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Abstract

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Meeting the Competition: Commitment and Competitive Behavior

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1 Introduction

The representation of price determination in oligopolistic markets as a two-stage game, with the first stage determining the strategy space, and the second determining the resulting prices and quantities, has yielded a range of insights. First-stage interactions typically allow firms to move away from more competitive outcomes.[1] For example, in the seminal paper by Kreps and Scheinkman (1983), the determination of capital stocks, prior to selecting prices, results in Cournot-like outcomes which are considerably less competitive than Bertrand competition, even when price is the second-stage strategic variable.[2] In Grant and Quiggin (1996) model firms competing in supply function schedules with precommitment to the choice of capital. They show that the equilibrium corresponds to the one where firms choose mark-ups and the equilibrium outcome becomes more competitive as the share of capital in the production function decreases.[3]

In this paper we explore the competitive impact of marketing strategy based on 'meeting the competition'. This term refers to the guarantees announced by firms who promise to meet their competitors' prices either by matching it or offering a further discount. Such price guarantees are popular among retailers. Examples of retailers who exercise best price guarantees include Tire Kingdom, Staples, and Tesco. Some retailers offer selected price guarantee. Examples include Amazon's TV price guarantee, Target's holiday price guarantee, and Sears' price guarantee against its major competitors. Using data from tire advertisements from twenty-seven different cities in the United States, Arbatskaya, Hviid, and Shaffer (2006) found that 98 out of their total sample of 213 tire ads contained a low-price guarantee.

[1] The first stage interactions here are to be distinguished from literature on dynamic quantity competition. In the latter, firms compete in a repeated game and larger output levels in earlier periods facilitate the attainment of the Stackelberg leader position. With both firms engaging in this Stackelberg warfare, the equilibrium (when actions are strategic substitutes) is typically more competitive than its static analog. See for example, Jun and Vives (2004). Caruana and Einav (2008) has a similar flavor. Firms set production targets and can alter their output levels with adjustment costs later.

[2] See also extension by Boccard and Wauthy (2000).

[3] See also Dixon (1985, 1986) and Vives (1986).

In the ordinary use of the term 'competitive', a guarantee that 'we will meet or beat any price offered by another firm' appears to represent highly competitive behavior. However, economists have long understood that price matching guarantees can support a higher equilibrium price (Hay 1982, Salop 1986). The point may be illustrated by the simple case of homogenous consumers, symmetric firms, complete information with price competition. Absent price matching guarantees, Bertrand competition leads to marginal cost pricing. With price matching guarantees, monopoly pricing can be supported as an equilibrium since both firms are committed to price matching and thus no unilateral profitable deviation exists. The implications of price matching are further explored by Doyle (1988), Logan and Lutter (1989), Dixit and Nalebuff (1991), and Chen (1995).[4]

The literature on meeting the competition typically involves explicit or tacit collusion between firms. The promise to match a competitor's price is seen, not as an attempt to attract consumers, but as a warning to competitors not to deviate from the tacitly agreed monopoly price. However, everyday experience suggests some difficulties with this interpretation. Despite the existence of 'meet the competition' guarantees, retail trade is characterized by ubiquitous haggling, in which salespeople offer customers discounts and incentives on an individual basis. A further difficulty with the existing literature is that the availability of a 'meet the competition' guarantee is assumed to be exogenous, rather than arising from the strategic interactions among firms and between firms and consumers.

In this paper, we represent 'meet the competition' guarantees as the endogenous outcome of a non-cooperative game. We model the phenomenon by assuming that firms compete in supply schedules in a two-stage process. In the first stage, firms make investments that determine the slope of the supply schedule (a choice of responsiveness of their best reply functions). In the second stage, market prices and quantities are determined by the strategic choice of an intercept (a quantity or corresponding price). Meeting

[4] Other rationals for price matching guarantees include price discrimination (Png and Hirshleifer, 1987; Corts, 1997; Chen and Narasimhan, 2001) and signals of low prices (see for example, Moorthy and Winter, 2006).

the competition implies a commitment to sell more (say one more unit) at a lower price than originally advertised. In our framework, this translates into choosing a negatively sloped supply schedule. Our setup allows firms to commit to different degrees of competitiveness.

We assume that the choice of a negatively sloped supply schedule is costly. In particular, we use Cournot behavior as a benchmark. Cournot competition entails firms choosing a fixed quantity independent of the market price. We assume that it is costly for firms to deviate from a fixed output level. Our main result shows that in equilibrium, firms behave less competitively than the Cournot benchmark when they are able to commit to a degree of responsiveness in the first stage of the competition game.

2 The Model

Two firms compete in an industry with inverse demand curve:

$$p = 1 - (q_1 + q_2) \, . \tag{1}$$

The strategic choice for firm i is a choice of supply schedules, parametrized by the strategic variables α_i and β_i as follows:

$$q_i = \alpha_i + \beta_i p. \tag{2}$$

The timing of the move is that, in the first period, firms simultaneously choose β. The choice of β can be interpreted as committing to aggressive competitive behavior such as a meeting the competition clause. This commitment comes with a cost and takes the form of $c_i(\beta_i) = \frac{\theta}{2}\beta_i^2$, where $\theta > 0$ is a cost parameter. While firm i can produce the fixed quantity α_i without any additional cost, the flexibility of being able to adjust the output level contingent on the market price requires convex adjustment costs. For simplicity there are no other production costs. [5]

[5] The set up is similar to Caruana and Einav (2008). Caruana and Einav model the adjustment process of firms' production targets while here we assume that firms commit to a degree of responsiveness against the price, and thus the rival's action.

