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Small buyers

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Abstract

We develop a model of retail competition and negotiations with an upstream supplier for several firms of different sizes. Contrary to existing thinking, we demonstrate that the larger a buyer the less countervailing power he possesses over the supplier. The reason for this is that a buyer's outside option - the ability to integrate backwards - becomes proportionately weaker as he grows in size as self-production is characterised by diseconomies of scale.

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1 Introduction

Buyer power is an area of significant interest for both academics and increasingly for regulators, with the growth of large chain retailers meaning that such issues now frequently arise in antitrust investigations.[1] Traditionally the approach to assessing countervailing power has stressed the importance of a buyer's size, with the logic being that larger firms are somehow more able to extract lower input prices from their suppliers.

While this may indeed be the case, one must be careful not to blindly assert the existence of buyer power based on size alone. In fact here we demonstrate a result that runs contrary to this approach. In contrast to the majority of the literature, in our model larger buyers are in a weaker bargaining position and therefore actually end up paying disproportionately more for their inputs.

This possibility has been noted before in the literature, for example Chipty and Snyder (1999) and Raskovich (2003) examine cases where the aggregate surplus across negotiations may be convex, meaning that the per-unit marginal surplus is smaller for transactions involving a greater quantity. Similarly, Inderst (2005) shows that, when retailers negotiate with suppliers with convex costs, buyers that are small and that split their purchases over many suppliers may be able to procure at a discount.

In contrast to this existing work, we examine a model where buyers bargain with a supplier who can produce with constant production costs, and have an outside option in negotiations of being able to integrate backwards and self-supply. However, we consider the case when retailers suffer diseconomies of scale in production, meaning that larger buyers have an inferior outside option and thus must pay a larger proportion of their profits to suppliers.

2 The Model

2.1 Basic Setup

Upstream we have a monopolist S who produces an input at a constant marginal cost of c. Downstream, the industry is characterised by N symmetric

[1] For a policy orientated discussion see Doyle and Inderst (2007).

markets that are independent on the demand side, each of these markets is a duopoly.[2]

There are T firms that operate in the downstream markets; each of these retailers, whom we denote i, may own stores in several markets. However, we assume that no retailer owns both stores in any given market, so all firms have equal levels of output market power. Denote $\lambda_i \subseteq \{1, ..., N\}$ as the set of markets in which retailer i is present. The size of firm i, n_i, is the number of markets in which it is present, $n_i = |\lambda_i|$. We therefore have $n_i \leq N \ \forall \ i$, and $\sum_{i=1}^{T} n_i = 2N$.

In each of these markets we denote the price as p_j, which depends on the total market output Q_j according to the linear inverse demand curve $p_j = \alpha - Q_j$. Denote the vector of N output market prices as $\mathbf{p}$. Retailers compete in quantities; they select a production profile $\mathbf{q}_i \in \Psi_i$ where $\mathbf{q}_i$ is an N by 1 vector where element j, denoted q_{ij}, specifies retailer i's level of output in market j and Ψ_i is the set of feasible production profiles for retailer i, defined as the set of $\mathbf{q}_i$ for which we have $q_{ij} = 0 \ \forall \ j \notin \lambda_i$. We define the scalar $q_i = \sum_{j=1}^{N} q_{ij}$ as retailer i's total level of output.

In addition to being able to source from the supplier, retailers have an outside option of being able to integrate backwards into the upstream industry and produce their own input.[3]

Our central assumption is that when retailers integrate backwards and manufacture the intermediate good themselves, its production is characterised by diseconomies of scale. We assume that for retailer i the cost of producing a total level of input (and therefore output) of q_i, irrespective of n_i, is

$$C(q_i) = cq_i + \frac{q_i^2}{2}$$

For example this may be because an established supplier has experience

[2] This approach follows Katz (1987) and Inderst and Wey (2009) and allows us to model firms with different levels of buyer power without additionally introducing market power in output markets. These markets could for example be interpreted as being distinct geographic markets, perhaps representing different local towns.

