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

by

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DISCUSSION PAPER

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 and estimate two models of outlet entry, starting from the basic trade-off between market expansion and fixed costs. In the coordinated entry model the upstream firm sets a market-specific wholesale price to implement the first-best number of outlets. In the restricted/free entry model the upstream firm has insufficient price instruments to target local markets. It sets a uniform wholesale price, and restricts entry in markets where market expansion is low, while allowing free entry elsewhere. We apply the two models to magazine distribution. The evidence is more consistent with the second model where the upstream firm sets a uniform wholesale price and restricts the number of entry licenses. We use the model to assess the profitability of modifying the vertical restraints. A government ban on restriced licensing would reduce profits by a limited amount, so that the business rationale for restricted licensing should be sought elsewhere. Furthermore, introducing market-specific wholesale prices would implement the first-best, but the profit increase would be small, providing a rationale for the current uniform wholesale prices.

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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 consider 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 or fixed franchise fees, unrelated to the local circumstances. Furthermore, franchise fees are often small and may not even be sufficient to cover the upstream firm's own fixed costs of dealing with a retail outlet. Applying Rey and Vergé's (2008) classification of vertical restraints, if "payment schemes" cannot easily be implemented to control the number of retail outlets, then "provisions limiting the parties rights" may form a second-best alternative.

To assess the role of restricted licensing in the presence of imperfect payments schemes, we provide 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.[1] However, the MMC' s investigation did not offer a

[1] Instead, the MMC only made a suggestion that neighbouring outlets should be allowed to shift sales among each other.

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 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 charge a linear per-unit wholesale fee that both achieves the optimal number of retail outlets under free entry and extracts all profit rents, without a 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, a per-unit wholesale fee would only work if the wholesale fee can be differentiated, i.e. tailor-made to the local market demand and cost conditions. We focus on the common case where the upstream firm is constrained to charge a wholesale fee that is uniform across different 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 fixed costs associated with additional retail outlets. Put differently, if the upstream firm cannot set a market-specific wholesale price, it may want to restrict the number of licenses in those markets where business stealing (or "encroachment") is too strong relative to its fixed costs.

Based on this 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 per capita in the market as a function of the number of retail outlets, after controlling for market demographics. This equation enables us to assess the extent to which there is market expansion versus business stealing in response to an increase in the number of outlets. 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 profits of the upstream firm and its downstream retail outlets, trading-off market expansion against fixed costs. In this model the first-best solution (from the perspective of the firms) is obtained. Under uniform wholesale prices, we obtain a model where markets are in one of two possible regimes: *restricted entry or free entry.* The upstream firm prefers to restrict entry in markets where market expansion is too low and allow free entry in markets where market expansion is sufficiently high. This model yields a second-best outcome because the instruments are limited.

The entry equation serves two purposes. First, it provides a natural exclusion restriction (market size) to estimate the causal effect of the number of firms on revenues. 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 find that the coordinated entry model (with market-specific wholesale prices) is rejected in favor of the restricted/free entry model (with uniform wholesale prices). We find evidence that additional entry causes significant market expansion, but also business stealing or "encroachment". The outlet elasticity in a representative market is 0.31, meaning that an increase in the number of outlets by 10% raises total revenues by 3.1% but reduces revenues per outlet by 6.9%. More importantly, the extent of market expansion/business stealing shows substantial variation across markets. The outlet elasticity ranges from 0.18 in markets with a high outlet density to 0.46 in markets with a low outlet density. This variation across markets is reflected in a refusal to supply practice by the upstream firm 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 use the parameter estimates of the restricted/free entry model with a uniform wholesale price to perform policy counterfactuals. If the upstream firm would set a market-specific wholesale price to implement the first-best coordinated entry outcome, this would imply a relatively important differentiation in retail markups, but it would raise profits by only 2.8%. Hence, the second-best uniform wholesale price policy performs relatively well from the perspective of the upstream firm. Furthermore, a government ban on restricted licensing would raise the number of outlets by about 11%, but would reduce the upstream firm's profits by only 3.7%. The drop in profits is so small because the upstream firm simultaneously raises its wholesale price to prevent too much new entry. Indeed, if we hold the wholesale price constant, a ban on restricted licensing would more than double the number of outlets and reduce profits by 17%.

