitutes) and if $\varepsilon_i(N_i)$ is close to one, there is mainly market expansion (independent products). We will also assume that total demand is concave, $Q_i''(N_i) < 0$. In our empirical analysis we do not impose these assumptions, but we will check whether they are satisfied at the estimated parameters.

The upstream firm charges a linear wholesale price w_i. Our benchmark model will allow w_i to vary across markets; our alternative model will consider the case where w_i is uniform, $w_i = w$ for all i. The variable cost per unit sold is c, identical across markets and consisting of a part borne by the upstream firm (c^U) and a part borne by the downstream retailer (c^D), so $c = c^U + c^D$. The total fixed distribution cost per outlet is F_i, and may vary across markets. It consists of a part F_i^U borne by the upstream firm and a part F_i^D borne by the downstream firm, so that $F_i = F_i^U + F_i^D$. The fixed costs F_i^U and F_i^D are defined as net of any possible (market-specific) fixed fee paid by the downstream to the upstream firm.[5] In principle, F_i^U may be zero or negative (if the upstream firm charges a high fixed franchise fee), but in practice we do not expect this since fixed franchise fees are very small. We assume here that fixed costs per outlet are independent of the number of outlets in the market, but will generalize this in the empirical analysis to allow for (dis)economies of density. It is convenient to define $\delta_i = F_i^U / \left(F_i^U + F_i^D\right)$, i.e. the share of the fixed costs that is borne by the upstream firm, which may vary across markets.

The upstream firm's profit in market i is:

$$\Pi_i^U(N_i, w_i) = \left(w_i - c^U\right) Q_i(N_i) - \delta_i F_i N_i. \tag{1}$$

[5] So $F_i^U = \widetilde{F}_i^U - A_i$ and $F_i^D = \widetilde{F}_i^D + A_i$, where $\widetilde{F}_i^U$ and $\widetilde{F}_i^D$ are the real upstream and downstream fixed costs, and A_i is a fixed fee paid by the upstream to the downstream firm.

A downstream retailer's profit in market i is:[6]

$$\pi_i^D(N_i, w_i) = \left(p - w_i - c^D\right) \frac{Q_i(N_i)}{N_i} - (1 - \delta_i)F_i. \tag{2}$$

Total profit in the market is the sum of the upstream firm's and the downstream retailers' profit, and does not depend on the wholesale price:

$$\begin{aligned} \Pi_i(N_i) &= \Pi_i^U(N_i, w_i) + N_i \pi_i^D(N_i, w_i) \\ &= (p - c)\, Q_i(N_i) - F_i N_i. \end{aligned} \tag{3}$$

The upstream firm faces the following profit maximization problem

$$\max_{N_i, w_i} \sum_{i=1}^{M} \Pi_i^U(N_i, w_i) \quad \text{subject to} \quad \pi_i^D(N_i, w_i) \geq 0, \tag{4}$$

i.e. for each market i the upstream firm has to choose the optimal N_i and w_i to maximize total profits across markets. To solve maximization problem (4), we distinguish between two cases: the case of a market-specific wholesale price w_i, and the case of a uniform wholesale price w.[7]

2.2 Market-specific wholesale price: coordinated entry

Suppose the upstream firm can set a market-specific wholesale price w_i. In each market i, the upstream firm would set the highest w_i such that the downstream retail outlet's profit constraint is binding, i.e. $\pi_i^D(N_i, w_i) = 0$. Using (2), this requires setting w_i such that

$$\left(p - w_i - c^D\right) \frac{Q_i(N_i)}{N_i} = (1 - \delta_i)F_i. \tag{5}$$

Solving for w_i and substituting this into the upstream firm's profits (1) gives $\Pi_i^U(N_i, w_i^*) = \Pi_i(N_i)$. Hence, the upstream firm's maximization problem (4) simplifies to choosing the first-best N_i to maximize industry profit $\Pi_i(N_i)$ in each market i, and then extracting all rents through the wholesale price w_i. Using (3), the optimal N_i should satisfy the following first-order condition:

$$(p - c)Q_i'(N_i) = F_i, \tag{6}$$

[6] Note that a retailer may sell other products in addition to the upstream firm's magazines, e.g. newspapers, tobacco and lottery products. The retailer's fixed cost $(1 - \delta)F_i$ can therefore be interpreted as the retailer's total fixed cost of operating the outlet minus revenues from other products sold by the retailer.

[7] The upstream firm may also influence profits through its fixed franchise fee (market-specific or uniform). This amounts to endogenizing δ_i. We will consider this in the counterfactual analysis.

or in elasticity form:

$$(p-c)\varepsilon_i(N_i)\frac{Q_i(N_i)}{N_i} = F_i. \tag{7}$$

Equation (7) is the basic coordinated entry condition, which we will take to the data under the assumption of a market-specific wholesale price w_i. It describes the first-best number of retail outlets and reflects the basic trade-off between market expansion and fixed costs. On the one hand, an additional retail outlet increases access to consumers and therefore raises demand. On the other hand, it also involves additional duplicated fixed costs.

It is instructive to derive the share of the markup as captured by the downstream retailer. Define the upstream firm's share of the markup by $\omega_i = \left(w_i - c^U\right)/(p-c)$, so that the downstream firm's share is $1-\omega_i = \left(p - w_i - c^D\right)/(p-c)$. Dividing both sides of (5) by (7) and substituting $1-\omega_i$, we obtain

$$1-\omega_i = (1-\delta_i)\varepsilon_i(N_i). \tag{8}$$

Intuitively, the upstream firm pays a high percentage retail margin if the marginal retail outlet creates a lot of market expansion (high ε_i) and if the downstream firm bears a high fraction of the fixed cost (low δ_i). Note that this condition relates to Gallini and Winter's (1983) condition, $\frac{p-w-c^D}{p} = \varepsilon\eta$, where η is the price elasticity of market demand. In their formula the upstream firm has no fixed costs ($\delta = 0$) and the retail price is at the optimal level, $\frac{p-c}{p} = \frac{1}{\eta}$. See also Perry and Groff (1985).

Equation (8) provides an alternative theory to Bresnahan and Reiss' (1985) theory for the fraction of variable profits captured by the retailer. In their model, retail prices are endogenous and the number of downstream firms is fixed. The fraction of the margin captured by the retailer is determined by the curvature of demand in their model, instead of by the outlet elasticity as in our model.

2.3 Uniform wholesale price: restricted/free entry

Now suppose the upstream firm can only set a uniform wholesale price w (instead of a market-specific wholesale price w_i). To solve the constrained optimization problem (4), we first consider the optimal choice of N_i in each market i for a given uniform w, and then consider the optimal uniform wholesale price w.

For a given uniform w, the solution for N_i in market i is one of the following possibilities: (i) $\frac{\partial \Pi_i^U(N_i,w)}{\partial N_i} = 0$ and $\pi_i^D(N_i,w) > 0$, or (ii) $\frac{\partial \Pi_i^U(N_i,w)}{\partial N_i} > 0$ and $\pi_i^D(N_i,w) = 0$. If a market is in the first regime, the downstream retailers' profit constraints are nonbinding and the upstream firm finds it optimal to restrict entry to maximize its upstream profits in the market. The retailers who enter all earn positive rents. If a market is in the second regime, the retailers' profit constraints are binding and the upstream firm allows entry as long as this is profitable to the retail outlets. The upstream firm would prefer that more retailers enter since its marginal profits are still positive, but this is not profitable for the retailers.

The solution can be written more compactly as

$$\min\left\{\frac{\partial\Pi_i^U(N_i,w)}{\partial N_i},\pi_i^D(N_i,w)\right\}=0. \tag{9}$$

If the first part in braces is lower, the market will be characterized by restricted entry; if the reverse is true, there will be free entry. Substituting (1), (2) and the upstream firm's share of the markup $\omega=\left(w-c^U\right)/\left(p-c\right)$, we can write (9) as

$$(p-c)\min\left\{\frac{\omega}{\delta_i}\varepsilon_i(N_i),\frac{1-\omega}{1-\delta_i}\right\}\frac{Q_i(N_i)}{N_i}=F_i. \tag{10}$$

Equation (10) is the basic restricted/free entry condition, to be taken to the data under the assumption of a uniform wholesale price w. Parallel to the earlier condition (7), it describes the second-best number of retail outlets for a given uniform wholesale price w. It reflects a similar trade-off between market expansion and fixed costs. Because the upstream firm does not set a market-specific wholesale price, there is no first-best outcome and each market is characterized by either restricted or free entry. One can easily verify from (10) that market i is characterized by a restricted entry regime (left part in braces lower) if and only if

$$\varepsilon_i(N_i)<\frac{1-\omega}{\omega}\frac{\delta_i}{1-\delta_i}. \tag{11}$$

Intuitively, the upstream firm wants to restrict entry in those markets where additional entry creates insufficient market expansion or where it earns a too small wholesale margin (ω) to compensate for its share of fixed costs (δ_i). In other markets the upstream firm allows retailers to enter freely (although it would prefer even more retailers to enter).

