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Galbraith meets Weyl and Fabinger: Countervailing power and imperfect competition in the retail market[*]

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Abstract

I study how a change in countervailing power on the retailer side (Galbraith 1952) affects the retail and wholesale prices by employing Weyl and Fabinger's (2013) conduct parameter approach in a model of vertical relationships with Nash cooperative bargaining. I argue that the effects of countervailing power are affected by its relationship with the industry's conduct.

Keywords: Distribution Channels; Bargaining; Countervailing Power.

JEL Classification: D43; L13; L49.

1 Introduction

I study a tractable model of vertical relationships between N symmetric manufacturers and M symmetric retailers à la Gaudin (2016) to analyze two sources of Galbraith's (1952) countervailing power by retailers: (i) a decrease in the number of retailers as a result of consolidation, and (ii) an increase in the retailer's bargaining power. I particularly consider the effects on the retail sector's conduct by using the conduct parameter approach à la Weyl and Fabinger (2013) to model imperfect competition in the retail sector. By focusing on symmetric equilibrium retail and wholesale prices, I show that a decrease in the number of retailers as a way of creating countervailing power does not necessarily lower the retail price if the effects on the industry's conduct are taken into account. In contrast, the effects of a change in the retailer's bargaining power on the prices depend on whether it improves or worsens the industry's conduct.

2 Model

Suppose that there are $N \geq 1$ symmetric upstream firms (manufacturers) whose marginal cost of production is constant, $c^U \geq 0$. Here, N upstream firms are horizontally differentiated. There are also $M \geq 1$ symmetric common retailers: each downstream retailer $i \in \mathcal{M} \equiv \{1, 2, .., M\}$ transacts with all N upstream firms. Each manufacturer produces one type of product, and for each manufacturer's product, the retailer incurs a constant marginal cost of sales, $c^D \geq 0$. Each common retailer sells the manufacturers' products to the final market, and the demand for product ij (brand $j \in \mathcal{N} \equiv \{1, 2, .., N\}$ sold by retailer i) is $s_{ij}(\mathbf{P})$, where

$$
\mathbf{P} = \begin{pmatrix} p_{11} & p_{12} & \cdots & p_{1N} \\ p_{21} & \ddots & & \vdots \\ \vdots & & \ddots & \vdots \\ p_{M1} & \cdots & \cdots & p_{MN} \end{pmatrix}.
$$

Each common retailer i pays the unit price w_{ij} to manufacturer j: its total profit is written as $\Pi_i^D \equiv \sum_{j \in \mathcal{N}} (p_{ij} - w_{ij} - c^D) s_{ij}(\mathbf{P})$. Similarly, each retailer j's profit is given by $\pi_j^U \equiv$

$\sum_{i \in \mathcal{M}} (w_{ij} - c^U) s_{ij}(\mathbf{P})$.

In the following analysis, we focus on symmetric equilibrium prices p and w, and thus denote by $s(p)$ the per-product market demand corresponding to p: $s(p) \equiv s_{ij}(p, ..., p)$. where p is the symmetric price for $M \times N$ products. Note also that the wholesale and final prices are determined *simultaneously* as a pair $\{w, p\}$: this assumption is standard in empirical studies of bargaining in vertical relationships such as Draganska, Klapper, and Villas-Boas (2010), Meza and Sudhir (2010), Crawford and Yurukoglu (2012), Grennan (2013, 2014), Gowrisankaran, Nevo, and Town (2015), Ho and Lee (2017), Crawford, Lee, Whinston, and Yurukoglu (2018), and De los Santos, O'Brien, and Wildenbeest (2018).[1] I also employ the simplifying assumption that each bargaining is played one of the M delegates from a manufacturer and one of the N delegates from a retailer, and each bargaining is unobservable from the other delegates. Additionally, it is also assumed that players hold "passive beliefs" in the sense that even if a player in one bargaining process observes out-of-equilibrium price offer, the player still holds the belief that the equilibrium is played (in the bargaining and the pricing decisions) by the players outside of this bargaining process (McAfee and Schwartz 1994).