Taken together, these results explain why an upstream firm may often use uniform wholesale prices despite differing local market conditions. Furthermore, they indicate that the business rationale for restricted licensing is not the prevention of encroachment, since a uniform wholesale price can 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.

The theoretical framework and empirical analysis of magazine distribution in this paper builds on and contributes to the literature on vertical restraints. The theoretical literature on vertical restraints shows how upstream firms can control the retail price and the number of retail outlets and extract all profits, using any pair of the following three instruments: resale price maintenance (RPM), a linear wholesale price or a fixed fee. Dixit (1983), Gallini and Winter (1983), Perry and Groff (1985) and Shaffer (1995) show how resale price maintenance (RPM) can be combined with either a linear wholesale price or a fixed fee, or how a linear wholesale price can be combined with a fixed fee, without the need for RPM.[2] None of these papers thus explain why firms would want to restrict licensing. In our setting, firms do not have sufficient control over the wholesale price and fixed fee to obtain the optimal number of retail entrants per market. Firms may then want to restrict the number of entrants in those markets where market expansion effects are too low, i.e. where business stealing or encroachment effects are too high to justify the fixed costs from additional retail outlets.[3]

The empirical literature on vertical restraints is still small, and has not looked at the question how vertical restraints are used to control the size of a distribution network. Instead, most of this literature focused around the question how vertical restraints 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) combined demand models with pricing models to draw inferences about unobserved linear or non-linear wholesale tariffs, and show how these may influence downstream competition. Since we instead focus on the number of retail outlets, we combine a demand model with an entry model. Our approach therefore allows one to draw inferences about wholesale prices from an entry model instead of a pricing model as in other recent papers.

Our empirical model builds on the previous literature on market-level entry models.

[2] Gould and Preston (1965) provide an early analysis on RPM and the "outlets hypothesis". In a richer framework with endogenous retail services, Mathewson and Winter (1984) analyse how alternative vertical restraints can be used to achieve the optimal retail price, the optimal number of outlets and the optimal service level.

[3] 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.

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. The current paper 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 value advertizers, and that advertizers value readers more strongly than vice versa (Kaiser and Wright, 2006; Kaiser and Song, 2009). 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 where advertizers value readers, but readers do not value (nor 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 alternative restricted/free model where the upstream firm can only set a uniform wholesale price and restricts entry in some markets to obtain the second-best outcome. In Section 3 we provide an overview of how the two models can be taken to the data.

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 price p. Since the price is fixed, we suppress it as an argument from the demand function. Total demand in market i is $Q_i(N_i)$, where N_i is the number of retail outlets. 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.

Assumption 1. Market expansion

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

Assumption 2. Business stealing or encroachment

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

Hence, the outlet elasticity lies between zero and one: an additional outlet raises total market demand, so there is market expansion, but it reduces demand per retail outlet, so there is also business stealing. There will be mainly business stealing if the outlet elasticity is close to zero, while there will be mainly market expansion if the outlet elasticity is close to one. In addition, we will also assume that total demand is concave, $Q_i''(N_i) < 0$.

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 constrained to be uniform across markets, $w_i = w$ for all i. The variable cost per unit sold is c, identical across markets and consisting of a part borne by the upstream firm and a part borne by the downstream retailer, $c = c^U + c^D$. The total fixed distribution cost per outlet is F_i, of which the upstream firm bears a fraction $\delta \in (0, 1)$ and the downstream firm the remaining fraction $1 - \delta$. This means that any possible fixed fee charged by the upstream firm is insufficient to cover its own fixed costs.

The upstream firm's profit in market i is:

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

A downstream retailer's profit in market i is:[4]

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

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.

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

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

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:

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

or in elasticity form:

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

[4]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.

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

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

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).[5]

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.

[5] 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).

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 $\omega=\left(w-c^U\right)/(p-c)$, we can write (9) as

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

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

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

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). 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. From (11), this would happen if the upstream firm's share of fixed costs δ is zero or sufficiently small, or even if its share δ is large provided that $\varepsilon_i(N_i)$ shows no or limited variation across markets.[6] In contrast, if δ 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.