The discussion so far considered the optimal choice of N_i for a given uniform w. One can also derive the optimal w, for example by setting up the Lagrangian for the upstream firm's program (4). It is straightforward to see that the retailers' profit constraint must be binding in at least one market, i.e. in at least one market there is free entry and no restricted entry. Otherwise, the upstream firm can raise the uniform w further without losing retailers in any market, so that the upstream profits strictly increase. Furthermore, it is possible that the retailers' profit constraints are binding in *all* markets, so that there would be free entry everywhere. This would happen if $\delta_i\leq 0$, since then (11) is not satisfied for any market. Intuitively, if $\delta_i\leq 0$, the upstream firm receives a sufficiently high fixed fee to cover its fixed costs, so it would never restrict entry (even in the absence of market expansion). Free entry in all markets may also happen if δ_i is positive but sufficiently small. In contrast, if δ_i is sufficiently large and $\varepsilon_i(N_i)$ shows sufficient variation across markets, some markets will be characterized by free entry and other markets by restricted entry, depending on whether (11) is satisfied. Finally, note that if both δ_i and $\varepsilon_i(N_i)$ do not vary across markets, the uniform wholesale fee is in fact optimal. We are then back to the first-best coordinated entry solution, where the free entry condition holds in every market.

3 Econometric model

3.1 Overview and identification

In our empirical application we have a cross-section of local markets, $i = 1, \cdots, M$, and we aim to draw inferences about the extent of market expansion and fixed costs. On the demand side, we observe total revenues rather than demand, i.e.

$$R_i = R_i(N_i) = pQ_i(N_i). \tag{12}$$

On the supply side, this requires modifying the basic first-order conditions (7) and (10) for the determination of N_i under coordinated or restricted/free entry.

Defining the overall upstream and downstream markup $\mu = (p - c)/p$, we can rewrite the first-order condition (7) under a coordinated entry as

$$\mu\varepsilon_i(N_i)\frac{R_i(N_i)}{N_i} = F_i. \tag{13}$$

Similarly, we can rewrite the basic first-order condition (10) under restricted/free entry as

$$\mu \min\left\{\frac{\omega}{\delta_i}\varepsilon_i(N_i), \frac{1-\omega}{1-\delta_i}\right\}\frac{R_i(N_i)}{N_i} = F_i. \tag{14}$$

We thus have a simultaneous model for total market revenues R_i, given by (12), and for the number of retail outlets N_i, as given by either (13) or (14). This model can be estimated based on a cross-section of local markets.

Before turning to the details of the econometric specification, it is useful to discuss identification issues regarding μ and ω_i (or ω). First consider the coordinated entry model, where the upstream firm sets a market-specific wholesale price w_i. Given an estimate of the outlet elasticity $\varepsilon_i(N_i)$ from the revenue equation and outside information on the markup μ, the entry equation (13) enables us to uncover the fixed costs F_i. Identification of the fraction of the fixed costs borne by the upstream firm δ_i is not possible from (13). However, we can in principle make use of the optimal wholesale price condition (8) to infer δ_i from information on the upstream firm's markup share ω_i (if observed).

Now consider the restricted/free entry model, where the upstream firm sets a uniform wholesale price w. The identification issues can be explained with a parallel reasoning. Suppose we have an estimate of $\varepsilon_i(N_i)$ from the revenue equation and can make use of outside information on both μ and ω. The entry equation (10) then enables us to uncover both the fixed costs F_i and the fraction of fixed costs borne by the upstream firm δ_i. This seems to suggest we now need more outside information (also on ω). However, as we explain in more detail below, we can set ω (or w) such that it is optimal, i.e. maximizes the upstream firm's profits (4).

In sum, to estimate either the coordinated or the restricted/free entry model, we will need outside information on μ and make use of the optimality condition for the wholesale price to retrieve ω_i or ω.[8] We now describe the econometric specification of the revenue and entry equations. For the entry equations, we take into account that N_i can only take integer values.

3.2 Revenue equation

Consider the following multiplicative specification for the total revenue function (12):

$$R_i(N_i) = \exp\left(X_i\beta + \eta_{i1}\right) N_i^{\alpha_i} S_i, \tag{15}$$

where S_i is population size in market i, X_i is a vector of other observed market-level characteristics and η_{i1} is an unobserved error term affecting demand in market i. This specification assumes that per capita demand is independent of population size S_i. We obtain the following per capita total revenue equation:

$$\ln R_i/S_i = X_i\beta + \alpha_i \ln N_i + \eta_{i1}. \tag{16}$$

The parameter α_i is the outlet elasticity which may vary across markets. We allow α_i to depend on market demographics and $\ln N_i$. The only market demographic that turned out to be significant is the market surface area, so we specify

$$\alpha_i = \alpha^0 + \alpha^1 \ln(\text{surface}_i) + \ln N_i. \tag{17}$$

[8] Other recent entry models, such as Gowrisankaran and Krainer (2010) and Ishii (2008), also use outside cost information to obtain μ. Given the composition of variable costs, as discussed below, it appears reasonable to treat it as constant across markets.

3.3 Entry inequalities

Because the number of outlets N_i can only take integer values, the first-order conditions (13) and (14) should be modified to inequality conditions. Define the change in total revenues by $\Delta R_i(N_i) = R_i(N_i) - R_i(N_i - 1)$. In the coordinated entry model (market-specific wholesale price), the first order condition (13) becomes

$$\mu \Delta R_i(N_i + 1) < F_i \leq \mu \Delta R_i(N_i) \tag{18}$$

where we define $R_i(-1) \equiv -\infty$, so that the condition also applies to markets where $N_i = 0$. Similarly, in the restricted/free entry model (uniform wholesale price), the first-order condition (14) becomes

$$\mu \min \left\{ \frac{\omega}{\delta_i} \Delta R_i(N_i + 1), \frac{1-\omega}{1-\delta_i} \frac{R_i(N_i+1)}{N_i+1} \right\} < F_i \leq \mu \min \left\{ \frac{\omega}{\delta_i} \Delta R_i(N_i), \frac{1-\omega}{1-\delta_i} \frac{R_i(N_i)}{N_i} \right\}. \tag{19}$$

In both models we can thus bound the total fixed costs F_i based on an estimate of the revenue equation. In the second model we can also estimate the share of fixed costs borne by the upstream firm, δ_i.

It remains to provide a specification for F_i and δ_i. Since $F_i^U = \delta_i F_i$ and $F_i^D = (1 - \delta_i) F_i$, this is equivalent to specifying F_i^U and F_i^D. Consider the following specification

$$\begin{aligned} F_i^U &= \exp\left(W_i^U \delta^U + W_i \gamma + \eta_{i2}\right) \\ F_i^D &= \exp\left(W_i^D \delta^D + W_i \gamma + \eta_{i2}\right). \end{aligned} \tag{20}$$

where W_i is a vector of common characteristics affecting fixed costs, W_i^U and W_i^D are vectors of characteristics affecting only the upstream and downstream firm's part of fixed costs, and η_{i2} is an unobserved error term.[9] We can use (20) to obtain an expression for F_i and δ_i:

$$\begin{aligned} F_i &= \left(\exp\left(W_i^U \delta^U\right) + \exp\left(W_i^D \delta^D\right)\right) \exp\left(W_i \gamma + \eta_{i2}\right) \qquad (21) \\ \delta_i &= \frac{\exp\left(W_i^U \delta^U\right)}{\exp\left(W_i^U \delta^U\right) + \exp\left(W_i^D \delta^D\right)}. \end{aligned}$$

These expressions can be substituted into the entry inequalities (18) or (19), together with the revenue specification (15). In our empirical analysis, we will allow the upstream firm's fixed costs F_i^U to depend on N_i, accounting for (dis)economies of density. This requires modifying the entry inequalities (18) or (19), as shown in the Appendix.

[9] In the restricted/free entry model, we must exclude the constant from either δ^U or δ^D, since we already include a constant in γ. In the coordinated entry model, we must exclude the constant from both δ^U or δ^D, since δ_i does not enter (18) and is therefore not identified (as discussed above).