[3] We focus on the ability of firms to integrate backwards as defining their outside option in negotiations as this is the approach most frequently examined in the literature; see for example Katz (1987), Inderst and Valletti (2009) and Inderst and Wey (2009), though we assume no fixed cost is incurred in doing this. We also assume that backwards-integrated retailers cannot supply other retailers; for example they may lack the distribution network required to effectively sell the intermediate good on to other firms.

acquired from learning-by-doing, and may have been able to sign long-term contracts for its inputs at preferable rates, or may be vertically integrated further up the supply chain and therefore be self-sufficient in terms of its resource requirements.[4]

We have all retailers engaging in simultaneous Nash bargaining with the supplier to determine the cost of their inputs, using the threat of self-production to give them an outside option. We assume that firms contract using two part tariffs (w_i, Γ_i), where a retailer who purchases a total quantity of inputs of q_i must pay the supplier $\Gamma_i + q_i w_i$ if $q_i > 0$ and 0 otherwise. We follow the majority of the literature in assuming that contracts are unobservable; that a retailer doesn't know the details of the contracts its rivals have agreed with the supplier, and that firms have "passive beliefs" when they receive off-equilibrium contract offers.[5]

This means that here the supplier suffers from what is known as the "opportunism problem", as discussed by Hart and Tirole (1990), O'Brien and Shaffer (1992) and McAfee and Schwartz (1994). This then means that in equilibrium all retailers get supplied by S at a wholesale price $w_i = c \ \forall \ i$, and that negotiations effectively only take place over the fixed fees Γ_i. We also make the standard assumption that retailers have exogenous bargaining strength θ, which determines the split of any surplus above the parties' outside options.

2.2 Equilibrium

We have the standard Cournot equilibrium in all downstream markets so we can immediately solve for firm i's per-market flow profits as

$$\phi_i^* = \phi^* = \left(\frac{\alpha - c}{3}\right)^2 \tag{1}$$

Denote a retailer i's total profit level as $\Pi_i = n_i \pi_i$, where π_i is the per-market profit. In turn we have $\pi_i = \phi - \tau_i$, where $\tau_i = \frac{\Gamma_i}{n_i}$ is the effective

[4] An assumption of diseconomies of scale in production has previously been adopted in the buyer power literature, though more generally with regard to the incumbent supplier's production function; see for example Inderst (2005) and Inderst and Wey (2007).

[5] An assumption of passive beliefs means that when retailers receive an unexpected offer that is off the equilibrium path they do not revise their beliefs about the offers received by rival retailers. See for example White (2007).

per-market fixed fee for retailer i. We thus have that retailer i's total profits are given by

$$\Pi_i = n_i \phi - \Gamma_i \tag{2}$$

The key issue in solving the model is the outside options of firms, as this then pins down the bargaining game between suppliers and retailers and thus the division of industry profits.

Firstly, note that here the supplier has no outside option when it bargains with retailers; if negotiations break down it may well sell more units to the other stores present in the same markets as the given retailer but, since all negotiations take place simultaneously and equilibrium wholesale prices are equal to marginal cost, S makes no extra profit from these units. Therefore, we can effectively treat all bargains that the supplier undertakes as separate, as the specific tariff agreed in a given negotiation only affects the fixed fee paid by the retailer to the supplier, and has no impact upon market equilibrium.

Turning to the outside option of the retailer, we have to solve for the equilibrium levels of output and prices that would prevail were it to rely upon self-production following a break down in negotiations with the supplier.

Let us denote retailer i's profit function if it resorts to self-production as Φ_i

Therefore i's outside option, which we designate as Φ_i^*, is the equilibrium level of profit it would earn if it maximises this profit function while all other retailers continue to negotiate with the supplier. We are able to prove the following result.