[6]If $\varepsilon_i(N_i)$ does not vary across markets, the uniform wholesale fee is optimal and we are back in the 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

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

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 is not possible from (13). However, we can make use of the optimal wholesale price condition condition (8) to infer δ from information on the upstream firm's markup share ω_i. Or, equivalently, we can infer the upstream firm's markup share from information on δ.

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. 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 in such a way that the wholesale price 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. 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 simple multiplicative specification for the total revenue function (12):

$$R_i(N_i) = A_i N_i^{\alpha_i} S_i, \tag{15}$$

where S_i is population size in market i and A_i contains observed and unobserved demand determinants. This specification assumes that per capita demand is independent of population. Specify

$$\ln A_i = X_i \beta + \eta_{i1}. \tag{16}$$

where the vector X_i contains observed market-level characteristics and η_{i1} is an unobserved error term affecting demand in market i.

We obtain the following per capita total revenue equation:

$$\ln R_i/S_i = X_i \beta + \alpha_i \ln N_i + \eta_{i1}. \tag{17}$$

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

$$\alpha_i = \alpha^0 + \alpha^1 \ln(\text{surface}_i) + \ln N_i. \tag{18}$$

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

$$\mu \Delta R_i(N_i + 1) < F_i \leq \mu \Delta R_i(N_i) \tag{19}$$

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

$$\mu \min\left\{\frac{\omega}{\delta}\Delta R_i(N_i+1), \frac{1-\omega}{1-\delta}\frac{R_i(N_i+1)}{N_i+1}\right\} < F_i \leq \mu \min\left\{\frac{\omega}{\delta}\Delta R_i(N_i), \frac{1-\omega}{1-\delta}\frac{R_i(N_i)}{N_i}\right\}. \tag{20}$$

In both models we can thus bound the fixed costs based on an estimate of the revenue equation. Specify

$$\ln F_i = W_i\gamma + \eta_{i2}, \tag{21}$$

where W_i is a vector of market-level characteristics affecting fixed costs, and η_{i2} an unobserved error term.

To obtain the final entry inequalities, it remains to substitute (15), (16) and (21) into the entry inequalities (19) or (20).

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).

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

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

and using (15), (16) and (21), we can write the revenue equation (17) and the entry inequalities (19) more compactly as follows:

For $N_i = 0$: $\quad R_i$ unobserved

$$Z_i\theta < \overline{\eta}_{i2}$$

For $N_i > 0$: $\quad \ln R_i/S_i = X_i\beta + \alpha_i \ln N_i + \eta_{i1}$

$$Z_i\theta + \tau(N_i+1) < \overline{\eta}_{i2} \leq Z_i\theta + \tau(N_i).$$

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

The same is true for the model where the upstream firm sets a uniform wholesale price. In this case, we can use (15), (16) and (21) to summarize the revenue equation (17) and the entry inequalities (20) as follows:

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

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 an exclusion restriction in the revenue equation. Market size S_i does not affect per capita revenues R_i, and tends to be strongly correlated with N_i since it enters in the entry equation. 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 (2009) coordinated entry model, and follows comparable steps as in simpler Tobit II models.

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. But 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).

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 our analysis we treat the publisher and the wholesale distributor (AMP) as an integrated entity, the "upstream firm".[7]

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.[8] 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

[7] The distributors do not influence the retail pricing policies, and they tend to have a coordinating role in the publishers' licensing decisions, since the newspapers and magazines of the large publishers are typically available at all retail outlets.

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

an SOR policy.[9] 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 may be more uniform. While a uniform wholesale margin for all press shops is no contractual obligation, interviews with press shop owners indicate they may receive the same conditions. According to the above mentioned industry sources, gross retail margins on newspapers and magazines are about 25%, so $w/p = 75\%$.[10]

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 from which we obtained our dataset. 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.[11] 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 almost fully compensated by the variable advertizing benefits of 40%, leaving a net variable

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

[10] This is comparable to other countries. 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.

[11] 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 $\Pi_i^U(N_i, w_i) = \left(w_i - c_0^U + s(a)a\right) Q_i(N_i) + r(a, Q)a - \delta F_i N_i$, which is equal to (1) with $c^U \equiv c_0^U - s(a)a$.

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^U/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.[12] 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. As discussed by the MMC (1993), 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").[13] 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.

[12] 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.