3.4 Estimation

For a cross-section of local markets i, the two empirical models predict total revenues R_i for $N_i > 0$, and the total number of retail outlets N_i, conditional on the population size S_i and market demographics affecting demand (X_i) and fixed costs (W_i, W_i^U and W_i^D).

We first summarize the equations for the coordinated entry model. Defining

$$\begin{aligned}
\overline{\eta}_{i2} &\equiv \eta_{i2} - \eta_{i1} \\
Z_i\theta &\equiv \ln \mu + X_i\beta + \ln S_i - W_i\gamma - \ln\left(\exp\left(W_i^U\delta^U\right) + \exp\left(W_i^D\delta^D\right)\right) \\
\tau(N_i) &\equiv \ln(N_i^{\alpha_i} - (N_i - 1)^{\alpha_i}) \\
\widetilde{\tau}(N_i) &\equiv \ln(N_i^{(\alpha_i - 1)}),
\end{aligned} \tag{22}$$

and using (15) and (20), we can write the revenue equation (16) and the entry inequalities (18) more compactly as follows:

$$\begin{aligned}
&\text{For } N_i = 0: \quad && R_i \ \text{ unobserved} \\
& && Z_i\theta < \overline{\eta}_{i2} \\
&\text{For } N_i > 0: \quad && \ln R_i/S_i = X_i\beta + \alpha_i \ln N_i + \eta_{i1} \\
& && \quad Z_i\theta + \tau(N_i + 1) < \overline{\eta}_{i2} \leq Z_i\theta + \tau(N_i).
\end{aligned} \tag{23}$$

The coordinated entry model thus essentially consists of a revenue equation, and entry inequalities as in an ordered probit model.

The same is true for the restricted/free entry model (uniform wholesale price). Using (15) and (20), we now summarize the revenue equation (16) and the entry inequalities (19) as:

$$\begin{aligned}
&\text{For } N_i = 0: \quad R_i \ \text{ unobserved} \\
&\qquad\qquad Z_i\theta + \min\left\{\ln \tfrac{\omega}{\delta_i}, \ln \tfrac{1-\omega}{1-\delta_i}\right\} < \overline{\eta}_{i2} \\
&\text{For } N_i > 0: \quad \ln R_i/S_i = X_i\beta + \alpha_i \ln N_i + \eta_{i1} \\
&\qquad\qquad Z_i\theta + \min\left\{\ln \tfrac{\omega}{\delta_i} + \tau(N_i + 1), \ln \tfrac{1-\omega}{1-\delta_i} + \widetilde{\tau}(N_i + 1)\right\} < \overline{\eta}_{i2} \\
&\qquad\qquad \leq Z_i\theta + \min\left\{\ln \tfrac{\omega}{\delta_i} + \tau(N_i), \ln \tfrac{1-\omega}{1-\delta_i} + \widetilde{\tau}(N_i)\right\}.
\end{aligned} \tag{24}$$

Estimating the revenue equation separately using OLS would be unwarranted because it does not take into account that the number of retail outlets N_i is endogenous and that only markets with $N_i > 0$ are selected. Intuitively, R_i and N_i tend to be correlated even in the absence of a causal relationship, because unobserved demand shocks affect both demand and the equilibrium number of entrants, i.e. $\overline{\eta}_{i2}$ also contains the demand component η_{i1}. We therefore estimate the revenue and entry equations simultaneously.

Identification of the causal effect of N_i on R_i obtains because of several exclusion restrictions in the revenue equation. The main exclusion restriction is market size S_i. This variable does not affect per capita revenues R_i, and tends to be strongly correlated with N_i since it enters in the entry equation, i.e. the number of retail outlets is likely to be higher in larger markets because it becomes easier to recoup fixed costs. Berry and Waldfogel (1999) used a similar exclusion restriction. In principle, even if S_i does not mechanically affect revenue per capita, it may still proxy for omitted demand variables, for example more educated or wealthier people may live in bigger (urban) areas. While some caution on using S_i as an exclusion restriction is thus warranted, it appears quite reasonable here since we have already controlled for several market characteristics in X_i (such as personal income) in the revenue equation, and since our sample does not include large city areas with different social composition.[10] Furthermore, the revenue equation also has other exclusion restrictions: real estate prices for commercial property and distance to nearest wholesale distributor warehouse affect fixed costs and hence the entry decision, but do not directly affect revenues per capita.

We use maximum likelihood to estimate the model, assuming η_{i1} and $\overline{\eta}_{i2}$ have a bivariate normal distribution with means zero, variances σ_1^2 and σ_2^2 and a covariance σ_{12}. For both models the derivation of the likelihood function is similar to Ferrari, Verboven and Degryse's (2010) coordinated entry model, and follows comparable steps as in simpler Tobit II models.[11] Finally, note that in contrast with typical latent variable models, the standard deviation σ_2 is identified here, since the parameter for market size S_i is restricted to 1 in the entry equation.

4 Industry background and data set

To estimate the model, we obtained a data set on magazine revenues and the number of outlets from the largest Belgian magazine publisher. We will therefore focus our discussion of the relevant industry background on Belgium, based on a recent sector report of the Belgian Federation of Entrepreneurs (UNIZO, 2005), interviews with retail outlets, and information provided by the magazine publisher. Because of the large similarities between the magazines market in Belgium and the U.K., we also draw on the detailed reports of the U.K.'s Monopolies and Mergers Commission (MMC, 1993) and Office of fair Trading (OFT, 2008).

[10] A reduced form regression of revenue per capita on the exogenous variables X_i, W_i and S_i shows that S_i is significant.

[11] Most entry papers that used maximum likelihood estimation have assumed normality of the error terms. An exception is Abraham, Gaynor and Vogt (2007), who follow a discrete factor approximation as in Heckman and Singer (1984).

4.1 Industry background

Upstream and downstream relationships The market for magazines and newspapers consists of three levels: publishers, wholesale distributors and retailers. The two upstream levels (publishers and wholesale distributors) are highly concentrated. Only four publishers realize about 80 percent of the 180 million magazines sold per year (Editions Ciné Revue, Magnet Magazines, Roularta Media Group and Sanoma Magazines Belgium). The publisher for which we have data is by far the largest with a market share close to 50%. Concentration is even higher at the wholesale distribution level. The largest player (AMP) has a market share of about 80 percent, while the other two (Imapress and Tondeur) essentially fill in the niche segments of the market. In practice, all publishers sell their magazines through the entire distribution network, so it appears a reasonable simplification to treat the publisher and the wholesale distributor (AMP) as an integrated entity, the "upstream firm".

The dowstream level consists of the retailers and has a rather fragmented structure. In many countries including Belgium and the U.K., publishers sell their newspapers and magazines through a network of specialized retail outlets or "press shops". In Belgium there are no major chains, so most of the press shops are independent.[12] The publishers also make use of alternative distribution channels, such as grocery stores, supermarkets and petrol stations, and they sell their magazines through subscriptions. In our analysis we focus on the distribution through the press shops, and in particular how the upstream firm can influence their entry decisions through vertical restraints. We treat the availability of alternative channels as exogenous, but will take into account how this may influence the sales and profitability of the press shops.

We will discuss three main decisions: retail pricing, wholesale pricing and licensing. We assume that the publishers make these decisions as take-it-or-leave-it offers to the retail outlets. This is a reasonable assumption for the small press shops on which we focus, in contrast with the other distribution channels such as supermarkets and petrol stations, which may have some bargaining power.

Resale price maintenance While resale price maintenance (RPM) is in general prohibited, newspapers and magazines have been exempted in many countries (OECD, 1997). In other countries publishers follow a sales or return (SOR) policy: they retain ownership until the good is sold to consumers, and unsold items are returned to the publisher. Under such a policy the publishers can also legally implement RPM. Belgium is one of the countries with

[12] This is different from the U.K. where chains at the retail level are important.

an SOR policy.[13] Hence, publishers have complete control over the cover prices of magazines and newspapers. In practice, they set a uniform retail price per magazine across the country. Retail outlets are not allowed to sell items at a discount.