Lemma 1 *A retailer's' outside option is given by*

$$\Phi_i^* = n_i (\alpha - c)^2 \frac{(2 + n_i)}{2 (3 + 2n_i)^2}$$

Proof. See Appendix. ■

Solving the bargaining problem between suppliers and retailers, we get that the fixed fee that must be paid by retailer i in equilibrium is therefore

$$\Gamma_i^* = (1 - \theta) (n_i \phi^* - \Phi_i^*)$$

Substituting this into equation (2) we get

$$\Pi_i^* = \theta n_i \phi^* + (1-\theta)\,\Phi_i^*$$

Substituting in the equilibrium value of Φ_i^* from Lemma 1 and ϕ^* from equation (1) we get retailers' total equilibrium profits as

$$\Pi_i^* = n_i\,(\alpha - c)^2 \left(\theta\frac{1}{9} + (1-\theta)\,\frac{(2+n_i)}{2\,(3+2n_i)^2}\right)$$

Therefore we can solve for per-market profits as

$$\pi_i^* = (\alpha - c)^2 \left(\theta\frac{1}{9} + (1-\theta)\,\frac{(2+n_i)}{2\,(3+2n_i)^2}\right)$$

Similarly we can calculate the fixed price that a retailer must pay for its inputs per market in which it is active as

$$\tau_i^* = (1-\theta)\,(\alpha - c)^2 \left(\frac{1}{9} - \frac{2+n_i}{2\,(3+2n_i)^2}\right)$$

We are now able to present our main result

Proposition 2 *The larger the buyer, the disproportionately more it pays for its inputs and therefore the lower its profits per market*

$$\frac{\partial \tau_i}{\partial n_i} > 0 \; ; \; \frac{\partial \pi_i}{\partial n_i} < 0$$

Proof. See Appendix. ■

This result indicates that, contrary to most existing research and conventional belief, larger buyers may pay disproportionately more than smaller buyers.

3 Concluding Remarks

We have presented a model where the greater a retailer's size the weaker its bargaining position, and therefore the more it has to pay for its inputs.

This results runs counter to most of the literature and the prevailing assumption in antitrust practice of there being a positive relationship between the size of a buyer and the amount of countervailing power it is able to exercise over its suppliers. By demonstrating that the opposite may be the case, our results emphasise that it is essential that regulators adopt a sophisticated approach to assessing buyer power that fully examines the bargaining positions of all firms in terms of their outside options in negotiations.

4 Appendix

Proof of Lemma 1

Denote the quantity of the backwards integrating firm as q_{ij} and that of rival retailers as q_{kj}. In equilibrium we will have a symmetric outcome giving us

$$\Phi_i = n_i q_{ij} \left(\alpha - q_{ij} - q_{kj}\right) - n_i q_{ij} c - \frac{\left(n_i q_{ij}\right)^2}{2}$$

We can therefore solve for firms' best response functions

$$q_{ij} = \frac{\alpha - q_{kj} - c}{2 + n_i} \ ; \ q_{kj} = \frac{\alpha - q_{ij} - c}{2}$$

In equilibrium for the markets in which the integrating firm is present

$$q_{ij}^* = \frac{\alpha - c}{3 + 2n_i} \ ; \ q_{kj}^* = \left(1 + n_i\right) \frac{\alpha - c}{3 + 2n_i}$$

$$p_j^* = \frac{\left(1 + n_i\right)\alpha + \left(2 + n_i\right)c}{3 + 2n_i}$$

$$\Phi_i^* = n_i \left(\alpha - c\right)^2 \frac{\left(2 + n_i\right)}{2\left(3 + 2n_i\right)^2}$$

Proof of Proposition 2

We have

$$\frac{\partial \tau_i}{\partial n_i} = \left(1 - \theta\right) \frac{\left(\alpha - c\right)^2 \left(2n_i + 5\right)}{2\left(2n_i + 3\right)^3} > 0$$

$$\frac{\partial \pi_i}{\partial n_i} = -\left(1 - \theta\right) \frac{\left(\alpha - c\right)^2 \left(2n_i + 5\right)}{2\left(2n_i + 3\right)^3} < 0$$

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