[13] For an interesting and more detailed discussion of the admission process we refer to MMC (1993), Chapter 6, in particular paragraphs 6.17–6.36.

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.[14]

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 950 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.[15] 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 950 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 0.5 for supermarkets, 0.38 for grocery stores and 0.17 for petrol stations. Finally, Table 2 shows summary statistics of the market demographics: 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, and a dummy variable for the region of Flanders (Dutch-speaking part of Belgium). 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 6,438 across all markets, but up to 9,005 in markets with at least one press shop.

[14] 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).

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

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.[16] This is essentially specification (17), 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 increase in the number of press shops from 5 to 6 (so a 20% increase) would lead to a market expansion of 9.2% and a business stealing of 10.8%. Furthermore, the coefficients on the other number of outlets of other distribution channels show that 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 not statistically significant).

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

[16] 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.

geographically large markets with a high expected distance to the retail outlet, and travel to press shops in small markets.

5 Empirical analysis

In a first step we estimate the parameters of the structural econometric model derived in Sections 2 and 3. We infer the extent of market expansion and the magnitude of fixed costs per outlet (press shop). We consider both the model of coordinated entry and the model of restricted/free entry, and we compare both models using a test for non-nested models.

In the second step we focus on the preferred restricted/free entry model with uniform wholesale fees and perform policy counterfactuals. We 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. As shown below, 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.

5.1 Econometric results

The coordinated entry model consists of the revenue equation (17) and the entry inequalities (19), as summarized by (23). The restricted/free entry model consists of the same revenue equation (17) and the entry inequalities (20), summarized by (24). To estimate both models we use data for a cross-section of 950 local markets, as discussed in Section 4. The endogenous variables are total revenues from press shops R_i and the number of press shops N_i. The variable market size S_i does not affect per capita total revenues R_i/S_i, so that it serves as an exclusion restriction to identify the market expansion effects. Finally, the model contains two vectors of market characteristics, X_i and W_i. The vector X_i enters the revenue equation (17) and 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 vector W_i affects fixed costs per outlet (F_i) in the entry equation and only includes the market demographics.

Coordinated entry model The left part of Table 4 shows the maximum likelihood estimates for the coordinated entry model. 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 (18), which depends on the ln(surface$_i$) and $\ln N_i$.[17] The outlet elasticity is 0.49 in a representative market (with average market surface area and number of outlets). Furthermore, the outlet elasticity shows important variation across markets, varying between 0.20 and 0.73. As expected, the outlet elasticity is significantly higher in markets where the surface area is large and in markets where there are currently 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 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.

Finally, consider the fixed cost parameters (γ) in the coordinated entry model. Fixed costs per outlet (F_i) tend to be larger in markets with a high per capita income and unemployment rate, and a low fraction of foreigners and elderly. The fixed costs per outlet in a representative market (evaluated at sample means) are $F_i = \exp(W_i\gamma) =$€$4,704$, with a 95 percent confidence interval of $[4,413;\ 4,995]$. The R^2 is equal to 0.51 for the revenue equation and 0.85 for the entry equation.[18]

Restricted/free entry model The right part of Table 4 shows the estimates for the restricted/free entry model. The estimated outlet elasticity is 0.31 in a representative market, which is lower than in the coordinated entry model. The outlet elasticity again shows important variation across markets, from 0.18 in markets with a high outlet density to 0.46 in markets with a low outlet density (i.e. high surface area or low number of outlets). The other parameters in the revenue equation (β) and the fixed cost parameters (γ) are similar to those obtained in the coordinated entry model. The fixed costs per outlet in a representative market $F_i = \exp(W_i\gamma) =$€$2,844$, with a 95 percent confidence interval of $[2,125;\ 3,564]$. The model contains one additional parameter, δ, which is the fraction of the fixed costs borne by

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

[18] To obtain a measure of the R^2 for the entry equation, we follow an approach similar to Berry and Waldfogel (1999) and compute 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). This correlation is 0.92, implying an R^2 of 0.85.

upstream firm. We find that $\delta = 0.95$ (with a standard error of 0.01), implying that 95% of the fixed costs are borne by the upstream firm. With an R^2 of 0.50 for the revenue equation and 0.86 for the entry equation, the fit of the restricted/free entry model appears similar as the one of the coordinated entry models.