Wholesale prices and fixed fees Publishers also determine the gross retail margins, either by explicitly fixing the wholesale prices paid by the retailer or by specifying minimum discounts off the cover prices to be granted to the retailer. In Belgium, the retail margins may differ across the distribution channels, e.g. reflecting the bargaining power of supermarkets relative to the traditional press shops. However, within the same retail channel retail margins appear to be uniform. While a uniform wholesale margin for all press shops is no contractual obligation, the publisher declared it offers uniform conditions, and in several interviews press shop owners also confirmed they expect to receive the same conditions. According to the above mentioned industry sources, gross retail margins on newspapers and magazines are 25%, so $w/p = 75\%$.[14]

As discussed in Section 3.1, to estimate the model we need outside information on the overall upstream and downstream markup $\mu = (p-c)/p = (p - c^U - c^D)/p$, where c^U and c^D are the upstream and downstream variable costs. First, consider the upstream variable costs c^U/p. This evidently includes the variable production costs (mainly paper costs and printing services), which amounts to about 45% of the sales value according to the publisher. However, the publisher also has advertizing as a source of revenue, and this can be interpreted as a negative variable cost compensating for the production costs.[15] It turns out that advertizing is about 40% of the sales value, according to the same Belgian publisher. Taken together, the variable production costs of 45% are thus almost fully compensated by the variable

[13] Other countries with an SOR policy are the U.S. and the U.K., as documented by the MMC (1993) and OECD (1997).

[14] This is comparable to many other countries, such as the large German market studied by Kaiser and Wright (2006) and Kaiser and Song (2009). According to MMC (1993), the recommended retailer discount on daily editions in the U.K. was 28 percent prior to 1989 and 26.5 percent since then, while in other EC countries retail margins are more often around 20 percent on average.

[15] Consider a simple one-sided market model where advertisers value readers but not vice versa. This is in the spirit of the empirical results of Kaiser and Wright (2006). In particular, suppose the upstream firm has a constant marginal production cost c_0^U. Furthermore, suppose that (in addition to circulation revenues $w \cdot Q$), it earns advertizing revenues $r \cdot a$, where a is the number of ads and r is the price per ad. Let $r = r(a, Q)$ be the inverse advertizing demand function, decreasing in the number of ads and increasing in output or circulation Q. Assume that $r(a, Q) = s(a)Q$, i.e. the circulation elasticity $(\partial r/\partial Q)/(r/Q)$ is equal to 1. Under this assumption, advertizing revenues per unit of output are independent of output, i.e. $r \cdot a/Q = s(a)a$. So the upstream firm's profits (the sum of circulation and advertizing revenues minus production costs) becomes $\Pi_i^U(N_i, w_i) = \left(w_i - c_0^U + s(a)a\right) Q_i(N_i) - \delta F_i N_i$, which is equal to (1) with $c^U \equiv c_0^U - s(a)a$.

advertizing benefits of 40%, leaving a net variable cost of about 5%. For simplicity, we will set $c^U/p = 0$ in our analysis, but results are very similar under a variable cost of $c^U/p = 5\%$.

Now consider the downstream variable costs c^D/p. According to the MMC, the downstream net retail margins $(p - w - c^D)/p$ are about 3%. Given that $w/p = 75\%$, this implies that c^D/p is about 22%. In our further analysis, we will set $c^D/p = 22.85\%$ following the reasoning in Section 3.1: this is the value such that the observed $w/p = 75\%$ is the optimal uniform wholesale price, maximizing the upstream firm's profits (4).

In addition to variable wholesale prices, there are also fixed fees to be paid by the retailers. Retail outlets pay a small percentage of the cover price as a carriage charge to the distributor, and a moderate fixed fee when the retailer's total press turnover does not meet a certain threshold.[16] Hence, in general the fixed fee paid by the retail outlets is insufficient to cover the fixed costs per outlet incurred by the publisher/distributor.

Licensing The admission process for retail outlets to become newsagents is similar in many countries. The MMC (1993) provides an interesting discussion for the U.K. (in Chapter 6, in particular paragraphs 6.17–6.36). U.K. wholesale distributors evaluate new applications based on two broad criteria. First, there is a quality assessment of whether the outlet run by the applicant would be "suitable" to become a newsagency. This is evaluated based on physical and commercial criteria, such as space and opening times. Second, there is an assessment of whether the new outlet would generate sufficient extra sales (market expansion), or whether the area is already adequately served and would therefore merely lead to sales losses of neighboring newsagents (business stealing or "encroachment"). According to the MMC, this admission process resulted in a refusal rate of new applications in the U.K. of about 60 percent.

In Belgium the admission process is based on a similar assessment. Publishers screen new entry applications and the wholesale distributor tends to have a coordinating role, as the newspapers and magazines of the large publishers tend to be available across all outlets. The large magazine publisher from which we obtained our data reported around 300 new applications per year (compared to over 6,000 existing ones), out of which 75 percent were refused. Acquisitions of existing outlets are usually approved. In some cases the publishers themselves make unsolicited approaches to retail outlets where they consider that the area is not yet adequately served.

[16] In 2003 the percentage carriage charge amounted to 0.95 percent of the previous month's press turnover (evaluated at wholesale prices), with a minimum of €92.51 per month. The monthly flat rate was €74.27, unless yearly press turnover (evaluated at wholesale prices) exceeded €31,662.

4.2 Data set and OLS regressions

The data set Our main data set consists of total magazine revenues and the total number of retail outlets for a cross-section of local markets in Belgium in 2001, as obtained from the largest Belgian magazine publisher. This information is broken down by type of distribution channel: press shops, grocery stores, supermarkets and petrol stations. For each local market we also observe revenues from subscriptions. We supplement this main data set with data on various market-level demographic characteristics such as population size.[17]

The markets are defined by postal codes, which are part of administrative municipalities and typically consist of about one or two traditional towns. To reduce potential problems with overlapping markets, we focus on a subsample of 949 non-urban markets (defined as markets with a population density of less than 800 per km^2), having on average about 6,400 inhabitants.

To estimate our empirical model we will focus on the press shops, since the upstream firm can influence their entry decisions through vertical restraints.[18] We treat the number of outlets of other distribution channels as control variables. So our earlier variable R_i will refer to total press shop revenues, and similarly N_i will refer to the total number of press shops.

Table 1 provides precise definitions of our variables, and Table 2 presents summary statistics for the cross-section of 949 non-urban markets, and the subsample with at least one press shop. Per capita total revenues from press shops are on average €5.19 across markets, which is considerably higher than per capita revenues from subscriptions (€1.48). Table 2 also reveals the density of the various distribution channels. The average number of press shops per market is 2.12, versus only 0.50 for supermarkets, 0.38 for grocery stores and 0.17 for petrol stations. Finally, Table 2 shows summary statistics of the market characteristics: population (number of inhabitants per market), the market surface area (in km^2), the fraction of foreigners, the fraction of young (under the age of 18) and elderly (over the age of 65), average income, the unemployment rate, a dummy variable for the region of Flanders (Dutch-speaking part of Belgium), real estate price for commercial property and distance to the nearest wholesale distributor warehouse. Table 2 shows that several of the demographics may differ depending on whether the full sample or the subsample of markets with at least one press shop is considered. For example, the average population size is 6,441 across all markets, but up to 9,013 in markets with at least one press shop.

[17] The demographic characteristics were obtained from the N.I.S. (National Institute of Statistics), Ecodata (Federal Government Agency for Economics), and the R.S.Z. (the National Institute of Social Security).

[18] Note also that press shops constitute most of the revenues (60 percent) and of the number of outlets (62 percent).

Our data and analysis is based on a cross-section of local markets in 2001, but we also looked at other years.[19] There was very limited entry and exit from 2000 to 2001. In 921 out of the 949 markets there was no change in the number of outlets. In only 14 markets there was one new entrant and in no markets there was more than one new entrant. Similarly, there were only 13 markets with 1 exit and just 1 market with 2 exits. We therefore look at a quite stable period, and our empirical results gave very similar conclusions for other years.[20]

OLS regressions To obtain first insights into the relationship between total revenues and the number of outlets, we first run a simple OLS regression for the log of per capita press shop revenues ($\ln R_i/S_i$) on the log of the number of press shops ($\ln N_i$), the number of outlets of the other types and the market characteristics.[21] This is essentially specification (16), except that the coefficient for $\ln N_i$ is assumed constant across markets, $\alpha_i = \alpha$. This coefficient is the outlet elasticity, measuring the extent of market expansion, but it should be interpreted with caution here since we have not yet accounted for the endogeneity of N_i.

The left part of Table 3 shows the results. Consider first the estimated market expansion and business stealing effects for press shops, the main focus of our analysis. The estimated outlet elasticity is 0.46, showing that both market expansion and business stealing are important. For example, a 20% increase in the number of press shops (from 5 to 6, say) would lead to a 9.2% increase in total revenues (market expansion), and a 10.8% decrease in revenues per outlet (business stealing). Furthermore, there is significant business stealing from other distribution channels. An additional supermarket in the market reduces revenues by 11%, whereas an additional grocery store or petrol station reduces revenues by respectively 9% and 5% (although the latter effect is only marginally statistically significant).

