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Who benefits from price indexation?

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Abstract

We consider two products traded in two duopoly markets, where competition is assumed a la Hotelling. Firms A and B are operating in Market 1, while Firm B is also competing in Market 2 with Firm C. Prices in Market 2 are pegged linearly to the average price in Market 1. We show that price indexation has anticompetitive consequences that always benefit Firm A, and that benefit Firm B operating in both markets if the size of the reference market is large enough.

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1 Introduction

Indexation or pegging is a pricing mechanism that is used in different markets, such as commodities. For example, natural gas contract prices in most of European countries are indexed to fuel oil prices, and LNG prices in Asia are linked to average prices of different imported crude oil streams. The link to a spot market helps reduce pricing uncertainties in the contracts markets.

There is an important literature on long-term contracts. The economics of long-term and-short term contracts in the gas industry are analyzed in Neuhoff and Von HirchHausen (2005); the authors show that, if the long-run demand elasticity is significantly higher than the short-term elasticity, then the strategic producers and consumers benefit from lower prices and larger volumes. The (anti) competitive consequences of long-term contracting are discussed in Allaz and Vila (1983); the authors show that forward trading fosters competition. Le Coq (2004) and Liski and Montero (2004) find that forward trading induces collusions in the spot market.

In this note, we consider the effect of a linear indexation pricing in the two markets involved: Market 2 which is using the indexation mechanism (gas for example), and Market 1, the "benchmark" market (oil for example). We analyze the situation where both markets are competitive. Recent development in LNG markets, for example, support our assumption for Market 2. Indeed, most of the LNG contracts that were signed in the 70s and 80s have approached their maturation. Besides, an important train capacity was added in the last decade. Therefore, some customers were able to profit from such a situation to secure a competitive pricing. For example, in the recent tender for Guangdong LNG terminal, Chinese buyers were able to secure a contract with a much better indexation (proportionality coefficient) than what was used for other Asian countries.

We analyze the interactions in the two markets in the presence of a common firm operating in both markets. Note that the following analysis is conducted without reference to contracts: we consider two different duopoly markets whereby the price in one market is pegged to the average price in the other.

The remainder of this note is organized as follows: Section 2 describes the setting, Section 3 derives the equilibrium solution and Section 4 concludes.

2 The two duopoly markets

We consider two products traded in two seperate markets, labeled Market 1 and Market 2; each market is represented by a set of consumers distributed with a density equal to 1 in the interval $[0, L_i], i = 1, 2$. Three firms are competing on these markets: Firms A and B are competing in Market 1 while Firms B and C are competing in Market 2. Firm B is operating in both markets; it is located in the right (left) end of Market 1(2). All firms have zero marginal costs.

As in the standard Hotelling model, a consumer pays a price P for the product and a linear transportation cost. All consumers derive the same intrinsic utility from consumption, which is assumed large so that all consumers want to consume the product .

Market shares are defined by the location of the indifferent consumer. The indifferent consumers' locations in both markets are respectively:

$$\begin{aligned} x_1 &= \frac{P_{B1} - P_{A1}}{2t_1} + \frac{L_1}{2} \\ x_2 &= \frac{P_{C2} - P_{B2}}{2t_2} + \frac{L_2}{2} \end{aligned}$$

where P_{ij} is the price of firm i in market j and t_j is the unit transportation cost in market j. We assume that

$$\frac{t_1 L_1^2}{t_2 L_2^2} \geq \frac{1}{15},$$

where Market 2 is the one where price indexation is used. Recalling that the total profit in a standard Hoteling model is tL^2, this condition, which will be derived in the next section, can be interpreted as a relative profit condition: total profit in the reference market is not too small compared to the profit in the price-indexed market.

We consider the case where prices in Market 2 are indexed to the average of prices in Market 1. Firms B and C independently choose their proportionality coefficients, so that:

$$\begin{aligned} P_{B2} &= \alpha(P_{B1} + P_{A1}) \\ P_{C2} &= \beta(P_{B1} + P_{A1}). \end{aligned}$$

We assume that price information is conveyed instantaneously from Market 1 to Market 2.

3 Equilibrium

We first we derive the equilbium prices and markets shares in both markets. We consider the case where contract delivery time coincides with spot market clearing and abstract from any time strategy behavior. Therefore, we need only one stage interaction.