To compare the coordinated entry model with the restricted/free entry model, we apply the test of Vuong (1989), which is a likelihood ratio test to select among non-nested or overlapping models. According to the null-hypothesis H_0 the two models are indistinguishable from one another. According to the first alternative hypothesis, H_C, the coordinated entry model is superior to the restricted/free entry model. According to the second alternative hypothesis, H_{RF}, the restricted/free entry model is superior. Vuong's test statistic ψ converges in distribution to a standard normal so that $\psi = 0$ under H_0, $\psi > 0$ under H_C and $\psi < 0$ under H_{RF}. The log-likelihood is -1424.70 under the coordinated entry model and -1407.80 under the restricted/free entry model. The resulting test statistic, adjusted for the fact that the restricted/free parameter has one additional parameter δ, is 1.93 implying that the coordinated entry model should be rejected in favor of the restricted/free entry model at a significance level close to 5%.

5.2 The role of vertical restraints

Based on the parameter estimates we now perform policy counterfactuals to assess the role of vertical restraints. We focus on the model of restricted/free entry, with a uniform wholesale price, since this was preferred over the model of coordinated entry, with a market-specific wholesale price. We consider four scenarios. The first scenario is the status quo, where the upstream firm sets a uniform wholesale price and can restrict entry. In the second and third scenario the upstream firm still sets a uniform wholesale price but is no longer allowed to restrict entry. The second scenario keeps the uniform wholesale price constant, whereas the third scenario allows the upstream firm to raise its uniform wholesale price to prevent to much entry. In the fourth scenario the upstream firm sets a market-specific wholesale price, so that it can achieve the first-best without a need to directly restrict entry. In each of these scenarios we compute the wholesale price (uniform or differentiated), the number of retail outlets and the upstream and downstream profits.

5.2.1 Methodology

To predict the market outcomes under the various 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}. First consider the status quo scenario, where the upstream firm sets a uniform wholesale price and can restrict entry. For each market and draw we start from a given uniform wholesale price w/p and we compute the upstream firm's profit maximizing number of outlets, under the constraint that retail profits are nonnegative. We then sum the upstream firm's profits across all markets and search for the w/p that maximizes the upstream firm's total profits across markets. We will verify whether the obtained optimal w/p is similar to the w/p assumed to estimate the model. If so, this indicates that our assumed parameter for the retail cost $c^D/p = 22.85\%$ is consistent with an optimal uniform w/p.

Now consider the second and third scenarios, where the upstream firm still sets a uniform wholesale price but is banned from restricting entry. We again start from a given uniform wholesale price. For each market and draw we now do not compute the profit-maximizing, but instead the maximum number of outlets such that retail profits are still positive (as under free entry). In the second scenario we simply set w/p equal to the status quo level (as found in first scenario), whereas in the second scenario we search for the w/p that maximizes the upstream firm's total profits across markets.

Finally, consider the fourth scenario with market-specific 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.

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 Results

Table 5 shows the results from the counterfactuals. Let us begin with the first scenario of the status quo (left column). The uniform wholesale price $w/p = 74.99\%$, which is close to the wholesale price of 75% assumed to estimate the model. This shows that our assumed retail cost parameter $c^D/p = 22.85\%$ is consistent with the optimal wholesale price.[19] The predicted total number of retail outlets across all markets is 2006, and this does not differ significantly from the actual number of outlets (2013). Total profits (upstream plus downstream) are €18.61 million. Because uniform prices imply restricted entry in almost 50% of the markets (471 markets), the retail outlets earn some rents, but they turn out to be very small in the aggregate (€0.34 million or 1.8% of total profits).

Now consider the second and third scenario (two middle columns), where there is still a uniform wholesale price but the government imposes a ban on restricted licensing. If the

[19] We also estimated the model under alternative assumed values for the value c^D/p. Under these alternative values, the status quo prediction for the optimal uniform wholesale price was always further away from 75%.

upstream firm keeps its wholesale price constant (second scenario), the number of retail outlets more than doubles, from 2006 to 4310, and its profits would go down by almost 17% (from 18.27 to 15.20). However, the upstream firm can adjust its wholesale price instrument to avoid too much entry (third scenario). This shows the upstream firm would raise its wholesale price from 74.99% to 75.77%. Because the retail costs $c^D/p = 22.85\%$, this implies a drop in the retailers' net margins from 2.16% to 1.38%. Accounting for this adjusted wholesale price, the ban on restricted licensing leads to an increase in the number of retail outlets by only 11%, from 2006 to 2225. Furthermore, the drop in the upstream firm's profits is no longer 17% but only 3.7% if the upstream firm can adjust its wholesale price.