The regression also shows the role of market characteristics. Press shop revenues are larger in geographically small markets (with a small surface area), in markets with a small fraction of foreigners and in markets with a high unemployment rate.[22] Income per capita

[19] A full dynamic analysis would be interesting, but is beyond the scope of this paper and would require a data set with more variation in entry and exit across markets.

[20] We also looked at whether exit in one year is followed by entry in the next year, to see whether the upstream firm is more likely to accept an application if an outlet exited recently. However, the aggregate number of firms declined by about 10% over the subsequent decade, so exit in a market did not typically lead to new admissions.

[21] We use the level rather than log of the number of outlets of other types, since we do not want to exclude markets where there are zero outlets of the other types.

[22] The positive effect of unemployment rate on press shop revenue seems surprising. Since we control for income, one interpretation is that unemployed have more time to read magazines. More generally, unemployment (and several other variables) may also proxy for other socio-demographic features affecting preferences

and the number of elderly do not have a significant effect.

It is interesting to compare the press shop revenue regression with a similar regression for subscription revenues. While this is not the focus of our paper and we will not look into this further, it does reveal some interesting differences. The right part of Table 3 shows that subscription revenues suffer from significant but small business stealing from press shops: an additional press shop in the market reduces subscription revenues by 2%. The extent of business stealing from other distribution channels on subscription revenues is not statistically significant. Markets with high unemployment and a low fraction of foreigners tend to have higher subscription revenues, similar to what we found for press shops. However, income per capita and the number of elderly also have a positive effect on subscription revenues, in contrast to our findings for press shops. This indicates that high income and elderly people prefer a subscription over a visit to the press shop. Furthermore, the subscription revenues are larger in geographically large markets, the opposite of what we found for press shops. This indicates the importance of transportation costs: people tend to buy subscriptions in geographically large markets with a high expected distance to the retail outlet, and travel to press shops in small markets.

In sum, apart from indicating interesting effects of market demographics, these preliminary findings suggest that the number of press shop outlets mainly affects press shop revenues, and has only a very small effect on subscription revenues. We therefore do not account for the effects on the subscription distribution channel in our further analysis.

5 Empirical analysis

In a first step we estimate the revenue and fixed cost parameters of the structural econometric model derived in Sections 2 and 3. While the industry background suggests the company uses uniform fees as in the restricted/free entry model, we also estimated the coordinated entry model as a simpler benchmark for comparison.

In the second step we use the preferred restricted/free entry model with uniform wholesale fees to perform policy counterfactuals. We first ask by how much profits would drop if the government would ban restricted licensing policies, and by how much profits would increase if the upstream firm would set market-specific wholesale fees to implement the first-best coordinated outcome. We also ask how profits and entry would change it the upstream firm uses fixed fee instead of wholesale fees. These counterfactuals contribute to understanding the rationale for how and why an upstream firm uses vertical restraints to determine the size of its distribution network.

for magazines relative to other goods (newspapers, books, etc).

5.1 Econometric results

To estimate the coordinated entry model (23) and the restricted/free entry model (24) we use data for a cross-section of 949 local markets, as discussed in Section 4. The revenue equation depends on the vector X_i, which consists of two parts: variables measuring the availability of competing channels (number of supermarkets, grocery stores and petrol stations), and a vector of market demographics (the market's surface area, the fraction of foreigners, the fraction of young and elderly, average income, the unemployment rate and a region dummy for Flanders). The entry inequalities depend on the common and the upstream and downstream-specific fixed cost determinants W_i, W_i^U and W_i^D. W_i consists of the market demographics. W_i^U consists of the distance to the nearest wholesale distributor warehouse (as a measure of the transport costs from the distribution center to the retail outlets) and the total number of retail outlets in the local market (i.e. the sum of press shops, grocery stores, supermarkets and petrol stations) to allow for economies of density. Finally, W_i^D consists of the market's real estate price of commercial property (as a measure of location costs). We also estimated a simpler specification without economies of density and without variables in the upstream and downstream-specific fixed costs (so that $\delta_i = \delta$). Since the results were quite similar, we report them in Appendix.

Table 4 shows the maximum likelihood estimates for the benchmark coordinated entry model and the restricted/free entry model. We focus our discussion on the restricted/free entry model (right panel) since this is the more realistic one, consistent with the company's practice of uniform wholesale fees.[23]

First, consider the parameters in the revenue equation (α_i and β). Recall that the outlet elasticity α_i varies across markets according to equation (17), which depends on the $\ln(\text{surface}_i)$ and $\ln N_i$.[24] The outlet elasticity is 0.29 in a representative market, and it shows important variation across markets, varying between 0.13 and 0.46. As expected, the outlet elasticity is significantly higher in markets with a large surface area and with few outlets. Intuitively, an additional outlet especially leads to strong market expansion in markets where the outlet density is low, as may be expected if outlets are mainly differentiated in a spatial

[23] While the restricted/free entry model is preferable to the coordinated entry model on *a priori* grounds, it is interesting to note that it also turns out to be more favorable on statistical grounds. To compare both models, we applied Vuong's (1989) non-nested likelihood ratio test. The log-likelihood is -1422.96 under the coordinated entry model and -1399.85 under the restricted/free entry model, which results in a standard normal Vuong test statistic (adjusted for the additional parameter in the restricted/free model) equal to 2.55. This implies that the coordinated entry model can be rejected in favor of the restricted/free entry model at a significance level close to 1%.

[24] We also allowed the outlet elasticity to depend on other market demographics, but these were not significant.

sense.

Now consider the other parameter estimates in the revenue equation (β). Additional grocery stores still imply significant business stealing from press shops, as found in the OLS regression. However, additional supermarkets lead to smaller business stealing than in the OLS regression and petrol stations no longer have a significant business stealing effect. The effect of the market demographics is similar to the OLS regression. Markets with a high surface area tend to have lower press shop revenues. Markets with a high unemployment rate and a low fraction of foreigners imply higher revenues.

Next, consider the fixed cost parameters (γ, δ^U, δ^D, λ,). Total fixed costs per outlet tend to be larger in Flanders (compared to Wallonia) and in markets with a low fraction of foreigners and elderly. Whereas downstream fixed costs increase with real estate prices, upstream fixed costs are not significantly affected by the distance to the nearest warehouse. There is some evidence of (limited) economies of density ($\lambda = -0.15$): upstream fixed costs decrease as the total number of outlets increases. The total fixed costs per outlet in a representative market (using (21), evaluated at sample means), are $F_i =$€$2,973$, with a 95 percent confidence interval of $[2,087;\ 3,859]$. Recall that the restricted/free entry model identifies the upstream firm's share of fixed costs δ_i (reflected in the fact that the constant in δ^U is estimated). The upstream firm's fixed cost share in a representative market is $\delta_i = 0.95$ (with small variation across markets from 0.93 to 0.96), implying that 95% of the fixed costs are borne by the upstream firm.[25] The share of fixed costs borne by the downstream retail outlets may thus seem low at first, but recall that they pay only limited fixed fees to the upstream firm and they also earn revenues from their other business activities so that their net fixed costs are small.

Finally, the covariance between η_{i1} and $\overline{\eta}_{i2} \equiv \eta_{i2} - \eta_{i1}$ is $\sigma_{12} = -0.07$. This implies that the covariance between the structural demand and fixed cost errors η_{i1} and η_{i2} is positive and equal to 0.21.[26] So the demand and fixed cost shocks show a positive correlation across markets.[27]

[25] Empirically, the estimated share of fixed costs δ_i is such that the restricted entry condition holds in part of the markets, and the free entry condition holds in the remaining part of the markets.

[26] Since η_{i1} and $\overline{\eta}_{i2}$ are bivariate normal, η_{i1} and $\eta_{i2} \equiv \eta_{i1} + \overline{\eta}_{i2}$ are also bivariate normal with variances of σ_1^2 and $\sigma_1^2 + \sigma_2^2 + 2\sigma_{12}$, and a covariance of $\sigma_1^2 + \sigma_{12}$.

[27] The R^2 is equal to 0.51 for the revenue equation and 0.85 for the entry equation. Our measure of the R^2 for the entry equation is similar to Berry and Waldfogel (1999). We compute the R^2 as implied by the correlation between the observed number of press shops and the number predicted from a large number of draws of η_{i1} and η_{i2} (1,000 draws per market).