Under these assumptions, we focus on the bargaining process over w_{ij}. Given the players' belief that the symmetric equilibrium $\{w, p\}$ is played, it is determined to maximize the Nash product, $[\Delta \Pi_{ij}^D]^\lambda [\Delta \pi_{ij}^U]^{1-\lambda}$ with respect to w_{ij}, where $\lambda \in [0, 1]$ is the common retailer's *Nash bargaining weight*,[2]

$$\begin{cases} \Delta \Pi_{ij}^D \equiv (p - w_{ij} - c^D) s(p) - (N-1)(p - w - c^D) \Delta s(p) \\ \Delta \pi_{ij}^U \equiv (w_{ij} - c^U) s(p) - (M-1)(w - c^U) \Delta s(p), \end{cases}$$

and $\Delta s(p) \equiv \widetilde{s}(p) - s(p) > 0$ is the market share difference, with $\widetilde{s}(p)$ being the market share of

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[1]Collard-Wexler, Gowrisankaran, and Lee (2019) provide a non-cooperative foundation for Nash's (1950) modeling. This timing assumption would be innocuous when the frequencies of price revisions are similar for wholesale and retail prices. In other cases, retail prices may be revised more frequently: it seems more natural to assume that retail prices are chosen after wholesale prices are determined. Nonetheless, this assumption is utilized in empirical studies to ease computational burden. See Iozzi and Valletti (2014) for a study of richer timing and information structure.

[2]The bargaining weight λ can be understood as the factor that summarizes "the tactics employed by the bargainers, the procedure through which negotiations are conducted, the information structure, and the player's discount rates." (Muthoo 1999, p.35).

product $(ij)' \neq ij$ when product ij is removed in the case of *disagreement*. It is assumed that $\Delta s(p)$ is strictly decreasing in the number of products for any $p \geq 0$. Note here that the retail prices are not reoptimized in such an event, and thus consumers still face the same price p for each product (except for the removed product ij). Note also that in symmetric equilibrium $\Delta \Pi_{ij}^D \equiv (p-w-c^D)[s(p)-(N-1)\Delta s(p)]$: this expression indicates that an additional profit gain for the common retailer from inviting one more upstream firm (transacting N firms instead of $(N-1)$ firms) comes from the increase in unit $s(p)$, multiplied by the unit margin $(p-w_j-c^D)$. However, this addition of an upstream firm reduces the output for each of the other $(N-1)$ firms: this negative effect is captured by the term $(N-1)\Delta s(p)$. The same reasoning applies to $\Delta \pi_{ij}^U \equiv (w-c^D)[s(p)-(M-1)\Delta s(p)]$ in symmetric equilibrium.[3]
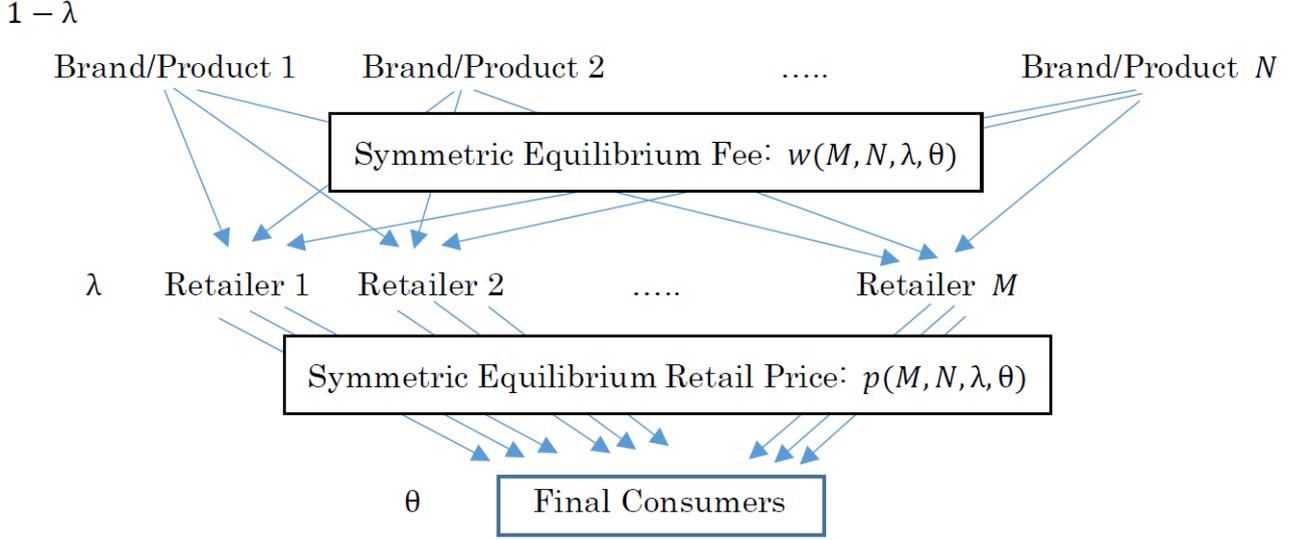
Finally, we follow Weyl and Fabinger's (2013) and introduce the *conduct parameter* $\theta \in [0,1]$ that measures the degree of imperfect competition in the retail market: with $\theta = 0$ being perfect competition and $\theta = 1$ being monopoly. We also define *the industry's price elasticity* of demand by $\epsilon(p) \equiv -ps'(p)/s(p) > 0$, where $s'(p) \equiv \frac{\partial s_{ij}}{\partial p_{ij}} + (MN-1)\frac{\partial s_{ij}}{\partial p_{kl}}$ for $k \neq i$ and $l \neq j$. Then, the equilibrium pair $\{w,p\}$ satisfies:

$$\begin{cases} \theta s(p) + (p-w-c^D)s'(p) = 0 \\ \lambda(w-c^U)\epsilon(p)[s(p)-(M-1)\Delta s(p)] - (1-\lambda)[s(p)-(N-1)\Delta s(p)]p = 0. \end{cases}$$

Essentially, our simplifying assumptions make it unnecessary to consider the dependence of p on w. Figure 1 depicts the situation under the symmetry assumption. Here, Holmes' (1989) decomposition indicates that under symmetric pricing, the industry's price elasticity is equal to *the firm's own price elasticity*, subtracted by *the cross price elasticity*: $\epsilon(p) = \epsilon_F(p) - \epsilon_C(p)$, where $\epsilon_F(p) \equiv -(p/s(p))\partial s_{ij}(\mathbf{p})/\partial p_{ij}|_{\mathbf{p}=(p,...,p)}$ and $\epsilon_C(p) \equiv (MN-1)(p/s(p))\partial s_{(ij)'}(\mathbf{p})/\partial p_{ij}|_{\mathbf{p}=(p,...,p)}$ for any distinct pair of indices ij and $(ij)'$.

---

[3]We make an additional restriction on $\Delta s(p)$: it must be the case that $\Delta s(p) < \min\{\frac{\tilde{s}(p)}{M}, \frac{s(p)}{M-1}, \frac{\tilde{s}(p)}{N}, \frac{s(p)}{N-1}\}$ is assumed for any $p \geq 0$, $M \geq 1$, and $N \geq 1$ to assure that $\Delta \Pi_{ij}^D$ and $\Delta \pi_{ij}^U$ are always positive.

$1 - \lambda$

Brand/Product 1   Brand/Product 2   .....   Brand/Product N

Symmetric Equilibrium Fee: $w(M, N, \lambda, \theta)$

λ Retailer 1   Retailer 2   .....   Retailer M

Symmetric Equilibrium Retail Price: $p(M, N, \lambda, \theta)$

θ Final Consumers

Note: $\lambda \in [0, 1]$ is the retailer's *Nash bargaining weight*, and $\theta \in [0, 1]$ is the *conduct parameter* in the retail market.

3   Analysis

Let $F(p, w; \theta, c^D) \equiv \theta s(p) + (p - w - c^D)s'(p)$ and $G(p, w; \lambda, c^U, M, N) \equiv \lambda(w - c^U)\epsilon(p)[s(p) - (M - 1)\Delta s(p)] - (1 - \lambda)[s(p) - (N - 1)\Delta s(p)]p$. Then,

$$
\underbrace{\begin{bmatrix} \dfrac{\partial F}{\partial p} & \dfrac{\partial F}{\partial w} \\[2em] \dfrac{\partial G}{\partial p} & \dfrac{\partial G}{\partial w} \end{bmatrix}}_{\equiv D} \begin{bmatrix} \dfrac{\partial p}{\partial M} \\[2em] \dfrac{\partial w}{\partial M} \end{bmatrix} = - \begin{bmatrix} \dfrac{\partial F}{\partial M} \\[2em] \dfrac{\partial G}{\partial M} \end{bmatrix}.
$$