The profits of firms A, B and C are:

$$\begin{aligned} \Pi_A &= P_{A1} x_1 \\ \Pi_B &= P_{B1}(L_1 - x_1) + P_{B2} x_2 \\ \Pi_C &= P_{C2}(L_2 - x_2). \end{aligned}$$

The FOC for firm A yields

$$P_{A1} = \frac{P_{B1}}{2} + \frac{t_1 L_1}{2}$$

Firm B maximizes its profits by choosing P_{B1} and α, knowing the indexing rule and the impact price P_{B1} has on the prices in Market 2. The optimality conditions for Firm B are then:

$$
\begin{aligned}
\frac{\partial \Pi_B}{\partial P_{B1}} &= 0 \Rightarrow 2P_{B1}\left(t_2 + \alpha(\alpha-\beta)t_1\right) = P_{A1}\left(t_2 - 2\alpha(\alpha-\beta)t_1\right) + (L_1 + \alpha L_2)t_1 t_2 \\
\frac{\partial \Pi_B}{\partial \alpha} &= 0 \Rightarrow L_2 t_2 = (2\alpha - \beta)\left(P_{A1} + P_{B1}\right). \qquad (1)
\end{aligned}
$$

Finally, for Firm C, we have:

$$
\frac{\partial \Pi_C}{\partial \beta} = 0 \Rightarrow L_2 t_2 = (2\beta - \alpha)\left(P_{A1} + P_{B1}\right). \qquad (2)
$$

Equations (1)-(2) imply that, at equilibrium,

$$
\alpha = \beta = \frac{t_2 L_2}{(P_{A1} + P_{B1})},
$$

and therefore the equilibrium prices on Market 2 are given by:

$$
P_{C2} = P_{B2} = t_2 L_2.
$$

Using $\alpha = \beta$ and solving for P_{A1} and P_{B1}, we get the equilibrium prices:

$$
\begin{aligned}
P_{A1} &= L_1 t_1 + \frac{1}{3}\alpha t_1 L_2 \\
P_{B1} &= L_1 t_1 + \frac{2}{3}\alpha t_1 L_2
\end{aligned}
$$

which implies

$$
\alpha = \frac{t_2 L_2}{2L_1 t_1 + \alpha t_1 L_2}.
$$

The only positive root of this equation is

$$
\alpha = \sqrt{\frac{t_2}{t_1} + \frac{L_1^2}{L_2^2}} - \frac{L_1}{L_2}.
$$

Now, under these prices, the indifferent consumers locations are

$$
\begin{aligned}
x_1 &= \frac{\alpha L_2}{6} + \frac{L_1}{2} \\
x_2 &= \frac{L_2}{2};
\end{aligned}
$$

where we need to have

$$
x_1 \leq L_1,
$$

which is equivalent to

$$\alpha \leq 3\frac{L_1}{L_2}$$

or

$$\frac{t_1 L_1^2}{t_2 L_2^2} \geq \frac{1}{15}.$$

We have the following results:

Result.1 In the present framework, price indexing induces the same prices, in Market 2, as in the standard Hotelling prices: competition forces in Market 2 are not affected by the indexation.

Result.2 Indexing has anticompetitive consequences in Market 1; prices are higher than in the standard Hotelling setup for both firms A and B.

Result.3 Firm A is better-off if indexation is used in Market 2: its profit is larger than in the standard Hotelling framework since both its price and market share are higher.

For Firm B, the consequences are not so clear-cut, since its market share decreases in Market 1 when prices are indexed. Firm B's profit in Market 1 is given by

$$\begin{aligned}
\Pi_B &= P_{B1}(L_1 - x_1) \\
&= \left(L_1 t_1 + \frac{2}{3}\alpha t_1 L_2\right)\left(L_1 - \left(\frac{\alpha L_2}{6} + \frac{L_1}{2}\right)\right) \\
&= \frac{1}{2} t_1 L_1^2 + \frac{1}{18}\alpha L_2 t_1 \left(3L_1 - 2\alpha L_2\right).
\end{aligned}$$

Therefore, its profit in Market 1 is higher with indexation than in the standard Hotelling case if $3L_1 - 2\alpha L_2 > 0$, or equivalently

$$\alpha < \frac{3L_1}{2L_2}.$$

Replacing with the equilibrium value of α, this condition reduces to

$$\sqrt{\frac{t_2}{t_1} + \frac{L_1^2}{L_2^2}} - \frac{L_1}{L_2} < \frac{3L_1}{2L_2},$$

or

$$\frac{t_1 L_1^2}{t_2 L_2^2} > \frac{4}{21}. \tag{3}$$

Result.4 Firm B's market share is lower in Market 1 under indexation than in the standard Hotelling case, and its Profit is higher than in the standard Hotelling case if $\frac{t_1 L_1^2}{t_2 L_2^2} > \frac{4}{21}$. Otherwise, Firm B is better-off when the two markets are independent.

Again, an interpretation of condition (3) is that profit in the reference market is large enough with respect to the one in the price-indexed market. For equal transportation costs, for instance, it means that the size of Market 1 is at least 44% of the size of Market 2.

4 Conclusion

Price indexing is a pricing mechanism used in different markets. In a simple Hotelling duopoly framework, we show that indexation does not affect competition forces in the market where indexation is used. However, indexation has anticompetitive consequenses in the reference market since prices are then higher than if no indexation were used. Finally, if a company is operating in both markets, its profit is higher under indexation only if the size of the reference market is sufficiently large with respect to the size of the price-indexed market.

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