5.2 The role of vertical restraints

We now perform policy counterfactuals to assess the role of vertical restraints. The results are based on the estimates of the restricted/free entry model, since this is consistent with the company's practice of uniform wholesale fees. We begin with three base scenarios assuming the fixed franchise fees remain constant:

(i) status quo: upstream firm sets uniform wholesale price (w/p) and can restrict entry;

(ii) licensing ban: upstream firm sets uniform wholesale price (w/p) but cannot restrict entry;

(iii) differentiated wholesale prices: upstream firm sets market-specific wholesale prices so it does not need a licensing policy to restrict entry.

We subsequently consider three twin scenarios where the wholesale price is assumed to be cost-based and where the upstream firm sets an optimal uniform or market-specific fixed franchise fee. We also considered three scenarios allowing both adjustments in the wholesale price and fixed franchise fees. But we do not report these, since these gave very similar findings to our three base scenarios.

5.2.1 Methodology

To predict the market outcomes under the three base scenarios, we proceed as follows. For each market we take 1,000 draws for the demand and fixed cost errors η_{i1} and η_{i2}.

(i) status quo For each market and draw we start from a given uniform wholesale price w/p and we compute the upstream firm's profit maximizing N_i, under the constraint that retail profits are nonnegative. We then search for the w/p that maximizes the upstream firm's total profits across markets.[28]

(ii) licensing ban For each market and draw we again start from a given uniform wholesale price, but we now compute the maximum N_i such that retail profits are still positive (as under free entry). We then again search for the w/p that maximizes the upstream firm's total profits across markets. We thus allow the upstream firm to optimally adjust its w/p in response to the licensing ban. But to provide further economic intuition we also present results holding w/p constant.

[28]We then verify whether the obtained optimal w/p is equal to the w/p assumed to estimate the model. If so, our assumed parameter for the retail cost $c^D/p = 22.85\%$ is consistent with an optimal uniform w/p; otherwise we search for another c^D/p.

(iii) differentiated wholesale prices For each market and draw we compute the joint-profit maximizing number of outlets and the maximum wholesale price w_i/p that implements this number of outlets.

We follow a similar approach for the three twin scenarios where the upstream firm sets optimal fixed franchise fees instead of wholesale prices. For each scenario we will present the calculated wholesale prices (mean and distribution), the total number of retail entrants, and the total profits across markets. Standard errors are obtained from our 1,000 draws.

5.2.2 The role of wholesale prices

Table 5 shows the results from the counterfactuals. We first discuss the top panel, where we keep the fixed fees constant to focus on the role of wholesale prices.

Let us begin with the first scenario (left column): the status quo with a uniform wholesale price and restricted licensing. The optimal uniform wholesale price $w/p = 75.02\%$, very close to the wholesale price of 75% assumed to estimate the model. This verifies that the assumed retail cost parameter $c^D/p = 22.85\%$ is consistent with the optimal wholesale price. The predicted total number of retail outlets across all markets is 2003, and this does not differ significantly from the actual number of outlets (2012). Total profits are €18.43 million, of which the upstream firm extracts €18.16 million. This is of a roughly similar order of magnitude as the profits reported by the company.[29] Because uniform prices imply restricted entry in almost 50% of the markets (438 markets), the retail outlets earn some rents, but they turn out to be very small in the aggregate (€0.28 million or 1.5% of total profits).

Now consider the second scenario (middle columns): still a uniform wholesale price but a government ban on restricted licensing policies. As a way to indirectly discourage entry, the upstream firm responds by raising its wholesale price to $w/p = 75.59\%$. At the retail cost of $c^D/p = 22.85\%$, this implies a drop in the retailers' net margins from 2.13% to 1.56%. The wholesale price increase enables the upstream firm to limit the increase in the number of outlets to 15% (from 2003 to 2300).[30] Without a wholesale price increase, however, the number of outlets would have increased by almost 80% (from 2003 to 3582). Furthermore, the ban on restricted licensing reduces the upstream firm's profits, as expected when a monopoly has fewer decision instruments at its disposal. However, the upstream firm's profit reduction is only 2.3% (from 18.16 to 17.75).[31] This is a rather limited reduction, taking into account

[29] The company reports a pre-tax operational profit of €15.8 million in 2003 and €17.4 in 2004.

[30] The distribution of outlets across markets becomes more polarized after a licensing ban. The number of markets with $N = 0$ increases from 320 to 413. The number of markets with $1 \leq N \leq 6$ decreases from 562 to 431, while the number of markets with $N \geqslant 7$ increases from 67 to 105.

[31] This limited profit reduction follows from the fact that the upstream firm can raise its wholesale fee. If

that the upstream firm requires quite some market information to implement a policy of restricted licensing to prevent encroachment.

Finally, consider the third scenario (right column): market-specific wholesale prices to implement the first-best (so that there is no need to restrict licensing). On average, the wholesale price is $w_i/p = 75.57\%$, which is close to the uniform wholesale price of 75.02%. The extent of differentiation in wholesale prices appears to be limited, varying from 74.03% (2.5% quantile) to 76.21% (97.5% quantile). Although this corresponds to a relatively large variation in the net retail margins, from 0.94% to 3.12%, these market-specific wholesale prices do not contribute much to raising the upstream firm's profits. The upstream firm can raise its profits from €18.16 million under the (second-best) status quo with a uniform wholesale price to €18.58 million under the first-best with market-specific wholesale prices, an increase by only 2.3%.

Summary We can summarize these findings as follows. First, a ban on restricted licensing reduces profits by only a limited amount, since the upstream firm can raise its uniform wholesale fee to indirectly discourage entry. This indicates that the profit rationale of restricted licensing should not be sought in preventing encroachment.[32] It is therefore likely that restricted entry licensing serves another goal, such as the maintenance of minimum quality standards or other efficiency reasons. We could not obtain data on admissions and rejections of entry applications, but it would be interesting to explore the determinants of admissions in future research.[33]

Second, customized or market-specific wholesale fees increase profits by only a limited amount (despite differing local market conditions). This provides a rationale why the upstream firm prefers to set a uniform wholesale fee, as there may be direct or indirect costs in implementing customized wholesale fees (according to theories such as Holmstrom and Milgrom (1987) or McAfee and Schwartz (1994)).

it could not adjust its wholesale fee, the upstream firm's profit reduction would amount to 7% (from 18.16 to 16.88).

[32] To obtain this conclusion, we assumed that the retail price p does not change after a licensing ban. Our results would be strengthened if we would allow the upstream firm to also adjust its retail price, since the retail price can serve as an extra instrument to influence profits through demand. However, this would require information (or assumptions) on the price elasticity of demand.

[33] Recall our earlier discussion that the company refuses about 75% of the applications, while accepting most acquisitions of existing outlets. A thorough analysis on the admission decision would have to take into account selection issues, since candidates may self-select before applying.

5.2.3 The role of fixed franchise fees

The policy counterfactuals so far assumed the upstream firm does not adjust its franchise fees. If the upstream firm can also adjust its franchise fees after a ban on restricted licensing (uniform or differentiated), our conclusions are very similar. The franchise fee only increases by a negligible amount, so there is still only a limited profit rationale for restricted licensing as a way to prevent encroachment.

We therefore considered another set of policy counterfactuals. Suppose the upstream firm were constrained to set cost-based wholesale prices. How would it adjust its fixed franchise fees and how would profits be affected? What would be the effects of a ban on restricted licensing? The bottom panel of Table 5 gives interesting further insights into these questions.

In the first scenario (left column) the upstream firm is restricted to a cost-based wholesale price, but can implement a uniform raise in its fixed franchise fee. The optimal franchise fee is close to €14,000 and the number of outlets would drop dramatically by 22.2% (from 2003 to 1558). There is essentially no restricted licensing (only 2 markets). Intuitively, with a cost-based wholesale price the upstream firm gets most of its revenues from the fixed fees, and these are much larger than its fixed costs, so that there is no reason to restrict licensing. The upstream firm's profits also drop dramatically by 23.8% (from 18.16 to 13.83). Hence, when contracts are uniform across outlets, wholesale prices are much more effective than fixed franchise fees. This is consistent with Bhattacharyya and Lafontaine (1995), who document the common use of uniform and largely linear contracting

The second scenario (middle columns) introduces a ban on restricted licensing, but this has virtually no effects because there was already almost no restricted licensing in the first scenario. The third scenario allows for differentiated fixed fees (continuing to assume cost-based wholesale prices). This evidently again leads to the first-best profits for the upstream firm (since either market-specific wholesale prices or fixed fees are sufficient to achieve the first-best number of retail outlets and extract all rents). However, this strategy requires a large amount of fixed fee differentiation across markets, ranging from about 1,815 (2.5% quantile) to almost 31,000 (97.5 quantile).