In the second stage, knowing all firms' chosen βs, firms simultaneously choose α. We work backwards to solve for the Subgame Perfect Nash equilibrium.

Replacing (2) into (1) yields:

$$p = \frac{1-\alpha_1-\alpha_2}{1+\beta_1+\beta_2}. \tag{3}$$

2.1 Second stage output choice

Firm i, taking first period β_j, $j \neq i$ as given, chooses α_i.[6] The resulting profits are

$$\pi_i = pq_i - \frac{\theta}{2}\beta_i^2. \tag{4}$$

Maximizing with respect to α_i gives

$$\frac{\partial p}{\partial \alpha_i} q_i + p\frac{\partial q_i}{\partial \alpha_i} = \frac{\partial p}{\partial \alpha_i}\left(\alpha_i + 2\beta_i p\right) + p = 0. \tag{5}$$

Using the expression of the inverse demand curve in Equation 3, we have

$$\left(\frac{-1}{1+\beta_1+\beta_2}\right)\left(\alpha_i + 2\beta_i\left(\frac{1-\alpha_i-\alpha_j}{1+\beta_1+\beta_2}\right)\right) + \left(\frac{1-\alpha_i-\alpha_j}{1+\beta_1+\beta_2}\right) = 0. \tag{6}$$

This yields the best response

$$\alpha_i = \frac{(1-\alpha_j)\left(1+\beta_j-\beta_i\right)}{2\left(1+\beta_j\right)}. \tag{7}$$

Therefore we have

$$\alpha_1^* = \frac{1-\beta_1+\beta_2}{\beta_1+\beta_2+3} \tag{8}$$

$$\alpha_2^* = \frac{1+\beta_1-\beta_2}{\beta_1+\beta_2+3}. \tag{9}$$

Note that $\frac{\partial \alpha_1}{\partial \beta_1} < 0$ and $\frac{\partial \alpha_1}{\partial \beta_2} > 0$. The resulting market price is $p = \frac{1}{\beta_1+\beta_2+3}$ with equilibrium quantities $q_1 = \frac{\beta_2+1}{\beta_1+\beta_2+3}$ and $q_2 = \frac{\beta_1+1}{\beta_1+\beta_2+3}$.

[6] Note that firm i can choose any point on the residual demand curve implied by the choices of other firms, regardless of its own choice of β_i.

3 First Stage Commitment

We now consider non-cooperative setting of β in the first stage. Given the second stage outcome, firm i solves

$$\max_{\beta_i} (\alpha_i + \beta_i p)\, p - \frac{\theta}{2}\beta_i^2. \tag{10}$$

The partial derivative with respect to β_i is

$$\begin{aligned}\frac{\partial \pi_i}{\partial \beta_i} &= \frac{\partial \alpha_i}{\partial \beta_i} p + p^2 + (\alpha_i + 2\beta_i p)\frac{\partial p}{\partial \beta_i} - \theta\beta_i \\ &= -2\frac{\beta_j + 1}{\left(\beta_i + \beta_j + 3\right)^3} - \theta\beta_i. \end{aligned} \tag{11}$$

Remark 1 *For non-cooperative setting of β, the second order condition is satisfied for sufficiently large θ.*

Proof.

$$\frac{\partial^2 \pi_i}{\partial \beta_i^2} < 0 \text{ for } \frac{2\left(\beta_j + 1\right)}{\left(\beta_i + \beta_j + 3\right)^4} < \theta. \tag{12}$$

■

For the second-order condition to be satisfied, we need such commitment to be costly enough. For example, if equilibrium $\beta_i = \beta_j = 0$, we require $\theta > \frac{2}{81}$. For equilibrium $\beta_i = \beta_j = -\frac{1}{2}$, we require $\theta > \frac{1}{16}$. For symmetric β, the critical θ required is decreasing in β if $\beta > -\frac{5}{6}$. The maximum θ that we would require for satisfying the second order condition is $\theta > \frac{27}{256}$.

Proposition 1 *In equilibrium, $\beta < 0$. The market equilibrium is less competitive than the Cournot benchmark when firms are able to commit to a degree of responsiveness in the first stage of the competition game.*

Proof. From Equation 11, the first term is always negative for positive outputs. Only $\beta < 0$ can satisfy the first order condition. ■

From the first order condition on β and the fact that higher θ makes adjustment more costly, we have:

Corollary 1 *The equilibrium β increases (gets closer to 0) as θ increases.*

Example 1 *For $\theta = 1$, we have the equilibrium $\beta_1^* = \beta_1^* = -0.08$ and $\alpha_1^* = \alpha_2^* = 0.352$. The resulting $q_1^* = q_2^* = 0.324$. With strategic setting of β in the first stage, the market outcome is less competitive compared with the Cournot outcome where $q_1^C = q_2^C = \frac{1}{3}$.*

4 Discussion

The literature on best price guarantees focuses on either matching or beating the rivals' prices. We show that the notion of meeting the competition is more general. By competing in supply function schedules and by committing to adjusting its output level according to the market price, firms can also effectively commit to meeting the competition. The resulting market structure is less competitive than the Cournot benchmark.

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