Finally, consider the fourth scenario (right column), where the upstream firm sets market-specific wholesale prices to implement the first-best and extract all rents. On average, the wholesale price is $w_i/p = 75.53\%$, which is close to the uniform wholesale price of 74.99%. The extent of differentiation in wholesale prices appears to be limited, varying from 73.51% (2.5% quantile) to 76.25% (97.5% quantile). But this results in a relatively large variation of the net retail margins, from 0.90% to 3.64% (because of the retail costs of $c^D/p = 22.85\%$). However, these market-specific wholesale margins do not contribute much to raising profits. Under the (second-best) status quo with an optimal uniform wholesale price total profits are €18.61 million, of which the upstream firm extracts €18.27 million. Under the first-best with the optimal market-specific wholesale price total profits are €18.79 million, which are fully extracted by the upstream firm. Hence, the upstream firm would be able raise its profits by only 2.8% if it would optimally differentiate its wholesale prices across markets.

As a sensitivity check, we also performed parallel counterfactuals under the assumption that the coordinated entry model applies (although we showed earlier that this model had less support by the data compared with the restricted/free entry model). We consider the same four scenarios, where evidently the fourth scenario now receives the interpretation of the status quo. The results, shown in the next Table 6, show broadly similar results, including the limited profitability of differentiated fees and of restricted licensing under uniform pricing policies.

To summarize, the limited profitability of restricted licensing indicates that the rationale of this common practice should not be sought in preventing encroachment in the absence of a market-specific wholesale price. It is therefore likely that restricted entry licensing serves another goal, such as the maintenance of minimum quality standards or other efficiency reasons. Furthermore, the limited profitability of differentiated wholesale fees (despite differing local market conditions) provides a rationale why the upstream firm prefers to set a uniform wholesale fee, as there may be considerable transaction costs in implementing wholesale fees at the market level.

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: in markets with low market expansion the upstream firm imposes restricted licensing and in markets with high market expansion the upstream firm allows free entry.

We find that the model of restricted/free entry (with a uniform wholesale price) is preferred over the model of coordinated entry (with market-specific wholesale prices). The outlet elasticity in a representative market is 0.31, and it shows substantial variation across the sample of local markets, ranging from 0.18 in markets with a high outlet density to 0.46 in markets with a low outlet density. This variation across markets is reflected in restricted licensing in about 50% of the markets (the markets with the lowest market expansion). Our policy counterfactuals show that a government ban on restricted licensing increases the number of retail outlets, but reduces 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. These findings imply that the business rationale for restricted licensing is not the prevention of encroachment, at least in our application. The rationale for restricted licensing should therefore be sought elsewhere, perhaps the maintenance of minimum quality standards. Our findings also provide a rationale for the practice of uniform wholesale prices, since transactions costs associated with market-specific wholesale prices may be too high to justify the benefits.

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 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 and figures

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 in local market
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

Table 2: Summary statistics

	all markets		markets with $N_i > 0$	
	mean	st. dev.	mean	st. dev.
press shop revenues (R_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	2.73	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)	6438	7039	9005	7360
surface	29.83	28.22	36.91	29.44
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
number of observations	950		631	

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. 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	1.96	(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	−1.67	(1.35)	1.43	(0.73)
elderly	−0.92	(1.00)	1.27	(0.62)
income	−0.13	(0.16)	0.84	(0.11)
unemployment rate	5.06	(1.83)	6.62	(1.21)
Flanders	0.65	(0.06)	0.81	(0.04)
R^2	0.51		0.52	
number of observations	631		949	