Now, let the determinant be defined by $\det(D) \equiv \left(\frac{\partial F}{\partial p}\right)\left(\frac{\partial G}{\partial w}\right) - \left(\frac{\partial F}{\partial w}\right)\left(\frac{\partial G}{\partial p}\right)$. Specifically, it is verified that

$$
\begin{aligned}
\det(D) = s'\lambda \cdot \Big((1 + \theta - \sigma)[s - (M - 1)\Delta s]\epsilon \\
+ (w - c^U)\Big\{ [s - (M - 1)\Delta s]\left(\epsilon' - \frac{\epsilon}{p}\right) \\
+ \epsilon \frac{[s - (N - 1)\Delta s][s' - (M - 1)\Delta s'] - [s - (M - 1)\Delta s][s' - (N - 1)\Delta s']}{[s - (N - 1)\Delta s]} \Big\} \Big),
\end{aligned}
$$

where, for example, $\Delta s' \equiv \frac{d\Delta s}{dp}(p)$ and $\sigma(p) \equiv ss''/[s']^2$ is the *demand curvature* under symmetry. It is assumed that $s(p)$ is not "too convex," that is, $\sigma < 1$ (Adachi and Ebina 2014; Chen and Schwartz 2015; and Gaudin 2015). For $\det(D)$ to be negative, it is sufficient to assume that $\epsilon' \geq \epsilon/p$ and that

$$[s - (N-1)\Delta s][s' - (M-1)\Delta s'] \geq [s - (M-1)\Delta s][s' - (N-1)\Delta s'].$$

Thus, it is observed that

$$\begin{bmatrix} \dfrac{\partial p}{\partial M} \\[2em] \dfrac{\partial w}{\partial M} \end{bmatrix} = \underbrace{\dfrac{-1}{\det(D)}}_{>0} \begin{bmatrix} (-\lambda\epsilon)\left\{ \underbrace{[s-(M-1)\Delta s]\left(-\dfrac{\partial\theta}{\partial M}s\right)}_{\geq 0} + \underbrace{s'(w-c^U)\Delta s}_{<0} \right\} \\[2em] -\lambda\left\{ \underbrace{H\dfrac{\partial\theta}{\partial M}s}_{\leq 0} + \underbrace{(1+\theta-\sigma)s'(w-c^U)\epsilon\Delta s}_{<0} \right\} \end{bmatrix},$$

where it is assumed that the conduct parameter θ is decreasing in M: $\frac{\partial\theta}{\partial M} \leq 0$, and

$$H \equiv \frac{1}{\lambda}\frac{\partial G}{\partial p} = (w - c^U)\left\{ [s - (M-1)\Delta s]\left(\epsilon' - \frac{\epsilon}{p}\right) \right.$$
$$\left. + \epsilon\frac{[s-(N-1)\Delta s][s'-(M-1)\Delta s'] - [s-(M-1)\Delta s][s'-(N-1)\Delta s']}{[s-(N-1)\Delta s]} \right\} > 0.$$

This result indicates that while the wholesale price decreases as the number of retailers decreases (i.e., $\frac{\partial w}{\partial M} > 0$), the retail price can increase if $\left|\frac{\partial\theta}{\partial M}\right|$ is sufficiently large. It may be the case that the retail sector's consolidation may induce collusive pricing; if this effect is severe, this works as a countervailing effect for countervailing power.

Similarly, it is observed that

$$
\begin{bmatrix} \dfrac{\partial p}{\partial \lambda} \\[2ex] \dfrac{\partial w}{\partial \lambda} \end{bmatrix} = \underbrace{\dfrac{-1}{\det(D)}}_{>0} \begin{bmatrix} \underbrace{\lambda \epsilon [s - (M-1)\Delta s]\left(\dfrac{\partial \theta}{\partial \lambda}s\right)}_{\gtreqless 0} + \underbrace{s'\dfrac{\partial G}{\partial \lambda}}_{<0} \\[4ex] \underbrace{-\lambda H \dfrac{\partial \theta}{\partial \lambda}s}_{\lesseqgtr 0} + \underbrace{s'(1 + \theta - \sigma)\dfrac{\partial G}{\partial \lambda}}_{<0} \end{bmatrix},
$$

where

$$
\frac{\partial G}{\partial \lambda} = (w - c^U)\epsilon[s - (M-1)\Delta s] + [s - (N-1)\Delta s]p > 0.
$$

Hence, if an increase in the retailer's bargaining power raises the conduct parameter (i.e., $\frac{\partial \theta}{\partial \lambda} \geq 0$), then the retail price may go up as above. However, the wholesale price always decreases. If the opposite is the case (i.e., $\frac{\partial \theta}{\partial \lambda} \leq 0$), then the retail price always decreases, whereas the wholesale price may rise.

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