Summary We can summarize these findings as follows. First, a uniform fixed fee is a much less effective instrument to cope with differences in local market conditions than a uniform wholesale price. Second, with only a uniform fixed fee and a cost-based wholesale price, there is no need to restrict entry since the upstream firm recoups more than its fixed costs. Third, to obtain the first-best the upstream firm must apply a much larger differentiation in fixed fees than in wholesale prices.

6 Conclusions

We have asked how an upstream firm determines the size of its distribution network, and what is the role played by vertical restraints. To address these questions we have provided an empirical analysis of magazine distribution. We developed two entry models, starting from the basic trade-off between market expansion and fixed costs from investing in additional outlets. In the coordinated entry model the upstream firm sets a market-specific wholesale price and can implement the first-best outcome. In the restricted/free entry model the upstream firm sets a uniform wholesale price, and each market is in one of two possible regimes: restricted licensing in markets with low market expansion and free entry in markets with high market expansion.

We considered the coordinated entry model as a simple benchmark and favoured the restricted/free entry model since it is consistent with the practice of uniform wholesale price contracts in the magazine industry and elsewhere. The outlet elasticity in a representative market is 0.29, and it shows substantial variation across markets, ranging from 0.13 in markets with a high outlet density to 0.46 in markets with a low outlet density. This variation leads to restricted licensing in almost 50% of the markets (the markets with the lowest market expansion). Our policy counterfactuals show that a government ban on restricted licensing would increase the number of retail outlets, but reduce the upstream firm's profits by only a modest amount. Furthermore, if the upstream firm were to set market-specific wholesale prices to implement the first-best number of retail outlets in every market, this would raise profits by only a small amount. Finally, uniform fixed franchise fees are much less effective to deal with local market circumstances than uniform wholesale fees.

These findings imply that the business rationale for restricted licensing is not the prevention of encroachment, at least not in our application. The rationale for restricted licensing should therefore be sought elsewhere, perhaps the maintenance of minimum quality standards. It would be interesting to explore this in future research, for example by obtaining data on the actual admission decisions of new entry licenses.

Our findings on the limited profitability of market-specific wholesale prices also provide a business rationale for the common practice of uniform wholesale prices, since transaction or other costs associated with customized wholesale prices may be too high to justify the benefits. It would be interesting to see whether our model extends to other applications where wholesale prices are uniform, for example based on the data of the hotel industry in Kosova, Lafontaine and Perrigot (2010).

In this paper, we focused on the profit effects of vertical restraints aimed at influencing the size of distribution networks. We did not consider the consumer and total welfare effects of vertical restraints. This would also be an interesting topic for future research. More generally, we hope that future research will further explore other institutional environments where the entry process is more complex than in traditional free entry models.

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Tables

Table 1: Variable description (referring to the sample of markets)

press shops revenues (R_i)	yearly revenues from magazine sales at press shops (in market i)
subscription revenues	yearly per capita revenues from subscriptions
press shops (N_i)	number of press shops (in market i)
supermarkets	number of supermarkets (that sell the publisher's magazines)
grocery stores	number of grocery stores (that sell the publisher's magazines)
petrol stations	number of petrol stations (that sell the publisher's magazines)
population size (S_i)	number of inhabitants (of market i)
surface	surface area (in km^2)
foreign	fraction of foreigners in the population
young	fraction of population under 18
elderly	fraction of population over 65
income	average income (in €10,000)
unemployment rate	unemployment rate
Flanders	indicator variable for Dutch-speaking part of Belgium
distance to warehouse	distance to the nearest wholesale distributor warehouse (in 100 km)
real estate price	average sale price for commercial property (€1,000 per m^2)

Table 2: Summary statistics

	all markets		markets with $N_i > 0$	
	mean	st. dev.	mean	st. dev.
press shop revenues (R_i/S_i)	5.19	2.76	5.58	2.45
subscriptions revenues	1.48	0.55	1.49	0.54
press shops (N_i)	2.12	2.74	3.19	2.80
supermarkets	0.50	0.90	0.72	1.02
grocery stores	0.38	0.77	0.47	0.87
petrol stations	0.17	0.52	0.24	0.61
population (S_i)	6441	7042	9013	7363
surface	29.85	28.23	36.95	29.45
foreign	0.04	0.06	0.05	0.06
young	0.22	0.03	0.22	0.02
elderly	0.16	0.03	0.16	0.02
income	2.48	0.39	2.52	0.37
unemployment rate	0.03	0.02	0.03	0.02
Flanders	0.45	0.50	0.53	0.50
distance to warehouse	0.28	0.22	0.24	0.19
real estate price	0.19	0.05	0.20	0.05
number of observations	949		630	

Notes: For a description of the variables, see Table 1. Per capita press shop and subscription revenues are population-weighted. Income is in €10,000. Distance to warehouse is in 100 km. Real estate price is in €1,000. Sources: publisher data, N.I.S, Ecodata and R.S.Z.

Table 3: OLS revenue regressions

	param.	st. err.	param.	st. err.
	press shop revenues (R_i)		subscriptions revenues	
press shops (N_i)	0.46	(0.03)	−0.02	(0.01)
supermarkets	−0.11	(0.02)	−0.00	(0.02)
grocery stores	−0.09	(0.02)	0.00	(0.02)
petrol stations	−0.05	(0.03)	0.01	(0.03)
constant	1.99	(0.50)	−1.74	(0.30)
surface	−0.16	(0.03)	0.07	(0.02)
foreign	−2.35	(0.34)	−2.35	(0.24)
young	−1.75	(1.36)	1.42	(0.73)
elderly	−0.95	(1.00)	1.27	(0.62)
income	−0.13	(0.16)	0.84	(0.11)
unemployment rate	4.93	(1.84)	6.61	(1.22)
Flanders	0.65	(0.07)	0.81	(0.04)
R^2	0.51		0.52	
number of observations	630		948	

Notes: In the press shop regression, the number of press shops is expressed in logs. surface and income are in logs.

Table 4: Parameter estimates for coordinated and restricted/free entry model

	coordinated entry				restricted/free entry			
	revenue		entry		revenue		entry	
α_0	0.42	(0.04)			0.23	(0.04)		
α_1	0.06	(0.01)			0.05	(0.01)		
α_2	−0.08	(0.00)			−0.04	(0.01)		
	variables affecting revenues (X_i) or common fixed cost part (W_i)							
supermarkets	−0.04	(0.02)			−0.03	(0.02)		
grocery stores	−0.11	(0.02)			−0.11	(0.02)		
petrol stations	−0.01	(0.03)			−0.00	(0.03)		
constant	1.83	(0.54)	4.20	(0.58)	1.66	(0.55)	4.29	(0.56)
surface	−0.21	(0.03)	−0.01	(0.04)	−0.11	(0.03)	0.12	(0.04)
foreign	−2.34	(0.20)	−2.03	(0.29)	−2.05	(0.20)	−1.75	(0.25)
young	−1.16	(1.37)	0.64	(1.57)	−2.75	(1.42)	−1.44	(1.47)
elderly	−0.26	(1.09)	−3.18	(1.24)	−0.48	(1.12)	−3.61	(1.19)
income	−0.15	(0.17)	0.31	(0.19)	0.03	(0.18)	0.53	(0.18)
unemployment rate	5.07	(1.74)	2.26	(1.89)	8.58	(1.78)	6.27	(1.69)
Flanders	0.61	(0.06)	0.71	(0.07)	0.73	(0.07)	0.83	(0.07)
	variables entering only upstream or downstream fixed cost (W_i^U and W_i^D)							
constant (δ_0^U)			4.06	–			3.40	(0.22)
distance to warehouse			−0.04	(0.12)			0.01	(0.11)
econ. of density (λ)			−0.04	(0.05)			−0.15	(0.09)
real estate price			5.57	(2.70)			1.54	(0.45)
σ_1	0.45	(0.01)			0.46	(0.01)		
σ_2			0.38	(0.02)			0.37	(0.02)
σ_{12}			−0.05	(0.01)			−0.07	(0.01)
log likelihood			−1422.96				−1399.85	
R^2	0.51		0.85		0.49		0.85	

Notes: surface and income are in logs. To estimate the coordinated entry model, we set $\delta_0^U = 4.06$, consistent with an average $\delta_i = 0.95$ across markets. To estimate the restricted/free entry model, we set $w/p = 0.75$. Distance to warehouse and economies of density (λ) enter W_i^U. Real estate price enters W_i^D.