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 from simultaneous revenue and entry model

	param.	st. err.	param.	st. err.	param.	st. err.	param.	st. err.
	coordinated entry				restricted/free entry			
	revenue		entry		revenue		entry	
α (α_0)	0.43	(0.03)			0.23	(0.05)		
α_1	0.06	(0.01)			0.04	(0.01)		
α_2	−0.08	(0.01)			−0.04	(0.01)		
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	1.80	(0.53)	8.22	(0.58)	1.65	(0.55)	7.44	(0.58)
surface	−0.23	(0.03)	−0.03	(0.04)	−0.13	(0.03)	0.08	(0.04)
foreign	−2.36	(0.20)	−2.09	(0.29)	−2.10	(0.20)	−1.80	(0.25)
young	−0.89	(1.36)	1.08	(1.54)	−2.35	(1.42)	−0.65	(1.49)
elderly	−0.20	(1.09)	−3.06	(1.25)	−0.39	(1.11)	−3.25	(1.19)
income	−0.16	(0.17)	0.32	(0.19)	0.00	(0.17)	0.51	(0.18)
unemployment rate	4.86	(1.65)	2.00	(1.76)	8.11	(1.78)	5.67	(1.71)
Flanders	0.61	(0.06)	0.71	(0.07)	0.71	(0.07)	0.82	(0.07)
δ							0.95	(0.01)
σ_1	0.45	(0.01)			0.46	(0.01)		
σ_2			0.38	(0.02)			0.38	(0.01)
σ_{12}			−0.05	(0.01)			−0.07	(0.01)
log likelihood			−1424.70				−1407.80	
R^2	0.51		0.85		0.50		0.86	

Notes: surface and income are in logs. For the estimation of the restricted free entry model, we set $w/p = 0.75$.

Table 5: The role of vertical restraints: restricted/free entry

	uniform w/p			different. w_i/p
	restricted licensing (st. quo)	ban on restr. licensing (constant w/p)	ban on restr. on licensing (flexible w/p)	(first-best)
w/p	74.99	74.99	75.77	75.53
	(0.13)	(0.13)	(0.05)	(0.02)
2.5% w/p				73.51
				(0.08)
97.5% w/p				76.25
				(0.01)
$\sum_i N_i$	2006	4310	2225	2097
	(38.49)	(375.41)	(121.31)	(36.23)
# markets with restricted licensing	471.25	0	0	0
	(35.27)			
$\sum_i N_i \pi_i^D$	0.34	0.04	0.03	0.00
	(0.05)	(0.00)	(0.00)	(0.00)
$\sum_i \Pi_i^U$	18.27	15.20	17.59	18.79
	(0.63)	(0.91)	(0.62)	(0.64)
$\sum_i \Pi_i$	18.61	15.24	17.62	18.79
	(0.64)	(0.90)	(0.62)	(0.64)

Notes: Simulation results based on 1,000 draws per market. The first column shows the status quo of this model, with uniform w/p and restricted licensing. The second and third column show the effect of a ban on restricted licensing, holding w/p constant or allowing w/p to adjust optimally. The fourth column 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. 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.

Table 6: The role of vertical restraints: coordinated entry

	uniform w/p			different. w_i/p
	restricted licensing	ban on licensing (constant w/p)	ban on on licensing (flexible w/p)	(first-best and st. quo)
w/p	74.49	74.49	75.34	75.02
	(0.12)	(0.12)	(0.05)	(0.02)
2.5% w/p				73.36
				(0.06)
97.5% w/p				76.00
				(0.03)
$\sum_i N_i$	1913	3867	2065	2002
	(38.98)	(275.06)	(113.40)	(36.37)
# markets with restricted licensing	361.81	0	0	0
	(27.27)			
$\sum_i N_i \pi_i^D$	0.36	0.04	0.03	0.00
	(0.04)	(0.00)	(0.00)	(0.00)
$\sum_i \Pi_i^U$	15.59	11.76	14.49	16.11
	(0.60)	(0.84)	(0.57)	(0.61)
$\sum_i \Pi_i$	15.95	11.81	14.52	16.11
	(0.61)	(0.84)	(0.57)	(0.61)

Notes: Simulation results based on $1,000$ draws per market. The first column shows the case with uniform w/p and restricted licensing. The second and third column show the effect of a ban on restricted licensing, holding w/p constant or allowing w/p to adjust optimally. The fourth column shows the status quo of this model, which is 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. We assume $c^U/p = 0$, $c^D/p = 22.85\%$ and $\delta = 0.95$. Profits are expressed in millions of euros per year. Standard errors are in parentheses.