Table 5: The role of vertical restraints (based on restricted/free entry model)

	Optimal wholesale price (no adjustment in fixed fee)							
	restricted licensing (=status quo)		ban on estricted licensing				differentiated w_i/p (first-best)	
			fixed w/p		optimal w/p			
wholesale price (w/p)	75.02	(0.12)	75.02	–	75.59	(0.05)	75.57	(0.02)
2.5% w/p							74.03	(0.07)
2.5% w/p							76.21	(0.02)
total number of outlets ($\sum_i N_i$)	2003	(38.01)	3582	(281.29)	2300	(113.95)	2044	(34.46)
# markets with restricted licensing	438.06	(38.45)	0		0		0	
total downstream profits ($\sum_i N_i \pi_i^D$)	0.28	(0.04)	0.05	(0.00)	0.04	(0.00)	0.00	(0.00)
total upstream profits ($\sum_i \Pi_i^U$)	18.16	(0.62)	16.88	(0.69)	17.75	(0.61)	18.58	(0.63)
total profits ($\sum_i \Pi_i$)	18.43	(0.62)	16.93	(0.69)	17.79	(0.61)	18.58	(0.63)
	Optimal fixed fees (cost-based wholesale price)							
	restricted licensing		ban on restricted licensing				differentiated A_i (first-best)	
			fixed A		optimal A			
fixed fee (A)	13954	(978.75)	13954	–	14126	(981.85)	10635	(218.65)
2.5% A							1815	(125.49)
2.5% A							30850	(1546)
total number of outlets ($\sum_i N_i$)	1558	(133.29)	1570	(137.67)	1542	(133.58)	2044	(34.46)
# markets with restricted licensing	1.98	(1.56)	0		0		0	
total downstream profits ($\sum_i N_i \pi_i^D$)	1.57	(0.06)	1.58	(0.06)	1.59	(0.06)	0.00	(0.00)
total upstream profits ($\sum_i \Pi_i^U$)	13.83	(0.52)	13.81	(0.53)	13.81	(0.53)	18.58	(0.63)
total profits ($\sum_i \Pi_i$)	15.41	(0.55)	15.39	(0.55)	15.39	(0.55)	18.58	(0.63)

Notes: Simulation results based on $1,000$ draws per market. The first column of the upper panel shows the status quo of this model, with uniform w/p and restricted licensing. The second and third column of the upper panel show the effect of a ban on restricted licensing, holding w/p constant or allowing the upstream firm to adjust w/p optimally. The fourth column of the upper panel shows the first-best with a differentiated w_i/p. 2.5% w/p and 97.5% w/p indicate the 2.5 and 97.5 percentiles of w/p. The lower panel shows equivalent scenarios with w/p assumed to be cost-based and fixed fees A as a pricing instrument. We assume $c^U/p = 0$ and $c^D/p = 22.85\%$. Profits are expressed in millions of euros per year. Standard errors are in parentheses.

Appendix

(Dis)economies of density

In our empirical analysis, we generalize the specification of fixed costs to allow for (dis)economies of density, i.e. we allow fixed costs to depend on the number of outlets in the market. This requires adjusting the first-order conditions (when N_i is a continuous variable) and the entry inequality conditions (when N_i can only take integer values). Adjusting the first-order conditions is straightforward; we show here how to obtain the entry inequality conditions, entering our likelihood function.

More specifically, we generalize the upstream firm's fixed costs per outlet to

$$\overline{F}_i^U(N_i) = F_i^U \cdot (N_i)^\lambda$$

so that the total fixed costs per outlet are

$$\overline{F}_i(N_i) = F_i^U \cdot (N_i)^\lambda + F_i^D.$$

If $\lambda = 0$, fixed costs per outlet do not depend on N_i, so we are back in the original specification. If $\lambda < 0$, there are economies of density (and vice versa).

Define the change in total fixed costs and the upstream fixed costs for all outlets in the local market as $\Delta\left(\overline{F}_i(N_i)N_i\right) = N_i\overline{F}_i(N_i) - (N_i - 1)\overline{F}_i(N_i - 1)$ and $\Delta\left(\overline{F}_i^U(N_i)N_i\right) = N_i\overline{F}_i^U(N_i) - (N_i - 1)\overline{F}_i^U(N_i - 1)$. In the coordinated entry model, the inequality conditions (18) become

$$\mu\Delta R_i(N_i + 1) < \Delta\left(\overline{F}_i(N_i + 1)(N_i + 1)\right) \quad \text{and} \quad \mu\Delta R_i(N_i) > \Delta\left(\overline{F}_i(N_i)N_i\right). \qquad (25)$$

Similarly, in the restricted/free entry model, the inequality conditions (19) become

$$\begin{aligned} \mu \min\left\{\omega\Delta R_i(N_i + 1) - \Delta\left(\overline{F}_i^U(N_i + 1)(N_i + 1)\right), (1-\omega)\frac{R_i(N_i + 1)}{N_i + 1} - F_i^D\right\} &< 0, \quad \text{and} \\ \mu \min\left\{\omega\Delta R_i(N_i) - \Delta\left(\overline{F}_i^U(N_i)N_i\right), (1-\omega)\frac{R_i(N_i)}{N_i} - F_i^D\right\} &> 0. \qquad (26) \end{aligned}$$

We can then substitute (20) and (15) in the inequalities (25) of the coordinated entry model or in the inequalities (26) of the restricted/free entry model. This gives a similar but more tedious ordered structure as the model without economies of density ($\lambda = 0$). Finally, note that this exposition assumes fixed costs only depend on the number of press shop outlets N_i. In our empirical application we allow fixed costs to depend on the total number of outlets, i.e. the sum of press shops N_i, grocery stores, supermarkets and petrol stations. The results were very similar in both cases.

Identification of λ is based on exclusion restrictions in the entry equation. The number of outlets of each distribution channel may affect revenues, but only the sum of these variables enters in the entry equation. As such, the number of supermarkets, grocery stores and petrol stations serve as exclusion restrictions to identify λ in the entry equation. This is parallel to the earlier discussed variables market size, real estate prices and distance to nearest wholesale distributor warehouse, which serve as exclusion restrictions to identify the effect of N_i in the revenue equation.

Estimation results for uniform delta ($\delta_i = \delta$)

Table A1: Parameter estimates from restricted/free entry model (uniform delta)

	coordinated entry				restricted/free entry			
	revenue		entry		revenue		entry	
α_0	0.43	(0.03)			0.23	(0.05)		
α_1	0.06	(0.01)			0.04	(0.01)		
α_2	−0.08	(0.00)			−0.04	(0.01)		
	variables affecting revenues (X_i) or common fixed cost part (W_i)							
supermarkets	−0.04	(0.02)			−0.02	(0.02)		
grocery stores	−0.11	(0.02)			−0.11	(0.02)		
petrol stations	−0.01	(0.03)			−0.00	(0.03)		
constant	1.83	(0.53)	5.28	(0.58)	1.67	(0.55)	4.53	(0.56)
surface	−0.22	(0.03)	−0.03	(0.04)	−0.13	(0.03)	0.08	(0.04)
foreign	−2.37	(0.20)	−2.10	(0.29)	−2.10	(0.20)	−1.81	(0.25)
young	−0.98	(1.36)	0.96	(1.55)	−2.40	(1.42)	−0.75	(1.49)
elderly	−0.22	(1.09)	−3.09	(1.25)	−0.41	(1.11)	−3.28	(1.20)
income	−0.17	(0.17)	0.31	(0.19)	−0.00	(0.17)	0.51	(0.18)
unemployment rate	4.73	(1.66)	1.81	(1.77)	8.02	(1.79)	5.51	(1.72)
Flanders	0.60	(0.06)	0.71	(0.07)	0.70	(0.07)	0.82	(0.07)
	variables entering only upstream or downstream fixed cost (W_i^U and W_i^D)							
constant (δ_0^U)			2.94	–			2.90	(0.15)
distance to warehouse			0	–			0	–
econ. of density (λ)			0	–			0	–
real estate price			0	–			0	–
σ_1	0.45	(0.01)			0.45	(0.01)		
σ_2			0.38	(0.02)			0.38	(0.02)
σ_{12}			−0.05	(0.01)			−0.07	(0.01)
log likelihood			−1423.83				−1406.96	
R^2	0.51		0.85		0.50		0.86	

Notes: surface and income are in logs. To estimate the coordinated entry model, we set $\delta_0^U = 2.94$, consistent with an average $\delta_i = 0.95$ across markets. For the estimation of the restricted free entry model, we set $w/p = 0.75$.